SOLANO COUNTYWIDE LOCAL ROAD SAFETY PLAN

AUGUST 2022

DKS

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CHAPTER 1:
COUNTYWIDE LOCAL ROAD SAFETY

1.1 INTRODUCTION

The Solano Transportation Authority (STA) is a Joint Powers Authority (JPA) and a Congestion Management Agency (CMA) for the cities and unincorporated areas in Solano County. In addition to unincorporated areas, Solano County includes the seven cities of Benicia, Dixon, Fairfield, Rio Vista, Suisun City, Vacaville, and Vallejo. In coordination with their member jurisdictions, this Plan provides a data- and community-driven framework to systematically identify, analyze, and prioritize safety concerns and recommend safety improvements on local roads. This Plan summarizes observed crash trends and compares proportions of crash types for each city to countywide and statewide crash proportions. This chapter presents the vision statement for STA, a summary of crash patterns, safety emphasis areas, and suggested facilitation and funding strategies for STA.

VISION STATEMENT

To eliminate fatal and severe injuries on roadways throughout Solano County by creating an equitable, sustainable, and multimodal transportation system where people of all ages and abilities can travel free from harm.

CALTRANS LOCAL ROAD SAFETY PLAN

In support of the California Strategic Highway Safety Plan, Caltrans has encouraged jurisdictions throughout the State of California to prepare Local Roadway Safety Plans (LRSP) that document local transportation safety concerns and identify a prioritized list of improvements and actions. To further encourage development of LRSPs, Caltrans has provided $18 million in state funding to local jurisdictions to prepare LRSPs and required an LRSP or an equivalent plan for agencies to be eligible for federal Highway Safety Improvement Program (HSIP) funds for Cycle 11 (2022) and beyond.

LRSP DEVELOPMENT PROCESS

In late 2020 and early 2021, cities in Solano County applied for Caltrans grants to develop Local Roadway Safety Plans. After all cities were granted funding, STA prepared an MOU to combine funding and for STA to facilitate procurement and development of an LRSP in February 2021. STA then initiated the procurement process for this project which resulted in the release of an RFP in July 2021 and selection of the DKS Associates team to perform the work starting in October 2021.

The LRSP was developed over the past nine months, starting in October 2021 and approved by the Solano Transportation Authority Board in July 2022. The process has incorporated County efforts to apply for and secure funding for this effort, consultant procurement, identification of a project team and stakeholders, data collection and analysis, and ultimately drafting of the Plan.

STA LRSP TEAM MEMBERS

The core project delivery team consisted of representatives from STA, DKS Associates, and Fehr & Peers. The STA Project Development Working Group consisting of staff from each City assisted in the development of content and document review, and key stakeholders provided additional insights throughout the LRSP development.

SAFETY PARTNERS AND STAKEHOLDER ENGAGEMENT

This Plan was generated through discussions, input, and review by the following stakeholders representing STA, staff from each city, emergency services, and law enforcement.

Dan Sequeira, City of Benicia
Scott Alman, City of Dixon
Garland Wong, City of Fairfield
Hannah Lee, City of Fairfield
Tina Tran, City of Fairfield
Jason Riley, City of Fairfield
Robin Burre, City of Rio Vista
Nouae Vue, City of Suisun City
Nick Lozano, City of Suisun City
Gwen Owens, City of Vacaville
Mark Helmbrecht, City of Vallejo
Sam Kumar, City of Vallejo
Gary Hansen, City of Vallejo

Lt. Brad Dewall, Solano County Sheriff’s Department
Tom Cordova, Dixon Police Chief
Lt. Josh Kresha, Fairfield Police Department
Lt. Daniel Marshall, Fairfield Police Department
Scott Goodwin, Rio Vista Fire Chief
Jeff Henderson, Suisun City Police Commander

Stakeholder input was requested at four critical points during the project process:

- Existing Crash Trends and Emphasis Areas
- Diagnosis and Strategy Identification
- Local Concurrence of Plan Vision Statements and Goals
- Review of Draft Plan

The stakeholders were engaged each time through a combination of presentation, workshop, document review and feedback. Stakeholders were encouraged to distribute the draft documents internally to their relevant committees, departments, or agencies for further review and comment.

PUBLIC OUTREACH

This project benefitted greatly from a recent and parallel effort to prepare an Active Transportation Plan (ATP) for Solano County that involved significant public outreach and engagement focused on safety concerns and active transportation needs Countywide. The LRSP also incorporated recent outreach efforts focused on pedestrian and senior safety, funded through Office of Traffic Safety grants. Project materials were also presented to the Pedestrian Advisory Committee. Ultimately, the Final Plan will be presented and approved by the Solano Transportation Authority Board.

TIMELINE

This Plan proceeded along the following Timeline:

- February 2021 – Formation of Countywide MOU and STA facilitation of Countywide Local Road Safety Plan
- July 2021 – Advertise LRSP RFP and begin Consultant Procurement
- October 2021 – Award LRSP contract to Consultant and Project Kick-Off
- January 2022 – Finalization of Stakeholder Working Group and First Workshop
- March 2022 – Second LRSP Stakeholder Workshop
- May 2022 – Local Concurrence Meetings
- June 2022 – Third LRSP Stakeholder Workshop and Review of Draft Plan
- June 2022 – Draft LRSP Plan submitted to STA Technical Advisory Committee and opening of Public Comment period
- July 2022 – Final Plan submitted to Solano Transportation Authority Board
- July 2022 – Release of Final Plan for 30-day public comment approved by Solano Transportation Authority Board
- September 2022 – Final Plan adopted by Solano Transportation Authority Board

1.2 SOLANO COUNTY COMMITMENT TO TRANSPORTATION SAFETY

2018 TRAVEL SAFETY PLAN

The 2018 Solano Travel Safety Plan, which was funded by the Caltrans-created Systemic Safety Analysis Report Program (SSARP) grant, expanded a 2016 list of City-identified safety projects with additional projects identified through a data-driven analysis. The 2018 Travel Safety Plan was a systemic analysis of trends and patterns from the crash record that allowed for system-wide identification of improvements to address observed and potential safety issues. The resulting project list and analysis was meant to assist local agencies in prioritizing safety improvements that will qualify for Highway Safety Improvement Plan (HSIP) funding. The 2018 Travel Safety Plan also acted as a policy and guidance document to provide ongoing assistance to STA and staff from all of the Solano County jurisdictions in continuing to identify needed safety improvements as the roadway network and travel patterns continue to evolve.

HSIP GRANT APPLICATION EFFORTS

STA has facilitated and funded HSIP applications for cities in Solano County for the last two cycles, resulting in approximately $15 million in funded safety projects.

2019 PEDESTRIAN SAFETY OUTREACH

Solano Mobility facilitated a program of pedestrian safety analysis and outreach, funded by a California Office of Traffic Safety grant. The program culminated in a pedestrian safety symposium which included members of the public, elected officials, staff, and consultant discussions and presentations.

2020 SOLANO COUNTYWIDE ACTIVE TRANSPORTATION PLAN

The Solano County Active Transportation Plan provided a framework to help the Solano Transportation Authority (STA) improve active transportation conditions throughout Solano County. The Plan built upon previous active transportation planning efforts and consolidated STA's separate Countywide Bicycle, Pedestrian, Safe Routes to School, and Safe Routes to Transit Plans into one cohesive Plan. It established countywide priorities and provided project lists and program guidance which STA and local jurisdictions use to help people of all ages and abilities feel comfortable walking and bicycling.

2020 SAFE ROUTES FOR SENIORS

Solano Mobility facilitated a program of Safe Routes for Seniors involving safety analysis and outreach, funded by a California Office of Traffic Safety grant. The program involved identification of priority locations and projects, walking audits, and a presentation to the Senior Coalition.

1.3 CRASH DATA AND TRENDS

DATA SOURCES

This local road safety plan is centered on an evaluation of the most recent five years of available collision data. The key findings of the collision analysis framed the development of safety emphasis areas for Solano County and each member jurisdiction, as well as the identification of high-crash locations and recommended safety treatments to reduce the frequency and severity of collisions.

The following three databases provided the most recent five years of available collision data, from 1/1/2016 - 12/31/2020. In some jurisdictions, collision data from 1/1/2017-12/31/2021 was also available and utilized (as noted within each individual chapter of this plan).

STATEWIDE INTEGRATED TRAFFIC RECORDS SYSTEM (SWITRS)

The Statewide Integrated Traffic Records System (SWITRS) is a database that serves as a means to collect and process California crash data gathered from a collision scene. SWITRS processes all reported crashes that occurred on California's state highways and all other roadways, excluding private property. SWITRS allows for the creation of custom reports requested by the user based on different categories including, but not limited to locations, dates, and collision types.

TRANSPORTATION INJURY MAPPING SYSTEM (TIMS)

The Transportation Injury Mapping System (TIMS) is a crash-mapping and analysis application developed by SafeTREC to process and geocode crash data available by SWITRS. Specifically, the project looked at the needs of agencies to geocode and map the crashes in an efficient and simple manner. Further grants from OTS allowed SafeTREC to develop a geocoding methodology and apply it to SWITRS data statewide. As such, TIMS provides processed and cleaned data, but only includes fatal and injury crashes, excluding all crash reports resulting in only property damage.

CROSSROADS TRAFFIC COLLISION DATABASE

Crossroads is utilized by local agencies across the state to maintain and query local collision records. Some local agencies also use Crossroads to maintain traffic citation records. The system can only be accessed by local agencies and can be used to produce maps, queries, and reports. Crossroads data is not available for all jurisdictions in California, only those that purchase the software and regularly maintain the data. Because the data is maintained by individual local agencies, the accuracy and completeness of the data can vary. As such, Crossroads data was used to supplement and cross-check SWITRS and TIMS data, not as the primary data source.

Crash Record Data

For this project and most other safety analyses, the crash severity is defined in the Highway Safety Manual (HSM) as follows:

- **Fatal injury:** A crash that results in the death of a person within 30 days of the crash.
- **Severe (incapacitating) injury:** A crash that results in broken bones, dislocation, severe lacerations, or unconsciousness, but not death.
- **Other Visible injury (non-incapacitating):** A crash that results in other visible injuries, including minor lacerations, bruising, and rashes.
- **Possible injury (complaint of pain):** A crash that results in the complaint of non-visible pain/injury, such as confusion, limping, and soreness.
- **Property damage only (PDO):** A crash without injury or complaint of pain but resulting in property damage to a vehicle or other object, commonly referred to as a “fender bender.”

The most severe crashes, characterized as KSI (Killed or Severely Injured), and the systemic themes derived from them, are the primary focus of this LRSP.

CRASH TRENDS

The 2020-2024 California Strategic Highway Safety Plan (SHSP) was developed using the data findings and input from regional outreach events to determine effective strategies to reduce roadway fatalities and serious injuries. The SHSP included challenge areas that were identified as high priorities in California, representing the greatest opportunity to reduce fatalities and serious injuries across the state:

- Lane Departures
- Impaired Driving
- Speed Management / Aggressive Driving
- Pedestrians and Bicyclists
- Intersections

Crash proportions for fatal and severe injuries were calculated for Solano County and compared to statewide proportions and shown in Table 1.

TABLE 1. SUMMARY OF COUNTYWIDE FATAL AND SEVERE INJURY CRASH PROPORTIONS COMPARED TO STATEWIDE FATAL AND SEVERE INJURY CRASH PROPORTIONS

CATEGORY	PROPORTION OF CRASHES	
	Countywide	Statewide
Pedestrian Involved	21%	17%
Bicyclist Involved	7%	7%
Motorcycle Involved	21%	18%
Alcohol or Drug Involved	19%	28%
Speeding Involved	19%	34%
Lane Departure	43%	46%
Intersections	61%	23%

As shown, many of the crash categories are over-represented in fatal and severe injury (KSI) crashes, including pedestrians, bicyclists, motorcyclists, speeding, lane departure, and at intersections. Because the primary focus of a LRSP is to address KSI crash risks, the following sections present key trends related to these high severity crashes.

Physical Environment

Approximately 61% of KSI crashes occurred at intersections, while the remaining 39% occurred on roadway segments (including at driveways). Nearly 47% of all KSI crashes occurred during dark, dusk, or dawn conditions.

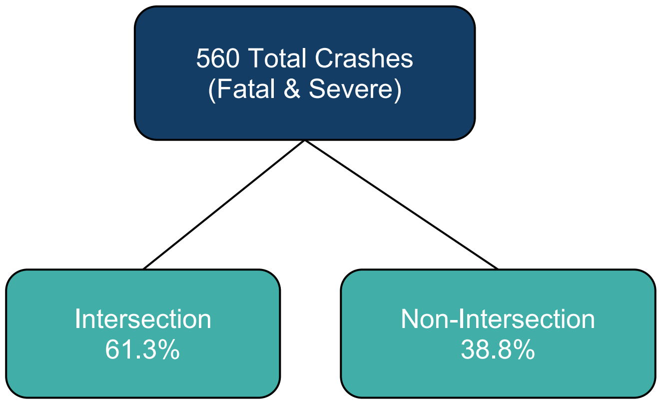

FIGURE 1: KSI LOCATION CRASH TREE

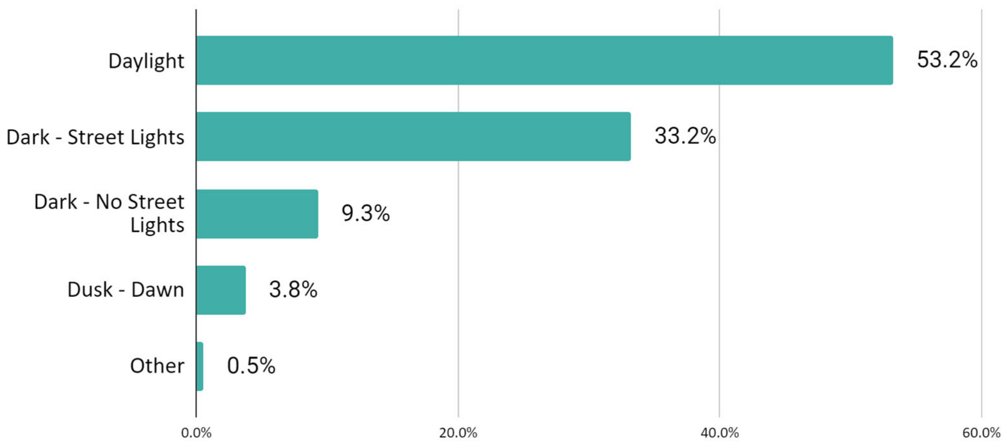

FIGURE 2: KSI LIGHTING CONDITIONS

Crash Types

Crash types provide insights into common conflicts that exist between road users. As shown in Figure 9, the three most common crash types resulting in fatalities or severe injuries are broadside (23%), pedestrian (21%), and hit object (20%). Other vulnerable road users, including bicycle-involved and motorcycle-involved crashes, are not specifically identified on this chart as any non-pedestrian crash is assigned to a crash type (e.g., a right-angle crash between a vehicle and bicycle would be coded as a broadside, and involvement of the bicyclists is noted in a separate field in the crash record). As shown previously in Table 1, 21% of KSI crashes involved a motorcyclist and 7% involved a bicyclist.

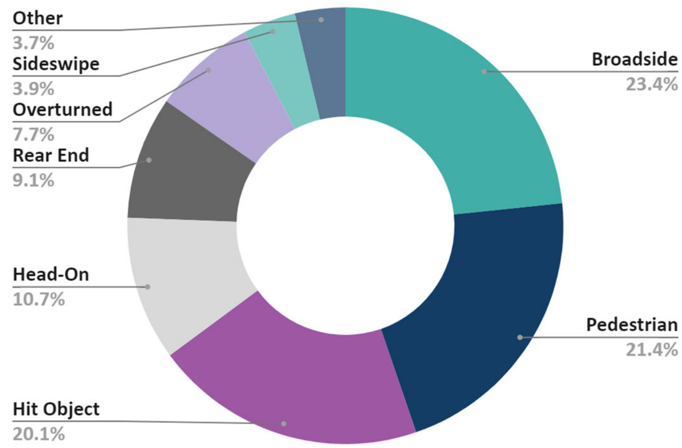

FIGURE 3: KSI CRASH TYPES

Contributing Factors

Primary contributing factors and violation categories can provide insights into human behavior associated with a crash. As shown in Figure 4, the most common violations reported in fatal and severe injury crashes were driving under the influence (20%), unsafe speed (19%) and improper passing (18%). Note that roadway design contributing factors are not included on a collision report, so the comparable role of design and behavior, and how those relate, cannot be determined based on a collision report alone.

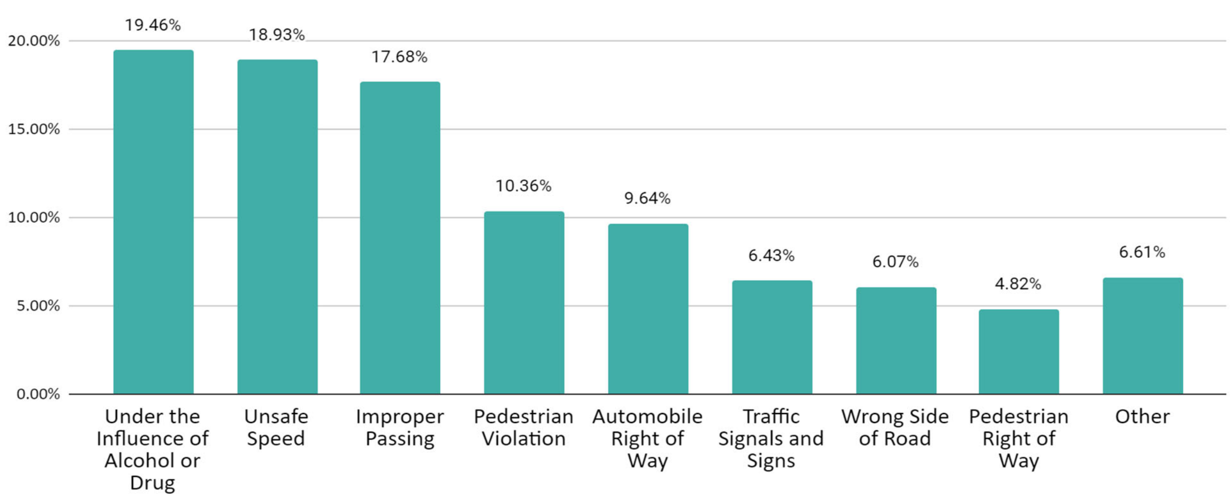

FIGURE 4: KSI CONTRIBUTING FACTORS

1.4 EMPHASIS AREAS

Emphasis Areas provide a strategic framework for developing and implementing strategies and actions for the LRSP. The Emphasis Areas were developed, using the results of crash data analysis and input from staff and stakeholders. For each emphasis area, quantitative crash reduction goals were identified to provide a metric to evaluate the ongoing effectiveness of this Plan in reducing crash rates, especially those resulting in fatal or severe injuries. To help achieve the desired crash reduction, a set of infrastructure and non-infrastructure strategies was identified for each emphasis area, and categorized by the five cross-disciplinary Safe System elements[1]:

- Safe Road Users – Improving the safety of all road users across all modes
- Safe Vehicles – Improving safety through the design and interaction of vehicles with other vehicles, bicyclists, pedestrians, and infrastructure
- Safe Speeds – Reducing speeds to reduce kinetic energy and related forces experienced by road users in a crash, providing more time to stop or recover before a crash, and improving visibility
- Safe Roads – Designing roads, sidewalks, and multi-use paths to accommodate mistakes and increase redundancy
- Post-Crash Care – Reducing the time it takes for emergency responders to arrive to a crash site, provide on-site care, and transport to an appropriate medical facility. Post-crash care also includes providing resources for victims, their families, and friends such as mental health resources and physical therapy.

Infrastructure-based strategies are capital improvements that improve the roadway environment and generally have an associated crash reduction factor identified through comparative studies. The majority of infrastructure-based strategies identified in this Plan come from the Caltrans *Local Roadway Safety Manual*[2] and are summarized in the Countermeasure Toolbox provided in the Appendix. Additional sources for infrastructure-based countermeasures are the *Highway Safety Manual*[3], *FHWA Proven Safety Countermeasures*[4], and the CMF Clearinghouse[5].

Non-Infrastructure-based countermeasures encompass a wide range of strategies that do not directly affect the roadway environment, generally incorporating programs and policies that aim to improve awareness and safe behaviors through education, enforcement, emergency response, and post-crash care. The majority of non-infrastructure-based strategies identified in this Plan come from the National Highway Traffic Safety Administration (NHTSA) *Countermeasures That Work: A Highway Safety Countermeasure Guide*[6] and are summarized in the Countermeasure Toolbox

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[1] https://safety.fhwa.dot.gov/zerodeaths/docs/FHWA_SafeSystem_Brochure_V9_508_200717.pdf

[2] https://dot.ca.gov/-/media/dot-media/programs/local-assistance/documents/hsip/2020/lrsm2020.pdf

[3] https://www.highwaysafetymanual.org/Pages/default.aspx

[4] https://safety.fhwa.dot.gov/provencountermeasures/

[5] https://www.cmfclearinghouse.org/

[6] https://www.nhtsa.gov/sites/nhtsa.gov/files/2021-09/Countermeasures-10th_080621_v5_tag.pdf

provided in the Appendix. Additional sources for infrastructure-based countermeasures are also referenced in the toolbox.

For the development of strategies, the Emphasis Areas were categorized in four broader groups: Vulnerable Users, Risky Behaviors, Infrastructure, and Improved Systems. Each group is described below with the associated Emphasis Areas.

Vulnerable Road Users

Vulnerable road users can be characterized by the amount of protection they have when using the transportation system. For example, pedestrians, bicyclists, and motorcyclists are more exposed than people in vehicles, making them more susceptible to injury in the event of a crash. In Solano County, the proportion of fatal and severe injury crash rates involving vulnerable users are equal to or greater than proportions Statewide.

As a result, the following Emphasis Areas were identified:

- **Pedestrians -** focuses on crashes involving someone walking. Pedestrians are some of the most vulnerable users of a roadway network, and crashes involving pedestrians are more likely to result in a fatal or severe injury. In addition, many younger and older road users travel on foot, which compounds this vulnerability.
- **Bicyclists -** focuses on crashes which involve someone riding a bicycle. Bicyclists are considered vulnerable road users and crashes involving a cyclist typically result in severe injuries. In addition, younger and older road users often travel via bicycle, which compounds this vulnerability.
- **Motorcyclists -** focuses on crashes which involve someone riding a motorcycle. Motorcyclists are vulnerable users, much like bicyclists and pedestrians, because they do not have the protection of an enclosed vehicle. However, unlike bicyclists and pedestrians, motorcyclists travel at vehicular travel speeds. Because of this, crashes involving motorcyclists often result in serious injuries or fatalities.

Risky Behaviors

Reductions in fatalities and serious injuries can be accomplished by deterring unsafe or risky behaviors made by drivers and other transportation users. For this category, no Emphasis Areas were identified for STA.

Table 2 summarizes the goals and strategies for each of these emphasis areas. Additional information on specific countermeasures, treatments, and strategies can be found in the Countermeasure Toolboxes in the Appendix.

TABLE 2. EMPHASIS AREAS, GOALS, AND STRATEGIES FOR VULNERABLE ROAD USERS

EMPHASIS AREA	GOALS	STRATEGIES
	• **Eliminate** fatal and serious injury crashes involving pedestrians **by 2040**.	
	• **Eliminate** fatal and serious injury crashes involving bicyclists **by 2040**.	• Facilitate and fund the identification and implementation of safety projects and programs in Solano County that reduce the rate of crashes involving vulnerable road users
	• **Eliminate** fatal and serious injury crashes involving motorcyclists **by 2040**.	

Infrastructure

Multimodal transportation assets can be constructed or retrofitted to reduce the risk of fatal and serious injury crashes. Opportunities to do this include implementing safety treatments at intersections and along and across roadways. In Solano County, the proportion of fatal and severe injury crash rates involving lane departures and intersections are similar to or greater than proportions Statewide.

As a result, the following Emphasis Areas were identified:

- **Intersections -** focuses on crashes that occur within the functional area of an intersection. Intersections are the primary source of conflicts between road users of all types. Crash severity and patterns vary based on traffic control type, but intersection-related crashes that involve speeding, red-light running, and vulnerable users often result in fatal and serious injuries.
- **Lane Departure -** focuses on crashes that fall within two categories: crashes caused by crossing into the opposing lane and crashes caused by running off the road. These crashes are prone to more severe outcomes and are often associated with risky driver behaviors such as speeding, distraction, and impairment.

Table 3 summarizes the goals and strategies for each of these emphasis areas. Additional information on specific countermeasures, treatments, and strategies can be found in the Countermeasure Toolboxes in the Appendix.

TABLE 3: EMPHASIS AREAS, GOALS, AND STRATEGIES FOR INFRASTRUCTURE

EMPHASIS AREA	GOALS	STRATEGIES
	• **Eliminate** fatal and serious injury crashes at intersections **by 2040**.	• Facilitate and fund the identification and implementation of safety projects and programs in Solano County that reduce the rate of crashes occurring at intersections or resulting in lane departures
	• **Eliminate** fatal and serious injury crashes resulting from lane departure **by 2040**.	

Improved Systems

Improved data collection and management, implementation of emerging technology, and coordination between agencies will all help to improve the process of identifying safety needs and implementing solutions. The specifics of this will be left to the individual member agencies while STA will continue to facilitate the process.

1.5 IMPLEMENTATION AND EVALUATION

This Local Road Safety Plan is the framework for engaging residents, stakeholders, employers, planners, engineers, enforcement agencies, and emergency medical service providers across the County in improving transportation safety in Solano County. As the CMA, STA is responsible for:

- Countywide transportation planning,
- Transportation program funds,
- Managing and providing transportation programs and services,
- Delivering transportation projects, and
- Setting transportation priorities.

The emphasis areas and strategies in this Plan present short-term safety needs and solutions that can be used by stakeholders countywide as funding and implementation opportunities present themselves. STA will continue to facilitate coordination and collaboration efforts to set the stage to evaluate progress on policies, programs, and projects.

Using the goals and strategies in the LRSP, planners and engineers can track and plan for safety on the transportation system by:

- Reviewing past, current, and predicted safety trends – Are trends changing? Are the identified strategies reducing fatal and severe crashes within each emphasis area?

- Revising safety goals and strategies – Have the goals been achieved early, or are they progressing slower than expected? Are the responsible parties implementing the strategies, and if not, what are the barriers to implementation (funding, staff resources, lacking champions)?

- Identifying new projects and strategies to achieve results – Safety research and innovative programs are continually advancing. Are new and more effective strategies available that can be used to better improve safety?

- Monitoring and evaluating system performance – Are systems in place to effectively monitor and evaluate safety throughout the city? Do opportunities exist to improve data collection and accuracy/quality?

COLLABORATION

STA will continue to facilitate collaboration through existing committees and groups, including:

- Project Delivery Working Group (PDWG)
- Technical Advisory Committee (TAC)
- Pedestrian Advisory Committee (PAC)
- Bicycle Advisory Committee (BAC)
- Solano Mobility

These groups will discuss new and ongoing strategy implementations, new strategic and funding opportunities, and barriers to implementation. The purpose of these meetings is to encourage and to maintain communication across stakeholders and provide accountability for implementation. Whenever possible, these meetings should include the representatives from emergency and enforcement services, regional agencies and school districts, and relevant public committees.

INSTITUTIONALIZATION

STA will identify funding sources and opportunities for the priority and systemic projects identified in this LRSP, focused on:

- Federal and State grant opportunities, including OBAG, OTS, HSIP, ATP, and SS4A

- Capital Improvement Projects, such as repaving efforts

- Development Impact Review and Mitigation - new guidance from the Institute of Transportation Engineers presents opportunities for bring the Safe System approach into the development review process: https://www.ite.org/pub/?id=94372DF6-BAB5-AE00-E6D5-471ED4F338CE

EVALUATION

STA will continue to support efforts by City staff to prepare a memo every two years that will summarize crash trends for each city focused on the Emphasis Areas and the stated goals of their current Local Road Safety Plan. This frequency will coincide with the frequency of Caltrans HSIP and ATP funding cycles, allowing the analysis to inform priority projects and funding applications. The memo or findings of the evaluation will be made publicly available to local residents.

The Emphasis Areas and Strategies identified in the Local Road Safety Plan will be re-evaluated every four years as a countywide effort, facilitated by STA, and revised based upon the results of the crash trend analysis.

CHAPTER 2:
BENICIA LOCAL ROAD SAFETY

2.1 INTRODUCTION

Benicia is located in the southern extents of Solano County, along the Interstate-680 (I-680) and Interstate-780 (I-780) corridor, which connects to Vallejo in the west and Fairfield in the north. Based on the United States Census Bureau, Benicia is the third smallest city in Solano County, with a population of 27,131 people as of 2020.

A local road safety plan provides a data- and community-driven framework to systematically identify, analyze and prioritize safety problems and recommend safety improvements on local roads. The following chapter presents the vision statement, summarizes crash data, identifies emphasis areas, recommends high priority project locations, and outlines the implementation and evaluation strategies for the City of Benicia.

VISION STATEMENT

To eliminate fatal and severe injuries on roadways within the City of Benicia by creating an equitable, sustainable, and multimodal transportation system where people of all ages and abilities can travel free from harm.

2.2 CRASH DATA AND TRENDS

DATA SOURCES

This safety analysis used crash data from both the Statewide Integrated Traffic Records System (SWITRS) and Transportation Injury Mapping System (TIMS). The crash data analyzed for this project included all crashes recorded in SWITRS and/or TIMS during the five-year period between January 1, 2016, and December 31, 2020.

Crash Record Data

For this project and most other safety analyses, the crash severity is defined in the Highway Safety Manual (HSM) as follows:

- **Fatal injury:** A crash that results in the death of a person within 30 days of the crash.
- **Severe (incapacitating) injury:** A crash that results in broken bones, dislocation, severe lacerations, or unconsciousness, but not death.
- **Other Visible injury (non-incapacitating):** A crash that results in other visible injuries, including minor lacerations, bruising, and rashes.
- **Possible injury (complaint of pain):** A crash that results in the complaint of non-visible pain/injury, such as confusion, limping, and soreness.
- **Property damage only (PDO):** A crash without injury or complaint of pain but resulting in property damage to a vehicle or other object, commonly referred to as a "fender bender."

The most severe crashes, characterized as KSI (Killed or Severely Injured), and the systemic themes derived from them, are the primary focus of this LRSP.

CRASH TRENDS

Figure 5 provides a heatmap of all the crashes within the Benicia boundary. A high concentration of crashes is located in the southwestern location closer to downtown.

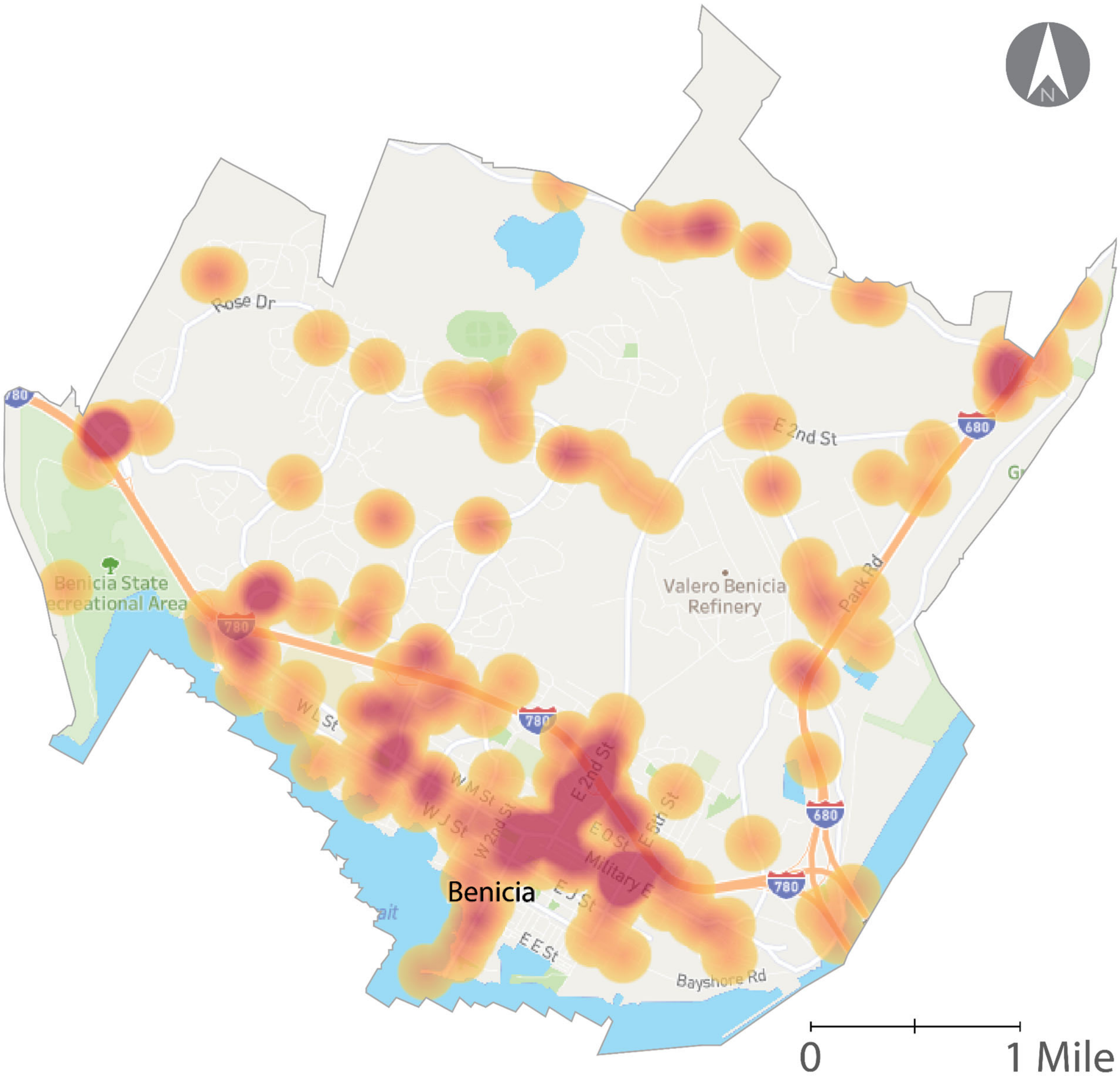


FIGURE 5: HEAT MAP OF ALL NON-INTERSTATE CRASHES WITHIN BENICIA.

MTC also provides a tool that displays the Regional High Injury Network (HIN) for full access roadways[7]. Figure 6 shows the identified Regional HIN in Benicia. Between 2016 and 2020, a total of 226 reported crashes occurred in Benicia, including 4 fatal crashes and 11 severe injury crashes. The following table summarizes key crash statistics that illustrate contextual and behavioral patterns.

[7] https://bayviz.mysidewalk.com/

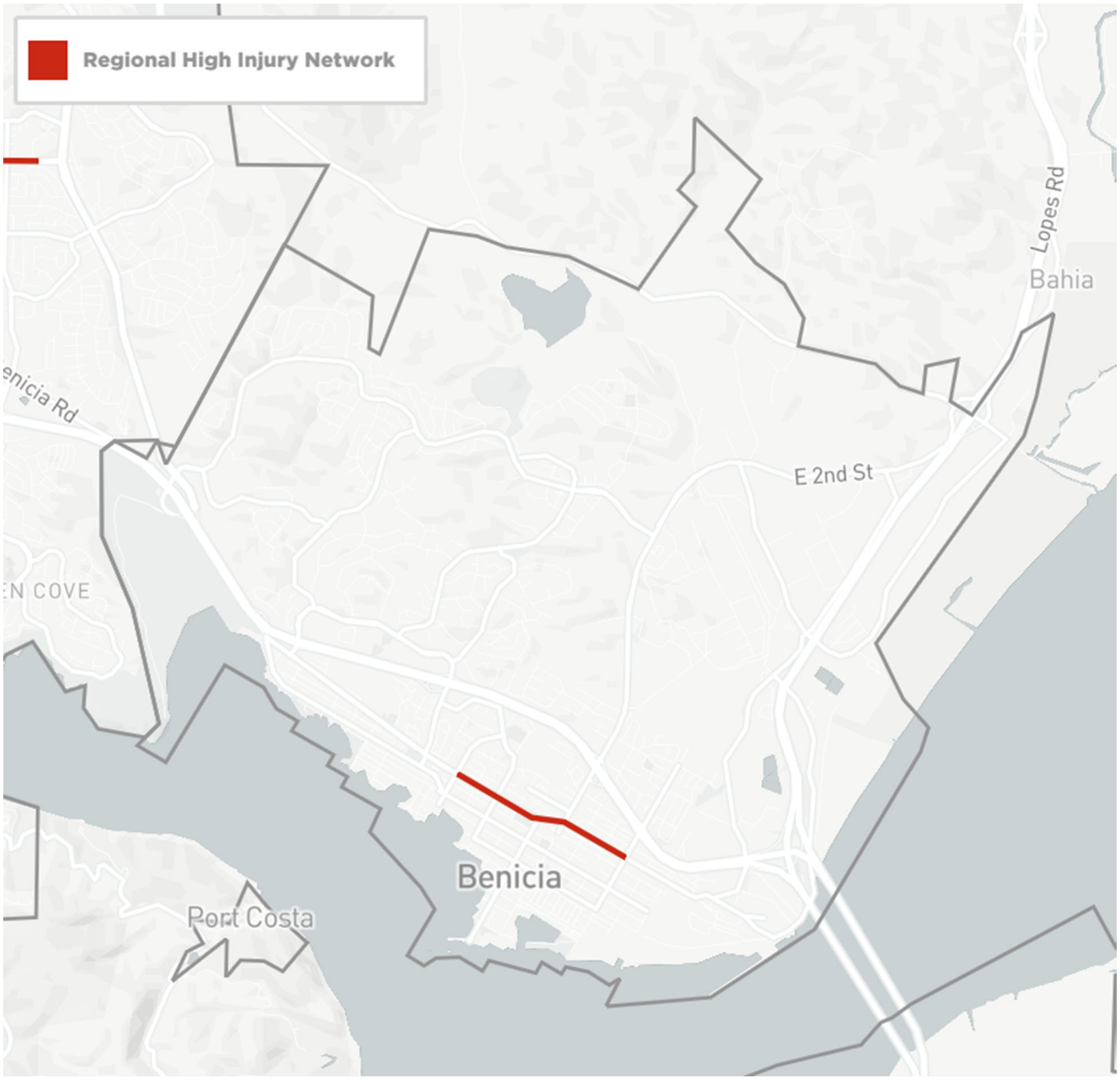


FIGURE 6: REGIONAL HIGH INJURY NETWORK WITHIN BENICIA

TABLE 4: BENICIA SUMMARY OF CRASH STATISTICS

CATEGORY	PROPORTION OF CRASHES	
	All Severities (226 crashes)	Fatal and Severe Crashes (15 crashes)
Pedestrian Involved	16.8%	26.7%
Bicyclist Involved	12.8%	20.0%
Motorcycle Involved	8.0%	33.3%
Alcohol or Drug Involved	7.5%	0.0%
Wet Road Surface	7.1%	13.3%
Speeding Involved	19.5%	46.7%
Lane Departure	38.5%	46.7%
Intersections	71.2%	66.7%

As shown, many of the crash categories are over-represented in fatal and severe injury (KSI) crashes, including pedestrians, bicyclists, motorcyclists, speeding, lane departure, and at intersections. Because the primary focus of a LRSP is to address KSI crash risks, the following sections present key trends related to these high severity crashes.

Physical Environment

Approximately 67% of KSI crashes occurred at intersections, while the remaining 33% occurred on roadway segments (including at driveways). Nearly 20% of all KSI crashes occurred during dark conditions.

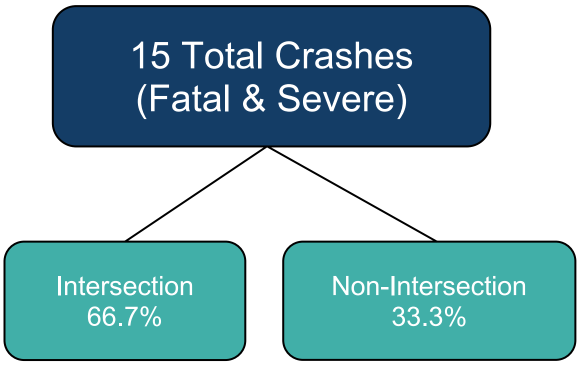


FIGURE 7: KSI LOCATION CRASH TREE

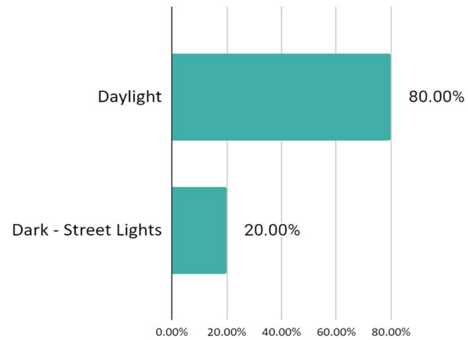


FIGURE 8: KSI LIGHTING CONDITIONS

Crash Types

Crash types provide insights into common conflicts that exist between road users. As shown in Figure 9, the three most common crash types resulting in fatalities or severe injuries are overturned (27%), pedestrian (27%), and hit object (20%). Other vulnerable road users, including bicycle-involved and motorcycle-involved crashes, are not specifically identified on this chart as any non-pedestrian crash is assigned to a crash type (e.g., a right-angle crash between a vehicle and bicycle would be coded as a broadside, and involvement of the bicyclists is noted in a separate field in the crash record). As shown previously in Table 4, 33% of KSI crashes involved a motorcyclist and 20% involved a bicyclist.

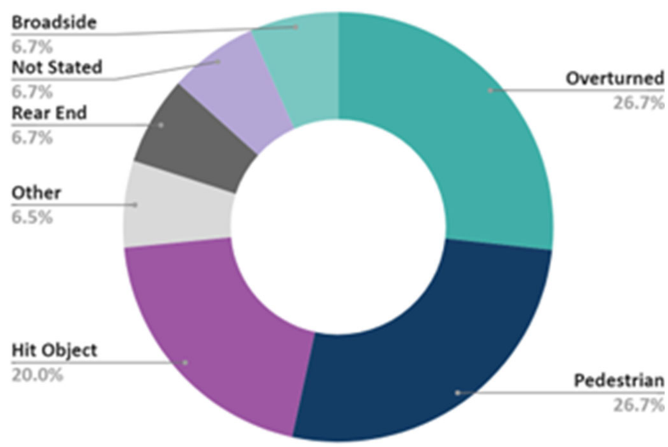


FIGURE 9: KSI CRASH TYPES

Contributing Factors

Primary contributing factors and violation categories can provide insights into human behavior associated with a crash. As shown in Figure 10, the most common violations reported in fatal and severe injury crashes were unsafe speed (47%) and improper passing (20%). Note that roadway design contributing factors are not included on a collision report, so the comparable role of design and behavior, and how those relate, cannot be determined based on a collision report alone.

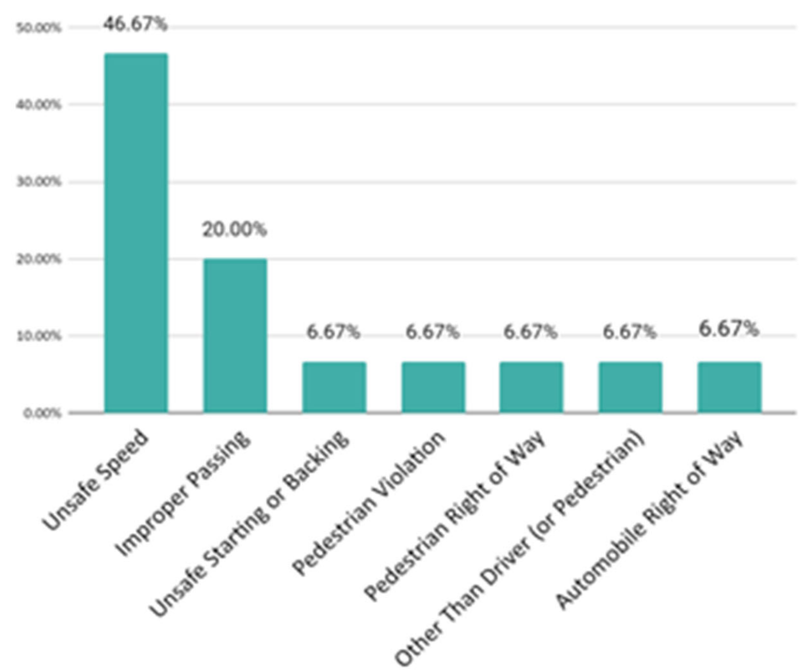


FIGURE 10: KSI PRIMARY VIOLATION CATEGORY

2.3 EMPHASIS AREAS

Emphasis Areas provide a strategic framework for developing and implementing strategies and actions for the LRSP. The Emphasis Areas were developed, using the results of crash data analysis and input from staff and stakeholders. For each emphasis area, quantitative crash reduction goals were identified to provide a metric to evaluate the ongoing effectiveness of project implementation, programs, and policies. The goal to eliminate severe and fatal crashes requires the holistic implementation of the Safe System approach with the use of infrastructure-based and non-infrastructure countermeasures to create redundancies in the roadway system and through education and enforcement practices. A detailed summary and additional sources for infrastructure and non-infrastructure based countermeasures are provided in the Appendix. For the development of strategies, the Emphasis Areas were categorized in four broader groups: Vulnerable Users, Risky Behaviors, Infrastructure, and Improved Systems. Each group is described below with the associated Emphasis Areas.

Vulnerable Road Users

Vulnerable road users can be characterized by the amount of protection they have when using the transportation system. For example, pedestrians, bicyclists, and motorcyclists are more exposed than people in vehicles, making them more susceptible to injury in the event of a crash. Countywide, crashes involving vulnerable users make up 49% of all Fatal or Severe Injury crashes, while in Benicia they make up 80%. Aging drivers and pedestrians can also be more vulnerable to severe injuries when a crash occurs. In Benicia, children under 18 riding bikes are over-represented in fatal or severe crashes (34%) as compared to their proportion of the population (20% of Benicia residents are under 18 years old).

For this group, the following Emphasis Areas were identified:

- **Pedestrians -** focuses on crashes involving someone walking. Pedestrians are some of the most vulnerable users of a roadway network, and crashes involving pedestrians are more likely to result in a fatal or severe injury. In addition, many younger and older road users travel on foot, which compounds this vulnerability.
- **Bicyclists -** focuses on crashes which involve someone riding a bicycle. Bicyclists are considered vulnerable road users and crashes involving a cyclist typically result in severe injuries. In addition, younger and older road users often travel via bicycle, which compounds this vulnerability.
- **Motorcyclists -** focuses on crashes which involve someone riding a motorcycle. Motorcyclists are vulnerable users, much like bicyclists and pedestrians, because they do not have the protection of an enclosed vehicle. However, unlike bicyclists and pedestrians, motorcyclists travel at vehicular travel speeds. Because of this, crashes involving motorcyclists often result in serious injuries or fatalities.

Consideration of Location Types. Pedestrian-involved crashes tend to occur most often in downtown core areas, consistent with higher pedestrian activity. High-volume signalized intersections can increase pedestrian crash risk due to complexities resulting from multiple types of road users (pedestrians, bicyclists, passenger vehicles, buses, trucks) and heavy turning movements at the location. Motorcyclist-involved collisions occur system-wide, and often involve high speeds of either the motorcyclist, other vehicle, or both.

Following the Safe System approach, Table 5 summarizes the goals and strategies for each of these emphasis areas. Additional information on specific countermeasures, treatments, and strategies can be found in the Countermeasure Toolboxes in the Appendix.

TABLE 5: EMPHASIS AREAS, GOALS, AND STRATEGIES FOR VULNERABLE ROAD USERS

EMPHASIS AREA	GOALS	STRATEGIES
	• Reduce the proportion of fatal and serious injury crashes involving pedestrians by **17% by 2035**. • **Eliminate** fatal and serious injury crashes involving pedestrians **by 2040**.	**Safe Roads** • Install engineering countermeasures focused on increasing driver awareness of pedestrians and reducing conflict zones between vehicles and pedestrians • Develop and implement a Construction Accessibility Policy to maintain accessibility during construction and maintenance projects **Safe Road Users** • Improve infrastructure connectivity for pedestrians, especially along safe routes to school, and gap closure within the sidewalk and trail network • Expand safe routes to school programming • Pair education with key engineering and enforcement countermeasures
	• Reduce the proportion of fatal and serious injury crashes involving bicyclists **equivalent to the current proportion (13%) by 2035**. • **Eliminate** fatal and serious injury crashes involving bicyclists **by 2040**.	**Safe Roads** • Install engineering countermeasures focused on increasing driver awareness of bicyclists and reducing conflicts between vehicles and bicyclists • Develop and implement a Construction Accessibility Policy to maintain accessibility during construction and maintenance projects **Safe Road Users** • Improve infrastructure connectivity for bicyclists, especially along safe routes to school • Expand safe routes to school programming • Pair education with key engineering and enforcement countermeasures • Develop a Vision Zero policy to modify LOS standards and parking along preferred bicycle corridors
	• Reduce the proportion of fatal and serious injury crashes involving motorcycles **below the statewide proportion (18%) by 2035**. • **Eliminate** fatal and serious injury crashes involving motorcyclists **by 2040**.	**Safe Roads** • Install engineering countermeasures focused on improving pavement friction on curves and locations with high motorcycle crash frequency **Safe Road Users** • Partner with motorcycle advocacy groups to effectively promote safe behaviors • Pair education with key engineering and enforcement countermeasures

Risky Behaviors

Reductions in fatalities and serious injuries can be accomplished by deterring unsafe or risky behaviors made by drivers and other transportation users. For this category, the following Emphasis Areas were identified:

- **Speeding -** focuses on speeding as a driving behavior that puts the driver and other road users at risk. Speeding not only increases the risk of a crash occurring, but also results in more severe injuries to those involved. Speeding can be addressed with roadway design and management to encourage safe speeds, separate users in space and time, reduce kinetic energy transfer, and manipulate crash angles.

Consideration of Location Types. Fatal and serious injury crashes that involve impairment are often identified on low-volume suburban or rural roads, as impaired drivers may choose to avoid high-volume roads like freeways. This can result in roadway departure crash events at and near horizontal curves. Speed affects both the likelihood of a crash occurring and crash severity, regardless of location. For example, speeding drivers may be more likely to depart the road at a horizontal curve. In a downtown setting, vehicle speed is directly correlated to the injury severity of a pedestrian-involved or bicyclist-involved crash.

Following the Safe System approach, Table 6 summarizes the goals and strategies for this emphasis area. Additional information on specific countermeasures, treatments, and strategies can be found in the Countermeasure Toolboxes in the Appendix.

TABLE 6: EMPHASIS AREAS, GOALS, AND STRATEGIES FOR RISKY BEHAVIORS

EMPHASIS AREA	GOALS	STRATEGIES
	• Reduce the rate of fatal and serious injury crashes resulting from unsafe speeds **below the countywide proportion (19%) by 2035**. • **Eliminate** fatal and serious injury crashes resulting from unsafe speeds **by 2040**.	**Safe Roads** • Install engineering countermeasures focused on designing and improving roadways that lead to more appropriate speeds to the surrounding land uses **Safe Vehicles** • Develop a readiness plan for Connected and Automated Vehicles (CAVs) **Safe Road Users** • Implement high-visibility enforcement campaigns • Partner with local businesses and organizations on educational efforts and campaigns along hot spot corridors **Safe Speeds** • Use recent legislation and national research to set context-appropriate speeds suitable for all road users • Implement a safe speeds education campaign **Other** • Coordinate with STA to implement data management strategies and better monitor system safety performance, including contextual data inventory, crash risk indicators, and crash reporting

Infrastructure

Multimodal transportation assets can be constructed or retrofitted to reduce the risk of fatal and serious injury crashes. Opportunities to do this include implementing safety treatments at intersections and along and across roadways. For this category, the following Emphasis Areas were identified:

- **Intersections -** focuses on crashes that occur within the functional area of an intersection. Intersections are the primary source of conflicts between road users of all types. Crash severity and patterns vary based on traffic control type, but intersection-related crashes that involve speeding, red-light running, and vulnerable users often result in fatal and serious injuries.
- **Lane Departure -** focuses on crashes that fall within two categories: crashes caused by crossing into the opposing lane and crashes caused by running off the road. These crashes are prone to more severe outcomes and are often associated with risky driver behaviors such as speeding, distraction, and impairment.

Consideration of Location Types. Intersection collisions occur most often at 2-way stop controlled and signalized locations. The severity of intersection crashes may be more likely in higher-speed environments (e.g., suburban, rural). Lane departure crashes are often assumed to only occur in rural areas, but lane departures can also be problematic in downtown areas due to the close proximity of roadside fixed objects (e.g., utility poles, mailboxes, vegetation).

Following the Safe System approach, Table 7 summarizes the goals and strategies for each of these emphasis areas. Additional information on specific countermeasures, treatments, and strategies can be found in the Countermeasure Toolboxes in the Appendix.

TABLE 7: EMPHASIS AREAS, GOALS, AND STRATEGIES FOR INFRASTRUCTURE

EMPHASIS AREA	GOALS	STRATEGIES
	• Reduce the rate of fatal and serious injury crashes occurring at intersections by **50% by 2035**. • **Eliminate** fatal and serious injury crashes at intersections **by 2040**.	**Safe Roads** • Install engineering countermeasures focused on increasing visibility and driver awareness of intersections, reducing conflicts between road users, and improving signal operations **Safe Vehicles** • Develop a readiness plan for Connected and Automated Vehicles (CAVs) **Safe Road Users** • Implement high-visibility enforcement campaigns **Safe Speeds** • Use recent legislation and national research to set context-appropriate speeds suitable for all road users • Implement a safe speeds education campaign

EMPHASIS AREA	GOALS	STRATEGIES
		• Implement automated speed enforcement **Other** • Coordinate with STA to implement data management strategies and better monitor system safety performance, including contextual data inventory, crash risk indicators, and crash reporting
	• Reduce the rate of fatal and serious injury crashes resulting from lane departure by **50% by 2035**. • **Eliminate** fatal and serious injury crashes resulting from lane departure **by 2040**.	**Safe Roads** • Install engineering countermeasures focused on increasing road/lane awareness and providing more roadside recovery opportunities **Safe Vehicles** • Develop a readiness plan for Connected and Automated Vehicles (CAVs) **Safe Road Users** • Implement high-visibility enforcement campaigns **Safe Speeds** • Use recent legislation and national research to set context-appropriate speeds suitable for all road users • Implement a safe speeds education campaign **Other** • Coordinate with STA to implement data management strategies and better monitor system safety performance, including contextual data inventory, crash risk indicators, and crash reporting

Emerging Technology

New and innovative technological advances can help improve current safety practices. Table 8 highlights some of the goals and strategies for emerging technology.

TABLE 8: GOALS AND STRATEGIES FOR EMERGING TECHNOLOGY

GOALS	STRATEGIES
• Maintain and build awareness of how emerging technology solutions can improve understanding of crash trends and user safety. • Identify and fund pilot programs for effective technology solutions for increasing safety (e.g. near miss analytics, crash analytics dashboards). • Build and maintain a comprehensive citywide crash and inventory database.	• Contextual Data Inventory – Vendors such as Mapillary and Ecopia provide up-to-date data on transportation infrastructure, including roadway characteristics, intersection characteristics, and signs. Updated inventory can help City staff identify project synergies, such as including a safety countermeasure with a repaving project and support systemic safety analysis for future safety plans and evaluations. • Crash Risk Indicators - Surrogate safety measures, such as "near-miss" crashes, hard braking data, speed data, community-reported hazards, and high stress facilities provide an understanding of the safety landscape and enable proactive interventions. Technology such as video data and platforms which provide public crowdsourcing can close the gap and provide key insights regarding near miss data in the absence of crash data. • Crash Reporting **-** Crash reporting practices, such as complete data collection and documentation of road user behavior and infrastructure, can lead to a greater understanding of the holistic safety landscape, and thus lead to improved investments in safety.

COMPLEMENTARY PROGRAMS AND PRACTICES

Crash history and other types of safety data can be advanced to better understand the causes and locations of crashes, leading to effective solutions. One framework is the list of USDOT's data quality attributes: timeliness, accuracy, completeness, uniformity, integration, and accessibility. Training is used to educate planners, engineers, designers, and construction staff about the importance of safety and how to incorporate it into their everyday job responsibilities. This also includes training staff on culturally relevant community engagement. Fully funded, staffed, and trained law enforcement and emergency response agencies can direct their efforts toward keeping users safe and, when crashes do occur, have the resources and systems in place so traffic incident management and emergency medical services personnel are available to respond.

Strategy - Culturally Relevant Community Engagement and Street Safety Ambassador Program – Community engagement is not a one-size-fits-all model. Culturally relevant community engagement strategies can help education and programming around traffic safety reach a larger audience and be more impactful by making materials readable for all and meeting the community where they are.

Strategy - Rapid Response Safety Communication Protocol and Multi-Disciplinary Team - An internal, multi-department communication strategy should be deployed in response to severe and fatal crashes. This includes immediate on-the ground-response to an investigation of severe and

fatal crashes, ensuring a multi-disciplinary response team focused both on the behavioral and engineering elements of a crash. This team also supports timely data sharing among City departments, ensures data accuracy, and develops near-term interventions.

Strategy - Victim and Family Support - Post-crash care includes providing resources to both the victim, their friends, and their families. To ensure a crash survivor receives the care needed to recover and restore body and mind to an active life within society, they require medical rehabilitation with specialists that can range from orthopedics, neurosurgery, physical and occupational therapy, and prosthetics to psychology and neuropsychology. Resources for crash survivors, their family, and friends, can be found on Solano County Behavioral Health Services' website: https://www.solanocounty.com/depts/mhs/default.asp

2.4 HIGH PRIORITY LOCATIONS AND PROJECTS

With a focus on fatal and severe injury crashes, the project team identified locations within the City of Benicia that experienced a high frequency or severity of crashes. Once the high-crash locations were identified, each location was scored (or ranked) based on the following metrics.

- **In 2018 Plan?** This identifies whether a safety project was listed at this location in the 2018 Solano County Travel Safety Plan.
- **KSI Crashes.** The number of crash events resulting in a fatality or severe injury at this location.
- **Total Crashes.** The total number of crashes reported and verified to be related to this location.
- **EPDO Score.** The EPDO score, described previously, provides a weighted ranking that accounts for the number and severity of crashes at each location.
- **Number of Emphasis Areas (EAs).** This is the number of EAs that are reflected in the details of the reported crashes at this location.

Within Benicia, 12 high crash locations were identified, which are summarized in Table 9 and shown on Figure 11. A one-page summary of each location is also provided, which includes an overview of the location, the reported crash patterns, and potential engineering countermeasures. Additional non-infrastructure countermeasures and resources can be found in Appendix A.

TABLE 9: BENICIA HIGH CRASH LOCATIONS

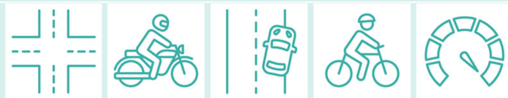
#	LOCATION	IN 2018 PLAN?	KSI CRASHES	TOTAL CRASHES	EPDO SCORE	NUMBER OF EAs (5 max)
1	2nd Street & Riverhill Drive	No	1	6	206	5
2	Military & 1st Street	Yes	1	5	215	3
3	Military W & W 5th Street	No	1	4	183	5

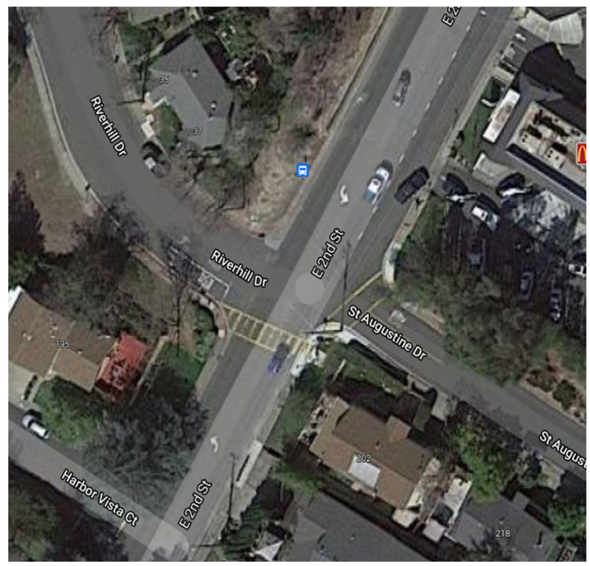
#	LOCATION	IN 2018 PLAN?	KSI CRASHES	TOTAL CRASHES	EPDO SCORE	NUMBER OF EAs (5 max)
4	Riverhill Drive & Bayview Circle	No	1	2	201	2
5	Lake Herman Road & Reservoir Road	No	1	7	165	2
6	L Street & 5th Street	Yes	1	1	190	2
7	K Street & 5th Street	No	1	1	190	3
8	Rose Drive & Morning Glory Drive	No	1	1	190	2
9	Rose Drive & Dempsey Drive	No	1	1	165	4
10	5th Street & Vista Grande Avenue	No	1	1	165	1
11	Lake Herman Road & Goodyear Road	No	1	1	165	4
12	Drolette Way (Military Street to Goettel Court)	Yes	1	2	171	2

FIGURE 11: MAP OF BENICIA HIGH CRASH LOCATIONS

LOCATION 1: 2ND STREET & RIVERHILL DRIVE

REPORT CARD

Priority Ranking	1
EPDO Score	206
Associated Emphasis Areas	
In 2018 Solano Travel Safety Plan?	No
Safety Improvements since 2018?	
Funded HSIP Projects?	No
In Active Transportation Plan?	No



- **Description**: This stop-controlled intersection has four approaches with stop signs on the Riverhill Drive and St Augustine Drive (minor street) approaches. The intersection is primarily surrounded by residential land use with some commercial land use on the northeast corner. There are sidewalks on all approaches and marked pedestrian crosswalks on all approaches and marked crosswalks on the south leg (school crossing) and east leg. There is a significant downgrade on the southbound approach of 2nd Street. There are no marked bicycle facilities.

- **Crash Data**: This intersection had a total of six (6) crashes between 2016 – 2020, including one severe injury crash. The severe injury crash involved a motorcycle that was speeding and overturned; no other vehicles were involved. Of the six crashes that occurred here, one involved a bicycle, 2 involved speeding, 3 resulted in lane departures, and 3 occurred at night.

- **Diagnosis:** The intersection had three crashes that occurred at night. The intersection has poor lighting with only one light provided at the southwest corner. The lane alignment is not well marked on the 2nd Street approaches and may have been a factor in the lane departure crashes.

- **Potential countermeasures**:
  - **NS1:** Install intersection lighting.
  - **NS7:** Upgrade pavement markings, including recessed pavement markers (RPMs) and better lane alignment through the intersection.
  - **R33PB:** Install separated bike lane
  - **R31:** Install edgeline rumble strips/stripes

LOCATION 2: MILITARY & 1ST STREET

REPORT CARD

Priority Ranking	2
EPDO Score	215
Associated Emphasis Areas	  
In 2018 Travel Safety Plan?	Yes
Safety Improvements since 2018?	No
Funded HSIP Projects?	No
In Active Transportation Plan?	No

- **Description**: This signalized intersection has four approaches and is surrounded by commercial and retail land use. There are sidewalks and marked pedestrian crossings on all approaches. There are marked bicycle lanes on Military Street. On-street, parallel parking is present on the west side of 1st Street (south leg). Intersection lighting is present.

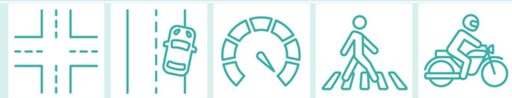
- **Crash Data**: This intersection had five (5) crashes between 2016 – 2020, including one severe injury crash. The severe injury crash occurred when a left-turning vehicle struck a pedestrian in the crosswalk. Of the crashes that occurred at this intersection, two involved pedestrians during the daytime.

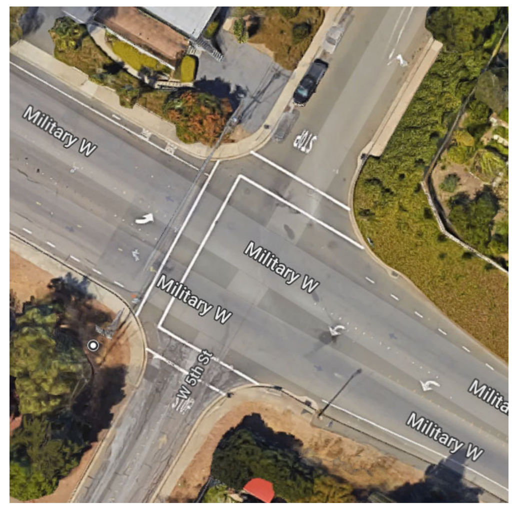
- **Diagnosis:** The two pedestrian crashes involved left-turning vehicles. Currently, the northbound and southbound left turn phasing is permissive. It is recommended that the left turn phasing be updated to protected-permissive; this would require restriping the south leg on 1st Street to a dedicated left turn lane and a shared through-right turn lane.

- **Potential countermeasures**:
    - S2: Install signal visibility upgrades
    - S3: Implement phasing and clearance intervals
    - S4: Install advanced dilemma zone detection
    - S7: Implement protected intersection
    - S21PB: Implement leading pedestrian interval (not applicable if "No Turn When Ped Present" is included with S7)
    - S17PB: Install countdown timers
    - Consider installing high-visibility crosswalks

LOCATION 3: MILITARY W & W 5TH STREET

REPORT CARD

Priority Ranking	3
EPDO Score	183
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	No
Safety Improvements since 2018?	
Funded HSIP Projects?	No
In Active Transportation Plan?	No



- **Description**: This four-leg intersection is stop-controlled with stop signs on the northbound and southbound approaches (W 5th Street). The intersection is surrounded by residential land uses. There are sidewalks on Military W west of the intersection and on 5th Street north of the intersection. There are marked pedestrian crossings on three of the intersection approaches. Marked bicycle lanes are provided on the Military W. There is a significant downgrade southbound on 5th Street through the intersection.

- **Crash Data**: This intersection had four (4) crashes between 2016 – 2020, including one fatal crash. The fatal crash involved a pedestrian in a motorized wheelchair who was struck in the road by a vehicle. Of the four crashes that have occurred here, 1 involved a pedestrian, 1 involved a motorcycle, and 2 occurred in the dark.

- **Diagnosis:** The intersection lighting is poor with street lights provided on two of the four corners. The posted speed is 40 mph. The crosswalk across Military W is wide (5 lanes, 75 feet) and pedestrian visibility at the crosswalk could be improved.

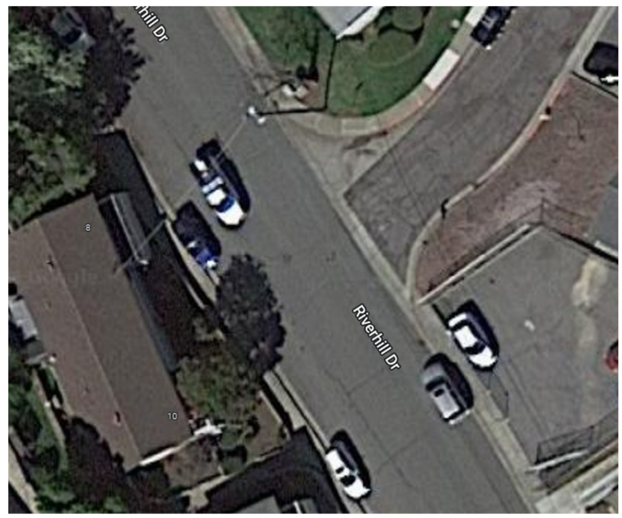
- **Potential countermeasures**:

  - NS1: Install improved intersection street lighting
  - NS20: Install high-visibility crosswalks
  - NS23PB: Install pedestrian hybrid beacon (PHB)
  - NS22PB: Install a rectangular rapid flashing beacon (RRFB)
  - R14: Road diet
  - R34PB: Install sidewalk
  - R35PB: Install/upgrade pedestrian crossing at uncontrolled locations (signs and markings only)
  - Consider marking the missing leg and sharks teeth

LOCATION 4: RIVERHILL DRIVE & BAYVIEW CIRCLE

REPORT CARD

Priority Ranking	4
EPDO Score	201
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	No
Safety Improvements since 2018?	No
Funded HSIP Projects?	No
In Active Transportation Plan?	No



- **Description**: This three-leg intersection is uncontrolled, with Bayview Circle being a one-way (eastbound) loop. The intersection is generally surrounded by residential land uses. There are sidewalks on all approaches. There are no marked pedestrian crosswalks or marked bicycle facilities. There is one street light on the northeast corner.

- **Crash Data**: This intersection had two (2) crashes between 2016 – 2020, including one that resulted in a severe injury. The severe injury crash involved a bicycle that was making a left turn and overturned. It was raining and the pavement was wet, no vehicle was involved. The other crash also involved a bicycle that was struck by a driver making a left turn.

- **Diagnosis:** This intersection is a low-volume neighborhood street with parking permitted on all approaches. The parked vehicles may be hindering sight distance at this intersection. There is also a horizontal and vertical curve north of the intersection on Riverbend Drive that may inhibit visibility for vehicles approaching from the north.

- **Potential countermeasures**:

    - NS2: Convert to all-way stop
    - NS11: Remove obstructions for sightlines
    - NS20: Install marked crosswalks

LOCATION 5: LAKE HERMAN ROAD & RESERVOIR ROAD

REPORT CARD

Priority Ranking	10
EPDO Score	165
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	No
Safety Improvements since 2018?	
Funded HSIP Projects?	No
In Active Transportation Plan?	No

- **Description**: This three-leg intersection is stop-controlled with stop signs on the Reservoir Road approach. The intersection is located in a rural, undeveloped area. There are no sidewalks, bike lanes, pedestrian crossings, or intersection lighting.

- **Crash Data**: There was one crash that occurred at this intersection between 2016 – 2020 that resulted in a fatality. The crash occurred during the daytime when a truck attempted to pass another vehicle and overturned in the process. No other vehicle was involved in the crash.

- **Diagnosis:** Lake Herman Road was recently repaved and improved in 2019; however, the repaving project stopped just east of the intersection. Based on aerial imagery, the intersection appears to be used for spinning "donuts".

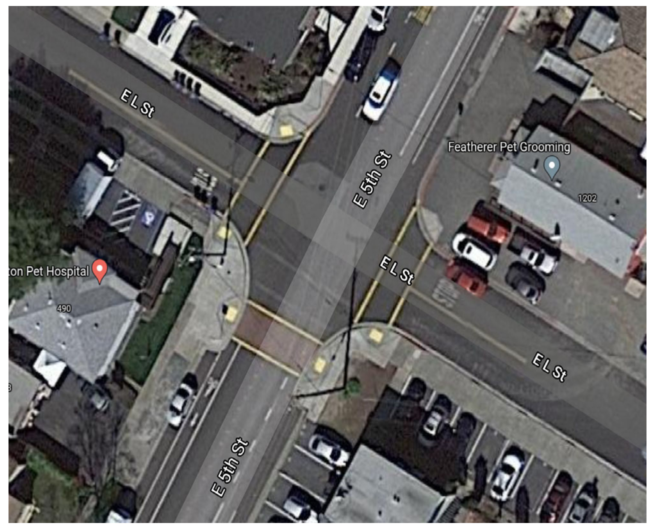
- **Potential countermeasures**:

  - NS6: Install larger or additional intersection warning/regulatory signs
  - NS7: Upgrade intersection pavement markings
  - Consider including in a systemic stop control upgrade project

LOCATION 6: E L STREET & E 5TH STREET

REPORT CARD

Priority Ranking	6
EPDO Score	190
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	Yes
Safety Improvements since 2018?	No
Funded HSIP Projects?	No
In Active Transportation Plan?	No



- **Description**: This four-leg intersection is stop-controlled with stop signs on the E L Street approaches. The surrounding land use is mixed-use. There are sidewalks on all approaches and marked pedestrian crossings on all legs except the north leg. Marked bicycle facilities are provided on E 5th Street. On-street parking is permitted on all four approaches. Intersection lighting is present on the southwest corner.

- **Crash Data**: This intersection had one (1) crash between 2016 – 2020, which resulted in a severe injury. The crash occurred during the daytime when a motorcycle making a left turn sideswiped another vehicle.

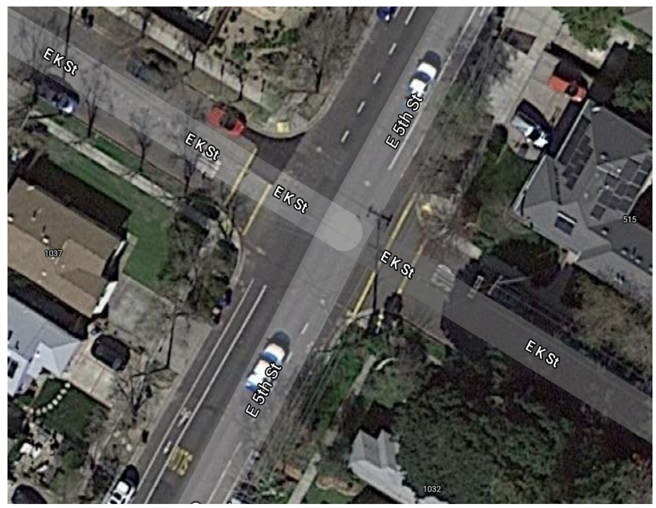
- **Diagnosis:** The sight distance at this intersection could be improved for vehicles making turns from L Street onto 5th Street.

- **Potential countermeasures**:
  - NS2: Convert to all-way stop
  - NS11: Improve sight distance (remove some on-street parking)
  - NS20: Install high-visibility crossing (school crossing) and add missing crosswalk on the fourth leg
  - See Location 7, which is an adjacent intersection

LOCATION 7: E K STREET & E 5TH STREET

REPORT CARD

Priority Ranking	5
EPDO Score	190
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	No
Safety Improvements since 2018?	No
Funded HSIP Projects?	No
In Active Transportation Plan?	Yes



- **Description**: This four-leg intersection is stop-controlled with stop signs on the side street approaches. The surrounding land use is mixed-use with an elementary school located just one block to the south and a high school located one block to the west. There are sidewalks on all approaches and marked pedestrian crossings across K Street. Marked bicycle lanes are provided on E 5th Street. Parking is permitted on all four approaches. Intersection lighting is present on the southeast corner.

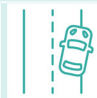
- **Crash Data**: This intersection had one (1) crash between 2016 – 2020, which resulted in a severe injury. The crash occurred during the nighttime when it was raining and a speeding driver struck a pedestrian, who was not in a marked crosswalk.

- **Diagnosis:** This intersection is located in close proximity to an elementary school and high school, and may be a good candidate for enhanced pedestrian crossing treatments.

- **Potential countermeasures**:
  - NS11: Remove obstructions for sightlines
  - NS19PB: Install refuge islands
  - NS20: Install high-visibility crosswalks
  - NS22PB: Install Rectangular Rapid Flashing Beacons (RRFB). Includes upgraded signage and striping as needed. (ADA Ramp in ATP Ped Project)
  - Consider installing advanced yield limit lines
  - See Location 6, which is an adjacent intersection

LOCATION 8: ROSE DRIVE & MORNING GLORY DRIVE

REPORT CARD

Priority Ranking	7
EPDO Score	190
Associated Emphasis Areas	 
In 2018 Travel Safety Plan?	No
Safety Improvements since 2018?	No
Funded HSIP Projects?	No
In Active Transportation Plan?	No

- **Description**: This three-leg intersection is stop-controlled with a stop sign on the Morning Glory Drive approach. The surrounding land use is residential and Matthew Turner Elementary School is located just 500 feet to the east. There are sidewalks on all approaches but no marked pedestrian crossings. Marked bicycle lanes are present on Rose Drive. Ornamental street lighting is present on the southwest corner only.

- **Crash Data**: This intersection had one (1) crash between 2016 – 2020, which resulted in a severe injury. The crash occurred during the daytime when a driver attempted to make an improper passing maneuver and hit a fixed object.

- **Diagnosis:** This crash may have been a result of a vehicle attempting to avoid rear-ending a vehicle waiting to make a left turn onto Morning Glory Drive. Improved signage and striping at the intersection may increase the awareness of drivers on Rose Drive.

- **Potential countermeasures**:

    - NS6: Install larger or additional intersection warning/regulatory signs
    - NS7: Upgrade intersection pavement markings
    - R35PB: Install/upgrade pedestrian crossing at uncontrolled locations (signs and markings only)

LOCATION 9: ROSE DRIVE & DEMPSEY DRIVE

REPORT CARD

Priority Ranking	8
EPDO Score	165
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	No
Safety Improvements since 2018?	No
Funded HSIP Projects?	No
In Active Transportation Plan?	No

- **Description**: This three-leg intersection is an all-way stop-controlled intersection with a dedicated eastbound left turn lane and southbound left turn lane. This intersection is the main access to Matthew Turner Elementary School and Benicia Community Park. There are sidewalks on all approaches and marked school crossings on the west and south legs. Marked bicycle lanes are provided on Rose Drive. Intersection lighting is present on the northeast corner.

- **Crash Data**: This intersection had one (1) crash between 2016 – 2020 and resulted in a fatal crash. The crash occurred during the daytime when a bicycle on Dempsey Drive was struck by a speeding vehicle.

- **Diagnosis:** This crash occurred on Dempsey Drive, which does not currently have bike lanes.

- **Potential countermeasures**:
  - R33PB: Install bike lanes along Dempsey Drive. There appears to be sufficient width for bike lanes, road may only need restriping.

LOCATION 10: 5TH STREET & VISTA GRANDE AVENUE

REPORT CARD

Priority Ranking	12
EPDO Score	165
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	No
Safety Improvements since 2018?	No
Funded HSIP Projects?	No
In Active Transportation Plan?	No

- **Description**: This three-leg intersection is stop-controlled with single lane approaches and a stop sign on the Vista Grande Avenue approach. There is a significant downgrade on Vista Grande Avenue approaching the intersection. The intersection is surrounded by residential land uses. There are sidewalks on the east side of 5th Street and the north side of Vista Grande Avenue. There are no marked pedestrian crossings or marked bicycle facilities at this intersection. Intersection lighting is present on the northwest corner.

- **Crash Data**: This intersection had one (1) crash between 2016 – 2020, which resulted in a severe injury. The crash occurred during the nighttime when a vehicle attempted to illegally pass another vehicle and struck a parked car on the north side of the intersection.

- **Diagnosis:** This intersection is poorly lit with only one light provided on the northwest corner. Improved intersection visibility may improve driver awareness of potential conflicts at the intersection.

- **Potential countermeasures**:

  - NS1: Install lighting
  - NS6: Install intersection warning signs
  - R1: Segment lighting
  - Consider including in a systemic stop controlled intersection upgrade application

LOCATION 11: LAKE HERMAN ROAD & GOODYEAR ROAD

REPORT CARD

Priority Ranking	9
EPDO Score	165
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	No
Safety Improvements since 2018?	No
Funded HSIP Projects?	No
In Active Transportation Plan?	No

- **Description**: This intersection is a four-leg intersection that has stop signs on all approaches. This intersection is in close proximity to the I-680 interchange.
- **Crash Data**: This location had one crash between 2016 – 2020 and it involved a severe injury. The crash occurred during the daytime and was a result of a motorcyclist on Goodyear Road hitting a fixed object while backing up illegally.
- **Diagnosis:** Based on the crash information, there are no feasible recommendations. Images show a concrete barrier is installed all along the road, which is likely what the motorcycle hit. More recent imagery shows that it has been removed.
- **Potential countermeasures**:
  - Consider including in a systemic stop upgrade application.

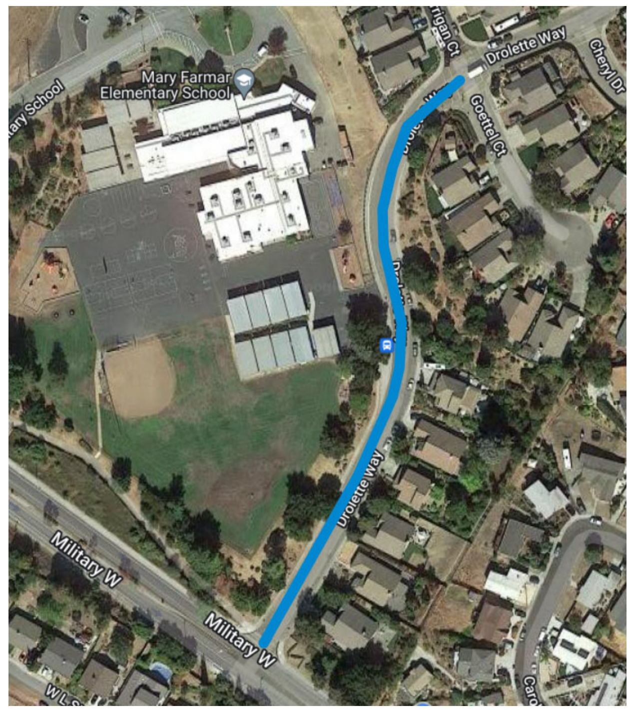
LOCATION 12: DROLETTE WAY (MILITARY W TO GOETTEL COURT)

REPORT CARD

Priority Ranking	11
EPDO Score	171
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	Yes
Safety Improvements since 2018?	No
Funded HSIP Projects?	No
In Active Transportation Plan?	No

- **Description**: This location is the segment of Drolette Way from Military W to Goettel Court (approximately 800 feet). This location is primarily surrounded by residential land use and is adjacent to the Mary Farmar Elementary School. A public transit stop is located on the west side of the road near the elementary school driveway. Sidewalks and on-street parking are present along the entire corridor. There are no marked bicycle facilities present and sparse street lighting.

- **Crash Data**: This location had two crashes between 2016 – 2020, including one severe injury crash. The severe injury crash occurred during the daytime when a speeding driver struck a pedestrian near the transit bus stop. The other crash also occurred during the daytime and involved a speeding vehicle that hit a parked car.



- **Diagnosis:** Because this segment is located near an elementary school, enhanced pedestrian treatments are recommended here. Based on the crash data, both crashes involved speeding and traffic calming treatments are also recommended along this segment.

- **Potential countermeasures**: These countermeasures align with the recommendations from the 2018 Solano County Travel Safety Plan.
    - NS21PB - Install/upgrade pedestrian crossing at uncontrolled location (with enhanced safety features)
    - R33PB: Install bike lanes
    - Install traffic calming along Drolette Way

HIGH CRASH LOCATIONS IDENTIFIED IN 2020 ACTIVE TRANSPORTATION PLAN

The project team also revisited the pedestrian and bicycle safety corridors identified in the 2020 Solano County Active Transportation Plan. The following corridors have at least one reported fatal or serious injury crash and could be candidate locations for HSIP funded projects.

TABLE 10: CRASHES ON PEDESTRIAN SAFETY CORRIDORS

#	LOCATION	KSI CRASHES	TOTAL CRASHES
1	Military E from E 5th Street to W 3rd Street	1	23
2	1st Street from Military E to W J Street	1	7

TABLE 11: CRASHES ON BICYCLE SAFETY CORRIDORS

#	LOCATION	KSI CRASHES	TOTAL CRASHES
1	E 5th Street from E O St to E J Street	2	13
2	Military E from Hospital Road to Denfield Avenue	2	31

CITYWIDE SYSTEMIC OPPORTUNITIES

Systemic safety solutions are a key component of the Safe System approach, as they address underlying crash risks on a large scale (a corridor, neighborhood, or entire city), including locations with no reported crash history. By treating the known characteristics that are contributing to crashes on a broad scale, a systemic safety project can proactively eliminate crash risks before a crash occurs. Systemic safety solutions are generally low cost treatments that have a proven safety benefit. The following countermeasures (or groups of countermeasures) could be implemented across the city to address the most common crash risks identified thus far.

- **Stop controlled intersection upgrades –** Improve the visibility of stop-controlled intersections by upgrading signing and striping. Upgrades may include: pavement markings, high-visibility stop signs, larger or doubled-up regulatory and warning signs, retroreflective tape on sign posts, and flashing beacons. Countermeasure IDs: NS6, NS7, NS8, NS9

- **Enhanced pedestrian crossing treatments (unsignalized intersection or midblock) –** Improve driver awareness of potential conflicts with vulnerable road users in locations with nearby pedestrian generators (transit stops, commercial/retail and mixed-use land uses, parks, etc.) and along Safe Routes to School. Treatments may include: high-visibility crosswalks, advanced warning signs, curb extensions, median refuge islands, and active warning devices like RRFBs or PHBs, referencing the FHWA STEP Guide for countermeasure selection. Countermeasure IDs: NS19PB, NS20PB, NS21PB, NS22PB, NS23PB, R35PB, R36PB, R37PB. HSIP grants also commonly offer a set-aside for pedestrian crossing treatments.

- **Enhanced pedestrian crossing treatments (signalized intersection) –** Improve driver awareness of potential conflicts with vulnerable road users in locations with nearby pedestrian generators (transit stops, commercial/retail and mixed-use land uses, parks, etc.) and along Safe Routes to School. Treatments may include: high-visibility crosswalks, curb extensions, pedestrian countdown heads, leading pedestrian intervals, medians, right and left turn prohibitions, channelized right turn redesign, lighting improvements, slower pedestrian walking speeds, and protected intersections. Countermeasure IDs: S6/7, S17PB, S18PB, S20PB, S21PB

2.5 IMPLEMENTATION AND EVALUATION

This Local Road Safety Plan is the framework for engaging residents, stakeholders, employers, planners, engineers, enforcement agencies, and emergency medical service providers across the County in improving transportation safety in Benicia. While safety-specific plans and programs are critical to achieving the vision for safety in Benicia, traditional transportation planning, design, operations and maintenance decision making processes, programs, and policies should proactively integrate safety as well. The emphasis areas and strategies in this Plan present short-term safety needs and solutions that can be used by stakeholders countywide as funding and implementation opportunities present themselves. Ongoing coordination and collaboration will enhance implementation efforts and set the stage to evaluate progress on policies, programs, and projects.

Using the goals and strategies in the LRSP, planners and engineers can track and plan for safety on the transportation system by:

- Reviewing past, current, and predicted safety trends – Are trends changing? Are the identified strategies reducing fatal and severe crashes within each emphasis area?
- Revising safety goals and strategies – Have the goals been achieved early, or are they progressing slower than expected? Are the responsible parties implementing the strategies, and if not, what are the barriers to implementation (funding, staff resources, lacking champions)?
- Identifying new projects and strategies to achieve results – Safety research and innovative programs are continually advancing. Are new and more effective strategies available that can be used to better improve safety?
- Monitoring and evaluating system performance – Are systems in place to effectively monitor and evaluate safety throughout the city? Do opportunities exist to improve data collection and accuracy/quality?

COLLABORATION

Benicia will meet with STA and agency partners on a regular basis to discuss new and ongoing strategy implementations, new strategic and funding opportunities, and barriers to implementation. The purpose of these meetings is to encourage and to maintain communication across stakeholders and provide accountability for implementation. Whenever possible, these meetings should include the representatives from emergency and enforcement services, regional agencies and school districts, and relevant public committees.

POLICY SUPPORT

Projects following the Safe System approach may often require tradeoffs to be made between on-street parking, vehicle level of service, and pedestrian and bicycle safety and accessibility, when funding and/or right of way are limited. A Vision Zero policy and Council Resolution in support of this can help clarify how these decisions will be made at a citywide scale rather than on a project-by-project basis. The policy can also support equity goals in the community by precluding unequal opportunities to those with the historically “loudest” voices or most resources for civic participation.

Other complementary policies to this Plan may include a citywide crosswalk policy and transition plan and a speed management policy and program. The Vision Zero Network website provides additional guidance: https://visionzeronetwork.org/where-to-start/

INSTITUTIONALIZATION

In addition to pursuing funding for the priority and systemic projects identified in this LRSP via upcoming grant opportunities, Benicia should consider reactive and project safety project opportunities through:

- Capital Improvement Projects, such as repaving efforts
- Development Impact Review and Mitigation - new guidance from the Institute of Transportation Engineers presents opportunities for bring the Safe System approach into the development review process: https://www.ite.org/pub/?id=94372DF6-BAB5-AE00-E6D5-471ED4F338CE

EVALUATION

Benicia will prepare a memo every two years that will summarize crash trends for the city focused on the Emphasis Areas and the stated goals of the current Local Road Safety Plan. This frequency will coincide with the frequency of Caltrans HSIP and ATP funding cycles, allowing the analysis to inform priority projects and funding applications. The memo or findings of the evaluation will be made publicly available to local residents.

The Emphasis Areas and Strategies identified in the Local Road Safety Plan will be re-evaluated every four years as a countywide effort, facilitated by STA, and revised based upon the results of the crash trend analysis.

CHAPTER 3:
DIXON LOCAL ROAD SAFETY

3.1 INTRODUCTION

Dixon is the northern most city in Solano County, along the Interstate-80 (I-80) corridor, which connects to Sacramento and Vacaville. Based on the United States Census Bureau, Dixon is the second smallest city in Solano County, with a population of 20,106 people as of 2020.

A local road safety plan provides a data- and community-driven framework to systematically identify, analyze and prioritize safety problems and recommend safety improvements on local roads. The following chapter presents the vision statement, summarizes crash data, identifies emphasis areas, recommends high priority project locations and outlines the implementation and evaluation strategies for the City of Dixon.

VISION STATEMENT

The City of Dixon aspires to reduce or eliminate fatal and severe injuries on roadways within the City of Dixon by creating an equitable, sustainable, and multimodal transportation system for people of all ages and abilities.

3.2 CRASH DATA AND TRENDS

DATA SOURCES

This safety analysis used crash data from the Statewide Integrated Traffic Records System (SWITRS), Transportation Injury Mapping System (TIMS), and the local Crossroads crash database. The crash data analyzed for this project included all geolocated crashes during the five-year period between January 1, 2016, and December 31, 2020.

Crash Record Data

For this project and most other safety analyses, the crash severity is defined in the Highway Safety Manual (HSM) as follows:

- **Fatal injury:** A crash that results in the death of a person within 30 days of the crash.
- **Severe (incapacitating) injury:** A crash that results in broken bones, dislocation, severe lacerations, or unconsciousness, but not death.
- **Other Visible injury (non-incapacitating):** A crash that results in other visible injuries, including minor lacerations, bruising, and rashes.
- **Possible injury (complaint of pain):** A crash that results in the complaint of non-visible pain/injury, such as confusion, limping, and soreness.
- **Property damage only (PDO):** A crash without injury or complaint of pain but resulting in property damage to a vehicle or other object, commonly referred to as a "fender bender."

The most severe crashes, characterized as KSI (Killed or Severely Injured), are the primary focus of this LRSP.

CRASH TRENDS

Figure 12 provides a heatmap of all the non-interstate crashes within the Dixon boundary, where a high concentration of crashes are located along A St and N 1st St.

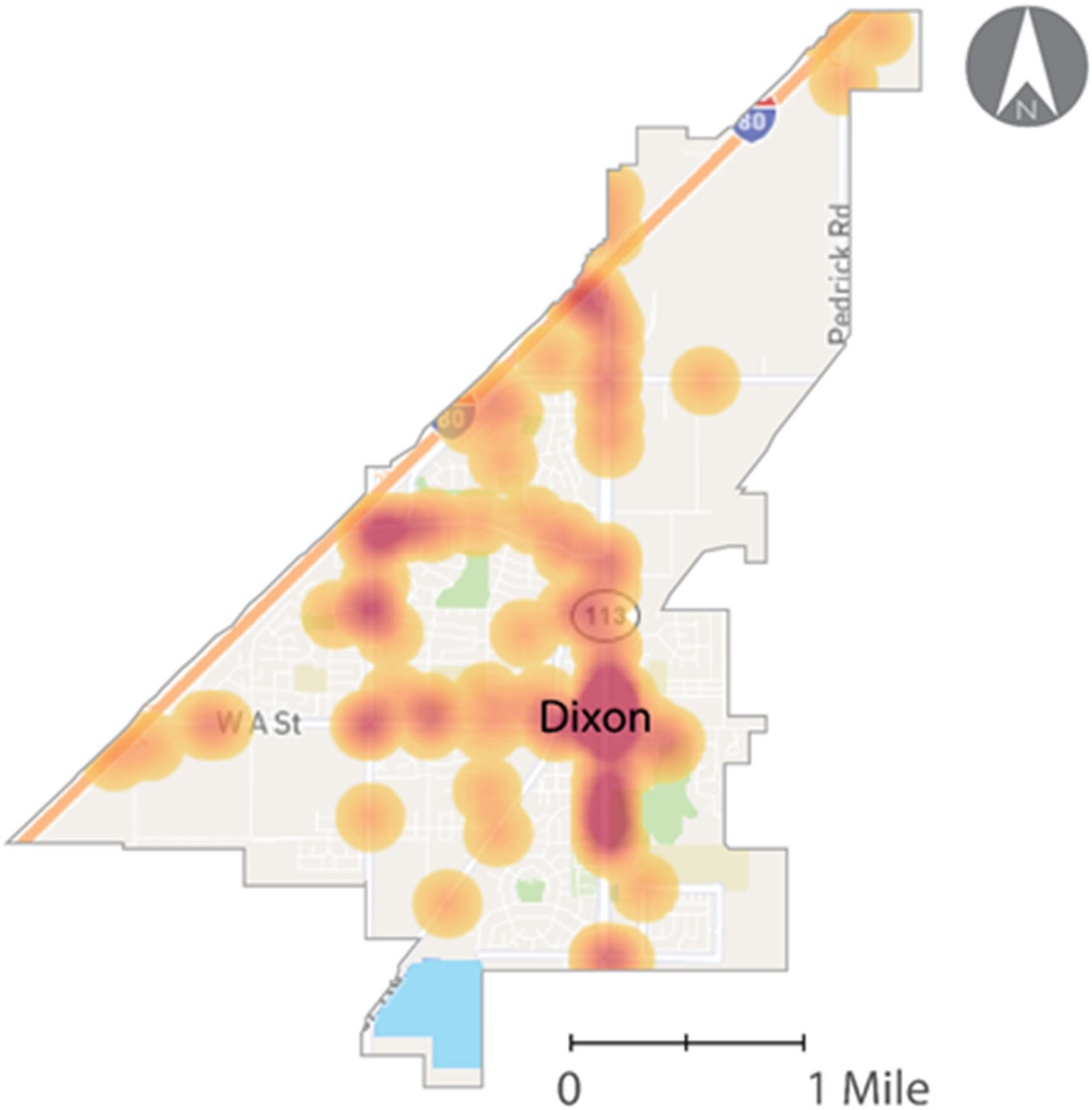


FIGURE 12: HEAT MAP OF ALL NON-INTERSTATE CRASHES WITHIN DIXON

MTC also provides a tool that displays the Regional High Injury Network (HIN) for full access roadways[8]. Figure 13 shows the identified Regional HIN in Dixon. Between 2016 and 2020, a total of 125 reported crashes occurred in Dixon, including 3 fatal crashes and 13 severe injury crashes. The following table summarizes key crash statistics that illustrate contextual and behavioral patterns.

[8] https://bayviz.mysidewalk.com/

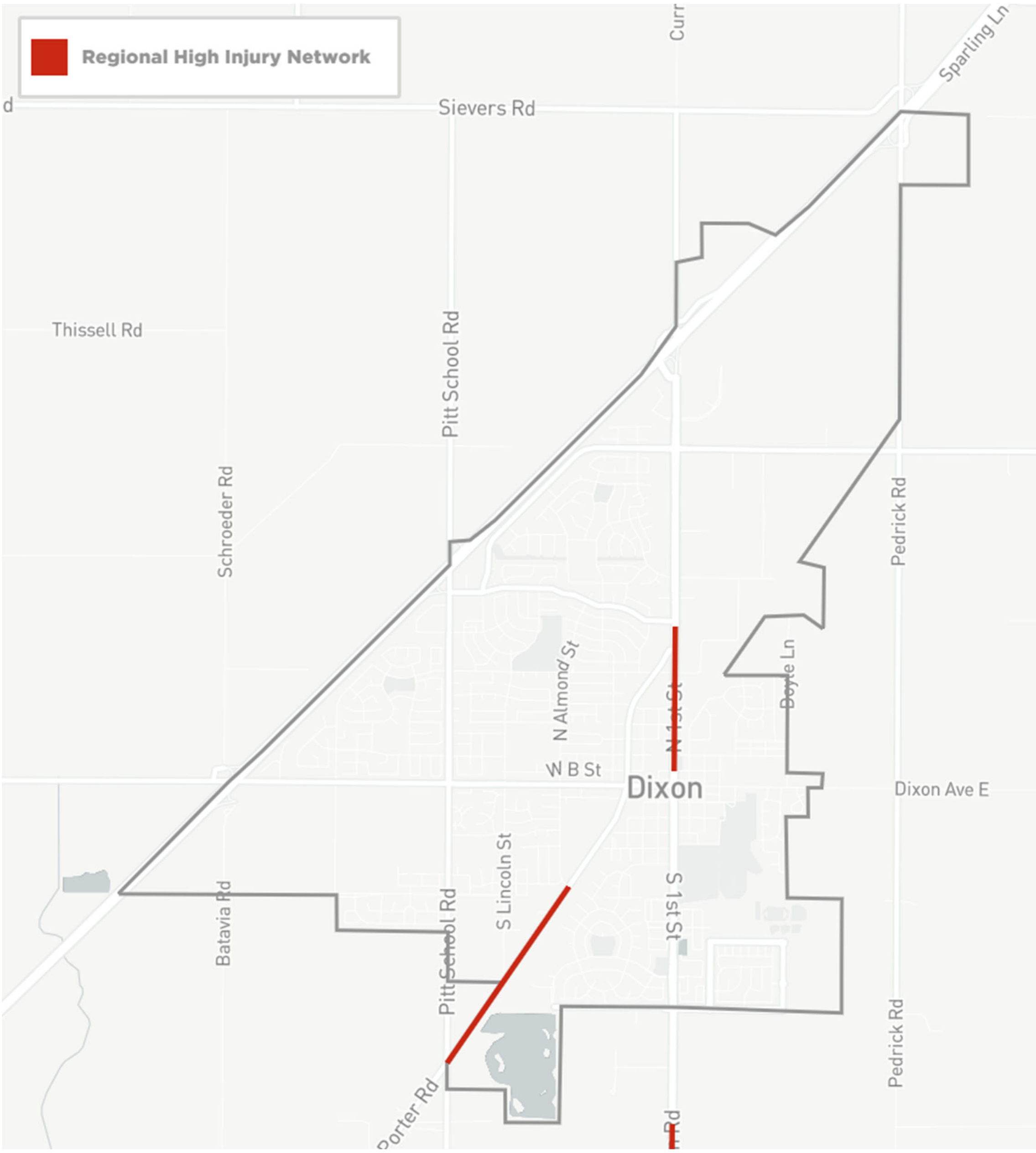


FIGURE 13: REGIONAL HIGH INJURY NETWORK WITHIN DIXON

TABLE 12: DIXON SUMMARY OF CRASH STATISTICS

CATEGORY	PROPORTION OF CRASHES	
	All Severities (125 crashes)	Fatal and Severe Crashes (16 crashes)
Pedestrian Involved	10.4%	25.0%
Bicyclist Involved	8.8%	6.3%
Motorcycle Involved	6.4%	25.0%
Alcohol or Drug Involved	11.2%	31.3%
Wet Road Surface	8.8%	6.3%
Speeding Involved	20.8%	12.5%
Lane Departure	35.2%	43.8%
Intersections	76.0%	62.5%

As shown, many of the crash categories are over-represented in fatal and severe injury (KSI) crashes, including pedestrians, motorcyclists, alcohol or drug involved, lane departure and intersections. Because the primary focus of a LRSP is to address KSI crash risks, the following sections present key trends related to these high severity crashes.

Physical Environment

Approximately 62% of KSI crashes occurred at intersections, while the remaining 38% occurred on roadway segments (including at driveways). Half of all KSI crashes occurred in dark, dusk, or dawn conditions.

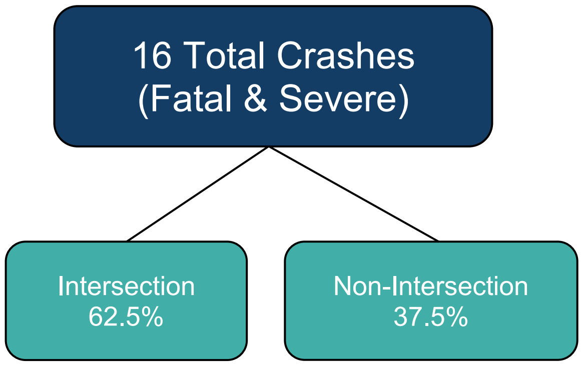


FIGURE 14: KSI LOCATION CRASH TREE

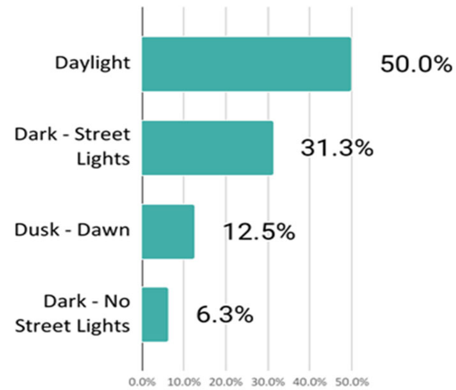


FIGURE 15: KSI LIGHTING CONDITIONS

Crash Types

Crash types provide insights into to common conflicts that exist between road users. As shown in Figure 16, the three most common crash types resulting in fatalities or severe injuries are broadside (31%), pedestrian-involved (25%), and overturned (19%). It should be noted that other vulnerable road users, including bicycle-involved and motorcycle-involved crashes, are not specifically identified on this chart as any non-pedestrian crash is assigned to a crash type (e.g., a right-angle crash between a vehicle and bicycle would be coded as a broadside, and involvement of the bicyclists is noted in a separate field in the crash record). As shown previously in Table 12, 25% of KSI crashes involved a motorcyclist.

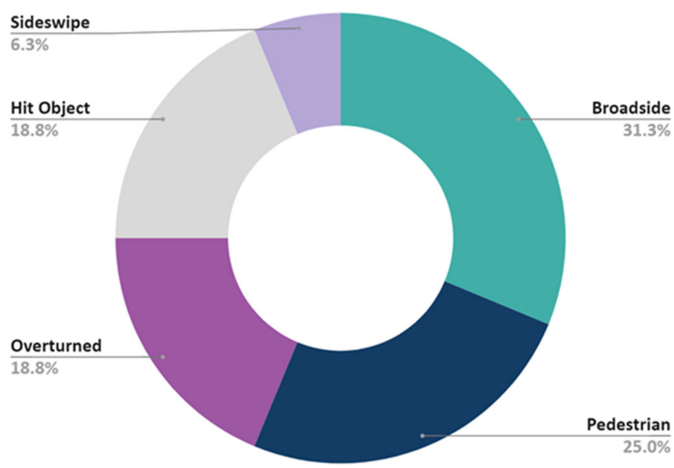


FIGURE 16: KSI CRASH TYPES

Contributing Factors: Traffic Violations

Primary contributing factors and violation categories provide insights into human behavior. As shown in Figure 17, the most common violations reported in fatal and severe injury crashes were improper passing (31%), under the influence of alcohol or drugs (31%) and unsafe speed (12.5%). Note that roadway design contributing factors are not included on a collision report, so the comparable role of design and behavior, and how those relate, cannot be determined based on a collision report alone.

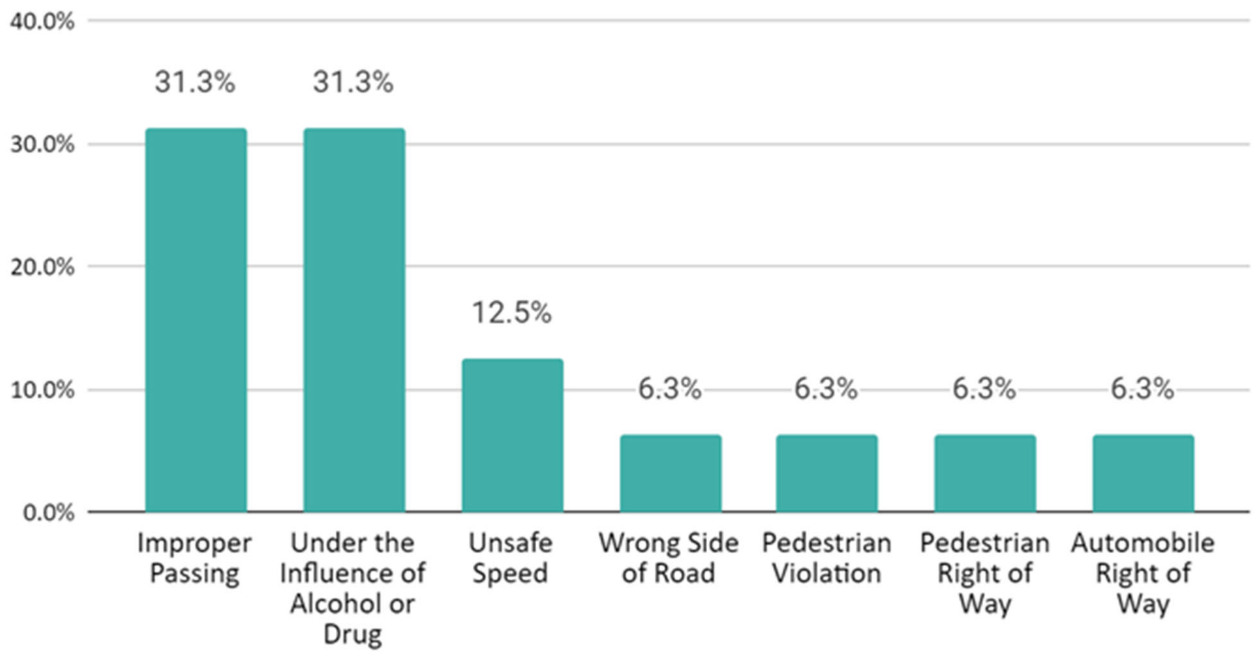


FIGURE 17: KSI PRIMARY VIOLATION CATEGORY

3.3 EMPHASIS AREAS

Emphasis Areas provide a strategic framework for developing and implementing strategies and actions for the LRSP. The Emphasis Areas were developed, using the results of crash data analysis and input from staff and stakeholders. For each emphasis area, quantitative crash reduction goals were identified to provide a metric to evaluate the ongoing effectiveness of project implementation, programs, and policies. The goal to eliminate severe and fatal crashes requires the holistic implementation of the Safe System approach with the use of infrastructure-based and non-infrastructure countermeasures to create redundancies in the roadway system and through education and enforcement practices. A detailed summary and additional sources for infrastructure and non-infrastructure based countermeasures are provided in the Appendix. For the development of strategies, the Emphasis Areas were categorized in four broader groups: Vulnerable Users, Risky Behaviors, Infrastructure, and Improved Systems. Each group is described below with the associated Emphasis Areas.

Vulnerable Road Users

Vulnerable road users can be characterized by the amount of protection they have when using the transportation system. For example, pedestrians, bicyclists, and motorcyclists are more exposed than people in vehicles, making them more susceptible to injury in the event of a crash. Countywide, crashes involving vulnerable users make up 49% of all Fatal or Severe Injury crashes, while in Dixon they make up 56%. Aging drivers and pedestrians can also be more vulnerable to severe injuries when a crash occurs. In Dixon, children under 18 are over-represented in fatal or severe crashes, specifically when riding bicycles (64%) as compared to their proportion of the population (27% of Dixon residents are under 18 years old).

For this group, the following Emphasis Areas were identified:

- **Pedestrians -** focuses on crashes involving someone walking. Pedestrians are some of the most vulnerable users of a roadway network, and crashes involving pedestrians are more likely to result in a fatal or severe injury. In addition, many younger and older road users travel on foot, which compounds this vulnerability.
- **Motorcyclists -** focuses on crashes which involve someone riding a motorcycle. Motorcyclists are vulnerable users, much like bicyclists and pedestrians, because they do not have the protection of an enclosed vehicle. However, unlike bicyclists and pedestrians, motorcyclists travel at vehicular travel speeds. Because of this, crashes involving motorcyclists often result in serious injuries or fatalities.

Consideration of Location Types. Pedestrian-involved crashes tend to occur most often in downtown core areas, consistent with higher pedestrian activity. High-volume signalized intersections can increase pedestrian crash risk due to complexities resulting from multiple types of road users (pedestrians, bicyclists, passenger vehicles, buses, trucks) and heavy turning movements at the location. Motorcyclist-involved collisions occur system-wide, and often involve high speeds of either the motorcyclist, other vehicle, or both.

Following the Safe System approach, Table 13 summarizes the goals and strategies for each of these emphasis areas. Additional information on specific countermeasures, treatments, and strategies can be found in the Countermeasure Toolboxes in the Appendix.

TABLE 13: EMPHASIS AREAS, GOALS, AND STRATEGIES FOR VULNERABLE ROAD USERS

EMPHASIS AREA	GOALS	STRATEGIES
	• **Reduce** the rate of fatal and serious injury crashes involving pedestrians **by 50% 2040**. • **Reduce** the rate of fatal and serious injury crashes involving pedestrians **by 50% by 2040**.	**Safe Roads** • Install engineering countermeasures focused on increasing driver awareness of pedestrians and reducing conflicts between vehicles and pedestrians, and improving pedestrian safety. • Develop and implement a Construction Accessibility Policy to maintain accessibility during construction and maintenance projects • Improve infrastructure connectivity for pedestrians, especially along safe routes to school **Safe Road Users** • Expand safe routes to school programming • Pair education with key engineering and enforcement countermeasures
	• **Reduce** the proportion of fatal and serious injury crashes involving motorcycles **below the Statewide proportion (18%) by 2035**. • **Reduce** the rate of fatal and serious injury crashes involving motorcycles **by 50% by 2040**.	**Safe Roads** • Implement engineering countermeasures focused on improving pavement friction at locations with curves and a high frequency of motorcycle crashes **Safe Road Users** • Coordinate with motorcycle advocacy groups (e.g. ABATE) about ways to effectively promote safe behaviors • Pair education with key engineering and enforcement countermeasures

Risky Behaviors

Reductions in fatalities and serious injuries can be accomplished by deterring unsafe or risky behaviors made by drivers and other transportation users. For this category, the following Emphasis Area was identified:

- **Impairment** - focuses on impairment as a driver behavior that puts the driver and other road suers at risk. Impairment not only increases the risk of a crash occurring, but also results in more severe injuries to those involved.

Consideration of Location Types. Fatal and serious injury crashes that involve impairment are often identified on low-volume suburban or rural roads, as impaired drivers may choose to avoid high-volume roads like freeways. This can result in roadway departure crash events at and near horizontal curves. Speed affects both the likelihood of a crash occurring and crash severity, regardless of location. For example, speeding drivers may be more likely to depart the road at a horizontal curve. In a downtown setting, vehicle speed is directly correlated to the injury severity of a pedestrian-involved or bicyclist-involved crash.

Following the Safe System approach, Table 14 summarizes the goals and strategies for these emphasis areas. Additional information on specific countermeasures, treatments, and strategies can be found in the Countermeasure Toolboxes in the Appendix.

TABLE 14: EMPHASIS AREAS, GOALS, AND STRATEGIES FOR RISKY BEHAVIORS

EMPHASIS AREA	GOALS	STRATEGIES
	• **Reduce** the proportion of fatal and serious injury crashes involving impaired drivers **below the Statewide proportion (28%) by 2035**. • **Reduce** the rate of fatal and serious injury crashes involving impaired drivers **by 50% by 2040.**	**Safe Road Users** • Implement education and public awareness campaigns targeted at specific behaviors • Implement high-visibility enforcement campaigns • Partner with local businesses and organizations on educational efforts and campaigns along hot spot corridors • Facilitate a Safe Ride Home program in partnership with STA, Police Departments, CHP, TNC Operators (e.g., Lyft, Uber), and local businesses

Infrastructure

Multimodal transportation assets can be constructed or retrofitted to reduce the risk of fatal and serious injury crashes. Opportunities to do this include implementing safety treatments at intersections and along and across roadways. For this category, the following Emphasis Areas were identified:

- **Intersections -** focuses on crashes that occur within the functional area of an intersection. Intersections are the primary source of conflicts between road users of all types. Crash severity and patterns vary based on traffic control type, but intersection-related crashes that involve speeding, red-light running, and vulnerable users often result in fatal and serious injuries.
- **Lane Departure -** focuses on crashes that fall within two categories: crashes caused by crossing into the opposing lane and crashes caused by running off the road. These crashes are prone to more severe outcomes and are often associated with risky driver behaviors such as speeding, distraction, and impairment.
- **Dark Conditions -** focuses on crashes that occur during dark, dawn, or dusk conditions. Crashes at night tend to be higher severity due to higher travel speeds (less congestion), increased impairment levels, and reduced visibility of vulnerable road users.

Consideration of Location Types. Intersection collisions occur most often at 2-way stop controlled and signalized locations. The severity of intersection crashes may be more likely in higher-speed environments (e.g., suburban, rural). Lane departure crashes are often assumed to only occur in rural areas, but lane departures can also be problematic in downtown areas due to the close proximity of roadside fixed objects (e.g., utility poles, mailboxes, vegetation).

Following the Safe System approach, Table 15 summarizes the goals and strategies for each of these emphasis areas. Additional information on specific countermeasures, treatments, and strategies can be found in the Countermeasure Toolboxes in the Appendix.

TABLE 15: EMPHASIS AREAS, GOALS, AND STRATEGIES FOR INFRASTRUCTURE

EMPHASIS AREA	GOALS	STRATEGIES
	• **Reduce** the rate of fatal and severe injury crashes occurring at intersections **by 50% by 2035**. • **Reduce** the rate of fatal and severe injury crashes occurring at intersections **by 75% by 2040**.	**Safe Roads** • Implement engineering countermeasures focused on increasing visibility and driver awareness of intersections, reducing conflict zones especially between modes, and improving signal operations **Safe Vehicles** • Develop a readiness plan for Connected and Automated Vehicles (CAVs) **Safe Road Users** • Implement high-visibility enforcement campaigns targeted at impairment and speeding **Safe Speeds**

EMPHASIS AREA	GOALS	STRATEGIES
		• Use recent legislation and national research to set context-appropriate speeds suitable for all road users • Implement a safe speeds education campaign **Other** • Coordinate with STA to implement data management strategies and better monitor system safety performance, including contextual data inventory, crash risk indicators, and crash reporting
	• **Reduce** the rate of fatal and severe injury crashes occurring at intersections **by 50% by 2035.** • **Reduce** the rate of fatal and severe injury crashes occurring at intersections **by 75% by 2040.**	**Safe Roads** • Implement engineering countermeasures focused on improving lane awareness and providing more recovery opportunities **Safe Vehicles** • Develop a readiness plan for Connected and Automated Vehicles (CAVs) **Safe Road Users** • Implement high-visibility enforcement campaigns targeted at impairment and speeding **Safe Speeds** • Use recent legislation and national research to set context-appropriate speeds suitable for all road users • Implement a safe speeds education campaign **Other** • Coordinate with STA to implement data management strategies and better monitor system safety performance, including contextual data inventory, crash risk indicators, and crash reporting
	• **Reduce** the rate of fatal and severe injury crashes occurring at intersections **by 50% by 2035.** • **Reduce** the rate of fatal and severe injury crashes occurring at intersections **by 75% by 2040.**	**Safe Roads** • Install engineering countermeasures focused on improving nighttime infrastructure awareness and decision making **Safe Vehicles** • Develop a readiness plan for Connected and Automated Vehicles (CAVs) **Safe Road Users**

EMPHASIS AREA	GOALS	STRATEGIES
		• Implement high-visibility enforcement campaigns targeted at impairment and speeding **Safe Speeds** • Use recent legislation and national research to set context-appropriate speeds suitable for all road users • Implement a safe speeds education campaign **Other** • Coordinate with STA to implement data management strategies and better monitor system safety performance, including contextual data inventory, crash risk indicators, and crash reporting

Emerging Technology

New and innovative technological advances can help improve current safety practices. Table 16 highlights some of the goals and strategies for emerging technology.

TABLE 16: GOALS AND STRATEGIES FOR EMERGING TECHNOLOGY

GOALS	STRATEGIES
• Maintain and build awareness of how emerging technology solutions can improve understanding of crash trends and user safety. • Identify and fund pilot programs for effective technology solutions for increasing safety (e.g. near miss analytics, crash analytics dashboards). • Build and maintain a comprehensive citywide crash and inventory database.	• Contextual Data Inventory – Vendors such as Mapillary and Ecopia provide up-to-date data on transportation infrastructure, including roadway characteristics, intersection characteristics, and signs. Updated inventory can help City staff identify project synergies, such as including a safety countermeasure with a repaving project and support systemic safety analysis for future safety plans and evaluations. • Crash Risk Indicators - Surrogate safety measures, such as "near-miss" crashes, hard braking data, speed data, community-reported hazards, and high stress facilities provide an understanding of the safety landscape and enable proactive interventions. Technology such as video data and platforms which provide public crowdsourcing can close the gap and provide key insights regarding near miss data in the absence of crash data. • Crash Reporting **-** Crash reporting practices, such as complete data collection and documentation of road user behavior and infrastructure, can lead to a greater understanding of the holistic safety landscape, and thus lead to improved investments in safety.

COMPLEMENTARY PROGRAMS AND PRACTICES

Crash history and other types of safety data can be advanced to better understand the causes and locations of crashes, leading to effective solutions. One framework is the list of USDOT's data quality attributes: timeliness, accuracy, completeness, uniformity, integration, and accessibility. Training is used to educate planners, engineers, designers, and construction staff about the importance of safety and how to incorporate it into their everyday job responsibilities. This also includes training staff on culturally relevant community engagement. Fully funded, staffed, and trained law enforcement and emergency response agencies can direct their efforts toward keeping users safe and, when crashes do occur, have the resources and systems in place so traffic incident management and emergency medical services personnel are available to respond.

Strategy - Culturally Relevant Community Engagement and Street Safety Ambassador Program – Community engagement is not a one-size-fits-all model. Culturally relevant community engagement strategies can help education and programming around traffic safety reach a larger audience and be more impactful by making materials readable for all and meeting the community where they are.

Strategy - Rapid Response Safety Communication Protocol and Multi-Disciplinary Team - An internal, multi-department communication strategy should be deployed in response to severe and fatal crashes. This includes immediate on-the ground-response to an investigation of severe and

fatal crashes, ensuring a multi-disciplinary response team focused both on the behavioral and engineering elements of a crash. This team also supports timely data sharing among City departments, ensures data accuracy, and develops near-term interventions.

Strategy - Victim and Family Support - Post-crash care includes providing resources to both the victim, their friends, and their families. To ensure a crash survivor receives the care needed to recover and restore body and mind to an active life within society, they require medical rehabilitation with specialists that can range from orthopedics, neurosurgery, physical and occupational therapy, and prosthetics to psychology and neuropsychology. Resources for crash survivors, their family, and friends, can be found on Solano County Behavioral Health Services' website: https://www.solanocounty.com/depts/mhs/default.asp

3.4 HIGH PRIORITY LOCATIONS AND PROJECTS

With a focus on fatal and severe injury crashes, the project team identified locations within the City of Dixon that experienced a high frequency or severity of crashes. Once the high-crash locations were identified, each location was scored (or ranked) based on the following metrics.

- **In 2018 Plan?** This identifies whether a safety project was listed at this location in the 2018 Solano County Travel Safety Plan.
- **KSI Crashes.** The number of crash events resulting in a fatality or severe injury at this location.
- **Total Crashes.** The total number of crashes reported and verified to be related to this location.
- **EPDO Score.** The EPDO score, described previously, provides a weighted ranking that accounts for the number and severity of crashes at each location.
- **Number of Emphasis Areas (EAs).** This is the number of EAs that are reflected in the details of the reported crashes at this location.

Within Dixon, there were a total of 8 high crash locations identified, which are summarized in Table 17 and shown on Figure 18. A one-page summary of each location is also provided.

TABLE 17: DIXON HIGH CRASH LOCATIONS (NOT IN PRIORITY ORDER)

#	LOCATION	IN 2018 PLAN?	KSI CRASHES	TOTAL CRASHES	EPDO SCORE	NUMBER OF EAs (5 max)
1	N 1st Street & B Street	No	1	4	403	4
2	S 1st Street & Parkway Blvd	No	1	3	219	4
3	Harvard Drive & College Way	No	1	1	190	5
4	S 2nd Street & E Broadway Street	No	1	1	165	3
5	Stratford Avenue & Parkgreen Drive	No	1	1	165	3
6	Stratford Avenue & Newgate Way	No	1	1	183	2
7	Currey Road & Milk Farm Road	No	1	1	175	4
9	State Route 113 (1st Street)	Partial	3	37	1,081	3

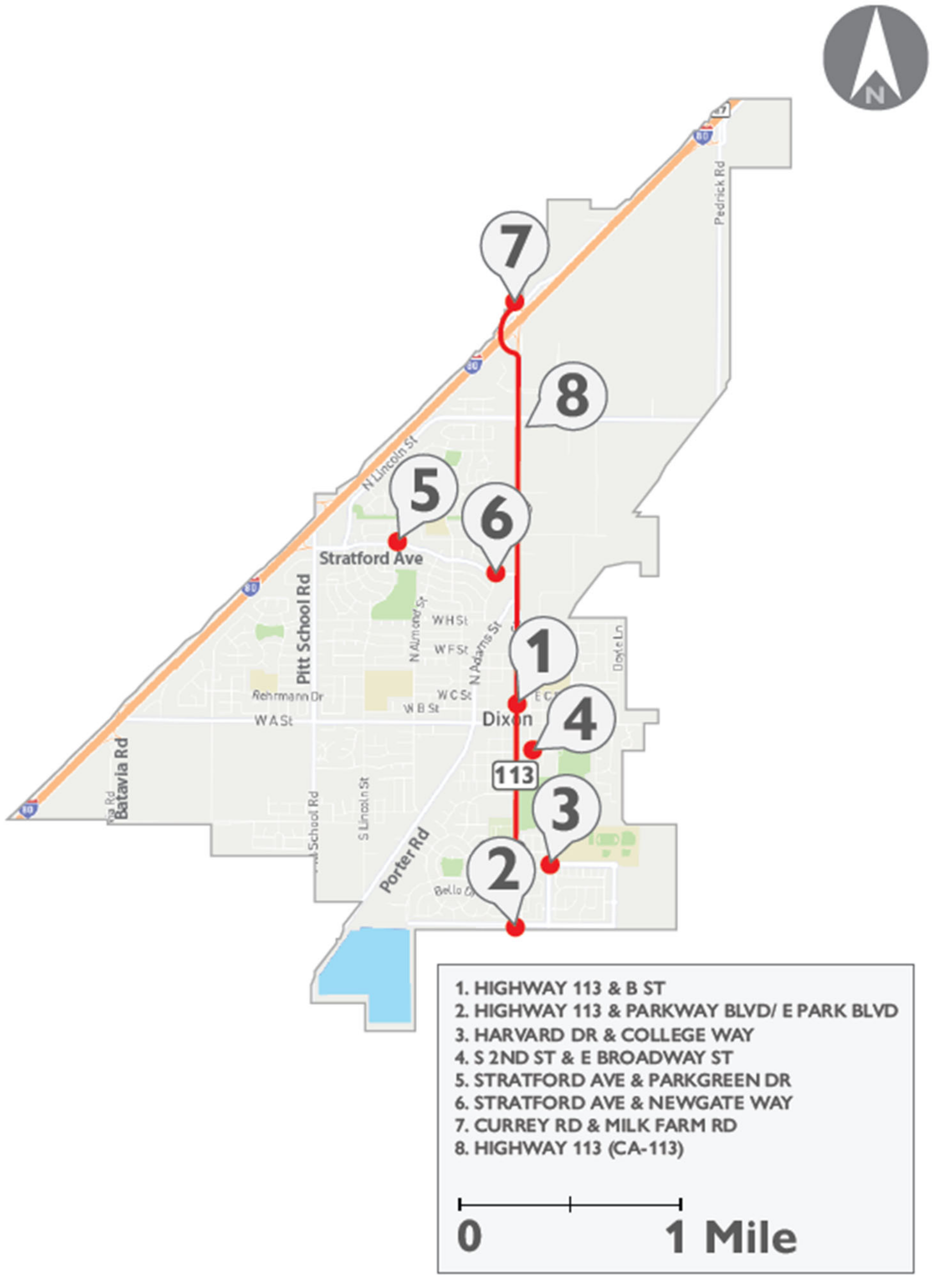


FIGURE 18: MAP OF DIXON HIGH CRASH LOCATIONS

LOCATION 1: N 1ST STREET & B STREET

REPORT CARD

Priority Ranking	1
EPDO Score	403
Associated Emphasis Areas	
In 2018 Solano Travel Safety Plan?	No
Safety Improvements since 2018?	No
Funded HSIP Projects?	No
In Active Transportation Plan?	No

- **Description**: This stop-controlled intersection has four single-lane approaches with a center turn lane on N 1st Street (major street) with stop signs on the B Street (minor street) approaches. The intersection is surrounded by commercial and retail land uses. There are sidewalks on all approaches and marked pedestrian crosswalks on all approaches. In-street "Yield to Pedestrian" signs are present on the N 1st Street approaches. There are no marked bicycle facilities. On-street, parallel parking is present on all four approaches. Ornamental intersection lighting is present.

- **Crash Patterns**: This intersection had a total of four (4) crashes between 2016 – 2020, including one fatal crash involving a pedestrian. The fatal crash involved a hit-and-run incident where a pedestrian was struck in the crosswalk at nighttime. Two of the other three non-fatal crashes involved unsafe vehicle speeds and half of the crashes occurred at nighttime.

- **Diagnosis:** Although this intersection has ornamental lighting, half of the crashes occurred in the nighttime. Lighting could be improved at this location. Pedestrian crossing enhancements could also be installed across N 1st Street to improve visibility and safety. The severity of the crash may provide an opportunity to help fund a broader scope systemic application covering multiple locations.

- **Potential countermeasures**:
  - NS1: Improve intersection lighting. Consider ped-level lighting.
  - NS21PB: Install/upgrade pedestrian crossing at uncontrolled locations (with enhanced safety features)

LOCATION 2: S 1ST STREET & PARKWAY BOULEVARD/PARK BOULVEARD

REPORT CARD

Priority Ranking	2
EPDO Score	219
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	No
Safety Improvements since 2018?	No
Funded HSIP Projects?	No
In Active Transportation Plan?	No

- **Description**: This four-leg intersection is signalized with dual left turn lanes on the north bound and southbound approaches. The intersection is located at the south end of the city limits and is generally surrounded by residential land uses. There are sidewalks on the north side of Parkway Boulevard and on S 1st Street. There are marked pedestrian crossings on three of the intersection approaches. Marked bicycle lanes are provided on the north, east, and west approaches. Intersection lighting is present.

- **Crash Patterns**: This intersection had three (3) crashes between 2016 – 2020, including one that resulted in a severe injury. The severe injury crash occurred during the daytime and involved a left turning vehicle and through vehicle. Alcohol was involved. The other two crashes resulted in possible injuries.

- **Diagnosis:** The east and west approaches are not aligned at this intersection. There are advanced warning signs and flashers on the northbound approach. Based on the crash data, it is recommended that additional signal enhancements be installed to alert drivers to the presence of the signal. The City's South 1st Street Corridor Improvements project recommends installing buffered bicycle lanes on First Street north of Parkway Boulevard.

- **Potential countermeasures**:

    - S2: Improve signal hardware (lenses, backplates, size and number of heads)

    - S3: Improve signal timing and coordination

    - S4: Provide advanced dilemma-zone detection on high speed approaches

LOCATION 3: HARVARD DRIVE & COLLEGE WAY

REPORT CARD

Priority Ranking	3
EPDO Score	190
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	No
Safety Improvements since 2018?	Yes
Funded HSIP Projects?	No
In Active Transportation Plan?	No

- **Description**: This three-leg intersection is stop-controlled with stop signs on all three approaches. The north leg of this intersection is one of two accesses to the Dixon High School. There are sidewalks and marked pedestrian crossings on the east and south legs. Marked bicycle lanes are provided on College Way and Harvard Drive. Ornamental lighting is present.

- **Crash Patterns**: This intersection had one (1) crash between 2016 – 2020, which resulted in a fatality. The crash occurred at nighttime when a vehicle struck a motorcycle in the intersection. Alcohol was involved.

- **Diagnosis:** Although ornamental lighting is present, improved intersection light is recommended here. The severity of the crash may provide an opportunity to help fund a broader scope systemic application covering multiple locations.

- **Potential countermeasures**:
  - NS1 – Improve intersection lighting
  - NS21PB: Install/upgrade pedestrian crossing at uncontrolled locations (with enhanced safety features)

LOCATION 4: S 2ND STREET & E BROADWAY STREET

REPORT CARD

Priority Ranking	6 (tied)
EPDO Score	165
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	No
Safety Improvements since 2018?	No
Funded HSIP Projects?	No
In Active Transportation Plan?	No

- **Description**: This four-leg intersection is stop-controlled with stop signs on the E Broadway Street (minor street) approaches. The surrounding land use is residential. There are sidewalks on all approaches but no marked pedestrian crossings. No marked bicycle facilities are provided. On-street parking is permitted on all four approaches. Intersection lighting is present on one corner of the intersection.

- **Crash Patterns**: This intersection had one (1) crash between 2016 – 2020, which resulted in a severe injury. The crash occurred at dusk when a vehicle struck a pedestrian, who was not in the crosswalk.

- **Diagnosis:** Because this intersection currently has limited lighting and the crash occurred at dusk, it is recommended that improved lighting be installed. The severity of the crash may provide an opportunity to help fund a broader scope systemic application covering multiple locations.

- **Potential countermeasures**:
  - NS1 – Improve intersection lighting (consider pedestrian-level lighting)
  - NS21PB: Install/upgrade pedestrian crossing at uncontrolled locations (with enhanced safety features)

LOCATION 5: STRATFORD AVENUE & PARKGREEN DRIVE

REPORT CARD

Priority Ranking	6 (tied)
EPDO Score	165
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	No
Safety Improvements since 2018?	No
Funded HSIP Projects?	No
In Active Transportation Plan?	No

- **Description**: This four-leg intersection is stop-controlled with stop signs on all four approaches. The surrounding land use is residential. There are sidewalks on all approaches but no marked pedestrian crossings. No marked bicycle facilities are provided. Parking is permitted on all four approaches. No intersection lighting is present.

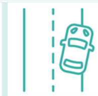
- **Crash Patterns**: This intersection had one (1) crash between 2016 – 2020, which resulted in a severe injury. The crash occurred during the daytime when a speeding vehicle struck a pedestrian, who was not in the crosswalk. Alcohol was involved.

- **Diagnosis:** This crash occurred in the same neighborhood as Location 6 (Stratford Avenue & Newgate Way). Both locations had crashes due to unsafe vehicle speeds.

- **Potential countermeasures**:
    - Neighborhood traffic calming and speed management strategies
    - NS21PB: Install/upgrade pedestrian crossing at uncontrolled locations (with enhanced safety features)

LOCATION 6: STRATFORD AVENUE & NEWGATE WAY

REPORT CARD

Priority Ranking	4
EPDO Score	183
Associated Emphasis Areas	 
In 2018 Travel Safety Plan?	No
Safety Improvements since 2018?	No
Funded HSIP Projects?	No
In Active Transportation Plan?	No

- **Description**: This four-leg intersection is stop-controlled with stop signs on all four approaches. The surrounding land use is mainly residential with commercial land uses to the east. There are sidewalks on all approaches but no marked pedestrian crossings. No marked bicycle facilities are provided. Parking is permitted on all approaches except the westbound approach. Intersection lighting is present on the southwest corner only.

- **Crash Patterns**: This intersection had one (1) crash between 2016 – 2020, which resulted in a severe injury. The crash occurred during the daytime when a speeding vehicle left the roadway and struck a fixed object.

- **Diagnosis:** This crash occurred in the same neighborhood as Location 5 (Stratford Avenue & Parkgreen Drive). Both locations had crashes due to unsafe vehicle speeds.

- **Potential countermeasures**:
    - Neighborhood traffic calming and speed management strategies
    - NS21PB: Install/upgrade pedestrian crossing at uncontrolled locations (with enhanced safety features)

LOCATION 7: CURREY ROAD & MILK FARM ROAD

REPORT CARD

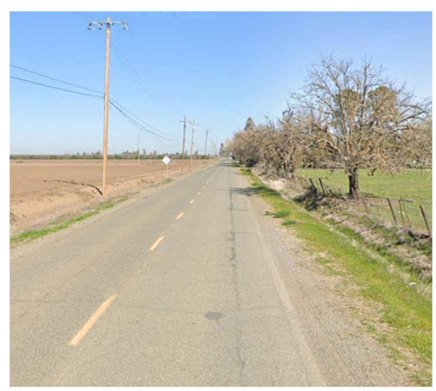
Priority Ranking	5
EPDO Score	175
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	No
Safety Improvements since 2018?	No
Funded HSIP Projects?	No
In Active Transportation Plan?	No

- **Description**: This three-leg intersection is stop-controlled with a stop sign on the Milk Farm Road (minor street) approach. The intersection is located near the I-80 interchange and is surrounded by rural agriculture land uses. There are no sidewalks, marked pedestrian crossings, or bike lanes at this intersection. Intersection lighting is present.

- **Crash Patterns**: There was one (1) crash between 2016 – 2020, which resulted in a severe injury. The crash occurred approximately 400 feet north of the intersection and occurred during the nighttime when a vehicle left the roadway and struck a fixed object. Alcohol was involved.

- **Diagnosis:** The roadway width where the crash occurred is 20 feet with narrow unimproved shoulders. Both sides of the road are flanked by drainage ditches with utility poles on one side, creating an unforgiving roadside.

  There is significant planned development along Milk Farm Road, which will change travel patterns notably in the area. Planned improvements include a traffic control and alignment upgrade, which will improve safety and reduce speeds along Currey Road.



- **Potential countermeasures**:
  - R2 - Remove or relocate fixed objects outside of clear recovery zone
  - R15 - Widen paved shoulder
  - R31 - Install edgeline rumble strips/stripes
  - NS3/NS5 – Install traffic signal or roundabout

LOCATION 8: STATE ROUTE 113 (1ST STREET)

REPORT CARD

Priority Ranking	-
EPDO Score	1,081
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	Partial
Safety Improvements since 2018?	No
Funded HSIP Projects?	No
In Active Transportation Plan?	No

- **Description**: This location is the segment of State Route 113 (CA-113) between Midway Road and Currey Road (approximately 4.1 miles). This segment of CA-113 ranges from two lanes to five lanes and runs north-south through the City of Dixon.

- **Crash Patterns**: This corridor experienced 37 crashes between 2016 – 2020, including one fatal and two severe injury crashes. The fatal crash occurred at B Street and involved a hit-and-run incident where a pedestrian was struck in the crosswalk at nighttime. One of the severe injury crashes occurred at Stratford Avenue at nighttime when a vehicle illegally passed a stopped vehicle using the shoulder of the road and struck a pedestrian walking along the side of the road. The other severe injury crash was a broadside crash at Parkway Boulevard that involved impairment. The most common crash types were rear-end (40%) and broadside (20%).

- **Diagnosis:** Five of the corridor crashes involved a pedestrian, including one fatal and severe injury. Enhanced pedestrian crossings may increase driver awareness of vulnerable road users. Many of the crashes resulted in rear-end crashes and involved unsafe speed. The severity of the crashes may provide an opportunity to help fund a broader scope systemic application covering multiple locations. Additionally, approximately 30% of all crashes occurred at night. The City has identified several future improvements to the corridor as part of their S First Street Corridor Improvement Plan, including the installation of bicycle and pedestrian upgrades such as Class IV bicycle lanes, lighting upgrades, sidewalk infill, a multi-use path, and an RRFB crossing near Cherry Street.

- **Potential countermeasures**:
  - NS1/R1 - Add intersection and segment lighting (consider pedestrian-level lighting)
  - NS6/NS7 - Systemic stop upgrades (larger/additional signs and pavement markings)
  - NS20/21PB/R35PB - Install enhanced pedestrian crossings at uncontrolled locations
  - R32PB/R33PB – Install bicycle lanes or a separated multi-use path
  - Install dynamic speed feedback signs

LOCATIONS IDENTIFIED IN 2021 RAILROAD SAFETY STUDY

The project team also revisited the locations identified in the 2021 Dixon Area Advanced Traffic and Railroad Safety Study. Between 2016-2020, there was one confirmed collision at an at-grade rail crossing that resulted in a fatality. While no additional train-involved collisions were reported during the study period, several collisions were reported in earlier years. Additionally, there are several low severity vehicle crashes in the vicinity of these at-grade rail crossings that may be indirectly related to train events. The following railroad safety projects will provide a safety benefit to pedestrians, bicyclists, and drivers navigating the at-grade rail crossings.

TABLE 18: RAILROAD SAFETY PROJECTS

RAILROAD CROSSING	KSI CRASHES	TYPE OF IMPROVEMENT	RECOMMENDED IMPROVEMENT
PEDRICK ROAD	0	At-Grade	At-grade crossing improvements including striping, signing and enhanced pedestrian and bicycle facilities
		Grade Separation/ Crossing Closure	Grade separation of Pedrick Road is recommended as a long-term solution
VAUGHN ROAD	0	Grade Separation/ Crossing Closure	Vaughn Road realignment and at-grade crossing closure
FIRST STREET	0	At-Grade	Enhanced overhead street lighting near the railroad crossing and enhanced pedestrian crossings on First Street
A STREET	0	At-Grade	At-grade crossing improvements including enhanced pedestrian and bicycle facilities, automatic pedestrian gate arms, enhanced overhead street lighting, wayfinding signage
		Grade Separation/ Crossing Closure	A Street underpass has been studied previously and is preferred by the City as a long-term solution. Note that UPRR no longer allows railroad underpasses as a matter of policy and instead strongly favors overpasses
PITT SCHOOL ROAD	1[a]	At-Grade	The County is currently pursuing at-grade crossing improvements at this location including adding a median on Pitt School Road, realigning the gate arm and restriping the intersection. Additional improvements include upgrading signing and striping to MUTCD standard.
		Grade Separation/ Crossing Closure	Closure of the at-grade crossing, construction of Parkway Boulevard grade separation

[a] Crash is not in the SWITRS or TIMS database, but was confirmed via news articles as a fatal vehicle-train collision in 2017.

HIGH CRASH LOCATIONS IDENTIFIED IN 2020 ACTIVE TRANSPORTATION PLAN

The project team also revisited the pedestrian and bicycle safety corridors identified in the 2020 Solano County Active Transportation Plan. The following corridors have at least one reported fatal or serious injury crash and could be candidate locations for HSIP funded projects.

TABLE 19: CRASHES ON PEDESTRIAN SAFETY CORRIDORS

#	LOCATION	KSI CRASHES	TOTAL CRASHES
1	Highway 113 from W Cherry Street to Vaughn Road	2	29

CITYWIDE SYSTEMIC OPPORTUNITIES

Systemic safety solutions are a key component of the safe system approach, as they address underlying crash risks on a large scale (a corridor, neighborhood, or entire city), including locations with no reported crash history. By treating the known characteristics that are contributing to crashes on a broad scale, a systemic safety project can proactively eliminate crash risks before a crash occurs. Systemic safety solutions are generally low cost treatments that have a proven safety benefit. The following countermeasures (or groups of countermeasures) could be implemented across the city to address the most common crash risks identified thus far.

- **Potential countermeasures**:
  - **Stop controlled intersection upgrades –** Improve the visibility of stop-controlled intersections by upgrading signing and striping. Upgrades may include: pavement markings, high-visibility stop signs, larger or doubled-up regulatory and warning signs, retroreflective tape on sign posts, and flashing beacons. Countermeasure IDs: NS6, NS7, NS8, NS9
  - **Enhanced pedestrian crossing treatments (unsignalized intersection or midblock) –** Improve driver awareness of potential conflicts with vulnerable road users in locations with nearby pedestrian generators (transit stops, commercial/retail and mixed-use land uses, parks, etc.) and along Safe Routes to School. Treatments may include: high-visibility crosswalks, advanced warning signs, curb extensions, median refuge islands, and active warning devices like RRFBs or PHBs, referencing the FHWA STEP Guide for countermeasure selection. Countermeasure IDs: NS19PB, NS20PB, NS21PB, NS22PB, NS23PB, R35PB, R36PB, R37PB. HSIP grants also commonly offer a set-aside for pedestrian crossing treatments.
  - **Enhanced pedestrian crossing treatments (signalized intersection) –** Improve driver awareness of potential conflicts with vulnerable road users in locations with nearby pedestrian generators (transit stops, commercial/retail and mixed-use land uses, parks, etc.) and along Safe Routes to School. Treatments may include: high-visibility

crosswalks, curb extensions, pedestrian countdown heads, leading pedestrian intervals, medians, right and left turn prohibitions, channelized right turn redesign, lighting improvements, slower pedestrian walking speeds, and protected intersections. Countermeasure IDs: S6/7, S17PB, S18PB, S20PB, S21PB

  - **Lighting upgrade** – Install new or supplemental lighting to improve nighttime visibility of intersections and other high-conflict locations. Consider installing pedestrian-level lighting in locations with higher pedestrian and cycling activity, and along Safe Routes to School. Countermeasure IDs: S1, NS1, R1

3.5 IMPLEMENTATION AND EVALUATION

This Local Road Safety Plan is the framework for engaging residents, stakeholders, employers, planners, engineers, enforcement agencies, and emergency medical service providers across the County in improving transportation safety in Dixon. While safety-specific plans and programs are critical to achieving the vision for safety in Dixon, traditional transportation planning, design, operations and maintenance decision making processes, programs, and policies should proactively integrate safety as well. The emphasis areas and strategies in this Plan present short-term safety needs and solutions that can be used by stakeholders countywide as funding and implementation opportunities present themselves. Ongoing coordination and collaboration will enhance implementation efforts and set the stage to evaluate progress on policies, programs, and projects.

Using the goals and strategies in the LRSP, planners and engineers can track and plan for safety on the transportation system by:

- Reviewing past, current, and predicted safety trends – Are trends changing? Are the identified strategies reducing fatal and severe crashes within each emphasis area?
- Revising safety goals and strategies – Have the goals been achieved early, or are they progressing slower than expected? Are the responsible parties implementing the strategies, and if not, what are the barriers to implementation (funding, staff resources, lacking champions)?
- Identifying new projects and strategies to achieve results – Safety research and innovative programs are continually advancing. Are new and more effective strategies available that can be used to better improve safety?
- Monitoring and evaluating system performance – Are systems in place to effectively monitor and evaluate safety throughout the city? Do opportunities exist to improve data collection and accuracy/quality?

COLLABORATION

Dixon will meet with STA and agency partners on a regular basis to discuss new and ongoing strategy implementations, new strategic and funding opportunities, and barriers to implementation. The purpose of these meetings is to encourage and to maintain communication across stakeholders and provide accountability for implementation. Whenever possible, these meetings should include the representatives from emergency and enforcement services, regional agencies and school districts, and relevant public committees.

POLICY SUPPORT

Projects following the Safe System approach may often require tradeoffs to be made between on-street parking, vehicle level of service, and pedestrian and bicycle safety and accessibility, when funding and/or right of way are limited. A Vision Zero policy and Council Resolution in support of this can help clarify how these decisions will be made at a citywide scale rather than on a project-by-project basis. The policy can also support equity goals in the community by precluding unequal opportunities to those with the historically "loudest" voices or most resources for civic participation.

Other complementary policies to this Plan may include a citywide crosswalk policy and transition plan and a speed management policy and program. The Vision Zero Network website provides additional guidance: https://visionzeronetwork.org/where-to-start/

INSTITUTIONALIZATION

In addition to pursuing funding for the priority and systemic projects identified in this LRSP via upcoming grant opportunities, Dixon should consider reactive and project safety project opportunities through:

- Capital Improvement Projects, such as repaving efforts
- Development Impact Review and Mitigation - new guidance from the Institute of Transportation Engineers presents opportunities for bring the Safe System approach into the development review process: https://www.ite.org/pub/?id=94372DF6-BAB5-AE00-E6D5-471ED4F338CE

EVALUATION

Dixon will prepare a memo every two years that will summarize crash trends for the city focused on the Emphasis Areas and the stated goals of the current Local Road Safety Plan. This frequency will coincide with the frequency of Caltrans HSIP and ATP funding cycles, allowing the analysis to inform priority projects and funding applications. The memo or findings of the evaluation will be made publicly available to local residents.

The Emphasis Areas and Strategies identified in the Local Road Safety Plan will be re-evaluated every four years as a countywide effort, facilitated by STA, and revised based upon the results of the crash trend analysis.

CHAPTER 4:
FAIRFIELD LOCAL ROAD SAFETY

4.1 INTRODUCTION

Fairfield is located in the center of Solano County, along the Interstate-80 (I-80) corridor, which connects to Sacramento and Vacaville. Based on the United States Census Bureau, Fairfield is the third largest city in Solano County, with a population of 119,881 people as of 2020.

A local road safety plan provides a data- and community-driven framework to systematically identify, analyze and prioritize safety problems and recommend safety improvements on local roads. The following chapter presents the vision statement, summarizes crash data, identifies emphasis areas, recommends high priority project locations and outlines the implementation and evaluation strategies for the City of Fairfield.

VISION STATEMENT

To reduce fatal and severe injuries on roadways within the City of Fairfield by creating an equitable, sustainable, and multimodal transportation system where people of all ages and abilities can travel free from harm. Reduce traffic crashes and enhance the safety for all users.

4.2 CRASH DATA AND TRENDS

DATA SOURCES

This safety analysis used crash data from both the Statewide Integrated Traffic Records System (SWITRS), Transportation Injury Mapping System (TIMS), and the local Crossroads crash database. The crash data analyzed for this project included all geolocated crashes during the five-year period between January 1, 2016, and December 31, 2020.

Crash Record Data

For this project and most other safety analyses, the crash severity is defined in the Highway Safety Manual (HSM) as follows:

- **Fatal injury:** A crash that results in the death of a person within 30 days of the crash.
- **Severe (incapacitating) injury:** A crash that results in broken bones, dislocation, severe lacerations, or unconsciousness, but not death.
- **Other Visible injury (non-incapacitating):** A crash that results in other visible injuries, including minor lacerations, bruising, and rashes.
- **Possible injury (complaint of pain):** A crash that results in the complaint of non-visible pain/injury, such as confusion, limping, and soreness.
- **Property damage only (PDO):** A crash without injury or complaint of pain but resulting in property damage to a vehicle or other object, commonly referred to as a "fender bender."

The most severe crashes, characterized as KSI (Killed or Severely Injured), are the primary focus of this LRSP.

CRASH TRENDS

Figure 19 provides a heatmap of all the crashes within the Fairfield boundary. There is a high concentration of crashes located along major east-west arterials in the central region of the city, such as Air Base Pkwy, Tabor Ave, Travis Blvd, Texas St, and Beck Ave.

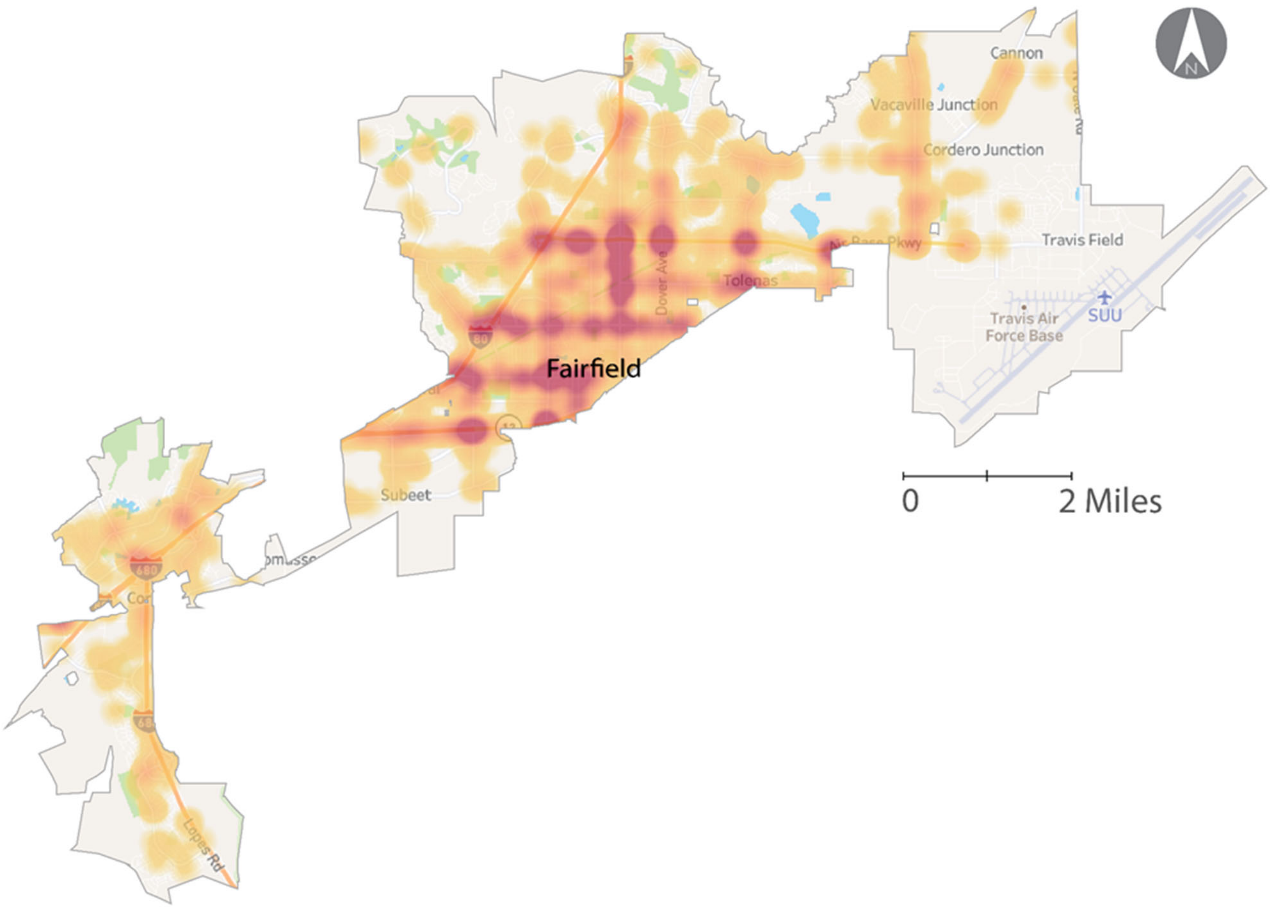


FIGURE 19: HEAT MAP OF ALL NON-INTERSTATE CRASHES WITHIN FAIRFIELD.

MTC also provides a tool that displays the Regional High Injury Network (HIN) for full access roadways[9]. Figure 20 shows the identified Regional HIN in Fairfield. Between 2016 and 2020, a total of 2,313 reported crashes occurred in Fairfield, including 24 fatal crashes and 126 severe injury crashes. The following table summarizes key crash statistics that illustrate contextual and behavioral patterns.

[9] https://bayviz.mysidewalk.com/

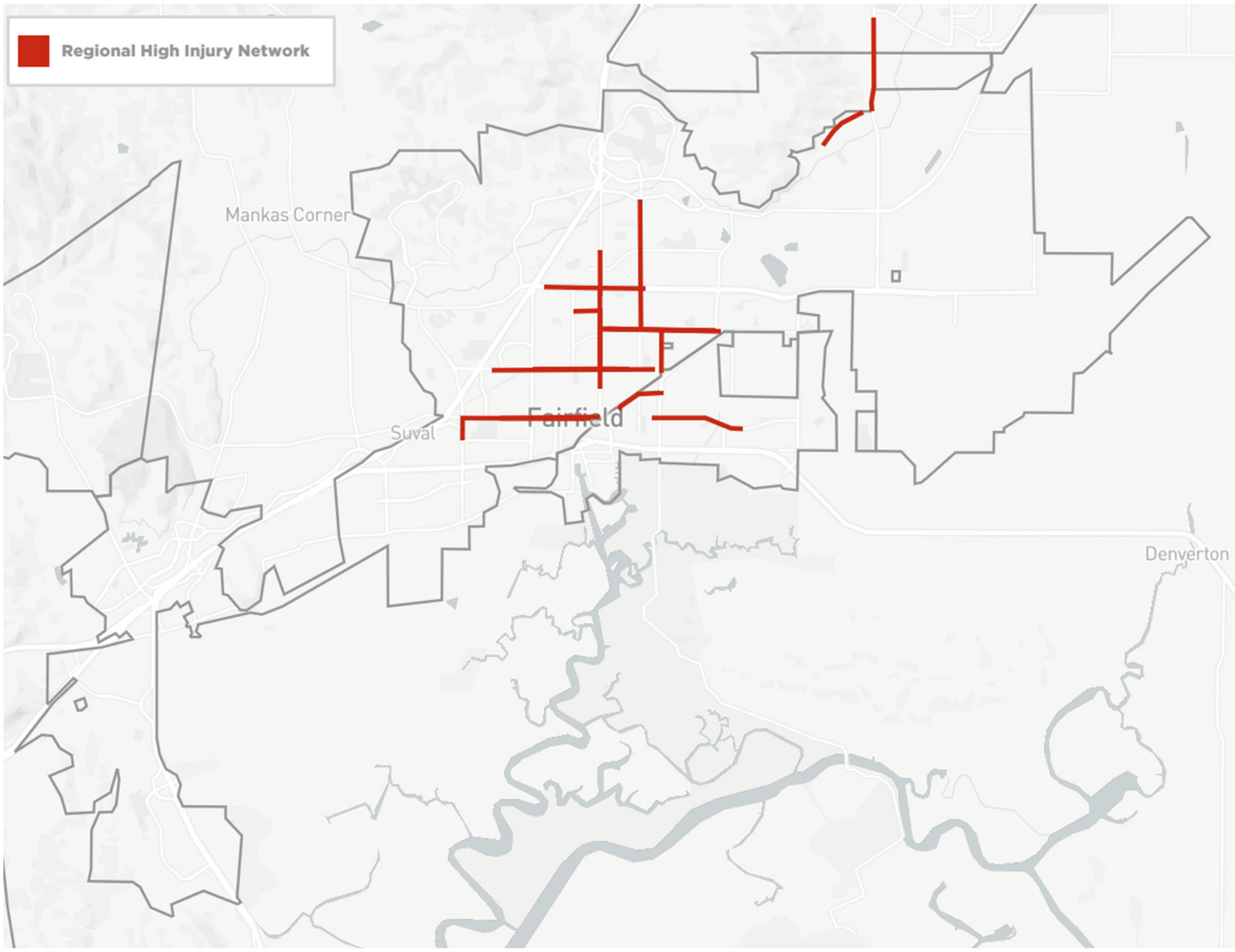


FIGURE 20: REGIONAL HIGH INJURY NETWORK WITHIN FAIRFIELD

TABLE 20: FAIRFIELD SUMMARY OF CRASH STATISTICS

CATEGORY	PROPORTION OF CRASHES	
	All Severities (2313 crashes)	Fatal and Severe Crashes (150 crashes)
Pedestrian Involved	7.6%	26.0%
Bicyclist Involved	5.3%	8.0%
Motorcycle Involved	5.9%	21.3%
Alcohol or Drug Involved	7.5%	20.0%
Wet Road Surface	10.2%	10.0%
Speeding Involved[10]	28.3%	18.7%
Lane Departure	30.0%	34.0%
Intersections	69.5%	60.7%

As shown, many of the crash categories are over-represented in fatal and severe injury (KSI) crashes, including pedestrians, motorcyclists, alcohol or drug involved, lane departure and intersections. Because the primary focus of a LRSP is to address KSI crash risks, the following sections present key trends related to these high severity crashes.

[10] The increased kinetic energy from higher speed crashes is generally associated with higher severity crashes. The seeming reduced proportion of speeding-related crashes that result in a KSI may be due to the crash reporting constraint of only having one primary crash factor reported. As a result, a crash that may have involved unsafe speeds may be associated with a different cause of crash

Physical Environment

Approximately 61% of KSI crashes occurred at intersections, while the remaining 39% occurred on roadway segments (including at driveways). Nearly 49% of all KSI crashes occurred in dark, dusk, or dawn conditions.

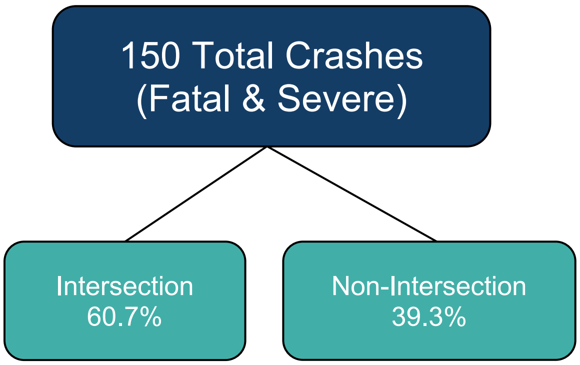


FIGURE 21: KSI LOCATION CRASH TREE

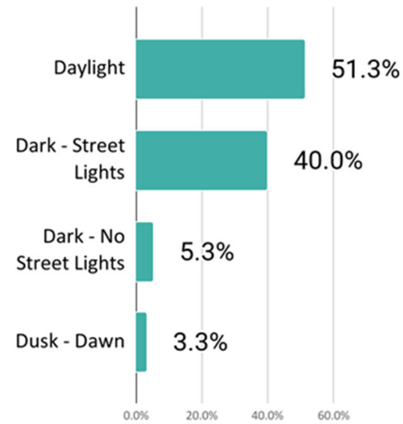


FIGURE 22: KSI LIGHTING CONDITIONS

Crash Types

Crash types provide insights into to common conflicts that exist between road users. As shown in Figure 23, the three most common crash types resulting in fatalities or severe injuries are pedestrian-involved (26%), broadside (24%), and hit object (15.3%). It should be noted that other vulnerable road users, including bicycle-involved and motorcycle-involved crashes, are not specifically identified on this chart as any non-pedestrian crash is assigned to a crash type (e.g., a right-angle crash between a vehicle and bicycle would be coded as a broadside, and involvement of the bicyclists is noted in a separate field in the crash record). As shown previously in Table 20, 21% of KSI crashes involved a motorcyclist.

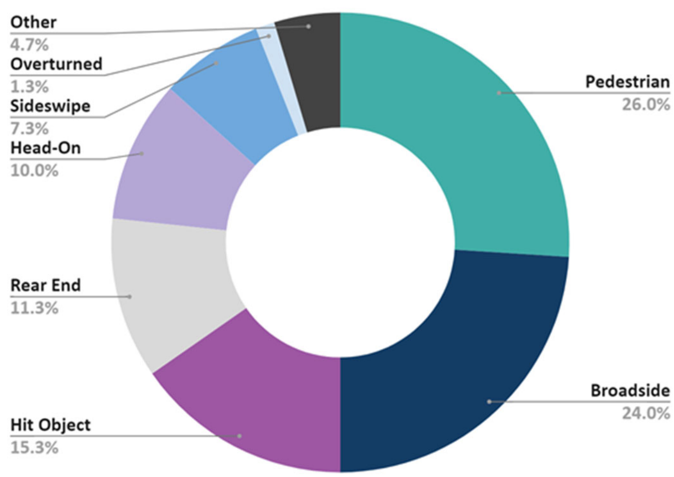


FIGURE 23: KSI CRASH TYPES

Contributing Factors

Primary contributing factors and violation categories provide insights into human behavior. As shown in Figure 24, the most common violations reported in fatal and severe injury crashes were failure to yield automobile impairment (20%), unsafe speeds (19%), pedestrian violation (13%), and improper passing 13%. Note that roadway design contributing factors are not included on a collision report, so the comparable role of design and behavior, and how those relate, cannot be determined based on a collision report alone.

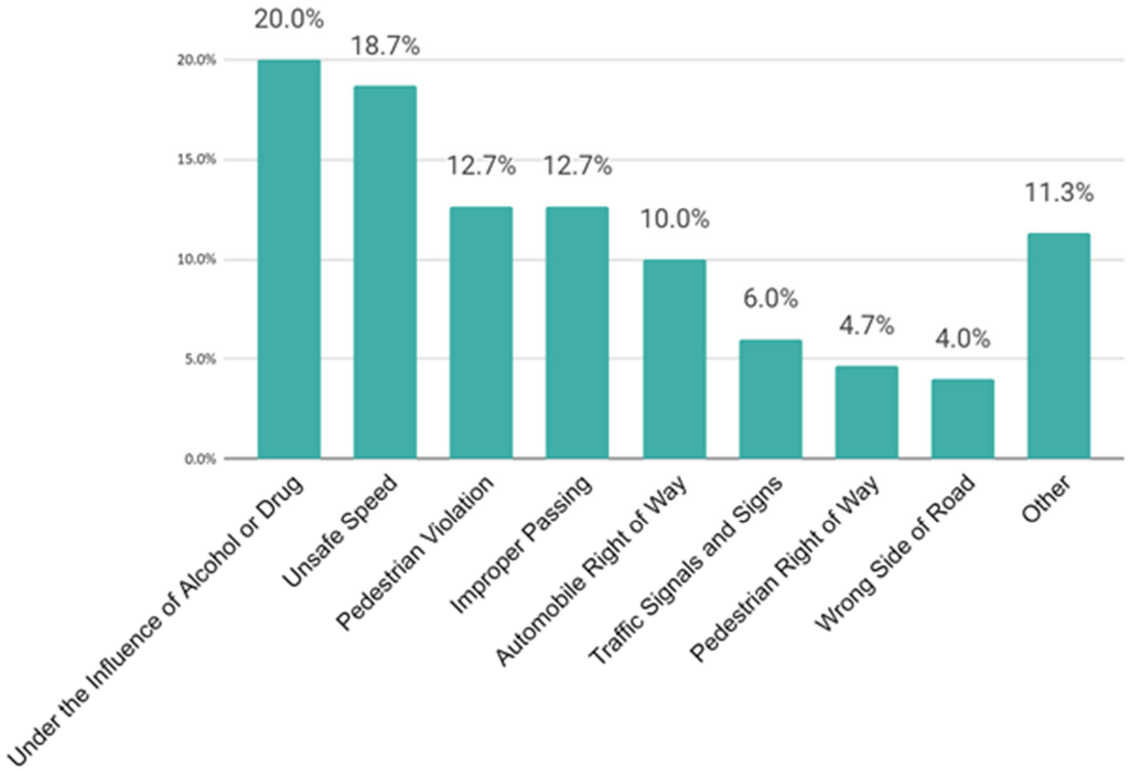


FIGURE 24: KSI PRIMARY VIOLATION CATEGORY

4.3 EMPHASIS AREAS

Emphasis Areas provide a strategic framework for developing and implementing strategies and actions for the LRSP. The Emphasis Areas were developed, using the results of crash data analysis and input from staff and stakeholders. For each emphasis area, quantitative crash reduction goals were identified to provide a metric to evaluate the ongoing effectiveness of project implementation, programs, and policies. The goal to eliminate severe and fatal crashes requires the holistic implementation of the Safe System approach with the use of infrastructure-based and non-infrastructure countermeasures to create redundancies in the roadway system and through education and enforcement practices. A detailed summary and additional sources for infrastructure and non-infrastructure based countermeasures are provided in the Appendix.

For the development of strategies, the Emphasis Areas were categorized in four broader groups: Vulnerable Users, Risky Behaviors, Infrastructure, and Improved Systems. Each group is described below with the associated Emphasis Areas.

Vulnerable Road Users

Vulnerable road users can be characterized by the amount of protection they have when using the transportation system. For example, pedestrians, bicyclists, and motorcyclists are more exposed than people in vehicles, making them more susceptible to injury in the event of a crash. Countywide, crashes involving vulnerable users make up 49% of all Fatal or Severe Injury crashes, while in Fairfield they make up 32%. Aging drivers and pedestrians can also be more vulnerable to severe injuries when a crash occurs. In Fairfield, children under 18 are over-represented in fatal or severe crashes specifically as pedestrians (28%) or riding bicycles (29%) as compared to their proportion of the population (14% of Fairfield residents are under 18 years old).

For this group, the following Emphasis Areas were identified:

- **Pedestrians -** focuses on crashes involving someone walking. Pedestrians are some of the most vulnerable users of a roadway network, and crashes involving pedestrians are more likely to result in a fatal or severe injury. In addition, many younger and older road users travel on foot, which compounds this vulnerability.
- **Motorcyclists -** focuses on crashes which involve someone riding a motorcycle. Motorcyclists are vulnerable users, much like bicyclists and pedestrians, because they do not have the protection of an enclosed vehicle. However, unlike bicyclists and pedestrians, motorcyclists travel at vehicular travel speeds. Because of this, crashes involving motorcyclists often result in serious injuries or fatalities.

Consideration of Location Types. Pedestrian-involved crashes tend to occur most often in downtown core areas, consistent with higher pedestrian activity. High-volume signalized intersections can increase pedestrian crash risk due to complexities resulting from multiple types of road users (pedestrians, bicyclists, passenger vehicles, buses, trucks) and heavy turning movements at the location. Motorcyclist-involved collisions occur system-wide, and often involve high speeds of either the motorcyclist, other vehicle, or both.

Following the Safe System approach, Table 21 summarizes the goals and strategies for each of these emphasis areas. Additional information on specific countermeasures, treatments, and strategies can be found in the Countermeasure Toolboxes in the Appendix.

TABLE 21: EMPHASIS AREAS, GOALS, AND STRATEGIES FOR VULNERABLE ROAD USERS

EMPHASIS AREA	GOALS	STRATEGIES

	• **Reduce** the proportion of fatal and serious injury crashes involving pedestrians **below the Statewide proportion (17%) by 2035.**
	• **Reduce** the rate of fatal and serious injury crashes involving pedestrians **by 50% by 2040.**
		Safe Roads
		• Engineering countermeasures focused on increasing driver awareness of pedestrians and reducing conflicts between vehicles and pedestrians, and improving pedestrian safety, such as:
		  ◦ Enhance existing midblock pedestrian crossing treatments nearby transit stops, schools and parks, trail crossings, and other high pedestrian demand locations
		  ◦ Pedestrian scale lighting upgrades or installations
		  ◦ Curb extensions and refuge islands at long crossings
		  ◦ Installation of Class I multi-use trails that connect residential areas to high pedestrian demand locations
		  ◦ Gap closure within the sidewalk and trail network
		Safe Road Users
		• Improve Infrastructure Connectivity for Vulnerable Road Users – Apply for grant funding that supports safe and connected infrastructure for all roadway users. STA's 2020 Solano County Active Transportation Plan can serve as a guide with previously identified projects.
		• Expand Safe Routes to School - Expansion of school area traffic safety measures provides an opportunity to conduct further outreach on projects proposed in this LRSP, expand the toolkit to additional school areas, and pair engineering and non-engineering countermeasures citywide.
		• Pair Education with Key Engineering and Enforcement Countermeasures – Educational material, presented in multiple languages, can be used to teach people how to use new and unfamiliar safety countermeasures, such as pedestrian hybrid beacons (PHB), rectangular rapid flashing beacons (RRFB), and roundabouts.
		• Develop and implement a Construction Accessibility Policy - Have a policy in place for accessibility to be maintained during construction and road maintenance projects is crucial for maintaining safety on City roads.

EMPHASIS AREA	GOALS	STRATEGIES
	• **Reduce** the proportion of fatal and serious injury crashes involving motorcycles **by 50% by 2035.** • **Reduce** the rate of fatal and serious injury crashes involving motorcycles **by 50% by 2040.**	**Safe Roads** • Implement engineering countermeasures focused on improving pavement friction at locations with curves and a high frequency of motorcycle crashes **Safe Road Users** • Coordinate with motorcycle advocacy groups (e.g. ABATE) about ways to effectively promote safe behaviors • Pair education with key engineering and enforcement countermeasures- Educational material, presented in multiple languages, can be used to teach safe driver behaviors and situational awareness

Risky Behaviors

Reductions in fatalities and serious injuries can be accomplished by deterring unsafe or risky behaviors made by drivers and other transportation users. For this category, the following Emphasis Areas were identified:

- **Impairment** - focuses on impairment as a driver behavior that puts the driver and other road suers at risk. Impairment not only increases the risk of a crash occurring, but also results in more severe injuries to those involved.

- **Speeding** - focuses on speeding as a driving behavior that puts the driver and other road users at risk. Speeding not only increases the risk of a crash occurring, but also results in more severe injuries to those involved.

Consideration of Location Types. Fatal and serious injury crashes that involve impairment are often identified on low-volume suburban or rural roads, as impaired drivers may choose to avoid high-volume roads like freeways. This can result in roadway departure crash events at and near horizontal curves. Speed affects both the likelihood of a crash occurring and crash severity, regardless of location. For example, speeding drivers may be more likely to depart the road at a horizontal curve. In a downtown setting, vehicle speed is directly correlated to the injury severity of a pedestrian-involved or bicyclist-involved crash.

Following the Safe System approach, Table 22 summarizes the goals and strategies for these emphasis areas. Additional information on specific countermeasures, treatments, and strategies can be found in the Countermeasure Toolboxes in the Appendix.

TABLE 22: EMPHASIS AREAS, GOALS, AND STRATEGIES FOR RISKY BEHAVIORS

EMPHASIS AREA	GOALS	STRATEGIES
	• **Reduce** the rate of fatal and serious injury crashes involving impaired drivers **by 50% by 2040**.	**Safe Road Users** • Implement education and public awareness campaigns targeted at specific behaviors • Implement high-visibility enforcement campaigns • Partner with local businesses and organizations on educational efforts and campaigns along hot spot corridors • Facilitate a Safe Ride Home program in partnership with STA, Police Departments, CHP, TNC Operators (e.g., Lyft, Uber), and local businesses

EMPHASIS AREA	GOALS	STRATEGIES
	• **Reduce** the rate of fatal and severe injury crashes resulting from unsafe speeds **by 50% by 2035**.	**Safe Roads** • Implement engineering countermeasures focused on designing or improving roads that lead to speeds more appropriate to the surrounding land use **Safe Vehicles** • Develop a readiness plan for Connected and Automated Vehicles (CAVs) **Safe Road Users** • Implement high-visibility enforcement campaigns **Safe Speeds** • Use recent legislation and national research to set context-appropriate speeds suitable for all road users • Implement a safe speeds education campaign **Other** • Coordinate with STA to implement data management strategies and better monitor system safety performance, including contextual data inventory, crash risk indicators, and crash reporting

Infrastructure

Multimodal transportation assets can be constructed or retrofitted to reduce the risk of fatal and serious injury crashes. Opportunities to do this include implementing safety treatments at intersections and along and across roadways. For this category, the following Emphasis Areas were identified:

- **Intersections -** focuses on crashes that occur within the functional area of an intersection. Intersections are the primary source of conflicts between road users of all types. Crash severity and patterns vary based on traffic control type, but intersection-related crashes that involve speeding, red-light running, and vulnerable users often result in fatal and serious injuries.
- **Lane Departure -** focuses on crashes that fall within two categories: crashes caused by crossing into the opposing lane and crashes caused by running off the road. These crashes are prone to more severe outcomes and are often associated with risky driver behaviors such as speeding, distraction, and impairment.

Consideration of Location Types. Intersection collisions occur most often at 2-way stop controlled and signalized locations. The severity of intersection crashes may be more likely in higher-speed environments (e.g., suburban, rural). Lane departure crashes are often assumed to only occur in rural areas, but lane departures can also be problematic in downtown areas due to the close proximity of roadside fixed objects (e.g., utility poles, mailboxes, vegetation).

Following the Safe System approach, Table 23 summarizes the goals and strategies for each of these emphasis areas. Additional information on specific countermeasures, treatments, and strategies can be found in the Countermeasure Toolboxes in the Appendix.

TABLE 23: EMPHASIS AREAS, GOALS, AND STRATEGIES FOR INFRASTRUCTURE

EMPHASIS AREA	GOALS	STRATEGIES
	• **Reduce** the rate of fatal and severe injury crashes occurring at intersections **by 50% by 2035**. • **Reduce** the rate of fatal and severe injury crashes occurring at intersections **by 50% by 2040.**	**Safe Roads** • Implement engineering countermeasures focused on increasing visibility and driver awareness of intersections, reducing conflict zones especially between modes, and improving signal operations **Safe Vehicles** • Develop a readiness plan for Connected and Automated Vehicles (CAVs) **Safe Road Users** • Implement high-visibility enforcement campaigns **Safe Speeds** • Use recent legislation and national research to set context-appropriate speeds suitable for all road users • Implement a safe speeds education campaign **Other** • Implement access control and management at unsignalized intersections
	• **Reduce** the rate of fatal and severe injury crashes resulting from lane departures **by 50% by 2035.** • **Eliminate** fatal and severe injury crashes resulting from lane departures **by 2040**.	**Safe Roads** • Implement engineering countermeasures focused on improving lane awareness and providing more recovery opportunities **Safe Vehicles** • Develop a readiness plan for Connected and Automated Vehicles (CAVs) **Safe Road Users** • Implement high-visibility enforcement campaigns **Safe Speeds** • Use recent legislation and national research to set context-appropriate speeds suitable for all road users • Implement a safe speeds education campaign **Other** • Coordinate with STA to implement data management strategies and better monitor system safety performance, including contextual data inventory, crash risk indicators, and crash reporting

Emerging Technology

New and innovative technological advances can help improve current safety practices. Table 24 highlights some of the goals and strategies for emerging technology.

TABLE 24: GOALS AND STRATEGIES FOR EMERGING TECHNOLOGY

GOALS	STRATEGIES
• Maintain and build awareness of how emerging technology solutions can improve understanding of crash trends and user safety. • Identify and fund pilot programs for effective technology solutions for increasing safety (e.g. near miss analytics, crash analytics dashboards). • Build and maintain a comprehensive citywide crash and inventory database.	• Contextual Data Inventory – Vendors such as Mapillary and Ecopia provide up-to-date data on transportation infrastructure, including roadway characteristics, intersection characteristics, and signs. Updated inventory can help City staff identify project synergies, such as including a safety countermeasure with a repaving project and support systemic safety analysis for future safety plans and evaluations. • Crash Risk Indicators - Surrogate safety measures, such as "near-miss" crashes, hard braking data, speed data, community-reported hazards, and high stress facilities provide an understanding of the safety landscape and enable proactive interventions. Technology such as video data and platforms which provide public crowdsourcing can close the gap and provide key insights regarding near miss data in the absence of crash data. • Crash Reporting **-** Crash reporting practices, such as complete data collection and documentation of road user behavior and infrastructure, can lead to a greater understanding of the holistic safety landscape, and thus lead to improved investments in safety.

COMPLEMENTARY PROGRAMS AND PRACTICES

Crash history and other types of safety data can be advanced to better understand the causes and locations of crashes, leading to effective solutions. One framework is the list of USDOT's data quality attributes: timeliness, accuracy, completeness, uniformity, integration, and accessibility. Training is used to educate planners, engineers, designers, and construction staff about the importance of safety and how to incorporate it into their everyday job responsibilities. This also includes training staff on culturally relevant community engagement. Fully funded, staffed, and trained law enforcement and emergency response agencies can direct their efforts toward keeping users safe and, when crashes do occur, have the resources and systems in place so traffic incident management and emergency medical services personnel are available to respond.

Strategy - Culturally Relevant Community Engagement and Street Safety Ambassador Program – Community engagement is not a one-size-fits-all model. Culturally relevant community engagement strategies can help education and programming around traffic safety reach a larger audience and be more impactful by making materials readable for all and meeting the community where they are.

Strategy - Rapid Response Safety Communication Protocol and Multi-Disciplinary Team - An internal, multi-department communication strategy should be deployed in response to severe and fatal crashes. This includes immediate on-the ground-response to an investigation of severe and

fatal crashes, ensuring a multi-disciplinary response team focused both on the behavioral and engineering elements of a crash. This team also supports timely data sharing among City departments, ensures data accuracy, and develops near-term interventions.

Strategy - Victim and Family Support - Post-crash care includes providing resources to both the victim, their friends, and their families. To ensure a crash survivor receives the care needed to recover and restore body and mind to an active life within society, they require medical rehabilitation with specialists that can range from orthopedics, neurosurgery, physical and occupational therapy, and prosthetics to psychology and neuropsychology. Resources for crash survivors, their family, and friends, can be found on Solano County Behavioral Health Services' website: https://www.solanocounty.com/depts/mhs/default.asp

4.4 HIGH PRIORITY LOCATIONS AND PROJECTS

With a focus on fatal and severe injury crashes, the project team identified locations within the City of Fairfield that experienced a high frequency or severity of crashes. Once the high-crash locations were identified, each location was scored (or ranked) based on the following metrics.

- **In 2018 Plan?** This identifies whether a safety project was listed at this location in the 2018 Solano County Travel Safety Plan.
- **KSI Crashes.** The number of crash events resulting in a fatality or severe injury at this location.
- **Total Crashes.** The total number of crashes reported and verified to be related to this location.
- **EPDO Score.** The EPDO score, described previously, provides a weighted ranking that accounts for the number and severity of crashes at each location.
- **Number of Emphasis Areas (EAs).** This is the number of EAs that are reflected in the details of the reported crashes at this location.

Within Fairfield, there were a total of 12 high crash locations identified, which are summarized in Table 25 and shown on Figure 25. A one-page summary of each location is also provided.

TABLE 25: FAIRFIELD HIGH CRASH LOCATIONS (NOT IN PRIORITY ORDER)

#	LOCATION	IN 2018 PLAN?	KSI CRASHES	TOTAL CRASHES	EPDO SCORE	NUMBER OF EAs (5 max)
1	Hwy 12 (RT 12) & Beck Ave	Yes	6	40	1313	5
2	Hwy 12 (RT 12) & Pennsylvania Ave	Yes	2	31	528	5
3	Air Base Pkwy & Dover Ave	Yes	2	32	586	5
4	N Texas St & E Pacific Ave	Yes	2	31	520	5

#	LOCATION	IN 2018 PLAN?	KSI CRASHES	TOTAL CRASHES	EPDO SCORE	NUMBER OF EAs (5 max)
5	Air Base Pkwy & Heath Dr	Yes	1	25	363	6
6	Air Base Pkwy & Clay Bank Rd	Yes	2	23	522	5
7	N Texas St & Acacia St	Yes	2	20	517	4
8	Dover Ave & E Atlantic Ave	No	2	12	455	4
9	Peabody Rd & Cement Hill Rd/ Vanden Rd	No	2	7	427	4
10	Travis Blvd & Clay St	Yes	2	6	383	4
11	E Tabor Avenue, Grande Circle to Railroad Avenue	No	3	29	732	5
12	State Route 12	Yes	18	255	4364	5

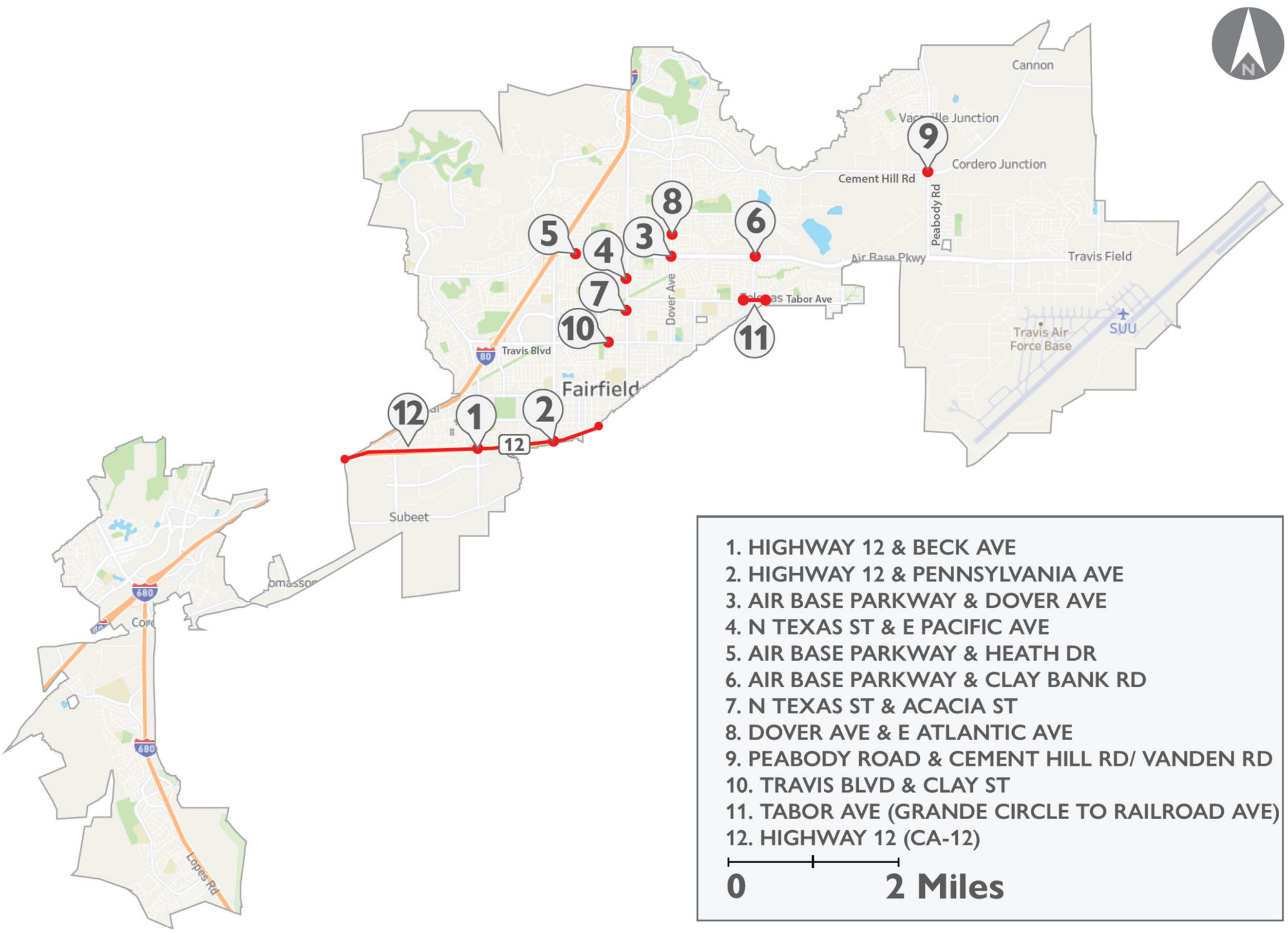


FIGURE 25: MAP OF FAIRFIELD HIGH CRASH LOCATIONS

The following sections provide a safety diagnosis and list of potential countermeasures for each high crash location.

LOCATION 1: SR 12 & BECK AVENUE

REPORT CARD

Priority Ranking	1
EPDO Score	1313
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	Yes
Safety Improvements since 2018?	No
Funded HSIP Projects?	No
In Active Transportation Plan?	Yes

Description: This is an at-grade signalized intersection on a limited access highway with separate left-turn lanes on all legs, and large radius, channelized right-turn movements on all corners. Marked pedestrian crossings are present only on the east leg. There are no marked bicycle facilities and no on-street parking allowed. Intersection lighting is present.

Crash Pattern: There were four (4) fatal and two (2) severe injury reported crashes between 2016 and 2020 that were either rear end or broadside crash types. Two of these crashes occurred 500 feet west within the functional area of the intersection. The primary driver errors involved unsafe speed and traffic signal and sign violations. One crash involved a pedestrian violation (crossing against the signal) and one involved impairment DUI.

Diagnosis: Existing safety measures at this intersection include reflectorized backplates, protected left turn phasing on all approaches, and advanced warning signs on SR 12. This high-speed intersection on a limited access highway suggests that drivers might not anticipate the need to stop for a signal or they may encounter unexpected vehicle queues. Fatal or severe rear-end crashes were attributed to unsafe speeds. Fatal or severe broadside crashes were attributed to failure to obey signals/signs, and one involved an impaired bicyclist.

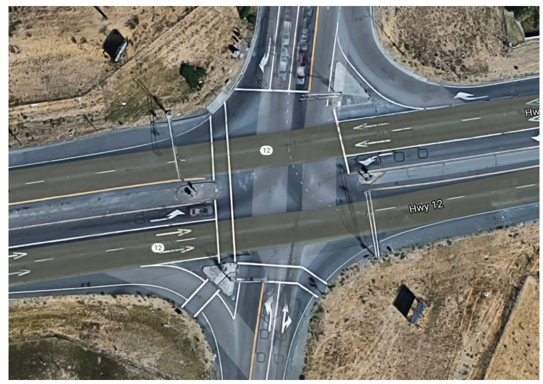
Potential countermeasures:

- S2 - Additional signal visibility upgrades, including larger lenses and supplemental near-side signal heads
- S3 - Improve signal timing and coordination (particularly with adjacent SR 12/Pennsylvania intersection)
- S4 - Provide advanced dilemma zone detection for high-speed approaches
- S10 - Install additional intersection warning (upgrade to high-visibility sheeting on signs). Consider coordinated beacons tied to signal timing.
- Install grade-separated interchange (Pedestrian Overcrossing in ATP)

LOCATION 2: SR 12 & PENNSYLVANIA AVENUE

REPORT CARD

Priority Ranking	2
EPDO Score	528
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	Yes
Safety Improvements since 2018?	No
Funded HSIP Projects?	No
In Active Transportation Plan?	Yes



Description: This is a signalized intersection on a limited access highway. The signal is operated as a split phase on Pennsylvania Avenue. Pedestrian crossings are provided on the west leg of SR 12 and the south leg of Pennsylvania Ave. Curb ramps are provide in the northwest corner; however, there are no sidewalks within 500 feet of the intersection and pedestrians must walk on the paved shoulder. There are no marked bicycle facilities and no on-street parking allowed. Intersection lighting is present.

Crash Patterns: This intersection had one (1) fatal and one (1) severe injury crash between 2016 – 2020. These crashes occurred during the daytime. The fatal crash involved a motor vehicle and a motorcycle in a sideswipe collision on the west leg of the intersection that involved impairment. The other severe crash involved two vehicles in a broadside collision when one driver was conducting an improper passing maneuver.

Diagnosis: Existing safety measures include reflectorized backplates, protected left turn phasing, and advanced warning signs on RT 12. This is a high-speed intersection on limited access highway one mile from the nearest at-grade intersection, which suggests that drivers might not be anticipating the need to stop for a signal or they might be encountering unexpected vehicle queues. Fatal or severe rear-end crashes involved unsafe speeds as a contributor. About half of the reported crashes occurred on the east leg of SR 12.

Potential countermeasures:

- S2 - Additional signal visibility upgrades, including larger lenses and supplemental near-side signal heads
- S3 - Improve signal timing and coordination (particularly with adjacent SR12/Beck intersection)
- S4 - Provide advanced dilemma zone detection for high-speed approaches
- S10 - Install additional intersection warning (upgrade to high-visibility sheeting on signs). Consider coordinated beacons tied to signal timing.
- Install grade-separated interchange (Class 1 Multi-use Path in ATP Bike Project)

LOCATION 3: AIR BASE PARKWAY & DOVER AVE

REPORT CARD

Priority Ranking	3
EPDO Score	586
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	Yes
Safety Improvements since 2018?	No
Funded HSIP Projects?	No
In Active Transportation Plan?	Yes

Description: This is a large signalized intersection with dedicated left-turn lanes and channelized right-turn lanes on all approaches, though the channelized right-turn from WB Air Base Parkway to NB Dover Avenue has been abandoned and is gated. Pedestrian crossings are provided on all legs with connections to sidewalks on Dover Avenue. There are no marked bicycle facilities intersection lighting is present.

Crash Patterns: This intersection had one (1) fatal and one (1) severe injury crashes between 2016 – 2020. One was a rear-end crash occurred during the daytime and the other was a head-on fatal crash at night. In addition, two bicycle crashes occurred in which the cyclist failed to follow traffic signals or signs.

Diagnosis: Existing safety measures include reflectorized backplates on Air Base Parkway approaches, and protected left turn phasing. Field observations noted fade pavement markings and outdated crosswalk striping. The Parkway is a high-speed limited access facility with the nearest at-grade intersection about one-mile to the east. About half of the reported crashes occurred during dark, dusk, or dawn lighting conditions.

Potential countermeasures:

- S1 - Improve intersection lighting
- S2 - Additional signal visibility upgrades, including larger lenses and supplemental near-side signal heads
- S3 - Improve signal timing and coordination (with adjacent SR12/Beck Avenue int.)
- S4 - Provide advanced dilemma zone detection for high-speed approaches
- S10 - Install additional intersection warning (upgrade to high-visibility sheeting on signs) Consider coordinated beacons tied to signal timing.
- Install a grade-separated interchange
- Install a Class IV Separated Bikeway

LOCATION 4: NORTH TEXAS ST & E PACIFIC AVENUE

REPORT CARD

Priority Ranking	6
EPDO Score	520
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	Yes
Safety Improvements since 2018?	
Funded HSIP Projects?	No
In Active Transportation Plan?	No

Description: This signalized intersection has two-lane approaches with center two-way left-turns lanes on North Texas Street (north-south), and a one-lane approach with a separate right-turn lane on both approaches of East Pacific Avenue (east-west). Pedestrian crossings and sidewalks are present on all legs. Driveway access points for the adjoining retail centers are within 200 feet of the intersection on all four approaches. There are no marked bicycle facilities and no on-street parking allowed. Intersection lighting is present.

Crash Patterns: This intersection had two (2) severe injury crashes between 2016 – 2020. Both crashes involved a pedestrian. One was in the crosswalk (pedestrian signal for that leg was not activated) and one crossed outside of the crosswalk. One occurred during daylight hours and one after dark. Other reported crashes were primarily rear-end and broadside type of crashes.

Diagnosis: The traffic signal is operated with protected left-turn phasing on North Texas St., and protected-permitted phasing on Pacific Ave. None of the pedestrian crashes involved left-turn vehicles. The majority of rear end type crashes occur along North Texas Street, with almost all were cited for unsafe speeds. The majority of broadside crashes were due to failure to follow the traffic signals and signs. About 30 percent of the crashes occurred during dark conditions (night, dusk, or dawn hours).

Potential countermeasures:

- S1 - Improve intersection lighting (consider pedestrian-level lighting)
- S2 - Install signal visibility upgrades, including larger lenses, reflectorized backplates, supplemental signal heads
- S3 - Improve signal timing and coordination – potential to add adaptive signal on Texas Avenue
- S21PB - Install leading pedestrian interval (LPI)

LOCATION 5: AIR BASE PARKWAY & HEATH DRIVE

REPORT CARD

Priority Ranking	10
EPDO Score	363
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	Yes
Safety Improvements since 2018?	
Funded HSIP Projects?	No
In Active Transportation Plan?	No

Description: This signalized intersection has dedicated left-turn lanes and channelized right-turn lanes on all approaches. Pedestrian crossings are provided on all legs with connections to sidewalks Heath Drive, and the north side of Air Base Parkway west of Heath. There is no direct driveway access within the intersection influence area; however, there is a looping right-turn movement in the SW quadrant that continues onto Alaska Avenue. The north leg of Heath Drive intersects Dahlia Street 150 feet to the north, which limits vehicle queue space and speeds on that leg. There are no marked bicycle facilities and no on-street parking allowed. Intersection lighting is present. The intersection is bounded by two grade-separated interchanges on either direction on Air Base Parkway, and the posted speed is 55 miles per hour.

Crash Patterns: This intersection had one (1) severe injury crash between 2016 – 2020, which occurred during the daytime and involved two motor vehicles in a broadside crash with the violation of not following traffic signals or signs. Three vehicle occupants were injured.

Diagnosis: Existing safety measures include reflectorized backplates and protected left-turn phasing on Air Base Parkway approaches and split phased signal timing on Heath Drive. The eastbound right-turn from Air Base Parkway has candlestick reflectors installed to clearly delineate the lane drop on that approach. About 25 percent of the reported crashes involved lane departures on the east and west approaches.

Potential countermeasures:

- S2 - Additional signal visibility upgrades, including larger lenses and supplemental near-side signal heads, and retroreflective backplates on Heath Drive
- S4 - Provide advanced dilemma zone detection for high-speed approaches
- S10 - Install advanced intersection warning signs, including lane assignment signs

LOCATION 6: AIR BASE PARKWAY & CLAY BANK ROAD

REPORT CARD

Priority Ranking	5
EPDO Score	522
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	Yes
Safety Improvements since 2018?	
Funded HSIP Projects?	No
In Active Transportation Plan?	No

Description: This is a large signalized intersection with dedicated left-turn and right-turn lanes on all approaches. The right turn lanes are channelized on the NW, SW and SE corners. The NE corner is undeveloped currently and pedestrian crossings are provided on the west leg only. There is no direct driveway access within the intersection influence area. There are no marked bicycle facilities and no on-street parking allowed. Intersection lighting is present.

Crash Patterns: This intersection had two (2) severe injury crashes between 2016 – 2020. The first was a daytime overturning crash involving a motorcycle that was completing an improper passing maneuver. The other crash occurred at night and involved a bicyclist.

Diagnosis: Existing safety measures include reflectorized backplates on Air Base Parkway approaches, and protected left turn phasing on all approaches. This at-grade intersection is isolated from other nearby cross streets, which are about one mile in either direction. This type of limited access facility design enables higher vehicles speeds, and reduces driver expectation to slow or stop. The posted speed limit on Air Base Parkway is 55 miles per hour. About 25 percent of the reported crashes at this location involved lane departures on Air Base Parkway. Most of the rear end crashes occurred on the west leg of Air Base Parkway in the east bound direction.

Potential countermeasures:

- S2 - Additional signal visibility upgrades, including larger lenses and supplemental near-side signal heads, and retroreflective backplates on Clay Bank
- S4 - Provide advanced dilemma zone detection for high-speed approaches
- S10 - Install intersection warning signs with high-visibility sheeting on east/west approaches. Consider coordinated beacons tied to signal timing.

LOCATION 7: NORTH TEXAS ST & ACACIA STREET

REPORT CARD

Priority Ranking	7
EPDO Score	517
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	Yes
Safety Improvements since 2018?	
Funded HSIP Projects?	No
In Active Transportation Plan?	No

Description: This signalized intersection provides dedicated left-turn lanes on all approaches, including the east leg which is a commercial driveway. Pedestrian crossings are provided on all legs with connections to sidewalks on both sides of all approaches. Driveway accesses for the adjoining retail centers are within 200 feet of the intersection on all approaches. There are no marked bicycle facilities and no on-street parking allowed. Intersection lighting is present.

Crash Patterns: This intersection had two (2) severe injury crashes between 2016 – 2020. One occurred midday when a driver struck a pedestrian while making a left-turn. The other was a broadside vehicle crash at night.

Diagnosis: The traffic signal is operated with a permissive left-turn phase on Acacia approaches which means conflicting vehicles must yield the proper right-of-way when entering the intersection. These side street approaches have traffic signals mounted on side pedestals rather than on mast arms like on North Texas Street approaches. These lower signal heads are subject to driver view blockage when buses and larger vehicles pass by. In addition, the shopping center driveway has several conflict zones associated with nearby parking aisles on the signal approach which can distract driver attention. The majority of rear end type crashes occur along North Texas Street, with almost all were cited for unsafe speeds or following too closely.

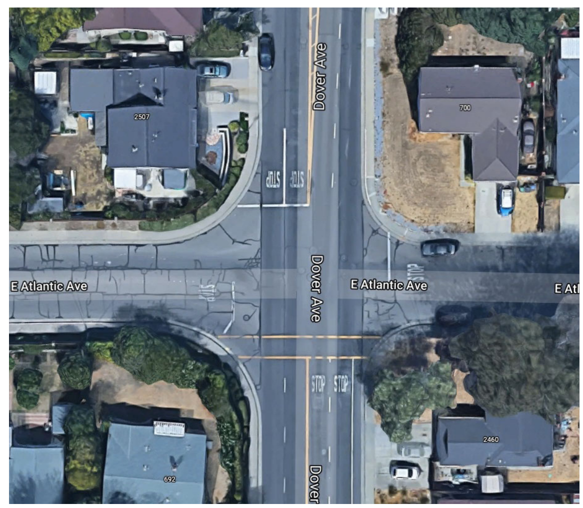
Potential countermeasures:

- S1 - Improve intersection lighting (consider pedestrian-level lighting)
- S2 - Install signal visibility upgrades, including larger lenses, reflectorized backplates, supplemental signal heads
- S3 - Improve signal timing and coordination
- S21PB - Install leading pedestrian interval (LPI)

LOCATION 8: DOVER AVENUE & E ATLANTIC AVENUE

REPORT CARD

Priority Ranking	8
EPDO Score	455
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	No
Safety Improvements since 2018?	
Funded HSIP Projects?	No
In Active Transportation Plan?	No



Description: This all-way stop-controlled intersection has two-lane approaches on Dover Avenue (north-south) and single lane approaches on Atlantic Avenue. No dedicated turn lanes are present. There is a marked pedestrian crossing on the south leg of Dover Avenue only. Sidewalks are present on all approaches of both streets. This is a residential neighborhood with driveways in close proximity to the intersection. There are no marked bicycle facilities and on-street parking is allowed on each leg except for the eastbound Atlantic Avenue approach. Intersection lighting is present.

Crash Patterns: This intersection had two (2) severe injury crashes between 2016 – 2020. One occurred near midnight when a driver struck a pedestrian while making a left-turn. The other severe incident was a daytime sideswipe crash between a vehicle and a motorcycle, with illegal passing noted as a contributing factor. A total of ten minor injury crashes also occurred at this intersection.

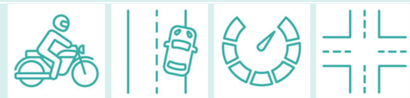
Diagnosis: This intersection lies along primary access routes for Fairfield High School, with Dover Avenue serving as a major north/south arterial for vehicles and transit, while pedestrian, bicycle, and vehicle traffic from the surrounding residential areas use E Atlantic Avenue as a collector. The intersection lacks appropriate crossing opportunities and pedestrian and bicycle facilities. Striped crossings, wider sidewalks, and bicycle lanes would increase visibility and reduce conflict points between vehicles and modes.

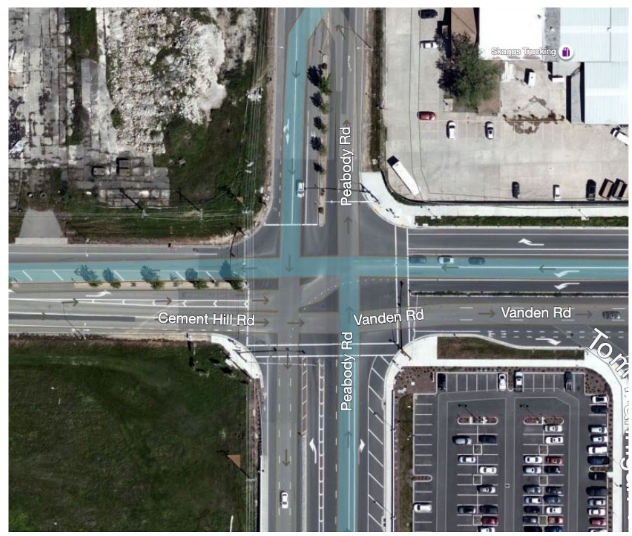
Potential countermeasures:

- NS6 - Install/upgrade larger or additional stop signs or warning/regulatory signs and reflective strips
- NS7 - upgrade intersection pavement markings
- Install high-visibility marked crosswalks on all legs

LOCATION 9: PEABODY ROAD & CEMENT HILL ROAD/VANDEN ROAD

REPORT CARD

Priority Ranking	9
EPDO Score	427
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	No
Safety Improvements since 2018?	
Funded HSIP Projects?	No
In Active Transportation Plan?	No



Description: This signalized intersection has multi-lane approaches on Peabody Road (north-south) and on Cement Hill Rd/Vanden Road (east-west) with center median islands, separated left-turn lanes, and dedicated right-turn lanes. There is pedestrian crossing on the south leg of Peabody Road and the east leg of Vanden Road which connect to sidewalks and adjoining office and industrial land uses. There are marked bicycle facilities on all approaches. On-street parking is not allowed. Intersection lighting is present.

Crash Patterns: This intersection had two (2) severe injury crashes between 2016 – 2020. Both occurred during daylight hours and involved two motor vehicles. One was a rear end crash, and the other was a broadside crash. Of the six other reported crashes, all had minor injuries, and involved either fixed object, rear end, or broadside crashes.

Diagnosis: This intersection is isolated with higher posted speeds (45 mph). There is substantial extra pavement width to accommodate future added travel lanes. All approaches offer protected left-turn signal controls. Most of the seven reported crashes were broadside or rear end type crashes. The severity of the crashes may provide an opportunity to help fund a broader scope systemic application covering multiple signalized locations.

Potential countermeasures:

- S2 - Improve signal visibility w/ retroreflective backplates, supplemental heads mounted on mast arms, larger lenses, etc. on all approaches
- S4 - Provide advanced dilemma zone detection for high-speed approaches
- S10 - Install intersection warning signs with high-visibility sheeting on east/west approaches. Consider coordinated beacons tied to signal timing.

LOCATION 10: TRAVIS BOULEVARD & CLAY STREET

REPORT CARD

Priority Ranking	11
EPDO Score	383
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	No
Safety Improvements since 2018?	
Funded HSIP Projects?	Yes
In Active Transportation Plan?	Yes

Description: This two-way stop-controlled intersection has two-lane approaches on Travis Boulevard (east-west) with a center two-way left-turn lane. An RRFB is present on the west leg, and marked crosswalks are also present on the north and south legs connecting to sidewalks on all approaches. On Travis Boulevard, there are marked shared route bicycle pavement and on-street parking is prohibited. Intersection lighting is present on the SW corner.

Crash Patterns: This intersection had two (2) severe injury crashes between 2016 – 2020. Both occurred at night and involved pedestrians crossing Travis Blvd. Four other injury crashes were reported and two did include bicyclists.

Diagnosis: The intersection only has overhead street lighting on one corner, at the south side of the RRFB crossing of Travis Blvd. Two-thirds of the crashes occurred during night hours. The pavement legends and striping for the RRFB crossing are a typical and may be confusing for motorists. A HAWK signal is planned to be installed as part of the HSIP project and pavement markings should be designed according to CAMUTCD standards and best practices.

Potential countermeasures:

- NS1 - Add intersection lighting. Consider pedestrian-level lighting

Funded HSIP Projects

- NS21 - Install/upgrade pedestrian crossing at uncontrolled locations (curb extensions, in-street pedestrian signs, etc.)

LOCATION 11: TABOR AVENUE BETWEEN GRANDE CIRCLE AND RAILROAD AVENUE

REPORT CARD

Priority Ranking	2
EPDO Score	732
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	No
Safety Improvements since 2018?	
Funded HSIP Projects?	No
In Active Transportation Plan?	No

Description: Tabor Avenue is a two-lane local street segment that includes several stop-controlled intersections and an at-grade railroad crossing. There is a raised median on the approaches to the railroad crossing. Lighting is present only on the north side of the roadway.

Crash Patterns: The segment experienced a total of 29 crashes, including three severe injury crashes. One crash involved a pedestrian, one involved a bicyclist, and three involved a motorcyclist. Over half of the segment crashes occurred at the Railroad Avenue intersection, almost all of which involved a left-turning vehicle. Approximately 30% of all crashes involved lane departure, including five head-on crashes (two of which resulted in severe injuries).

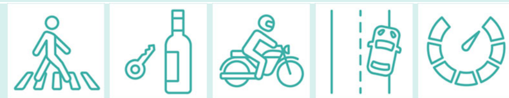
Diagnosis: The vast majority of crashes on this segment are related to failure to yield automobile right-of-way, including lane departures, left turns at intersections, and improper passing. There were five crashes involving impairment, and 25% occurred in dark conditions.

Potential countermeasures:

- R1 – Install segment lighting
- R8 - Install raised median
- NS15 - Create directional median openings to restrict left-turns at Railroad Avenue
- R34PB – Install sidewalk (consistent with ATP project)

LOCATION 12 - STATE ROUTE 12

REPORT CARD

Priority Ranking	-
EPDO Score	4365
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	Yes
Safety Improvements since 2018?	
Funded HSIP Projects?	No
In Active Transportation Plan?	No

Description: This state highway facility connects from State Highway 116 in Sonoma County to State Highway 49 in Calaveras County. Locally, it is a major regional east-west route between Interstate 80 (I-80) and Interstate 5. The segment within the City of Fairfield generally is a four-lane limited access highway that spans about four miles in length and includes local access at Jackson Street and Webster Street in downtown Fairfield, as well as Pennsylvania Avenue, Beck Avenue, and Chadbourne Road. The local connections are a mix of grade-separated interchanges and at-grade signalized intersections. There is no dedicated walking or bicycling facilities within the highway right-of-way; however, there is a wide paved shoulder on both sides which has been used for both non-motor vehicle purposes as well as vehicle break down areas.

Crash Patterns: This highway corridor has a high frequency and severity of rear end crashes to intersections. Many of the reported crashes are attributed to unsafe vehicle speeds. In addition, three of the severe injuries were pedestrians walking the roadway, which were struck a vehicle that departed its travel lane onto the shoulder. Driving under the influence accounts for two (2) fatal and one severe injury crash. Approximately one-third of all reported crashes were lane departures.

Diagnosis: Of the 18 fatal and severe injury crashes, six were rear-end and six were broadside, many attributed to unsafe speed. This may indicate that drivers do not expect to stop at the grade-separated intersections along the highway and are approaching at high speeds. There is a lack of east-west connectivity on parallel routes for bicyclists and pedestrians.

Potential countermeasures:

- R26 - Install dynamic/variable speed warning along the corridor
- R34PB - Install sidewalk/pathway parallel to Highway 12
- R31 - Install edge line rumble strips/stripes (where not present)
- S4 - Provide dilemma zone detection for all high-speed intersection approaches
- S3 - Improve signal timing: coordination and clearance intervals for all signalized intersections
- R1/S1/NS1 - Improve lighting on segments and at intersections
- S10 - Install additional intersection warning (upgrade warning signs to high vis sheeting). Consider coordinated beacons tied to signal timing.

HIGH CRASH LOCATIONS IDENTIFIED IN 2020 ACTIVE TRANSPORTATION PLAN

The project team also revisited the pedestrian and bicycle safety corridors identified in the 2020 Solano County Active Transportation Plan. The following corridors have at least one reported fatal or serious injury crash and could be candidate locations for HSIP funded projects.

TABLE 26: CRASHES IN PEDESTRIAN SAFETY CORRIDORS

#	Location	KSI Crashes	Total Crashes
1	W Texas Street from I-80 interchange to Washington Street	8	141
2	Pennsylvania Avenue from Texas Street to Essex Drive	3	76
3	Travis Boulevard from Pennsylvania Avenue to Sunset Avenue	8	140
4	N Texas Street from W Texas Street to Hawthorn Drive	16	211
5	E Tabor Avenue from N Texas Street to Clay Bank Road	6	76

TABLE 27: CRASHES IN BICYCLE SAFETY CORRIDORS

#	Location	KSI Crashes	Total Crashes
1	W Texas Street from Beck Avenue to Washington Street	8	137
2	Travis Boulevard from Holiday Lane to Sunset Avenue	13	203
3	N Texas Street from E Travis Boulevard to Dickson Hill Road	16	218
4	Air Base Parkway from Dover Avenue to Clay Bank Road	5	65

CITYWIDE SYSTEMIC OPPORTUNITIES

Systemic safety solutions are a key component of the safe system approach, as they address underlying crash risks on a large scale (a corridor, neighborhood, or entire city), including locations with no reported crash history. By treating the known characteristics that are contributing to crashes on a broad scale, a systemic safety project can proactively eliminate crash risks before a crash occurs. Systemic safety solutions are generally low cost treatments that have a proven safety benefit. The following countermeasures (or groups of countermeasures) could be implemented across the city to address the most common crash risks identified thus far.

- **Potential countermeasures**:
    - **Stop controlled intersection upgrades –** Improve the visibility of stop-controlled intersections by upgrading signing and striping. Upgrades may include: pavement markings, high-visibility stop signs, larger or doubled-up regulatory and warning signs, retroreflective tape on sign posts, and flashing beacons. Countermeasure IDs: NS6, NS7, NS8, NS9
    - **Enhanced pedestrian crossing treatments (unsignalized intersection or midblock) –** Improve driver awareness of potential conflicts with vulnerable road users in locations with nearby pedestrian generators (transit stops, commercial/retail and mixed-use land uses, parks, etc.) and along Safe Routes to School. Treatments may include: high-visibility crosswalks, advanced warning signs, curb extensions, median refuge islands, and active warning devices like RRFBs or PHBs, referencing the FHWA STEP Guide for countermeasure selection. Countermeasure IDs: NS19PB, NS20PB, NS21PB, NS22PB, NS23PB, R35PB, R36PB, R37PB. HSIP grants also commonly offer a set-aside for pedestrian crossing treatments.
    - **Enhanced pedestrian crossing treatments (signalized intersection) –** Improve driver awareness of potential conflicts with vulnerable road users in locations with nearby pedestrian generators (transit stops, commercial/retail and mixed-use land uses, parks, etc.) and along Safe Routes to School. Treatments may include: high-visibility crosswalks, curb extensions, pedestrian countdown heads, leading pedestrian intervals, medians, right and left turn prohibitions, channelized right turn redesign, lighting improvements, slower pedestrian walking speeds, and protected intersections. Countermeasure IDs: S6/7, S17PB, S18PB, S20PB, S21PB
    - **Lighting upgrade** – Install new or supplemental lighting to improve nighttime visibility of intersections and other high-conflict locations. Consider installing pedestrian-level lighting in locations with higher pedestrian and cycling activity, and along Safe Routes to School. Countermeasure IDs: S1, NS1, R1
    - **Signalized Intersection Visibility, Hardware, and Timing Upgrade (General)** – Improve the visibility of signalized intersections and modify signal timing to reduce rear-end and broadside crashes. These may include: larger lenses, reflectorized backplates, improved signal head mounting, size and number of signal heads, upgrade to flashing yellow arrow, and improved signal coordination. Countermeasure IDs: S2, S3
    - **Signalized Intersection Visibility, Hardware, and Timing Upgrade (High Speed)** – Improve the visibility of signalized intersections and modify signal timing to reduce rear-end and broadside crashes. These may include: larger lenses, reflectorized backplates, improved signal head mounting, size and number of signal heads, upgrade to flashing yellow arrow, improved signal coordination, advanced intersection warning signs/beacons, and advanced dilemma zone detection for high-speed approaches. Countermeasure IDs: S2, S3, S4, S10

4.5 IMPLEMENTATION AND EVALUATION

This Local Road Safety Plan is the framework for engaging residents, stakeholders, employers, planners, engineers, enforcement agencies, and emergency medical service providers across the County in improving transportation safety in Fairfield. While safety-specific plans and programs are critical to achieving the vision for safety in Fairfield, traditional transportation planning, design, operations and maintenance decision making processes, programs, and policies should proactively integrate safety as well. The emphasis areas and strategies in this Plan present short-term safety needs and solutions that can be used by stakeholders countywide as funding and implementation opportunities present themselves. Ongoing coordination and collaboration will enhance implementation efforts and set the stage to evaluate progress on policies, programs, and projects.

Using the goals and strategies in the LRSP, planners and engineers can track and plan for safety on the transportation system by:

- Reviewing past, current, and predicted safety trends – Are trends changing? Are the identified strategies reducing fatal and severe crashes within each emphasis area?
- Revising safety goals and strategies – Have the goals been achieved early, or are they progressing slower than expected? Are the responsible parties implementing the strategies, and if not, what are the barriers to implementation (funding, staff resources, lacking champions)?
- Identifying new projects and strategies to achieve results – Safety research and innovative programs are continually advancing. Are new and more effective strategies available that can be used to better improve safety?
- Monitoring and evaluating system performance – Are systems in place to effectively monitor and evaluate safety throughout the city? Do opportunities exist to improve data collection and accuracy/quality?

COLLABORATION

Fairfield will meet with STA and agency partners on a regular basis to discuss new and ongoing strategy implementations, new strategic and funding opportunities, and barriers to implementation. The purpose of these meetings is to encourage and to maintain communication across stakeholders and provide accountability for implementation. Whenever possible, these meetings should include the representatives from emergency and enforcement services, regional agencies and school districts, and relevant public committees.

POLICY SUPPORT

Projects following the Safe System approach may often require tradeoffs to be made between on-street parking, vehicle level of service, and pedestrian and bicycle safety and accessibility, when funding and/or right of way are limited. A Vision Zero policy and Council Resolution in support of this can help clarify how these decisions will be made at a citywide scale rather than on a project-

by-project basis. The policy can also support equity goals in the community by precluding unequal opportunities to those with the historically “loudest” voices or most resources for civic participation.

Other complementary policies to this Plan may include a citywide crosswalk policy and transition plan and a speed management policy and program. The Vision Zero Network website provides additional guidance: https://visionzeronetwork.org/where-to-start/

INSTITUTIONALIZATION

In addition to pursuing funding for the priority and systemic projects identified in this LRSP via upcoming grant opportunities, Fairfield should consider reactive and project safety project opportunities through:

- Capital Improvement Projects, such as repaving efforts
- Development Impact Review and Mitigation - new guidance from the Institute of Transportation Engineers presents opportunities for bring the Safe System approach into the development review process: https://www.ite.org/pub/?id=94372DF6-BAB5-AE00-E6D5-471ED4F338CE

EVALUATION

Fairfield will prepare a memo every two years that will summarize crash trends for the city focused on the Emphasis Areas and the stated goals of the current Local Road Safety Plan. This frequency will coincide with the frequency of Caltrans HSIP and ATP funding cycles, allowing the analysis to inform priority projects and funding applications. The memo or findings of the evaluation will be made publicly available to local residents.

The Emphasis Areas and Strategies identified in the Local Road Safety Plan will be re-evaluated every four years as a countywide effort, facilitated by STA, and revised based upon the results of the crash trend analysis.

CHAPTER 5:
RIO VISTA LOCAL ROAD SAFETY

5.1 INTRODUCTION

Rio Vista is located on the eastern edge of Solano County, along the Route 12 corridor, which connects to Fairfield to the west and Lodi to the east. The south terminal of Route 84 also connects to Route 12 in Rio Vista. Based on the United States Census Bureau, Rio Vista is the smallest city in Solano County, with a population of 10,005 people as of 2020.

A local road safety plan provides a data- and community-driven framework to systematically identify, analyze and prioritize safety problems and recommend safety improvements on local roads. The following chapter presents the vision statement, summarizes crash data, identifies emphasis areas, recommends high priority project locations and outlines the implementation and evaluation strategies for the City of Rio Vista.

VISION STATEMENT

To eliminate fatal and severe injuries on roadways within the City of Rio Vista by creating an equitable, sustainable, and multimodal transportation system where people of all ages and abilities can travel free from harm.

5.2 CRASH DATA AND TRENDS

DATA SOURCES

This safety analysis used crash data from both the Statewide Integrated Traffic Records System (SWITRS), Transportation Injury Mapping System (TIMS), and the local Crossroads crash database. The crash data analyzed for this project included all geolocated crashes during the five-year period between January 1, 2016, and December 31, 2020.

Crash Record Data

For this project and most other safety analyses, the crash severity is defined in the Highway Safety Manual (HSM) as follows:

- **Fatal injury:** A crash that results in the death of a person within 30 days of the crash.
- **Severe (incapacitating) injury:** A crash that results in broken bones, dislocation, severe lacerations, or unconsciousness, but not death.
- **Other Visible injury (non-incapacitating):** A crash that results in other visible injuries, including minor lacerations, bruising, and rashes.
- **Possible injury (complaint of pain):** A crash that results in the complaint of non-visible pain/injury, such as confusion, limping, and soreness.
- **Property damage only (PDO):** A crash without injury or complaint of pain but resulting in property damage to a vehicle or other object, commonly referred to as a “fender bender.”

The most severe crashes, characterized as KSI (Killed or Severely Injured), are the primary focus of this LRSP.

CRASH TRENDS

Figure 26 provides a heatmap of all the crashes within the Rio Vista boundary. Over half of all reported crashes occurred along Route 12. There is also a relatively high density of crashes in the downtown area, most of which were low severity crash types.

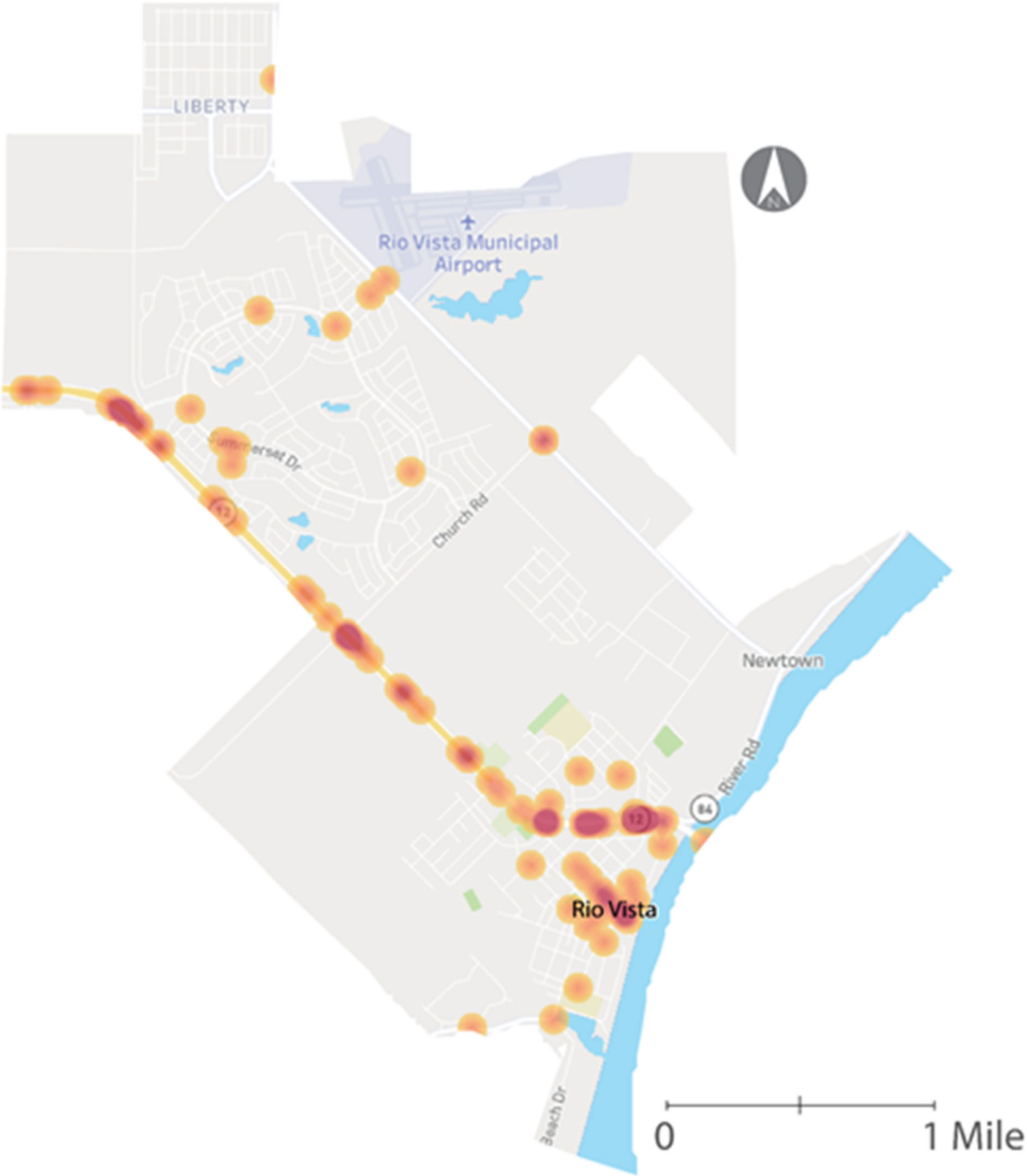


FIGURE 26: HEAT MAP OF ALL NON-INTERSTATE CRASHES WITHIN RIO VISTA.

MTC also provides a tool that displays the Regional High Injury Network (HIN) for full access roadways[11]. There are no identified HIN roadways in Rio Vista. Between 2016 and 2020, a total of 111 reported crashes occurred in Rio Vista, including 2 fatal crashes and 3 severe injury crashes.

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[11] https://bayviz.mysidewalk.com/

The following table summarizes key crash statistics that illustrate contextual and behavioral patterns.

TABLE 28: RIO VISTA SUMMARY OF CRASH STATISTICS

CATEGORY	PROPORTION OF CRASHES	
	All Severities (111 crashes)	Fatal and Severe Crashes (5 crashes)
Pedestrian Involved	3.6%	20.0%
Bicyclist Involved	3.6%	0.0%
Motorcycle Involved	6.3%	20.0%
Alcohol or Drug Involved	6.3%	0.0%
Wet Road Surface	8.1%	40.0%
Speeding Involved	41.4%	20.0%
Lane Departure	23.4%	0.0%
Intersections	72.1%	60.0%

While this table is provided for consistency with the information presented for other Cities, it is not practical to make inferences about differences in crash trends between severity levels using such a small data set (where a single crash event equates to 20% of the total). Because the primary focus of a LRSP is to address KSI crash risks, the following sections present data related to these high severity crashes, which can still provide valuable insights while recognizing these statistical limitations.

Physical Environment

A total of three KSI crashes (60%) occurred at intersections, while the remaining two crashes (40%) occurred on roadway segments (including at driveways). Four of the five (80%) KSI crashes occurred in dark conditions.

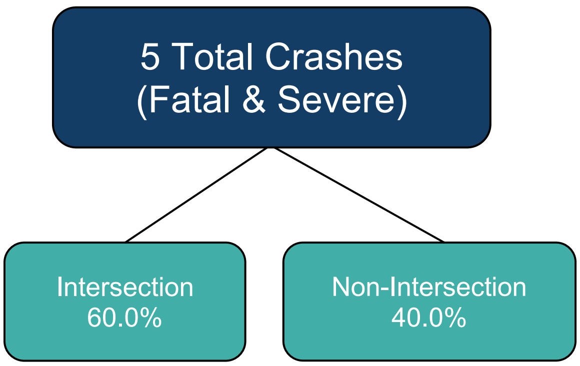


FIGURE 27: KSI LOCATION CRASH TREE

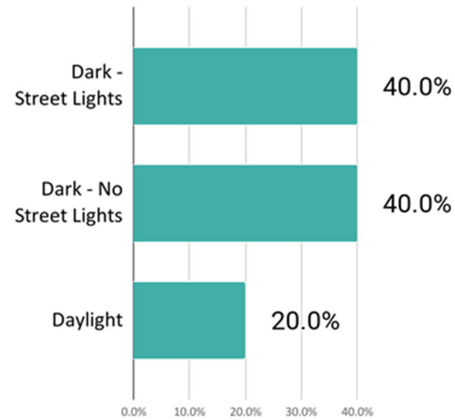


FIGURE 28: KSI LIGHTING CONDITIONS

Crash Types

Crash types provide insights into common conflicts that exist between road users. As shown in Figure 29, three of the five KSI crashes were a result of a broadside crash. One KSI crash involved a pedestrian, and one involved a rear-end motor vehicle crash.

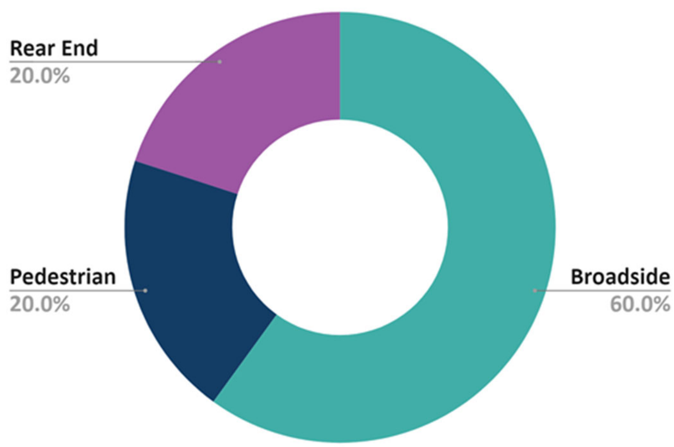


FIGURE 29: KSI CRASH TYPES

Contributing Factors

Primary contributing factors and violation categories provide insights into human behavior. As shown in Figure 30, each of the five KSI crashes had a unique primary contributing factor. Note that roadway design contributing factors are not included on a collision report, so the comparable role of design and behavior, and how those relate, cannot be determined based on a collision report alone.

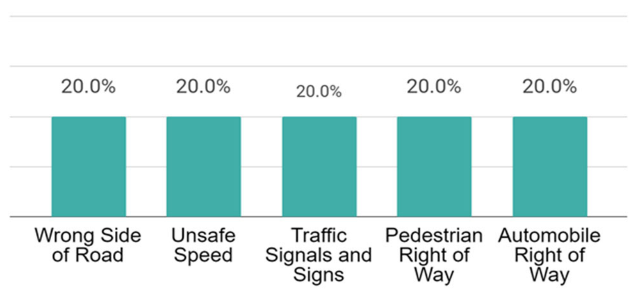


FIGURE 30: KSI PRIMARY VIOLATION CATEGORY

5.3 EMPHASIS AREAS

Emphasis Areas provide a strategic framework for developing and implementing strategies and actions for the LRSP. The Emphasis Areas were developed, using the results of crash data analysis and input from staff and stakeholders. For each emphasis area, quantitative crash reduction goals were identified to provide a metric to evaluate the ongoing effectiveness of project implementation, programs, and policies. The goal to eliminate severe and fatal crashes requires the holistic implementation of the Safe System approach with the use of infrastructure-based and non-infrastructure countermeasures to create redundancies in the roadway system and through education and enforcement practices. A detailed summary and additional sources for infrastructure and non-infrastructure based countermeasures are provided in the Appendix. For the development of strategies, the Emphasis Areas were categorized in four broader groups: Vulnerable Users, Risky Behaviors, Infrastructure, and Improved Systems. Each group is described below with the associated Emphasis Areas.

Vulnerable Road Users

Vulnerable road users can be characterized by the amount of protection they have when using the transportation system. For example, pedestrians, bicyclists, and motorcyclists are more exposed than people in vehicles, making them more susceptible to injury in the event of a crash. Countywide, crashes involving vulnerable users make up 49% of all Fatal or Severe Injury crashes. Because of the overall low number of crashes, especially high severity crashes, in Rio Vista, no Emphasis Areas specific to vulnerable users were identified. However, it should be noted that the current Rio Vista transportation system provides limited opportunities for safe and comfortable walking and cycling. Future transportation projects should consider vulnerable road users and incorporate best practices and standards for improving the connectivity and safety for pedestrians and cyclists.

Consideration of Location Types. Pedestrian-involved crashes tend to occur most often in downtown core areas, consistent with higher pedestrian activity. High-volume signalized intersections can increase pedestrian crash risk due to complexities resulting from multiple types of road users (pedestrians, bicyclists, passenger vehicles, buses, trucks) and heavy turning movements at the location. Motorcyclist-involved collisions occur system-wide, and often involve high speeds of either the motorcyclist, other vehicle, or both.

Risky Behaviors

Reductions in fatalities and serious injuries can be accomplished by deterring unsafe or risky behaviors made by drivers and other transportation users. For this category, the following Emphasis Areas were identified:

- **Speeding -** focuses on speeding as a driving behavior that puts the driver and other road users at risk. Speeding not only increases the risk of a crash occurring, but also results in more severe injuries to those involved.

Consideration of Location Types. Fatal and serious injury crashes that involve impairment are often identified on low-volume suburban or rural roads, as impaired drivers may choose to avoid high-volume roads like freeways. This can result in roadway departure crash events at and near horizontal curves. Speed affects both the likelihood of a crash occurring and crash severity, regardless of location. For example, speeding drivers may be more likely to depart the road at a horizontal curve. In a downtown setting, vehicle speed is directly correlated to the injury severity of a pedestrian-involved or bicyclist-involved crash.

Following the Safe System approach, Table 29 summarizes the goals and strategies for each of these emphasis areas. Additional information on specific countermeasures, treatments, and strategies can be found in the Countermeasure Toolboxes in the Appendix.

TABLE 29: EMPHASIS AREAS, GOALS, AND STRATEGIES FOR RISKY BEHAVIORS

EMPHASIS AREA	GOALS	STRATEGIES
	• **Eliminate** fatal and serious injury crashes resulting from unsafe speeds **by 2035**.	**Safe Roads** • Engineering countermeasures focused on designing or improving roads that lead to travel speeds more appropriate to the surrounding land use (e.g., road diets, raised medians and edge treatments, and variable speed warning signs). **Safe Vehicles** • Develop a readiness plan for Connected and Automated Vehicles (CAVs) **Safe Road Users** • Implement high-visibility enforcement campaigns **Safe Speeds** • Use recent legislation and national research to set context-appropriate speeds suitable for all road users • Implement a safe speeds education campaign

Infrastructure

Multimodal transportation assets can be constructed or retrofitted to reduce the risk of fatal and serious injury crashes. Opportunities to do this include implementing safety treatments at intersections and along and across roadways. For this category, the following Emphasis Areas were identified:

- **Intersections -** focuses on crashes that occur within the functional area of an intersection. Intersections are the primary source of conflicts between road users of all types. Crash severity and patterns vary based on traffic control type, but intersection-related crashes that involve speeding, red-light running, and vulnerable users often result in fatal and serious injuries.
- **Lane Departure -** focuses on crashes that fall within two categories: crashes caused by crossing into the opposing lane and crashes caused by running off the road. These crashes are prone to more severe outcomes and are often associated with risky driver behaviors such as speeding, distraction, and impairment.
- **Dark Conditions –** focuses on crashes that occur at night. These crashes are prone to more severe outcomes, often involve vulnerable road users, and are often associated risky driver behaviors such as impairment.

Consideration of Location Types. Intersection collisions occur most often at 2-way stop controlled and signalized locations. The severity of intersection crashes may be more likely in higher-speed environments (e.g., suburban, rural). Lane departure crashes are often assumed to only occur in rural areas, but lane departures can also be problematic in downtown areas due to the close proximity of roadside fixed objects (e.g., utility poles, mailboxes, vegetation).

Following the Safe System approach, Table 30 summarizes the goals and strategies for each of these emphasis areas. Additional information on specific countermeasures, treatments, and strategies can be found in the Countermeasure Toolboxes in the Appendix.

TABLE 30: EMPHASIS AREAS, GOALS, AND STRATEGIES FOR INFRASTRUCTURE

EMPHASIS AREA	GOALS	STRATEGIES
	• **Eliminate** fatal and serious injury crashes at intersections **by 2035**.	**Safe Roads** • Engineering countermeasures focused on increasing visibility and driver awareness of intersections, reducing conflicts between road users, and reducing conflicts between road users. **Safe Vehicles** • Develop a readiness plan for Connected and Automated Vehicles (CAVs) **Safe Road Users** • Implement high-visibility enforcement campaigns **Safe Speeds**

EMPHASIS AREA	GOALS	STRATEGIES
		• Use recent legislation and national research to set context-appropriate speeds suitable for all road users • Implement a safe speeds education campaign **Other** • Coordinate with STA to implement data management strategies and better monitor system safety performance, including contextual data inventory, crash risk indicators, and crash reporting
	• **Continue** having no fatal or serious injury crashes resulting from lane departures.	**Safe Roads** • Engineering countermeasures focused on increasing road/lane awareness and providing a more recoverable roadside **Safe Vehicles** • Develop a readiness plan for Connected and Automated Vehicles (CAVs) **Safe Road Users** • Implement high-visibility enforcement campaigns **Safe Speeds** • Use recent legislation and national research to set context-appropriate speeds suitable for all road users • Implement a safe speeds education campaign **Other** • Coordinate with STA to implement data management strategies and better monitor system safety performance, including contextual data inventory, crash risk indicators, and crash reporting
	• **Eliminate** fatal and serious injury crashes occurring in dark conditions **by 2035**.	**Safe Roads** • Engineering countermeasures focused on installing or upgrading segment and intersections lighting and improving visibility of intersections **Safe Vehicles** • Develop a readiness plan for Connected and Automated Vehicles (CAVs) **Safe Road Users** • Implement high-visibility enforcement campaigns **Safe Speeds**

EMPHASIS AREA	GOALS	STRATEGIES
		• Use recent legislation and national research to set context-appropriate speeds suitable for all road users • Implement a safe speeds education campaign **Other** Coordinate with STA to implement data management strategies and better monitor system safety performance, including contextual data inventory, crash risk indicators, and crash reporting

Emerging Technology

New and innovative technological advances can help improve current safety practices. Table 31highlights some of the goals and strategies for emerging technology.

TABLE 31: GOALS AND STRATEGIES FOR EMERGING TECHNOLOGY

GOALS	STRATEGIES
• Maintain and build awareness of how emerging technology solutions can improve understanding of crash trends and user safety. • Identify and fund pilot programs for effective technology solutions for increasing safety (e.g. near miss analytics, crash analytics dashboards). • Build and maintain a comprehensive citywide crash and inventory database.	• Contextual Data Inventory – Vendors such as Mapillary and Ecopia provide up-to-date data on transportation infrastructure, including roadway characteristics, intersection characteristics, and signs. Updated inventory can help City staff identify project synergies, such as including a safety countermeasure with a repaving project and support systemic safety analysis for future safety plans and evaluations. • Crash Risk Indicators - Surrogate safety measures, such as "near-miss" crashes, hard braking data, speed data, community-reported hazards, and high stress facilities provide an understanding of the safety landscape and enable proactive interventions. Technology such as video data and platforms which provide public crowdsourcing can close the gap and provide key insights regarding near miss data in the absence of crash data. • Crash Reporting **-** Crash reporting practices, such as complete data collection and documentation of road user behavior and infrastructure, can lead to a greater understanding of the holistic safety landscape, and thus lead to improved investments in safety.

COMPLEMENTARY PROGRAMS AND PRACTICES

Crash history and other types of safety data can be advanced to better understand the causes and locations of crashes, leading to effective solutions. One framework is the list of USDOT's data quality attributes: timeliness, accuracy, completeness, uniformity, integration, and accessibility. Training is used to educate planners, engineers, designers, and construction staff about the importance of safety and how to incorporate it into their everyday job responsibilities. This also includes training staff on culturally relevant community engagement. Fully funded, staffed, and trained law enforcement and emergency response agencies can direct their efforts toward keeping users safe and, when crashes do occur, have the resources and systems in place so traffic incident management and emergency medical services personnel are available to respond.

Strategy - Culturally Relevant Community Engagement and Street Safety Ambassador Program – Community engagement is not a one-size-fits-all model. Culturally relevant community engagement strategies can help education and programming around traffic safety reach a larger audience and be more impactful by making materials readable for all and meeting the community where they are.

Strategy - Rapid Response Safety Communication Protocol and Multi-Disciplinary Team - An internal, multi-department communication strategy should be deployed in response to severe and fatal crashes. This includes immediate on-the ground-response to an investigation of severe and

fatal crashes, ensuring a multi-disciplinary response team focused both on the behavioral and engineering elements of a crash. This team also supports timely data sharing among City departments, ensures data accuracy, and develops near-term interventions.

Strategy - Victim and Family Support - Post-crash care includes providing resources to both the victim, their friends, and their families. To ensure a crash survivor receives the care needed to recover and restore body and mind to an active life within society, they require medical rehabilitation with specialists that can range from orthopedics, neurosurgery, physical and occupational therapy, and prosthetics to psychology and neuropsychology. Resources for crash survivors, their family, and friends, can be found on Solano County Behavioral Health Services' website: https://www.solanocounty.com/depts/mhs/default.asp

5.4 HIGH PRIORITY LOCATIONS AND PROJECTS

With a focus on fatal and severe injury crashes, the project team identified locations within the City of Rio Vista that experienced a high frequency or severity of crashes. Once the high-crash locations were identified, each location was scored (or ranked) based on the following metrics.

- **In 2018 Plan?** This identifies whether a safety project was listed at this location in the 2018 Solano County Travel Safety Plan.
- **KSI Crashes.** The number of crash events resulting in a fatality or severe injury at this location.
- **Total Crashes.** The total number of crashes reported and verified to be related to this location.
- **EPDO Score.** The EPDO score, described previously, provides a weighted ranking that accounts for the number and severity of crashes at each location.
- **Number of Emphasis Areas (EAs).** This is the number of EAs that are reflected in the details of the reported crashes at this location.

Within Rio Vista, there were a total of five high crash locations identified, which are summarized in Table 32 and shown on Figure 11. A one-page summary of each location is also provided.

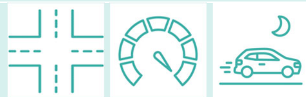
TABLE 32: RIO VISTA HIGH CRASH LOCATIONS

#	LOCATION	IN 2018 PLAN?	KSI CRASHES	TOTAL CRASHES	EPDO SCORE	NUMBER OF EAs (4 max)
1	Highway 12 & Virginia Drive	No	1	11	270	3
2	Highway 12 & Summerset Road	Yes	1	11	239	4
3	Waterwood Drive & Summerset Drive	No	1	1	190	2
4	Church Road & Marks Road	No	1	1	190	1
5	Highway 12 (CA-12)	Yes	3	70	1013	4

FIGURE 31: MAP OF RIO VISTA HIGH CRASH LOCATIONS

LOCATION 1: HIGHWAY 12 & VIRGINIA DRIVE

REPORT CARD

Priority Ranking	2
EPDO Score	270
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	No
Safety Improvements since 2018?	No
Funded HSIP Projects?	No
In Active Transportation Plan?	No

- **Description:** This minor street stop-controlled T-intersection has single-lane approaches with an eastbound left turn lane on Highway 12. The intersection is surrounded by commercial and retail land uses. There is a pedestrian crosswalk on Virginia Drive and sidewalks along the north side of Highway 12 and on both sides of Virginia Drive. There are no marked bicycle facilities. Street lighting is present on the southwest corner of the intersection.

- **Crash Patterns:** This intersection had a total of 11 crashes between 2016 - 2020, including one severe injury crash. The severe injury crash was a broadside crash between a truck and motorcycle in dark conditions on wet pavement. In total, 55% (6) were broadside crashes, 36% (4) were rear-end crashes, 45% (5) of the crashes involved unsafe vehicle speeds, and one crash involved a pedestrian.

- **Diagnosis:** Many of the crashes (broadside and rear-end) are likely a result of the congestion and queuing stemming from the nearby bridge crossing and the high volume of truck traffic. A traffic control change would address many of the conflicts at this intersection that resulted in crashes. As this is a state route, this would require a signal warrant and an Intersection Control Evaluation. As part of the Caltrans Complete Highway 12 project, Caltrans plans to restrict the north leg to a right-turn only from Virginia Drive onto Highway 12. This turn movement restriction may mitigate a significant portion of the crash risks at this location. The City should evaluate the safety performance of this intersection after implementation, and if crash risks persist, consider the following countermeasures.

- **Potential countermeasures**:
  - Install a roundabout (NS5) or traffic signal (NS3)

LOCATION 2: HIGHWAY 12 & SUMMERSET ROAD

REPORT CARD

Priority Ranking	3
EPDO Score	239
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	Yes
Safety Improvements since 2018?	No
Funded HSIP Projects?	No
In Active Transportation Plan?	No

- **Description:** This is a signalized T-intersection with dedicated left turn and right turn lanes on Highway 12 (major street) and separate left and right turn lanes on Summerset Road (minor street). The intersection provides access to a large housing development and golf club. There are no sidewalks, marked pedestrian crossings, or bicycle facilities at the intersection. Intersection lighting is present. This location is part of the Caltrans Complete Highway 12 project.

- **Crash Patterns:** This intersection had a total of 11 crashes between 2016 - 2020, including one severe injury crash. The severe injury crash resulted in a rear-end and involved speeding when it was dark. In total, 64% (7) crashes resulted in rear-ends, 55% (6) of the crashes involved speeding, 27% (3) involved drivers under the influence (DUI), and 18% (2) involved trucks.

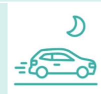
- **Diagnosis:** Based on the crash data, unsafe speeds contributed to crashes at this intersection. The intersection is also wide (with reserved pavement width for future capacity expansions) and may be confusing to drivers, especially drivers under the influence. There is a high volume of truck traffic through this area as well. A roundabout would take advantage of the large existing right of way and would slow traffic without requiring the occasional full stop from a traffic signal. As this is a state route, this would require a signal warrant and an Intersection Control Evaluation.

- **Potential countermeasure(s)**:

  - Install a roundabout (NS5) - Roundabouts slow vehicle speeds and reduce delay for minor street traffic. At this intersection, it will act as a gateway into Rio Vista.

LOCATION 3: SUMMERSET DRIVE & WATERWOOD DRIVE

REPORT CARD

Priority Ranking	4 (tied)
EPDO Score	190
Associated Emphasis Areas	 
In 2018 Travel Safety Plan?	No
Safety Improvements since 2018?	No
Funded HSIP Projects?	No
In Active Transportation Plan?	No

- **Description:** This is a two-way stop-controlled intersection with single-lane approaches, left turn lanes on both Summerset Drive (major street) approaches and stop signs on the Waterwood Drive (minor street) approaches. The intersection serves as an access to the Golf Club (north) and single-family housing (south). There are no sidewalks on the north side of Summerset Drive and the east side of Waterwood Drive. One marked pedestrian crossing is present on the east leg. There are no bicycle facilities at the intersection. This location is a private street owned by the Trilogy HOA.

- **Crash Patterns:** This intersection experienced one crash between 2016 – 2020. The crash was a severe injury crash in which a driver struck a pedestrian at night.

- **Diagnosis:** With only one reported crash, treatments should be focused on the underlying conflicts and crash risks present at this location as opposed to specific crash details. Improving the visibility of the intersection and the awareness of conflicts between vehicles and vulnerable users will mitigate the underlying risks.

- **Potential countermeasure(s)**:
  - Install Lighting (NS1)
  - Install Pedestrian Signage (NS20PB)
  - Install Pedestrian Refuge Median (NS19PB) on the east leg at the marked crosswalk.

LOCATION 4: CHURCH ROAD & MARKS ROAD

REPORT CARD

Priority Ranking	4 (tied)
EPDO Score	190
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	No
Safety Improvements since 2018?	No
Funded HSIP Projects?	No
In Active Transportation Plan?	No

- **Description:** This intersection is unsignalized and has approaches with a separate left and right turn lanes on the Marks Road (minor street) approach. The intersection serves as an access to the housing development on the south end. Just the west of the intersection (approximately 200 feet), there is a locked gate that is accessed by a code. There are no sidewalks except on the north side of Marks Road. There are no marked pedestrian crossing or bicycle facilities at the intersection. Street lighting is preset on the southwest corner. There are plans to add a Class IV Bike/Ped facility with landscaping on Church Rd along the Trilogy Development to Airport Road. A Class IV trail exists from Liberty Island Road to Church Road along Airport Road. The planned project will add the Class IV lane from Church Road to Norman Richard (Business Park).

- **Crash Patterns:** This intersection had one crash between 2016 – 2020. The crash was a fatal crash that resulted in a broadside crash between two vehicles in the daytime while it was raining.

- **Diagnosis:** Based on the crash data information, it is unknown which direction the vehicles were traveling. With only one reported crash, treatments should be focused on the underlying conflicts and crash risks present at this location as opposed to specific crash details. Advance intersection signing may be missing in both directions on Church Road and should either be added or upgraded for improved intersection visibility.

- **Potential countermeasure(s)**:
  - Upgrade Intersection Pavement Markings (NS7)
  - Install Larger or Additional Intersection Warning/Regulatory Signs (NS6)

LOCATION 5: HIGHWAY 12 (CA-12) CORRIDOR

REPORT CARD

Priority Ranking	1
EPDO Score	1013
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	Yes
Safety Improvements since 2018?	No
Funded HSIP Projects?	No
In Active Transportation Plan?	No

- **Description:** This location is the segment of State Route 12 within Rio Vista city limits, approximately from Cattey Lane to the Sacramento River Bridge (3.1 miles). The corridor is a two-lane highway with turn lanes at Summerset Road that transitions to a three-lane cross section between Drouin Drive and the bridge through the downtown commercial area. There are traffic signals at the intersections of Summerset Road and Hillside Terrace.

- **Crash Patterns:** This segment experienced a total of 70 crashes between 2016 – 2020, including one fatal crash and two severe injury crashes. The fatal crash occurred approximately 0.4 miles south of Summerset Road intersection (Postmile 24.16) and was a result of a vehicle that was driving on the wrong side of the road and collided with another vehicle. One of the severe injury crashes occurred at Summerset Road intersection, resulted in a rear-end, and involved unsafe speed. The other severe injury crash occurred at the intersection of Virginia Drive and involved a motorcycle. Over half (39) of the 70 crashes along the segment resulted in rear-end crashes and more than half (38) including speeding. One crash involved a pedestrian and 23% (16) of crashes resulted from a lane/roadway departure.

- **Diagnosis:** Speed was a contributing factor to many of the crashes along the segment. The posted speed is 35 mph in the downtown area and increases to 45 mph just west of where the highway transitions between two and three lanes. 100% of the fatal and severe injury crashes occurred in dark conditions. The number of fatal and severe crashes along this corridor may provide an opportunity to help fund a broader scope systemic application covering multiple locations.

- **Potential countermeasure(s)**:
    - The two severe injury crashes are addressed in Location #1 (Virginia Drive) and Location #2 (Summerset Road)
    - R1 – Install street lighting along the highway segment.
    - NS5/S16 - Install roundabouts at key intersections to encourage slower speeds and reduce high-severity crashes.

CITYWIDE SYSTEMIC OPPORTUNITIES

Systemic safety solutions are a key component of the safe system approach, as they address underlying crash risks on a large scale (a corridor, neighborhood, or entire city), including locations with no reported crash history. By treating the known characteristics that are contributing to crashes on a broad scale, a systemic safety project can proactively eliminate crash risks before a crash occurs. Systemic safety solutions are generally low cost treatments that have a proven safety benefit. The following countermeasures (or groups of countermeasures) could be implemented across the city to address the most common crash risks identified thus far.

- **Potential countermeasures**:
  - **Stop controlled intersection upgrades –** Improve the visibility of stop-controlled intersections by upgrading signing and striping. Upgrades may include: pavement markings, high-visibility stop signs, larger or doubled-up regulatory and warning signs, retroreflective tape on sign posts, and flashing beacons. Countermeasure IDs: NS6, NS7, NS8, NS9
  - **Enhanced pedestrian crossing treatments (unsignalized intersection or midblock) –** Improve driver awareness of potential conflicts with vulnerable road users in locations with nearby pedestrian generators (transit stops, commercial/retail and mixed-use land uses, parks, etc.) and along Safe Routes to School. Treatments may include: high-visibility crosswalks, advanced warning signs, curb extensions, median refuge islands, and active warning devices like RRFBs or PHBs, referencing the FHWA STEP Guide for countermeasure selection. Countermeasure IDs: NS19PB, NS20PB, NS21PB, NS22PB, NS23PB, R35PB, R36PB, R37PB. HSIP grants also commonly offer a set-aside for pedestrian crossing treatments.

5.5 IMPLEMENTATION AND EVALUATION

This Local Road Safety Plan is the framework for engaging residents, stakeholders, employers, planners, engineers, enforcement agencies, and emergency medical service providers across the County in improving transportation safety in Rio Vista. While safety-specific plans and programs are critical to achieving the vision for safety in Rio Vista, traditional transportation planning, design, operations and maintenance decision making processes, programs, and policies should proactively integrate safety as well. The emphasis areas and strategies in this Plan present short-term safety needs and solutions that can be used by stakeholders countywide as funding and implementation opportunities present themselves. Ongoing coordination and collaboration will enhance implementation efforts and set the stage to evaluate progress on policies, programs, and projects.

Using the goals and strategies in the LRSP, planners and engineers can track and plan for safety on the transportation system by:

- Reviewing past, current, and predicted safety trends – Are trends changing? Are the identified strategies reducing fatal and severe crashes within each emphasis area?

- Revising safety goals and strategies – Have the goals been achieved early, or are they progressing slower than expected? Are the responsible parties implementing the strategies, and if not, what are the barriers to implementation (funding, staff resources, lacking champions)?

- Identifying new projects and strategies to achieve results – Safety research and innovative programs are continually advancing. Are new and more effective strategies available that can be used to better improve safety?

- Monitoring and evaluating system performance – Are systems in place to effectively monitor and evaluate safety throughout the city? Do opportunities exist to improve data collection and accuracy/quality?

COLLABORATION

Rio Vista will meet with STA and agency partners on a regular basis to discuss new and ongoing strategy implementations, new strategic and funding opportunities, and barriers to implementation. The purpose of these meetings is to encourage and to maintain communication across stakeholders and provide accountability for implementation. Whenever possible, these meetings should include the representatives from emergency and enforcement services, regional agencies and school districts, and relevant public committees.

POLICY SUPPORT

Projects following the Safe System approach may often require tradeoffs to be made between on-street parking, vehicle level of service, and pedestrian and bicycle safety and accessibility, when funding and/or right of way are limited. A Vision Zero policy and Council Resolution in support of this can help clarify how these decisions will be made at a citywide scale rather than on a project-by-project basis. The policy can also support equity goals in the community by precluding unequal opportunities to those with the historically "loudest" voices or most resources for civic participation.

Other complementary policies to this Plan may include a citywide crosswalk policy and transition plan and a speed management policy and program. The Vision Zero Network website provides additional guidance: https://visionzeronetwork.org/where-to-start/

INSTITUTIONALIZATION

In addition to pursuing funding for the priority and systemic projects identified in this LRSP via upcoming grant opportunities, Rio Vista should consider reactive and project safety project opportunities through:

- Capital Improvement Projects, such as repaving efforts

- Development Impact Review and Mitigation - new guidance from the Institute of Transportation Engineers presents opportunities for bring the Safe System approach into the development review process: https://www.ite.org/pub/?id=94372DF6-BAB5-AE00-E6D5-471ED4F338CE

EVALUATION

Rio Vista will prepare a memo every two years that will summarize crash trends for the city focused on the Emphasis Areas and the stated goals of the current Local Road Safety Plan. This frequency will coincide with the frequency of Caltrans HSIP and ATP funding cycles, allowing the analysis to inform priority projects and funding applications. The memo or findings of the evaluation will be made publicly available to local residents.

The Emphasis Areas and Strategies identified in the Local Road Safety Plan will be re-evaluated every four years as a countywide effort, facilitated by STA, and revised based upon the results of the crash trend analysis.

CHAPTER 6:
SUISUN CITY LOCAL ROAD SAFETY

6.1 INTRODUCTION

Suisun City is located in the central area of Solano County, just south of the City of Fairfield. State Route 12 runs through Suisun City and connects Sebastopol in the west to State Route 49, just north of San Andreas in Calaveras County. Based on the United States Census Bureau, Suisun City is the fourth largest city in Solano County, with a population of 29,518 people as of 2020.

A local road safety plan provides a data- and community-driven framework to systematically identify, analyze and prioritize safety problems and recommend safety improvements on local roads. The following chapter presents the vision statement, summarizes crash data, identifies emphasis areas, recommends high priority project locations and outlines the implementation and evaluation strategies for the City of Suisun City.

VISION STATEMENT

To eliminate fatal and severe injuries on roadways within the City of Suisun City by creating an equitable, sustainable, and multimodal transportation system where people of all ages and abilities can travel free from harm.

6.2 CRASH DATA AND TRENDS

DATA SOURCES

This safety analysis used crash data from both the Statewide Integrated Traffic Records System (SWITRS) and Transportation Injury Mapping System (TIMS). The crash data analyzed for this project included all crashes recorded in SWITRS and/or TIMS during the five-year period between January 1, 2016, and December 31, 2020.

Crash Record Data

For this project and most other safety analyses, the crash severity is defined in the Highway Safety Manual (HSM) as follows:

- **Fatal injury:** A crash that results in the death of a person within 30 days of the crash.
- **Severe (incapacitating) injury:** A crash that results in broken bones, dislocation, severe lacerations, or unconsciousness, but not death.
- **Other Visible injury (non-incapacitating):** A crash that results in other visible injuries, including minor lacerations, bruising, and rashes.
- **Possible injury (complaint of pain):** A crash that results in the complaint of non-visible pain/injury, such as confusion, limping, and soreness.
- **Property damage only (PDO):** A crash without injury or complaint of pain but resulting in property damage to a vehicle or other object, commonly referred to as a “fender bender.”

The most severe crashes, characterized as KSI (Killed or Severely Injured), and the systemic themes derived from them, are the primary focus of this LRSP.

CRASH TRENDS

Figure 32 provides a heatmap of all the crashes within the Suisun City boundary. A high concentration of crashes are located along the major east-west corridor of Highway 12 and the north-south corridor of Sunset Ave. In particular, intersection hotspots are located at Railroad Ave and Sunset Avenue, Pintail Drive and Sunset Avenue, Merganser Drive and Sunset Avenue, and almost every major intersection along Highway 12. Highway 12 is a State Route owned and operated by Caltrans.

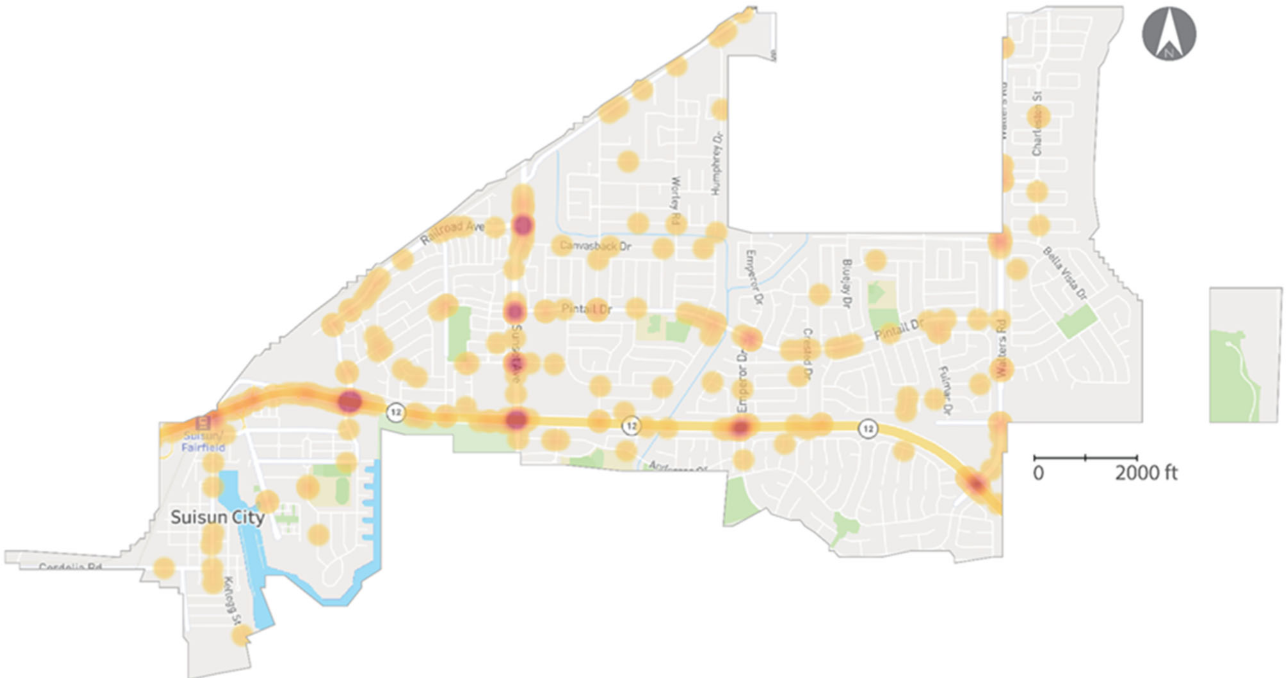


FIGURE 32: HEAT MAP OF ALL NON-INTERSTATE CRASHES WITHIN SUISUN CITY.

MTC also provides a tool that displays the Regional High Injury Network (HIN) for full access roadways[12]. Figure 33 shows the identified Regional HIN in Suisun City. Between 2016 and 2020, a total of 356 reported crashes occurred in Suisun City, including six fatal crashes and 24 severe injury crashes. The following table summarizes key crash statistics that illustrate contextual and behavioral patterns.

[12] https://bayviz.mysidewalk.com/

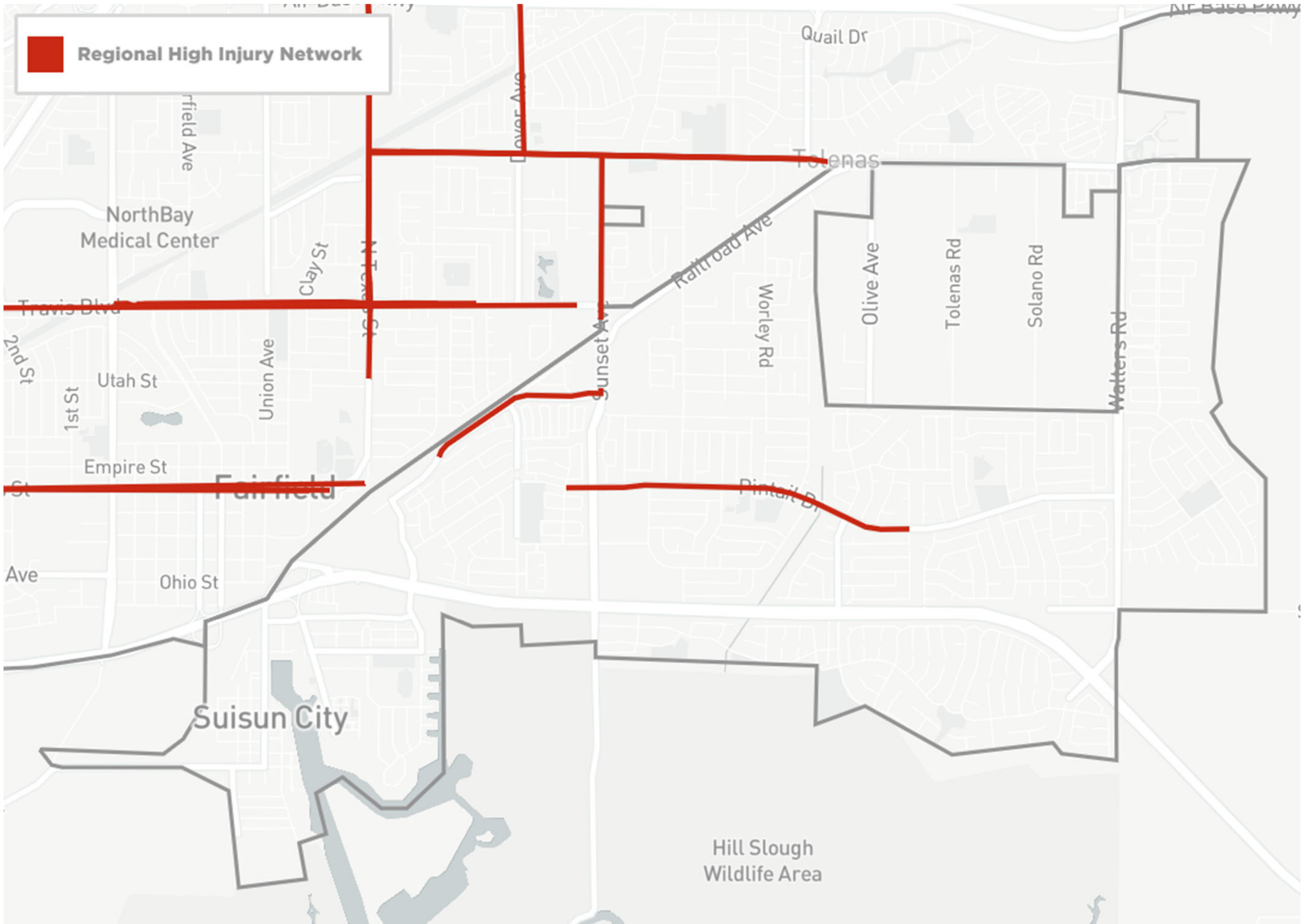


FIGURE 33: REGIONAL HIGH INJURY NETWORK WITHIN SUISUN CITY

TABLE 33: SUISUN CITY SUMMARY OF CRASH STATISTICS

CATEGORY	PROPORTION OF CRASHES	
	All Severities (356 crashes)	Fatal and Severe Crashes (30 crashes)
Pedestrian Involved	12.1%	26.7%
Bicyclist Involved	4.8%	16.7%
Motorcycle Involved	4.8%	13.3%
Alcohol or Drug Involved	5.1%	13.3%
Wet Road Surface	10.4%	10.0%
Speeding Involved[13]	44.4%	40.0%
Lane Departure	30.1%	23.3%
Intersections	75.8%	86.7%

As shown, many of the crash categories are over-represented in fatal and severe injury (KSI) crashes, including pedestrians, bicyclists, motorcyclists, DUI, and at intersections. Because the primary focus of a LRSP is to address KSI crash risks, the following sections present key trends related to these high severity crashes.

[13] The increased kinetic energy from higher speed crashes is generally associated with higher severity crashes. The seeming reduced proportion of speeding-related crashes that result in a KSI may be due to the crash reporting constraint of only having one primary crash factor reported. As a result, a crash that may have involved unsafe speeds may be associated with a different cause of crash

Physical Environment

Approximately 87% of KSI crashes occurred at intersections, while the remaining 13% occurred on roadway segments (including at driveways). Nearly 53% of all KSI crashes occurred during dark conditions.

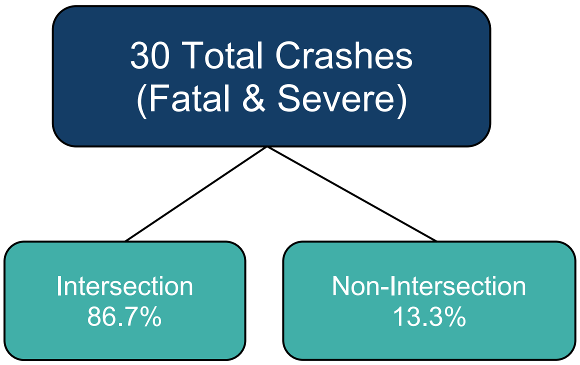


FIGURE 34: KSI LOCATION CRASH TREE

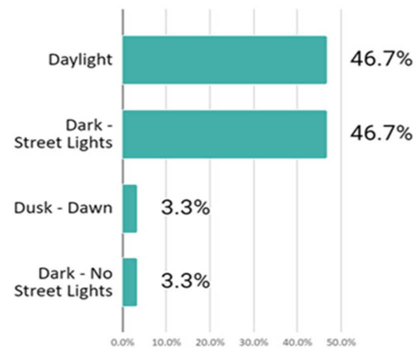


FIGURE 35: KSI LIGHTING CONDITIONS

Crash Types

Crash types provide insights into common conflicts that exist between road users. As shown in Figure 36, the two most common crash types resulting in fatalities or severe injuries are pedestrian (27%) and other (20%). Other vulnerable road users, including bicycle-involved and motorcycle-involved crashes, are not specifically identified on this chart as any non-pedestrian crash is assigned to a crash type (e.g., a right-angle crash between a vehicle and bicycle would be coded as a broadside, and involvement of the bicyclists is noted in a separate field in the crash record). As shown previously in Table 33, 13% of KSI crashes involved a motorcyclist and 17% involved a bicyclist.

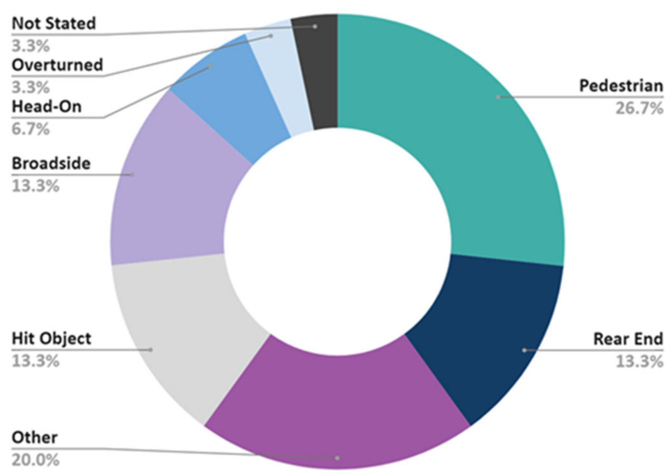


FIGURE 36: KSI CRASH TYPES

Contributing Factors

Primary contributing factors and violation categories can provide insights into human behavior associated with a crash. As shown in Figure 37, the most common violations reported in fatal and severe injury crashes were unsafe speed (40%) and impaired driving (13%). Note that roadway design contributing factors are not included on a collision report, so the comparable role of design and behavior, and how those relate, cannot be determined based on a collision report alone.

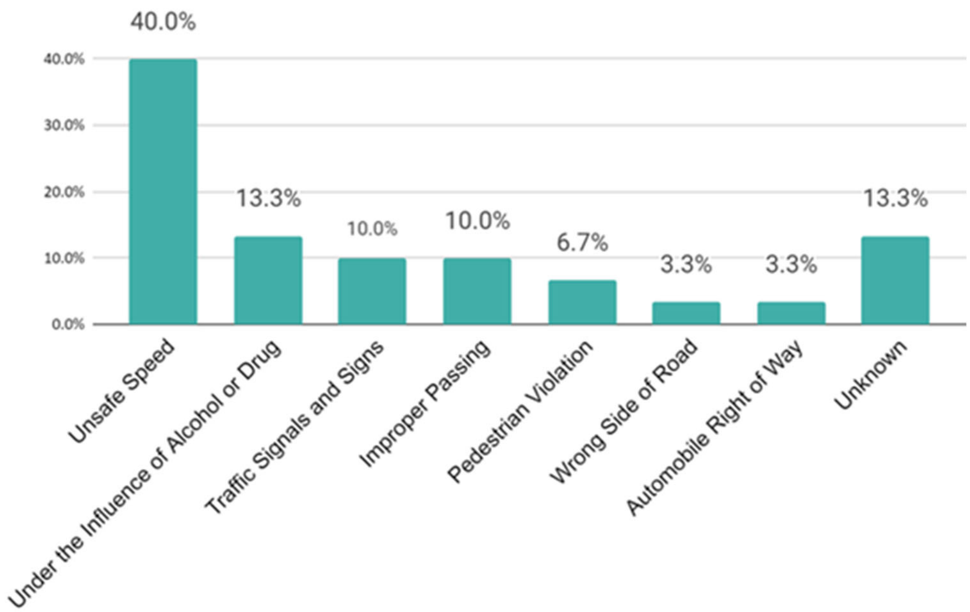


FIGURE 37: KSI PRIMARY VIOLATION CATEGORY

6.3 EMPHASIS AREAS

Emphasis Areas provide a strategic framework for developing and implementing strategies and actions for the LRSP. The Emphasis Areas were developed, using the results of crash data analysis and input from staff and stakeholders. For each emphasis area, quantitative crash reduction goals were identified to provide a metric to evaluate the ongoing effectiveness of project implementation, programs, and policies. The goal to eliminate severe and fatal crashes requires the holistic implementation of the Safe System approach with the use of infrastructure-based and non-infrastructure countermeasures to create redundancies in the roadway system and through education and enforcement practices. A detailed summary and additional sources for infrastructure and non-infrastructure based countermeasures are provided in the Appendix. For the development of strategies, the Emphasis Areas were categorized in four broader groups: Vulnerable Users, Speeding, Dark Conditions, Infrastructure, and Improved Systems. Each group is described below with the associated Emphasis Areas.

Vulnerable Road Users

Vulnerable road users can be characterized by the amount of protection they have when using the transportation system. For example, pedestrians, bicyclists, and motorcyclists are more exposed than people in vehicles, making them more susceptible to injury in the event of a crash. Countywide, crashes involving vulnerable users make up 49% of all Fatal or Severe Injury crashes, while in Suisun City they make up 57%. Aging drivers and pedestrians can also be more vulnerable to severe injuries when a crash occurs. In Suisun City, children under 18 riding bikes are over-represented in fatal or severe crashes (29%) as compared to their proportion of the population (24% of Suisun City residents are under 18 years old).

For this group, the following Emphasis Areas were identified:

- **Pedestrians -** focuses on crashes involving someone walking. Pedestrians are some of the most vulnerable users of a roadway network, and crashes involving pedestrians are more likely to result in a fatal or severe injury. In addition, many younger and older road users travel on foot, which compounds this vulnerability.

Consideration of Location Types. Pedestrian-involved crashes tend to occur most often in downtown core areas, consistent with higher pedestrian activity. High-volume signalized intersections can increase pedestrian crash risk due to complexities resulting from multiple types of road users (pedestrians, bicyclists, passenger vehicles, buses, trucks) and heavy turning movements at the location. Motorcyclist-involved collisions occur system-wide, and often involve high speeds of either the motorcyclist, other vehicle, or both.

Following the Safe System approach, Table 34 summarizes the goals and strategies for each of these emphasis areas. Additional information on specific countermeasures, treatments, and strategies can be found in the Countermeasure Toolboxes in the Appendix.

TABLE 34: EMPHASIS AREAS, GOALS, AND STRATEGIES FOR VULNERABLE ROAD USERS

EMPHASIS AREA	GOALS	STRATEGIES
	• Reduce the Statewide proportion of fatal and serious injury crashes involving pedestrians by **17% by 2035**. • **Eliminate** fatal and serious injury crashes involving pedestrians **by 2040**.	**Safe Roads** • Install engineering countermeasures focused on increasing driver awareness of pedestrians and reducing conflict zones between vehicles and pedestrians • Develop and implement a Construction Accessibility Policy to maintain accessibility during construction and maintenance projects **Safe Road Users** • Improve infrastructure connectivity for pedestrians, especially along safe routes to school • Expand safe routes to school programming • Pair education with key engineering and enforcement countermeasures

Risky Behaviors

Reductions in fatalities and serious injuries can be accomplished with roadway design and management to encourage safe speeds, separate users in space and time, reduce kinetic energy transfer, and manipulate crash angles by deterring unsafe or risky behaviors made by drivers and other transportation users. For this category, the following Emphasis Areas were identified:

- **Speeding -** focuses on speeding as a driving behavior that puts the driver and other road users at risk. Speeding not only increases the risk of a crash occurring, but also results in more severe injuries to those involved.

Consideration of Location Types. Fatal and serious injury crashes that involve impairment are often identified on low-volume suburban or rural roads, as impaired drivers may choose to avoid high-volume roads like freeways. This can result in roadway departure crash events at and near horizontal curves. Speed affects both the likelihood of a crash occurring and crash severity, regardless of location. For example, speeding drivers may be more likely to depart the road at a horizontal curve. In a downtown setting, vehicle speed is directly correlated to the injury severity of a pedestrian-involved or bicyclist-involved crash.

Following the Safe System approach, Table 35 summarizes the goals and strategies for this emphasis areas. Additional information on specific countermeasures, treatments, and strategies can be found in the Countermeasure Toolboxes in the Appendix.

TABLE 35: EMPHASIS AREAS, GOALS, AND STRATEGIES FOR RISKY BEHAVIORS

EMPHASIS AREA	GOALS	STRATEGIES
	• Reduce the rate of fatal and serious injury crashes resulting from unsafe speeds **by 15% by 2035**. • **Eliminate** fatal and serious injury crashes resulting from unsafe speeds **by 2040**.	**Safe Roads** • Install engineering countermeasures focused on designing and improving roadways that lead to more appropriate speeds to the surrounding land uses **Safe Vehicles** • Develop a readiness plan for Connected and Automated Vehicles (CAVs) **Safe Road Users** • Implement high-visibility enforcement campaigns • Partner with local businesses and organizations on educational efforts and campaigns along hot spot corridors **Safe Speeds** • Use recent legislation and national research to set context-appropriate speeds suitable for all road users • Implement a safe speeds education campaign **Other** • Coordinate with STA to implement data management strategies and better monitor system safety performance, including contextual data inventory, crash risk indicators, and crash reporting

Infrastructure

Multimodal transportation assets can be constructed or retrofitted to reduce the risk of fatal and serious injury crashes. Opportunities to do this include implementing safety treatments at intersections and along and across roadways. For this category, the following Emphasis Areas were identified:

- **Intersections -** focuses on crashes that occur within the functional area of an intersection. Intersections are the primary source of conflicts between road users of all types. Crash severity and patterns vary based on traffic control type, but intersection-related crashes that involve speeding, red-light running, and vulnerable users often result in fatal and serious injuries.
- **Lane Departure -** focuses on crashes that fall within two categories: crashes caused by crossing into the opposing lane and crashes caused by running off the road. These crashes are prone to more severe outcomes and are often associated with risky driver behaviors such as speeding, distraction, and impairment.
- **Dark Conditions -** focuses on crashes that occur during dark, dawn, or dusk conditions. Crashes at night tend to be higher severity due to higher travel speeds (less congestion), increased impairment levels, and reduced visibility of vulnerable road users.

Consideration of Location Types. Intersection collisions occur most often at 2-way stop controlled and signalized locations. The severity of intersection crashes may be more likely in higher-speed environments (e.g., suburban, rural). Lane departure crashes are often assumed to only occur in rural areas, but lane departures can also be problematic in downtown areas due to the close proximity of roadside fixed objects (e.g., utility poles, mailboxes, vegetation).

Following the Safe System approach, Table 36 summarizes the goals and strategies for each of these emphasis areas. Additional information on specific countermeasures, treatments, and strategies can be found in the Countermeasure Toolboxes in the Appendix.

TABLE 36: EMPHASIS AREAS, GOALS, AND STRATEGIES FOR INFRASTRUCTURE

EMPHASIS AREA	GOALS	STRATEGIES
	• Reduce the rate of fatal and serious injury crashes occurring at intersections by **50% by 2035**. • **Eliminate** fatal and serious injury crashes at intersections **by 2040**.	**Safe Roads** • Install engineering countermeasures focused on increasing visibility and driver awareness of intersections, reducing conflicts between road users, and improving signal operations **Safe Vehicles** • Develop a readiness plan for Connected and Automated Vehicles (CAVs) **Safe Road Users** • Implement high-visibility enforcement campaigns

EMPHASIS AREA	GOALS	STRATEGIES
		Safe Speeds • Use recent legislation and national research to set context-appropriate speeds suitable for all road users • Implement a safe speeds education campaign • Implement automated speed enforcement when available **Other** • Coordinate with STA to implement data management strategies and better monitor system safety performance, including contextual data inventory, crash risk indicators, and crash reporting
	• Reduce the rate of fatal and serious injury crashes resulting from lane departure by **50% by 2035**. • **Eliminate** fatal and serious injury crashes resulting from lane departure **by 2040**.	**Safe Roads** • Install engineering countermeasures focused on increasing road/lane awareness and providing more roadside recovery opportunities **Safe Vehicles** • Develop a readiness plan for Connected and Automated Vehicles (CAVs) **Safe Road Users** • Implement high-visibility enforcement campaigns **Safe Speeds** • Use recent legislation and national research to set context-appropriate speeds suitable for all road users • Implement a safe speeds education campaign **Other** • Coordinate with STA to implement data management strategies and better monitor system safety performance, including contextual data inventory, crash risk indicators, and crash reporting
	• Reduce the proportion of fatal and serious injury crashes occurring in dark conditions **below the Countywide proportion (46%) by 2035**. • **Eliminate** datal and serious injury crashes occurring in dark conditions **by 2040**.	**Safe Roads** • Install engineering countermeasures focused on improving nighttime infrastructure awareness and decision making **Safe Vehicles** • Develop a readiness plan for Connected and Automated Vehicles (CAVs)

EMPHASIS AREA	GOALS	STRATEGIES
		Safe Road Users • Implement high-visibility enforcement campaigns targeted at impairment and speeding **Safe Speeds** • Use recent legislation and national research to set context-appropriate speeds suitable for all road users • Implement a safe speeds education campaign **Other** • Coordinate with STA to implement data management strategies and better monitor system safety performance, including contextual data inventory, crash risk indicators, and crash reporting

Emerging Technology

New and innovative technological advances can help improve current safety practices. Table 37 highlights some of the goals and strategies for emerging technology.

TABLE 37: GOALS AND STRATEGIES FOR EMERGING TECHNOLOGY

GOALS	STRATEGIES
• Maintain and build awareness of how emerging technology solutions can improve understanding of crash trends and user safety. • Identify and fund pilot programs for effective technology solutions for increasing safety (e.g. near miss analytics, crash analytics dashboards). • Build and maintain a comprehensive citywide crash and inventory database.	• Contextual Data Inventory – Vendors such as Mapillary and Ecopia provide up-to-date data on transportation infrastructure, including roadway characteristics, intersection characteristics, and signs. Updated inventory can help City staff identify project synergies, such as including a safety countermeasure with a repaving project and support systemic safety analysis for future safety plans and evaluations. • Crash Risk Indicators - Surrogate safety measures, such as "near-miss" crashes, hard braking data, speed data, community-reported hazards, and high stress facilities provide an understanding of the safety landscape and enable proactive interventions. Technology such as video data and platforms which provide public crowdsourcing can close the gap and provide key insights regarding near miss data in the absence of crash data. • Crash Reporting **-** Crash reporting practices, such as complete data collection and documentation of road user behavior and infrastructure, can lead to a greater understanding of the holistic safety landscape, and thus lead to improved investments in safety.

COMPLEMENTARY PROGRAMS AND PRACTICES

Crash history and other types of safety data can be advanced to better understand the causes and locations of crashes, leading to effective solutions. One framework is the list of USDOT's data quality attributes: timeliness, accuracy, completeness, uniformity, integration, and accessibility. Training is used to educate planners, engineers, designers, and construction staff about the importance of safety and how to incorporate it into their everyday job responsibilities. This also includes training staff on culturally relevant community engagements. Fully funded, staffed, and trained law enforcement and emergency response agencies can direct their efforts toward keeping users safe and, when crashes do occur, have the resources and systems in place so traffic incident management and emergency medical services personnel are available to respond.

Strategy - Culturally Relevant Community Engagement and Street Safety Ambassador Program – Community engagement is not a one-size-fits-all model. Culturally relevant community engagement strategies can help education and programming around traffic safety reach a larger audience and be more impactful by making materials readable for all and meeting the community where they are.

Strategy - Rapid Response Safety Communication Protocol and Multi-Disciplinary Team - An internal, multi-department communication strategy should be deployed in response to severe and fatal crashes. This includes immediate on-the ground-response to an investigation of severe and

fatal crashes, ensuring a multi-disciplinary response team focused both on the behavioral and engineering elements of a crash. This team also supports timely data sharing among City departments, ensures data accuracy, and develops near-term interventions.

Strategy - Victim and Family Support - Post-crash care includes providing resources to both the victim, their friends, and their families. To ensure a crash survivor receives the care needed to recover and restore body and mind to an active life within society, they require medical rehabilitation with specialists that can range from orthopedics, neurosurgery, physical and occupational therapy, and prosthetics to psychology and neuropsychology. Resources for crash survivors, their family, and friends, can be found on Solano County Behavioral Health Services' website: https://www.solanocounty.com/depts/mhs/default.asp

6.4 HIGH PRIORITY LOCATIONS AND PROJECTS

With a focus on fatal and severe injury crashes, the project team identified locations within the City of Suisun City that experienced a high frequency or severity of crashes. Once the high-crash locations were identified, each location was scored (or ranked) based on the following metrics.

- **In 2018 Plan?** This identifies whether a safety project was listed at this location in the 2018 Solano County Travel Safety Plan.
- **KSI Crashes.** The number of crash events resulting in a fatality or severe injury at this location.
- **Total Crashes.** The total number of crashes reported and verified to be related to this location.
- **EPDO Score.** The EPDO score, described previously, provides a weighted ranking that accounts for the number and severity of crashes at each location.
- **Number of Emphasis Areas (EAs).** This is the number of EAs that are reflected in the details of the reported crashes at this location.

Within Suisun City, eight high crash locations were identified, which are summarized in Table 38 and shown on Figure 38. Note that locations #1, 2, 4, and 8 are within state jurisdiction/rights-of-way and as such are operated and maintained by Caltrans. A one-page summary of each location is also provided.

TABLE 38: SUISUN CITY HIGH CRASH LOCATIONS

#	LOCATION	IN 2018 PLAN?	KSI CRASHES	TOTAL CRASHES	EPDO SCORE	NUMBER OF EAs (5 max)
1	Hwy 12 & Marina Boulevard	No	4	39	991	5
2	Hwy 12 & Sunset Avenue	No	0	22	175	5
3	Sunset Avenue & Pintail Drive	No	2	16	447	4

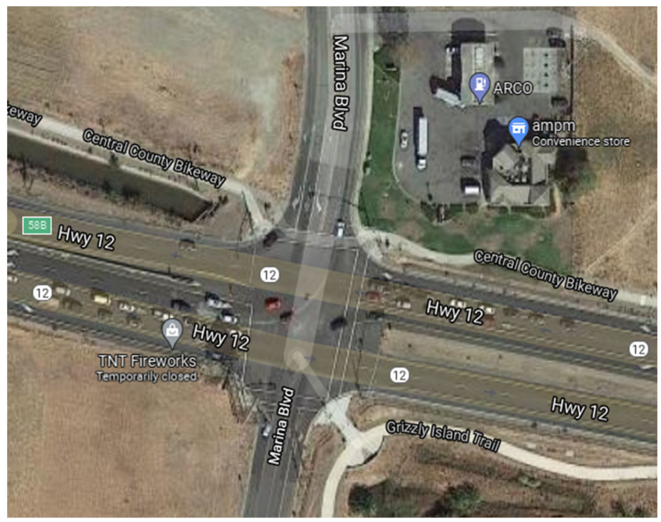
#	LOCATION	IN 2018 PLAN?	KSI CRASHES	TOTAL CRASHES	EPDO SCORE	NUMBER OF EAs (5 max)
4	Hwy 12 & Walters Road	Yes	1	15	282	5
5	Sunset Avenue & Merganser Drive	No	1	12	280	5
6	Walters Road & Montebello Drive	No	1	3	207	3
7	Walters Road & McClellan Drive	No	1	3	207	3
8	State Route 12	No	8	154	2,682	5

FIGURE 38: MAP OF SUISUN CITY HIGH CRASH LOCATIONS

LOCATION 1: HIGHWAY 12 & MARINA BOULEVARD

REPORT CARD

Priority Ranking	1
EPDO Score	991
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	No
Safety Improvements since 2018?	Yes
Funded HSIP Projects?	No
In Active Transportation Plan?	No



Description: This four-leg intersection is signalized and has two through lanes on Highway 12 and single through lanes on the Marina Boulevard approaches with dedicated left and right turn lanes. The intersection is located along a major highway that provides access to residential areas. There are marked pedestrian crosswalks on three of the four legs. There is a general lack of sidewalk facilities except for the Grizzly Island Trail, the Central County Bikeway, and the sidewalk along the east side of Marina Boulevard. There are no on-street bicycle facilities, but the Central County Bikeway runs along the north side of Highway 12. Intersection lighting is present. Highway 12 and this intersection are operated and maintained by Caltrans.

Summary of Recent Safety Improvements: In late 2020, advance warning devices (flashing beacons) were completed to alert EB motorists to vehicle stacking on Highway 12 east of Marina Boulevard. The flashing beacons are located on the south side of Highway 12 at the Civic Center Boulevard off-ramp. In addition, a few months ago, Caltrans upgraded the crosswalks to high-visibility crosswalks (north and east legs only). Caltrans has recently also installed Ped Crossing Warning Signs for WB Highway 12 motorists turning right onto NB Marina Boulevard as well as for NB motorists turning right onto EB Highway 12.

Crash Data: This intersection had a total of 39 crashes between 2016 – 2020, including two fatal crashes and two severe injury crashes. One fatal crash involved a pedestrian that was struck by a vehicle while in the crosswalk and involved alcohol. The other fatal crash involved a bicycle that was struck by a vehicle while it was raining. The severe injury collisions resulted in rear-end and broadside collisions and both involved trucks. All four of these collisions occurred in the nighttime when it was dark.

Diagnosis: Over half of the collisions (56%) occurred in dark conditions and 41% involved unsafe speeds. The severity of the crashes may provide an opportunity to help fund a broader scope systemic application covering multiple signalized locations.

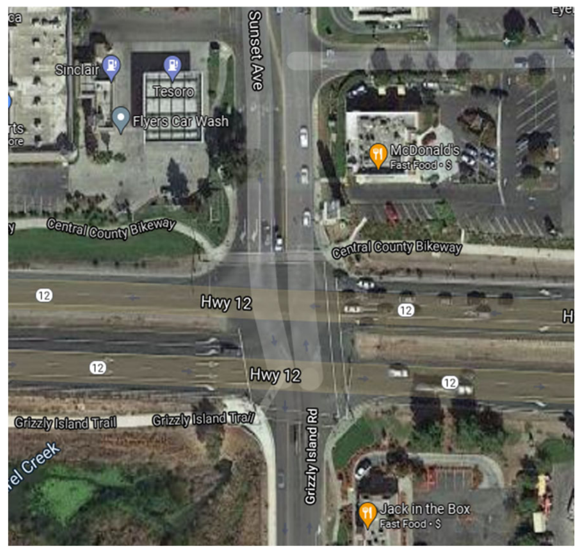
Potential countermeasures:

- S1- Install intersection lighting and advanced lighting approaching intersection
- S4 – Install advanced dilemma zone detection for WB Highway 12 motorists
- S10 - Provide advances intersection warning signs and beacons

LOCATION 2: HIGHWAY 12 & SUNSET AVENUE

REPORT CARD

Priority Ranking	4
EPDO Score	175
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	No
Safety Improvements since 2018?	Yes
Funded HSIP Projects?	No
In Active Transportation Plan?	Yes



Description: This intersection is signalized with two through lanes on Highway 12 and single through lanes on Sunset Avenue/Grizzly Island Road with split phasing. The intersection is surrounded by commercial land. The Grizzly Island Trail and Central County Bikeway run along Highway 12 and provide pedestrian and bicycle facilities. However, the existing dual southbound right conflicts with the Central County Bikeway. There are marked pedestrian crosswalks on three of the four approaches. Intersection lighting is present. Highway 12 and this intersection are operated and maintained by Caltrans.

Summary of Recent Safety Improvements:
Caltrans has recently installed Ped Crossing Warning Signs for WB Highway 12 motorists turning right onto NB Sunset Avenue as well as for NB motorists turning right onto EB Highway 12.

Crash Data: This intersection had 22 crashes between 2016 – 2020, with no fatal or severe injury crashes. Of the crashes that occurred here, almost half (10 of 22, 45%) resulted in a rear-end collision and 27% (6 of 22) resulted in a broadside collision. Almost half involved unsafe speeds (10 of 22, 45%), one involved a pedestrian, and 2 involved a bicycle.

Diagnosis: The intersection is wide and there is less than 1 signal head per travel lane on most approaches. Signal backplates were recently installed on the existing signal heads. Many of the crashes involved speeding and resulted in rear-end collisions, indicating there may be a need for advance signal warning improvements.

Potential countermeasures:

- S1 - Install intersection lighting and advanced lighting approaching intersection
- S2 – Improve signal hardware (supplemental signal heads, larger lenses, etc.)
- S4 – Install advanced dilemma zone detection

- S10 – Install advanced warning signs and beacons on Highway 12
- S21PB: Install leading pedestrian interval (Pedestrian Refuge/ADA Ramp in ATP Ped Project)

LOCATION 3: SUNSET AVENUE & PINTAIL DRIVE

REPORT CARD

Priority Ranking	-
EPDO Score	447
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	No
Safety Improvements since 2018?	No
Funded HSIP Projects?	Yes
In Active Transportation Plan?	No

Description: This four-leg intersection is signalized with two through lanes with dedicated left turn lanes on Sunset Avenue and single through lanes with dedicated left turn lanes on Pintail Drive. The intersection is surrounded by residential land uses with a gas station and convenience store on the northeast corner. There are sidewalks on all approaches and marked crosswalks on all four legs. There are marked bicycle lanes on Sunset Avenue. Intersection lighting is present.

Crash Data: This intersection had 16 crashes between 2016 – 2020, including one that resulted in a fatal crash and one that resulted in a severe injury. The fatal crash involved a pedestrian not in the crosswalk that was struck by a vehicle. The severe injury crash involved a left turning vehicle and a bicycle. Both collisions occurred during the daytime.

Of the 16 crashes that occurred at this intersection, 44% (7 of 16) involved left turning vehicles, 4 resulted in a head-on collision, and 3 resulted in broadside collisions.

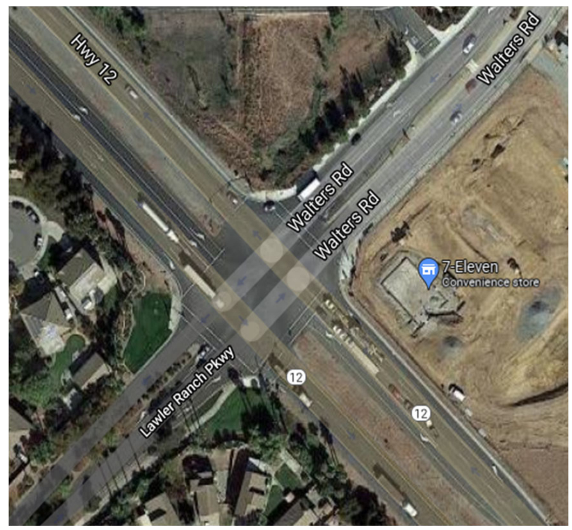
Diagnosis: The left turn phasing on Pintail Drive approaches is permissive only. Installing protected left turn phasing may help reduce the number of left turn/broadside collisions. Pedestrian improvements to the signal timing could also be considered at this intersection.

Potential countermeasures: Signalized intersection upgrades identified in the 2018 Travel Safety Plan, including protected left-turn phasing and pedestrian enhancements, were funded in HSIP Cycle 10 and are currently being designed. No additional countermeasures are recommended at this time.

LOCATION 4: HIGHWAY 12 & WALTERS ROAD

REPORT CARD

Priority Ranking	2
EPDO Score	287
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	Yes
Safety Improvements since 2018?	Yes
Funded HSIP Projects?	No
In Active Transportation Plan?	No



- **Description**: This four-leg intersection is signalized with two through lanes on Highway 12 and single through lanes on Walters Road/Lawler Ranch Parkway. The adjacent land use is residential to the south/west and of the intersection. There is a Walmart on the north corner and developing commercial on the east corner. There are sidewalks on Walters Road and Lawler Ranch Parkway, but none on Highway 12. Marked, signalized pedestrian crossings are provided on three of the four legs. Intersection lighting is present. The signal timing on the Lawler Ranch Parkway and Walters Road approaches have split timing phasing. Highway 12 and this intersection are operated and maintained by Caltrans.

- **Summary of Recent Safety Improvements:** Cobra head street lighting were installed on the east side of Walters Road, immediately north of Highway 12.

- **Crash Data**: This intersection had 15 crashes between 2016 – 2020, including one fatal crash. The fatal crash involved a pedestrian that was walking along the side of the road on Highway 12 and was struck by a speeding vehicle. Of the crashes at this intersection, 53% (8 of 15) involved speeding, 33% (5 of 15) occurred when it was dark, and 13% (2 of 15) involved drivers under the influence. Rear-end collisions made up almost half (7 of 15, 47%) of the crashes at this location.

- **Diagnosis:** Because of the high number of rear end collisions and collisions involve speeding, advance signal warning for EB Highway 12 and signal timing improvements are recommended at this location. The severity of the crashes may provide an opportunity to help fund a broader scope systemic application covering multiple signalized locations.

- **Potential countermeasures**:
  - S1 – Install street lighting at intersection
  - S2 – Improve signal hardware (reflectorized backplates, supplemental heads, etc.)
  - S3 - Improve signal coordination & phasing
  - S4 – Install advanced dilemma zone detection
  - S10 – Install advanced intersection warning signs and beacons on EB Highway 12

LOCATION 5: SUNSET AVE & MERGANSER DRIVE

REPORT CARD

Priority Ranking	-
EPDO Score	280
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	No
Safety Improvements since 2018?	No
Funded HSIP Projects?	Yes
In Active Transportation Plan?	No

- **Description**: This four-leg intersection is signalized and is located near commercial and retail land uses. There are sidewalks and marked pedestrian crossings on all legs. Marked bicycle lanes are provided on Sunset Avenue. Intersection lighting is present.

- **Crash Data**: This intersection had 12 crashes between 2016 – 2020, including one severe injury crash. The severe injury crash occurred when a left turning vehicle struck a pedestrian who was in the crosswalk. Of the crashes at this intersection, 50% (6 of 12) involved a pedestrian, 33% (4 of 12) involved speeding, and 1 involved a driver under the influence.

- **Diagnosis:** This intersection has a high percentage of pedestrian-involved crashes as well as turning and rear-end collisions.

- **Potential countermeasures**: Signalized intersection upgrades identified in the 2018 Travel Safety Plan, including protected left-turn phasing and pedestrian enhancements, were funded in HSIP Cycle 10 and are currently being designed. No additional countermeasures are recommended at this time.

LOCATION 6: WALTERS ROAD & MONTEBELLO DRIVE

REPORT CARD

Priority Ranking	-
EPDO Score	207
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	No
Safety Improvements since 2018?	No
Funded HSIP Projects?	Yes
In Active Transportation Plan?	No

- **Description**: This four-leg intersection is signalized with two through lanes and dedicated left turn lanes on Walters Road. The surrounding land use is residential. There are sidewalks on all approaches and marked pedestrian crossings on three of the four legs. There are marked bicycle facilities on Walters Road. Intersection lighting is present on the northeast and southwest corners.

- **Crash Data**: This intersection had three (3) crashes between 2016 – 2020, including one severe injury crash. The severe injury crash involved a motorcycle that collided with a left-turning vehicle. Of the crashes at this intersection, all three involved left turning vehicles and two involved vehicle lane departures.

- **Diagnosis**: Because all of the crashes at this location involved left turning vehicles, dedicated left turns on Montebello Drive/Mammoth Way are recommended with protected left turn phasing. Additionally, the signal heads for the Mammoth Way and Montebello Drive approaches should be upgraded to mast arms at this location.

- **Potential countermeasures**: Signalized intersection upgrades identified in the 2018 Travel Safety Plan, including protected left-turn phasing and pedestrian enhancements, were funded in HSIP Cycle 10 and are currently being designed. No additional countermeasures are recommended at this time.

LOCATION 7: WALTERS ROAD & MCCLELLAN DRIVE

REPORT CARD

Priority Ranking	3
EPDO Score	207
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	No
Safety Improvements since 2018?	No
Funded HSIP Projects?	No
In Active Transportation Plan?	No

- **Description**: This three-leg intersection is stop controlled with stop sign on the McClellan Drive approach. Walters Road has a five-lane cross section at this location. The surrounding land use is residential. There are sidewalks on all approaches and marked bicycle lanes on Walters Road. Intersection lighting is present.
- **Crash Data**: This intersection had three (3) crashes between 2016 – 2020, including one severe injury crash. The severe injury crash involved a left turning vehicle and occurred in the nighttime. Alcohol was involved. Of the crashes at this intersection, all three involved left turning vehicles, one involved a truck, and one was a result of a lane departure.
- **Diagnosis:** All of the crashes at this location resulted in angle collisions, which is common at a stop-controlled intersections with a high volume of vehicles on the major street. Improved intersection warning signage, specifically an intersection ahead warning sign (W2-2) along Walters Road is recommended.
- **Potential countermeasures**:
    - N6 – Upgrade intersection regulatory/warning signs

LOCATION 8: HIGHWAY 12

REPORT CARD

Priority Ranking	-
EPDO Score	2,682
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	No
Safety Improvements since 2018?	No
Funded HSIP Projects?	No
In Active Transportation Plan?	Yes

Description: This location is the segment of Highway 12 (CA-12) that is within City limits (approximately 3.2 miles). This segment of CA-12 runs east-west through Suisun City and has a five-lane cross section with single and dual left and right turn lanes at major intersections.

Crash Data: This intersection had 154 crashes between 2016 – 2020, including three fatal crashes and five severe injury crashes. Of the three fatal crashes, two involved pedestrians and one involved a bicycle. Two of the fatal crashes occurred at Marina Boulevard intersection and the other occurred at the Walters Road intersection. All crashes occurred when it was dark or dusk. Of the severe injury crashes, three involved trucks, one involved a bicycle, and one involved alcohol. All crashes occurred when it was dark or dusk.

Diagnosis: Based on the crash data, the most common type of crash was rear-end collisions (92 of 154, 60%). There were 57% of crashes that involved speeding (88 of 154) and 32% of crashes occurred when it was dark or dusk (49 of 154). Improved intersection warning signage and lighting along the corridor is recommended to address these types of crashes. The severity of the crashes may provide an opportunity to help fund a broader scope systemic application covering multiple roadway segment improvements.

Potential countermeasures:

- R1: Roadway lighting along the SR12 segment. (Location #8)
- S1: Improve intersection lighting (Location #1, 2, 4, 8)
- S2: Improve signal hardware (supplemental signal heads, larger lenses, etc.) (Location #2, 4)
- S3: Improve signal coordination & phasing (Location #4)
- S4: Install advanced dilemma zone detection (Location #1, 2, 4)
- S10: Provide advances intersection warning signs and beacons (Location #1, 2, 4)
- S21PB: Install leading pedestrian interval (Pedestrian Refuge/ADA Ramp in ATP Ped Project) (Location #2)
- NS6: Install advanced warning signs ahead of intersections warning turning vehicles of bike/ped conflicts (Location #8)
-

HIGH CRASH LOCATIONS IDENTIFIED IN 2020 ACTIVE TRANSPORTATION PLAN

The project team also revisited the pedestrian and bicycle safety corridors identified in the 2020 Solano County Active Transportation Plan. The following corridors have at least one reported fatal or serious injury crash and could be candidate locations for HSIP funded projects.

TABLE 39: CRASHES ON PEDESTRIAN SAFETY CORRIDORS

#	LOCATION	KSI CRASHES	TOTAL CRASHES
1	Pintail Drive from Blossom Avenue to Sunset Avenue	1	18
2	Sunset Avenue from Pintail Drive to Highway 12	2	37

CITYWIDE SYSTEMIC OPPORTUNITIES

Systemic safety solutions are a key component of the Safe System approach, as they address underlying crash risks on a large scale (a corridor, neighborhood, or entire city), including locations with no reported crash history. By treating the known characteristics that are contributing to crashes on a broad scale, a systemic safety project can proactively eliminate crash risks before a crash occurs. Systemic safety solutions are generally low cost treatments that have a proven safety benefit. The following countermeasures (or groups of countermeasures) could be implemented across the city to address the most common crash risks identified thus far.

- **Stop controlled intersection upgrades –** Improve the visibility of all-way stop-controlled intersections by upgrading signing and striping. Upgrades may include: pavement markings, high-visibility stop signs, larger or doubled-up regulatory and warning signs, retroreflective tape on sign posts, flashing beacons, conversion to roundabouts, and signalization. Countermeasure IDs: NS4, NS6, NS7, NS8, NS9

- **Enhanced pedestrian crossing treatments (unsignalized intersection or midblock) –** Improve driver awareness of potential conflicts with vulnerable road users in locations with nearby pedestrian generators (transit stops, commercial/retail and mixed-use land uses, parks, etc.) and along Safe Routes to School. Treatments may include: high-visibility crosswalks, advanced warning signs, curb extensions, median refuge islands, and active warning devices like RRFBs or PHBs, referencing the FHWA STEP Guide for countermeasure selection. Countermeasure IDs: NS19PB, NS20PB, NS21PB, NS22PB, NS23PB, R35PB, R36PB, R37PB. HSIP grants also commonly offer a set-aside for pedestrian crossing treatments.

- **Enhanced pedestrian crossing treatments (signalized intersection) –** Improve driver awareness of potential conflicts with vulnerable road users in locations with nearby pedestrian generators (transit stops, commercial/retail and mixed-use land uses, parks, etc.) and along Safe Routes to School. Treatments may include: high-visibility crosswalks, curb extensions, pedestrian countdown heads, leading pedestrian intervals, medians, pedestrian scramble, right and left turn prohibitions, channelized right turn redesign, lighting improvements, slower pedestrian walking speeds, and protected intersections. Countermeasure IDs: S17PB, S18PB, S20PB, S21PB

- **Lighting upgrade** – Install new or supplemental lighting to improve nighttime visibility of intersections and other high-conflict locations. Consider installing pedestrian-level lighting in locations with higher pedestrian and cycling activity, and along Safe Routes to School corridors. Countermeasure IDs: S1, NS1, R1

- **Signalized Intersection Visibility, Hardware, and Timing Upgrade (General)** – Improve the visibility of signalized intersections and modify signal timing to reduce rear-end and broadside crashes. These may include: larger lenses, reflectorized backplates, improved signal head mounting, size and number of signal heads, upgrade to flashing yellow arrow, and improved signal coordination. Countermeasure IDs: S2, S3

- **Signalized Intersection Visibility, Hardware, and Timing Upgrade (High Speed)** – Improve the visibility of signalized intersections and modify signal timing to reduce rear-end and broadside crashes. These may include: larger lenses, reflectorized backplates, improved signal head mounting, size and number of signal heads, upgrade to flashing yellow arrow, improved signal coordination, advanced intersection warning signs/beacons, and advanced dilemma zone detection for high-speed approaches. Countermeasure IDs: S2, S3, S4, S10

6.5 IMPLEMENTATION AND EVALUATION

This Local Road Safety Plan is the framework for engaging residents, stakeholders, employers, planners, engineers, enforcement agencies, and emergency medical service providers across the County in improving transportation safety in Suisun City. While safety-specific plans and programs are critical to achieving the vision for safety in Suisun City, traditional transportation planning, design, operations and maintenance decision making processes, programs, and policies should proactively integrate safety as well. The emphasis areas and strategies in this Plan present short-term safety needs and solutions that can be used by stakeholders countywide as funding and implementation opportunities present themselves. Ongoing coordination and collaboration will enhance implementation efforts and set the stage to evaluate progress on policies, programs, and projects.

Using the goals and strategies in the LRSP, planners and engineers can track and plan for safety on the transportation system by:

- Reviewing past, current, and predicted safety trends – Are trends changing? Are the identified strategies reducing fatal and severe crashes within each emphasis area?
- Revising safety goals and strategies – Have the goals been achieved early, or are they progressing slower than expected? Are the responsible parties implementing the strategies, and if not, what are the barriers to implementation (funding, staff resources, lacking champions)?
- Identifying new projects and strategies to achieve results – Safety research and innovative programs are continually advancing. Are new and more effective strategies available that can be used to better improve safety?
- Monitoring and evaluating system performance – Are systems in place to effectively monitor and evaluate safety throughout the city? Do opportunities exist to improve data collection and accuracy/quality?

COLLABORATION

Suisun City will meet with STA and agency partners on a regular basis to discuss new and ongoing strategy implementations, new strategic and funding opportunities, and barriers to implementation. The purpose of these meetings is to encourage and to maintain communication across stakeholders and provide accountability for implementation. Whenever possible, these meetings should include the representatives from emergency and enforcement services, regional agencies and school districts, and relevant public committees.

POLICY SUPPORT

Projects following the Safe System approach may often require tradeoffs to be made between on-street parking, vehicle level of service, and pedestrian and bicycle safety and accessibility, when funding and/or right of way are limited. A Vision Zero policy and Council Resolution in support of this can help clarify how these decisions will be made at a citywide scale rather than on a project-

by-project basis. The policy can also support equity goals in the community by precluding unequal opportunities to those with the historically "loudest" voices or most resources for civic participation.

Other complementary policies to this Plan may include a citywide crosswalk policy and transition plan and a speed management policy and program.

Core Elements of Vision Zero and "Where to Get Started" on Vision Zero can be found at the following links:

https://visionzeronetwork.org/wp-content/uploads/2018/11/VZN_CoreElements_FINAL.pdf

https://visionzeronetwork.org/where-to-start/

INSTITIONALIZATION

In addition to pursuing funding for the priority and systemic projects identified in this LRSP via upcoming grant opportunities, Suisun City should consider reactive and project safety project opportunities through:

- Capital Improvement Projects, such as repaving efforts
- Development Impact Review and Mitigation - new guidance from the Institute of Transportation Engineers presents opportunities for bring the Safe System approach into the development review process: https://www.ite.org/pub/?id=94372DF6-BAB5-AE00-E6D5-471ED4F338CE

EVALUATION

Suisun City will prepare a memo every two years that will summarize crash trends for the city focused on the Emphasis Areas and the stated goals of the current Local Road Safety Plan. This frequency will coincide with the frequency of Caltrans HSIP and ATP funding cycles, allowing the analysis to inform priority projects and funding applications.

The Emphasis Areas and Strategies identified in the Local Road Safety Plan will be re-evaluated every four years as a countywide effort, facilitated by STA, and revised based upon the results of the crash trend analysis.

CHAPTER 7:
VACAVILLE LOCAL ROAD SAFETY

7.1 INTRODUCTION

Vacaville is located in the north-central area in Solano County, along the Interstate-80 (I-80) corridor, which connects to Sacramento and Fairfield. Based on the United States Census Bureau, Vacaville is the third largest city in Solano County, with a population of 102,386 people as of 2020.

A local road safety plan provides a data- and community-driven framework to systematically identify, analyze and prioritize safety problems and recommend safety improvements on local roads. The following chapter presents the vision statement, summarizes crash data, identifies emphasis areas, recommends high priority project locations and outlines the implementation and evaluation strategies for the City of Vacaville.

VISION STATEMENT

To reduce fatal and severe injuries on roadways within the City of Vacaville by creating an equitable, sustainable, and multimodal transportation system where people of all ages and abilities can travel free from harm.

7.2 CRASH DATA AND TRENDS

DATA SOURCES

This safety analysis used crash data from both the Statewide Integrated Traffic Records System (SWITRS), Transportation Injury Mapping System (TIMS), and the local Crossroads crash database. The crash data analyzed for this project included all geolocated crashes during the five-year period between January 1, 2016, and December 31, 2020.

Crash Record Data

For this project and most other safety analyses, the crash severity is defined in the Highway Safety Manual (HSM) as follows:

- **Fatal injury:** A crash that results in the death of a person within 30 days of the crash.
- **Severe (incapacitating) injury:** A crash that results in broken bones, dislocation, severe lacerations, or unconsciousness, but not death.
- **Other Visible injury (non-incapacitating):** A crash that results in other visible injuries, including minor lacerations, bruising, and rashes.
- **Possible injury (complaint of pain):** A crash that results in the complaint of non-visible pain/injury, such as confusion, limping, and soreness.
- **Property damage only (PDO):** A crash without injury or complaint of pain but resulting in property damage to a vehicle or other object, commonly referred to as a "fender bender."

The most severe crashes, characterized as KSI (Killed or Severely Injured), are the primary focus of this LRSP.

CRASH TRENDS

Figure 39 provides a heatmap of all the crashes within the Vacaville boundary. There is a high concentration of crashes located on major arterials such as Alamo Drive, Marshall Road and Elmira Road. Intersections that experienced a high number of crashes include Alamo Lane/Alamo Drive, Alamo Drive/Peabody Road, Elmira Road/Peabody Road, Nut Tree Parkway/Nut Tree Road, and E Monte Vista Avenue/Depot Street.

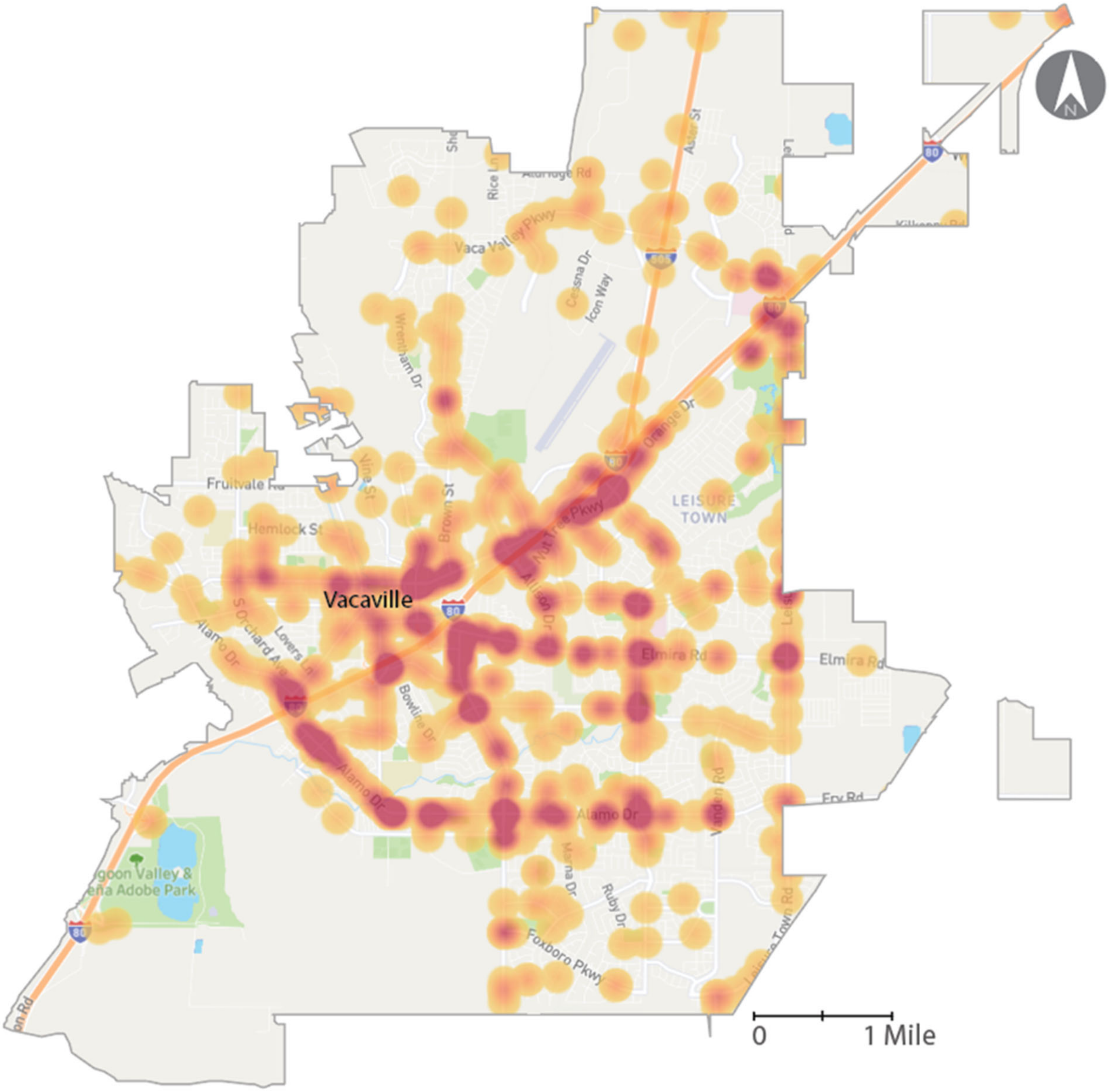


FIGURE 39: HEAT MAP OF ALL NON-INTERSTATE CRASHES WITHIN VACAVILLE.

MTC also provides a tool that displays the Regional High Injury Network (HIN) for full access roadways[14]. Figure 40 shows the identified Regional HIN in Vacaville. Between 2016 and 2020, a total of 1,099 reported crashes occurred in Vacaville, including 11 fatal crashes and 47 severe injury crashes. The following table summarizes key crash statistics that illustrate contextual and behavioral patterns.

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[14] https://bayviz.mysidewalk.com/

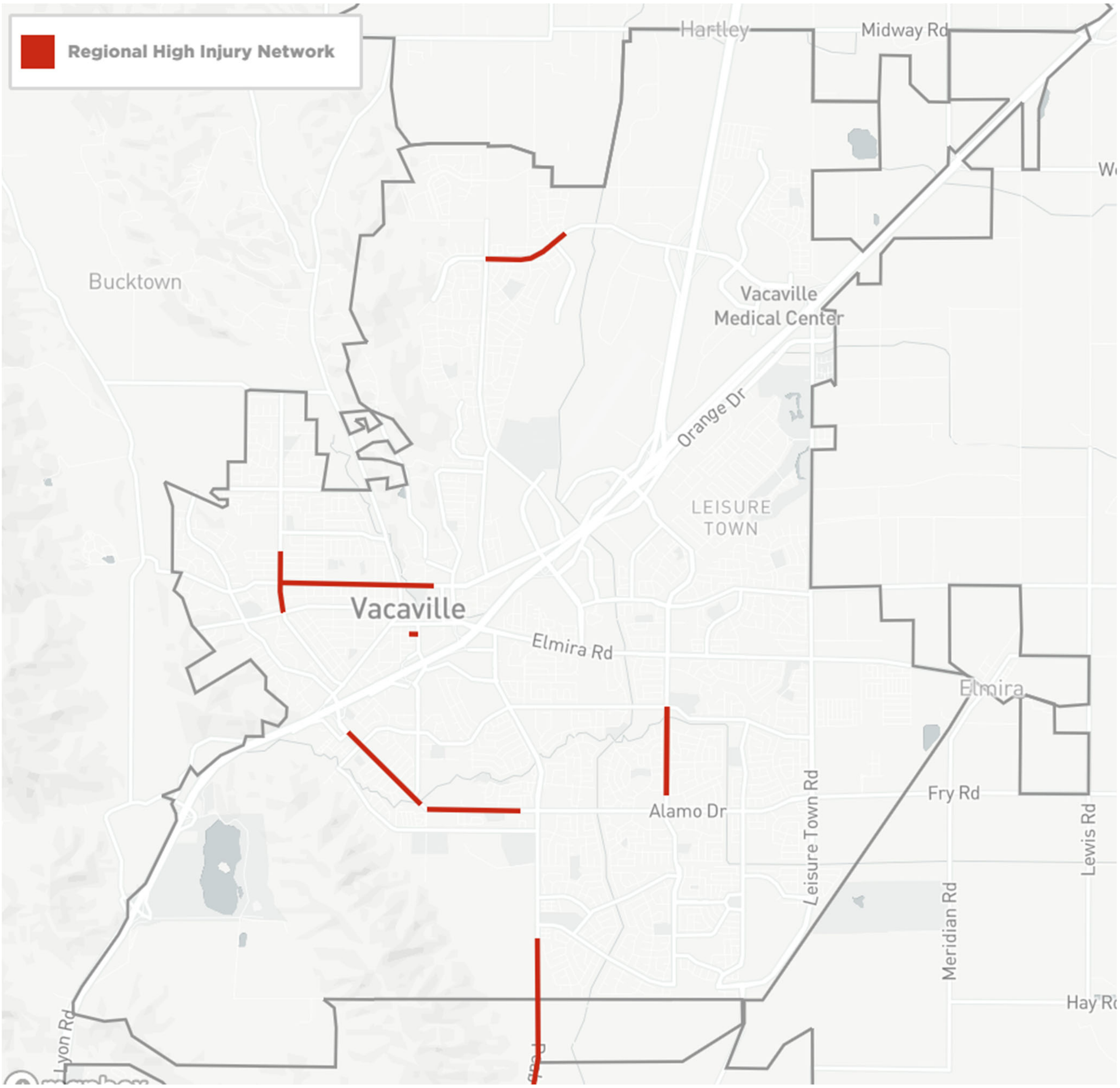


FIGURE 40: REGIONAL HIGH INJURY NETWORK WITHIN VACAVILLE

TABLE 40: VACAVILLE SUMMARY OF CRASH STATISTICS

CATEGORY	PROPORTION OF CRASHES	
	All Severities (1,099 crashes)	Fatal and Severe Crashes (58 crashes)
Pedestrian Involved	6.1%	15.5%
Bicyclist Involved	6.5%	10.3%
Motorcycle Involved	7.2%	32.8%
Alcohol or Drug Involved	7.8%	17.2%
Wet Road Surface	9.6%	3.4%
Speeding Involved	27.8%	15.5%
Lane Departure	25.3%	36.2%
Intersections	73.7%	69.0%

As shown, many of the crash categories are over-represented in fatal and severe injury (KSI) crashes, including pedestrians, bicyclists, motorcyclists, alcohol or drug involved, and lane departure. Because the primary focus of a LRSP is to address KSI crash risks, the following sections present key trends related to these high severity crashes.

Physical Environment

Approximately 69% of KSI crashes occurred at intersections, while the remaining 31% occurred on roadway segments (including at driveways). Nearly 26% of all KSI crashes occurred in dark, dusk, or dawn conditions.

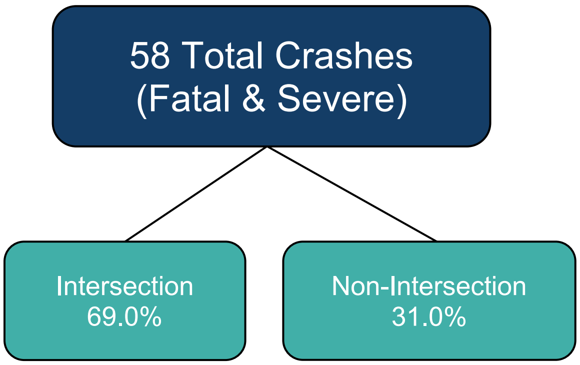


FIGURE 41: KSI LOCATION CRASH TREE

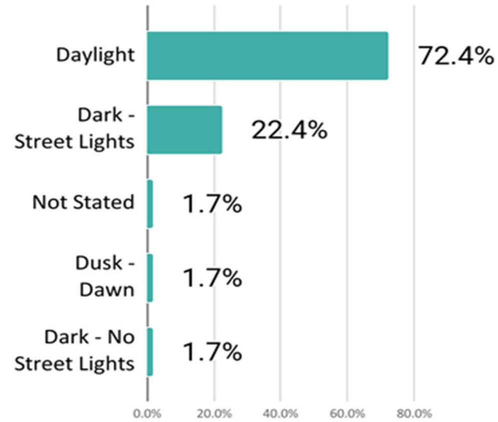


FIGURE 42: KSI LIGHTING CONDITIONS

Crash Types

Crash types provide insights into to common conflicts that exist between road users. As shown in Figure 43, the three most common crash types resulting in fatalities or severe injuries are broadside (35%), hit object (21%), and pedestrian-involved (16%). It should be noted that other vulnerable road users, including bicycle-involved and motorcycle-involved crashes, are not specifically identified on this chart as any non-pedestrian crash is assigned to a crash type (e.g., a right-angle crash between a vehicle and bicycle would be coded as a broadside, and involvement of the bicyclists is noted in a separate field in the crash record). As shown previously in Table 40, 33% of KSI crashes involved a motorcyclist and 10% involved a bicyclist.

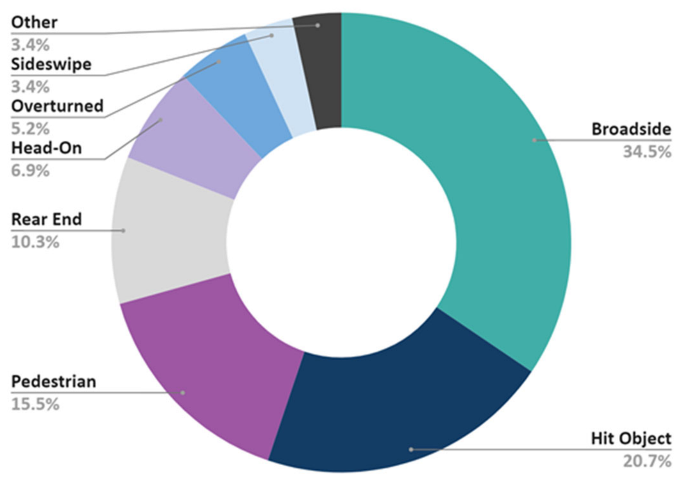


FIGURE 43: KSI CRASH TYPES

Contributing Factors

Primary contributing factors and violation categories provide insights into human behavior. As shown in Figure 44, the most common violations reported in fatal and severe injury crashes were failure to yield automobile right-of-way (21%), improper passing (19%), impairment (17%), and unsafe speeds (16%). Note that roadway design contributing factors are not included on a collision report, so the comparable role of design and behavior, and how those relate, cannot be determined based on a collision report alone.

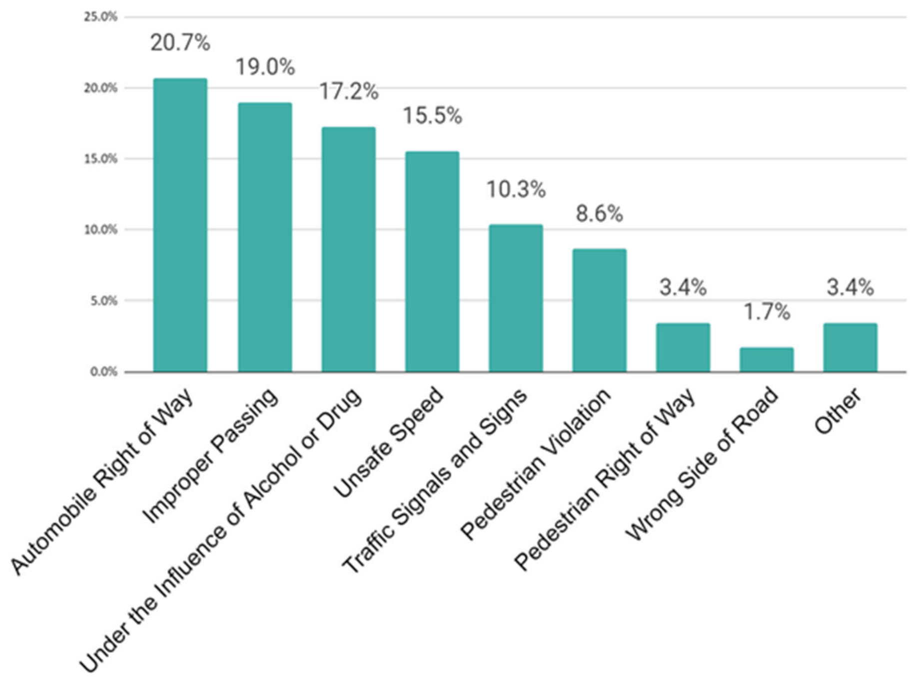


FIGURE 44: KSI PRIMARY VIOLATION CATEGORY

7.3 EMPHASIS AREAS

Emphasis Areas provide a strategic framework for developing and implementing strategies and actions for the LRSP. The Emphasis Areas were developed, using the results of crash data analysis and input from staff and stakeholders. For each emphasis area, quantitative crash reduction goals were identified to provide a metric to evaluate the ongoing effectiveness of project implementation, programs, and policies. The goal to eliminate severe and fatal crashes requires the holistic implementation of the Safe System approach with the use of infrastructure-based and non-infrastructure countermeasures to create redundancies in the roadway system and through education and enforcement practices. A detailed summary and additional sources for infrastructure and non-infrastructure based countermeasures are provided in the Appendix. For the development of strategies, the Emphasis Areas were categorized in four broader groups: Vulnerable Users, Risky Behaviors, Infrastructure, and Improved Systems. Each group is described below with the associated Emphasis Areas.

Vulnerable Road Users

Vulnerable road users can be characterized by the amount of protection they have when using the transportation system. For example, pedestrians, bicyclists, and motorcyclists are more exposed than people in vehicles, making them more susceptible to injury in the event of a crash. Countywide, crashes involving vulnerable users make up 49% of all Fatal or Severe Injury crashes, while in Vacaville they make up 58%. Aging drivers and pedestrians can also be more vulnerable to severe injuries when a crash occurs. In Vacaville, children under 18 are over-represented in fatal or severe crashes specifically as pedestrians (29%) or riding bicycles (36%) as compared to their proportion of the population (23% of Vacaville residents are under 18 years old).

For this group, the following Emphasis Areas were identified:

- **Pedestrians -** focuses on crashes involving someone walking. Pedestrians are some of the most vulnerable users of a roadway network, and crashes involving pedestrians are more likely to result in a fatal or severe injury. In addition, many younger and older road users travel on foot, which compounds this vulnerability.
- **Bicyclists -** focuses on crashes which involve someone riding a bicycle. Bicyclists are considered vulnerable road users and crashes involving a cyclist typically result in severe injuries. In addition, younger and older road users often travel via bicycle, which compounds this vulnerability.
- **Motorcyclists -** focuses on crashes which involve someone riding a motorcycle. Motorcyclists are vulnerable users, much like bicyclists and pedestrians, because they do not have the protection of an enclosed vehicle. However, unlike bicyclists and pedestrians, motorcyclists travel at vehicular travel speeds. Because of this, crashes involving motorcyclists often result in serious injuries or fatalities.

Consideration of Location Types. Pedestrian-involved crashes tend to occur most often in downtown core areas, consistent with higher pedestrian activity. High-volume signalized intersections can increase pedestrian crash risk due to complexities resulting from multiple types of road users (pedestrians, bicyclists, passenger vehicles, buses, trucks) and heavy turning movements at the location. Motorcyclist-involved collisions occur system-wide, and often involve high speeds of either the motorcyclist, other vehicle, or both.

Following the Safe System approach Table 41 summarizes the goals and strategies for each of these emphasis areas. Additional information on specific countermeasures, treatments, and strategies can be found in the Countermeasure Toolboxes in the Appendix.

TABLE 41: EMPHASIS AREAS, GOALS, AND STRATEGIES FOR VULNERABLE ROAD USERS

EMPHASIS AREA	GOALS	STRATEGIES
	• Reduce the proportion of fatal and serious injury crashes involving pedestrians by **50% by 2035**. • **Eliminate** fatal and serious injury crashes involving pedestrians **by 2040**.	**Safe Roads** • Install engineering countermeasures focused on increasing driver awareness of pedestrians and reducing conflicts between vehicles and pedestrians • Develop and implement a Construction Accessibility Policy to maintain accessibility during construction and maintenance projects • Improve infrastructure connectivity for pedestrians, especially along safe routes to school **Safe Road Users** • Expand safe routes to school programming • Pair education with key engineering and enforcement countermeasures
	• Reduce the proportion of fatal and serious injury crashes involving bicyclists **below the statewide proportion (7%) by 2035**. • **Eliminate** fatal and serious injury crashes involving bicyclists **by 2040**.	**Safe Roads** • Install engineering countermeasures focused on increasing driver awareness of bicyclists and reducing conflicts between vehicles and bicyclists • Develop and implement a Construction Accessibility Policy to maintain accessibility during construction and maintenance projects • Improve infrastructure connectivity for pedestrians, especially along safe routes to school **Safe Road Users** • Expand safe routes to school programming • Pair education with key engineering and enforcement countermeasures • Develop a policy to modify LOS standards along preferred bicycle corridors, for example allowing higher vehicle delays if some of the available cross-section is used to safely accommodate bicycles

EMPHASIS AREA	GOALS	STRATEGIES
	• Reduce the proportion of fatal and serious injury crashes involving motorcycles **below the statewide proportion (18%) by 2035**. • **Eliminate** fatal and serious injury crashes involving motorcyclists **by 2040**.	**Safe Roads** • Install engineering countermeasures focused on improving pavement friction on curves and locations with high motorcycle crash frequency **Safe Road Users** • Partner with motorcycle advocacy groups to effectively promote safe behaviors • Pair education with key engineering and enforcement countermeasures

Risky Behaviors

Reductions in fatalities and serious injuries can be accomplished by deterring unsafe or risky behaviors made by drivers and other transportation users. For this category, no Emphasis Areas were identified for Vacaville.

Consideration of Location Types. Fatal and serious injury crashes that involve impairment are often identified on low-volume suburban or rural roads, as impaired drivers may choose to avoid high-volume roads like freeways. This can result in roadway departure crash events at and near horizontal curves. Speed affects both the likelihood of a crash occurring and crash severity, regardless of location. For example, speeding drivers may be more likely to depart the road at a horizontal curve. In a downtown setting, vehicle speed is directly correlated to the injury severity of a pedestrian-involved or bicyclist-involved crash.

Infrastructure

Multimodal transportation assets can be constructed or retrofitted to reduce the risk of fatal and serious injury crashes. Opportunities to do this include implementing safety treatments at intersections and along and across roadways. For this category, the following Emphasis Areas were identified:

- **Intersections -** focuses on crashes that occur within the functional area of an intersection. Intersections are the primary source of conflicts between road users of all types. Crash severity and patterns vary based on traffic control type, but intersection-related crashes that involve speeding, red-light running, and vulnerable users often result in fatal and serious injuries.
- **Lane Departure -** focuses on crashes that fall within two categories: crashes caused by crossing into the opposing lane and crashes caused by running off the road. These crashes are prone to more severe outcomes and are often associated with risky driver behaviors such as speeding, distraction, and impairment.

Consideration of Location Types. Intersection collisions occur most often at 2-way stop controlled and signalized locations. The severity of intersection crashes may be more likely in higher-speed environments (e.g., suburban, rural). Lane departure crashes are often assumed to only occur in rural areas, but lane departures can also be problematic in downtown areas due to the close proximity of roadside fixed objects (e.g., utility poles, mailboxes, vegetation).

Following the Safe System approach, Table 42 summarizes the goals and strategies for each of these emphasis areas. Additional information on specific countermeasures, treatments, and strategies can be found in the Countermeasure Toolboxes in the Appendix.

TABLE 42: EMPHASIS AREAS, GOALS, AND STRATEGIES FOR INFRASTRUCTURE

EMPHASIS AREA	GOALS	STRATEGIES
	• Reduce the rate of fatal and serious injury crashes occurring at intersections by **50% by 2035**. • **Eliminate** fatal and serious injury crashes at intersections **by 2040**.	**Safe Roads** • Install engineering countermeasures focused on increasing visibility and driver awareness of intersections, reducing conflicts between road users, and improving signal operations. **Safe Vehicles** • Develop a readiness plan for Connected and Automated Vehicles (CAVs) **Safe Road Users** • Implement high-visibility enforcement campaigns **Safe Speeds** • Use recent legislation and national research to set context-appropriate speeds suitable for all road users • Implement a safe speeds education campaign • Implement automated speed enforcement **Other** • Coordinate with STA to implement data management strategies and better monitor system safety performance, including contextual data inventory, crash risk indicators, and crash reporting
	• Reduce the rate of fatal and serious injury crashes resulting from lane departure by **50% by 2035**. • **Eliminate** fatal and serious injury crashes resulting from lane departure **by 2040**.	**Safe Roads** • Install engineering countermeasures focused on increasing road/lane awareness and providing a more recoverable roadside **Safe Vehicles** • Develop a readiness plan for Connected and Automated Vehicles (CAVs) **Safe Road Users** • Implement high-visibility enforcement campaigns **Safe Speeds** • Use recent legislation and national research to set context-appropriate speeds suitable for all road users • Implement a safe speeds education campaign **Other** • Coordinate with STA to implement data management strategies and better monitor system safety performance, including contextual data inventory, crash risk indicators, and crash reporting

Emerging Technology

New and innovative technological advances can help improve current safety practices. Table 43 highlights some of the goals and strategies for emerging technology.

TABLE 43: GOALS AND STRATEGIES FOR EMERGING TECHNOLOGY

GOALS	STRATEGIES
• Maintain and build awareness of how emerging technology solutions can improve understanding of crash trends and user safety. • Identify and fund pilot programs for effective technology solutions for increasing safety (e.g. near miss analytics, crash analytics dashboards). • Build and maintain a comprehensive citywide crash and inventory database.	• Contextual Data Inventory – Vendors such as Mapillary and Ecopia provide up-to-date data on transportation infrastructure, including roadway characteristics, intersection characteristics, and signs. Updated inventory can help City staff identify project synergies, such as including a safety countermeasure with a repaving project and support systemic safety analysis for future safety plans and evaluations. • Crash Risk Indicators - Surrogate safety measures, such as "near-miss" crashes, hard braking data, speed data, community-reported hazards, and high stress facilities provide an understanding of the safety landscape and enable proactive interventions. Technology such as video data and platforms which provide public crowdsourcing can close the gap and provide key insights regarding near miss data in the absence of crash data. • Crash Reporting **-** Crash reporting practices, such as complete data collection and documentation of road user behavior and infrastructure, can lead to a greater understanding of the holistic safety landscape, and thus lead to improved investments in safety.

COMPLEMENTARY PROGRAMS AND PRACTICES

Crash history and other types of safety data can be advanced to better understand the causes and locations of crashes, leading to effective solutions. One framework is the list of USDOT's data quality attributes: timeliness, accuracy, completeness, uniformity, integration, and accessibility. Training is used to educate planners, engineers, designers, and construction staff about the importance of safety and how to incorporate it into their everyday job responsibilities. This also includes training staff on culturally relevant community engagement. Fully funded, staffed, and trained law enforcement and emergency response agencies can direct their efforts toward keeping users safe and, when crashes do occur, have the resources and systems in place so traffic incident management and emergency medical services personnel are available to respond.

Strategy - Culturally Relevant Community Engagement and Street Safety Ambassador Program – Community engagement is not a one-size-fits-all model. Culturally relevant community engagement strategies can help education and programming around traffic safety reach a larger audience and be more impactful by making materials readable for all and meeting the community where they are.

Strategy - Rapid Response Safety Communication Protocol and Multi-Disciplinary Team - An internal, multi-department communication strategy should be deployed in response to severe and fatal crashes. This includes immediate on-the ground-response to an investigation of severe and fatal crashes, ensuring a multi-disciplinary response team focused both on the behavioral and engineering elements of a crash. This team also supports timely data sharing among City departments, ensures data accuracy, and develops near-term interventions.

Strategy - Victim and Family Support - Post-crash care includes providing resources to both the victim, their friends, and their families. To ensure a crash survivor receives the care needed to recover and restore body and mind to an active life within society, they require medical rehabilitation with specialists that can range from orthopedics, neurosurgery, physical and occupational therapy, and prosthetics to psychology and neuropsychology. Resources for crash survivors, their family, and friends, can be found on Solano County Behavioral Health Services' website: https://www.solanocounty.com/depts/mhs/default.asp

7.4 HIGH PRIORITY LOCATIONS AND PROJECTS

With a focus on fatal and severe injury crashes, the project team identified locations within the City of Vacaville that experienced a high frequency or severity of crashes. Once the high-crash locations were identified, each location was scored (or ranked) based on the following metrics.

- **In 2018 Plan?** This identifies whether a safety project was listed at this location in the 2018 Solano County Travel Safety Plan.
- **KSI Crashes.** The number of crash events resulting in a fatality or severe injury at this location.
- **Total Crashes.** The total number of crashes reported and verified to be related to this location.
- **EPDO Score.** The EPDO score, described previously, provides a weighted ranking that accounts for the number and severity of crashes at each location.
- **Number of Emphasis Areas (EAs).** This is the number of EAs that are reflected in the details of the reported crashes at this location.

Within Vacaville, there were a total of 13 high crash locations identified, which are summarized in Table 44 and shown on Figure 45. A one-page summary of each location is also provided.

TABLE 44: VACAVILLE HIGH CRASH LOCATIONS

#	LOCATION	IN 2018 PLAN?	KSI CRASHES	TOTAL CRASHES	EPDO SCORE	NUMBER OF EAs (5 max)
1	Nut Tree Road & Orange Drive	No	1	17	371	4
2	Alamo Drive & Peabody Road	Yes	1	15	324	5

#	LOCATION	IN 2018 PLAN?	KSI CRASHES	TOTAL CRASHES	EPDO SCORE	NUMBER OF EAs (5 max)
3	Hume Way & Davis Street	No	1	12	304	5
4	Alamo Drive & Alamo Lane	Yes	1	12	429	4
5	Peabody Road & Cliffside Drive	Yes	1	11	294	3
6	Alamo Drive & Marshall Road	Yes	2	10	463	3
7	Nut Tree Road & Marshall Road	No	1	9	288	2
8	Vaca Valley Parkway & Crescent Drive	No	1	9	276	4
9	Nut Tree Road & Fairview Drive	No	2	6	401	3
10	Monte Vista Avenue & Tracy Drive	No	2	4	352	4
11	Monte Vista Avenue & Eldridge Avenue	No	2	3	366	2
12	Peabody Road (Elmira Road to Hume Way)	Yes	1	35	563	3
13	Monte Vista Avenue (Cernon Street to Brown Street)	Yes	2	37	772	4

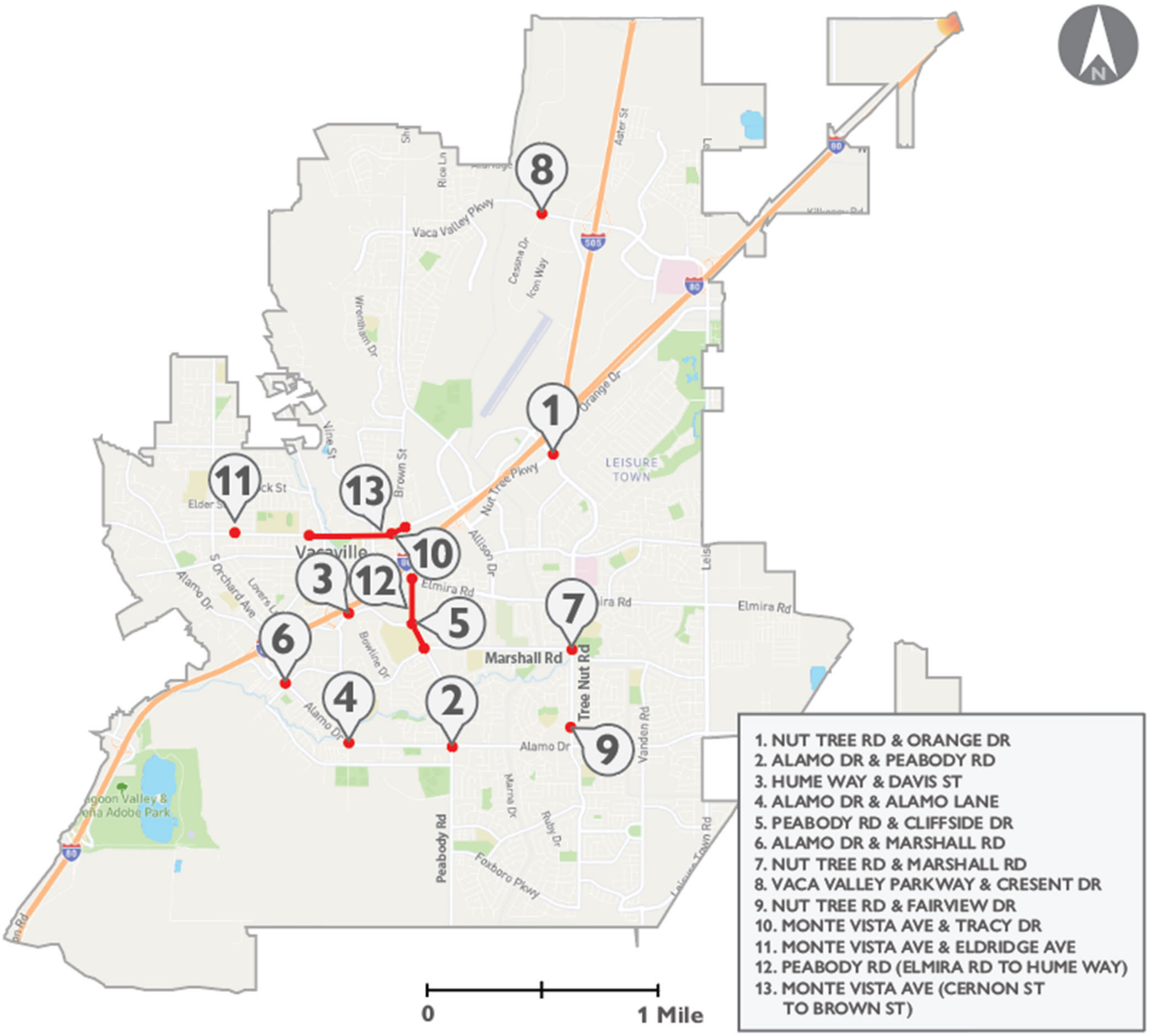
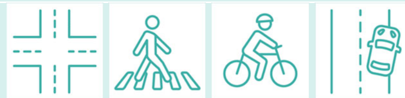


FIGURE 45: MAP OF VACAVILLE HIGH CRASH LOCATIONS

LOCATION 1: NUT TREE ROAD & ORANGE DRIVE

REPORT CARD

Priority Ranking	6
EPDO Score	371
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	No
Safety Improvements since 2018?	
Funded HSIP Projects?	No
In Active Transportation Plan?	No

- **Description**: This four-leg intersection is signalized and has three through lanes on Orange Drive and two through lanes on the other approaches with dedicated left and right turn lanes. The intersection is surrounded by commercial and retail land uses. There are sidewalks on all approaches and marked pedestrian crosswalks on all approaches. There are marked bicycle facilities. On-street, parallel parking is present on all four approaches. Intersection lighting is present.

- **Crash Data**: This intersection had a total of 17 crashes between 2016 – 2020, including one severe injury crash resulting in a broadside crash involving alcohol. Almost half (8) of the crashes involved unsafe speed, 29% (5) of the crashes involved a driver aged 65+, one crash involved a pedestrian, and one crash involved a bicycle.

- **Diagnosis:** The posted speed at this intersection is 35 mph. However, based on the high number of crashes involving unsafe speeds and size of the intersections, actual speeds are likely much higher. The severity of the crash may provide an opportunity to help fund a broader scope systemic application covering multiple signalized locations.

- **Potential countermeasures**
  - S2 - Improve signal hardware (reflectorized back plates, supplemental heads, etc.)
  - S4 – Install advanced dilemma zone detection
  - S17PB – Install pedestrian countdown timers
  - Install speed feedback signs in advance of the intersection to slow speeds
  - Evaluate feasibility of installing pedestrian refuge/right turn channelization islands to reduce pedestrian crossing distances

LOCATION 2: ALAMO DRIVE & PEABODY ROAD

REPORT CARD

Priority Ranking	9
EPDO Score	324
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	Yes
Safety Improvements since 2018?	
Funded HSIP Projects?	Yes
In Active Transportation Plan?	No

- **Description**: This intersection is signalized with three through lanes on Peabody Drive and two through lanes on Alamo Drive with dedicated left and right turn lanes on all approaches. The intersection is mainly surrounded by commercial land uses with some residential land uses nearby. There are sidewalks and marked pedestrian crosswalks on all approaches. There are marked bicycle facilities on all approaches. Intersection lighting is present.

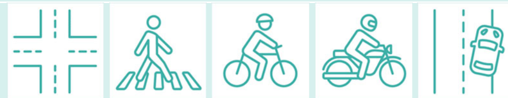
- **Crash Data**: This intersection had 15 crashes between 2016 – 2020, with one that resulted in a severe injury. The crash occurred during the nighttime and resulted in a broadside crash. Of the crashes that occurred here, almost half (7) occurred at nighttime, 27% (4) of the crashes involved alcohol, 27% involved speeding, 13% (2) involved a motorcycle, 1 involved a pedestrian, and 1 involved a bicycle. There were no lighting or weather concerns.

- **Diagnosis:** The cross sections of Peabody Road and Alamo Drive are 6 lanes and 9 lanes, respectively. This results in long pedestrian crossing distances that are between 120 feet to 140 feet. Improved visibility of the intersection, signal indications, and pedestrians may address these crash patterns. The severity of the crashes may provide an opportunity to help fund a broader scope systemic application covering multiple signalized locations. It should be noted that signal visibility upgrades and advanced dilemma zone detection were funded in previous HSIP cycles and are currently being designed.

- **Potential countermeasures**:
    - S1 – Improve intersection lighting
    - S17PB – Add pedestrian countdown timers
    - Install speed feedback signs in advance of the intersection to slow speeds
    - Evaluate feasibility of installing pedestrian refuge/right turn channelization islands to reduce pedestrian crossing distances.

LOCATION 3: HUME WAY & DAVIS STREET

REPORT CARD

Priority Ranking	10
EPDO Score	301
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	No
Safety Improvements since 2018?	
Funded HSIP Projects?	No
In Active Transportation Plan?	No

- **Description**: This four-leg intersection is signalized with two through lanes on Davis Street and one through lane on Hume Way and dedicated left turn lanes on all approaches. There is a right-turn slip lane on the westbound Hume Way approach onto northbound Davis Street. The intersection is generally surrounded by commercial land uses. There are sidewalks on all approaches and marked crosswalks on the north, west, and south legs. There are no marked bicycle lanes. Intersection lighting is present.

- **Crash Data**: This intersection had 12 crashes between 2016 – 2020, including one that resulted in a severe injury. The severe injury crash occurred during the daytime and involved a left turning vehicle and through vehicle. Of the crashes that occurred at this intersection, 58% (7) involved left turning vehicles, 3 resulted from drivers disregarding the traffic control, 2 involved pedestrians, 1 involved a bicycle, and 1 involved a motorcycle.

- **Diagnosis:** Based on the crash data, the left turning crashes seem to be related to the alignment of the approaches and sight distance issues caused by the I-80 overcrossing. Supplemental signal heads are currently provided. Another trend in the crash data shows that vehicles are also running red lights at this intersection. This intersection could benefit from signal visibility improvements. The severity of the crashes may provide an opportunity to help fund a broader scope systemic application covering multiple signalized locations.

- **Potential countermeasures**:
    - S2 – Improve signal hardware (reflectorized back plates, larger lenses, etc.)
    - S4 – Install advanced dilemma zone detection

LOCATION 4: ALAMO DRIVE & ALAMO LANE

REPORT CARD

Priority Ranking	4
EPDO Score	429
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	Yes
Safety Improvements since 2018?	
Funded HSIP Projects?	Yes
In Active Transportation Plan?	No

- **Description**: This three-leg intersection is signalized with a five-lane cross section on Alamo Drive. The intersection is generally surrounded by residential land uses to the north and west and industrial/commercial land uses to the east. There are sidewalks and marked pedestrian crossings on the south and east leg. Marked bicycle lanes are provided on Alamo Lane and the east leg of Alamo Drive. Intersection lighting is present.

- **Crash Data**: This intersection had 12 crashes between 2016 – 2020, including one fatal crash where the driver, who was under the influence, left the roadway and hit a fixed object. Of the crashes at this intersection, 42% (5) resulted in vehicles leaving the roadway, 33% (4) involved left turning vehicles, 25% (3) involved drivers under the influence, 1 involved a pedestrian, and 1 involved a bicycle.

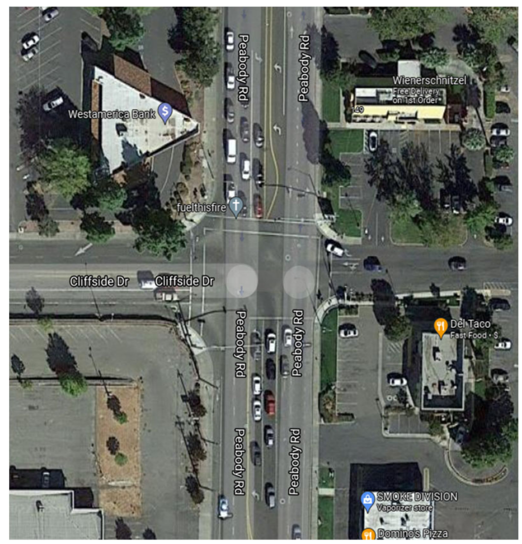
- **Diagnosis:** For drivers under the influence, the curve on the eastbound approach is difficult to navigate, resulting in the high number of lane departure crashes. Also, there are several driveways located within the influence area of the intersection that may be contributing to some of the turning-related crashes. The severity of the crash may provide an opportunity to help fund a broader scope systemic application covering multiple signalized locations. It should be noted that signal visibility upgrades and advanced dilemma zone detection were funded in previous HSIP cycles and are currently being designed.

- **Potential countermeasures**:
  - S10 – Install advanced intersection warning with beacon
  - S12 – Evaluate the feasibility of installing median traffic separators on Alamo Lane approaches

LOCATION 5: PEABODY ROAD & CLIFFSIDE DRIVE

REPORT CARD

Priority Ranking	11
EPDO Score	294
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	Yes
Safety Improvements since 2018?	
Funded HSIP Projects?	Yes
In Active Transportation Plan?	No



- **Description**: This four-leg intersection is signalized with a private driveway on the east leg providing access to a commercial site. There are sidewalks and marked pedestrian crossings on all legs except the south leg. Marked bicycle lanes are provided on Peabody Road. Intersection lighting is present.

- **Crash Data**: This intersection had 11 crashes between 2016 – 2020, including one severe injury crash. The severe injury crash involved a left turning vehicle and a violation of the traffic signal. Of the crashes at this intersection, 36% (4) involved speeding, 27% (3) involved a violation of the traffic signal, one involved a pedestrian, and 1 involved a bicycle.

- **Diagnosis:** The predominant contributing factors to crashes at this intersection are unsafe speed and drivers disregarding the signal. This intersection may benefit from improved visibility of the intersection and signal indications. The signal runs split phasing for the east and west approaches. Additional traffic analysis, including traffic volume data, may be needed to determine additional countermeasures**.** The severity of the crashes may provide an opportunity to help fund a broader scope systemic application covering multiple signalized locations. It should be noted that signal visibility upgrades and advanced dilemma zone detection were funded in previous HSIP cycles and are currently being designed.

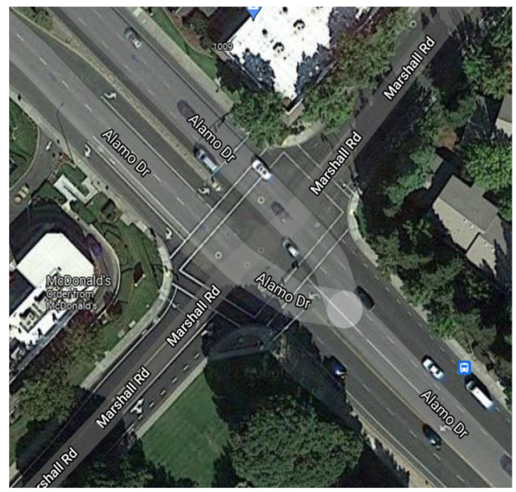
- **Potential countermeasures**:

  There are no recommended countermeasures. Signal visibility upgrades (signal backplates, supplemental heads, etc.) and advanced dilemma zone detection are currently being designed and are anticipated to address the predominant crash patterns. The City should analyze post-installation crash data and determine if there are remaining safety needs.

LOCATION 6: ALAMO DRIVE & MARSHALL ROAD

REPORT CARD

Priority Ranking	3
EPDO Score	463
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	Yes
Safety Improvements since 2018?	
Funded HSIP Projects?	Yes
In Active Transportation Plan?	No



- **Description**: This four-leg intersection is signalized with 2-3 through lanes on Alamo Drive and a single through lane on Marshall Road. The surrounding land use is primarily residential with some commercial land uses to the north. There are sidewalks and marked pedestrian crossings on all approaches. There are marked bicycle facilities on Alamo Drive and the north leg of Marshall Road. Intersection lighting is present.

- **Crash Data**: This intersection had ten (10) crashes between 2016 – 2020, including one fatal and one severe injury crash. Both crashes were broadside crashes involving a left-turn and the primary error was running the red light. Of the crashes at this intersection, 50% were rear-ends crashes, 40% (4) involved speeding, 40% (4) involved left-turning vehicles, and 1 involved a motorcycle.

- **Diagnosis**: Because most of the crashes involved broadside or rear-end crashes, this intersection may benefit from improved visibility of the intersection and signal indications. There are already supplemental signal heads at this intersection. The severity of the crashes may provide an opportunity to help fund a broader scope systemic application covering multiple signalized locations. It should be noted that signal visibility upgrades and advanced dilemma zone detection were funded in previous HSIP cycles and are currently being designed.

- **Potential countermeasures**:

  There are no recommended countermeasures. Signal visibility upgrades (signal backplates, supplemental heads, etc.) and advanced dilemma zone detection are currently being designed and are anticipated to address the predominant crash patterns. The City should analyze post-installation crash data and determine if there are remaining safety needs.

LOCATION 7: NUT TREE ROAD & MARSHALL ROAD

REPORT CARD

Priority Ranking	12
EPDO Score	288
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	No
Safety Improvements since 2018?	
Funded HSIP Projects?	No
In Active Transportation Plan?	No

- **Description**: This four-leg intersection is signalized with two through lanes on Nut Tree Road. The surrounding land use is residential with the Vaca Pena Middle School located on the northwest corner of the intersection. There are sidewalks and marked pedestrian crossings on all approaches. Marked bicycle lanes are present on the north leg of Nut Tree Road. Intersection lighting is present.

- **Crash Data**: This intersection had 9 crashes between 2016 – 2020, including one fatal crash. The fatal crash was a result of a driver under the influence that ran a red light and struck another vehicle in a broadside crash. Of the crashes that occurred at this intersection, all were either broadside or rear-end crashes. Over half (5) involved speeding and one involved a motorcycle.

- **Diagnosis:** Because most of the crashes involved broadside or rear-end crashes, this intersection may benefit from increased visibility of the intersection and signal indications. The severity of the crash may provide an opportunity to help fund a broader scope systemic application covering multiple signalized locations.

- **Potential countermeasures**:
  - S2 – Improve signal hardware (supplemental heads, reflectorized backplates, etc.)
  - S4 – Install advanced dilemma zone detection

LOCATION 8: VACA VALLEY PARKWAY & CRESCENT DRIVE

REPORT CARD

Priority Ranking	13
EPDO Score	276
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	No
Safety Improvements since 2018?	
Funded HSIP Projects?	No
In Active Transportation Plan?	No

- **Description**: This four-leg intersection is signalized with 2-3 through lanes on Vaca Valley Parkway and a single through lane on Crescent Drive. The intersection provides access to a large medical center to the south and housing to the north. There are sidewalks and marked pedestrian crossings on all approaches except the east leg. Marked bicycle facilities are provided on Crescent Drive and in the westbound direction on Vaca Valley Parkway. Intersection lighting is present.

- **Crash Data**: This intersection had nine (9) crashes between 2016 – 2020, including one severe injury crash. The severe injury crash resulted when a vehicle departed the travel lane and struck another vehicle head-on. Of the nine crashes that occurred at this intersection, 3 involved motorcycles (two of which also involved improper passing), 1 involved a bicycle, and 3 involved lane departures.

- **Diagnosis:** Half of the crashes were attributed to drivers disregarding the traffic signal, suggesting that this intersection could benefit from signal visibility enhancements. The severity of the crashes may provide an opportunity to help fund a broader scope systemic application covering multiple signalized locations.

- **Potential countermeasures**:
  - S2 - Improve signal hardware (supplemental heads, reflectorized backplates, etc.)
  - S4 – Install advanced dilemma zone detection

LOCATION 9: NUT TREE DRIVE & FAIRVIEW DRIVE

REPORT CARD

Priority Ranking	5
EPDO Score	401
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	No
Safety Improvements since 2018?	
Funded HSIP Projects?	No
In Active Transportation Plan?	No
In Safe Routes for Seniors Plan?	

- **Description**: This four-leg intersection is stop-controlled with stop signs on the eastbound approach (private driveway to shopping center) and westbound approach (Fairview Drive). Nut Tree Road has a five-lane cross section at this location. The land use directly to the west of the intersection is commercial/retail, but the majority of the surrounding land use is residential. There are sidewalks on all approaches, but no marked bicycle facilities. Intersection lighting is present.

- **Crash Data**: This intersection had six (6) crashes between 2016 – 2020, including one fatal crash and one severe injury crash. The fatal crash was a broadside crash that involved a motorcycle; impairment was noted as a contributing factor. The severe injury crash occurred when a motorcycle struck a pedestrian who was not in the roadway. The reason for the crash is not documented in the crash data. Of the six crashes that occurred at this intersection, 2 involved motorcycles, 1 involved a pedestrian, and 3 involved left turning vehicles. 44% of crashes occurred in dark conditions.

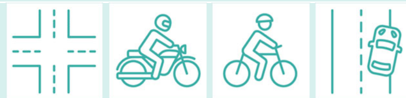
- **Diagnosis:** The adjacent grocery store and restaurants may be a notable pedestrian destination for the neighborhood. Depending on the minor street volumes, traffic control could be added to this location, either in the form of a small roundabout or traffic signal, either of which could be funded based on the severity of the crashes involved.

- **Potential countermeasures**:
  - NS1 – Improve intersection lighting
  - NS19PB – Evaluate feasibility of installing raised medians on Nut Tree Road (refuge island on south leg, would restrict driveway turning movements)

- NS22PB – Evaluate the need (based on pedestrian demand) for a rectangular rapid flashing beacon (RRFB) on Nut Tree Road
- NS05/NS03 – Evaluate feasibility of installing a roundabout or traffic signal

LOCATION 10: MONTE VISTA AVENUE & TRACY DRIVE

REPORT CARD

Priority Ranking	8
EPDO Score	352
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	No
Safety Improvements since 2018?	
Funded HSIP Projects?	No
In Active Transportation Plan?	Yes

- **Description**: This four-leg intersection is stop-controlled with stop signs on the southbound approach (Tracy Drive) and northbound approach (private driveway to commercial land uses). Monte Vista Avenue has a five-lane cross section at this location. The surrounding land use is mixed-use. There are sidewalks along Monte Vista Avenue. There are no marked bicycle facilities. Intersection lighting is present. **(Related to Location 13)**

- **Crash Data**: This intersection had four (4) crashes between 2016 – 2020, including one fatal crash and one severe injury crash. The fatal crash resulted in a sideswipe accident where a vehicle making an improper passing maneuver struck a motorcycle. The severe injury crash occurred when a vehicle struck a bicycle making an improper passing maneuver. Of the four crashes that occurred at this intersection, 1 involved a motorcycle, 1 involved a bicycle, and 3 involved improper passing.

- **Diagnosis:** The crashes that occurred here are likely due to the multi-lane cross section and unconventional access management along Monte Vista Avenue.

- **Potential countermeasures**:
  - NS14- Evaluate feasibility of installing a full median along E Monte Vista Avenue to restrict left turn movements
  - R32PB- Evaluate feasibility of installing bike lanes on E Monte Vista Avenue (consistent with ATP project)

LOCATION 11: MONTE VISTA AVENUE & ELDRIDGE AVENUE

REPORT CARD

Priority Ranking	7
EPDO Score	366
Associated Emphasis Areas	 
In 2018 Travel Safety Plan?	No
Safety Improvements since 2018?	
Funded HSIP Projects?	No
In Active Transportation Plan?	Yes

- **Description**: This four-leg intersection is an all-way stop-controlled with stop signs on all four approaches. The surrounding land use is primary residential but is located within 1,000 feet of Vacaville High School. There are sidewalks along all four approaches and marked pedestrian crossings on the west and south leg. There are no marked bicycle facilities or lighting present.

- **Crash Data**: This intersection had three (3) crashes between 2016 – 2020, including two severe injury crashes. One of the severe injury crashes occurred when a vehicle failed to yield to a pedestrian in the crosswalk. The second severe injury crash occurred when a vehicle attempted to pass another vehicle and struck a parked car. Of the three crashes that occurred at this intersection, 2 involved a pedestrian, 2 involved an aging person (age 65+), and 1 involved a young party (age less than 18). All three crashes occurred during the day.

- **Diagnosis:** High severity crashes at all-way stop intersections may suggest that drivers are not anticipating the need to stop, and intersection visibility upgrades may address some of the crash risks. The severity of the crashes may provide an opportunity to help fund a broader scope systemic application covering multiple stop-controlled locations.

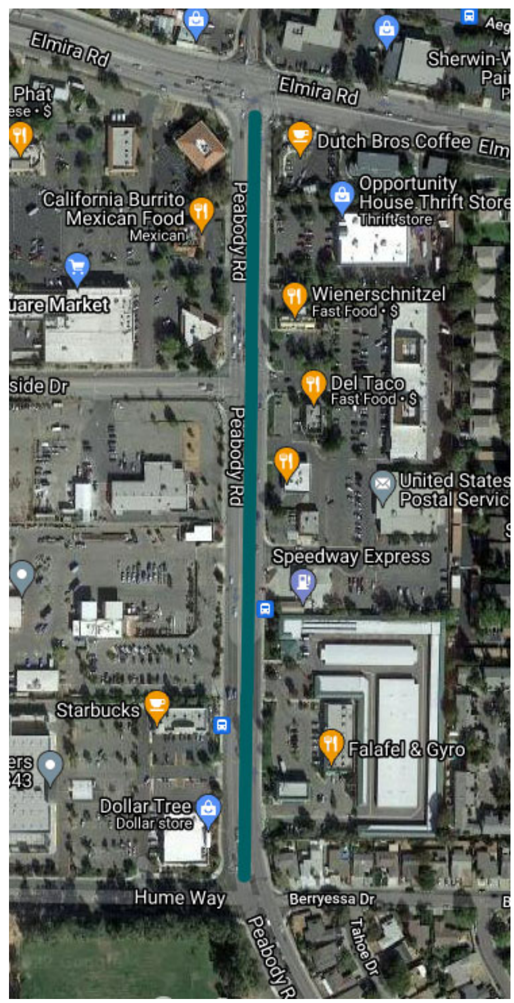
- **Potential countermeasures**:
  - NS6/NS7 – Install stop-controlled intersection upgrades (improved pavement markings, larger/doubled-up stop signs)
  - NS21PB – Upgrade pedestrian crossing with enhanced safety features (curb extensions, high-visibility crosswalks)
  - NS7 - Install flashing beacons at stop-controlled intersections
  - Evaluate feasibility of installing a third marked pedestrian crossing (consistent with ATP Ped Project).

LOCATION 12: PEABODY ROAD (ELMIRA ROAD TO HUME WAY)

REPORT CARD

Priority Ranking	1
EPDO Score	563
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	Yes
Safety Improvements since 2018?	
Funded HSIP Projects?	No
In Active Transportation Plan?	No

- **Description**: This location is the segment of Peabody Road from Elmira Road to Hume Way (approximately 0.33 miles). Peabody Road is six lanes wide at this location. The surrounding land use is primary commercial retail. There are sidewalks and marked bicycle lanes along the segment with three signalized intersections (Elmira Road, Cliffside Drive, and Hume Way). Lighting is present.



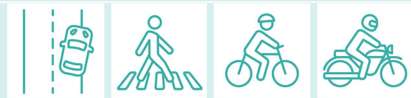
- **Crash Data**: This segment had 35 total crashes between 2016 – 2020, including one severe injury crash. The severe injury crashes occurred at Cliffside Drive (signal) where a left-turning vehicle collided with another vehicle resulting in a broadside crash. There is no directional data provided. Of the 35 crashes that occurred along this segment, 46% (16) resulted in rear-end crashes, 43% (15) resulted in broadside (turning-related) crashes, and 40% involved speeding. Two of the crashes involved drivers under the influence, two involved pedestrians, and one involved a bicycle.

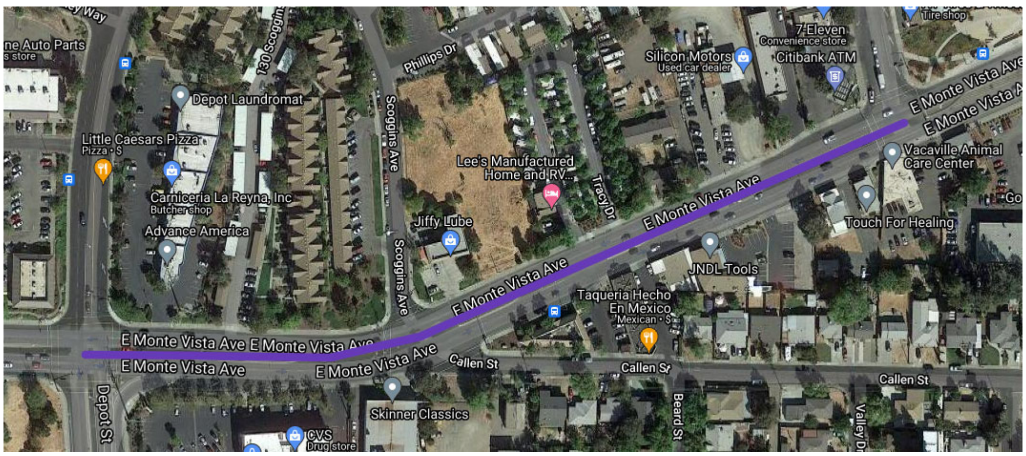
- **Diagnosis:** Speeding, turning-related crashes, and rear-end crashes are the main crash patterns along this corridor. Improvements that reduce speeds, eliminate or reduce left turns, and increase driver awareness of traffic signals will address the predominant crash patterns. The severity of the crashes may provide an opportunity to help fund a broader scope systemic application covering multiple similar segments. It should be noted that signal visibility upgrades and advanced dilemma zone detection were funded in previous HSIP cycles and are currently being designed.

- **Potential countermeasures**:
  - S3 – Improve signal coordination/phasing
  - NS14: Evaluate feasibility of installing raised medians along Peabody Road. Some medians currently exist along the segment; however, medians could be extended to slow speeds and reduce left turn crashes. Access management would be required.
  - Consider installing dynamic speed feedback signs to reduce speeding
  - R36PB – Evaluate the need (based on pedestrian demand) and feasibility of installing midblock pedestrian crossing near transit stops

LOCATION 13: MONTE VISTA AVENUE (CERNON STREET TO BROWN STREET)

REPORT CARD

Priority Ranking	2
EPDO Score	518
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	Yes
Safety Improvements since 2018?	
Funded HSIP Projects?	No
In Active Transportation Plan?	Yes



- **Description**: This location is the segment of Monte Vista Avenue from Cernon Street to Brown Street (approximately 4,000 feet). Monte Vista Avenue is four to five lanes wide at this location. The surrounding land use is mixed-use. There are sidewalks along the segment with five signalized intersections (Cernon Street, Dobbins Street, Markham Avenue, Scoggins Avenue, Brown Street). Lighting is present. No marked bicycle facilities are present and many driveways are located along the segment. **(Related to Location 10)**

- **Crash Data**: This segment had 37 total crashes between 2016 – 2020, including one fatal crash and one severe injury crash that both occurred at the intersection of Tracy Drive as well as an additional severe injury crash that occurred at the intersection of Vine Street. The fatal crash resulted in a sideswipe accident where a vehicle making an improper passing maneuver struck a motorcycle. One severe injury crash occurred when a vehicle struck a bicycle making an improper passing maneuver while the other involved a vehicle striking a pedestrian crossing Monte Vista Avenue against the signal. Of the 37 crashes that occurred along this segment, 32% (12) were a result of speeding and 16% (6) were a result of improper passing. Approximately 43% (16) of crashes resulted in rear-end crashes and 22% (8) resulted in broadside (turning-related) crashes. Two of the crashes involved drivers under the influence, 4 involved pedestrians, and 1 involved a bicycle.

- **Diagnosis:** Speeding, improper passing, and rear-ends are primary crash patterns in this segment. Improvements that restrict turns at mid-block locations and warn drivers of approaching traffic signals are recommended. The severity of the crashes may provide an opportunity to help fund a broader scope systemic application covering multiple similar segments.

- **Potential countermeasures**:

  - S1/NS1/R1 - Improve lighting
  - S2 - Improve signal hardware
  - S3 - Improve signal coordination/phasing
  - NS14/NS15 – Evaluate feasibility of installing raised medians along E Monte Vista Avenue (restrict midblock turns)
  - R32PB – Evaluate feasibility of installing bike lane along E Monte Vista Avenue (consistent with ATP)

HIGH CRASH LOCATIONS IDENTIFIED IN 2020 ACTIVE TRANSPORTATION PLAN

The project team also revisited the pedestrian and bicycle safety corridors identified in the 2020 Solano County Active Transportation Plan. The following corridors have at least one reported fatal or serious injury crash and could be candidate locations for HSIP funded projects.

TABLE 45: CRASHES ON PEDESTRIAN SAFETY CORRIDORS

#	LOCATION	KSI CRASHES	TOTAL CRASHES
1	Monte Vista Avenue from Orchard Avenue to Allison Drive	6	68
2	Peabody Road from Elmira Road to Alamo Drive	2	74
3	Alamo Drive from Butcher Road to Nut Tree Road	7	113
4	Nut Tree Road from Keith Way to Arcadia Drive	1	27

TABLE 46: CRASHES ON BICYCLE SAFETY CORRIDORS

#	Location	KSI CRASHES	TOTAL CRASHES
1	Nut Tree Road from Keith Way to Nut Tree Parkway	3	45
2	Peabody Road from Elmira Road to Marshall Road	1	49

CITYWIDE SYSTEMIC OPPORTUNITIES

Systemic safety solutions are a key component of the safe system approach, as they address underlying crash risks on a large scale (a corridor, neighborhood, or entire city), including locations with no reported crash history. By treating the known characteristics that are contributing to crashes on a broad scale, a systemic safety project can proactively eliminate crash risks before a crash occurs. Systemic safety solutions are generally low cost treatments that have a proven safety benefit. The following countermeasures (or groups of countermeasures) could be implemented across the city to address the most common crash risks identified thus far.

- **Stop controlled intersection upgrades –** Improve the visibility of stop-controlled intersections by upgrading signing and striping. Upgrades may include: pavement markings, high-visibility stop signs, larger or doubled-up regulatory and warning signs, retroreflective tape on sign posts, and flashing beacons. Countermeasure IDs: NS6, NS7, NS8, NS9

- **Enhanced pedestrian crossing treatments (unsignalized intersection or midblock) –** Improve driver awareness of potential conflicts with vulnerable road users in locations with nearby pedestrian generators (transit stops, commercial/retail and mixed-use land uses, parks, etc.) and along Safe Routes to School. Treatments may include: high-visibility crosswalks, advanced warning signs, curb extensions, median refuge islands, and active warning devices like RRFBs or PHBs, referencing the FHWA STEP Guide for countermeasure selection. Countermeasure IDs: NS19PB, NS20PB, NS21PB, NS22PB, NS23PB, R35PB, R36PB, R37PB. HSIP grants also commonly offer a set-aside for pedestrian crossing treatments.

- **Enhanced pedestrian crossing treatments (signalized intersection) –** Improve driver awareness of potential conflicts with vulnerable road users in locations with nearby pedestrian generators (transit stops, commercial/retail and mixed-use land uses, parks, etc.) and along Safe Routes to School. Treatments may include: high-visibility crosswalks, curb extensions, pedestrian countdown heads, leading pedestrian intervals, medians, right and left turn prohibitions, channelized right turn redesign, lighting improvements, slower pedestrian walking speeds, and protected intersections. Countermeasure IDs: S6/7, S17PB, S18PB, S20PB, S21PB

- **Lighting upgrade** – Install new or supplemental lighting to improve nighttime visibility of intersections and other high-conflict locations. Consider installing pedestrian-level lighting in locations with higher pedestrian and cycling activity, and along Safe Routes to School. Countermeasure IDs: S1, NS1, R1

- **Signalized Intersection Visibility, Hardware, and Timing Upgrade (General)** – Improve the visibility of signalized intersections and modify signal timing to reduce rear-end and broadside crashes. These may include: larger lenses, reflectorized backplates, improved signal head mounting, size and number of signal heads, upgrade to flashing yellow arrow, and improved signal coordination. Countermeasure IDs: S2, S3

- **Signalized Intersection Visibility, Hardware, and Timing Upgrade (High Speed)** – Improve the visibility of signalized intersections and modify signal timing to reduce rear-end and broadside crashes. These may include: larger lenses, reflectorized backplates, improved signal head mounting, size and number of signal heads, upgrade to flashing yellow arrow, improved signal coordination, advanced intersection warning signs/beacons, and advanced dilemma zone detection for high-speed approaches. Countermeasure IDs: S2, S3, S4, S10

7.5 IMPLEMENTATION AND EVALUATION

This Local Road Safety Plan is the framework for engaging residents, stakeholders, employers, planners, engineers, enforcement agencies, and emergency medical service providers across the County in improving transportation safety in Vacaville. While safety-specific plans and programs are critical to achieving the vision for safety in Vacaville, traditional transportation planning, design, operations and maintenance decision making processes, programs, and policies should proactively integrate safety as well. The emphasis areas and strategies in this Plan present short-term safety needs and solutions that can be used by stakeholders countywide as funding and implementation opportunities present themselves. Ongoing coordination and collaboration will enhance implementation efforts and set the stage to evaluate progress on policies, programs, and projects.

Using the goals and strategies in the LRSP, planners and engineers can track and plan for safety on the transportation system by:

- Reviewing past, current, and predicted safety trends – Are trends changing? Are the identified strategies reducing fatal and severe crashes within each emphasis area?
- Revising safety goals and strategies – Have the goals been achieved early, or are they progressing slower than expected? Are the responsible parties implementing the strategies, and if not, what are the barriers to implementation (funding, staff resources, lacking champions)?
- Identifying new projects and strategies to achieve results – Safety research and innovative programs are continually advancing. Are new and more effective strategies available that can be used to better improve safety?
- Monitoring and evaluating system performance – Are systems in place to effectively monitor and evaluate safety throughout the city? Do opportunities exist to improve data collection and accuracy/quality?

COLLABORATION

Vacaville will meet with STA and agency partners on a regular basis to discuss new and ongoing strategy implementations, new strategic and funding opportunities, and barriers to implementation. The purpose of these meetings is to encourage and to maintain communication across stakeholders and provide accountability for implementation. Whenever possible, these meetings should include the representatives from emergency and enforcement services, regional agencies and school districts, and relevant public committees.

POLICY SUPPORT

Projects following the Safe System approach may often require tradeoffs to be made between on-street parking, vehicle level of service, and pedestrian and bicycle safety and accessibility, when funding and/or right of way are limited. A Vision Zero policy and Council Resolution in support of this can help clarify how these decisions will be made at a citywide scale rather than on a project-by-project basis. The policy can also support equity goals in the community by precluding unequal opportunities to those with the historically "loudest" voices or most resources for civic participation.

Other complementary policies to this Plan may include a citywide crosswalk policy and transition plan and a speed management policy and program. The Vision Zero Network website provides additional guidance: https://visionzeronetwork.org/where-to-start/

INSTITUTIONALIZATION

In addition to pursuing funding for the priority and systemic projects identified in this LRSP via upcoming grant opportunities, Vacaville should consider reactive and project safety project opportunities through:

- Capital Improvement Projects, such as repaving efforts
- Development Impact Review and Mitigation - new guidance from the Institute of Transportation Engineers presents opportunities for bring the Safe System approach into the development review process: https://www.ite.org/pub/?id=94372DF6-BAB5-AE00-E6D5-471ED4F338CE

EVALUATION

Vacaville, with assistance from STA, will conduct a bi-annual review of safety conditions in anticipation of Caltrans HSIP and ATP funding cycles, allowing the analysis to inform priority projects and funding applications. The memo or findings of the evaluation will be made publicly available to local residents.

The Emphasis Areas and Strategies identified in the Local Road Safety Plan will be re-evaluated every four years as a countywide effort, facilitated by STA, and revised based upon the results of the crash trend analysis.

CHAPTER 8:
VALLEJO LOCAL ROAD SAFETY

8.1 INTRODUCTION

Vallejo is located in the southwestern extents of Solano County. State Route 29 (SR 29) and Interstate-80 (I-80) run north-south through the city while State Route 37 (SR 37) and Interstate-780 (I-780) run east-west through the city. Based on the United States Census Bureau, Vallejo is the largest city in Solano County, with a population of 126,090 people as of 2020.

A local road safety plan provides a data- and community-driven framework to systematically identify, analyze and prioritize safety problems and recommend safety improvements on local roads. The following chapter presents the vision statement, summarizes crash data, identifies emphasis areas, recommends high priority project locations and outlines the implementation and evaluation strategies for the City of Vallejo.

VISION STATEMENT

To eliminate fatal and severe injuries on roadways within the City of Vallejo by creating an equitable, sustainable, and multimodal transportation system where people of all ages and abilities can travel free from harm.

8.1A VALLEJO'S VISION ZERO EFFORTS

Fehr & Peers and MIG assisted the City of Vallejo with the initial stages of its Vision Zero process. Fehr & Peers performed collision analysis and created profiles of emphasis that highlighted the most common types of crashes, and also created a high-injury network showing the locations with the highest concentrations of crashes in the city. MIG helped the city perform outreach through the deployment of a survey and is coordinating with the city to create an outreach strategy around Vision Zero and roadway safety.

This LRSP chapter includes updated years of crash data analysis and project profiles, with corresponding engineering and non-infrastructure countermeasures. The strategies included below build upon the efforts completed by Fehr & Peers and MIG.

8.2 CRASH DATA AND TRENDS

DATA SOURCES

This safety analysis used crash data from both the Statewide Integrated Traffic Records System (SWITRS) and Transportation Injury Mapping System (TIMS). The crash data analyzed for this project included all crashes recorded in SWITRS and/or TIMS during the five-year period between January 1, 2016, and December 31, 2020.

Crash Record Data

For this project and most other safety analyses, the crash severity is defined in the Highway Safety Manual (HSM) as follows:

- **Fatal injury:** A crash that results in the death of a person within 30 days of the crash.
- **Severe (incapacitating) injury:** A crash that results in broken bones, dislocation, severe lacerations, or unconsciousness, but not death.
- **Other Visible injury (non-incapacitating):** A crash that results in other visible injuries, including minor lacerations, bruising, and rashes.
- **Possible injury (complaint of pain):** A crash that results in the complaint of non-visible pain/injury, such as confusion, limping, and soreness.
- **Property damage only (PDO):** A crash without injury or complaint of pain but resulting in property damage to a vehicle or other object, commonly referred to as a “fender bender.”

The most severe crashes, characterized as KSI (Killed or Severely Injured), and the systemic themes derived from them, are the primary focus of this LRSP.

CRASH TRENDS

Figure 46 provides a heatmap of all the crashes within the Vallejo boundary. As expected, there is a high concentration of crashes located near the downtown area, west of SR-80. In particular, the corridors along Sonoma Blvd (Highway 29) and Highway 37 have the highest number of fatal and severe injuries.

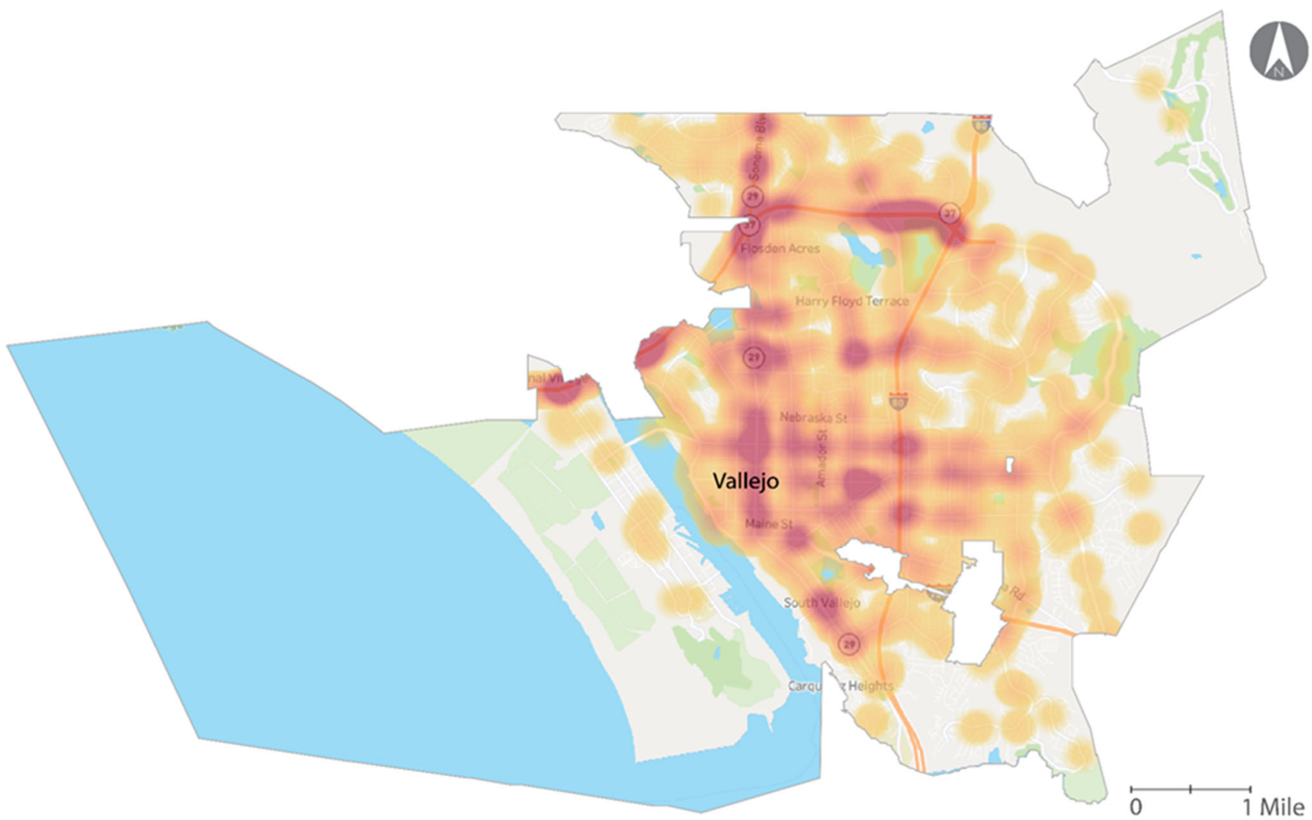


FIGURE 46: HEAT MAP OF ALL NON-INTERSTATE CRASHES WITHIN VALLEJO.

MTC also provides a tool that displays the Regional High Injury Network (HIN) for full access roadways[15]. Figure 47 shows the identified Regional HIN in Vallejo. Between 2016 and 2020, a total of 2,324 reported crashes occurred in Vallejo, including 41 fatal crashes and 124 severe injury crashes. The following table summarizes key crash statistics that illustrate contextual and behavioral patterns.

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[15] https://bayviz.mysidewalk.com/

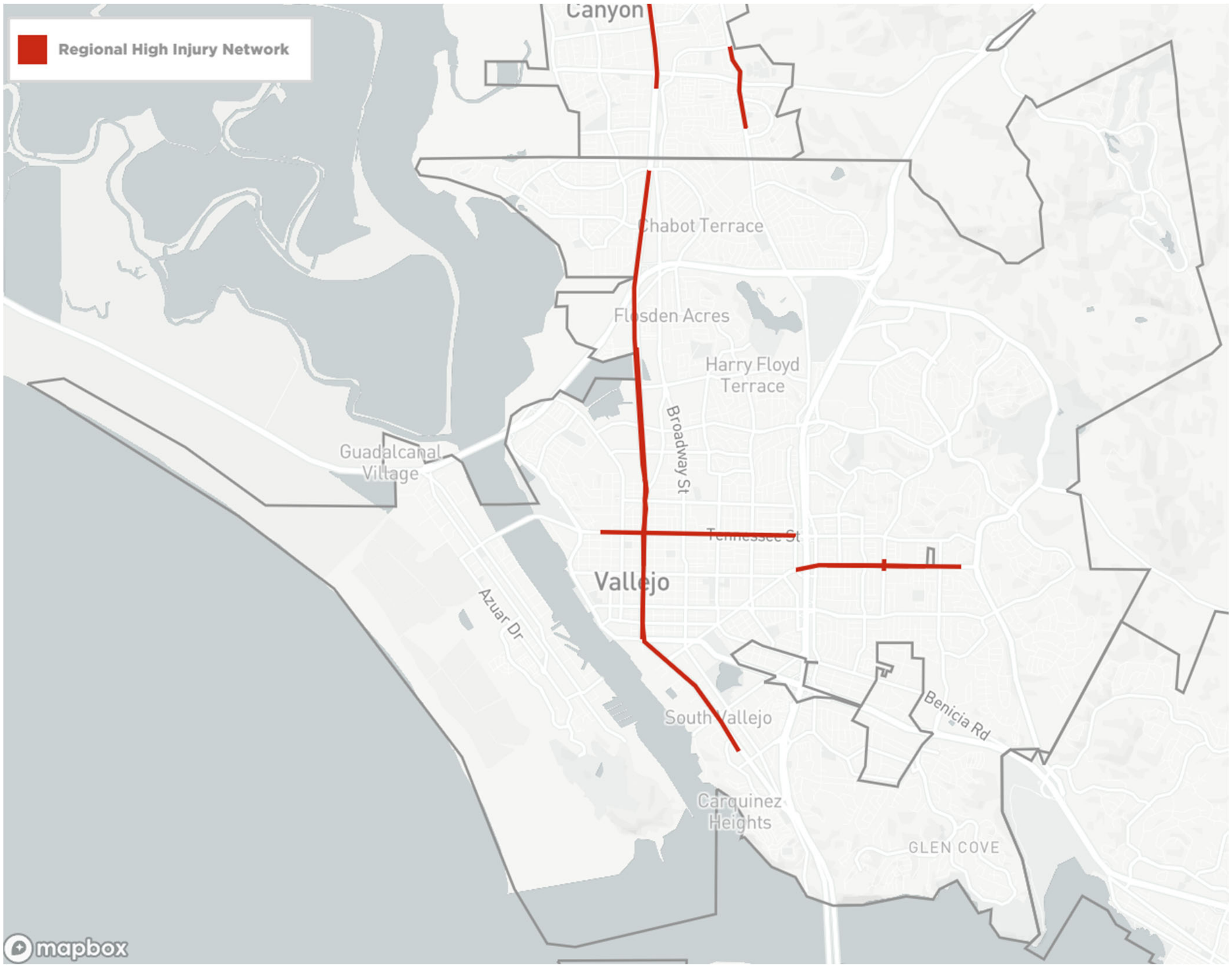


FIGURE 47: REGIONAL HIGH INJURY NETWORK WITHIN VALLEJO

TABLE 47: VALLEJO SUMMARY OF CRASH STATISTICS

CATEGORY	PROPORTION OF CRASHES	
	All Severities (2,324 crashes)	Fatal and Severe Crashes (165 crashes)
Pedestrian Involved	8.1%	31.5%
Bicyclist Involved	3.3%	4.2%
Motorcycle Involved	3.7%	13.3%
Alcohol or Drug Involved	6.6%	16.4%
Wet Road Surface	12.4%	11.5%
Speeding Involved[16]	21.9%	11.5%
Lane Departure	36.4%	38.2%
Intersections	70.2%	72.1%

As shown, many of the crash categories are over-represented in fatal and severe injury (KSI) crashes, including pedestrians, bicyclists, motorcyclists, impaired driving, lane departure, and at intersections. Because the primary focus of a LRSP is to address KSI crash risks, the following sections present key trends related to these high severity crashes.

[16] The increased kinetic energy from higher speed crashes is generally associated with higher severity crashes. The seeming reduced proportion of speeding-related crashes that result in a KSI may be due to the crash reporting constraint of only having one primary crash factor reported. As a result, a crash that may have involved unsafe speeds may be associated with a different cause of crash

Physical Environment

Approximately 72% of KSI crashes occurred at intersections, while the remaining 28% occurred on roadway segments (including at driveways). Nearly 59% of all KSI crashes occurred during dark conditions.

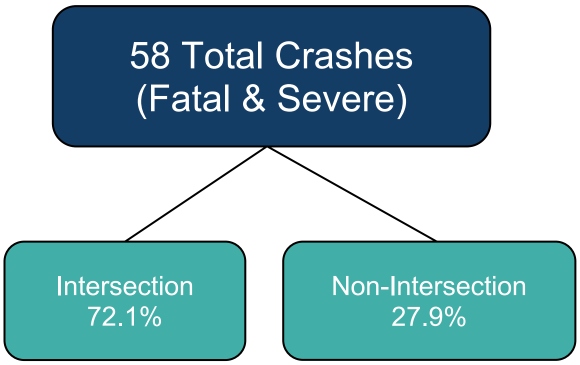


FIGURE 48: KSI LOCATION CRASH TREE

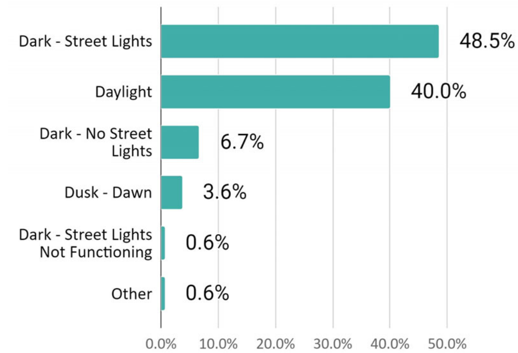


FIGURE 49: KSI LIGHTING CONDITIONS

Crash Types

Crash types provide insights into common conflicts that exist between road users. As shown in Figure 50, the three most common crash types resulting in fatalities or severe injuries are pedestrian (32%), broadside (22%), and hit object (18%). Other vulnerable road users, including bicycle-involved and motorcycle-involved crashes, are not specifically identified on this chart as any non-pedestrian crash is assigned to a crash type (e.g., a right-angle crash between a vehicle and bicycle would be coded as a broadside, and involvement of the bicyclists is noted in a separate field in the crash record). As shown previously in Table 47, 13% of KSI crashes involved a motorcyclist and 4% involved a bicyclist.

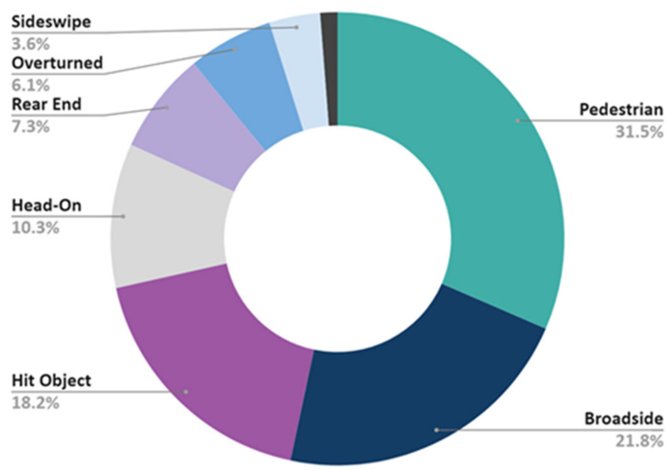


FIGURE 50: KSI CRASH TYPES

Contributing Factors

Primary contributing factors and violation categories can provide insights into human behavior associated with a crash. As shown in Figure 51, the most common violations reported in fatal and severe injury crashes were improper passing (19%), pedestrian violations (18%), and impairment (16%). Note that roadway design contributing factors are not included on a collision report, so the comparable role of design and behavior, and how those relate, cannot be determined based on a collision report alone.

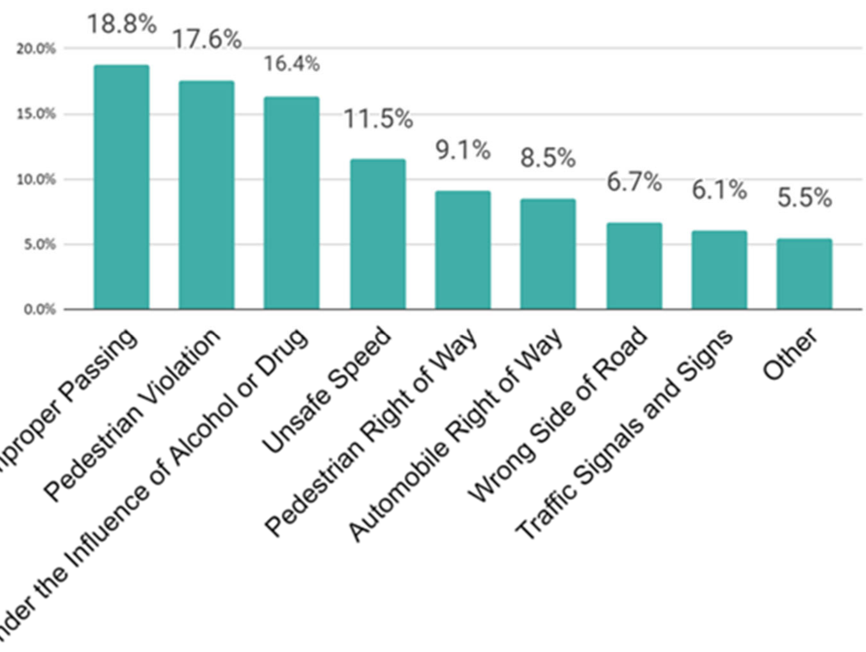


FIGURE 51: KSI PRIMARY VIOLATION CATEGORY

8.3 EMPHASIS AREAS

Emphasis Areas provide a strategic framework for developing and implementing strategies and actions for the LRSP. The Emphasis Areas were developed, using the results of crash data analysis and input from staff and stakeholders. For each emphasis area, quantitative crash reduction goals were identified to provide a metric to evaluate the ongoing effectiveness of project implementation, programs, and policies. The goal to eliminate severe and fatal crashes requires the holistic implementation of the Safe System approach with the use of infrastructure-based and non-infrastructure countermeasures to create redundancies in the roadway system and through education and enforcement practices. A detailed summary and additional sources for infrastructure and non-infrastructure based countermeasures are provided in the Appendix. For the development of strategies, the Emphasis Areas were categorized in five broader groups: Vulnerable Users, Impairment, Dark Conditions, Infrastructure, and Improved Systems. Each group is described below with the associated Emphasis Areas.

Vulnerable Road Users

Vulnerable road users can be characterized by the amount of protection they have when using the transportation system. For example, pedestrians, bicyclists, and motorcyclists are more exposed than people in vehicles, making them more susceptible to injury in the event of a crash. Countywide and in Vallejo, crashes involving vulnerable users make up 49% of all Fatal or Severe Injury crashes. Aging drivers and pedestrians can also be more vulnerable to severe injuries when a crash occurs. In Vallejo, children under 18 riding bikes are over-represented in fatal or severe crashes (22%) as compared to their proportion of the population (20% of Vallejo residents are under 18 years old).

For this group, the following Emphasis Areas were identified:

- **Pedestrians -** focuses on crashes involving someone walking. Pedestrians are some of the most vulnerable users of a roadway network, and crashes involving pedestrians are more likely to result in a fatal or severe injury. In addition, many younger and older road users travel on foot, which compounds this vulnerability.
- **Bicyclists -** focuses on crashes which involve someone riding a bicycle. Bicyclists are considered vulnerable road users and crashes involving a cyclist typically result in severe injuries. In addition, younger and older road users often travel via bicycle, which compounds this vulnerability.
- **Motorcyclists -** focuses on crashes which involve someone riding a motorcycle. Motorcyclists are vulnerable users, much like bicyclists and pedestrians, because they do not have the protection of an enclosed vehicle. However, unlike bicyclists and pedestrians, motorcyclists travel at vehicular travel speeds. Because of this, crashes involving motorcyclists often result in serious injuries or fatalities.

Consideration of Location Types. Pedestrian-involved crashes tend to occur most often in downtown core areas, consistent with higher pedestrian activity. High-volume signalized intersections can increase pedestrian crash risk due to complexities resulting from multiple types of road users (pedestrians, bicyclists, passenger vehicles, buses, trucks) and heavy turning movements at the location. Motorcyclist-involved collisions occur system-wide, and often involve high speeds of either the motorcyclist, other vehicle, or both

Following the Safe System approach, Table 48 summarizes the goals and strategies for each of these emphasis areas. Additional information on specific countermeasures, treatments, and strategies can be found in the Countermeasure Toolboxes in the Appendix.

TABLE 48: EMPHASIS AREAS, GOALS, AND STRATEGIES FOR VULNERABLE ROAD USERS

EMPHASIS AREA	GOALS	STRATEGIES
	• Reduce the proportion of fatal and serious injury crashes involving pedestrians by **17% by 2035**. • **Eliminate** fatal and serious injury crashes involving pedestrians **by 2040**.	**Safe Roads** • Install engineering countermeasures focused on increasing driver awareness of pedestrians and reducing conflict zones between vehicles and pedestrians • Develop and implement a Construction Accessibility Policy to maintain accessibility during construction and maintenance projects **Safe Road Users** • Improve infrastructure connectivity for pedestrians, especially along safe routes to school • Expand safe routes to school programming • Pair education with key engineering and enforcement countermeasures

Risky Behaviors

Reductions in fatalities and serious injuries can be accomplished with education, public awareness and partnerships, and high-visibility enforcement. For this category, the following Emphasis Area was identified:

- **Impairment -** focuses on crashes in which the driver or cyclist was under the influence of alcohol or drugs (DUI)

Consideration of Location Types. Fatal and serious injury crashes that involve impairment are often identified on low-volume suburban or rural roads, as impaired drivers may choose to avoid high-volume roads like freeways. This can result in roadway departure crash events at and near horizontal curves. Speed affects both the likelihood of a crash occurring and crash severity, regardless of location. For example, speeding drivers may be more likely to depart the road at a horizontal curve. In a downtown setting, vehicle speed is directly correlated to the injury severity of a pedestrian-involved or bicyclist-involved crash.

Following the Safe System approach, Table 49 summarizes the goals and strategies for this emphasis area. Additional information on specific countermeasures, treatments, and strategies can be found in the Countermeasure Toolboxes in the Appendix.

TABLE 49: EMPHASIS AREAS, GOALS, AND STRATEGIES FOR RISKY BEHAVIORS

EMPHASIS AREA	GOALS	STRATEGIES
	• Reduce the proportion of fatal and serious injury crashes involving impaired drivers **below the countywide proportion (19%) by 2035**. • **Eliminate** fatal and serious injury crashes involving impaired drivers **by 2040**.	**Safe Road Users** • Implement education and public awareness campaigns targeted at impaired driving • Implement high-visibility enforcement campaigns • Partner with local businesses and organizations along hot spot corridors on educational efforts and campaigns • Implement a Safe Ride Home partnership between the City, STA, Police Departments, CHP, TNC Operators, and local businesses

Infrastructure

Multimodal transportation assets can be constructed or retrofitted to reduce the risk of fatal and serious injury crashes. Opportunities to do this include implementing safety treatments at intersections and along and across roadways. For this category, the following Emphasis Areas were identified:

- **Intersections -** focuses on crashes that occur within the functional area of an intersection. Intersections are the primary source of conflicts between road users of all types. Crash severity and patterns vary based on traffic control type, but intersection-related crashes that involve speeding, red-light running, and vulnerable users often result in fatal and serious injuries.
- **Lane Departure -** focuses on crashes that fall within two categories: crashes caused by crossing into the opposing lane and crashes caused by running off the road. These crashes are prone to more severe outcomes and are often associated with risky driver behaviors such as speeding, distraction, and impairment.
- **Dark Conditions -** focuses on crashes that occur during dark, dawn, or dusk conditions. Crashes at night tend to be higher severity due to higher travel speeds (less congestion), increased impairment levels, and reduced visibility of vulnerable road users.

Consideration of Location Types. Intersection collisions occur most often at 2-way stop controlled and signalized locations. The severity of intersection crashes may be more likely in higher-speed environments (e.g., suburban, rural). Lane departure crashes are often assumed to only occur in rural areas, but lane departures can also be problematic in downtown areas due to the close proximity of roadside fixed objects (e.g., utility poles, mailboxes, vegetation).

Following the Safe System approach, Table 50 summarizes the goals and strategies for each of these emphasis areas. Additional information on specific countermeasures, treatments, and strategies can be found in the Countermeasure Toolboxes in the Appendix.

TABLE 50: EMPHASIS AREAS, GOALS, AND STRATEGIES FOR INFRASTRUCTURE

EMPHASIS AREA	GOALS	STRATEGIES
	• Reduce the rate of fatal and serious injury crashes occurring at intersections by **50% by 2035**. • **Eliminate** fatal and serious injury crashes at intersections **by 2040**.	**Safe Roads** • Install engineering countermeasures focused on increasing visibility and driver awareness of intersections, reducing conflicts between road users, and improving signal operations **Safe Vehicles** • Develop a readiness plan for Connected and Automated Vehicles (CAVs) **Safe Road Users** • Implement high-visibility enforcement campaigns **Safe Speeds** • Use recent legislation and national research to set context-appropriate speeds suitable for all road users • Implement a safe speeds education campaign • Implement automated speed enforcement when available **Other** • Coordinate with STA to implement data management strategies and better monitor system safety performance, including contextual data inventory, crash risk indicators, and crash reporting
	• Reduce the rate of fatal and serious injury crashes resulting from lane departure by **50% by 2035**. • **Eliminate** fatal and serious injury crashes resulting from lane departure **by 2040**.	**Safe Roads** • Install engineering countermeasures focused on increasing road/lane awareness and providing more roadside recovery opportunities **Safe Vehicles** • Develop a readiness plan for Connected and Automated Vehicles (CAVs) **Safe Road Users** • Implement high-visibility enforcement campaigns **Safe Speeds** • Use recent legislation and national research to set context-appropriate speeds suitable for all road users • Implement a safe speeds education campaign

EMPHASIS AREA	GOALS	STRATEGIES
		Other • Coordinate with STA to implement data management strategies and better monitor system safety performance, including contextual data inventory, crash risk indicators, and crash reporting
	• Reduce the proportion of fatal and serious injury crashes occurring in dark conditions **below the Countywide proportion (46%) by 2035**. • **Eliminate** datal and serious injury crashes occurring in dark conditions **by 2040**.	**Safe Roads** • Implement engineering countermeasures focused on improving nighttime infrastructure awareness and decision making **Safe Vehicles** • Develop a readiness plan for Connected and Automated Vehicles (CAVs) **Safe Road Users** • Implement high-visibility enforcement campaigns targeted at safety walking and bicycling in the dark **Safe Speeds** • Use recent legislation and national research to set context-appropriate speeds suitable for all road users • Implement a safe speeds education campaign **Other** • Coordinate with STA to implement data management strategies and better monitor system safety performance, including contextual data inventory, crash risk indicators, and crash reporting

Emerging Technology

New and innovative technological advances can help improve current safety practices. Table 51 highlights some of the goals and strategies for emerging technology.

TABLE 51: GOALS AND STRATEGIES FOR EMERGING TECHNOLOGY

GOALS	STRATEGIES
• Maintain and build awareness of how emerging technology solutions can improve understanding of crash trends and user safety. • Identify and fund pilot programs for effective technology solutions for increasing safety (e.g. near miss analytics, crash analytics dashboards). • Build and maintain a comprehensive citywide crash and inventory database.	• Contextual Data Inventory – Vendors such as Mapillary and Ecopia provide up-to-date data on transportation infrastructure, including roadway characteristics, intersection characteristics, and signs. Updated inventory can help City staff identify project synergies, such as including a safety countermeasure with a repaving project and support systemic safety analysis for future safety plans and evaluations. • Crash Risk Indicators - Surrogate safety measures, such as "near-miss" crashes, hard braking data, speed data, community-reported hazards, and high stress facilities provide an understanding of the safety landscape and enable proactive interventions. Technology such as video data and platforms which provide public crowdsourcing can close the gap and provide key insights regarding near miss data in the absence of crash data. • Crash Reporting **-** Crash reporting practices, such as complete data collection and documentation of road user behavior and infrastructure, can lead to a greater understanding of the holistic safety landscape, and thus lead to improved investments in safety.

COMPLEMENTARY PROGRAMS AND PRACTICES

Crash history and other types of safety data can be advanced to better understand the causes and locations of crashes, leading to effective solutions. One framework is the list of USDOT's data quality attributes: timeliness, accuracy, completeness, uniformity, integration, and accessibility. Training is used to educate planners, engineers, designers, and construction staff about the importance of safety and how to incorporate it into their everyday job responsibilities. This also includes training staff on culturally relevant community engagement. Fully funded, staffed, and trained law enforcement and emergency response agencies can direct their efforts toward keeping users safe and, when crashes do occur, have the resources and systems in place so traffic incident management and emergency medical services personnel are available to respond.

Strategy - Culturally Relevant Community Engagement and Street Safety Ambassador Program – Community engagement is not a one-size-fits-all model. Culturally relevant community engagement strategies can help education and programming around traffic safety reach a larger audience and be more impactful by making materials readable for all and meeting the community where they are.

Strategy - Rapid Response Safety Communication Protocol and Multi-Disciplinary Team - An internal, multi-department communication strategy should be deployed in response to severe and fatal crashes. This includes immediate on-the ground-response to an investigation of severe and fatal crashes, ensuring a multi-disciplinary response team focused both on the behavioral and engineering elements of a crash. This team also supports timely data sharing among City departments, ensures data accuracy, and develops near-term interventions.

Strategy - Victim and Family Support - Post-crash care includes providing resources to both the victim, their friends, and their families. To ensure a crash survivor receives the care needed to recover and restore body and mind to an active life within society, they require medical rehabilitation with specialists that can range from orthopedics, neurosurgery, physical and occupational therapy, and prosthetics to psychology and neuropsychology. Resources for crash survivors, their family, and friends, can be found on Solano County Behavioral Health Services' website: https://www.solanocounty.com/depts/mhs/default.asp

8.4 HIGH PRIORITY LOCATIONS AND PROJECTS

With a focus on fatal and severe injury crashes, the project team identified locations within the City of Vallejo that experienced a high frequency or severity of crashes. Once the high-crash locations were identified, each location was scored (or ranked) based on the following metrics.

- **In 2018 Plan?** This identifies whether a safety project was listed at this location in the 2018 Solano County Travel Safety Plan.
- **KSI Crashes.** The number of crash events resulting in a fatality or severe injury at this location.
- **Total Crashes.** The total number of crashes reported and verified to be related to this location.
- **EPDO Score.** The EPDO score, calculated based on the cost of a crash by severity in equivalent property damage crashes, provides a weighted ranking that accounts for the number and severity of crashes at each location.
- **Number of Emphasis Areas (EAs).** This is the number of EAs that are reflected in the details of the reported crashes at this location.

Within Vallejo, 16 high crash locations identified, which are summarized in Table 52 and shown on Figure 52. A one-page summary of each location is also provided.

TABLE 52: VALLEJO HIGH CRASH LOCATIONS

#	LOCATION	IN 2018 PLAN?	KSI CRASHES	TOTAL CRASHES	EPDO SCORE	NUMBER OF EAs (5 max)
1	Sonoma Boulevard (SR29) & Redwood Street	No	2	18	481	5
2	Sonoma Boulevard (SR29) & Lemon Street	Yes	2	16	496	5
3	Sonoma Boulevard (SR29) & Mini Drive	Yes	2	16	534	5
4	Tennessee Street & Amador Street	No	1	12	292	4
5	Sonoma Boulevard (SR29) & Georgia Street	Yes	3	10	630	5
6	Sonoma Boulevard (SR29) & Cherry Street	No	2	9	436	5
7	Sonoma Boulevard (SR29) & Nebraska Street	No	2	9	412	5

#	LOCATION	IN 2018 PLAN?	KSI CRASHES	TOTAL CRASHES	EPDO SCORE	NUMBER OF EAs (5 max)
8	Tennessee Street & Mariposa Street	No	2	10	439	5
9	Curtola Parkway & Lemon Street	No	2	9	651	4
10	Sonoma Boulevard (SR29) & Arkansas Street	No	2	9	402	5
11	Georgia Street & Maple Avenue	No	2	7	630	4
12	Redwood Parkway & Admiral Callaghan Lane	No	2	8	444	5
13	Sonoma Boulevard (SR29) & Maine Street	Yes	2	6	415	4
14	Springs Road & Oakwood Avenue	No	3	5	523	5
15	Tennessee Street & Branciforte Street	No	2	5	373	4
16	SR 29 Corridor	Yes	38	332	10,012	5

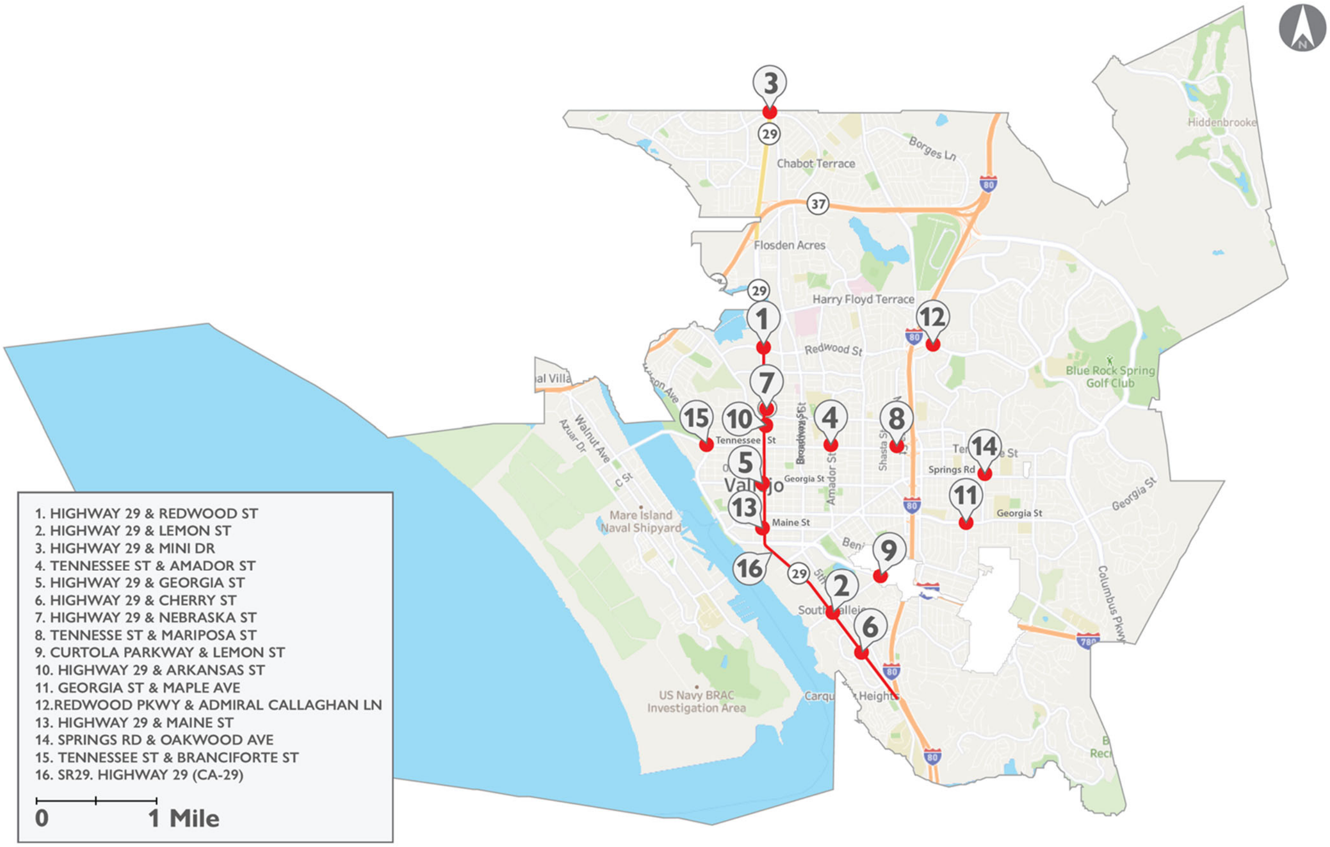


FIGURE 52: MAP OF VALLEJO HIGH CRASH LOCATIONS

LOCATION 1: SONOMA BOULEVARD (SR29) & REDWOOD STREET

REPORT CARD

Priority Ranking	7
EPDO Score	481
Associated Emphasis Areas	
In 2018 Solano Travel Safety Plan?	No
Safety Improvements since 2018?	Signal Visibility Upgrades
Funded HSIP Projects?	No
In Active Transportation Plan?	No

- **Description**: This Caltrans-owned signalized intersection has four approaches with three through lanes on Sonoma Boulevard (SR 29) and two through lanes on Redwood Street with right turn slip lanes on the northbound and southbound approaches. The slightly skewed intersection is surrounded by commercial land uses. There are sidewalks and marked pedestrian crosswalks on all approaches. There are no marked bicycle facilities. Intersection lighting is present.

- **Crash Data**: This intersection had a total of 18 crashes between 2016 – 2020, including one fatal crash and one severe injury crash. The fatal crash involved a pedestrian that was struck by a vehicle while in the crosswalk when it was dark. The severe injury crash resulted in a broadside collision during the daytime. The most common crash type at this location was broadside collisions (44%). Approximately 28% of crashes occurred in the dark and 2 crashes involved pedestrians. Seven crashes were a result of drivers disregarding the traffic signal.

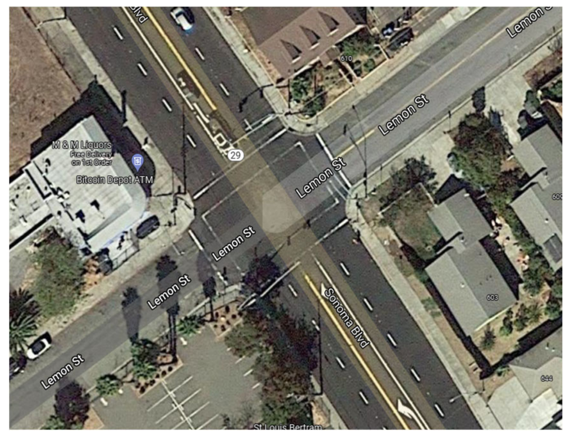
- **Diagnosis:** Based on the predominant crash type and reason for crashes at this location, signal visibility improvements are recommended.

- **Potential countermeasures**: There are no recommended countermeasures currently. Signal visibility upgrades (signal backplates, supplemental heads, etc.) were installed in the last few years, which are anticipated to address the predominant crash patterns. The City should analyze post-installation crash data and determine if there are remaining safety needs.

LOCATION 2: SONOMA BOULEVARD (SR29) & LEMON STREET

REPORT CARD

Priority Ranking	6
EPDO Score	496
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	Yes
Safety Improvements since 2018?	Signal Visibility Upgrades
Funded HSIP Projects?	No
In Active Transportation Plan?	No



- **Description**: This Caltrans-owned signalized intersection has four approaches and is surrounded by a mix of residential and commercial land uses. Sonoma Boulevard (SR29) is a five-lane cross section at this location and Lemon Street is a two-lane cross section. There is a downgrade southbound on Sonoma Boulevard. There are sidewalks and marked pedestrian crossings on all approaches. There are no marked bicycle lanes. Intersection lighting is present.

- **Crash Data**: This intersection had 16 crashes between 2016 – 2020, including one fatal crash and one severe injury crash. The fatal crash occurred when a driver under the influence struck a fixed object when it was dark. The severe injury crash occurred when a vehicle struck another vehicle in a broadside collision. Of the crashes that occurred at this intersection, 63% resulted in a broadside collision, over half (56%) occurred when it was dark, and two involved pedestrians.

- **Diagnosis:** Many collisions occurred when it was dark, therefore, improved street lighting is recommended. Left-turn improvements for the side-streets may address the high number of broadside collisions. Pedestrian crossing improvements are also recommended at this location.

- **Potential countermeasures**: Signal visibility upgrades (signal backplates, supplemental heads, etc.) were installed in the last few years, which are anticipated to address some of the crash patterns. The City should analyze post-installation crash data and determine if there are remaining safety needs.
  - S1: Lighting upgrade
  - S6/S7: Implement signal timing adjustments (adjust pedestrian walking speed, protected lefts)
  - S17PB: Install ped countdown timers
  - S21PB: Install leading pedestrian interval
  - Consider installing advanced stop bars and high-visibility striping

LOCATION 3: SONOMA BOUELVARD (SR29) & MINI DRIVE

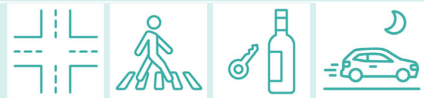
REPORT CARD

Priority Ranking	4
EPDO Score	534
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	Yes
Safety Improvements since 2018?	Signal Visibility Upgrades
Funded HSIP Projects?	No
In Active Transportation Plan?	No

- **Description**: This Caltrans-owned four-leg intersection is signalized and has two through lanes with dedicated left and right turn lanes on Sonoma Boulevard. The intersection is located near a shopping center and provides access to housing developments to the east and west. There are sidewalks on all approaches except the west side of Sonoma Boulevard south of the intersection. There are marked pedestrian crossings on all approaches. There are no marked bicycle facilities. Intersection lighting is present.
- **Crash Data**: This intersection had 16 crashes between 2016 – 2020, including two severe injury crashes. One severe injury crash resulted in a rear-end when the driver was speeding in foggy conditions. The other severe injury crash involved a pedestrian who was struck by a vehicle in the crosswalk when it was dark. Over half (56%) of the total crashes at this location resulted in rear-end collisions. The majority (75%) occurred when it was dark or dusk, 31% involved speeding, and two crashes involved pedestrians.
- **Diagnosis:** Many collisions occurred when it was dark, therefore, improved street lighting is recommended. Signal visibility upgrades at this location may help reduce the high number of rear-end collisions here. Pedestrian crossing improvements are also recommended at this location.
- **Potential countermeasures**: Signal visibility upgrades (signal backplates, supplemental heads, etc.) were installed in the last few years, which are anticipated to address some of the crash patterns. The City should analyze post-installation crash data and determine if there are remaining safety needs.
    - S1: Lighting upgrade
    - S17PB: Install ped countdown timers and adjust pedestrian walking speed
    - S21PB: Install leading pedestrian interval
    - Consider radar speed feedback signs on SB approach

LOCATION 4: TENNESSEE STREET & AMADOR STREET

REPORT CARD

Priority Ranking	15
EPDO Score	292
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	No
Safety Improvements since 2018?	No
Funded HSIP Projects?	No
In Active Transportation Plan?	No

- **Description**: This four-leg intersection is signalized with protected left turns on Tennessee Street and permissive left turns on Amador Street. The intersection is surrounded by a mix of commercial and residential land uses. There are sidewalks and marked pedestrian crossings on all approaches. There are no marked bicycle facilities. Intersection lighting is present.

- **Crash Data**: This intersection had 12 crashes between 2016 – 2020, including one severe injury crash. The severe injury crash involved a vehicle that was driving on the wrong side of the road. The predominant crash type at this location was broadside collisions (67%) and the most common reason for crashes was drivers disregarding the traffic signal (67%).

- **Diagnosis:** Signal visibility upgrades and timing improvements would address the predominant reason for crashes and crash types at this intersection. The severity of the crash may provide an opportunity to help fund a broader scope systemic application covering multiple signalized locations.

- **Potential countermeasures**:

  - S2: Install signal hardware visibility upgrades
  - S3: Improve signal timing/coordination
  - S7: Implement signal timing adjustments (protected only), upgrade to flashing yellow arrow (FYA).
  - S16: Convert to roundabout

LOCATION 5: SONOMA BOULEVARD (SR29) & GEORGIA STREET

REPORT CARD

Priority Ranking	2
EPDO Score	630
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	Yes
Safety Improvements since 2018?	Signal Visibility Upgrades
Funded HSIP Projects?	No
In Active Transportation Plan?	No

- **Description**: This Caltrans-owned four-leg intersection is signalized with single through lanes on Georgia Street and two through lanes on Sonoma Boulevard (SR29). The intersection is located in a commercial-retail area where the posted speed is 25 mph. There are sidewalks and marked crosswalks on all approaches. There are marked bike lanes on Sonoma Boulevard and Georgia Street east of the intersection. Intersection lighting is present.

- **Crash Data**: There was 10 crashes that occurred at this intersection between 2016 – 2020, including three severe injury crashes. Two of the severe injury crashes involved pedestrians and the other severe injury resulted in a head-on collision when a vehicle left its lane. Half (50%) of the crashes at this intersection occurred when it was dark, 3 crashes involved pedestrians, and 4 crashes involved left-turning vehicles.

- **Diagnosis:** Signal visibility and phasing upgrades, pedestrian crossing improvements, and improved lighting would address the predominant crash patterns at this location. The severity of the crashes may provide an opportunity to help fund a broader scope systemic application covering multiple signalized locations.

- **Potential countermeasures**: Signal visibility upgrades (signal backplates, supplemental heads, etc.) were installed in the last few years, which are anticipated to address some of the crash patterns. The City should analyze post-installation crash data and determine if there are remaining safety needs.
  - S1: Lighting upgrade (consider pedestrian level lighting)
  - S6/S7: Implement signal timing adjustments (adjust pedestrian walking speed and protected left turns)
  - S17PB: Install pedestrian countdown timers
  - S21PB: Install leading pedestrian interval

LOCATION 6: SONOMA BOULEVARD (SR29) & CHERRY STREET

REPORT CARD

Priority Ranking	10
EPDO Score	436
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	No
Safety Improvements since 2018?	Signal Visibility Upgrades
Funded HSIP Projects?	No
In Active Transportation Plan?	No

- **Description**: This Caltrans-owned four-leg intersection is stop-controlled with stop signs on the Cherry Street approaches. There is a significant downgrade traveling northbound on Sonoma Boulevard (SR29). The surrounding land use is residential. There are sidewalks and marked pedestrian crossings on all approaches with warning signs and high-visibility pavement markings for the crosswalks on Sonoma Boulevard. There are no marked bicycle facilities and on-street parking is permitted on Cherry Street and the west side of Sonoma Boulevard. Intersection lighting is present.

- **Crash Data**: This intersection had nine (9) crashes between 2016 – 2020, including two fatal crashes. One fatal crash occurred during the nighttime and involved a pedestrian that was struck while not in the crosswalk. Alcohol was involved. The other fatal crash occurred when a vehicle left the travel lane and struck another vehicle head-on during the nighttime. Over 60% of crashes (6 of 9) occurred when it was dark and 40% of crashes involved left-turning vehicles.

- **Diagnosis:** On-street parking and the vertical grade on Sonoma Boulevard may limit sight distance at this intersection. Improved lighting and enhanced pedestrian crossing treatments are recommended. Depending on vehicle volumes, traffic control may be warranted; however, being on a State Route will require an Intersection Control Evaluation and evaluation of a roundabout even if the existing ROW is restrictive, which should be included in the cost. The severity of the crashes may provide an opportunity to help fund a broader scope systemic application covering multiple stop-controlled locations.

- **Potential countermeasures**:
  - NS1: Improve lighting

- NS21: Install enhanced ped crossing safety features (curb extensions, refuge island)
- NS11 - Improve intersection sight distance (pull back on-street parking)
- NS3/NS5 - Upgrade traffic control to signal or roundabout

LOCATION 7: SONOMA BOULEVARD (SR29) & NEBRASKA STREET

REPORT CARD

Priority Ranking	11
EPDO Score	412
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	No
Safety Improvements since 2018?	Signal Visibility Upgrades
Funded HSIP Projects?	No
In Active Transportation Plan?	No

- **Description**: This four-leg intersection is signalized with a five-lane cross section on Sonoma Boulevard (SR29). The surrounding land use is commercial. There are sidewalks on all approaches and marked pedestrian crossings on all legs. On-street parking is permitted on Nebraska Street. Intersection lighting is present on the southwest and northeast corners.

- **Crash Data**: This intersection had nine (9) crashes between 2016 – 2020, including two severe injury crashes. One of the severe injury crashes occurred when a pedestrian who was not in the crosswalk was struck by a vehicle in dark, wet conditions. The other severe injury crash occurred when a vehicle whose driver was under the influence left the travel lane and hit another vehicle head-on.

- **Diagnosis:** Of the nine total crashes at this location, three resulted in broadside collisions, two rear-end collisions, and one head-on collision. Over half (55%) occurred when it was dark. Because the minor street signal heads are pedestal-mounted only, the visibility of those signal heads could be improved.

- **Potential countermeasures**: Signal visibility upgrades (signal backplates, supplemental heads, etc.) were installed in the last few years, which are anticipated to address some of the crash patterns. The City should analyze post-installation crash data and determine if there are remaining safety needs.

    - S1: Improve lighting, consider ped level lighting
    - S8: Convert signal to mast arm
    - S17PB: Install ped countdown heads
    - S21PB: implement leading ped interval

LOCATION 8: TENNESSEE STREET & MARIPOSA STREET

REPORT CARD

Priority Ranking	9
EPDO Score	439
Associated Emphasis Areas	
In 2018 Travel Safety Plan?	No
Safety Improvements since 2018?	
Funded HSIP Projects?	No
In Active Transportation Plan?	No

- **Description**: This four-leg intersection is signalized and located just west of the I-80 interchange. The surrounding land use is primarily residential. There are sidewalks and marked pedestrian crossings on all approaches. There are no marked bicycle facilities. On-street parking is permitted on Mariposa Street and Tennessee Street west of the intersection. Lighting is present.

- **Crash Data**: This intersection had 10 crashes between 2016 – 2020, including two severe injury crashes. One severe injury crashed involved a pedestrian who was struck by a left-turning vehicle while in the crosswalk when it was dark. The other severe injury crash occurred during the daytime when a left turning vehicle collided with another vehicle in a broadside collision. Of the crashes that occurred at this location, 5 resulted in broadside collisions, 2 resulted in rear-end collisions, and 2 involved pedestrians.

- **Diagnosis:** The predominant crash patterns at this location would be treated by signal visibility improvements, left-turn lanes, and phasing adjustments. Pedestrian crossing features could also be improved at this location. The severity of the crash may provide an opportunity to help fund a broader scope systemic application covering multiple signalized locations.

- **Potential countermeasures**:
    - S2: Signal hardware visibility upgrades
    - S3: Signal timing and coordination
    - S6: Install left-turn lane and add protected left-turn phase
    - S17PB: Install ped countdown heads
    - S21PB: implement leading ped interval

LOCATION 9: CURTOLA PARKWAY/I-780 & LEMON STREET

REPORT CARD

Priority Ranking	1
EPDO Score	651
Associated Emphasis Areas	
In 2018 Solano Travel Safety Plan?	No
Safety Improvements since 2018?	
Funded HSIP Projects?	No
In Active Transportation Plan?	No

- **Description**: This is a skewed signalized intersection that serves as the western terminus of I-780 (I-780 transitions into Curtola Parkway west of Lemon Street). There are advanced intersection warning signs with flashers on the westbound approach. The posted speed for westbound I-780 vehicles is 55 mph. Reflectorized backplates are present on three of the four approaches (none on the northbound approach). There is one marked pedestrian crossing on the west leg.

- **Crash Data**: This intersection had a total of nine (9) crashes between 2016 – 2020, including two severe injury crashes. Both severe injury crashes were broadside crashes that occurred at in dark conditions; one was attributed to impairment and the other was attributed to disregarding traffic signals and signs. Of the nine crashes, there were five broadside, two rear end, one sideswipe, and one pedestrian-involved. Three crashes involved impairment.

- **Diagnosis:** The transition from interstate to the local street system is likely contributing to higher approach speeds and may be contributing to red light running. Over half (55%) of the crashes at this intersection occurred in dark conditions. The severity of the crash may provide an opportunity to help fund a broader scope systemic application covering multiple signalized locations.

- **Potential countermeasures**:
    - S1 – Install intersection lighting.
    - S4 – Provide advanced dilemma zone detection for high-speed approaches.

LOCATION 10: SONOMA BOULEVARD (SR 29) & ARKANSAS STREET

REPORT CARD

Priority Ranking	12
EPDO Score	402
Associated Emphasis Areas	
In 2018 Solano Travel Safety Plan?	No
Safety Improvements since 2018?	No
Funded HSIP Projects?	No
In Active Transportation Plan?	No

- **Description**: This is two-way stop-controlled intersection with high-visibility marked crosswalks on the north and south legs as well as pedestrian crossing warning signs. There is on-street parallel parking on all approaches.

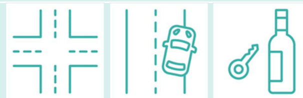
- **Crash Data**: This intersection had a total of eight (8) crashes between 2016 – 2020, including two severe injury crashes. There were three broadside crashes, two rear end crashes, two pedestrian crashes, one bicycle crash, and one head on crash. Both pedestrian crashes (including one severe injury) occurred in dark conditions, involved impairment, and involved a pedestrian crossing outside of the crosswalk. The second severe injury crash involved a bicyclist traveling on the wrong side of the road in dark conditions.

- **Diagnosis:** Approximately 38% of crashes involved a vulnerable user. Although this crossing location is uncontrolled along Sonoma Boulevard, there is a HAWK signal one block south and a full signal one block north. Two-thirds of all crashes occurred in dark conditions. The on-street parking and vertical grade on Sonoma Boulevard may limit sight distance for vehicles entering from Arkansas Street. The severity of the crashes may provide an opportunity to help fund a broader scope systemic application covering multiple stop-controlled locations.

- **Potential countermeasures**:
    - NS1: Install intersection lighting
    - NS21PB**:** Install enhanced pedestrian crossing safety features (curb extensions)
    - NS11: Improve intersection sight distance (pull back on-street parking)

LOCATION 11: GEORGIA STREET & MAPLE AVENUE

REPORT CARD

Priority Ranking	3
EPDO Score	630
Associated Emphasis Areas	
In 2018 Solano Travel Safety Plan?	No
Safety Improvements since 2018?	No
Funded HSIP Projects?	No
In Active Transportation Plan?	No

- **Description**: This is a signalized intersection with protected left-turn phasing on Georgia Street and permissive left-turns on Maple Avenue. There are marked crosswalks on all four legs, and there is on-street parallel parking on all approaches.

- **Crash Data**: This intersection had a total of seven (7) crashes between 2016 – 2020, including two severe injury crashes. There were four broadside crashes (one severe injury), one rear end crash (severe injury), one head on crash, and one crash of unknown type. One crash involved a left-turning vehicle and all crashes occurred during daylight.

- **Diagnosis:** Over half (57%) of crashes were broadside and all involved drivers disregarding the traffic signal or signs. Intersection visibility improvements may help at this location; however, the existing intersection footprint provides an opportunity to install a multi-lane roundabout at this location to reduce vehicle conflicts. The severity of the crashes may provide an opportunity to help fund a broader scope systemic application covering multiple signalized locations.

- **Potential countermeasures**:

    - S2: Improve signal hardware (e.g., reflectorized back plates, larger lenses, supplemental signal heads, etc.)
    - S6/S7: Modify signal timing (provide split phasing and adjust walking speed on Maple Avenue or provide protected left-turn phasing, which would require installation of left-turn lanes)
    - S16: Convert to single-lane roundabout

LOCATION 12: REDWOOD PARKWAY & ADMIRAL CALLAGHAN LANE

REPORT CARD

Priority Ranking	8
EPDO Score	444
Associated Emphasis Areas	
In 2018 Solano Travel Safety Plan?	No
Safety Improvements since 2018?	Signal Visibility Upgrades
Funded HSIP Projects?	No
In Active Transportation Plan?	No

- **Description**: The I-80 off-ramp forms the south leg of this Caltrans-owned skewed signalized intersection. There is one marked pedestrian crossing on the north leg. Signal visibility upgrades (reflectorized backplates and supplemental heads) were recently installed. Protected left-turn phasing is provided for all approaches.

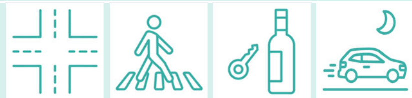
- **Crash Data**: This intersection had a total of eight (8) crashes between 2016 – 2020, including two severe injury crashes. There were four broadside crashes, one rear end crash, one pedestrian crash, one sideswipe crash, and one overturned crash. Both severe injury crashes were broadside type involving left-turns and occurred at night.

- **Diagnosis:** Half of the crashes were broadside and 60% were attributed to drivers disregarding the traffic signal or signs. Both of these crash patterns will be partially addressed by the recently installed signal visibility upgrades. 75% of crashes occurred in dark conditions, and 37% involved a left-turning vehicle. Based upon the unconventional intersection design and approaches and large existing footprint, conversion to a roundabout may be an option if the recent improvements do not significantly decrease crash rates.

- **Potential countermeasures**:
  - S1: Install intersection lighting
  - S16: Convert to roundabout (if a road diet to create a single-lane roundabout isn’t feasible fix intersection geometry by squaring up approaches and dropping excess approach/receiving lanes as feasible)
  - Reevaluate broadside and rear-end crash patterns for the period after installation of signal visibility upgrades to determine if there are remaining safety needs.

LOCATION 13: SONOMA BOULEVARD (SR 29) & MAINE STREET

REPORT CARD

Priority Ranking	13
EPDO Score	415
Associated Emphasis Areas	
In 2018 Solano Travel Safety Plan?	Yes
Safety Improvements since 2018?	Signal Visibility Upgrades
Funded HSIP Projects?	No
In Active Transportation Plan?	No

- **Description**: This signalized intersection with permissive left-turn phasing on all approaches is a Caltrans-owned intersection. There are marked crosswalks on all four legs. Signal visibility upgrades (reflectorized backplates and supplemental signal heads) were recently installed.

- **Crash Data**: This intersection had a total of six (6) crashes between 2016 – 2020, including two severe injury crashes. There were four broadside crashes (one severe injury), one rear end crash, and one pedestrian crash (severe injury). The severe injury pedestrian crash involved a left-turning vehicles and a pedestrian crossing in the crosswalk. One crash involved impairment.

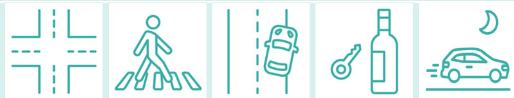
- **Diagnosis:** 75% of the crashes were broadside and 33% were attributed to drivers disregarding the traffic signal/signs. Both of these crash patterns will be partially addressed by the recently installed signal visibility upgrades. Another 33% involved a left-turning vehicle. If crash rates do not decrease significantly from the recent improvements, there are multiple other improvements which can further address the observed crash patterns.

- **Potential countermeasures**:

    - S6/S7: Modify signal timing (provide split phasing or provide protected left-turn phasing, which would require installation of left-turn lanes)
    - S17PB: Install pedestrian countdown signal heads and adjust pedestrian walking speed
    - S21PB: Install leading pedestrian interval with No RTOR blank outs
    - Reevaluate broadside and rear-end crash patterns for the period after installation of signal visibility upgrades to determine if there are remaining safety needs
    - Eliminate parking at corners and add bulbouts

LOCATION 14: OAKWOOD AVENUE & SPRINGS ROAD

REPORT CARD

Priority Ranking	5
EPDO Score	523
Associated Emphasis Areas	
In 2018 Solano Travel Safety Plan?	No
Safety Improvements since 2018?	No
Funded HSIP Projects?	No
In Active Transportation Plan?	No

- **Description**: This is a signalized intersection with protected left-turn phasing on all approaches. There are marked crosswalks on all four legs and there are several schools nearby. All pavement markings, including the crosswalks, are faded.

- **Crash Data**: This intersection had a total of five (5) crashes between 2016 – 2020, including one fatal and two severe injury crashes. There were two pedestrian crashes (one fatal, one severe injury), one sideswipe bicycle crash (severe injury), one rear end crash, and one broadside crash. Both pedestrian crashes involved a pedestrian crossing outside of the crosswalk, and the fatal pedestrian crash occurred at night.

- **Diagnosis:** The surrounding land uses are strong pedestrian generators (convenience stores, fast food restaurants, schools, transit stops). 60% of the crashes involved a vulnerable road user. Both pedestrian crashes involved a pedestrian crossing outside of the crosswalk. The severity of the crashes may provide an opportunity to help fund a broader scope systemic application covering multiple signalized locations.

- **Potential countermeasures**:
  - S2 – Improve signal hardware (e.g., reflectorized back plates, larger lenses, supplemental signal heads, etc.)
  - S17PB – Install pedestrian countdown signal heads with No RTOR blank outs
  - S21PB – Install leading pedestrian interval and adjust pedestrian walking speed
  - Consider a road diet on Springs Road and Oakwood with bicycle and pedestrian enhancements
  - Consider installing advanced stop bars

LOCATION 15: TENNESSEE STREET & BRANCIFORTE STREET

REPORT CARD

Priority Ranking	14
EPDO Score	373
Associated Emphasis Areas	
In 2018 Solano Travel Safety Plan?	No
Safety Improvements since 2018?	No
Funded HSIP Projects?	No
In Active Transportation Plan?	No

- **Description**: This is a two-way stop-controlled intersection with on-street parallel parking on all approaches. All pavement markings, including the crosswalks, are faded.

- **Crash Data**: This intersection had a total of five (5) crashes between 2016 – 2020, including two severe injury crashes. There were two pedestrian crashes (both severe injury), two broadside crashes, and one non-collision crash. Both pedestrian crashes involved a pedestrian crossing outside of the crosswalk.

- **Diagnosis:** Both severe injury pedestrian crashes occurred at night, suggesting a need for improved visibility of pedestrians. The marked crossings may not be a desirable crossing as both pedestrians involved in crashes were crossing outside of the crosswalk. The severity of the crashes may provide an opportunity to help fund a broader scope systemic application covering multiple stop-controlled locations.

- **Potential countermeasures**:
    - NS1: Install intersection lighting (consider pedestrian-level lighting)
    - NS21PB: Install enhanced pedestrian crossing safety features (e.g., high-visibility crosswalk, curb extensions, etc.)
    - NS11: Improve intersection sight distance (pull back on-street parking)
    - NS22PB: Install RRFB
    - Consider restriping lane markings and crosswalks

LOCATION 16: SONOMA BOULEVARD (SR 29) CORRIDOR

REPORT CARD

Priority Ranking	-
EPDO Score	10,012
Associated Emphasis Areas	
In 2018 Solano Travel Safety Plan?	Yes
Safety Improvements since 2018?	
Funded HSIP Projects?	No
In Active Transportation Plan?	No

- **Description**: This is a major arterial state highway that runs primarily north-south through the City. The north portion of the corridor (north of the railroad crossing near Couch Street) is a five to six lane divided roadway serving predominantly commercial and retail land uses. The southern segment is a four-lane undivided arterial with on-street parking and a mix of low-density commercial and residential land uses. Caltrans recently installed several safety upgrades along the corridor, including signal visibility improvements and enhanced pedestrian crossings (most are crosswalks and signs only)

- **Crash Data**: This corridor experienced 332 crashes between 2016 – 2020, including 15 fatal crashes and 23 severe injury crashes. Approximately 17% of all crashes involved a vulnerable road user (45 pedestrian crashes and 14 bicycle crashes), yet 53% of all fatal crashes involved a pedestrian. The most common crash types are broadside (34%) and rear end (32%).

- **Diagnosis:** The most predominant crash types (broadside, rear end, and pedestrian) will be at least partially addressed by the recent safety improvements. Although upgraded crosswalk striping was installed, there is still opportunity for additional crossing enhancements. 100% of the fatal crashes occurred in dark conditions.

- **Potential countermeasures**:
    - S1/NS1/R1 – Install intersection and segment lighting (consider pedestrian-level lighting)
    - S17PB – Install pedestrian countdown signal heads
    - S21PB – Install leading pedestrian intervals
    - NS21PB – Install enhanced pedestrian crossing safety features (curb extensions where on-street parking is present)
    - NS22PB – Install RRFBs
    - R32PB - Install bicycle lanes

HIGH CRASH LOCATIONS IDENTIFIED IN 2020 ACTIVE TRANSPORTATION PLAN

The project team also revisited the pedestrian and bicycle safety corridors identified in the 2020 Solano County Active Transportation Plan. The following corridors have at least one reported fatal or serious injury crash and could be candidate locations for HSIP funded projects.

TABLE 53: CRASHES ON PEDESTRIAN SAFETY CORRIDORS

#	LOCATION	KSI CRASHES	TOTAL CRASHES
1	Springs Road from Columbus Parkway to Amador Street	8	90
2	Tennessee Street from Lassen Street to Marin Street	6	95
3	Highway 29 from Highway 37 to Curtola Parkway	20	184

TABLE 54: CRASHES ON BICYCLE SAFETY CORRIDORS

#	LOCATION	KSI CRASHES	TOTAL CRASHES
1	Highway 29 from Highway 37 to I-80 interchange	27	247

CITYWIDE SYSTEMIC OPPORTUNITIES

Systemic safety solutions are a key component of the Safe System approach, as they address underlying crash risks on a large scale (a corridor, neighborhood, or entire city), including locations with no reported crash history. By treating the known characteristics that are contributing to crashes on a broad scale, a systemic safety project can proactively eliminate crash risks before a crash occurs. Systemic safety solutions are generally low cost treatments that have a proven safety benefit. The following countermeasures (or groups of countermeasures) could be implemented across the city to address the most common crash risks identified thus far.

- **Stop controlled intersection upgrades –** Improve the visibility of stop-controlled intersections by upgrading signing and striping. Upgrades may include: roundabouts, pavement markings, high-visibility stop signs, larger or doubled-up regulatory and warning signs, retroreflective tape on sign posts, flashing beacons, and signalization.
  Countermeasure IDs: NS4, NS6, NS7, NS8, NS9

- **Enhanced pedestrian crossing treatments (unsignalized intersection or midblock) –** Improve driver awareness of potential conflicts with vulnerable road users in locations with nearby pedestrian generators (transit stops, commercial/retail and mixed-use land uses, parks, etc.) and along Safe Routes to School. Treatments may include: high-visibility crosswalks, advanced warning signs, curb extensions, median refuge islands, and active warning devices like RRFBs or PHBs, referencing the FHWA STEP Guide for countermeasure selection.

Countermeasure IDs: NS19PB, NS20PB, NS21PB, NS22PB, NS23PB, R35PB, R36PB, R37PB. HSIP grants also commonly offer a set-aside for pedestrian crossing treatments.

- **Enhanced pedestrian crossing treatments (signalized intersection) –** Improve driver awareness of potential conflicts with vulnerable road users in locations with nearby pedestrian generators (transit stops, commercial/retail and mixed-use land uses, parks, etc.) and along Safe Routes to School. Treatments may include: high-visibility crosswalks, curb extensions, pedestrian countdown heads, leading pedestrian intervals, medians, pedestrian scramble, right and left turn prohibitions, channelized right turn redesign, lighting improvements, slower pedestrian walking speeds, and protected intersections. Countermeasure IDs: S6/7, S17PB, S18PB, S20PB, S21PB

- **Lighting upgrade** – Install new or supplemental lighting to improve nighttime visibility of intersections and other high-conflict locations. Consider installing pedestrian-level lighting in locations with higher pedestrian and cycling activity, and along Safe Routes to School. Countermeasure IDs: S1, NS1, R1

- **Signalized Intersection Visibility, Hardware, and Timing Upgrade (General)** – Improve the visibility of signalized intersections and modify signal timing to reduce rear-end and broadside crashes. These may include: larger lenses, reflectorized backplates, improved signal head mounting, size and number of signal heads, upgrade to flashing yellow arrow, and improved signal coordination. Countermeasure IDs: S2, S3

- **Signalized Intersection Visibility, Hardware, and Timing Upgrade (High Speed)** – Improve the visibility of signalized intersections and modify signal timing to reduce rear-end and broadside crashes. These may include: larger lenses, reflectorized backplates, improved signal head mounting, size and number of signal heads, upgrade to flashing yellow arrow, improved signal coordination, advanced intersection warning signs/beacons, and advanced dilemma zone detection for high-speed approaches. Countermeasure IDs: S2, S3, S4, S10

8.5 IMPLEMENTATION AND EVALUATION

This Local Road Safety Plan is the framework for engaging residents, stakeholders, employers, planners, engineers, enforcement agencies, and emergency medical service providers across the County in improving transportation safety in Vallejo. While safety-specific plans and programs are critical to achieving the vision for safety in Vallejo, traditional transportation planning, design, operations and maintenance decision making processes, programs, and policies should proactively integrate safety as well. The emphasis areas and strategies in this Plan present short-term safety needs and solutions that can be used by stakeholders countywide as funding and implementation opportunities present themselves. Ongoing coordination and collaboration will enhance implementation efforts and set the stage to evaluate progress on policies, programs, and projects.

Using the goals and strategies in the LRSP, planners and engineers can track and plan for safety on the transportation system by:

- Reviewing past, current, and predicted safety trends – Are trends changing? Are the identified strategies reducing fatal and severe crashes within each emphasis area?
- Revising safety goals and strategies – Have the goals been achieved early, or are they progressing slower than expected? Are the responsible parties implementing the strategies, and if not, what are the barriers to implementation (funding, staff resources, lacking champions)?
- Identifying new projects and strategies to achieve results – Safety research and innovative programs are continually advancing. Are new and more effective strategies available that can be used to better improve safety?
- Monitoring and evaluating system performance – Are systems in place to effectively monitor and evaluate safety throughout the city? Do opportunities exist to improve data collection and accuracy/quality?

COLLABORATION

Vallejo will meet with STA and agency partners on a regular basis to discuss new and ongoing strategy implementations, new strategic and funding opportunities, and barriers to implementation. The purpose of these meetings is to encourage and to maintain communication across stakeholders and provide accountability for implementation. Whenever possible, these meetings should include the representatives from emergency and enforcement services, regional agencies and school districts, and relevant public committees.

POLICY SUPPORT

Projects following the Safe System approach may often require tradeoffs to be made between on-street parking, vehicle level of service, and pedestrian and bicycle safety and accessibility, when funding and/or right of way are limited. A Vision Zero policy and Council Resolution in support of this can help clarify how these decisions will be made at a citywide scale rather than on a project-

by-project basis. The policy can also support equity goals in the community by precluding unequal opportunities to those with the historically "loudest" voices or most resources for civic participation.

Other complementary policies to this Plan may include a citywide crosswalk policy and transition plan and a speed management policy and program.

INSTITUTIONALIZATION

In addition to pursuing funding for the priority and systemic projects identified in this LRSP via upcoming grant opportunities, Vallejo should consider reactive and project safety project opportunities through:

- Capital Improvement Projects, such as repaving efforts
- Development Impact Review and Mitigation - new guidance from the Institute of Transportation Engineers presents opportunities to bring the Safe System approach into the development review process: https://www.ite.org/pub/?id=94372DF6-BAB5-AE00-E6D5-471ED4F338CE

EVALUATION

Vallejo will prepare a memo every two years that will summarize crash trends for the city focused on the Emphasis Areas and the stated goals of the current Local Road Safety Plan. This frequency will coincide with the frequency of Caltrans HSIP and ATP funding cycles, allowing the analysis to inform priority projects and funding applications.

The Emphasis Areas and Strategies identified in the Local Road Safety Plan will be re-evaluated every four years as a countywide effort, facilitated by STA, and revised based upon the results of the crash trend analysis.

CHAPTER 9:
UNINCORPORATED LOCAL ROAD SAFETY

9.1 INTRODUCTION

Solano County is located in the northeastern edge of the San Francisco Bay Area on Interstate 80 (I-80) midway between Sacramento and San Francisco. The County's estimated population is 453,491 (US Census 2020). According to the County's website, the estimated population in 2015 in the unincorporated areas of Solano County was 19,348. I-80 is the highest volume freeway in the county, connecting it with the rest of the Bay Area and Sacramento; supported by I-680, I-780, and I-505; as well as State Route (SR) 12, SR 29, and SR 113. Solano County is bordered by Napa County and Sonoma County to the west, Yolo County to the north and east, Sacramento County to the east, and Contra Costa County to the south.

The Local Road Safety Plan for unincorporated Solano County was prepared as part a separate effort, however key elements from the Plan are included in this chapter, and the Plan in full is included in the Appendix.

VISION STATEMENT

The County and its safety partners envision the elimination of fatal and severe injuries on roadways within unincorporated Solano County by creating an equitable, sustainable, multimodal transportation system where people of all ages and abilities can travel free from harm.

9.2 CRASH DATA AND TRENDS

DATA SOURCES

For the purpose of this analysis, five years of jurisdiction-wide collision data (2016 to 2020) was retrieved from the Transportation Injury Mapping System (TIMS) and the SWITRS. Collisions that occurred on state routes were excluded for this analysis. The data was analyzed and plotted in ArcMap to identify high-risk intersections and roadway segments.

CRASH TRENDS

Factors such as collision severity, type of collision, primary collision factor, lighting, weather and time of the day were analyzed. Following this, a more detailed analysis was conducted for F+SI collisions that occurred on the County's roadways, including analyzing intersection and roadway segment collisions separately.

After this data was separated between intersection collisions and roadway segment collisions, a comprehensive evaluation was conducted based on factors such as: collision severity, type of collision, primary collision factor, lighting, weather, and time of the day. A list of high-injury intersections and roadway segments were then identified and ranked based on the calculation of the equivalent property damage only (EPDO) scoring system. Figure 53 illustrates all the fatal and injury collisions that have occurred in unincorporated Solano County from 1/1/2016 to 12/31/2020.

MTC also provides a tool that displays the Regional High Injury Network (HIN) for full access roadways[17]. Figure 54 shows the identified Regional HIN throughout Solano County. Between 2016 and 2020, a total of 1,105 reported crashes occurred on unincorporated County roads, including 19 fatal crashes and 58 severe injury crashes.

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[17] https://bayviz.mysidewalk.com/

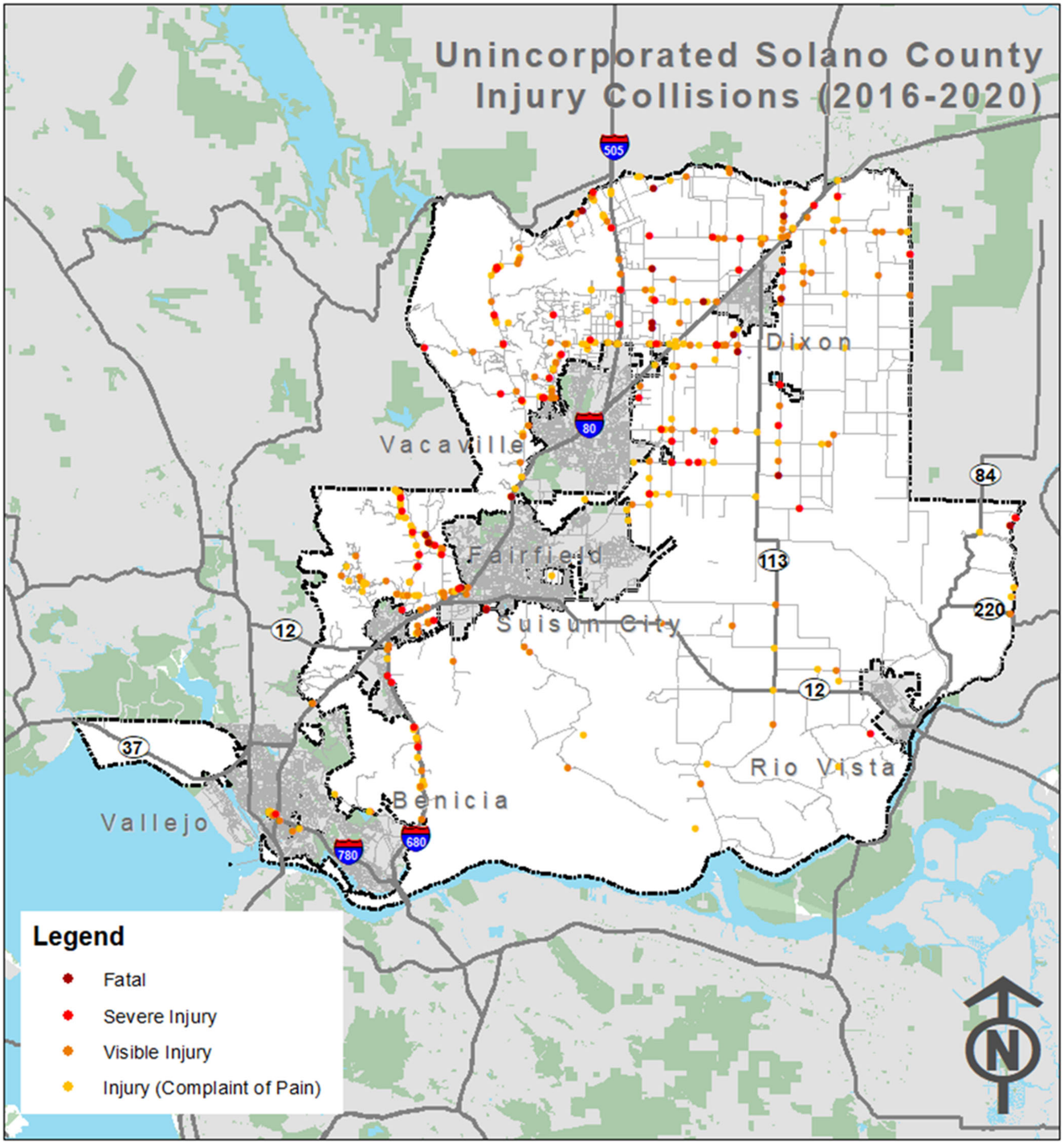


FIGURE 53: INJURY COLLISIONS UNINCORPORATED SOLANO COUNTY (2016-2020)

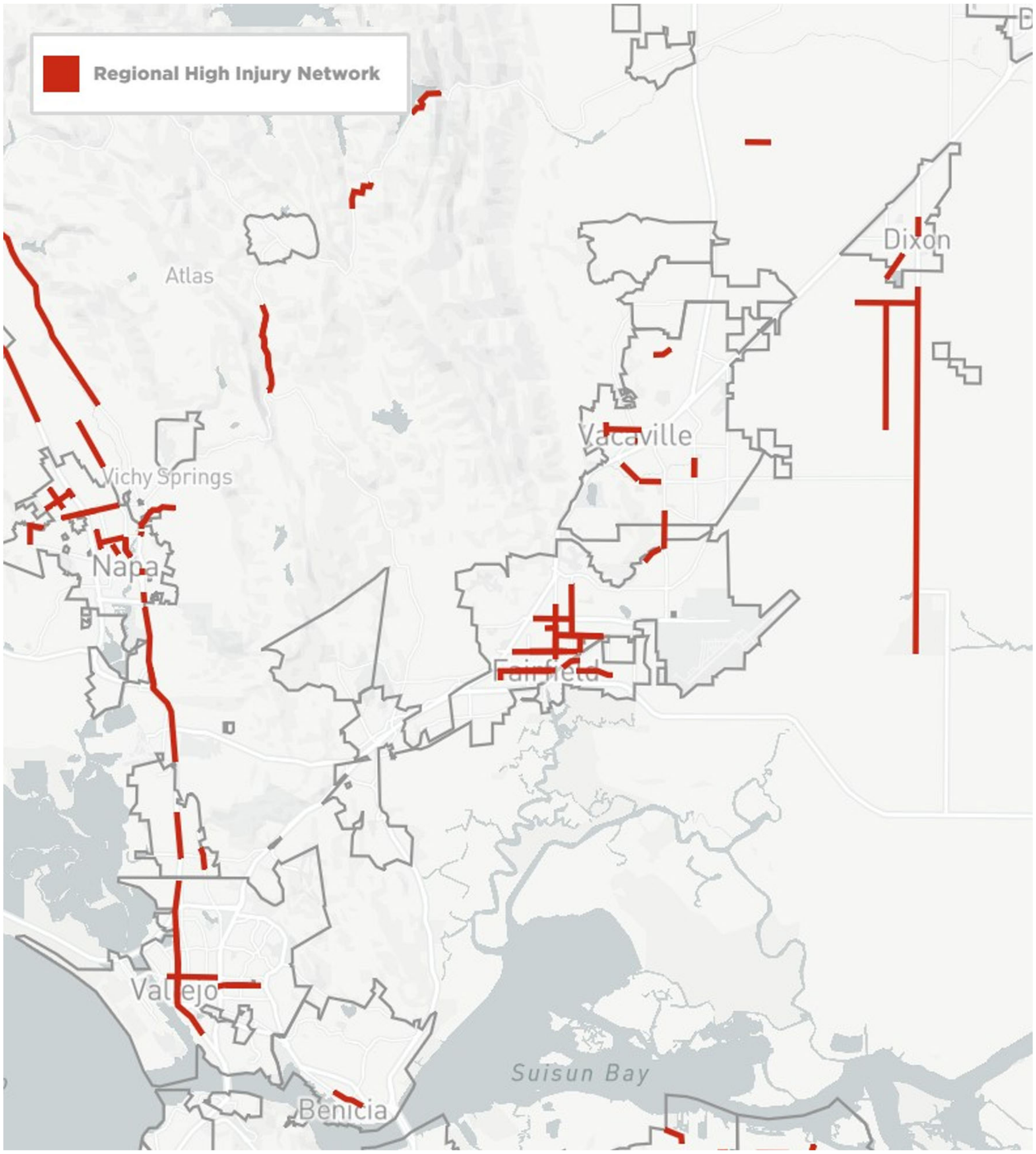


FIGURE 54: REGIONAL HIGH INJURY NETWORK THROUGHOUT SOLANO COUNTY

A majority of collisions occurred along roadway segments not near intersections. Based on the collision data, five prominent trends emerged: hit object collisions, nighttime collisions, DUI collisions, improper turning collisions, and overturned collisions. Each of these became the focus of analysis because they were prominent factors in causing F+SI collisions on Solano County roadways. A more detailed geographic analysis was conducted for each of the five identified trends.

Hit Object Collisions: This type of collision represented the highest proportion of F+SI collisions (44%), and collisions of all severity (47%). They are most concentrated on Pleasants Valley Road, Suisun Valley Road, Gibson Canyon Road, and Lopes Road.

Nighttime Collisions: 37% of all collisions and 34% of all F+SI collisions occurred at night. The majority of these nighttime collisions occurred in areas without street lights, given the rural nature of unincorporated Solano County. Higher concentrations of nighttime collisions were observed on Midway Road, Putah Creek Road, Suisun Valley Road, and Gibson Canyon Road.

DUI Collisions: 31% of F+SI collisions occurred as a result of motorists driving under the influence (compared to only 15% of collisions of all severities). They were observed to be more concentrated along Putah Creek Road, Fry Road, Gibson Canyon Road, and Lyon Road.

Improper Turning Collisions: This type of violation caused 23% of all F+SI collisions and was the most common violation type among collisions of all severity (34%). They were observed to be more concentrated along Pleasants Valley Road, Suisun Valley Road, Dixon Avenue, and Gibson Canyon Road.

Overturned Collisions: 22% of all F+SI collisions were overturned collisions, much higher than its share of collisions of all severity (10%). They were more concentrated on Dixon Avenue, Holland Road, Pleasants Valley Road, and Suisun Valley Road.

9.3 EMPHASIS AREAS

Emphasis areas are focus areas for the LRSP that are identified through the comprehensive collision analysis of the identified High Injury Network in Solano County. Emphasis areas help in identifying appropriate safety strategies and countermeasures with the greatest potential to reduce collisions occurring at high injury locations. They can include (but not be limited to): specific collision types, human behaviors, facility types, and specific intersections or corridors.

For the purposes of determining the emphasis areas, only injury collisions on the High Injury Network are presented below. There were a total of 139 of these collisions. Doing so allowed the project team to drill further down into the most predominant collision trends and specifically identify their causes at the high-risk locations. Three of the emphasis areas selected were also predominant collision trends in the unincorporated County from the 2018 Solano Travel Safety Plan: roadway departure collisions, DUI collisions, and improper turning collisions. The top six emphasis areas identified for unincorporated Solano County were:

- Emphasis Area 1 – Address Roadway Segment Collisions
- Emphasis Area 2 – Reduce Hit Object and Roadway Departure Collisions
- Emphasis Area 3 – Reduce Improper Turning Collisions
- Emphasis Area 4 – Address Driving Under the Influence Collisions
- Emphasis Area 5 – Reduce Overturned Collisions
- Emphasis Area 6 – Reduce Nighttime Collisions
- Emphasis Area 7 - Reduce Motorcycle Collisions
- Emphasis Area 8 - Address Younger Adult Party at Fault Collision

EMPHASIS AREA 1 – ADDRESS ROADWAY SEGMENT COLLISIONS

Of the 139 collisions that occurred on the High Injury Network, 72 (52%) of these collisions occurred on a roadway segment, including 24 F+SI collisions. The following collision data is based on only roadway segment injury collisions in the High Injury Network of the unincorporated Solano County, followed by 4 E's strategies selected to address roadway segment collisions.

46% Hit Object	**26% Overturned**	**46% Improper Turning**

TABLE 55: EMPHASIS AREA 1 STRATEGIES

OBJECTIVE REDUCE THE NUMBER OF FATAL AND SEVERE INJURY COLLISIONS ON ROADWAY SEGMENTS			
	STRATEGY	**PERFORMANCE MEASURE**	**AGENCIES/ ORGANIZATIONS**
Education	Conduct public information and education campaign for roadway safety laws regarding speeding, stop signs, and turning left or right.	Number of education campaigns and/or surveys	County/CHP
Enforcement	Targeted enforcement along high-risk roadway segments to monitor traffic law violations right-of-way violations, speed limit laws and other violations that occur along roadway segments.	Number of tickets issued	CHP
Engineering	• R01, Add Segment Lighting • R02, Remove or relocate fixed objects outside of Clear Recovery Zone • R04, Install Guardrail • R15, Widen shoulder • R21, Improve pavement friction (High Friction Surface Treatments) • R22, Install/Upgrade signs with new fluorescent sheeting (regulatory or warning) • R23, Install chevron signs on horizontal curves • R24 or R25, Install curve advance warning signs • R27, Install delineators, reflectors and/or object markers • R28, Install edge-lines and centerlines • R31, Install edge-line rumble strips/stripes	Number of roadways improved	County
EMS	S05, Install emergency vehicle pre-emption systems. Improve resource deployment and clear routes for emergency responses to collision sites.	EMS vehicle response time	Fire districts and EMS response teams

EMPHASIS AREA 2 – REDUCE HIT OBJECT AND ROADWAY DEPARTURE COLLISIONS

49 (35%) of the High Injury Network collisions were hit object collisions, including 16 F+SI collisions. 82% of roadway departure collisions resulted in a fixed object collision. These two are combined due to the strong correlation between roadway departures and hit object collisions. Roadway departure collisions were also identified as a prominent collision trend in the 2018 Solano Travel Safety Plan. The following collision data is based on only hit object injury collisions on the High Injury Network of unincorporated Solano County, followed by 4 E's strategies.

45% Improper Turning	35% DUI Collisions	51% Nighttime Collisions

TABLE 56: EMPHASIS AREA 2 STRATEGIES

OBJECTIVE REDUCE THE NUMBER OF FATAL AND SEVERE INJURY HIT OBJECT AND ROADWAY DEPARTURE COLLISIONS			
	STRATEGY	PERFORMANCE MEASURE	AGENCIES/ ORGANIZATIONS
Education	Conduct safety campaigns and outreach to raise awareness of safety needs against roadway departure crashes, such as unsafe speeds, distracted driving, improper turning, and driving under the influence. Continue to utilize existing CHP education campaigns/classes, such as Start Smart.	Number of education campaigns	County/CHP
Enforcement	Targeted enforcement at high-risk rural roadways where hit object/roadway departure collisions are more common.	Number of tickets issued	CHP
Engineering	• NS06, Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs • R01, Add Segment Lighting • R02, Remove or relocate fixed objects outside of Clear Recovery Zone • R04, Install Guardrail • R06 or R07, Flatten side slopes • R22, Install/Upgrade signs with new fluorescent sheeting (regulatory or warning) • R23, Install chevron signs on horizontal curves • R24 or R25, Install curve advance warning signs • R26, Install dynamic/variable speed warning signs • R27, Install delineators, reflectors and/or object markers • R28, Install edge-lines and centerlines	Number of locations improved	County

OBJECTIVE REDUCE THE NUMBER OF FATAL AND SEVERE INJURY HIT OBJECT AND ROADWAY DEPARTURE COLLISIONS			
	• R31, Install edge-line rumble strips/stripes		
EMS	S05, Install emergency vehicle pre-emption systems. Improve resource deployment and clear routes for emergency responses to collision sites.	EMS vehicle response time	Fire districts and EMS response teams

EMPHASIS AREA 3 – REDUCE IMPROPER TURNING COLLISIONS

44 (32%) of the collisions on the High Injury Network were improper turning collisions, including 13 F+SI collision. Improper turning collisions accounted for 25% of the total EPDO score in unincorporated Solano County from the 2018 Solano Travel Safety Plan. The following collision data is based on only improper turning caused injury collisions on the High Injury Network of unincorporated Solano County, followed by 4 E's strategies selected to address improper turning collisions.

55% Fixed Object Collisions	31% Nighttime	30% Overturned collisions

TABLE 57: EMPHASIS AREA 3 STRATEGIES

OBJECTIVE REDUCE THE NUMBER OF FATAL AND SEVERE INJURY COLLISIONS ON ROADWAY SEGMENTS AND INTERSECTIONS THAT ARE A RESULT OF IMPROPER TURNING			
	STRATEGY	**PERFORMANCE MEASURE**	**AGENCIES/ ORGANIZATIONS**
Education	Conduct safety campaigns and outreach to raise their awareness of safety needs against improper turning crashes, such as safe driving habits classes offered by CHP or Solano Mobility (a program of the STA).	Number of education campaigns	County/CHP
Enforcement	Targeted enforcement at high-risk intersections and roadway segments to monitor improper turning violations.	Number of tickets issued	CHP
Engineering	• S09, Install raised pavement markers and striping (Through Intersection) • S16/NS04/NS05, Convert intersection to roundabout • NS06, Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs • NS07, Upgrade intersection pavement markings (NS.I.) • NS11, Improve sight distance to intersection (Clear Sight Triangles) • NS14, Install raised median on approaches (NS.I.) • R02, Remove or relocate fixed objects outside of Clear Recovery Zone • R22, Install/Upgrade signs with new fluorescent sheeting (regulatory or warning) • R23, Install chevron signs on horizontal curves • R24 or R25, Install curve advance warning signs • R27, Install delineators, reflectors and/or object markers	Number of intersections and roadway segments improved	County

OBJECTIVE REDUCE THE NUMBER OF FATAL AND SEVERE INJURY COLLISIONS ON ROADWAY SEGMENTS AND INTERSECTIONS THAT ARE A RESULT OF IMPROPER TURNING			
	STRATEGY	**PERFORMANCE MEASURE**	**AGENCIES/ ORGANIZATIONS**
	• R28, Install edge-lines and centerlines • R31, Install edge-line rumble strips/stripes		
EMS	S05, Install emergency vehicle pre-emption systems. Improve resource deployment and clear routes for emergency responses to collision sites.	EMS vehicle response time	Fire districts and EMS response teams

EMPHASIS AREA 4 – ADDRESS DUI COLLISIONS

26 (19%) of the collisions on the High Injury Network were due to driving under the influence of alcohol or drugs, including 13 F+SI collision. DUI collisions accounted for 25% of the unincorporated County's EPDO score in the 2018 Solano Travel Safety Plan. The following collision data is based on only DUI injury collisions on the High Injury Network of unincorporated Solano County, followed by 4 E's strategies selected to address DUI collisions.

73% Fixed/Other Object Collisions	**23% Overturned Collisions**	**54% Nighttime Collisions**

TABLE 58: EMPHASIS AREA 4 STRATEGIES

OBJECTIVE REDUCE THE NUMBER OF FATAL AND SEVERE INJURY COLLISIONS THAT OCCUR DUE TO DRIVING UNDER THE INFLUENCE			
	STRATEGY	**PERFORMANCE MEASURE**	**AGENCIES/ ORGANIZATIONS**
Education	Conduct safety campaigns and outreach for safety laws regarding driving under the influence, such as existing CHP campaigns to address drunk driving.	Number of education campaigns	County/CHP
Enforcement	Targeted enforcement at high-risk intersections and roadway locations to monitor violations of driving under influence. Establish DUI check points near high-risk locations as appropriate.	Number of tickets issued	CHP
Engineering	• S02, Improve signal hardware: lenses, back-plates with retroreflective borders, mounting, size, and number • S09, Install raised pavement markers and striping (Through Intersection) • NS06, Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs • NS07, Upgrade intersection pavement markings (NS.I.) • NS09, Install flashing beacons as advance warning (NS.I.) • R01, Add Segment Lighting • R02, Remove or relocate fixed objects outside of Clear Recovery Zone • R04, Install Guardrail • R15, Widen shoulder • R22, Install/Upgrade signs with new fluorescent sheeting (regulatory or warning) • R27, Install delineators, reflectors and/or object markers	Number of locations improved	County

OBJECTIVE REDUCE THE NUMBER OF FATAL AND SEVERE INJURY COLLISIONS THAT OCCUR DUE TO DRIVING UNDER THE INFLUENCE			
	STRATEGY	**PERFORMANCE MEASURE**	**AGENCIES/ ORGANIZATIONS**
EMS	S05, Install emergency vehicle pre-emption systems. Improve resource deployment and clear routes for emergency responses to collision sites.	EMS vehicle response time	Fire districts and EMS response teams

EMPHASIS AREA 5 – REDUCE OVERTURNED COLLISIONS

23 (17%) of the collisions on the High Injury Network resulted in an overturned vehicle, including eight F+SI collisions. Of these overturned collisions, 13 collisions were due to improper turning, 18 were non-collision, and 11 occurred at night. The following collision data is based on only overturned injury collisions on the High Injury Network of unincorporated Solano County, followed by 4 E's strategies selected to address overturned collisions.

57% Improper Turning	34% F+SI Collision	48% Nighttime Collisions

TABLE 59: EMPHASIS AREA 5 STRATEGIES

OBJECTIVE REDUCE THE NUMBER OF FATAL AND SEVERE INJURY COLLISIONS THAT OCCUR DUE TO AN OVERTURNED VEHICLE			
	STRATEGY	**PERFORMANCE MEASURE**	**AGENCIES/ ORGANIZATIONS**
Education	Conduct safety campaigns and outreach to raise awareness of safety needs against roadway departure crashes, such as unsafe speeds, distracted driving, improper turning, and driving under the influence. Continue to utilize existing CHP education campaigns/classes, such as Start Smart.	Number of education campaigns	County/CHP
Enforcement	Targeted enforcement at high-risk intersections and roadway locations to monitor violations that could lead to an overturned collision, such as unsafe speed, distracted driving, or DUI.	Number of tickets issued	CHP
Engineering	• S09, Install raised pavement markers and striping (Through Intersection) • NS07, Upgrade intersection pavement markings (NS.I.) • R01, Add Segment Lighting • R04, Install Guardrail • R06 or R07, Flatten side slopes • R15, Widen shoulder • R16, Curve Shoulder widening (Outside only) • R17, Improve horizontal alignment (flatten curves) • R22, Install/Upgrade signs with new fluorescent sheeting (regulatory or warning) • R24 or R25, Install curve advance warning signs • R26, Install dynamic/variable speed warning signs • R28, Install edge-lines and centerlines • R31, Install edge-line rumble strips/stripes	Number of locations improved	County

OBJECTIVE REDUCE THE NUMBER OF FATAL AND SEVERE INJURY COLLISIONS THAT OCCUR DUE TO AN OVERTURNED VEHICLE			
	STRATEGY	**PERFORMANCE MEASURE**	**AGENCIES/ ORGANIZATIONS**
EMS	S05, Install emergency vehicle pre-emption systems. Improve resource deployment and clear routes for emergency responses to collision sites.	EMS vehicle response time	Fire districts and EMS response teams

EMPHASIS AREA 6 – REDUCE NIGHTTIME COLLISIONS

44 (32%) of the collisions on the High Injury Network occurred at night, including 14 F+SI collision. Of these nighttime collisions, 13 collisions were due to driving under the influence, 14 were due to improper turning, and 24 were hit object collisions. The following collision data is based on only nighttime injury collisions on the High Injury Network of unincorporated Solano County, followed by 4 E's strategies selected to address nighttime collisions.

30% Collisions due to DUI **32% Improper Turning** **55% Hit Object Collisions**

TABLE 60: EMPHASIS AREA 6 STRATEGIES

OBJECTIVE REDUCE THE NUMBER OF FATAL AND SEVERE INJURY COLLISIONS THAT OCCUR DURING NIGHTTIME			
	STRATEGY	**PERFORMANCE MEASURE**	**AGENCIES/ ORGANIZATIONS**
Education	Develop awareness program to inform motorists of safe nighttime driving habits, as well as high-risk collision locations and the most common violations/collision types occurring at night. Utilize existing CHP campaigns warning of the dangers of drunk driving.	Number of education campaigns	County/CHP
Enforcement	Targeted enforcement at high-risk intersections and roadway locations where nighttime collisions are more common. Establish DUI check points at night where appropriate.	Number of tickets issued	CHP
Engineering	• S01 or NS01, Install intersection lighting • S02, Improve signal hardware • NS06, Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs • NS07, Upgrade intersection pavement markings (NS.I.) • NS08, Install Flashing Beacons at Stop-Controlled Intersections • NS09, Install flashing beacons as advance warning (NS.I.) • R01, Add Segment Lighting • R02, Remove or relocate fixed objects outside of Clear Recovery Zone • R22, Install/Upgrade signs with new fluorescent sheeting (regulatory or warning) • R27, Install delineators, reflectors and/or object markers • R28, Install edge-lines and centerlines • R31, Install edge-line rumble strips/stripes	Number of locations improved	County

OBJECTIVE REDUCE THE NUMBER OF FATAL AND SEVERE INJURY COLLISIONS THAT OCCUR DURING NIGHTTIME			
	STRATEGY	**PERFORMANCE MEASURE**	**AGENCIES/ ORGANIZATIONS**
EMS	S05, Install emergency vehicle pre-emption systems. Improve resource deployment and clear routes for emergency responses to collision sites.	EMS vehicle response time	Fire districts and EMS response teams

EMPHASIS AREA 7 – REDUCE MOTORCYCLE COLLISIONS

15 (11%) of the collisions on the High Injury Network were motorcycle collisions, including seven F+SI collisions. Of these motorcycle collisions, six were collisions due to improper passing, seven were overturned, and six factored into non-collision. The following collision data is based on only motorcycle injury collisions on the High Injury Network of unincorporated Solano County, followed by 4 E's strategies selected to address motorcycle collisions.

40% Improper Passing **47% Overturned** **40% Non-Collision**

TABLE 61: EMPHASIS AREA 7 STRATEGIES

OBJECTIVE REDUCE THE NUMBER OF FATAL AND SEVERE INJURY MOTORCYCLE COLLISIONS			
	STRATEGY	**PERFORMANCE MEASURE**	**AGENCIES/ ORGANIZATIONS**
Education	Conduct public information and education campaign for safety laws regarding motorcycle collisions and motorcyclists' higher risk of fatal and severe injury collisions. Utilize existing CHP programs, such as the Motorcycle Safety Program, to encourage safe motorcycle riding habits.	Number of education campaigns	County/CHP
Enforcement	Targeted enforcement at high-risk locations to monitor motorcycle collisions.	Number of tickets issued	CHP
Engineering	• S16/NS04/NS05, Convert intersection to roundabout • NS06, Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs • NS07, Upgrade intersection pavement markings (NS.I.) • R04, Install Guardrail • R15, Widen shoulder • R22, Install/Upgrade signs with new fluorescent sheeting (regulatory or warning) • R26, Install dynamic/variable speed warning signs • R27, Install delineators, reflectors and/or object markers • R28, Install edge-lines and centerlines • R29, Install no-passing line • R31, Install edge-line rumble strips/stripes	Number of locations improved	County

OBJECTIVE REDUCE THE NUMBER OF FATAL AND SEVERE INJURY MOTORCYCLE COLLISIONS			
	STRATEGY	**PERFORMANCE MEASURE**	**AGENCIES/ ORGANIZATIONS**
EMS	S05, Install emergency vehicle pre-emption systems. Improve resource deployment and clear routes for emergency responses to collision sites.	EMS vehicle response time	Fire districts and EMS response teams

EMPHASIS AREA 8 – ADDRESS YOUNGER ADULT PARTY AT FAULT COLLISIONS

Of the 139 reported collisions on the High Injury Network of unincorporated Solano County, 42% were caused by a party at fault under the age of 30. The following is a review of the demographic data provided in the party at fault data of the collisions occurring on the High Injury Network, along with educational strategies to address younger adult party at fault collisions.

42% F+SI collisions party at fault was between the ages of 18-30	**78% F+SI collisions party at fault was a male**

TABLE 62: EMPHASIS AREA 8 STRATEGIES

OBJECTIVE REDUCE THE NUMBER OF FATAL AND SEVERE INJURY COLLISIONS CAUSED BY YOUNG ADULTS			
	STRATEGY	**PERFORMANCE MEASURE**	**AGENCIES/ORGANIZATIONS**
Education	Target educational programs for young adults. Distribute brochures/fliers with basic red light running, speeding, distracted driving, improper turning, aggressive driving and stop sign violations information at driver training programs. Include statistics of young adult larger risks of fatalities. Involve school districts in such campaigns. Utilize existing CHP programs and classes, such as Start Smart.	Number of education campaigns	County/School Districts/CHP

9.4 HIGH PRIORITY LOCATIONS AND PROJECTS

The highest-risk roadway segments and intersections in unincorporated Solano County were identified using the EPDO method. Figure 55 and Figure 56 show the top 15 high-collision roadway segments and top 16 high-collision intersections.

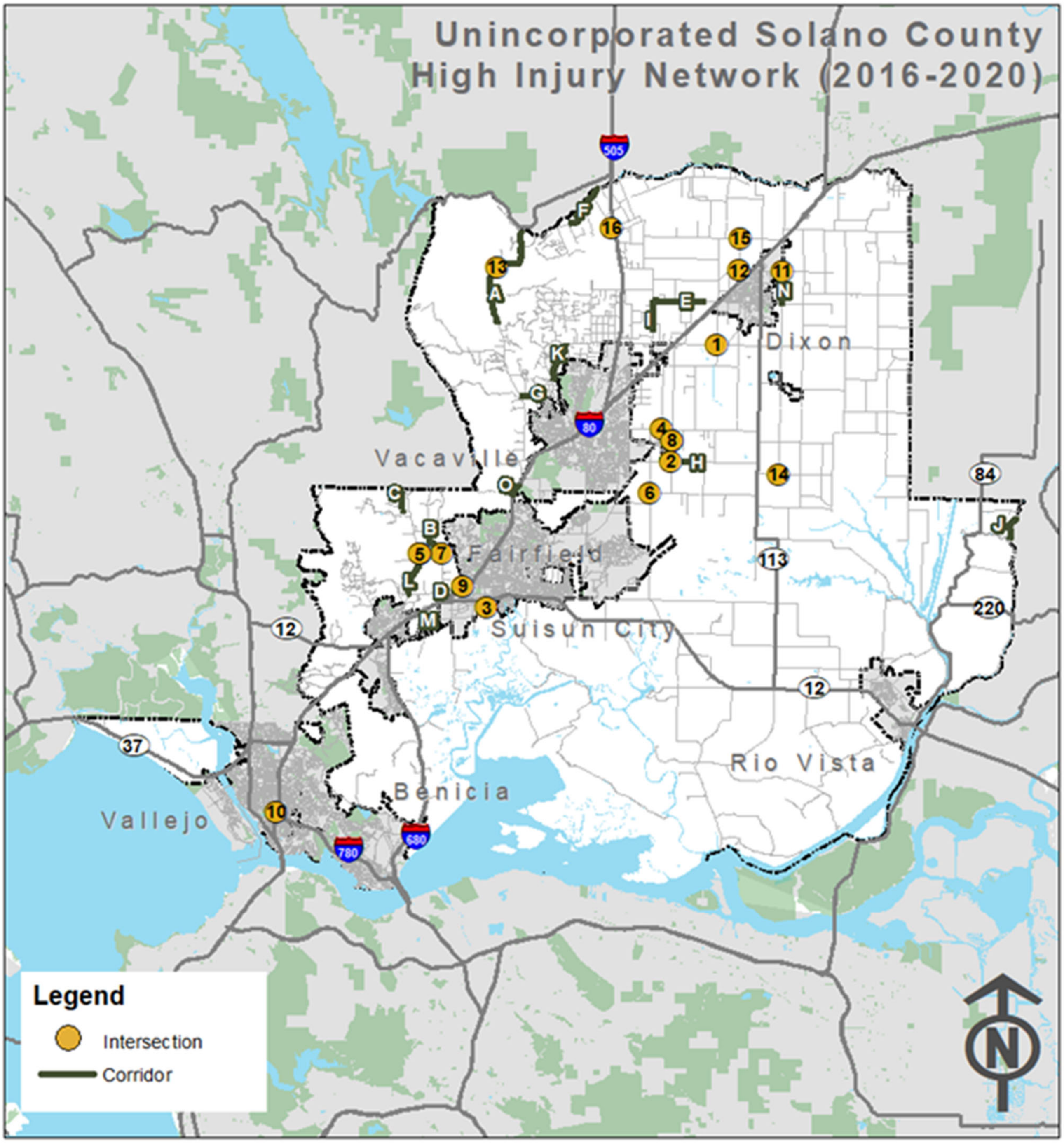


FIGURE 55: SOLANO COUNTY HIGH INJURY NETWORK

Unincorporated Solano County
High Injury Network (2016-2020)

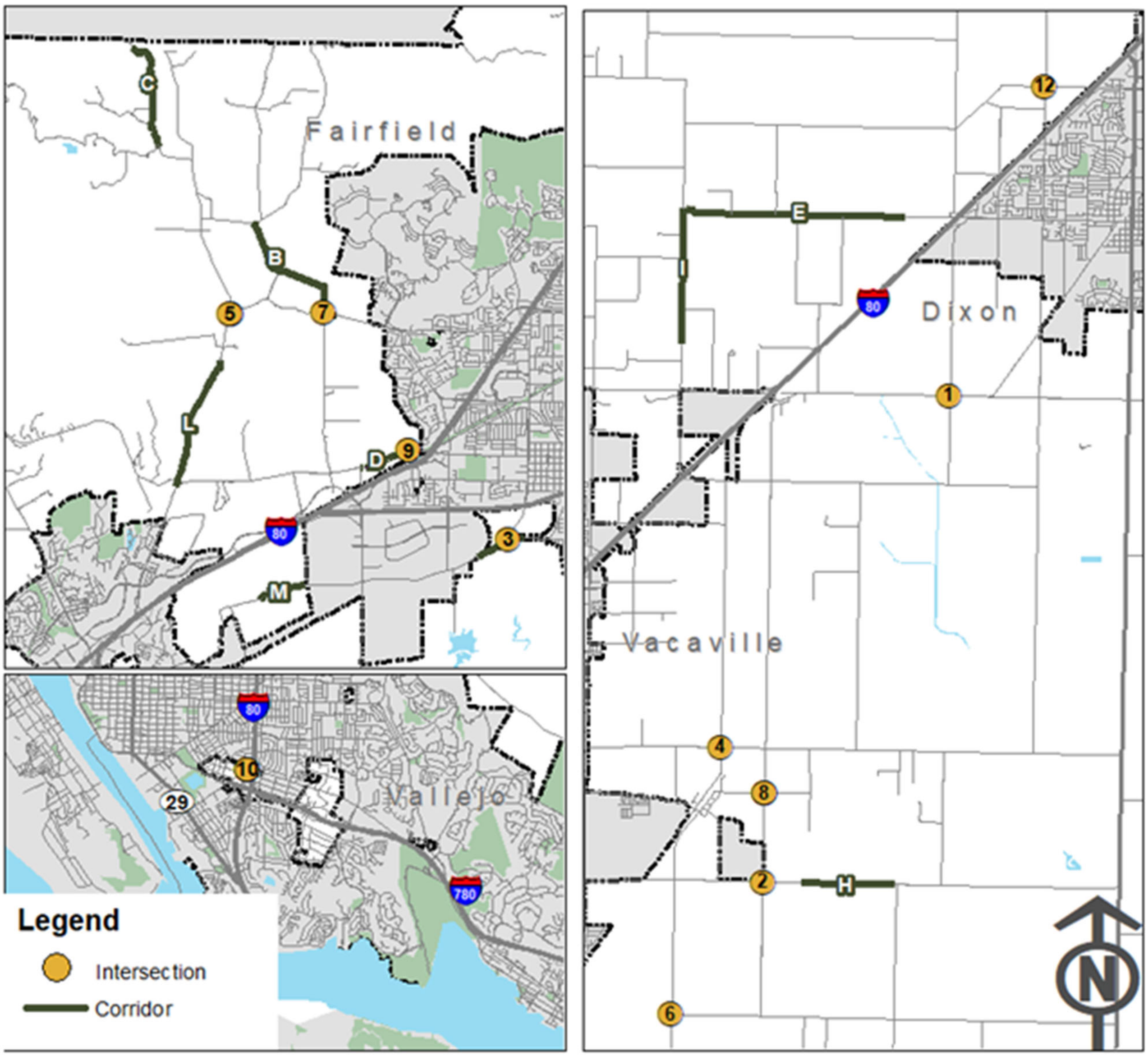


FIGURE 56: SOLANO COUNTY HIGH INJURY NETWORK INSET

Specific countermeasures and improvements were selected from the 2020 Caltrans LRSM, where:

- S refers to improvements at signalized locations,
- NS refers to improvements at non-signalized locations, and
- R refers to improvements on roadway segments.

The corresponding number refers to the countermeasure number in the LRSM (2020). The countermeasures were grouped into safety projects for high-risk intersections and roadway segments. A total of nine safety projects were developed. All countermeasures were identified based on the technical teams' assessment of viability that consisted of extensive analysis, observations, County staff input, and stakeholder/community input. The most applicable and appropriate countermeasures are grouped together to form projects that can help make high-risk locations safer.

Table 63 lists identified projects for the unincorporated areas of Solano County, with a base planning level cost estimate for each location and the resulting B/C Ratio of the project (the title of each countermeasure is located in Table 64)

TABLE 63: LIST OF VIABLE SAFETY PROJECTS

LOCATION	CM1	CM2	CM3	COST PER LOCATION	TOTAL COST	B/C RATIO
Project 1 – Unsignalized Intersections: Transverse Rumble Strips, Upgraded Intersection Pavement Markings, and Flashing Beacon at Intersection						
Byrnes Road and Hawkins Road*	NS10	NS08	NS07	$31,927	$317,754	83.32
Hay Road and Meridian Road	NS10	NS08	NS07	$18,572		
Abernathy Road and Mankas Corner Road	NS10	NS08	NS07	$54,940		
Holdener Road and Lewis Road	NS10	NS08	NS07	$34,902		
Vaughn Road and Pedrick Road	NS10	NS08	NS07	$72,254		
Silveyville Road and Pitt School Road	NS10	NS08	NS07	$36,964		
Maine Prairie Road and Pedrick Road	NS10	NS08	NS07	$16,485		
Sievers Road and Pitt School Road	NS10	NS08	NS07	$16,512		
Winters Road and Wolfskill Road	NS10	NS08	NS07	$17,658		
Pleasants Valley Road and Putah Creek Road	NS10	NS08	NS07	$17,539		
Project 2: Unsignalized Intersections: Install/Upgrade Larger or Additional Stop Signs or Other Intersection Warning/Regulatory Signs, and Flashing Beacons as Advance Warning*						

LOCATION	CM1	CM2	CM3	COST PER LOCATION	TOTAL COST	B/C RATIO
Ledgewood Road and Suisun Valley Road	NS06	NS09		$14,630	$86,485	140.29
Cordelia Road and Pennsylvania Road	NS06	NS09		$30,065		
Quail Canyon Road and Pleasants Valley Road	NS06	NS09		$20,930		
Lozano Lane and Rockville Road	NS06	NS09		$20,860		
Project 3: Lighting Improvements at Unsignalized Intersections						
Batavia Road and Midway Road	NS01			$110,915	$710,738	30.21
Byrnes Road and Hawkins Road	NS01			$101,220		
Fry Road and Lewis Road	NS01			$116,970		
Hay Road and Meridian Road	NS01			$100,457		
Maine Prairie Road and Pedrick Road	NS01			$92,582		
Sievers Road and Pitt School Road	NS01			$85,512		
Cordelia Road and Pennsylvania Avenue	NS01			$103,082		
Project 4: Unsignalized Intersections: Improve Pavement Friction and Improve Sight Distance						
Batavia Road and Midway Road	NS12			$71,302	$802,575	53.67
Ledgewood Road and Suisun Valley Road	NS12	NS11		$118,328		
Lozano Lane and Rockville Road	NS12	NS11		$65,233		
Silveyville Road and Pitt School Road	NS12	NS11		$155,540		
Quail Canyon Road and Pleasants Valley Road	NS12	NS11		$94,430		
Cordelia Road and Pennsylvania Avenue	NS12	NS11		$111,136		
Hay Road and Meridian Road	NS12			$71,876		

LOCATION	CM1	CM2	CM3	COST PER LOCATION	TOTAL COST	B/C RATIO
Abernathy Road and Mankas Corner Road	NS12	NS11		$71,988		
Sievers Road and Pitt School Road	NS12			$42,742		
Project 5: Roadway Segments: Install Edge line and Centerline Rumble Strips/Stripes						
Mankas Corner Road: Ledgewood Road to Clayton Road	R31	R30		$55,650	$634,935	32.53
Rockville Road: Lozano Lane to Chadbourne Road	R31	R30		$49,847		
Dixon Avenue: 1,500 ft. East to Meridian Road to I-80	R31	R30		$84,322		
Fry Road: Vacaville City Limits to SR 113	R31	R30		$77,098		
Suisun Valley Road: Rockville Road to Morrison Lane	R31	R30		$145,964		
Cordelia Road: Thomasson Lane to Fairfield City Limits	R31	R30		$140,154		
Putah Creek Road: Winters Road to Race Course Lane	R31	R30		$81,900		
Project 6: Roadway Segments: Install Chevron Signs on Horizontal Curves, and Install Curve Advance Warning Signs with Flashing Beacons						
Suisun Valley Road: Twin Sisters Road to Napa County Line	R23	R25		$35,140	$281,575	89.34
Dixon Avenue: Meridian Road to 1,500 ft. east of Meridian Road	R23	R25		$17,780		
Putah Creek Road: Holmes Lane to Race Course Lane	R23	R25		$61,180		
Vaca Valley: Pleasants Valley Road to Vacaville City Limits	R23	R25		$25,970		
Gibson Canyon Road: Farrel Road to Cantelow Road	R23	R25		$25,480		

LOCATION	CM1	CM2	CM3	COST PER LOCATION	TOTAL COST	B/C RATIO
Suisun Valley Road: Rockville Road to Morrison Lane	R23	R25		$45,675		
Cordelia Road: Thomasson Lane to Fairfield City Limits	R23	R25		$46,060		
Lyon Road: Fairfield City Limits to Cherry Glen Road	R23	R25		$24,290		
Project 7: Roadway Segments: Install Delineators/Reflectors/Object Markers, and Install/Upgrade Signs with New Fluorescent Sheeting						
Rockville Road: Lozano Lane to Chadbourne Road	R27	R22		$17,675	$503,755	55.14
Pleasants Valley Road: Cantelow Road to Yolo County Line	R27	R22		$142,275		
Dixon Avenue: Meridian Road to I-80	R27	R22		$51,065		
Putah Creek Road: Holmes Lane to Race Course Lane	R27	R22		$96,180		
Vaca Valley: Pleasants Valley Road to Vacaville City Limits	R27	R22		$24,220		
Fry Road: Vacaville City Limits to SR 113	R27	R22		$15,785		
Meridian Road: Midway Road to Silveyville Road	R27	R22		$29,785		
Holland Road: Oxford Road to 1 mile south of Oxford Road	R27	R22		$11,900		
Pedrick Road: Dixon Avenue to Dixon City Limits	R27	R22		$26,040		
Lyon Road: Fairfield City Limits to Cherry Glen Road	R27	R22		$16,730		
Cordelia Road: Thomasson Lane to Fairfield City Limits	R27	R22		$72,100		
Project 8: Roadway Segments: Install Guard Rail and Improve Pavement Friction (on curves)						
Putah Creek Road: Holmes Lane to Race Course Lane	R04	R21		$616,980	$1,511,335	28.40

LOCATION	CM1	CM2	CM3	COST PER LOCATION	TOTAL COST	B/C RATIO
Vaca Valley: Pleasants Valley Road to City Limits	R04	R21		$198,856		
Holland Road: Oxford Road to 1 mile south of Oxford Road	R04			$59,150		
Cordelia Road: Thomasson Lane to Fairfield City Limits		R21		$248,360		
Pleasants Valley Road: Cantelow Road to Yolo County Line	R04	R21		$233,485		
Gibson Canyon Road: Farrel Road to Cantelow Road	R04	R21		$200,004		
**Project 9: Install Edge line and Centerline Rumble Strips/Stripes, and Widen Shoulders ** **						
Pleasants Valley Road: 1,000 ft. south of Quail Canyon Road to Putah Creek Road	R31	R15	R30	$637,378	$2,715,202	35.97
Suisun Valley Road: Twin Sisters Road to 3,300 ft. north of Joyce Lane	R31	R15	R30	$466,858		18.81
Dixon Avenue: Meridian Road to 1500 ft. east of Meridian Road***	R31	R15	R30	$132,692		33.40
Putah Creek Road: Holmes Lane to Winters Road	R31	R15	R30	$644,420		13.57
Suisun Valley Road: Morrison Lane to 0.5 mi south of Morrison Lane	R31		R30	$288,652		60.83
Lyon Road: Fairfield City Limits to Cherry Glen Road	R31	R15	R30	$608,216		7.79
Pedrick Road: Dixon Avenue to Dixon City Limits	R31	R15	R30	$171,962		28.91

Notes: CM – countermeasure. B/C Ratio is the dollar amount of benefits divided by the cost of the countermeasure.

**Minimum HSIP grant request is $100,000, so it's recommended to include locations beyond the high-risk network if this application is pursued.*

***R15 countermeasure (CM) is required to be the last step of an incremental approach; that is, lower cost CMs must be implemented first. Further analysis of segments that received edge line striping treatments on County roads to determine effectiveness will be conducted should the County wish to pursue this application in the HSIP Cycle 11 call for projects. Additionally, per request of County staff, B/C ratios for Project 9 are broken down for each location, rather than the project as a whole.*

****Per County staff, Dixon Avenue from Meridian Road to 1,500’ East of Meridian Road will require future curve realignment.*

TABLE 64: LIST OF COUNTERMEASURES

COUNTERMEASURE NAME
NS01 - Add Intersection Lighting (Non-Signalized Intersection (NS.I.)
NS06 - Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs
NS07 - Upgrade intersection pavement markings
NS08 - Install Flashing Beacons at Stop-Controlled Intersections
NS09 - Install flashing beacons as advance warning (NS.I.)
NS10 - Install transverse rumble strips on approaches
NS11- Improve sight distance to intersection (Clear Sight Triangles)
NS12 - Improve pavement friction (High Friction Surface Treatment)
R04 - Install guard rail
R15 - Widen shoulder
R21 - Improve pavement friction (High Friction Surface Treatment)
R22 - Install/Upgrade signs with new fluorescent sheeting (regulatory or warning signs)
R23 - Install chevron signs on horizontal curves
R25 - Install curve warning signs (flashing beacon)
R27 - Install delineators, reflectors, and/or object markers
R28 - Install edge-lines and centerlines
R30 - Install centerline rumble strips/stripes
R31 - Install edge line rumble strips/stripes

9.5 IMPLEMENTATION AND EVALUATION

The LRSP is a guidance document and requires periodic updates to assess its efficacy and re-evaluate potential solutions. It is recommended to update the Plan every two to five years in coordination with the safety partners. This document was developed based on community needs, stakeholder input, and collision analysis conducted to identify priority emphasis areas throughout the County. The implementation of strategies under each emphasis area would aim to reduce Fatal and Severe Injury collisions.

IMPLEMENTATION

The LRSP is a guidance document that is recommended to be updated every two to five years in coordination with the safety partners. The LRSP document provides engineering, education, enforcement, and EMS-related countermeasures that can be implemented throughout the County to reduce Fatal and Severe Injury collisions. It is recommended that Solano County implement the selected projects in high-collision locations in coordination with other projects proposed for the County's infrastructure development in their future Capital Improvement Plans. After implementing countermeasures, the performance measures for each emphasis area should be evaluated annually. The most important measure of success of the LRSP should be reducing Fatal and Severe Injury collisions throughout the City. If the number of Fatal and Severe Injury collisions does not decrease over time, then the emphasis areas and countermeasures should be re-evaluated.

MONITORING AND EVALUATION

For the success of the LRSP, it is crucial to monitor and evaluate the 4 E-strategies continuously. Monitoring and evaluation creates accountability, ensures the effectiveness of the countermeasures for each emphasis area, and helps making decisions on the need for new strategies. Currently, County staff periodically monitor collision data gathered by the CHP. The LRSP process would help the County make informed decisions regarding the implementation plan's progress and accordingly, update the goals and objectives of the plan.

After implementing countermeasures, the strategies should be evaluated annually as per their performance measures. The evaluation should be recorded in a before-after study to validate the effectiveness of each countermeasure as per the following observations:

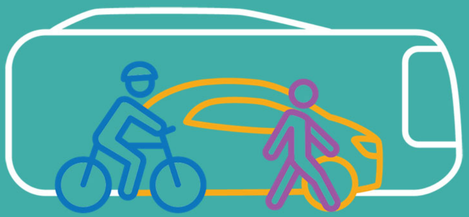
- Number of Fatal and Severe Injury collisions
- Number of law enforcement citations
- Number of public comments and concerns

Evaluation should be conducted during similar time periods each year. The most important measure of success of the LRSP should be reductions in F+SI collisions throughout the County. If the number of F+SI collisions doesn't decrease, then the countermeasures should be evaluated as per the other observations, as mentioned above. The effectiveness of the countermeasures should be compared to the goals for each emphasis area.

LRSP UPDATE

The LRSP is a guidance document and is recommended to be updated every two to five years after adoption. After monitoring performance measures focused on the status and progress of the E's strategies in each emphasis area, the next LRSP update can be tailored to resolve any continuing safety problems. An annual stakeholder meeting with the safety partners is also recommended to discuss the progress for each emphasis area and oversee the implementation plan. The document should then be updated as per the latest collision data, emerging trends, and the E's strategies' progress and implementation.

APPENDIX



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SECTION 1.1 INFRASTRUCTURE COUNTERMEASURE TOOLBOX

ADAPTED FROM THE CALTRANS LOCAL ROADWAY SAFETY MANUAL

A COUNTERMEASURES TOOLBOX

SIGNALIZED INTERSECTIONS

S1. IMPROVE INTERSECTION LIGHTING.

Applied to signalized intersections that have a disproportionate number of night-time crashes and do not currently provide lighting at the intersection or at its approaches. This countermeasure (CM) only applies to "night" crashes (all types) occurring within limits of the proposed roadway lighting 'engineered' area.

BENEFIT-COST

- Implementation of this treatment reduces crashes by 40%.
- 20 years of expected life.
- Estimated $92,500 per intersection.
- The provision of lighting involves both a fixed cost for lighting installation and an ongoing maintenance and power cost which results in a moderate to high cost.
- Eligible for 100% federal funding.

Sources: CA-Local Roadway Safety Manual

EXISTING CONDITIONS

S1 IMPLEMENTATION

S2. IMPROVE SIGNAL HARDWARE, MAY INCLUDE LENSES, BACK-PLATES, MOUNTING, SIZE AND NUMBER OF HEADS.

Applicable at signalized intersections with a high frequency of right-angle and rear-end crashes because drivers are unable to see traffic signals sufficiently in advance to safely negotiate the inter- section being approached. This CM does not apply to improvements like "battery backup systems", which do not provide better intersection/signal visibility or help drivers negotiate the intersection (unless applying past crashes that occurred when the signal lost power).

BENEFIT-COST

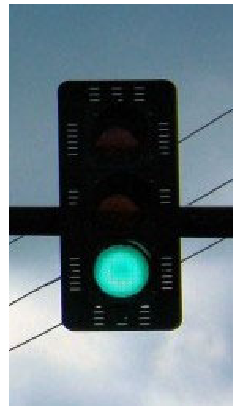
- Implementation of this treatment reduces crashes by 15%.
- 10 years of expected life.
- Estimated $44,700 per intersection.
- Cost variation based on size/number of signal heads.
- Eligible for 100% federal funding.

EXAMPLE LOCATION(S)

- Military E and E 5th Street, Benicia
- Broadway St and Sereno Dr, Vallejo

Sources: CA-Local Roadway Safety Manual

EXISTING CONDITIONS



S2 IMPLEMENTATION

S3. IMPROVE SIGNAL TIMING: COORDINATION, PHASING, CLEARANCE INTERVALS.

Effective at locations that have a crash history at multiple signalized intersections. Signalization improvements may include adding phases, lengthening clearance intervals, eliminating or restricting higher-risk movements, and coordinating signals at multiple locations. This treatment addresses all types of crashes that occur on the approaches / influence area of the new signal timing. This treatment does not apply to projects that only 'study' the signal network and do not make physical timing changes, including corridor operational studies and improvements to Traffic operation Centers. For projects coordination signals along a corridor, the crashes related to side-street movements should not be applied.

BENEFIT-COST

- Implementation of this treatment reduces crashes by 15%.
- 10 years of expected life.
- Estimated $3,000 per intersection.
- Cost variation based on number of signal heads and number of movements.
- Considering that it will improve the signal operation rather than merely the safety, this countermeasure is only eligible for 50% federal funding.

EXAMPLE LOCATION(S)

- Alamo Drive and Butcher Road, Vacaville
- Redwood Street and Fairgrounds Drive, Vallejo

Sources: CA-Local Roadway Safety Manual

EXISTING CONDITIONS

S3 IMPLEMENTATION

S4. PROVIDE ADVANCE DILEMMA-ZONE DETECTION FOR HIGH-SPEED APPROACHES.

Suitable in more rural/remote areas that have a high frequency of right-angle and rear-end crashes. The Advanced Dilemma-Zone Detection system enhances safety at signalized intersections by modifying traffic control signal timing to reduce the number of drivers that may have difficulty deciding whether to stop or proceed during a yellow phase. This CM only applies to crashes occurring on the approaches / influence area of the new detection and signal timing.

BENEFIT-COST

- Implementation of this treatment reduced crashes by 40%.
- 10 years of expected life.
- Estimated $36,500 for two approaches.
- Additional modification to the traffic signal controller may be necessary.
- Eligible for 100% federal funding.

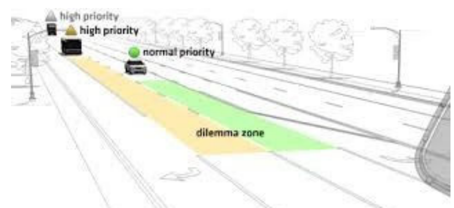
EXAMPLE LOCATION(S)

- Intersections along Peabody Road, Vacaville

Sources: CA-Local Roadway Safety Manual

EXISTING CONDITIONS

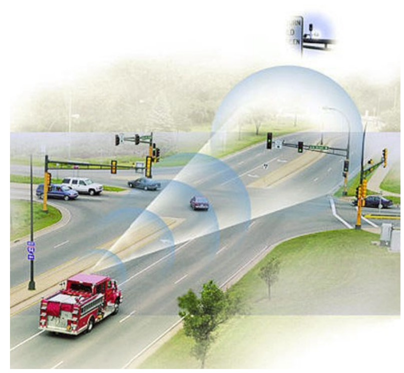
S4 IMPLEMENTATION



S5. INSTALL EMERGENCY VEHICLE PRE-EMPTION SYSTEMS.

Corridors that have a history of crashes involving emergency response vehicles. Sentence about when/where to use. The target of this strategy is signalized intersections where normal traffic operations impede emergency vehicles and where traffic conditions create a potential for conflicts between emergency and nonemergency vehicles. This CM addresses emergency vehicle related crashes only.

S5 IMPLEMENTATION



BENEFIT-COST

- Implementation of this treatment reduces crashes by 70%.
- 10 years of expected life.
- Life cost Estimated $10,000 per installation.
- Costs for installation of a signal preemption system will vary from medium to high, based upon the number of signalized intersections at which preemption will be installed and the number of emergency vehicles to be outfitted with the technology.
- Eligible for 100% federal funding.

Sources: CA-Local Roadway Safety Manual

S6. INSTALL LEFT-TURN LANE AND ADD TURN PHASE (SIGNAL HAS NO LEFT TURN LANE OR PHASE BEFORE).

Installed at signalized intersections that have a significant crash problem and the only alternative is to change the nature of the intersection itself. This treatment addresses all types of crashes, and the measure can be very effective at intersections with complex geometry and intersections with frequent left-turn movements.

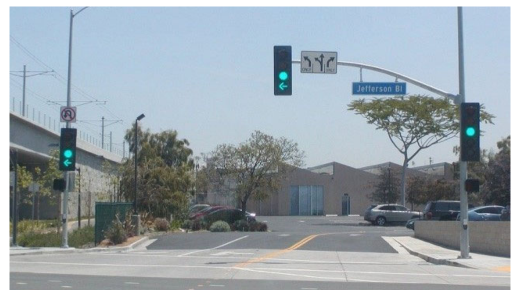
BENEFIT-COST

- Implementation of this treatment reduces crashes by 55%.
- 20 years of expected life.
- Estimated $700,000 per intersection with paving.
- Variation in cost depend on location, installation time based on restriping, acquisition of additional right-of-way, and extensive environmental process may be needed.
- Eligible for 90% of federal funding.

Sources: CA-Local Roadway Safety Manual

EXISTING CONDITIONS

S6 IMPLEMENTATION



S7. PROVIDE PROTECTED LEFT TURN PHASE (LEFT TURN LANE ALREADY EXITS).

Used at signalized intersections (with existing left turns pockets) that currently have a permissive left-turn or no left-turn protection that have a high frequency of angle crashes involving left turning, opposing through vehicles, and non-motorized road users.

A properly timed protected left-turn phase can also help reduce rear-end, broadside, and sideswipe crashes between left-turning vehicles and the through vehicles as well as vehicles behind them. This CM only applies to crashes occurring on the approaches / influence area of the new left turn phases. This CM does NOT apply to converting a single-left into double-left turn (unless the single left is unprotected and the proposed double left will be protected).

BENEFIT-COST

- Implementation of this treatment reduces crashes by 30%.
- 20 year of expected life.
- Estimated $8,400 for two approaches.
- If the existing traffic signal only requires a minor modification to allow for a protected left-turn phase, then the cost would also be low (installation is short because no actual construction). In-house signal maintainers can perform this operation once the proper signal phasing is determined so the cost is low.
- Eligible for 100% federal funding.

EXAMPLE LOCATION(S)

- Military E and E 2nd Street, Benicia

Sources: CA-Local Roadway Safety Manual

EXISTING CONDITIONS

S7 IMPLEMENTATION

S8. COVERT SIGNAL TO MAST ARM (FROM PEDESTAL-MOUNTED).

Applied to intersections currently controlled by pedestal mounted traffic signals (in medians and/ or on outside shoulder) that have a high frequency of right-angle and rear-end crashes occurring because drivers are unable to see traffic signals in advance to safely negotiate the intersection. Care should be taken to place the new signal heads (with back plates) as close to directly over the center of the travel lanes as possible.

EXISTING CONDITIONS

S8 IMPLEMENTATION

BENEFIT-COST

- Implementation of this treatment reduces crashes by 30%.
- 20 years of expected life.
- Estimated $148,900 per approach (requires 19-3-100 pole, brackets, and signs).
- Mast arm cost can vary and be expensive.
- Eligible for 100% federal funding.

Sources: CA-Local Roadway Safety Manual

S10. INSTALL FLASHING BEACONS AS ADVANCE WARNING (S.I.).

Add the flashing beacons at signalized intersections with crashes that are a result of drivers being unaware of the intersection or are unable to see the traffic control device in time to comply. In addition, the CM 9 addresses both read end and angle crashes. Most advance warning flashing beacons can be powered by solar, thus reducing the issues relating to power source. This CM only applies to crashes occurring on the approaches / influence area of the new flashing beacons.

BENEFIT-COST

- Implementation of this treatment reduces crashes by 30%.
- 10 years of expected life.
- Estimated $67,200 for one approaches.
- Before choosing this CM, the agency needs to confirm the ability to provide power to the site (solar may be an option).
- Eligible for 100% federal funding.

Sources: CA-Local Roadway Safety Manual

S10 IMPLEMENTATION

S11. IMPROVE PAVEMENT FRICTION (HIGH FRICTION SURFACE TREATMENTS).

Improvement for signalized Intersections noted as having crashes on wet pavements or under dry conditions when the pavement friction available is significantly less than needed for the actual

roadway approach speeds. This treatment is intended to target locations where skidding and failure to stop is determined to be a problem in wet or dry conditions and the target vehicle is unable to stop due to insufficient skid resistance. In addition, treatment also addresses night crashes all other crashes. This treatment does not apply to standard chip-seal or open-graded maintenance projects for long segments of corridors or structure repaving projects intended to fix failed pavement.

BENEFIT-COST

- Implementation of this treatment reduces crashes by 40%.
- 10 years of expected life.
- Estimated $5,000 per intersection for materials and equipment.
- Cost variation based on size of intersection and material (Estimated $30/sq.yd.).
- Eligible for 100% Federal Funding.

Sources: CA-Local Roadway Safety Manual

EXISTING CONDITIONS

S11 IMPLEMENTATION

S12. INSTALL RAISED MEDIAN ON APPROACHES.

Used at intersections noted as having turning movement crashes near the intersection as a result of insufficient access control. Application of this CM should be based on current crash data and a clearly defined need to restrict or accommodate the movement. Angle crashes are addressed through this CM. When agencies opt to install landscaping in conjunction with new raised medians, these locations must be excluded from their federally funded HSIP application scope. This CM only applies to crashes occurring on the approaches / influence area of the new raised median. All new raised medians funded with federal HSIP funding must not include the removal of the existing road- way structural section and must be doweled into the existing roadway surface.

EXISTING CONDITIONS

S12 IMPLEMENTATION

BENEFIT-COST

- Implementation of this treatment reduces crashes by 25%.
- 20 years of expected life.
- Estimated $14,100 per approach without additional paving.
- Raised medians at intersections may be most effective in retrofit situations where high volumes of turning vehicles have degraded operations and safety, and where more extensive CMs would be too expensive because of limited right-of-way and the constraints of the built environment.
- Eligible for 90% of federal funding.

Sources: CA-Local Roadway Safety Manual

S13PB. INSTALL PEDESTRIAN MEDIAN FENCING ON APPROACHES.

This countermeasure applies to signalized intersections with high pedestrian-generators nearby (transit stops) the location may experience a high volume of pedestrians jaywalking across the travel lanes at mid-block locations instead of walking to the intersection. When this safety issue cannot be mitigated with signal timing and shoulder/sidewalk treatments, then installing a continuous pedestrian barrier in the median may be a viable solution. This type of CM addresses pedestrian and bicycle crashes. Impacts to transit and other land uses may need to be considered and controversy can delay the implementation. This CM only applies to "Ped & Bike" crashes occurring on the approaches/influence area of the new pedestrian median fencing.

EXISTING CONDITIONS

S13PB IMPLEMENTATION

BENEFIT-COST

- Implementation of this treatment reduces crashes by 35%.
- 20 years of expected life.
- Estimated $3,000 per installation, depending on length.
- Costs associated with this strategy will vary widely depending on the type and placement of the median fencing.
- Eligible for 90% of federal funding.

Sources: CA-Local Roadway Safety Manual

S14. CREATE DIRECTIONAL MEDIAN OPENINGS TO ALLOW (OR RESTRICT) LEFT-TURNS AND U-TURNS.

Put in medians to reduce crashes related to turning maneuvers include angle, rear-end, pedestrian, and sideswipe (involving opposing left turns) type crashes. This treatment only applies to crashes occurring in the intersection/influence area of the new directional openings.

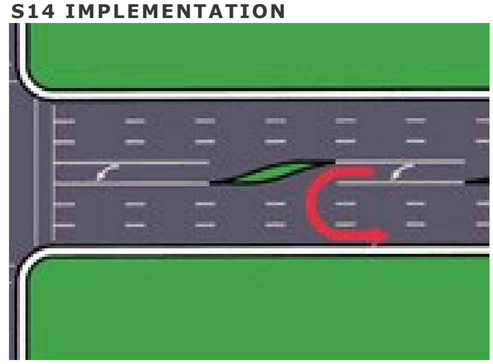
BENEFIT-COST

- Implementation of this treatment reduces crashes by 50%.
- 20 years of expected life.
- Estimated $75,000 per installation.
- The cost of this strategy will depend on the treatment.
- Eligible for 90% Federal Funding.

Sources: CA-Local Roadway Safety Manual

EXISTING CONDITIONS

S14 IMPLEMENTATION



S15. REDUCED LEFT-TURN CONFLICT INTERSECTIONS.

Design intersections to alter how left-turn movements occur and minimize the potential for related crashes. Two highly effective 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). This treatment only applies to crashes occurring in the intersection/influence areas of the new reduced left-turn conflict.

BENEFIT-COST

- Implementation of this treatment reduces crashes by 50%.
- 20 years of expected life.
- Cost varies.
- The cost of this strategy will depend on the treatment.
- Eligible for 90% of federal funding.

Sources: CA-Local Roadway Safety Manual

EXISTING CONDITIONS

S15 IMPLEMENTATION

S16. CONVERT INTERSECTION TO ROUNDABOUT (FROM SIGNAL).

Change signalized intersections that have a significant crash problem, and the only alternative is to change the nature of the intersection itself. This treatment addresses all type of crashes and can also be very effective at intersections with complex geometry and intersections with frequent left-turn movements. This treatment is not intended for mini-roundabouts.

BENEFIT-COST

- Crash Reduction Factor (CRF) varies.
- 20 years of expected life.
- Estimated $862,100 per intersection.
- Possible causes of variation in cost vary on project size, acquirements of right-of-way and can last for 4 years or longer.
- Eligible for 100% federal funding.

Sources: CA-Local Roadway Safety Manual

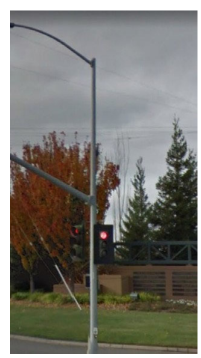
EXISTING CONDITIONS

S16 IMPLEMENTATION

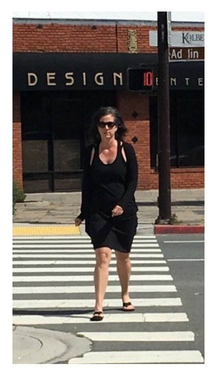
S17PB. INSTALL PEDESTRIAN COUNTDOWN SIGNAL HEADS.

Install at signals that have signalized pedestrian crossing with walk/don't walk indicators and where there have been pedestrian vs. vehicle crashes. The CM addresses both pedestrian and bicycle crashes. This CM only applies to "Ped & Bike" crashes occurring in the intersection/crossing with the new countdown heads.

EXISTING CONDITIONS



S17PB IMPLEMENTATION



BENEFIT-COST

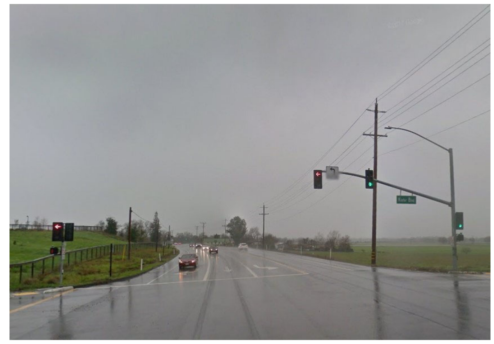
- Implementation of this treatment reduces crashes by 25%.
- 20 years of expected life.
- Estimated $1,900 per signal head (does not include push button or pole cost)
- Costs and time of installation will vary based on the number of intersections included in this strategy and if it requires new signal controllers capable of accommodating the enhancement. This CM can be effectively and efficiently implemented using a systematic approach with numerous locations, resulting in moderate cost projects that are more appropriate to seek state or federal funding.
- Eligible for 100% federal funding.

Sources: CA-Local Roadway Safety Manual

S18PB. INSTALL PEDESTRIAN CROSSING.

Should be placed at signalized Intersections with no marked crossing and pedestrian signal heads, where pedestrians are known to be crossing intersections that involve significant turning movements. They are especially important at intersections with (1) multiphase traffic signals, such as left-turn arrows and split phases, (2) school crossings, and (3) double-right or double-left turns. At signalized intersections, pedestrian crossings are often safer when the left turns have protected phases that do not overlap the pedestrian walk phase. The type of crashed address by this CM include Pedestrian and Bicycle. This CM only applies to "Ped & Bike" crashes occurring in the intersection/crossing with the new crossing. This CM is not intended to be used for high-cost aesthetic enhancements to intersection crosswalks (i.e., stamped concrete or stamped asphalt).

EXISTING CONDITIONS



S18PB IMPLEMENTATION

BENEFIT-COST

- Implementation of tis treatment reduces crashes by 25%.
- 20 years of expected life.
- Estimated $6,100 per crossing.
- When agencies opt to install aesthetic enhancement to intersection crosswalks like stamped concrete/asphalt, the project design and construction costs can significantly increase. For HSIP applications, these costs must be accounted for in the B/C calculation, but these costs (over standard crosswalk markings) must be tracked separately and are not federally reimbursable and will increase the agency's local-funding share for the project costs.
- Eligible for 100% federal funding.

Sources: CA-Local Roadway Safety Manual

S19PB. PEDESTRIAN SCRAMBLE.

Should be placed at signalized intersections with very high pedestrian/bike volumes (e.g., in an urban business district). This is a form of pedestrian “WALK” phase at a signalized intersection in which all vehicular traffic is required to stop, allowing pedestrians/bicyclists to safely cross through the intersection in any direction, including diagonally. Pedestrian Scramble has been shown to reduce injury risk and increase bicycle ridership due to its perceived safety and comfort. This CM only applies to “Ped & Bike” crashes occurring in the intersection/crossing with the new crossing.

BENEFIT-COST

- Implementation of this treatment reduces crashes by 40%.
- 20 years of expected life.
- Not involving any additional right-of-way, Pedestrian Scramble should not require a long development process and should be implemented reasonably soon. A systemic approach may be used in implementing this CM, resulting in cost efficiency with low to moderate cost.
- Eligible for 100% federal funding.

Sources: CA-Local Roadway Safety Manua

EXISTING CONDITIONS

S19PB IMPLEMENTATION

S20PB. INSTALL ADVANCE STOP BAY BEFORE CROSSWALK (BICYCLE BOX).

Installed signalized Intersections with a marked crossing, where significant bicycle and/or pedestrian volumes are known to occur. This treatment addresses pedestrian and bicycle crashes. This CM only applies to pedestrian and bike crashes occurring in the intersection-crossing with the new advanced stop bars.

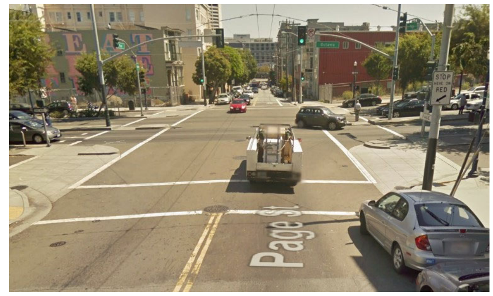
BENEFIT-COST

- Implementation of this treatment reduces crashes by 15%.
- 10 years of expected life.

  Estimated $10,400 per approach.
- Costs and time of installation will vary based on the number of intersections included in this strategy and if it requires new signal controllers capable of accommodating the enhancement.
- Eligible for 100% of federal funding.

Sources: CA-Local Roadway Safety Manual

EXISTING CONDITIONS



S20PB IMPLEMENTATION

S21PB. MODIFY SIGNAL PHASING TO IMPLEMENT A LEADING PEDESTRIAN INTERVAL (LPI).

Implement at intersections with signalized pedestrian crossings that have high turning vehicle volumes and have had pedestrian vs. vehicle crashes. This treatment addresses pedestrian and bicycle crashes. This CM only applies to "Ped & Bike" crashes occurring in the intersections with signalized pedestrian crossing with the newly implemented Leading Pedestrian Interval.

BENEFIT-COST

- Implementation of this treatment reduces crashes by 60%.
- 10 years of expected life.
- Estimated $200 per installation
- Costs are very low, since only minor signal timing alteration is required. When considered at a single location, the LPI is usually locally funded. This CM can be effectively and efficiently implemented using a systematic approach with numerous locations, resulting in moderate cost projects that are more appropriate to seek state or federal funding.
- Eligible for 100% of federal funding.

Sources: CA-Local Roadway Safety Manual

EXISTING CONDITIONS

S21PB IMPLEMENTATION

COUNTERMEASURES FOR NON-SIGNALIZED INTERSECTIONS

NS1. ADD INTERSECTION LIGHTING.

Effective at unsignalized intersections that have a disproportionate number of night-time crashes and do not currently have lighting. This treatment improves the safety of the intersection during nighttime by making drivers more aware of the surroundings at the intersection, enhancing driver's available sight distances and improving the visibility of non- motorists. This CM only applies to night crashes (all types) occurring within limits of the proposed roadway lighting 'engineered' area.

BENEFIT-COST

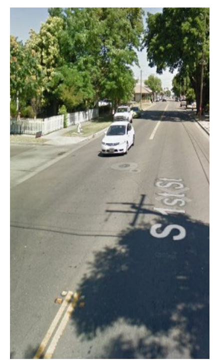
- Implementation of this treatment reduces crashes by 40%.
- 20 years of expected life.
- Estimated $170,200 per intersection.
- Cost variation based on cost for lighting installation and an ongoing maintenance and power cost.
- Eligible for 100% federal funding.

EXAMPLE LOCATION(S)

- Intersections along CA-29, Vallejo

Sources: CA-Local Roadway Safety Manual

EXISTING CONDITIONS



NS1 IMPLEMENTATION

NS2. CONVERT TO ALL-WAY STOP CONTROL (FROM 2-WAY OR YIELD CONTROL).

Applicable at unsignalized intersection locations with a crash history and have no controls on the major roadway approaches. The all way stop control is suitable only at intersections with moderate and relatively balanced volume levels on the intersection approaches. This treatment addresses to all type of crashes and only applies to crashes occurring in the intersection and/or influence area of the new control. CA-MUTCD warrant must be met.

BENEFIT-COST

- Implementation of this treatment reduces crashes by 50%.
- 10 years of expected life.
- Estimated $10,000 per intersection.
- Cost variation based on numbers of locations.
- Eligible for 100% federal funding.

EXAMPLE LOCATION(S)

- E 5th Street and E J Street, Benicia
- E 5th Street and E L Street, Benicia

Sources: CA-Local Roadway Safety Manual

EXISTING CONDITIONS

NS2 IMPLEMENTATION

NS3. INSTALL SIGNALS.

To signalized an unsignalized intersections should only be given after less restrictive forms of traffic control have been utilized as the installation of a traffic signal often leads to an increased frequency of crashes (rear-end) on major roadways and introduces congestion and signal warrants have been met. This CM only applies to crashes occurring in the intersection and/or influence area of the new signals. All new signals must meet MUTCD "safety" warrants 4, 5, or 7. Given the overarching operational changes that occur when an intersection is signalized, no other intersection CMs can be applied to the intersection crashes in conjunction with this CM.

BENEFIT-COST

- Implementation of this treatment reduces crashes by 30%.
- 20 years of expected life.
- Estimated $410,500 per intersection.
- Cost variation based on application, type of signal and right-of-away considerations.
- Eligible for 100% federal funding.

Sources: CA-Local Roadway Safety Manual

EXISTING CONDITIONS

NS3 IMPLEMENTATION

NS4. CONVERT INTERSECTION TO ROUNDABOUT (FROM ALL WAY STOP).

Implement at intersections that have a high frequency of right-angle and left-turn type crashes. Whether such intersections have existing crash patterns or not, a roundabout provides an alternative to signalization. The primary target locations for roundabouts should be moderate-volume unsignalized intersections. This CM only applies to crashes occurring in the intersection and/or influence area of the new control.

BENEFIT-COST

- Implementation of this treatment reduces crashes by a variable amount.
- 20 years of expected life.
- Estimated $840,300 per intersection.
- The benefit of this CM is calculated using Caltrans procedure. The benefit comes from both the reduction in the number and severity of the crashes.
- Construction of roundabouts are usually relatively costly and major projects, requiring the environmental process, right-of-way acquisition, and implementation under an agency’s long-term capital improvement program. Even with roundabouts higher costs, they can still have a relatively high effectiveness.
- Eligible for 100% federal funding.

Sources: CA-Local Roadway Safety Manual

EXISTING CONDITIONS

NS4 IMPLEMENTATION

NS5. CONVERT INTERSECTION TO ROUNDABOUT (FROM 2-WAY STOP OR YIELD CONTROL).

Effective at intersections that have a high frequency of right-angle and left-turn type crashes, primarily at unsignalized intersections with moderate-volumes. This CM only applies to crashes occurring in the intersection and/or influence area of the new control and is not eligible for use at existing all-way stop intersections.

BENEFIT-COST

- Implementation of this treatment, when used to reduce crashes, varies.
- 20 years of expected life.
- Estimated $840,300 per intersection.
- Cost variation based on the environmental process, right-of-way acquisition and implementation under an agency's long-term capital improvement program.
- Eligible for 100% federal funding.

EXAMPLE LOCATION(S)

- Meridian Road and Elizabeth Road, Suisun City

Sources: CA-Local Roadway Safety Manual

EXISTING CONDITIONS

NS5 IMPLEMENTATION

NS6. INSTALL/UPGRADE LARGER OR ADDITIONAL STOP SIGNS OR OTHER INTERSECTION WARNING/REGULATORY SIGNS.

Target unsignalized intersections with patterns of rear-end, right- angle, or turning collisions related to lack of driver awareness of the presence of the intersection. The ability of approaching drivers to perceive them can be enhanced by installing larger regulatory and warning signs at or prior intersections. This CM only applies to all type of crashes occurring in the intersection and/or influence area of the new signs. The influence area must be determined on a location-by-location basis.

BENEFIT-COST

- Implementation of this treatment reduces crashes by 15%.
- 10 years of expected life.
- Estimated $1,800 per sign.
- Cost variation based on the number of signs.
- Eligible for 100% federal funding.

EXAMPLE LOCATION(S)

- E 5th Street and E J Street, Benicia
- Porter Road and Pitt School Road, Solano County

Sources: CA-Local Roadway Safety Manual

EXISTING CONDITIONS

NS6 IMPLEMENTATION

NS7. UPGRADE INTERSECTION PAVEMENT MARKINGS.

Effective at unsignalized intersections that are not clearly visible to approaching motorists, particularly approaching motorists on the major road. This is appropriate for intersections with patterns of rear-end, right-angle or turning crashes related to lack of drivers' awareness of the presence of an intersection; and, at minor road approaches where conditions allow the stop bar to be seen by an approaching driver at a significant distance from the intersection. Improvements include "Stop Ahead" markings and the addition of Centerlines and Stop Bars. This CM applies to all type of crashes occurring on the approaches/ influence area of the new pavement markings. However, this CM is not intended to be used for general maintenance activities and must include ungraded safety features over the existing pavement markings and striping.

BENEFIT-COST

- Implementation of this treatment reduces crashes by 25%.
- 10 years of expected life.
- Estimated $10,500 per intersection.
- Cost variation based on the number of markings.
- Eligible for 100% federal funding.

EXAMPLE LOCATION(S)

- Porter Road and Pitt School Road, Solano County

Sources: CA-Local Roadway Safety Manual

EXISTING CONDITIONS

NS7 IMPLEMENTATION

NS8. INSTALL FLASHING BEACONS AT STOP-CONTROLLED INTERSECTIONS.

Installing flashing beacons to reinforce driver's awareness of the non-signalized intersection control and to help mitigate patterns of right-angle crashes related to stop sign violations. This CM applies to all type of crashes occurring on the stop-controlled approaches/ influence area of the new beacons.

BENEFIT-COST

- Implementation of this treatment reduces crashes by 15%.
- 10 years of expected life.
- Estimated $12,700 per approach.
- Cost variation based on the design, environmental, right-of-way issues.
- Eligible for 100% federal funding.

EXAMPLE LOCATION(S)

- Porter Road and Pitt School Road, Solano County

Sources: CA-Local Roadway Safety Manual

EXISTING CONDITIONS

NS8 IMPLEMENTATION

NS9. INSTALL FLASHING BEACONS AS ADVANCE WARNINGS (NS.I.).

Applicable to non-signalized intersections with patterns of crashes that could be related to lack of a driver's awareness of approaching intersection or controls at a downstream intersection. This CM applies to all type of crashes occurring on the approaches/influence area of the new beacons placed in advanced of the intersection.

BENEFIT-COST

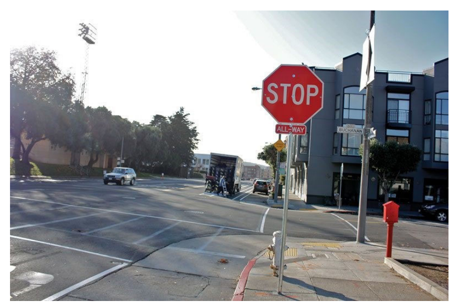
- Implementation of this treatment reduces crashes by 30%.
- 10 years of expected life.
- Estimated $76,800 per approach.
- Cost variation based on the size/number of flashing beacons.
- Eligible for 100% federal funding.

EXAMPLE LOCATION(S)

- Porter Road and Pitt School Road, Solano County

Sources: CA-Local Roadway Safety Manual

EXISTING CONDITIONS



NS9 IMPLEMENTATION

NS10. INSTALL TRANSVERSE RUMBLE STRIPS ON APPROACHES.

Transverse rumble strips are installed in the travel lane for providing an auditory and tactile sensation for each motorist approaching the intersection. They can be used at any stop or yield approach intersection, often in combination with advance signing to warn of the intersection ahead. This CM applies to all crashes occurring on the approach/influence area of the new rumble strips.

BENEFIT-COST

- Implementation of this treatment reduces crashes by 20%.
- 10 years of expected life.
- Estimated $5,000 per intersection.
- Cost variation based on the length of the rumble strips.
- Eligible for 90% federal funding.

Sources: CA-Local Roadway Safety Manual

EXISTING CONDITIONSA

NS10 IMPLEMENTATION

NS11. IMPROVE SIGHT DISTANCE TO INTERSECTION (CLEAR SIGHT TRIANGLE).

Applicable at unsignalized intersections with restricted sight distance and patterns of crashes related to lack of sight distance where the sight distance can be improved by clearing roadside obstructions without major reconstruction of the roadway. This CM applies to all crashes occurring on the approaching / influence area of the significantly improved new sight distance.

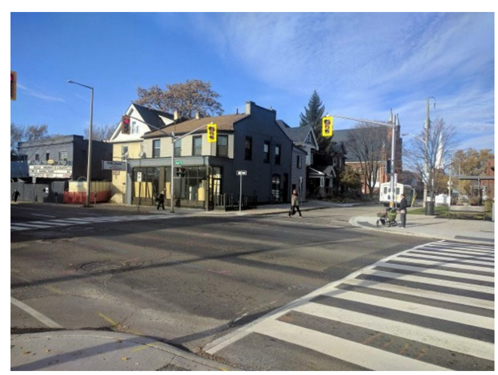
BENEFIT-COST

- Implementation of this treatment reduces crashes by 20%.
- 10 years of expected life.
- Estimated $100,000 per intersection.
- Cost variation based on the surrounding of the intersection.
- Eligible for 90% federal funding.

Sources: CA-Local Roadway Safety Manual

EXISTING CONDITIONS

NS11 IMPLEMENTATION



NS12. IMPROVE PAVEMENT FRICTION (HIGH FRICTION SURFACE TREATMENTS).

Applicable when non-signalized intersections are noted as having crashes on wet pavement, or under dry conditions when the pavement friction available is significantly less than needed for the actual roadway approach speeds. This treatment is used to target locations where skidding and/or failure to stop occur in wet or dry conditions. This CM reduces all crashes occurring within the limits of the improved friction overlay. Improved pavement friction is not intended to apply to standard chip-seal or open-graded maintenance projects for long segments of corridors or structure repaving projects intended to fix failed pavement.

EXISTING CONDITIONS

NS12 IMPLEMENTATION

BENEFIT-COST:

- Implementation of this treatment reduces crashes by 55%.
- 10 years of expected life.
- Estimated $5,000 per intersection.
- Cost variation based on size of intersection and material ($30/sq. yd.).
- Eligible for 100% federal funding.

Sources: CA-Local Roadway Safety Manual

NS13. INSTALL SPLITTER-ISLANDS ON THE MINOR ROAD APPROACHES.

Applicable for minor road approaches to unsignalized intersections where the presence of the intersection or the stop sign is not readily visible to approaching motorists. This CM is particularly appropriate for intersections where the speeds on the minor road are high. This CM allows for an additional stop sign to be placed in the median for the minor approach. All crashes occurring on the approaches / influence area of the new splitter island on the minor road approaches are reduced by the implementation of this CM.

EXISTING CONDITIONS

NS13 IMPLEMENTATION

BENEFIT-COST

- Implementation of this treatment reduces crashes by 40%.
- 20 years of expected life.
- Estimated $50,000 per intersection.
- Cost variation based on the size of the splitter-islands.
- Eligible for 90% federal funding.

Sources: CA-Local Roadway Safety Manual

NS14. INSTALL RAISED MEDIAN ON APPROACHES.

Effective for the location where related or nearby turning movements affect the safety and operation of an intersection. The number of intersection access points coupled with the speed differential between vehicles traveling along the roadway often contributes to crashes. Any access points within 250 feet upstream and downstream of an intersection are generally undesirable. This CM applies to all crashes occurring on the approaches/influence area of the new raised median. All new raised medians funded with federal HSIP funding must not include the removal of the existing roadway structural section and must be doweled into the existing roadway surface.

EXISTING CONDITIONS

NS14 IMPLEMENTATION

BENEFIT-COST

- Implementation of this treatment reduces crashes by 25%.
- 20 years of expected life.
  Estimated $14,100 per approach.
- Cost variation based on the size of the new median.
- Eligible for 90% federal funding.

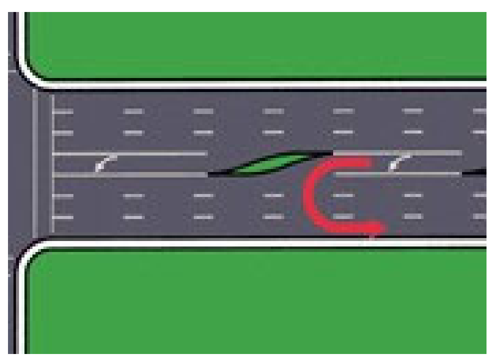
Sources: CA-Local Roadway Safety Manual

NS15. CREATE DIRECTIONAL MEDIAN OPENINGS TO ALLOW (AND RESTRICT) LEFT-TURNS AND U-TURNS.

Applicable when crashes related to turning maneuvers include angle, rear-end, pedestrian and sideswipe (involving opposing left turns) type crashes. Since raised medians limit property access to right turns only, they should be used in conjunction with efforts to provide alternative access ways and promote driveway spacing objectives. This CM applies to all crashes occurring in the intersection / influence area of the new directional openings.

EXISTING CONDITIONS

NS15 IMPLEMENTATION



BENEFIT-COST

- Implementation of this treatment reduces crashes by 50%.
- 20 years of expected life.
- Estimated $75,000 per intersection.
- Cost variation based on the size of the median.
- Eligible for 90% federal funding.

Sources: CA-Local Roadway Safety Manual

NS16. REDUCED LEFT-TURN CONFLICT INTERSECTIONS.

Design intersections to alter how left-turn movements occur and minimize the potential for related crashes. Two highly effective 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). This treatment only applies to crashes occurring in the intersection/influence areas of the new reduced left-turn conflict.

BENEFIT-COST

- » Implementation of this treatment reduces crashes by 50%.
- » 20 years of expected life.
- » Cost varies per installation.
- » The cost of this strategy will depend on the treatment.
- » Eligible for 90% federal funding.

Sources: CA-Local Roadway Safety Manual

EXISTING CONDITIONS

NS16 IMPLEMENTATION

NS17. INSTALL RIGHT-TURN LANE (NS.I.).

Applicable when many collisions at unsignalized intersections are related to right-turn maneuvers. This CM provides exclusive right-turn lanes, particularly on high-volume and high-speed major-road approaches to minimizing the collisions and applies to crashes occurring on the approaches/influence area of the new right-turn lanes. However, it is not eligible for use at existing all-way stop intersections.

BENEFIT-COST

- » Implementation of this treatment reduces crashes by 20%.
- » 20 years of expected life.
- » Estimated $200,000 per intersection.
- » Cost variation based on how wide the new right lane.
- » Eligible for 90% federal funding.

Sources: CA-Local Roadway Safety Manual

EXISTING CONDITIONS

NS17 IMPLEMENTATION

NS18. INSTALL LEFT-TURN LANE (WHERE NO LEFT-TURN LANE EXISTS).

Applicable when many collisions at unsignalized intersections are related to left-turn maneuvers. This CM provides exclusive left-turn lanes, particularly on high-volume and high-speed major-road approaches to minimizing the collisions. This CM applies to crashes occurring on the approaches / influence area of the new left- turn lanes, but is not eligible for use at existing all-way stop intersections.

BENEFIT-COST

- Implementation of this treatment reduces crashes by 35%.
- 20 years of expected life.
- Estimated $200,000 per intersection.
- Cost variation based on width of the new left lane.
- Eligible for 90% federal funding.

Sources: CA-Local Roadway Safety Manual

EXISTING CONDITIONS

NS18 IMPLEMENTATION

NS19PB. INSTALL RAISED MEDIANS (REFUGE ISLANDS).

Applicable when intersections have a long pedestrian crossing distance, a higher number of pedestrians, or a crash history. Raised medians can decrease the level of exposure for pedestrians and allow pedestrians to concentrate on (or cross) only one direction of traffic at a time. Raised medians only apply to pedestrian and bicycle crashes occurring on the approaches/influence area of the new left-turn lanes. This CM does not apply to converting a single- left into double left turn, nor is it eligible for use at existing all-way stop intersections.

BENEFIT-COST

- Implementation of this treatment reduces crashes by 45%.
- 20 years of expected life.
- Estimated $12,200 per island.
- Cost variation based on the size of the refuge islands.
- Eligible for 90% federal funding.

Sources: CA-Local Roadway Safety Manual

EXISTING CONDITIONS

NS19PB IMPLEMENTATION

NS20PB. INSTALL PEDESTRIAN CROSSING AT UNCONTROLLED LOCATIONS (SIGNS AND MARKINGS ONLY).

Applicable at non-signalized intersections without marked crossings, or at intersections with significant vehicular traffic or where pedestrians are known to be crossing. They are important near schools and intersections with right and/or left turns pockets. This CM only reduces “Ped and Bike” crashes that occur in the intersection/ crossing with the new crossing. It is not intended to be used for high-cost aesthetic enhancements to intersection crosswalks (i.e. stamped concrete or stamped asphalt).

BENEFIT-COST

- Implementation of this treatment reduces crashes by 20%.
- 10 years of expected life.
- Estimated $4,800 per crossing.
- Cost variation based on the length of the pedestrian crossing.
- Eligible for 100% federal funding.

Sources: CA-Local Roadway Safety Manual

NS20PB IMPLEMENTATION

NS21PB. INSTALL/UPGRADE PEDESTRIAN CROSSING AT UNCONTROLLED LOCATIONS (WITH ENHANCED SAFETY FEATURES).

NS21PB IMPLEMENTATION

Applicable at non-signalized intersections without a marked crossing, where pedestrians are known to be crossing, that involve significant vehicular traffic. They are important at school crossings and intersections with right and/or left turns pockets. Rectangular rapid flashing beacons, overhead flash- ing beacons, curb extensions, advanced “stop” or yield markings and other safety features should be added to complement the standard crossing elements. This CM only reduces “Ped & Bike” crashes occurring in the crossing (influence area) with the new enhanced safety features and is not intended to be used for high-cost aesthetic enhancements to intersection crosswalks (i.e. stamped concrete or stamped asphalt).

BENEFIT-COST:

- Implementation of this treatment reduces crashes by 35%.
- 20 years of expected life.
- Estimated $ 161,100 per crossing.
- Cost variation based on the length of the pedestrian crossing and the amount of safety signs.
- Eligible for 100% federal funding.

Sources: CA-Local Roadway Safety Manual

NS22PB. INSTALL RECTANGULAR RAPID FLASHING BEACON (RRFB).

Rectangular Rapid Flashing Beacon (RRFB) includes pedestrian-activated flashing lights and additional signage that enhance the visibility of marked crosswalks and alert motorists to pedestrian crossings. RRFBs are installed at unsignalized intersections and mid-block pedestrian crossings. This CM only applies to "Ped & Bike" crashes occurring in the influence area (expected to be a maximum of within 250') of the crossing which includes the RRFB.

BENEFIT-COST

- Implementation of this treatment reduces crashes by 35%.
- 20 years of expected life.
- Estimated $46,900 per crosswalk.
- Cost variation based on the size of the refuge islands.
- Eligible for 90% federal funding.

Sources: CA-Local Roadway Safety Manual

EXISTING CONDITIONS

NS22PB IMPLEMENTATION

NS23PB. INSTALL PEDESTRIAN SIGNAL OR HAWK.

Applicable when intersections are noted as having a history of pedestrian vs. vehicle crashes and in areas where the likelihood of a pedestrian related crash is significant. Corridors should also be assessed to determine if there are adequate safe opportunities for non-motorists to cross and if a pedestrian signal, HAWK, or hybrid beacon is needed to provide an active warning to motorists when pedestrians are in the crosswalk. This CM only reduces "Ped and Bike" crashes occurring in the intersection / crossing with the new signal.

BENEFIT-COST:

- Implementation of this treatment reduces crashes by 55%.
- 20 years of expected life.
- Estimated $184,300 per intersection.
- Cost variation based on the amount of pedestrian signal or HAWK.
- Eligible for 100% federal funding

EXAMPLE LOCATION(S)

- Intersections along Broadway Street, Vallejo

Sources: CA-Local Roadway Safety Manual

EXISTING CONDITIONS

NS23PB IMPLEMENTATION

COUNTERMEASURES FOR ROADWAY SEGMENTS

R1. ADD SEGMENT LIGHTING

Applied to night-time crashes. In particular, patterns of rear-end, right-angle, turning or roadway departure collisions on the roadways may indicate that night-time drivers can be unaware of the roadway characteristics. This treatment addresses only to all night type crashes.

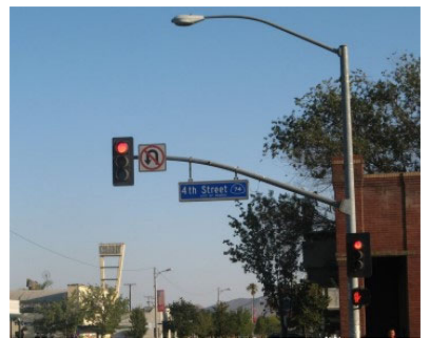
BENEFIT-COST

- Implementation of this treatment reduces crashes by 35%
- 20 years of estimated life.
- Estimated $8,00000 per quarter-mile with 125' spacing on both sides and new conduit.
- Cost variation depending if lighting connected to signal box. If yes, then no additional pullbox.
- Eligible for 100% federal funding.

Sources: CA-Local Roadway Safety Manual

EXISTING CONDITIONS

R1 IMPLEMENTATION



R2. REMOVE OR RELOCATE FIXED OBJECTS OUTSIDE OF CLEAR RECOVERY ZONE.

Applicable to known locations or roadway segments prone to collisions with fixed objects such as utility poles, drainage structures, trees, and other fixed objects, such as the outside of a curve, end of lane drops, and in traffic islands. This treatment addresses fixed object crashes that occur within the limits of the new clear recovery zone.

BENEFIT-COST

- Implementation of this treatment reduces crashes by 35%.
- 20 years of expected life.
- Estimated $2,200 per removed object (e.g. tree).
- Costs will generally be low, assuming that in most cases the objects to be removed are within the right-of-way.
- Eligible for 90% of federal funding.

Sources: CA-Local Roadway Safety Manual

EXISTING CONDITIONS

R1 IMPLEMENTATION

R3. INSTALL MEDIAN BARRIER.

Put in areas where crash history indicates drivers are unintentionally crossing the median and the cross-overs are resulting in high severity crashes. This treatment addressed only head-on crashes. This treatment is only applied to crashes occurring within the limits of the new barrier.

BENEFIT-COST

- Implementation of this treatment reduces crashes by 25%.
- 20 years of expected life.
- Estimated $150,000 varies.
- Costs will vary depending on the type of median barrier selected and whether the strategy is implemented as a stand-alone project or incorporated as part of a reconstruction or resurfacing effort.
- Eligible for 100% of federal funding.

Sources: CA-Local Roadway Safety Manual

EXISTING CONDITIONS

R3 IMPLEMENTATION

R4. INSTALL GUARDRAIL.

Guardrail is installed to reduce the severity of lane departure crashes. This treatment addresses fixed object and run-off road crashes. This treatment and corresponding CRF should only be applied to locations where past crash data or engineering judgement applied to existing attenuator conditions suggests the upgrade attenuators may result in a few or less severe crashes.

BENEFIT-COST

- Implementation of this treatment reduces crashes by 25%.
- 20 years of expected life.
- Estimated $50,000 per installment.
- Strategies range from relatively inexpensive too costly.
- Eligible for 100% of federal funding.

Sources: CA-Local Roadway Safety Manual

EXISTING CONDITIONS

R4 IMPLEMENTATION

R5. INSTALL IMPACT ATTENUATORS.

Impact attenuators are typically used to shield rigid roadside objects such as concrete barrier ends, steel guardrail ends and bridge pillars from oncoming automobiles. This treatment addresses fixed object and run-off road that occur with the limits of the new attenuators. This CM and corresponding CRF should only be applied to locations where past crash data or engineering judgement applied to existing attenuator conditions suggests the upgrade attenuators may result in a few or less severe crashes.

BENEFIT-COST

- Implementation of this treatment reduces crashes by 25%.
- 10 years of expected life.
- Estimated $5000 for steel railing, $2500 for traffic barrels.
- Costs depending on the scope of the project, type(s) used, and associated ongoing maintenance costs.
- Eligible for 100% of federal funding.

Sources: CA-Local Roadway Safety Manual

EXISTING CONDITIONS

R5 IMPLEMENTATION

R6. FLATTEN SIDE SLOPES.

Consider adding to roadways experiencing frequent lane departure crashes that result in roll-over type crashes as a result of the roadway slope being so severe as to not accommodate a reasonable degree of driver correction. This treatment addresses fixed object and run-off road crashes. This treatment only applies to crashes occurring within the limits of the new side slope. Minor/incidental flattening of side slopes would not likely result in the CRF shown below and may not be appropriate for use in Caltrans B/C calculations.

BENEFIT-COST

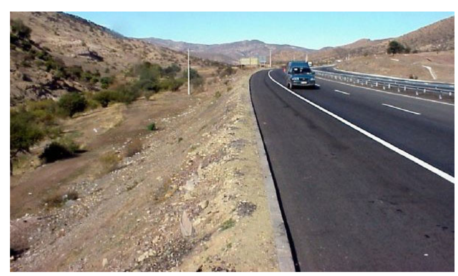
- Implementation of this treatment reduces crashes by 30%.
- 20 years of expected life.
- Estimated cost varies significantly based on shoulder conditions.
- Strategies that include creating safer side slopes where none exists can be moderately expensive based on the scope of the project and the associated clearing, grading, etc.
- Eligible for 90% federal funding.

EXAMPLE LOCATION(S)

- CA-113 between E C Street and W E Street, Dixon

Sources: CA-Local Roadway Safety Manual

EXISTING CONDITIONS



R6 IMPLEMENTATION

R7. FLATTEN SIDE SLOPES AND REMOVE GUARDRAIL.

Put in locations where high number of crashes originate as a lane departure and result in collision with guardrail or a fixed object located on the side slope shielded by guardrail. This treatment addresses roll over and fixed object crashes; but can still result in severe crashes in some locations. This treatment only applies to crashes occurring within the limits of both the removed guardrail and the new side slopes.

EXISTING CONDITIONS

R7 IMPLEMENTATION

BENEFIT-COST

- Implementation of this treatment reduces crashes by 40%.
- 20 years of expected life.
- Estimated $100,000 per implementation.
- Strategies that include creating safer side slopes where none exists can be moderately expensive based on the scope of the project and the associated clearing, grading, etc.
- Eligible for 90% of federal funding.

Sources: CA-Local Roadway Safety Manual

R8. INSTALL RAISED MEDIAN.

Installed in areas experiencing head-on collisions that may be affected by both the number of vehicles that cross the centerline and by the speed of oncoming vehicles. This address only head-on crashes and only applies to crashes occurring within the limits of the new raised median. Application of raised medians on roadways with higher speeds is not advised and documentation of impacts of additional turning movements at nearby intersection should be considered.

R8 IMPLEMENTATION

BENEFIT-COST

- Implementation of this treatment reduces crashes by 25%.
- 20 years of expected life.
- Estimated $200,000+ (depends on length, right-of-way, and surface treatment).
- Choosing to install landscaping can exclude agencies from their federally funded HSIP application scope.
- Eligible for 90% of federal funding.

Sources: CA-Local Roadway Safety Manual

R9. INSTALL MEDIAN (FLUSH).

Installed in areas experiencing head-on collisions that may be affected by both the number of vehicles that cross the centerline and by the speed of oncoming vehicles. This treatment addresses all types of crashes occurring within the limits of the new flush media.

R9 IMPLEMENTATION

BENEFIT-COST

- Implementation of this treatment measure reduces crashes by 15%.
- 20 years of expected life.
- Estimated $25,000 per segment (approximately 1,000 linear feet).
- Costs and time to implement could significantly increase if the paved area is not sufficient to include a median. This measure is only eligible for 90% of federal funding.

Sources: CA-Local Roadway Safety Manual

R10PB. INSTALLED PEDESTRIAN MEDIAN FENCING.

Put in roadway segments with high pedestrian-generators and pedestrian-destinations nearby (e.g. transit stops) may experience a high volume of pedestrians J-walking across the travel lanes at mid-block locations instead of walking to the nearest intersection or designated mid-block crossing. This type of treatment addresses bike and pedestrian crashes by adding pedestrian medians fencing that enhances pedestrian safety. This treatment only applies to Ped & Bike crashes occurring on the approaches/influence area of the new pedestrian median fencing.

BENEFIT-COST

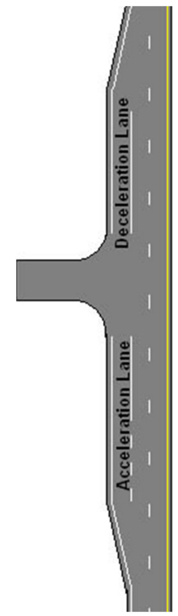
- Implementation of this treatment reduces crashes by 35%.
- 20 years of expected life.
- Estimated $3,000 (varies on placement of median).
- Costs associated with this strategy will vary widely depending on the type and placement of the median fencing.
- Only eligible for 90% of federal funding.

Sources: CA-Local Roadway Safety Manual

R11. INSTALL ACCELERATION/DECELERATION LANES.

Applicable in areas proven to have crashes that are the result of drivers not being able to turn onto a high-speed roadway to accelerate until the desired roadway speed is reached and areas that do not provide the opportunity to safety decelerate to negotiate a turning movement. This CM can also be used to improve the safety of merging vehicles at a lane-drop location. This type of CM addresses sideswipe and read-end. This CM only applies to crashes occurring within the limits of the new acceleration/deceleration lanes on high-speed roadways.

R11 IMPLEMENTATION



BENEFIT-COST

- Implementation of this treatment reduces crashes by 25%.
- 20 years of expected life.
- Estimated $700,000 (cost are highly variable).
- Where the roadway must be widened and additional right-of-way must be acquired, higher costs and a lengthy time-to-construct are likely.
- Eligible for 90% of federal funding.

Sources: CA-Local Roadway Safety Manual

R12. WIDEN LANE (INITIALLY LESS THAN 10FT).

Use on horizontal curves or tangents and low speed or high-speed roadways identified as having lane departure crashes, sideswipe or head-on crashes that can be attributed to an existing pavement width less than 10 feet. This treatment addresses all types of crashes that occur with increasing pavement width. This treatment only applies to crashes occurring within the limits of the widened lanes (widening must be a minimum of 1 foot).

BENEFIT-COST

- Implementation of this treatment reduces crashes by 25%.
- 20 years of expected life.
- Estimated $75,000.
- Horizontal curves or tangents and low speed or high-speed roadways identified as having lane departure crashes, sideswipe or head-on crashes that can be attributed to an existing pavement width less than 10 feet.
- Eligible for 90% of federal funding.

Sources: CA-Local Roadway Safety Manual

R13. ADD TWO-WAY LEFT-TURN LANE (WITHOUT REDUCING TRAVEL LANES).

Install on roadways having a high frequency of drivers being rear-ended while attempting to make a left turn across oncoming traffic. Also can be effective for drivers crossing the centerline of an undivided multilane roadway inadvertently. This treatment address all types of crashes by having two-way left turn lanes that provides a buffer between opposing directions of travel and separate left turning traffic from through traffic. This treatment only applies to crashes occurring within the limits of the new lane, where an existing median did not already exist.

BENEFIT-COST

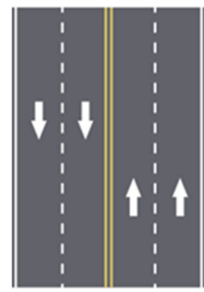
- Implementation of this treatment reduces crashes by 30%.
- 20 years of expected life.
- Estimated $800,000 (varies).
- Costs and time to implement could significantly increase if the paved area is not sufficient to include a median, requiring new right-of-way, and having significant environmental impacts.
- Eligible for 90% of federal funding.

Sources: CA-Local Roadway Safety Manual

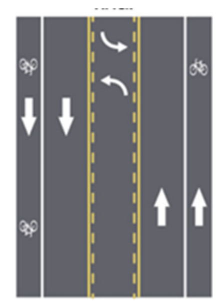
R14. ROAD DIET (REDUCE TRAVEL LANES FROM 4 TO 3 AND ADD A TWO-WAY LEFT-TURN AND BIKE LANES).

Applicable to areas noted as having a higher frequency of head-on, left-turn, and rear-end crashes with traffic volumes that can be handled by only 2 free flowing lanes. This treatment addresses all types of crashes that occur by reducing the roadway segment speeds and serious head-on crashes. This treatment only applies to crashes occurring within the limits of the new lane striping. "Intersection" crashes can only be applied when they resulted from turning movements that had no designated turn lanes/phases in the existing condition and the Road Diet will provide turn lanes/phases for these movements.

EXISTING CONDITIONS



R14 IMPLEMENTATION



This treatment does not apply to roadway sections that already included left turn lanes or two way left turn lanes before the lane reductions. new bike lanes are also expected to be part of these projects. Pre-approval from the HSIP program manager is needed for: 1) the use of this treatment without removing a travel lane in each direction and/or without adding new bike lanes; and/or 2) if any pavement is planned to be removed for the purpose of adding landscaping, planter-boxes, or other non-roadway user features.

BENEFIT-COST

- Implementation of this treatment reduces crashes by 30%.
- 20 years of expected life.
- Estimated $750,000 (varies).
- Projects that only require new lane markings and minor signalization modifications will have relatively low cost and can be very effective and can be considered on a systematic approach.
- Eligible for 90% of federal funding.

Sources: CA-Local Roadway Safety Manual

R15. WIDEN SHOULDER (PAVED).

Installed in roadways that have a frequent incidence of vehicles leaving the travel lane resulting in an unsuccessful attempt to reenter the roadway. The probability of a safe recovery is increased if an errant vehicle is provided with an increased paved area in which to initiate such a recovery. This type of CM addresses Fixed object, Run-off Road, and Sideswipe.

EXISTING CONDITIONS

R15 IMPLEMENTATION

BENEFIT-COST

- Implementation on this treatment reduces crashes by 30%.
- 20 years of expected life.
- Estimated $150,000 (cost depends on need for right-of-way or if roadside modification is needed).
- Shoulder widening costs would depend on whether new right-of-way is required and whether extensive roadside modification is needed. Since shoulder widening can be a relatively expensive treatment, one of the keys to creating a cost-effective project with at least a medium B/C ratio is targeting higher-hazard roadways.
- Eligible for 90% of federal funding.

EXAMPLE LOCATION(S)

- » Fry Road between Leisure Town Road and Meridian Road, Solano County

Sources: CA-Local Roadway Safety Manual

R16. CURVE SHOULDER WIDENING (OUTSIDE ONLY).

Installed in roadway curves noted as having frequent lane departure crashes due to inadequate or no shoulders, resulting in an unsuccessful attempt to reenter the roadway. Adding shoulders (outside only) creates a recovery area in which a driver can regain control of a vehicle, as well as lateral clearance to roadside objects. This CM only applies to crashes occurring within the limits (or influence area) of the new shoulder widening at curves.

BENEFIT-COST

- Implementation on this treatment reduces crashes by 45%.
- 20 years of expected life.
- Estimated cost.
- To minimize the right-of-way needs and the cost, only outside shoulder at curves is to be widened. This CM can be implemented in a relatively short timeframe.
- Eligible for 90% of federal funding.

Sources: CA-Local Roadway Safety Manual

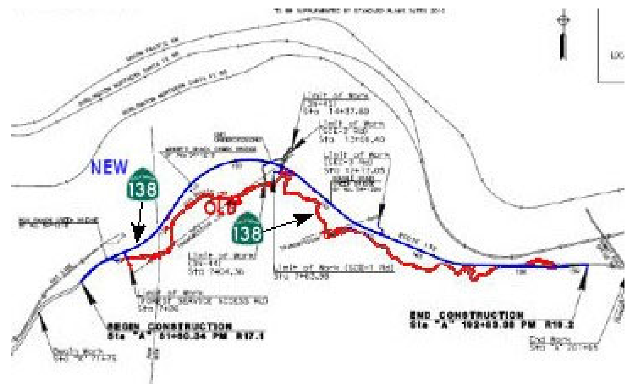
EXISTING CONDITIONS

R16 IMPLEMENTATION

R17. IMPROVE HORIZONTAL ALIGNMENT (FLATTEN CURVES).

Applicable to roadways with horizontal curves that have experienced lane departure crashes as a result of a roadway segment having compound curves or a severe radius. This treatment addresses all types and is very effective in improving the safety performance of the curve. This strategy should generally be considered only when less expensive strategies involving clearing of specific sight obstructions or modifying traffic control devices have been tried and have failed to ameliorate the crash patterns. This treatment only applies to crashes occurring within the limits (or influence area) of the improved alignment.

R17 IMPLEMENTATION



This treatment is not eligible unless it is done as the last step of an "incremental approach", including: the agency documents that: 1) they have already pursued and installed lower cost and lower impact CMs (i.e. signing/striping upgrades to MuTCD standards/recommendations, rumble strips, etc.), 2) they have already monitored the crash occurrences after these improvements were in- stalled, and 3) the 'after' crash rate is still unacceptably high. This 'incremental approach' (or a special exception from the HSIP program manager) must be documented in the narrative Questions in the application and a summary of the agency's 'before' and 'after' crash analysis must be attached to the application.

BENEFIT-COST

- Implementation on this treatment reduces crashes by 50%.
- 20 years of expected life.
- Estimated $1,000,000 higher-cost varies on location.
- Cost revolved around additional right-of-way, environmental review, and total reconstruction of the roadway.
- Eligible for 90% of federal funding.

Sources: CA-Local Roadway Safety Manual

R18. FLATTEN CREST VERTICAL CURVE.

The target for this strategy is usually unsignalized intersections with restricted sight distance due to vertical geometry and with patterns of crashes related to that lack of sight distance that cannot be ameliorated by less expensive methods. This strategy should generally be considered only when less expensive strategies involving clearing of specific sight obstructions or modifying traffic control devices have been tried and have failed to ameliorate the crash patterns. This treatment addresses all types of crashes by having acceptable sight distance for drivers at stopped approaches in an intersection. This treatment only applies to crashes occurring within the limits (or influence area) of the improved alignment. This treatment must follow the "incremental approach" discussed in treatment R17.

BENEFIT-COST

- Implementation of this treatment reduces crashes by 25%.
- 20 years of expected life.
- Estimated $750,000 per installation
- Varies based on slope and improvement can take several years.
- Eligible for 90% of federal funding.

Sources: CA-Local Roadway Safety Manual

R19. IMPROVE CURVE SUPER ELEVATION.

Applicable for roadways noted as having frequent lane departure crashes and inadequate or no superelevation. This treatment addresses specifically run-off road crashes but also all other crashes by improving the superelevation or restoring along curves where the actual superelevation is less than the optimal. This CM only applies to crashes occurring within the limits (or influence area) of the improved superelevation. This CM does not apply to sections of roadways where the horizontal or vertical alignments are changing via another CM.

BENEFIT-COST:

- Implementation of this treatment reduces crashes by 45%.
- 20 years of expected life.
- Estimated $700,000 (varies).
- Higher-cost alternative for improving the safety of a curve because it involves reconstruction to some degree. other projects may be able to be constructed by simple overlays and minimal reconstruction of roadway features.
- Eligible for 90% of federal funding.

Sources: CA-Local Roadway Safety Manual

R20. CONVERT FROM TWO-WAY TO ONE-WAY TRAFFIC.

One-way streets can offer improved signal timing and accommodate odd-spaced signals. One-way streets can simplify crossings for pedestrians, who must look for traffic in only one direction. This countermeasure addresses all types of crashes.

BENEFIT-COST

- Implementation of this treatment reduces crashes by 35%.
- 20 years of expected life.
- Estimated $50,000 per conversion.
- Costs may vary depending on length of treatment and if the conversion requires modification to signals.
- Eligible for 90% of federal funding.

Sources: CA-Local Roadway Safety Manual

R21. IMPROVE PAVEMENT FRICTION (HIGH FRICTION SURFACE TREATMENTS).

Areas as noted having crashes on wet pavements or under dry conditions when the pavement friction available is significantly less than actual roadway speeds; including but not limited to curves, loop ramps, intersections, and areas with short stopping or weaving distances. This treatment addresses all types of crashes including wet and rear-end crashes. This CM only applies to crashes occurring within the limits of the improved friction overlay. This CM is not intended to apply to standard chip-seal or open-graded maintenance projects for long segments of corridors or structure repaving projects intended to fix failed pavement.

BENEFIT-COST

- Implementation of this treatment reduces crashes by 55%.
- 10 years of expected life.
- Estimated $25,000
- Eligible for 100% of federal funding

Sources: CA-Local Roadway Safety Manual

R22. INSTALL/UPGRADE SIGNS WITH NEW FLUORESCENT SHEETING (REGULATORY OR WARNING).

The target for this strategy should be on roadway segments with patterns of head on, nighttime, non-intersection, run-off road, and sideswipe crashes related to lack of driver awareness of the presence of a specific roadway feature or regulatory requirement. This CM only applies to crashes occurring within the influence area of the new/upgraded signs. This CM is not intended for maintenance upgrades of street-name, parking, guide, or any other signs without a primary focus on roadway safety.

This CM is not eligible unless it is done as part of a larger sign audit project, including the study of: 1) The existing signs' locations, sizes and information per MuTCD standards, 2) missing signs per MuTCD standards, and 3) sign retroreflectivity. The overall sign audit scope (or a special exception from the HSIP program manager) must be documented in the narrative Questions in the application. Based on the scope of the project/audit, it may be appropriate to combine other CMs in the B/C calculation.

BENEFIT-COST

- Implementation of this treatment reduces crashes by 15%.
- 10 years of expected life.
- Estimated $1,000 per sign.
- Costs for implementing this strategy are nominal and depend on the number of signs. When considered at a single location, these low-cost improvements are usually funded through local funding by local maintenance crews. However, this treatment can be effectively and efficiently implemented using a systematic approach with numerous locations, resulting in moderate cost projects that are more appropriate to seek state or federal funding.
- Eligible for 100% of federal funding.

Sources: CA-Local Roadway Safety Manual

R23. INSTALL CHEVRON SIGNS ON HORIZONTAL CURVES.

Set up on roadways that have an unacceptable level of crashes on relatively sharp curves during periods of light and darkness. Ideally this type of safety CM would be combined with other sign evaluations and upgrades (install warning signs, delineators, markers, beacons, and relocation of existing signs per MuTCD standards). This treatment can address all types of crashes; but, specifically, run-off road crashes occurring near curves. This treatment only applies to crashes occurring within the influence area of the new signs (i.e. only through the curve).

R23 IMPLEMENTATION

BENEFIT-COST:

- Implementation of this treatment reduces crashes by 40%.
- 10 years of expected life.
- Estimated $1,000 per curve
- Costs for implementing this strategy are nominal and depend on the number of signs. When considered at a single location, these low-cost improvements are usually funded through local funding by local maintenance crews. However, this treatment can be effectively and efficiently implemented using a systematic approach with numerous locations, resulting in moderate cost projects that are more appropriate to seek state or federal funding.
- Eligible for 100% of federal funding.

Sources: CA-Local Roadway Safety Manual

R24. INSTALL CURVE ADVANCE WARNING SIGNS.

R24 IMPLEMENTATION

Roadways that have an unacceptable level of crashes on relatively sharp curves during periods of light and darkness. This treatment may also include horizontal alignment and/or advisory speed warning signs. Ideally this type of safety CM would be combined with other sign evaluations and upgrades (install warning signs, chevrons, delineators, markers, beacons, and relocation of existing signs per MuTCD standards). This treatment addresses all types of crashes; but, particularly helps reduce run-off road crashes that occur when there is no advance warning of unexpected or sharp curves. This CM only applies to crashes occurring within the influence area of the new signs. (i.e. only through the curve).

BENEFIT-COST

- » Implementation of this treatment reduces crashes by 25%.
- » 10 years of expected life.
- » Estimated $1,000 per curve.
- » Costs for implementing this strategy are nominal and depend on the number of signs. When considered at a single location, these low-cost improvements are usually funded through local funding by local maintenance crews. However, this treatment can be effectively and efficiently implemented using a systematic approach with numerous locations, resulting in moderate cost projects that are more appropriate to seek state or federal funding.
- » Eligible for 100% of federal funding.

Sources: CA-Local Roadway Safety Manual

R25. INSTALL CURVE ADVANCE WARNING SIGNS (FLASHING BEACON).

Installed on roadways that have an unacceptable level of crashes on relatively sharp curves. Flashing beacons in conjunction with warning signs should only be used on horizontal curves that have an established severe crash history to help maintain their effectiveness. This treatment addresses all types of crashes due to unexpected or sharp curve. This treatment only applies to crashes occurring within the influence area of the new signs. (i.e. only through the curve).

BENEFIT-COST

- Implementation of this treatment reduces crashes by 30%.
- 10 years of expected life.
- Estimated $25,000 per approach, depending on access to utilities.
- Before choosing this CM, the agency needs to confirm the ability to provide power to the site (solar may be an option).
- Eligible for 100% of federal funding.

Sources: CA-Local Roadway Safety Manual

R25 IMPLEMENTATION

R26. INSTALL DYNAMIC/VARIABLE SPEED WARNINGS SIGNS.

Curvilinear roadways that have an unacceptable level of crashes due to excessive speeds on relatively sharp curves. This type of treatment addresses all crashes caused by motorist traveling too fast around shape curves. Before choosing this treatment, the agency needs to confirm the ability to provide power to the site (solar may be an option). This treatment does not apply to dynamic regulatory speed warning signs.

BENEFIT-COST

- Implementation on this treatment reduces crashes by 30%.
- 10 years of expected life.
- Estimated $100,000 (varies).
- Cost varies on type of implementation.
- Eligible for 100% federal funding.

EXAMPLE LOCATION(S)

- Locations along W Texas Street, Fairfield

R26 IMPLEMENTATION

Sources: CA-Local Roadway Safety Manual

R27. INSTALL DELINEATORS, REFLECTORS AND/OR OBJECT MARKERS.

Set up on roadways that have an unacceptable level of crashes on curves (relatively flat to sharp) during periods of light and darkness. This treatment addresses all types of crashes occurring when drivers approaching curve or a fixed object cannot easily be removed. This treatment only applies to crashes occurring within the limits / influence area of the new features. Also, this is not a striping-related treatment.

BENEFIT-COST

- Implementation of this treatment reduces crashes by 15%.
- 10 years of expected life.
- Estimated $2,000 (depends on number and length of locations).
- Costs for implementing this strategy are nominal and depend on the number of locations. When considered at a single location, these low-cost improvements are usually funded through local funding by local maintenance crews. However, this treatment can be effectively and efficiently implemented using a systematic approach with numerous locations, resulting in low to moderate cost projects that are more appropriate to seek state or federal funding.
- Eligible for 100% of federal funding.

R27 IMPLEMENTATION

Sources: CA-Local Roadway Safety Manual

R28. INSTALL EDGE-LINES AND CENTERLINES.

Applicable on any road with a history of run-off-road right, head-on, opposite-direction-sideswipe, or run-off-road-left crashes is a candidate for this treatment – should be installed where the existing lane delineation is not sufficient to assist the motorist in understanding the existing limits of the roadway. This treatment addresses all types; but, specifically impacts head-on and run-off road crashes. This treatment only applies to crashes occurring within the limits of the new centerlines and/or edge-lines. The treatment is not intended to be used for general maintenance activities (i.e. the replacement of existing striping and RPMs in-kind) and must include upgraded safety features over the existing striping. For two lane roadways allowing passing, a striping audit must be done to ensure the passing limits meeting the MuTCD standards. Both the centerline and edge-lines are expected to be upgraded, unless prior approval is granted by Caltrans staff in writing and attached to application.

BENEFIT-COST

- Implementation of this treatment reduces crashes by 25%.
- 10 years of expected life.
- Estimated $4,000 (depends on number and length of segment, as well as striping material).
- Costs for implementing this strategy are nominal and depend on the number and length of segment as well as the striping material (paint, thermoplastic, etc.). This CM can be effectively and efficiently implemented using a systematic approach with numerous and long locations, resulting in low to moderate cost projects that are more appropriate to seek state or federal funding.
- Eligible for 100% of federal funding.

Sources: CA-Local Roadway Safety Manual

R29. INSTALL NO-PASSING LINE.

Installed on roadways that have a high percentage of head-on crashes suggesting that many head- on crashes may relate to failed passing maneuvers. no-passing lines should be installed where drivers "passing sight distance" is not available due to horizontal or vertical obstructions. This treatment addresses all types of crashes that occur when drivers cannot differentiate the centerline markings between passing and no-passing area. This treatment only applies to crashes occurring within the limits of the new or extended no-passing zones.

R29 IMPLEMENTATION

BENEFIT-COST

- Implementation of this treatment reduces crashes by 45%.
- 10 years of expected life.
- Estimated $2,000 (varies).
- When considered at a single location, these low-cost improvements are usually funded through local funding by local maintenance crews. However, this treatment can be effectively and efficiently implemented using a systematic approach with numerous and long locations, resulting in low to moderate cost projects that are more appropriate to seek state or federal funding.
- Eligible for 100% of federal funding.

Sources: CA-Local Roadway Safety Manual

R30. INSTALL CENTERLINE RUMBLE STRIPS/STRIPES.

Set up on center Line rumble strips/stripes can be used on virtually any roadway – especially those with a history of head-on crashes. This treatment addresses all types of crashes; but, specifically, it addresses head-on and side-swipe crashes by alerting drivers (using rumble strips) that occur while driving outside the travel lane. This treatment only applies to crashes occurring within the limits of the new rumble strips/stripes.

R30 IMPLEMENTATION

BENEFIT-COST

- Implementation of this treatment reduces crashes by 20%.
- 10 years of expected life.
- Estimated $3,000 per mile.
- Costs for implementing this strategy are nominal and depend on the number and length of locations.
- Eligible for 100% of federal funding.

Sources: CA-Local Roadway Safety Manual

R31. INSTALL EDGELINE RUMBLE STRIPS/STRIPES.

Shoulder and edge line milled rumble strips/stripes should be used on roads with a history of roadway departure crashes. This treatment address run-off road crashes by providing an auditory indication (through a rumble strip) and tactile rumble when driver on, alerting drivers drifting out of their travel lanes. This treatment only applies to crashes occurring within the limits of the new rumble strips/stripes.

R31 IMPLEMENTATION

BENEFIT-COST

- Implementation of this treatment reduces crashes by 15%.
- 10 years of expected life.
- Estimated $3,000 per mile.
- Costs for implementing this strategy are nominal and depend on the number and length of locations.
- Eligible for 100% of federal funding.

Sources: CA-Local Roadway Safety Manual

R32PB. INSTALL BIKE LANES.

Roadway segments noted as having crashes between bicycles and vehicles or crashes that may be preventable with a buffer/shoulder. This type of CM addresses both pedestrian and bicycle crashes and only applicable to "Ped & Bike" crashes occurring within the limits of the class II (not class III) bike lanes. When an off-street bike-path is proposed that is not adjacent to the roadway, the applicant must document the engineering judgment used to determine which "Ped & Bike" crashes to apply.

EXISTING CONDITIONS

R32PB IMPLEMENTATION

BENEFIT-COST

- Implementation on this treatment reduces crashes by 35%.
- 20 years of expected life.
- Estimated $90,000 per quarter-mile on both sides with striped buffer.
- It is most cost efficient to create bike lanes during street reconstruction, street resurfacing, or at the time of original construction.
- Eligible for 90% of federal funding.

EXAMPLE LOCATION(S)

- Military E and E 5th Street, Benicia

Sources: CA-Local Roadway Safety Manual

R33PB. INSTALL SEPARATED BIKE LANES.

Separated bikeways are most appropriate on streets with high volumes of bike traffic and/or high bike-vehicle collisions. This CM only applies to “Ped & Bike” crashes occurring within the limits of the separated bike lanes. When an off-street bike-path is proposed that is not adjacent to the roadway, the applicant must document the engineering judgement used to determine which “Ped & Bike” crashes to apply.

BENEFIT-COST

- Implementation on this treatment reduces crashes by 45%.
- 20 years of expected life.
- Estimated $178,800 per quarter-mile on both sides with tack-on PCC curb
- It is most cost efficient to create bike lanes during street reconstruction, street resurfacing, or at the time of original construction.
- Eligible for 90% of federal funding.

Sources: CA-Local Roadway Safety Manual

EXISTING CONDITIONS

R33PB IMPLEMENTATION

R34PB. INSTALL SIDEWALK/PATHWAY (TO AVOID WALKING ALONG ROADWAY).

Suitable for areas noted as not having adequate or no sidewalks and a history of walking along road- way pedestrian crashes. In rural areas asphalt curbs and/or separated walkways may be appropriate. This treatment addresses pedestrian and bicycle crashes by providing sidewalk and walkway people to travel within the public right-of-way that is separated from roadway vehicle. This treatment only applies to “Ped & Bike” crashes occurring within the limits of the new walkway. Also this treatment is not intended to be used where an existing sidewalk is being replaced with a wider one, unless prior Caltrans approval is included in the application. Lastly, when an off-street multi-use path is proposed that is not adjacent to the roadway, the applicant must document the engineering judgement used to determine which “Ped & Bike” crashes to apply.

BENEFIT-COST

- Implementation of this treatment reduces crashes by 80%.
- 20 years of expected life.
- Estimated $200,000 (varies type of project).
- Costs for sidewalks will vary, depending upon factors such as width, materials, and existing of curb, gutter and drainage.
- Eligible for 90% of federal funding.

Sources: CA-Local Roadway Safety Manual

R35PB. INSTALLED PEDESTRIAN CROSSING (WITH ENHANCED SAFETY FEATURES).

Set up on roadway segments with no controlled crossing for a significant distance in high-use mid-block crossing areas and/or multilane roads locations. This treatment addresses both pedestrian and bicycle by adding the following: curb extensions, raised medians, beacons, and lighting, combined with pavement markings delineating a portion of the roadway that is designated for pedestrian crossing. This treatment is not intended to be combined with the "install raised pedestrian crossing" when calculating the improvement's B/C ratio. Also, this treatment is not intended to be used for high-cost aesthetic enhancements to intersection crosswalk (i.e. stamped concrete or stamped asphalt). Lastly, this treatment only applies to "Ped & Bike" crashes occurring in the influence area (expected to be a maximum of within 250') of the new crossing which includes new enhanced safety features.

BENEFIT-COST

- Implementation of this treatment reduces crashes by 35%.
- 20 years of expected life.
- Estimated $200,000 varies on extent of treatment.
- Costs associated with this strategy will vary widely, depending on the extent of the curb extensions, raised medians, flashing beacons, and other pedestrian safety elements that are needed with the crossing. When considered at a single location, these improvements can sometimes be low cost and funded through local funding by local crews.
- Eligible for 90% of federal funding.

Sources: CA-Local Roadway Safety Manual

R36PB. INSTALLED RAISED PEDESTRIAN CROSSING.

Install on lower-speed roadways, where pedestrians are known to be crossing roadways that involve significant vehicular traffic. This treatment addresses pedestrian and bicycle crashes by enhancing pedestrian safety at locations noted as being especially problematic. Special requirements may apply and extra care should be taken when considering installing raised crossings to ensure unintended safety issues are not created, such as: emergency vehicle access or truck route issues.

BENEFIT-COST

- Implementation of this treatment reduces crashes by 35%.
- 20 years of expected life.
- Estimated $50,000 (varies).
- Cost varies on elements of the raised crossing and the need for a new curb ramps and sidewalk modifications.
- Eligible for 90% of federal funding.

Sources: CA-Local Roadway Safety Manual

R36PB IMPLEMENTATION

R37PB. INSTALL RECTANGULAR RAPID FLASHING BEACON (RRFB).

Rectangular Rapid Flashing Beacon (RRFB) includes pedestrian-activated flashing lights and additional signage that enhance the visibility of marked crosswalks and alert motorists to pedestrian crossings. RRFBs are installed at unsignalized intersections and mid-block pedestrian crossings. This CM only applies to "Ped & Bike" crashes occurring in the influence area (expected to be a maximum of within 250') of the crossing which includes the RRFB.

BENEFIT-COST

- Implementation of this treatment reduces crashes by 35%.
- 20 years of expected life.
- Estimated cost.
- RRFBs are a lower cost alternative to traffic signals and hybrid signals. This CM can often be effectively and efficiently implemented using a systematic approach with numerous locations.
- Eligible for 100% of federal funding.

Sources: CA-Local Roadway Safety Manual

EXISTING CONDITIONS

R37PB IMPLEMENTATION

R38PB. INSTALL ANIMAL FENCING.

Installed at locations with high percent of vehicular/animal crashes (reactive) or where there is a known high percent of animals crossing due to migratory patterns (proactive). This treatment addresses animal type related crashes by adding fencing that channelize animals to a natural or man-made crossing. This treatment only applies to "animals" crashes occurring within the limits of the new fencing.

BENEFIT-COST

- Implementation of this treatment reduces crashes by 80%.
- 20 years of expected life.
- Estimated $3,000 per installation.
- Costs will be fairly low but can increase greatly for longer segment lengths.
- Eligible for 90% of federal funding.

Sources: CA-Local Roadway Safety Manual

FIGURE LINKS

Signalized (S)

S1a https://www.aaroads.com/california/ca-238.html

S1b https://www.aaroads.com/california/ca-262.html

S2a http://santaclaritacitybriefs.com/2016/02/26/new-blue-light-traffic-enforcement-tool-installed-at-seven-intersections-throughout-santa-clarita/

S2b http://wishtv.com/2016/02/16/new-traffic-signals-aim-to-reduce-crashes/

S3a http://www.k-state.edu/roundabouts/ada/news/USNews.htm

S3b https://parade.com/19072/marilynvossavant/what-would-traffic-light-synchronization-cost/

S4a https://www.aaroads.com/forum/index.php?topic=1824.0

S4b http://www.advancedtraffic.com/products/wavetronix/smartsensor-advance/

S5a https://ops.fhwa.dot.gov/publications/fhwahop08024/chapter9.htm

S6a https://www.flickr.com/photos/raymondyue/8299071442

S6b https://www.flickr.com/photos/raymondyue/7130680785/sizes/l/

S7a https://www.fhwa.dot.gov/publications/research/safety/09036/index.cfm

S7b http://www.madriverunion.com/samoa-boulevard-traffic-light-system-changed-up/

S8a http://www.mantecabulletin.com/archives/77790/

S8b http://www.trafficsignals.net/west.htm

S9b http://elteccorp.com/warning_systems/solar-powered-lighting-systems/

S10a http://www.health.com/weight-loss/traffic-light-calorie-label

S10b https://www.ticketsnipers.com/article/red-light-cameras-may-increase-traffic-tickets-at-local-intersection

S11a http://www.cochraneeagle.com/article/Cochrane-familes-celebrate-cultural-diversity-20170803

S11b https://rspcb.safety.fhwa.dot.gov/noteworthy/html/edccasestudy_ky.aspx

S12a http://www.jurist.org/hotline/2014/03/zachary-heiden-maine-panhandling.php

S12b https://safety.fhwa.dot.gov/hsip/hrrr/manual/sec42.cfm

S13PBa http://sfcitizen.com/blog/2015/12/09/abbey-road-vs-post-street-even-the-long-haired-beatles-didnt-bring-along-chilrens-is-jaywalking-a-general-motors-conspiracy/

S13PBb http://erectionswa.com.au/products/ingal-pedestrian-barrier/

S14a https://bouldercolorado.gov/transportation/median-maintenance

S14b Unknown

S15a TBD

S15b TBD

S16a Unknown

S16B Google Streetview

S17PBa Google Streetview

S17PBb Unknown

S18PBa Unknown

S18PBb https://www.minnpost.com/cityscape/2014/07/everything-youve-always-wanted-know-about-crosswalks

S19PBa TBD

S19PBb TBD

S20PBa Google Streetview

S20PBb Google Streetview

S21PBa TBD

S21PBb TBD

Non-Signalized (NS)

NS1a Google Streetview

NS1b Unknown

NS2a Google Streetview

NS2b http://www.ite.org/uiig/types.asp

NS3a http://www.ite.org/uiig/problems.asp

NS3b Unknown

NS4a TBD

NS4b TBD

NS5a https://www.flickr.com/photos/repowers/2933707788/

NS5b Unknown

NS6a https://alchemistsdiary.wordpress.com/2017/07/22/

NS6b http://www.xwalk.com/pages/TS40-R5-1-Do-Not-Enter.htm

NS7a Unknown

NS7b http://www.pinsdaddy.com/signal-ahead-pavement-markings_pmmyKaBIkhEBxPhrBiiWMkFlQQFWhfqxyj3AuCoWiME/

NS8a http://www.ite.org/uiig/types.asp

NS8b http://www.renewa.es/renewa31/index.php/balizamiento/trafico/115-trafico/zonas-escolares/194-r829-semaforo-solar-zona-escolar

NS9a http://www.sfexaminer.com/stop-signs-installed-at-marina-intersection-where-driver-struck-boys/

NS9b Unknown

NS10a http://www.cleveland.com/berea/index.ssf/2012/11/berea_changes_stop_sign_parkin.html

NS10b https://radiobintangsembilan.com/2016/03/07/hindari-kecelakaan-anak-sekolah-warga-minta-garis-kejut/

NS11a https://www.strongtowns.org/journal/2017/4/18/are-one-way-streets-really-that-bad

NS11b Unknown

NS12a http://www.cochraneeagle.com/article/Cochrane-familes-celebrate-cultural-diversity-20170803

NS12b https://rspcb.safety.fhwa.dot.gov/noteworthy/html/edccasestudy_ky.aspx

NS13a https://safety.fhwa.dot.gov/hsip/hrrr/manual/sec43.cfm

NS13b https://safety.fhwa.dot.gov/intersection/other_topics/fhwasa08008/ue3.cfm

NS14a http://www.jurist.org/hotline/2014/03/zachary-heiden-maine-panhandling.php

NS14b https://www.edmonton.ca/transportation/on_your_streets/neighbourhood-traffic-concerns.aspx

NS15a https://bouldercolorado.gov/transportation/median-maintenance

NS15b Unknown

NS16a TBD

NS16b TBD

NS17a Google Streetview

NS17b https://ux.stackexchange.com/questions/42867/how-does-the-projection-angle-of-road-arrows-change-drivers-expectations-of-the

NS18a https://en.wikipedia.org/wiki/Uncontrolled_intersection

NS18b http://www.mikeontraffic.com/left-turn-lane-design-factors/

NS19PBa https://www.vosizneias.com/36699/2009/08/13/new-jersey-undercover-police-to-enforce-pedestrian-crosswalks-rules/

NS19PBb http://njbikeped.org/helping-to-tame-multi-lane-crossings/

NS20PBa N/A

NS20PBb https://michigancompletestreets.wordpress.com/2014/01/21/mid-block-pedestrian-crossings-explained/

NS21PBa N/A

NS21PBb https://nacto.org/publication/urban-bikeway-design-guide/bicycle-boulevards/major-street-crossing/

NS22PBa TBD

NS22PBb TBD

NS23PBa http://www.ite.org/uiig/ada.asp

NS23PBb https://www.fhwa.dot.gov/publications/research/safety/10045/index.cfm

Roadway Segments (R)

R1a https://www.aaroads.com/california/ca-238.html

R1b https://www.aaroads.com/california/ca-074.html

R2a Unknown

R2b Unknown

R3a Google Streetview

R3b Unknown

R4a Google Streetview

R4b https://www.reddit.com/r/funny/comments/4zcplq/a_local_plumbers_truck_decal/

R5a Unknown

R5b http://lslee.com/attenuators/Impact-Attenuators

R6a http://toolkit.irap.org/default.asp?page=treatment&id=57

R6b http://www.engr.uconn.edu/~garrick/ce371/l12-14.htm

R7a https://www.roadsbridges.com/lindsay-transportation-solutions

R7b https://www.fhwa.dot.gov/publications/publicroads/09mar/05.cfm

R8a N/A

R8b https://safety.fhwa.dot.gov/intersection/other_topics/corridor/cam_tech/sa1500505.cfm

R9a N/A

R9b https://safety.fhwa.dot.gov/intersection/other_topics/corridor/cam_tech/sa1500504.cfm

R10PBa N/A

R10PBb N/A

R11a N/A

R11b http://modot.mo.gov/northeast/programs/generalintersectionetiquette.htm

R12a N/A

R12b N/A

R13a N/A

R13b N/A

R14a https://www.littlerock.gov/for-residents/bikeped-little-rock/projects/road-diets/road-diets-and-safety/

R14b https://www.littlerock.gov/for-residents/bikeped-little-rock/projects/road-diets/road-diets-and-safety/

R15a Unknown

R15b http://ruraldesignguide.com/gallery

R16a TBD

R16b TBD

R17a N/A

R17b http://www.cahighways.org/137-144.html

R18a N/A

R18b N/A

R19a N/A

R19b N/A

R20a N/A

R20b N/A

R21a N/A

R21b N/A

R22a N/A

R22b N/A

R23a N/A

R23b https://www.fhwa.dot.gov/publications/research/safety/15030/009.cfm

R24a N/A

R24b http://countyprogress.com/road-safety-101/

R25a N/A

R25b https://safety.fhwa.dot.gov/roadway_dept/horicurves/fhwasa15084/ch4.cfm

R26a N/A

R26b https://www.fhwa.dot.gov/publications/publicroads/16marapr/04.cfm

R27a N/A

R27b https://safety.fhwa.dot.gov/roadway_dept/horicurves/fhwasa07002/ch2.cfm

R28a N/A

R28b N/A

R29a N/A

R29b https://content.govdelivery.com/accounts/ORDOT/bulletins/119b591

R30a N/A

R30b http://www.ct.gov/dot/cwp/view.asp?a=3199&q=526532

R31a N/A

R31b https://safety.fhwa.dot.gov/roadway_dept/pavement/rumble_strips/bike_ig/

R32PBa http://www.latimes.com/politics/la-pol-sac-enviro-bike-lanes-20160407-story.html

R32PBb http://moderntransit.org/expy/pa.html

R33PBa TBD

R33PBb TBD

R34PBa N/A

R34PBb N/A

R35PBa N/A

R35PBb N/A

R36PBa N/A

R36PBb https://www.arrivealive.co.za/Traffic-Calming-Speed-Calming-and-Road-Safety

R37PBa TBD

R37PBb TBD

R38PBa N/A

R38PBb http://www.henrycoate.co.uk/RCsite/HIGHWAYS%20AND%20RAILWAY%20FENCE%20SYSTEM.html

SECTION 1.2 NON-INFRASTRUCTURE STRATEGIES TOOLBOX

NON-INFRASTRUCTURE COUNTERMEASURES

Supplementing infrastructure-related countermeasures included above, this next section focuses on non-infrastructure countermeasures. This includes focused community engagement, policies and data, and additional safety countermeasures that fall under the Safe System elements including Safe Vehicles, Safe Road Users, Post-Crash Care, and Safe Speeds.

COUNTERMEASURES THAT WORK

In contrast to infrastructure-focused countermeasures, non-engineering countermeasures do not have an associated benefit-cost ratio. The National Highway Traffic Safety Administration (NHTSA) published the *Countermeasures That Work: A Highway Safety Countermeasure Guide for State Highway Safety Offices* (Tenth Edition, 2020). This document serves as a guide for practitioners in selecting effective, evidence-based countermeasures for traffic safety problems such as alcohol and drug impaired driving, speeding and speed management, and pedestrian and bicycle safety.
Each countermeasure includes an effectiveness rating, if applicable. Effectiveness of any countermeasure varies immensely depending on its implementation, broad publication to all communities, and satisfactory funding. The effectiveness data likely shows the maximum effect that can be achieved through comprehensive implementation and will only be listed if data is available.

★★★★★	★★★★	★★★	★★	★
Demonstrated to be effective by several high-quality evaluations with consistent results	**Demonstrated to be effective** in certain situations	**Likely to be effective** based on balance of evidence from high-quality evaluations or other sources	**Effectiveness still undetermined;** different methods of implementing this countermeasure produce different results	**Limited or no** high-quality evaluation evidence

EQUITABLE & CULTURALLY RELEVANT COMMUNITY ENGAGEMENT

Community engagement is not a one-size-fits-all model. By developing culturally relevant engagement strategies, all participants are invited into conversations about safety. Culturally relevant engagement strategies can help education and programming around traffic safety reach a larger audience and be more impactful.

Culturally relevant community engagement may include dissemination of materials and presentation of information in multiple languages, including English, Spanish, and/or Tagalog. Hosting safety-related engagement events at local parks of businesses may provide better accessibility and comfort for residents to receive information and provide feedback. Additionally, the creation of a Street Safety Ambassador Program can also help to build awareness within specific communities around roadway safety issues. Culturally relevant community engagement could be considered during the implementation of all roadway safety projects.

BEST PRACTICE RESOURCES:

The Los Angeles Department of Transportation (LADOT) Vision Zero Division launched the Dignity-Infused Community Engagement (DICE) strategy in 2019[1], which aims to center community members in the Vision Zero planning process from the beginning and weave all perspectives and lived experiences into the technical planning process. The DICE approach includes collaboration with local community-based organizations (CBOs); the provision of childcare, transportation, interpretation, and food at all engagement events; and the development of unique, culturally relevant engagement approaches that weave in community identity and markers. Beyond promoting the initiative, the dignity-infused planning process is an expansive approach to community engagement that seeks to heal and atone for the negative impacts of systems and practices within Los Angeles as well as the broader field of transportation planning.

[1] https://ladotlivablestreets.org/content-detail/Dignity-Infused-Community-Engagement-Strategy#:~:text=The%20Vision%20Zero%20Dignity%2DInfused,into%20the%20technical%20planning%20process

POLICIES AND DATA

When it comes time to make tradeoff decisions between vehicle roadway operations, parking, and safety, having policies in place guiding decision makers on prioritizing vulnerable users can streamline processes and provide consistency. Data inventory and management also play a role in the city's overall non-infrastructure framework for safety. Using advanced technology to determine crash risks allows cities to be proactive and systemic when identifying projects for funding and implementation.

PD1. SET A VISION ZERO GOAL.

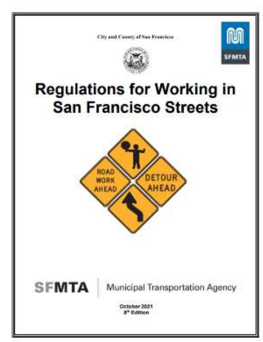
Becoming a Vision Zero jurisdiction includes a commitment to a goal of "zero" KSI collisions by an identified year. Jurisdictions must establish performance management strategies with periodic review and progress tracking.

PD2. SET A VISION ZERO POLICY THAT OUTLINES TRADEOFF DECISION MAKING AND PRIORITIZES VULNERABLE USERS.

Oversight and accountability of an LRSP includes a need for leadership. This includes strategies such as identifying a champion to advocate for the LRSPs project development and implementation. To prioritize zero deaths and severe injuries through projects and policies, a mayoral or City Council directive or ordinance can be enacted to acknowledge the need for trade-offs on the roadway system.

PD3. CONSTRUCTION ACCESSIBILITY POLICY.

Having a policy in place for accessibility to be maintained during construction and road maintenance projects is crucial for maintaining safety on City roads. These policies, including bicycle and pedestrian safety, can be included in a memorandum or report put out by a local jurisdiction. Some examples are City of Oakland Design Guidance[2] and Regulations for Working in San Francisco Streets[3].



[2] http://www2.oaklandnet.com/oakca1/groups/pwa/documents/memorandum/oak062315.pdf

[3] https://www.sfmta.com/sites/default/files/reports-and-documents/2021/10/blue_book_8th_ed_accessible_rev_10-2021v3_0.pdf

PD4. CRASH RISK INDICATORS.

Surrogate safety measures, such as "near-miss" collisions, hard braking data, speed data, community-reported hazards, and high stress facilities provide an understanding of the safety landscape and enable proactive interventions. Near misses have historically been difficult to study in practical safety applications due to an overall lack of reported information. In the absence of sufficient crash data, near miss data is an important indicator for guiding crash prevention. There are several technologies that are closing the gap and providing key safety insights regarding near misses, including:

- Video data — Video machine learning is an effective means of classifying collisions and collecting near miss data.
- Public crowdsourcing —Online web crowdsourcing platforms, such as UC Berkeley's SafeTREC Street Story tool (available in English and Spanish), allow anyone to anecdotally report incidents of near misses: https://safetrec.berkeley.edu/tools/street-story-platform-community-engagement. These data points are publicly available for analysis and contain important contextual information based on geographic location (e.g., road conditions, street lighting, and travel mode). Using a platform like Street Story in future projects also advances community education and engagement around road safety by providing an outlet and way for people to connect around each other's stories. Social pinpoint is another platform that allows for online and geolocated public input on safety needs and perceptions.

PD5. CONTEXTUAL DATA INVENTORY.

Up-to-date data on transportation infrastructure, including roadway characteristics, intersection characteristics, and signs, are valuable for planning and implementing future improvements. With an updated inventory, cities can identify project synergies, such as including a safety countermeasure with a repaving project. Finally, enhanced contextual data supports systemic safety analysis for future safety plans and evaluations. Examples of service providers available to assist with this work include the following:

- Mapillary uses crowdsourced or privately provided street-level imagery to extract and map signs, streetlamps, sidewalks, signals, and other objects: https://www. mapillary.com/
- Ecopia uses satellite imagery to extract features such as road centerlines, roadway cross-sections, sidewalks, and more: https://www.ecopiatech.com/

PD6. CRASH REPORTING.

Crash reporting practices, such as complete data collection and documentation of road user behavior and infrastructure, and sharing data across agencies or organizations (e.g., law enforcement, health officials, transportation officials, and hospitals) can lead to a greater understanding of the holistic safety landscape, and thus lead to improved investments in safety.

The following countermeasures follow the Safe System Elements including Safe Vehicles, Safe Road Users, Post-Crash Care, and Safe Speeds.

SAFE VEHICLES

SV1. EMERGING TECHNOLOGY, INCLUDING AUTONOMOUS AND CONNECTED VEHICLES.

Connected and Automated Vehicle (CAV) Readiness Planning

Having strategies prepared to meet and address the oncoming challenges posed by connected and automated vehicle (CAV) technology is crucial in advancing road safety. Fully automated vehicles have the potential to modify travel behavior and improve safety outcomes given that CAVs are ultimately intended to operate lawfully and eliminate or reduce human error. However, the need to integrate CAVs into the transportation system in the short term where there will be a mix of automated and non-automated vehicles also poses challenges.

Some strategies for preparation include educating the public on current and future safety features and limitations, continuing to upgrade signal equipment, installing EV charging citywide, installing Intelligent Transportation Systems (ITS) to enable vehicle safety features, identifying the ability for future fleet purchases to include CAV technology, having policies around curbside management, having policies around truck routes to keep them off main arterials if feasible, and maintaining roadway surfaces, striping and signage.

BEST PRACTICE RESOURCE

NHTSA Automated Vehicles for Safety

CONTEXT

Countywide

SAFE ROAD USERS

SRU1. EDUCATION AND PUBLIC AWARENESS CAMPAIGNS – TARGETED AT SPECIFIC BEHAVIORS.

Cities can expand upon any existing social media and portable and City Hall message boards to establish an ongoing public education media campaign focused on safe and responsible driving, discouraging drinking and driving, along with encouraging increased awareness of pedestrians and bicyclists. An example of this campaign is collaboration with local radio stations to disseminate safety messages. Cities can also coordinate with Solano County Health & Social Services or partner with school districts to host OTS Safety Programs or Campaigns at schools, libraries, parks or other high-volume pedestrian and bicycle areas that focus on raising awareness about traffic rules, rights, and responsibilities for all users.

The OTS Go Safety California campaign has free resources for local agencies to use in implementing public awareness campaigns.

BEST PRACTICE RESOURCES

USDOT Traffic Safety Marketing | OTS Go Safely California Campaign

San Francisco Municipal Transportation Agency's "Be Nice, Look Twice" pedestrian safety campaign and "Safety - It's Your Turn" campaign through social media, billboards, and bus posters, shown in multiple languages.

EFFECTIVENESS

★ ★ ★

Mass media campaign on DUI

CONTEXT

Countywide

SRU2. PARTNER WITH LOCAL BUSINESSES AND ORGANIZATIONS ON HOT SPOT CORRIDORS.

Local partners serve as community liaisons between STA, cities, and the public. Conducting targeted education with community partners and public institutions (businesses, libraries, churches, cultural organization) along the hot spot corridors strengthens the engagement process by building trust and drawing on an established base of stakeholders. Educational materials can include pamphlets, stickers, window displays, etc. This effort can include materials for libraries to display on bicycle safety or for restaurants to display resources to ensure patrons do not drive while under the influence (e.g., safe ride home number, local taxi number, etc.).

BEST PRACTICE RESOURCES

USDOT Traffic Safety Marketing | OTS Go Safely California Campaign

USDOT Traffic Safety Marketing provides images and GIFs discouraging DUI that can be displayed or posted on restaurants and nightlife establishments' social media accounts.

EFFECTIVENESS

★★★★

Pedestrian Safety Zones

★★★

Communications and Outreach Supporting Enforcement

CONTEXT

Hot Spot Corridors

SRU3. IMPROVE INFRASTRUCTURE CONNECTIVITY FOR VULNERABLE USERS.

Cities can apply for grant funding that supports safe and connected infrastructure for all roadway users. This includes addressing gap closures in bicycle facilities and sidewalks and prioritizing low stress connections to key destinations. STA's 2020 Solano County Active Transportation Plan can serve as a guide with previously identified projects.

BEST PRACTICE RESOURCES

STA Solano County Active Transportation Plan

STA's Solano County ATP provides project recommendations for all cities participating in this LRSP. Cities can apply for grant funding using the project recommendations included in the report, which includes a prioritization ranking and estimated cost.

CONTEXT

Countywide

SRU4. HIGH VISIBILITY ENFORCEMENT.

High-visibility enforcement is a multifaceted approach to enforcement that garners public attention to traffic safety laws through highly visible patrols, such as checkpoints, saturation patrols, or message boards. OTS provides three grant funding sources to supplement CHP in their high-visibility enforcement goals. The goal for Get Education and Ride Safe III (GEARS III) is to reduce the number of motorcycle-involved KSI collisions. The goal of the Safer Highways Statewide grant is to reduce the number of alcohol-involved KSI collisions. Lastly, the Regulate Aggressive Driving and Reduce Speed V (RADARS V) grant is aimed at reducing the number of victims killed or injured due to speed, improper turning, driving on the wrong side of the road, or reckless driving-related collisions.

The goal of high-visibility enforcement is to promote voluntary compliance with traffic laws and, according to National Highway Traffic Safety Administration (NHTSA) research, it is one of the most effective enforcement strategies for safety outcomes.[4]

EQUITY CONSIDERATIONS

Enforcement of traffic laws is a common strategy to increase street safety, but historical enforcement techniques and strategies have raised concerns about racial profiling, police violence, and the impacts of policing on communities of color. According to the US Department of Justice, Black and Hispanic people are more likely than white people to experience use of force when they are stopped by police. To ensure that efforts to improve safety recognize that all people have the right to move about their communities safely, cities have shifted to equity-based strategies that target specific reckless behaviors that pose the highest safety risk while working to mitigate potential inequities in enforcement. Equity considerations can be considered in a range of enforcement strategies, including enacting progressive fine structures, analyzing demographic data in traffic citations

EFFECTIVENESS

★★★★★

Publicized Sobriety Checkpoints

★★★★

High-Visibility Saturation Patrols

CONTEXT

Countywide

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[4] Richard, C. M., Magee, K., Bacon-Abdelmoteleb, P., & Brown, J. L. (2018). Countermeasures That Work: A Highway Safety Countermeasure Guide For State Highway Safety Offices, 2017 (No. DOT HS 812 478). United States. Department of Transportation. National Highway Traffic Safety Administration. https://www.nhtsa.gov/sites/nhtsa.gov/files/documents/812478_countermeasures-that-work-a-highway-safety-countermeasures-guide-.pdf. Accessed February 14, 2022.

SRU5. EXPAND SAFE ROUTES TO SCHOOL.

Expansion of school area traffic safety measures provides an opportunity to conduct further outreach on projects proposed in this LRSP, expand the toolkit to additional school areas, and pair engineering and non-engineering countermeasures citywide. This is funded through the Safe Routes to School grant awarded to the City in partnership with school districts,

BEST PRACTICE RESOURCE

Safe Routes – National Center for Safe Routes to School

EFFECTIVENESS

★ ★ ★

Safe Routes to School

CONTEXT

Schools Countywide

SRU6. PAIR EDUCATION WITH KEY ENGINEERING & ENFORCEMENT COUNTERMEASURES.

Educational materials can be used to teach people how to use new and unfamiliar safety countermeasures, such as pedestrian hybrid beacons (PHB), roundabouts, or protected bikeways. Example materials include informational signs or demonstration videos, presented in multiple languages such as English, Vietnamese, and Spanish.

BEST PRACTICE RESOURCES

City of Berkeley "How to Use a Pedestrian Hybrid Beacon" Flyer: The informational flyer shown on the following page was paired with the installation of a new PHB and includes both driver and pedestrian instruction for properly using the new countermeasure.

City of San Francisco Informational Signs: The San Francisco Municipal Transportation Agency posted signs with a brief explanation next to a newly installed protected bike lane in multiple languages as part of their Vision Zero SF initiative. This approach was also applied to educate people about pedestrian scrambles and bus bulb outs.

City of Los Angeles Education through Pop-Up Installations: LADOT used temporary pop-up installations to introduce safety improvements in specific neighborhoods. Hay bales and planters were used to test the roundabout design and educate drivers on how to use the countermeasure. In addition to introducing safety improvements, pop-up installations can bring out emergency vehicles to ensure the vehicles can navigate around roundabouts or curb extensions.

City of Sacramento Bicycle Education Videos

https://www.cityofsacramento.org/Public-Works/Transportation/Programs-and-Services/Bicycling-Program/Bicycle-Videos

SRU7. SAFE RIDE HOME.

Partnerships between each City, STA, Police Departments, CHP, TNC Operators (e.g., Lyft, Uber), and local businesses can be facilitated to offer promotional codes for free or discounted rides home from establishments or events to reduce the potential for DUI, drowsy driving, or distracted driving. This program may be focused on particular holidays or event days, or applied more broadly to weekend nights.

BEST PRACTICE RESOURCE

Portland Bureau of Transportation (PBOT) Safe Ride Home Program

PBOT partnered with the Portland Police Bureau, TriMet, Old Town Hospitality Group, and Portland cab companies Radio Cab, Broadway Cab, New Rose City Cab and United Independent Cab, as well as transportation network companies Lyft and Uber to provide promo codes for discounted rides. The program is funded by a 50-cent fee charged for every taxi and TNC ride in Portland.

EFFECTIVENESS

★ ★ ★

Alternative Transportation

CONTEXT

Countywide

POST-CRASH CARE

PCC1. RAPID RESPONSE SAFETY COMMUNICATION PROTOCOL & MULTI-DISCIPLINARY TEAM.

City Public Works and Police Department staff work closely to address safety challenges at key collision locations. Each City can employ, or continue to employ, an internal, multi-department communication strategy in response to severe and fatal collisions. The protocol will outline a path forward for Public Works staff to be a part of the immediate on-the ground-response to an investigation of severe and fatal collisions, ensuring a multi-disciplinary response team focused both on the behavioral and engineering elements of a collision. This multi-disciplinary team also supports timely data sharing among City departments, ensures data accuracy, and develops near-term interventions.

BEST PRACTICE RESOURCES

San Francisco Vision Zero Traffic Fatality Protocol

This protocol is an efficient and standardized procedure for reporting, investigating, and collecting data on traffic fatalities, with coordination across multiple city agencies.

CONTEXT

Countywide

PCC2. VICTIM AND FAMILY SUPPORT.

Post-crash care includes providing resources to both the victim, their friends, and their families. To ensure a crash survivor receives the care needed to recover and restore body and mind to an active life within society, they require medical rehabilitation with specialists that can range from orthopedics, neurosurgery, physical and occupational therapy, and prosthetics to psychology and neuropsychology.

Resources for crash survivors, their family, and friends, can be found on Solano County Behavioral Health Services' website, https://www.solanocounty.com/depts/mhs/default.asp.

Severe and fatal collisions not only affect the victim involved, but their family and friends as well. Across the nation, in Canada, and locally in the San Francisco Bay Area, there are chapters of Families for Safe Streets. This group advocates at the state capitol in Sacramento and works with lawmakers and non-profits like Mothers Against Drunk Driving to share their stories and testify before legislative committees. Supporting victims' families comes in many forms. For example, World Day of Remembrance for Road Traffic Victims is an annual event held on the third Sunday in November in remembrance of those who have died or have been affected by motor vehicle collisions, and to draw attention to the goal of Vision Zero.

BEST PRACTICE RESOURCES

World Health Organization's Post-Crash Response: Supporting Those Affected by Road Traffic Crashes

This booklet[5] describes the consequences of crashes that may not only include physical injuries resulting in disability, but also psychological trauma. WHO recognizes that an effective post-crash response requires the integration of injury care, mental health services, legal support and legislation, and data on crashes and injuries.

CONTEXT

Countywide

[5] https://www.who.int/violence_injury_prevention/publications/road_traffic/Post-crash_response_booklet.pdf

SAFE SPEEDS

SS1. SPEED LIMIT MODIFICATION.

California Assembly Bill (AB) 43 was passed in methodology to lower speed limits on additional corridors. Cities will have increasing flexibility moving forward to consider context as they set speed limits.

AB 43 features the following five major components, focused on providing local jurisdictions more flexibility in setting speed limits, especially regarding vulnerable road users:

- Engineering & Traffic Survey (E&TS) - option to extend enforceable time period
- Post E&TS - agency can elect to retain current or immediately prior speed limit
- Speed Limit Reduction - reduction of additional 5 mph based on several factors, including designation of local "Safety Corridors"
- Prima Facie Speed Limits - options for 15 and 25 mph in certain zones
- Business Activity Districts - option for 20 or 25 mph

BEST PRACTICE RESOURCE

NACTO City Limits Setting Safe Speed Limits on Urban Streets Guide | California Assembly Bill 43

Seattle Department of Transportation Speed Limit Case Studies[6] In supporting their commitment to Vision Zero, the City of Seattle completed their work of lowering speed limits to 25 mph on most major streets (totaling around 415 miles of arterial streets) and installed nearly 2,500 new speed limit signs.

With funding from the voter-approved Levy to Move Seattle, the City created a policy of 25 mph on arterial streets with a speed limit of 20 mph on smaller streets and near schools when children are present. They already conducted a case study in five Seattle neighborhoods. The data showed that lowering speed limits and increasing sign density – without any marketing campaigns, additional enforcement, re-timed signals, or engineering changes to the roadway – resulted in a 20-40% drop in the number of crashes in the study locations.

CONTEXT

Countywide

---

[6] https://www.seattle.gov/Documents/Departments/SDOT/VisionZero/SpeedLimit_CaseStudies_Report.pdf

SS2. SAFE SPEEDS EDUCATION CAMPAIGN.

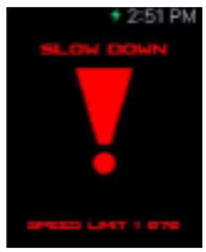
This measure creates a safety education campaign targeting safe speeds. This can include yard signs, wall boards/posters in prime injury-corridor neighborhoods, ads on bus exteriors, radio ads, changeable message signs, etc. To maximize effectiveness, this should be an ongoing program for cities.

The OTS Go Safety California campaign has free resources for local agencies to use in implementing public awareness campaigns.

BEST PRACTICE RESOURCES

USDOT Traffic Safety Marketing | OTS GO Safely California Campaign

Minnesota DOT Using Technology for In-Vehicle Alerts



Jurisdictions, such as the Minnesota Department of Transportation have also started to partner with technology companies to provide alerts to on-vehicle computer systems and phones when drivers pass through designated corridors that have been targeted for speed enforcement and education programs. These programs use geofencing technology and send push alerts urging drivers to travel at reasonable speeds.

EFFECTIVENESS

★ ★ ★

Communications and Outreach on Speeding

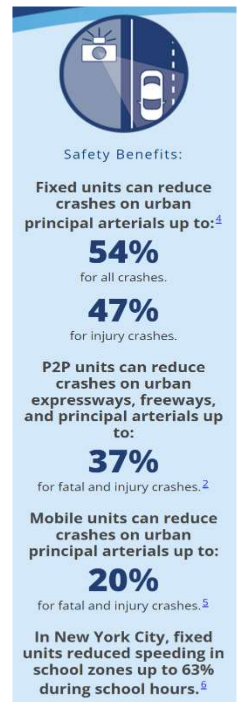
CONTEXT

Countywide

SS3. AUTOMATED ENFORCEMENT.

Automated enforcement methods, such as red-light cameras or speed safety cameras, equitably target the specific drivers who are behaving dangerously. Red light cameras (RLC) detect motor vehicles that pass over sensors in the pavement after a traffic signal has turned red. According to a National Cooperative Highway Research Program study conducted over five states, a downwards trend in red light running crashes and violations because of RLCs was reported.

Speed safety cameras (SSCs) use speed measurement devices to detect speeding and capture photographic or video evidence of vehicles that are violating a set speed threshold. SSCs can be deployed as fixed unit (single, stationary camera targeting one location), point-to-point (Multiple cameras capturing average speed over a certain distance) or mobile units (portable camera). The image to the right shows the safety benefits of SSCs.



Safety cameras are not currently allowed in California. City staff can monitor potential changes to state legislation for future use of this critical tool, should it become available.

BEST PRACTICE RESOURCE

EFFECTIVENESS

★★★★★

Automated Enforcement

CONTEXT

Countywide

SECTION 2: SOLANO COUNTY LOCAL ROAD SAFETY PLAN

Solano County
Local Road Safety Plan

SOLANO COUNTY 1850

DRAFT REPORT

June 2022

TJKM

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EXECUTIVE SUMMARY

The Solano County Local Road Safety Plan (LRSP) is a comprehensive plan that creates a framework to systematically identify and analyze traffic safety related issues and recommend projects and countermeasures in the unincorporated areas of Solano County. The LRSP aims to eliminate fatal and severe injury (F+SI) collisions through a holistic approach that includes setting a prioritized list of improvements under the 4 E's of traffic safety (Education, Enforcement, Engineering, and Emergency Medical Services [EMS]) that can enhance safety on local roadways.

The LRSP takes a proactive approach to addressing safety needs. It is viewed as a guidance document that can be a source of information and ideas. It can also be a living document, one that is routinely reviewed and updated by County staff and their safety partners to reflect evolving collision trends and community needs and priorities. With the LRSP as a guide, the County will be ready to apply for grant funds, such as the federal Highway Safety Improvement Program (HSIP) through Caltrans. This document summarizes the collision analysis, identifies high-risk locations and recommends countermeasures at each of these high-risk locations. This document is organized into seven chapters as follows:

CHAPTER 1 – INTRODUCTION

The Introduction presents the study, describes how this report is organized, summarizes the vision and goals, shows the study area, details how the report is organized and introduces the safety partners.

CHAPTER 2 – LITERATURE REVIEW

This chapter summarizes County and regional planning documents and projects that are relevant to the LRSP. It ensures that the recommendations of the LRSP are in line with established goals, objectives, policies, or projects.

CHAPTER 3 – COLLISION DATA COLLECTION AND ANALYSIS

This chapter summarizes the data analysis approach and presents preliminary as well as detailed collision analyses and findings. The analysis of F+SI collisions is performed by facility type (intersection and roadway segment). Collision data was obtained and analyzed for a five-year period from 2016 to 2020 from the California Highway Patrol's Statewide Integrated Traffic Records System (SWITRS) and the University of California at Berkeley SafeTREC's Transportation Injury Mapping Service (TIMS).

CHAPTER 4 - EMPHASIS AREAS

Emphasis areas are a focus of the LRSP that are identified through the various collision types and factors resulting in F+SI collisions within Solano County. The eight emphasis areas for Solano County are:

- Address Roadway Segment Collisions (collisions further than 250 feet [ft.] of intersections)
- Reduce Hit Object and Roadway Departure Collisions
- Reduce Improper Turning Collisions
- Address Driving Under the Influence Collisions
- Reduce Overturned Collisions
- Reduce Nighttime Collisions
- Reduce Motorcycle Collisions
- Address Younger Adult Party at Fault Collisions

CHAPTER 5 – COUNTERMEASURE IDENTIFICATION

Engineering countermeasures were selected for each of the high-risk locations and for the emphasis areas. These were based off of approved countermeasures from the Caltrans Local Roadway Safety Manual (LRSM) used in HSIP grant calls for projects. The intention is to give the County potential countermeasures for each location that can be implemented either in future HSIP calls for projects, or using other funding sources, such as the Solano County Capital Improvement Program. Non-engineering countermeasures were also selected using the 4 E's strategies, and are included with the emphasis areas and described in Chapter 5.

CHAPTER 6 – SAFETY PROJECTS

A set of nine safety projects were created for high-risk intersections and roadway segments, using groups of HSIP approved countermeasures that can help improve safety at the high-risk locations. These safety project sets are:

Project #1: Unsignalized Intersections: Transverse Rumble Strips, Upgrade Intersection Pavement Markings, and Flashing Beacon at Intersection

Project #2: Unsignalized Intersections: Install/Upgrade Larger or Additional Stop Signs or Other Intersection Warning/Regulatory Signs, and Flashing Beacons as Advance Warning

Project #3: Lighting Improvements at Unsignalized Intersections

Project #4: Unsignalized Intersections: Improve Payment Friction and Improve Sight Distance

Project #5: Roadway Segments: Install Edge line and Centerline Rumble Strips/Stripes

Project #6: Roadway Segments: Install Chevron Signs on Horizontal Curves, and Install Curve Advance Warning Signs with Flashing Beacons

Project #7: Roadway Segments: Install Delineators/Reflectors/Object Markers, and Install/Upgrade Signs with New Fluorescent Sheeting

Project #8: Roadway Segments: Install Guard Rail and Improve Pavement Friction (on curves)

Project #9: Install Edge line and Centerline Rumble Strips/Stripes, and Widen Shoulders

CHAPTER 7 – EVALUATION AND IMPLEMENTATION

The LRSP is a guidance document that is recommended to be updated every two to five years by Solano County in coordination with its safety partners. The LRSP document provides engineering, education, enforcement, and EMS -related countermeasures (the 4 E's of traffic safety) that can be implemented throughout the County to eliminate F+SI collisions. The chapter includes a list of potential grant funding sources that can help to implement the identified safety projects and countermeasures. After implementing countermeasures, the performance measures for each emphasis area should be evaluated annually. The most important measure of success of the LRSP should be eliminating F+SI collisions throughout the County. If the number of F+SI collisions does not decrease over time, then the emphasis areas and countermeasures should be re-evaluated.

INTRODUCTION

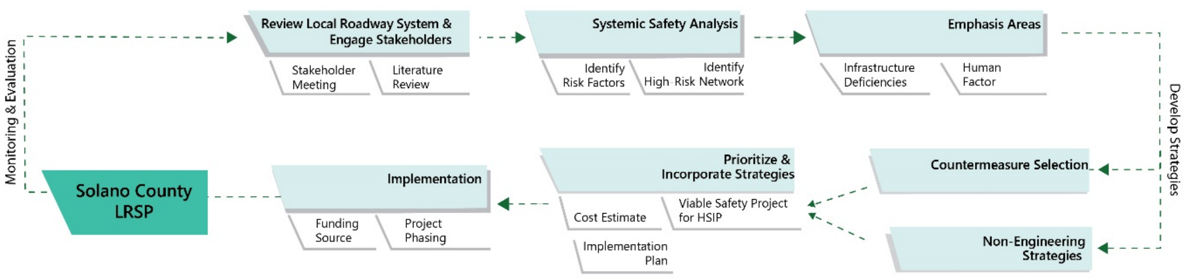
WHAT IS A LRSP?

The LRSP is a localized data-driven traffic safety plan that provides opportunities to address roadway safety needs and eliminating F+SI collisions. The emphasis is on reducing F+SI crashes because of the life-ending and life-changing effects of such collisions; if in the process the number of less severe injuries and property-damage only collisions is also reduced that will be an added benefit. The LRSP creates a framework to systematically identify and analyze traffic safety-related issues, and recommend safety projects and countermeasures. The LRSP facilitates the development of local agency partnerships and collaboration, resulting in the development of a prioritized list of improvements that can qualify for federal HSIP funding. The LRSP is a proactive approach to addressing safety needs and is viewed as a living document that can be constantly reviewed and revised to reflect evolving trends, and community needs and priorities.

PROCESS

The systemic approach used in preparing this LRSP involved the following steps (and shown in the graphic below):

- Develop plan goals and objectives
- Analyze collision data
- Meet with stakeholders/safety partners
- Determine focus areas and identify crash reduction strategies
- Prioritize countermeasures/projects
- Prepare the LRSP document



VISION STATEMENT OF THE SOLANO COUNTY LRSP

The County and its safety partners envision the elimination of fatal and severe injuries on roadways within unincorporated Solano County by creating an equitable, sustainable, multimodal transportation system where people of all ages and abilities can travel free from harm.

GOALS AND OBJECTIVES OF THE SOLANO COUNTY LRSP

GOAL #1: SYSTEMATICALLY IDENTIFY AND ANALYZE ROADWAY SAFETY PROBLEMS AND RECOMMEND IMPROVEMENTS

Objective 1: Use the Systemic Safety Analysis data-driven process to identify traffic collisions in the unincorporated areas (with an emphasis on F+SI collisions); where, when, and how they are occurring, and implement appropriate and proven rural road countermeasures.

Objective 2: Improve roadway planning, design, operations, and connectivity to enhance safety and mobility for users of all ages and abilities, with consideration to other rural roadway users (such as agricultural vehicles).

Objective 3: Implement traffic calming strategies to discourage speeding and other unsafe driving behaviors on residential streets, and on rural roadways where appropriate.

Objective 4: Ensure that all recommended improvements are consistent with County goals, as well as state and federal plans and goals (such as, but not limited to: California Strategic Highway Safety Plan, and the FHWA Local and Rural Road Safety Program).

Objective 5: Identify areas where cut-through traffic is occurring on unincorporated county roads as a result of increased congestion on nearby freeways, and implement strategies to improve safety along these corridors.

GOAL 2: IMPROVE THE SAFETY OF PEDESTRIANS AND BICYCLISTS BY USING PROVEN AND EFFECTIVE COUNTERMEASURES

Objective 1: Identify safety issues and hot spot locations where bicycle and pedestrian collisions occur in Solano County's unincorporated areas, and treat with appropriate and effective engineering countermeasures.

Objective 2: Provide educational programs for bicyclists, pedestrians, and motorists to inform them how to be safe in the public right-of-way; either through Solano Transportation Authority's (STA's) Safe Routes to School, law enforcement programs, or other public/private sponsored programs.

Objective 3: Improve sidewalks, walkways, and crossings to be free of hazards and increase the safety of crossing pedestrians.

GOAL 3: ENSURE COORDINATION AND COOPERATION OF KEY STAKEHOLDERS TO IMPLEMENT ROADWAY SAFETY IMPROVEMENTS AND EMERGENCY RESPONSE TO COLLISIONS WITHIN SOLANO COUNTY

Objective 1: Coordinate between County Departments, CHP, Sheriff's Office, Fire Districts, School Districts, and EMS agencies to ensure a coordinated and cooperative response to traffic safety, including:

- Implementation of safety improvements
- Public education on safely traveling in the public right-of-way, regardless of mode
- Enforcement of traffic safety laws in the public right-of-way
- Minimizing impacts to emergency response times

Objective 2: Coordinate with local, regional, and state partners (such as STA, Metropolitan Transportation Commission (MTC), or Caltrans), to identify and address traffic safety issues and ensure a coordinated response.

Objective 3: Coordinate with Solano County's incorporated cities to address mutual traffic safety concerns, and/or those near city limits.

GOAL 4: CONTINUALLY SEEK FUNDING FOR SAFETY IMPROVEMENTS

Objective 1: Ensure the LRSP meets HSIP guidelines in order to apply for funding for identified countermeasures.

Objective 2: Provide a list of prioritized improvements that guide County investments and grant funding applications.

Objective 3: Continually seek funding sources to implement engineering, education, enforcement, and emergency response solutions to roadway safety issues in Solano County.

GOAL 5: ENSURE THAT SAFETY IMPROVEMENTS ARE MADE IN A MANNER THAT IS FAIR AND EQUITABLE FOR ALL SOLANO COUNTY RESIDENTS

Objective 1: Where feasible, implement community outreach to inform the public about upcoming safety improvements and seek their input.

Objective 2: Provide a forum for residents to submit traffic safety related concerns; and for County staff and officials to respond to concerns.

Objective 3: Ensure the consideration of equity when selecting where to make traffic safety improvements.

STUDY AREA AND DEMOGRAPHIC INFORMATION

Solano County is located in the northeastern edge of the San Francisco Bay Area on Interstate 80 (I-80) midway between Sacramento and San Francisco. The County's estimated population is 453,491 (US Census 2020). According to the County's website, the estimated population in 2015 in the unincorporated areas of Solano County was 19,348. I-80 is the highest volume freeway in the county, connecting it with the rest of the Bay Area and Sacramento; supported by I-680, I-780, and I-505; as well as State Route (SR) 12, SR 29, and SR 113. Solano County is bordered by Napa County and Sonoma County to the west, Yolo County to the north and east, Sacramento County to the east, and Contra Costa County to the south. The study area is mapped in **Figure 1**.

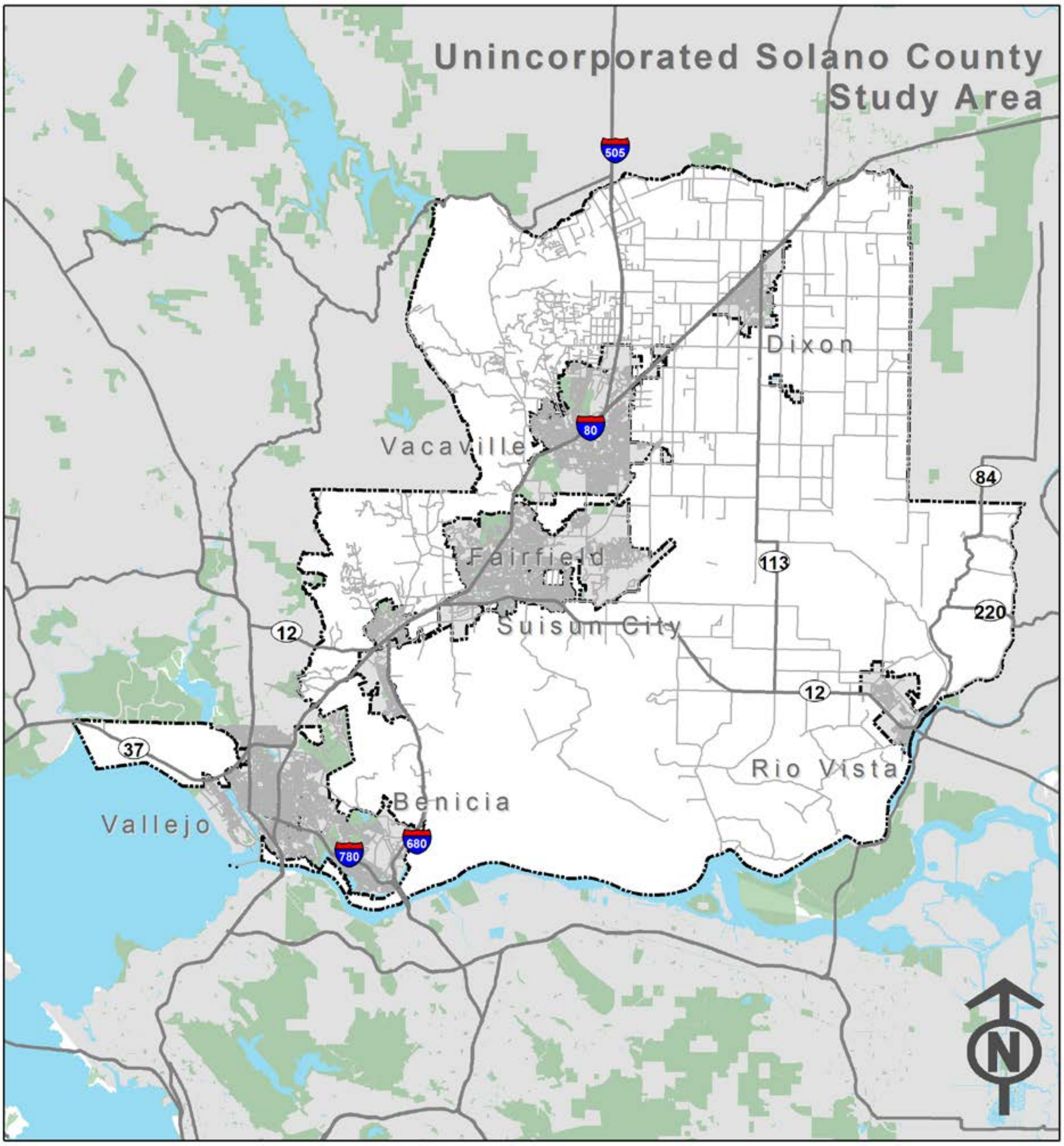


FIGURE 1: STUDY AREA

COMMUTE TO WORK

According to the U.S. Census Bureau's American Community Survey (ACS) 2015-2019 5-Year Estimates, 75.9% of Solano County commuters get to work by driving alone. The second most common method of commuting to work is carpooling at over 12%, which is higher than the state rate of 10.1% carpool commuters. The different modes of transportation used by Solano County residents to commute to work are shown in **Table 1**.

TABLE 1: SOLANO COUNTY COMMUTE TO WORK

COMMUTE TO WORK	SOLANO COUNTY	CALIFORNIA
Drive Alone	75.9%	73.7%
Carpool/Rideshare	12.7%	10.1%
Public Transportation	2.7%	5.1%
Walk	1.2%	2.6%
Bicycle/Motorcycle/Taxi Cab	1.2%	1.0%
Work from Home	6.4%	5.9%
Other	0.0%	1.6%

SAFETY PARTNERS

Safety partners are vital to the development of an LRSP and the implementation of priority projects. For Solano County, these include County Departments, CHP, and the STA. County staff and CHP attended a virtual stakeholder meeting, which took place on January 20, 2022 to review project goals and findings, and to solicit feedback from the group. Follow up coordination after the meeting also occurred with STA.

FIGURE 2: ZOOM MEETING FROM STAKEHOLDER MEETING

This stakeholder outreach was supplemented by a project website (www.solanocountysaferoads.com), with an interactive map tool platform. The interactive map was used to solicit input from Solano County residents outside the confines of traditional meetings.

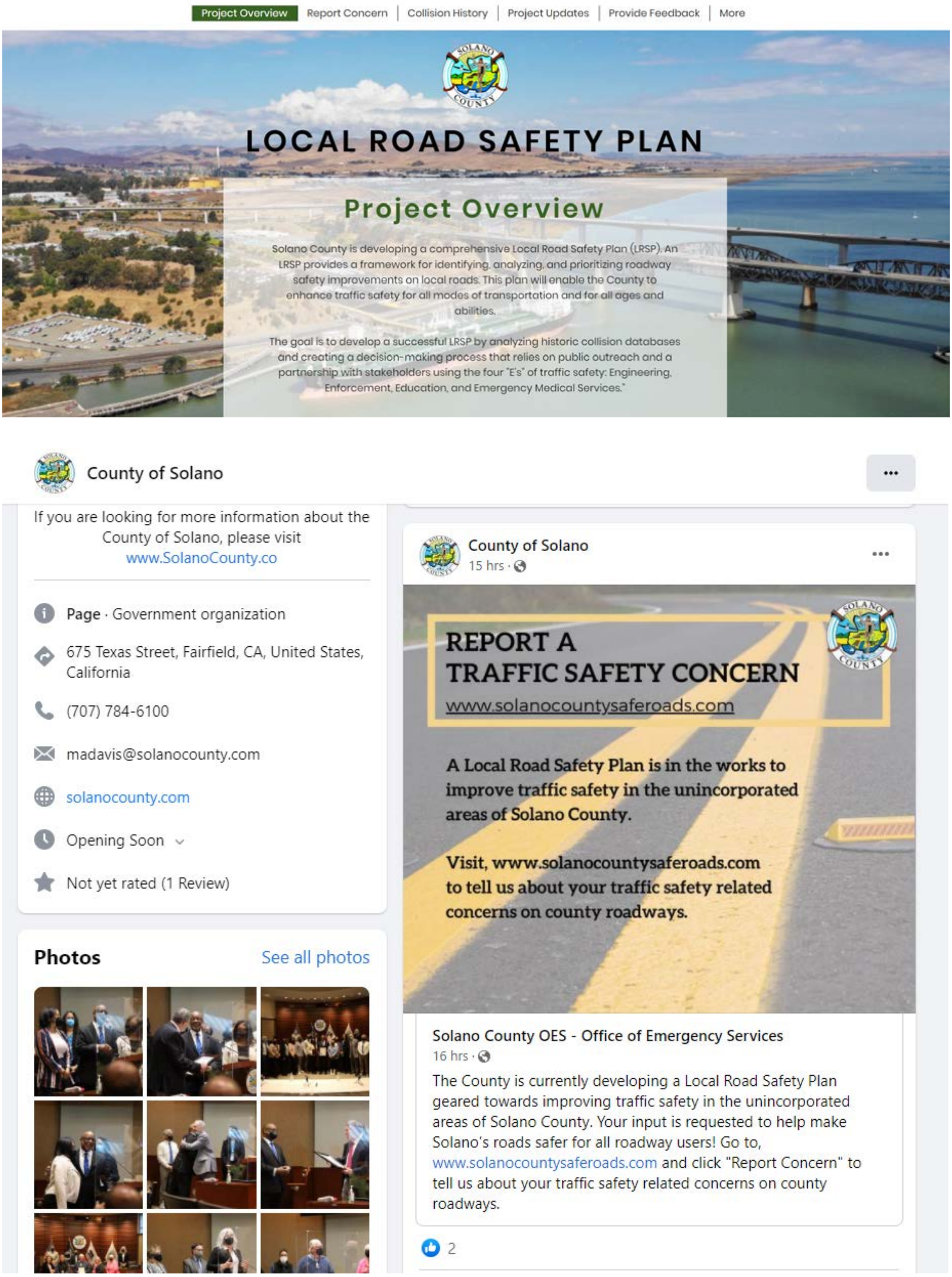


FIGURE 3: SOLANO COUNTY LRSP PROJECT WEBSITE AND FACEBOOK POST

In total, 51 comments were received on this map. The most common concern was speeding. The results of the interactive map are shown below in **Figure 4**, and summarized in **Figure 5**.

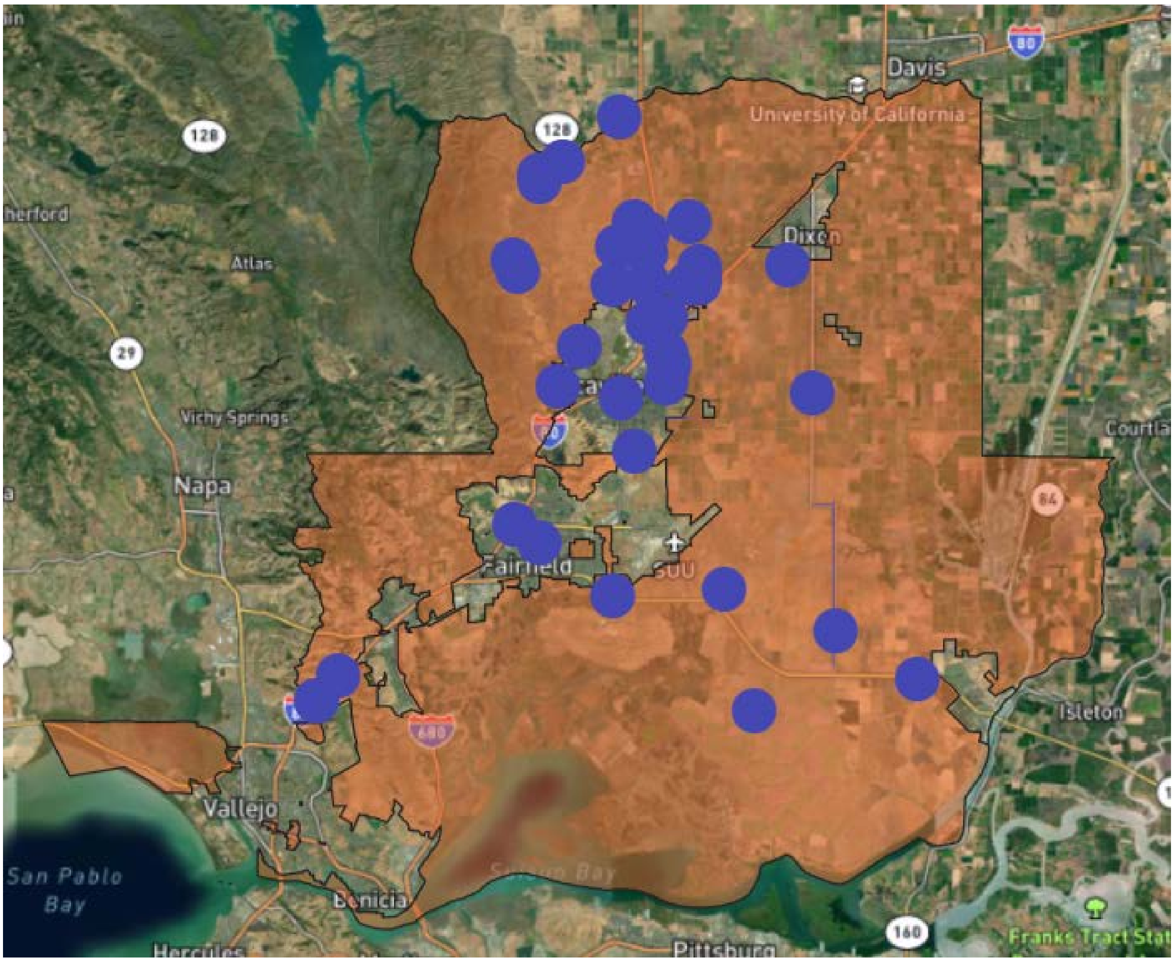


FIGURE 4: INTERACTIVE MAP COMMENT RESPONSES

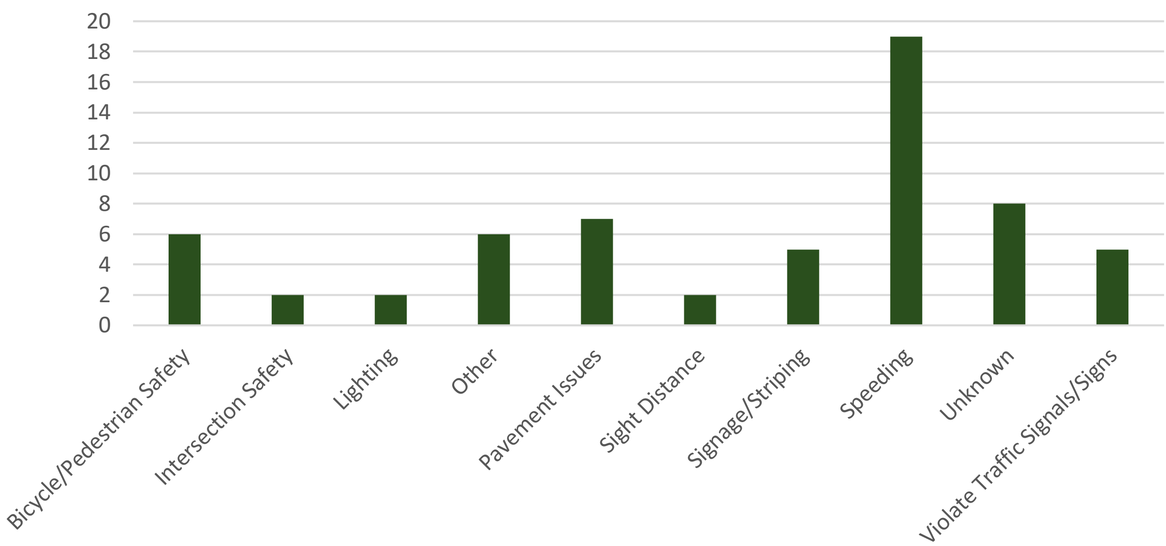


FIGURE 5: PUBLIC COMMENTS ON TRAFFIC SAFETY BY CATEGORY

EXISTING PLANNING EFFORTS

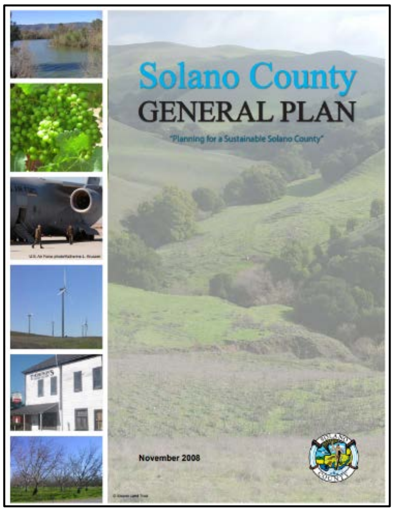
This chapter summarizes the planning documents, projects underway, and studies reviewed for the Solano County LRSP. The review was conducted to ensure that the LRSP vision, goals, and strategies are aligned with established vision, goals and strategies. The documents reviewed are listed below:

- Solano County General Plan Transportation and Circulation Element
- 2018 Solano Travel Safety Plan
- Solano Countywide Active Transportation Plan
- Solano Countywide Active Transportation Plan - Unincorporated County Chapter
- Suisun Valley Strategic Plan
- Middle Green Valley Specific Plan
- Solano 2040 Comprehensive Transportation Plan
- Solano Priority Conservation Area Assessment and Implementation Plan
- Solano County Public Works Capital Improvement Plan

Many of Solano County's existing planning documents contain safety related goals that work together to reduce/eliminate F+SI collisions, including in the 2018 Solano Travel Safety Plan, Solano Countywide Active Transportation Plan, and the County's General Plan. The LRSP will build upon these goals and prior efforts. The following is a brief description of each of these documents and how they informed the development of the LRSP. A detailed list of upcoming projects and relevant policies is listed in **Appendix A**.

RELEVANT CITY AND COUNTY PLANNING DOCUMENTS AND PROJECTS

SOLANO COUNTY GENERAL PLAN TRANSPORTATION AND CIRCULATION ELEMENT (2008)

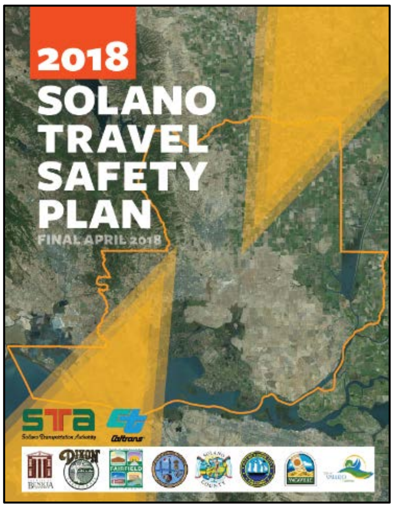


The General Plan was adopted by the Board of Supervisors and an "orderly growth management" element was supported by more than 70% of Solano County voters in 2008.The Transportation and Circulation chapter of the General Plan sets forth the policy framework to shape circulation within Solano County. While it primarily addresses roadways, it also considers bicycle and pedestrian systems, rail service, bus transit, air service, and waterway activity. The Transportation and Circulation chapter guides new investment choices within the county and assists in determining the role of new development in addressing future circulation issues. Overarching themes of the Transportation and Circulation chapter are to reduce reliance on automobile travel, providing accessible travel resources for all county residents, providing a range of sustainable travel choices that serve county residents and business, and improving circulation serving the county's agricultural community.

The Transportation and Circulation chapter contains goals regarding the following:

- Maintaining and improving current transportation systems to remedy safety and congestion issues
- Creating coordinated approaches with other agencies and cities to improve transportation corridors and facilities
- Encouraging land use patterns that maximize access and mobility options
- Minimizing congestion and greenhouse gas emissions
- Encouraging transit use
- Encouraging bicycling and walking
- Maintaining the safe, convenient transfer of goods and services from agricultural lands and industrial locations to regional and interregional transportation facilities

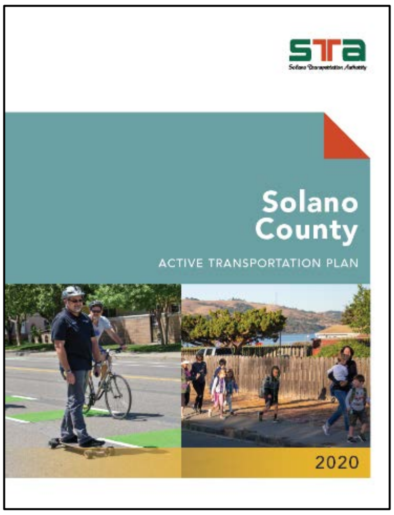
2018 SOLANO TRAVEL SAFETY PLAN (2018)



The Solano Travel Safety Plan was developed to identify and address traffic safety issues throughout the county. It was the fourth iteration of the plan, with previous versions developed in 1998, 2005, and 2016. The 2018 version was developed to be the County's Systemic Safety Analysis Report (SSAR), and included a comprehensive analysis of five years of traffic collision data for all seven cities and the unincorporated county. This was done to identify collision trends, such as crash types and violation types. These factors were used to identify specific countermeasures and project lists for each jurisdiction to be eligible for federal HSIP funding.

In the unincorporated county, recommended HSIP-eligible projects focused on paving and/or widening shoulders, installing additional signs/pavement markings/flashing warning signs, installing advance beacons and warning/regulatory signs, and converting intersection control to roundabouts. The treatments were suggested on Fry Road, Solar Hills Drive, Porter Road, SR-113, Meridian Road, Putah Creek Road, and Pitt School Road. Additional countermeasures that are ineligible for HSIP were also suggested.

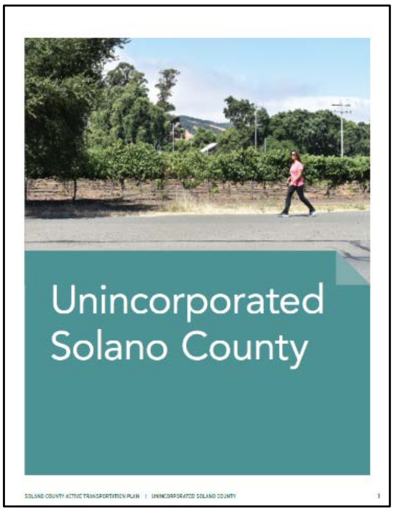
SOLANO COUNTYWIDE ACTIVE TRANSPORTATION PLAN (2020)



The Solano County Active Transportation Plan provides a framework to help the STA and partnering organizations identify projects that will improve active transportation conditions throughout Solano County. It combines four previous plans into one cohesive plan and establishes countywide priorities, project lists, and program guidance which STA and local jurisdictions can use to help people of all ages and abilities feel comfortable walking and bicycling.

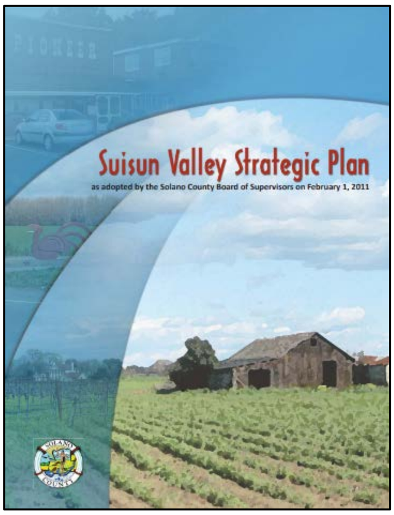
Development of the plan included a robust public outreach campaign in each jurisdiction, data driven analyses to identify the areas which have the highest propensity to produce walking and bicycling trips, and ultimately a list of recommended projects and all ages and abilities backbone network. A total of 312 bikeway projects and 148 pedestrian projects were recommended to form a connected active transportation network, improve access to schools and transit, and develop a regional trail network that enhances existing regional trails.

SOLANO ATP – UNINCORPORATED COUNTY CHAPTER (2020)



The Solano Countywide Active Transportation Plan was developed with a specific chapter for each jurisdiction in Solano County, so that it may serve as their own ATP. This includes one for the unincorporated areas of Solano County, which is primarily rural except for two small urbanized pockets within Vallejo. The chapter includes a summary of demographics of active transportation users in the unincorporated area, the existing pedestrian and bicycle networks, and an analysis of bicycle/pedestrian collisions on county roadways. Most of the bicycle network in the unincorporated county is focused on connections between the incorporated cities. Pedestrian facilities exist in isolated pockets; facilities are sparse due to the rural nature of the unincorporated areas. The suggested backbone network reflects this. A total of 117.2 miles of bikeways is recommended, primarily focusing on connecting cities. 14.5 miles of pedestrian facilities are also recommended, mostly in focused nodes or the unincorporated areas of Vallejo.

SUISUN VALLEY STRATEGIC PLAN (2010)



The Suisun Valley Strategic Plan lays out a vision to protect the rural, agricultural nature of the region and (among other things), provide infrastructure to support the growth and development of Suisun Valley. The study area is generally defined as the area between the City of Fairfield to the south and east, Green Valley to the west, and Napa County to the north. Planned improvements for Suisun Valley roadways will handle the expected increase in vehicle traffic volumes over the next twenty years, including an expected increase in non-auto traffic. The three-tier approach focuses on areas of immediate concern, including calming traffic, promoting active transportation, maintaining corridors for delivering goods and services, widening shoulders and providing pedestrian walkways, and addressing flooding concerns.

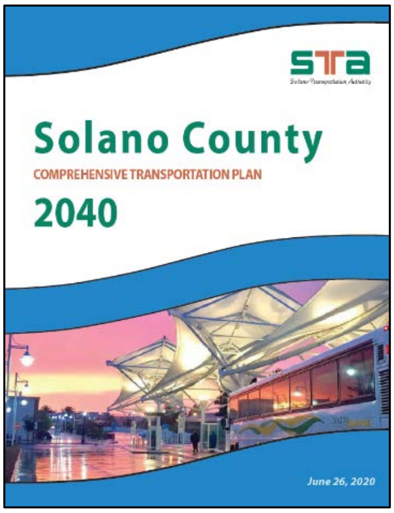
Suisun Valley wants to maintain its rural character. They want agricultural vehicles to continue to have access to roadways. They want to expand equestrian and pedestrian access and facilitate an expected increase of traffic in and through the valley for various purposes. Roadway improvements on the Valley's major roadways should be fit the character of the surrounding area, suitable to serve multiple modes of travel.

MIDDLE GREEN VALLEY SPECIFIC PLAN (2017)

The Middle Green Valley Specific Plan is a guide for the long-term realization of a series of connected and sustainable rural neighborhoods in the Middle Green Valley Specific Project Area of Solano County. It was built out of the recognized need to protect the unique rural qualities of the area, while providing a means for appropriate settlement patterns to take place. The study area includes agricultural and residential neighborhoods generally surrounding the intersection of Green Valley Road and Mason Road in the area northwest of the City of Fairfield.

As it pertains to traffic safety, the Plan includes street, circulation, and signage standards for the neighborhoods encompassing the Middle Green Valley. This includes standards for roundabouts, rural collector roads, local roads, and neighborhood roads. Complete streets elements are incorporated into all standards, including the provision for bicycle and pedestrian access across all neighborhoods. It also includes streetscape design standards and planned trail infrastructure in the area.

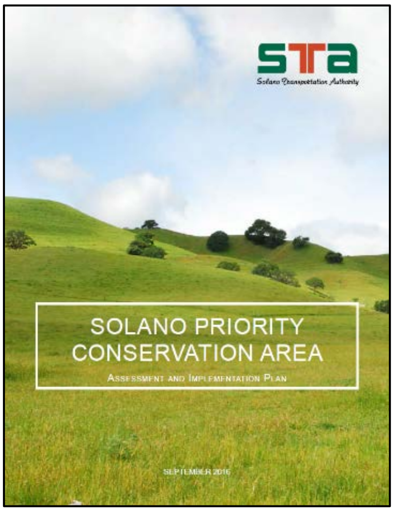
SOLANO 2040 COMPREHENSIVE TRANSPORTATION PLAN (2020)



The purpose of the Comprehensive Transportation Plan (CTP) is to help the STA fulfill its mission to improve the quality of life by delivering transportation projects that ensure mobility, travel safety, and economic vitality for all. This is an update to the 2005 CTP and addresses 2050 goals. The CTP is a federally required long-range planning document that contributes to the Bay Area's Regional Transportation Plan (RTP). The CTP is generally divided into three elements: the Arterials, Highways, and Freeways Element; Active Transportation Element; and Transit and Rideshare Element.

The CTP focuses on increasing multimodal access in the I-80 corridor, and providing more equitable access for seniors, people with disabilities, single parents, and those with limited means. Multimodal access in the I-80 corridor is defined as a linked series of Class I and Class II facilities from Davis and the Yolo/ Solano County line, along rural roads to and through Dixon to Vacaville; from there, along the Jepson Parkway to the Fairfield Linear Park, the North Connector, across the hills by way of McGary Road and the Solano Bikeway bike path, and finally along city streets in Vallejo to the Carquinez Bridge. A priority is to provide more facilities for pedestrian and bicyclist use of this transportation corridor. Each of the three elements includes priority projects divided into three tiers of project readiness. These elements assist STA when making funding decisions for roadway, active transportation, and transit projects.

SOLANO PRIORITY CONSERVATION AREA ASSESSMENT AND IMPLEMENTATION PLAN (2016)



The STA created the PCA Public Advisory Committee (PCA PAC)—a stakeholder-based planning process—to identify project opportunities that enhance the County's already rich agricultural heritage, recreation options, and open space areas. STA identified potential new conservation areas based on PCA Guidelines established by the Association of Bay Area Governments. The PCA PAC recommended nine areas as appropriate for designation as PCAs. This includes five previously adopted PCAs, plus four new areas.

Eleven focus areas were recommended, all of which could qualify for PCA status under the ABAG PCA Guidelines. These included the existing PCAs identified in 2007 and 2013 and several new areas. Several PCAs included roadway improvements and trail improvements/access. As part of this plan, a series of Farm to Market Road projects were identified to improve public access to Suisun Valley by providing pedestrian and bicycle safety and access enhancements, signage, lighting, and staging areas to trailheads.

SOLANO COUNTY PUBLIC WORKS CAPITAL IMPROVEMENT PLAN (2021)

PUBLIC WORKS
CAPITAL IMPROVEMENT PLAN
FY 2020/21 THROUGH FY 2025/26

Approved by the Board of Supervisors on February 2, 2021

The Solano County Public Works CIP outlines all roadway capital project investments from FY 2020-21 to FY 2025-26. This primarily includes road construction projects, right-of-way acquisition, rubberized chip seals, micro surfacing, paving projects, and bridge construction. Within road construction projects, the types of improvements include (but are not limited to): bicycle/pedestrian improvements, widen/pave shoulders, reconstruct and pave road, pavement overlay, sidewalk and gutter improvements, culvert replacements, road diets, guard rail repairs, intersection improvements, signal upgrades, refreshed striping, and more. The total estimated cost of the road construction projects is approximately $51 million, while the County's total CIP project cost is $108.3 million, $30.7 million of which remains unfunded.

COLLISION DATA COLLECTION AND ANALYSIS

This chapter summarizes the analysis of collisions that occurred in unincorporated Solano County between January 2016 and December 2020, as part of the LRSP. This chapter includes the following sections:

- Data Collection
- Collision Data Analysis
- F+SI Collision Analysis
- Geographic Collision Analysis
- High Injury Network
- Summary

The LRSP focuses on systemically identifying and analyzing traffic safety issues and recommends appropriate safety improvements. The chapter starts with a comprehensive analysis of collisions of all severity in unincorporated Solano County, including Property Damage Only (PDO) collisions, and compares this with F+SI collisions. Doing so gives a complete picture of collision trends that are occurring among all collisions, which can then be compared with trends occurring among only F+SI collisions. Factors such as collision severity, type of collision, primary collision factor, lighting, weather and time of the day were analyzed. Following this, a more detailed analysis was conducted for F+SI collisions that occurred on the County's roadways, including analyzing intersection and roadway segment collisions separately.

After this data was separated between intersection collisions and roadway segment collisions, a comprehensive evaluation was conducted based on factors such as: collision severity, type of collision, primary collision factor, lighting, weather, and time of the day. A list of high-injury intersections and roadway segments were then identified and ranked based on the calculation of the equivalent property damage only (EPDO) scoring system.

Figure 6 illustrates all the fatal and injury collisions that have occurred in unincorporated Solano County from 1/1/2016 to 12/31/2020.

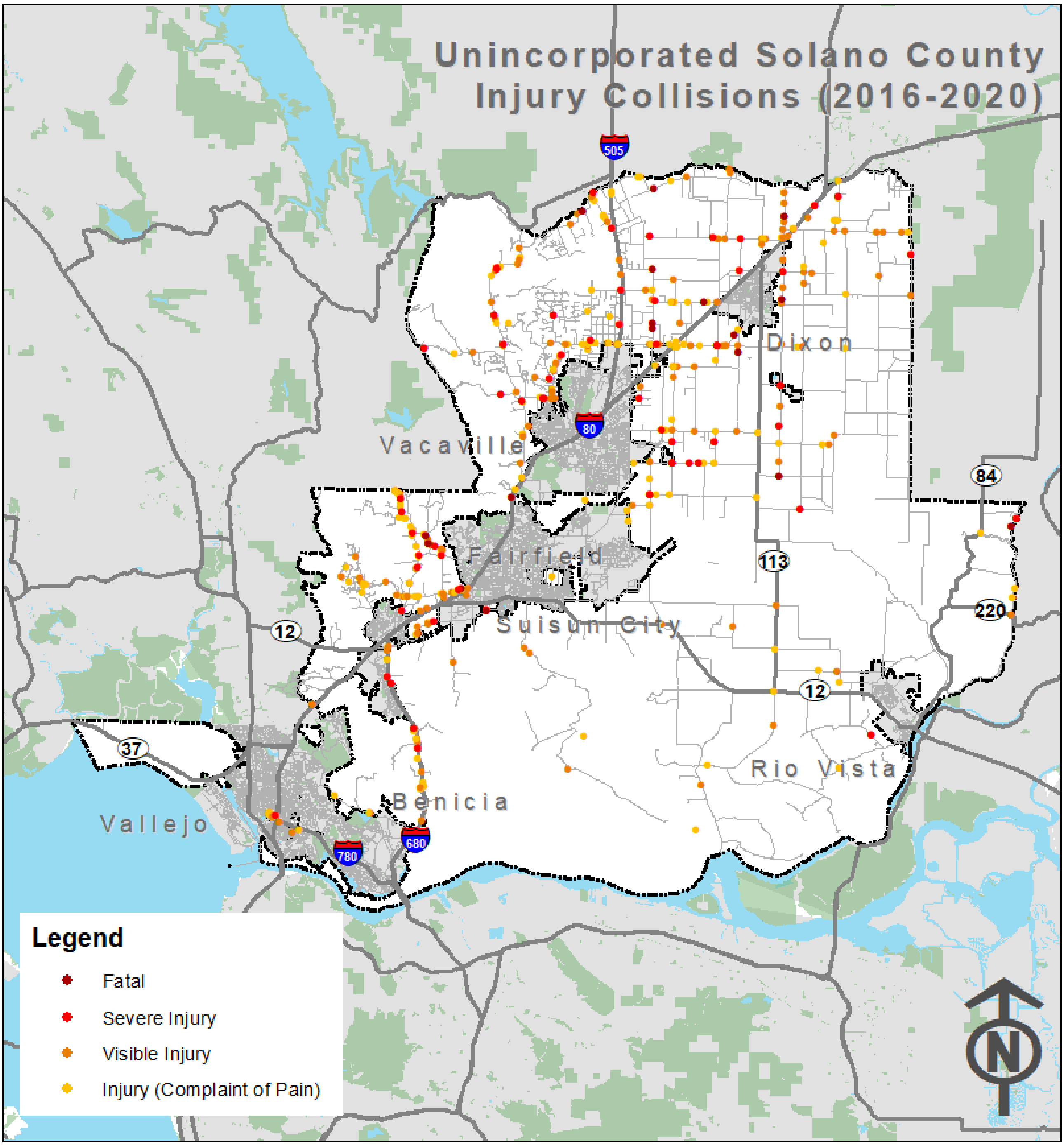


FIGURE 6: INJURY COLLISIONS UNINCORPORATED SOLANO COUNTY (2016-2020)

DATA COLLECTION

Analysts use collision data to understand different factors that might be leading to collisions and influencing collision patterns in a given area. For the purpose of this analysis, five years of jurisdiction-wide collision data (2016 to 2020) was retrieved from the Transportation Injury Mapping System (TIMS) and the SWITRS. Collisions that occurred on state routes were excluded for this analysis. The data was analyzed and plotted in ArcMap to identify high-risk intersections and roadway segments.

COLLISION DATA ANALYSIS RESULTS

COLLISION CLASSIFICATION

There were a total of 1,105 collisions reported on unincorporated County roads from 2016 to 2020. Out of these, 653 collisions (59%) were PDO collisions, 197 collisions (18%) led to a complaint of pain injury and 178 collisions (16%) led to a visible injury. There were 77 F+SI collisions, of which 58 collisions (5%) led to a severe injury and 19 collisions (1.7%) led to a fatality. **Figure 7** illustrates the classification of collisions based on severity.

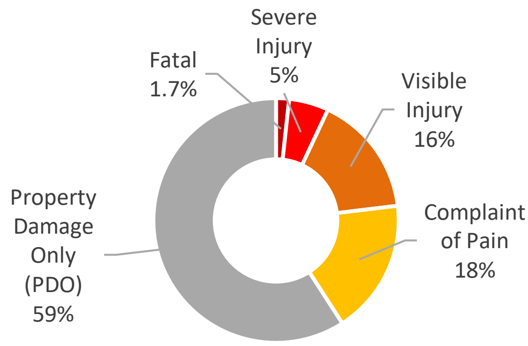


FIGURE 7: COLLISIONS BY SEVERITY (2016-2020)

The analysis first includes a comparative evaluation between all collisions and F+SI collisions, based on various factors including (but not limited to): collision trend, primary collision factor, collision type, facility type, motor vehicle involved with, weather, lighting, and time of the day. Following this, a comprehensive analysis is conducted for only F+SI collisions. F+SI collisions cause the most damage to those affected. The aftermath of these collisions can lead to great expenses for jurisdiction administration. The LRSP process thus focuses on F+SI collision locations to proactively identify and counter safety issues leading to these death and severe injury.

The collision data was separated by facility type, i.e. based on collisions occurring on intersections and roadway segments. For the purposes of the analysis and in accordance with HSIP guidelines, a collision was designated to have occurred at an intersection if it occurred within 250 ft. of it. The reported collisions categorized by facility type and collision severity are presented in **Table 2**.

TABLE 2: COLLISIONS BY SEVERITY AND FACILITY TYPE

COLLISION SEVERITY	ROADWAY SEGMENT	INTERSECTION	TOTAL
Fatal	13	6	19
Severe Injury	36	22	58
Subtotal F + SI	49	28	77
Visible Injury	102	76	178
Complaint of Pain	98	99	197
Property Damage Only (PDO)	366	287	653
Total	615	490	1,105

PRELIMINARY ANALYSIS

YEARLY TREND

The total number of reported collisions of all severity types decreased from 2016 to 2020. The year with the highest number of collisions was 2016 (239 collisions), while the year with the lowest number of collisions was 2019 (210 collisions). A total of 77 F+SI collisions occurred on County roads in unincorporated Solano County during the study period, increasing from 2016 to 2018. The least number of F+SI collisions occurred in 2016 (10 collisions), while the most occurred in 2018 (22 collisions). **Figure 8** illustrates the five-year collision trend for all collisions, F+SI collisions, and PDO collisions.

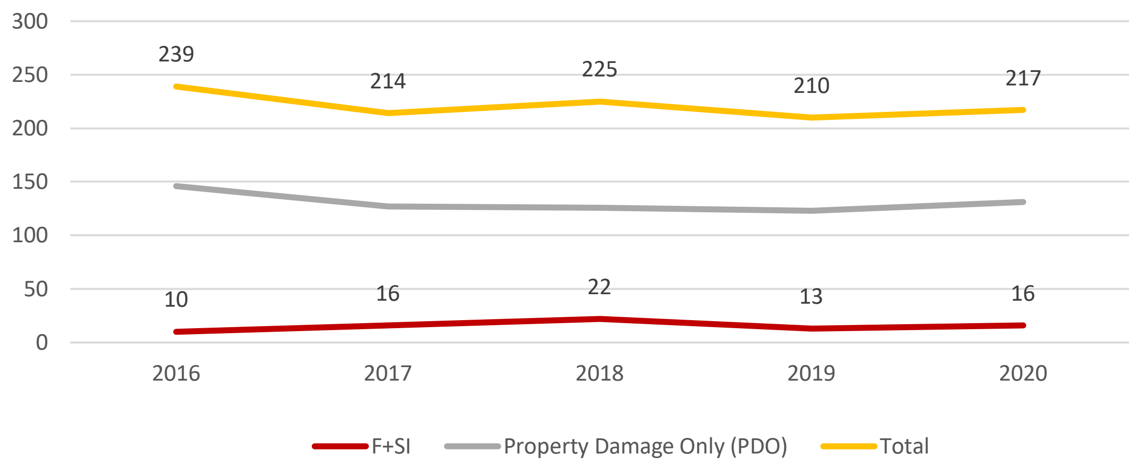


FIGURE 8: FIVE YEAR COLLISION TREND

ROADWAY SEGMENTS AND INTERSECTIONS

When evaluating location, the majority of collisions occurred along roadway segments rather than at intersections. In unincorporated Solano County, 56% of all collisions (1,245 collisions) occurred on roadway segments whereas 44% (568 collisions) occurred at intersections. A slightly stronger trend towards roadway segment collisions is seen when looking only at F+SI collisions. This classification by facility type can be observed in **Figure 9.**

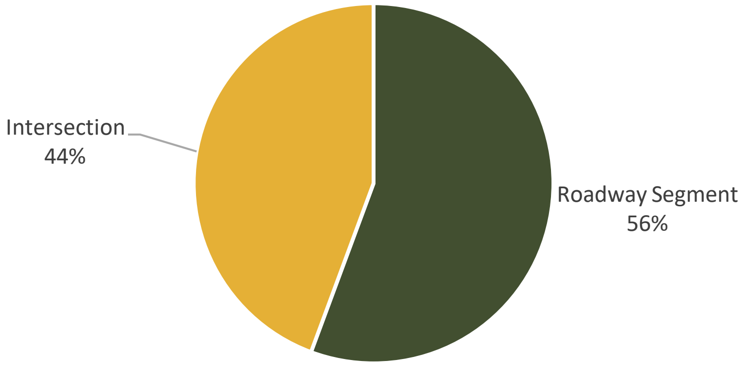


FIGURE 9: INTERSECTION AND ROADWAY COLLISIONS – ALL COLLISIONS

COLLISION TYPE

The most commonly occurring collision type was hit object (47%) and broadside (16%). The collision types for F+SI collisions follow a similar pattern, where the most commonly occurring collision type was hit object (45%), broadside (22%) and overturned vehicle (22%). **Figure 10** illustrates the collision type for all collisions as well as F+SI collisions.

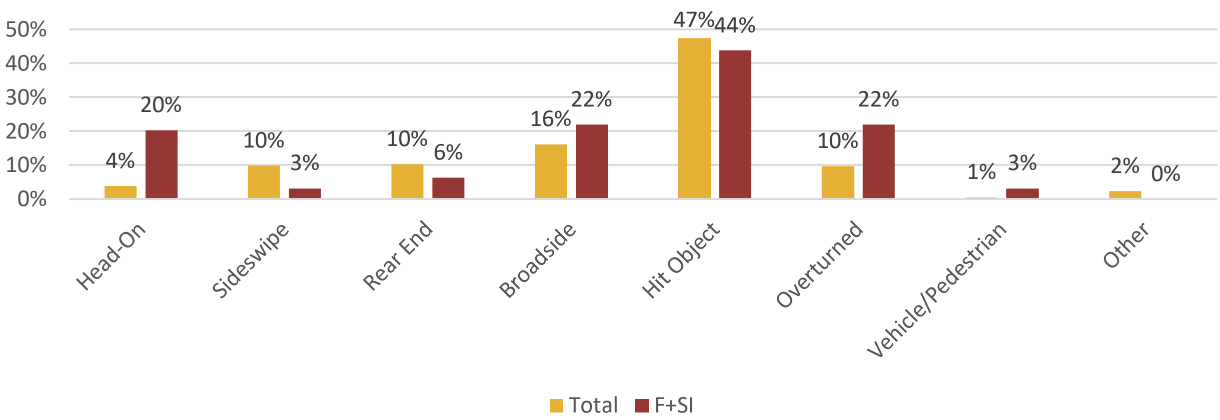


FIGURE 10: COLLISION TYPE – ALL COLLISIONS AND F+SI COLLISIONS

PRIMARY COLLISION FACTOR

The primary collision factor is determined from the type of violation noted by law enforcement officials at the site. For collisions of all severity, the most common violation category was observed to be improper turning (34%) and unsafe speed (18%). The most common primary violation categories for F+SI collisions were driving under the influence (DUI) (31%), improper turning (23%) and unsafe speed (17%). **Figure 11** illustrates the violation category for all collisions and F+SI collisions.

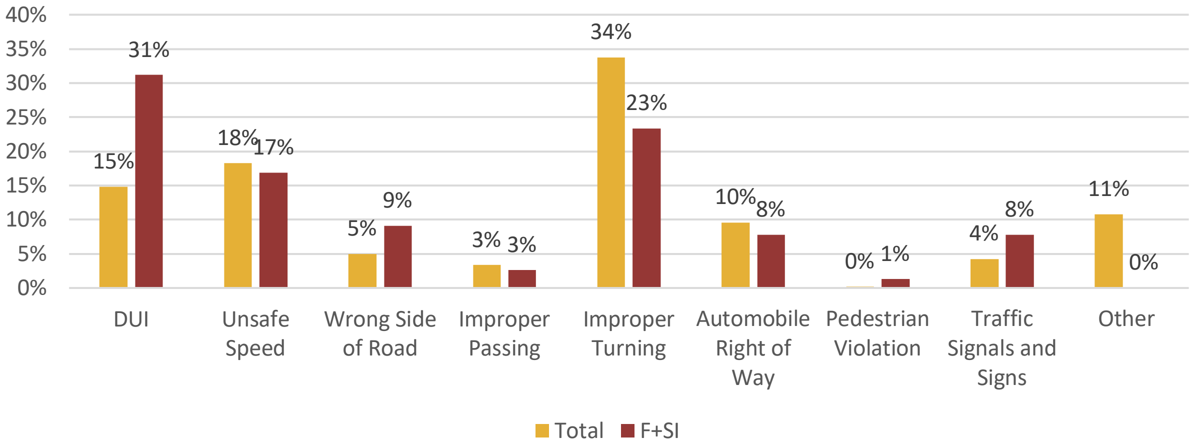


FIGURE 11: VIOLATION CATEGORIES: ALL COLLISIONS AND F+SI COLLISIONS

MOTOR VEHICLE INVOLVED WITH

Motor vehicles involved in a collision with an object, a person, an animal and another vehicle is noted by law enforcement. For collisions of all severity, 49% of the collisions occurred with a fixed object or other object. This was followed by motor vehicles colliding with other vehicles (37%), and non-collisions (7%). For F+SI collisions, 43% involved a fixed object or other object, 36% of the collisions involved another motor vehicle, and 13% were classified as a non-collision. **Figure 12** illustrates the motor vehicle involved with category for all collisions as well as F+SI collisions.

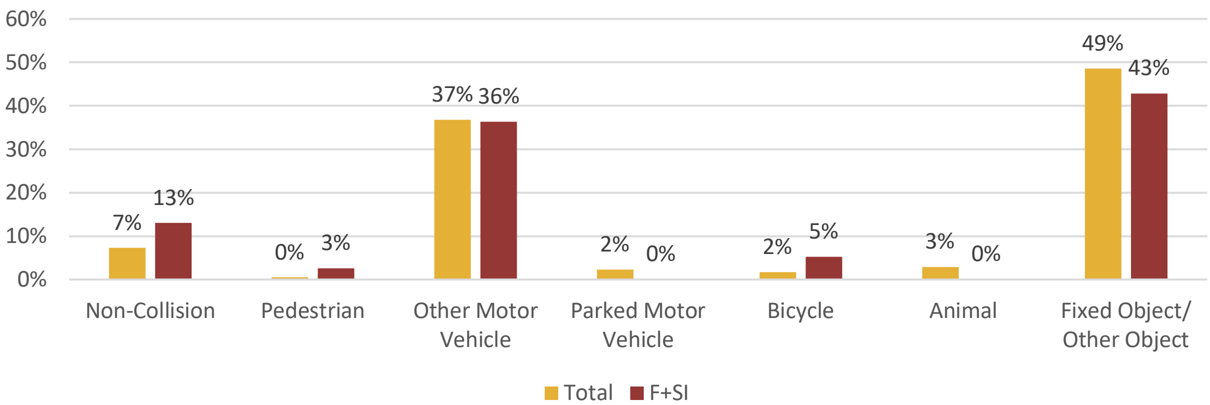


FIGURE 12: MOTOR VEHICLE INVOLVED WITH: ALL COLLISIONS AND F+SI COLLISIONS

MODES

In addition to motor vehicle involved with, modes include a more detailed breakdown of the vehicle type at fault in the accident, including motorcycles and trucks. For collisions of all severity, the majority occurred with another vehicle (67%), followed by truck or bus (19%). Crashes with other vehicles also makes up the majority of F+SI collisions, but motorcycle/scooter collisions comprise a significant percentage, underscoring the fact that riding scooters and motorcycles is more vulnerable to a fatality or severe injury. **Figure 13** illustrates the percentage for all collisions as well as F+SI collisions by mode.

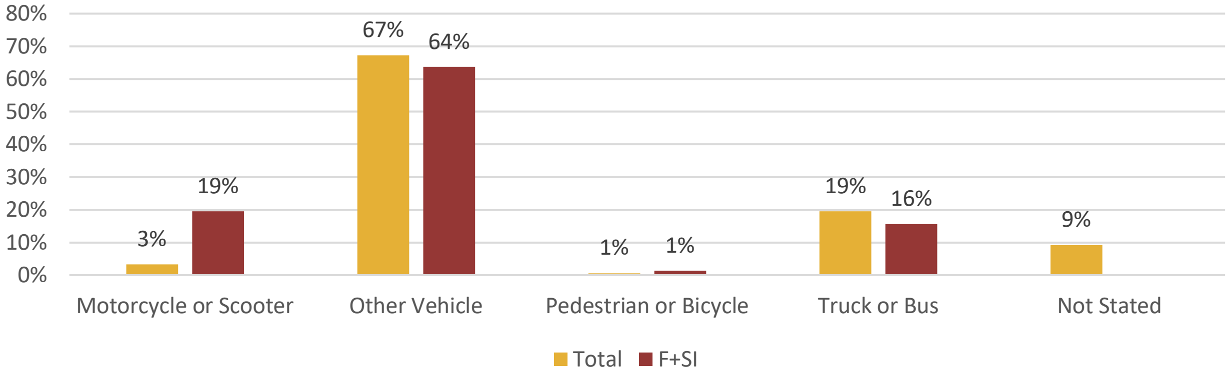


FIGURE 13: MODES: ALL COLLISIONS AND F+SI COLLISIONS

LIGHTING

For collisions of all severity, 59% of collisions occurred in daylight, while 29% of collisions occurred in the dark on streets with no street lights. For F+SI collisions, lighting conditions follow a similar trend, with 64% of collisions having occurred in daylight and 29% of collisions occurred in the dark on streets with no street lights. **Figure 14** illustrates the lighting condition for all collisions and F+SI collisions.

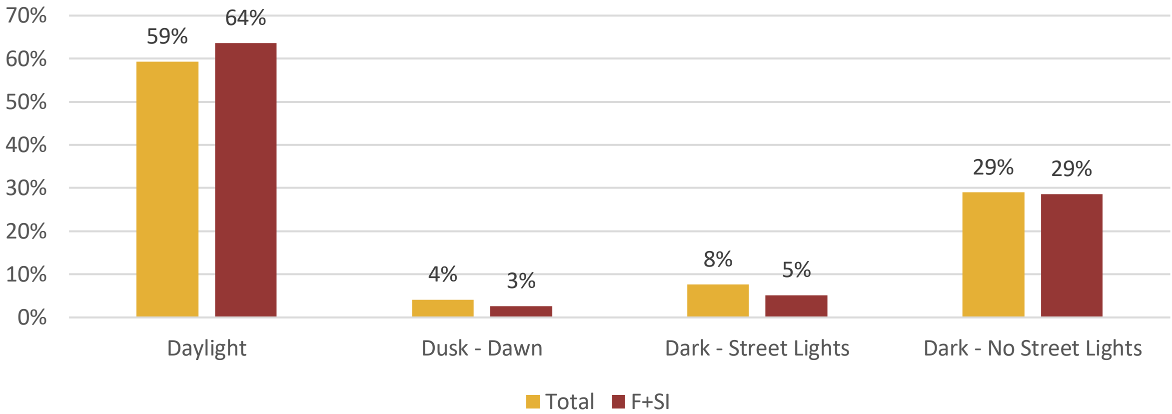


FIGURE 14: LIGHTING CONDITIONS: ALL COLLISIONS VS. F+SI COLLISIONS

WEATHER

For all collisions, the vast majority occurred during clear weather conditions (81%). For F+SI collisions similar trends have been observed, with 87% of the collisions having occurred during clear weather conditions. **Figure 15** illustrates the percent distribution of weather conditions during an occurrence of collisions of all severity as well as F+SI collisions.

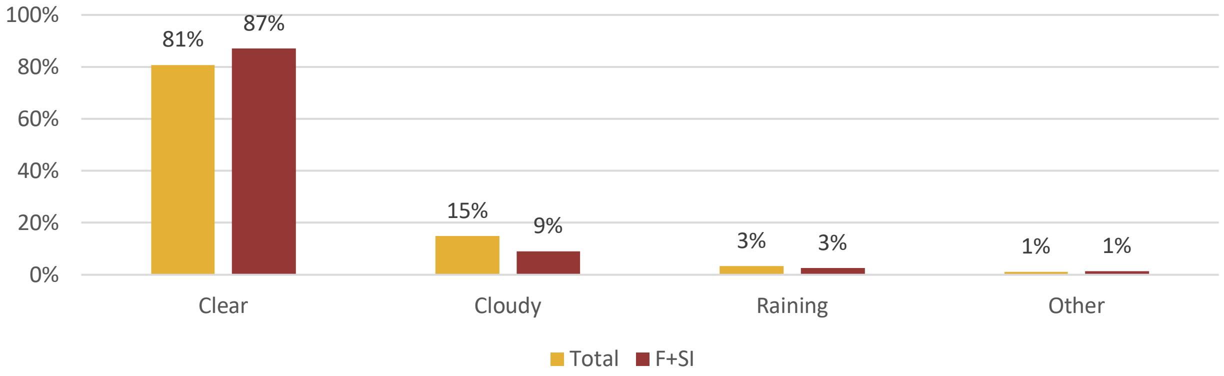


FIGURE 15: WEATHER CONDITIONS: ALL COLLISIONS AND F+SI COLLISIONS

TIME OF DAY

For collisions of all severity, the hour with the most number of collisions was between 5:00 p.m. to 6:00 p.m. (7%), while the hour with the fewest number of collisions was between 12:00 a.m. to 1:00 a.m. (2%). For all F+SI collisions, the maximum number of collisions occurred between 7:00 p.m. to 8:00 p.m. (12%). Other notable hours that had high F+SI collisions were 2:00 p.m. to 3:00 p.m. (10%), 4:00 p.m. to 5:00 p.m. (9%), and 5:00 p.m. to 6:00 p.m. (8%). The six-hour period beginning at 2:00 pm. and ending at 8:00 p.m. had 43% of F+SI collisions. **Figure 16** illustrates the percentage of collisions occurring during each hour of the day for all collisions as well as F+SI collisions.

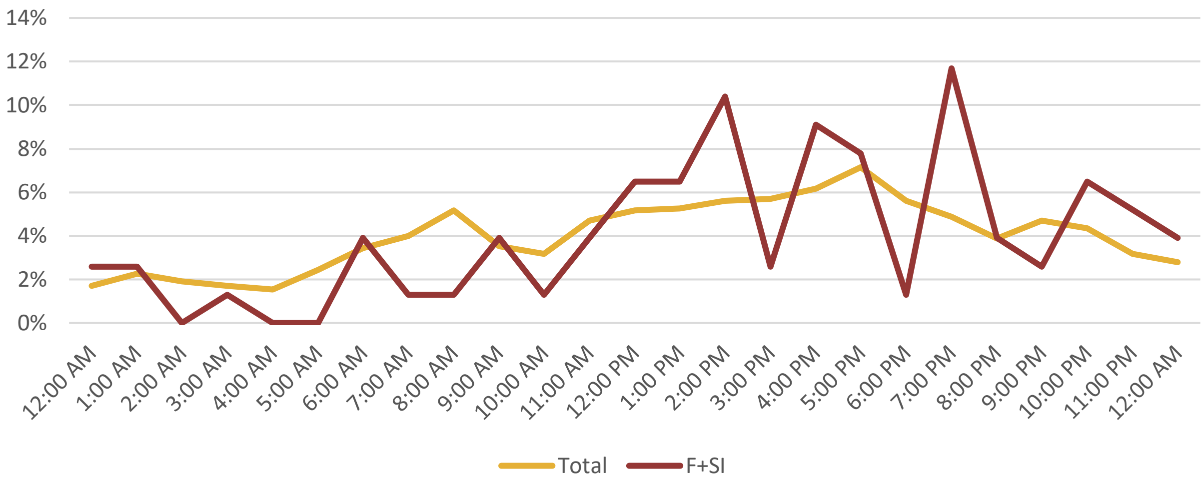


FIGURE 16: TIME OF DAY: ALL COLLISIONS AND F+SI COLLISIONS

FATAL AND SEVERE INJURY COLLISIONS

This section describes a detailed cross-tabulation collision analysis performed for F+SI collisions occurring at roadway segments and intersections in unincorporated Solano County. Of the total 77 F+SI collisions that occurred during the study period, 49 collisions (63%) occurred on roadway segments and 28 collisions (37%) occurred at intersections. This distribution is illustrated in **Figure 17**.

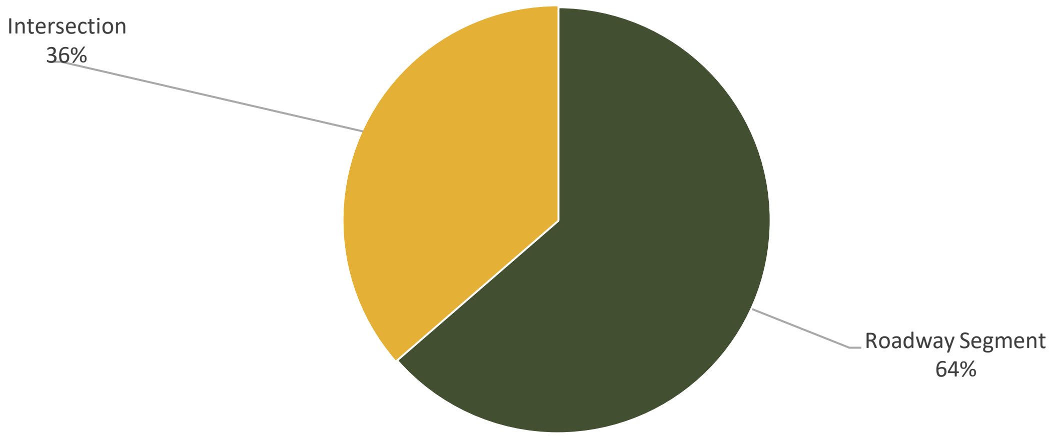


FIGURE 17: INTERSECTION AND ROADWAY SEGMENT COLLISIONS – F+SI COLLISIONS

Figure 18 maps the F+SI collisions that occurred in unincorporated Solano County during the study period.

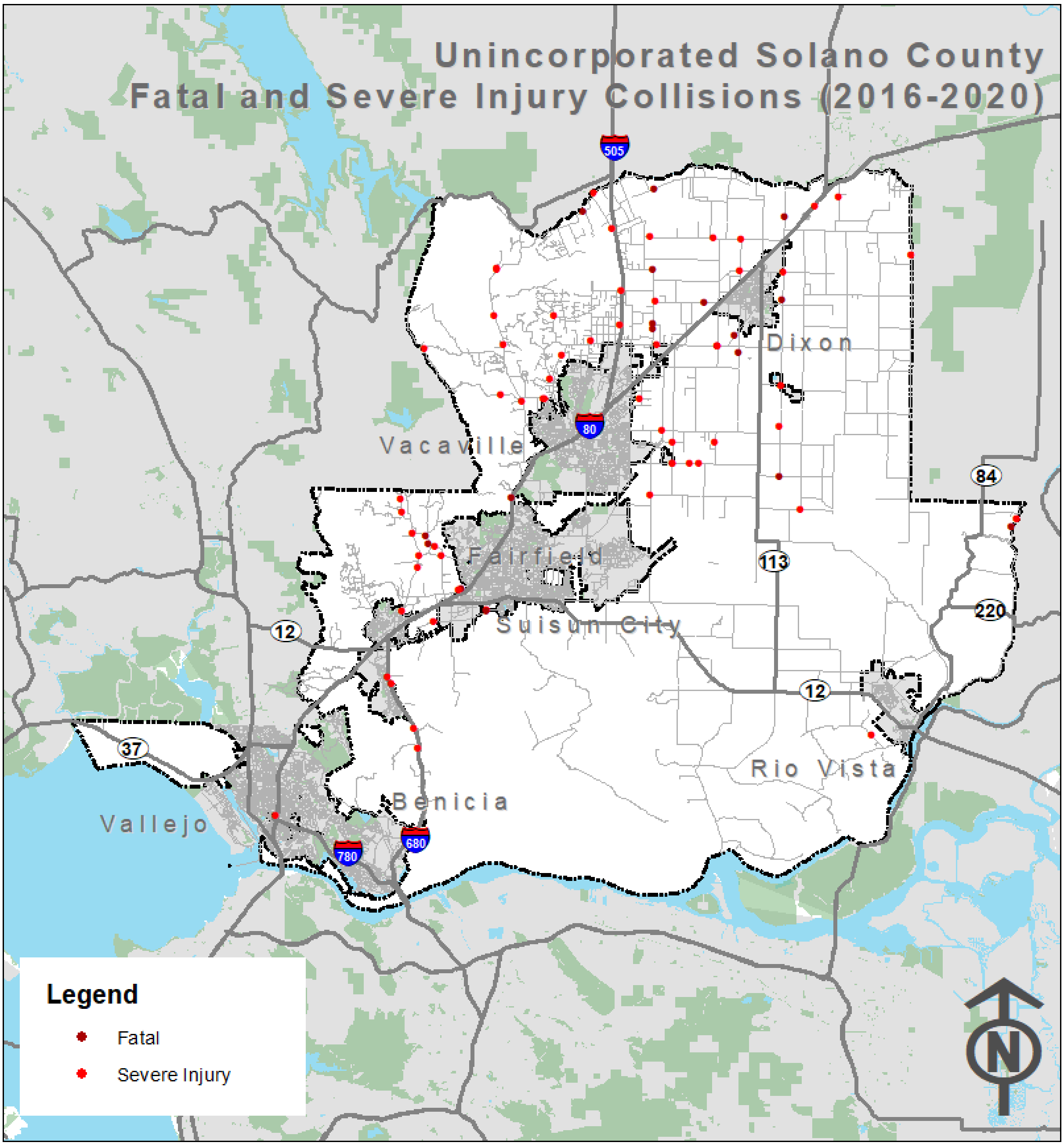


FIGURE 18: FATAL AND SEVERE INJURIES (2016-2020)

COLLISION TYPE AND LOCATION TYPE

The most common F+SI collision type was hit objects. These collisions were most likely to occur on roadway segments, along with overturned and head-on collisions. Broadside collisions that led to an F+SI more commonly occurred at intersections. **Figure 19** shows F+SI collisions locations as well as the collision type.

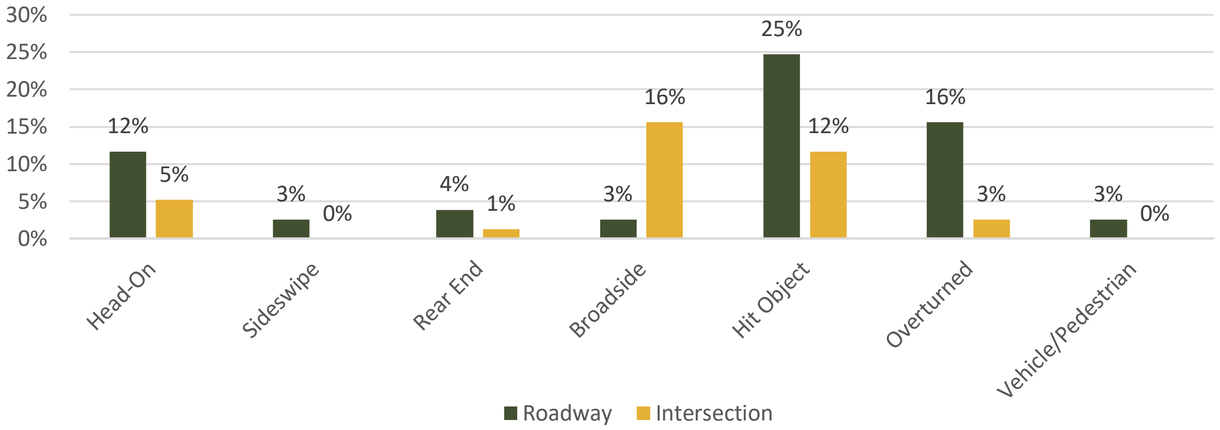


FIGURE 19: F+SI COLLISIONS: COLLISION TYPE AND LOCATION TYPE (2016-2020)

VIOLATION CATEGORY AND LOCATION TYPE

The most common F+SI collision type were DUI, improper turning, and unsafe speed collisions. These F+SI collisions primarily occurred on roadway segments. DUI was also the most common violation category at intersections, followed by automobile right of way and traffic signals and signs. **Figure 20** shows F+SI collisions as well as the location type and violation category.

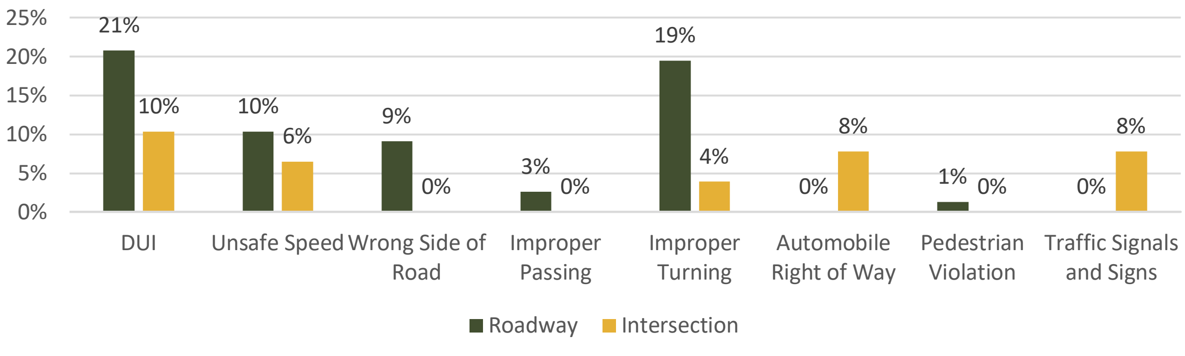


FIGURE 20: F+SI COLLISIONS: VIOLATION CATEGORY AND LOCATION TYPE (2016-2020)

MOTOR VEHICLE INVOLVED WITH AND LOCATION TYPE

Collisions involving a fixed or other object were the most common types of fatal + severe injury type collisions occurring on roadway segments. The same types of collisions occurred at intersections, however, more occurred with other motor vehicles than with fixed or other objects. **Figure 21** shows F+SI collision locations as well as the collision type.

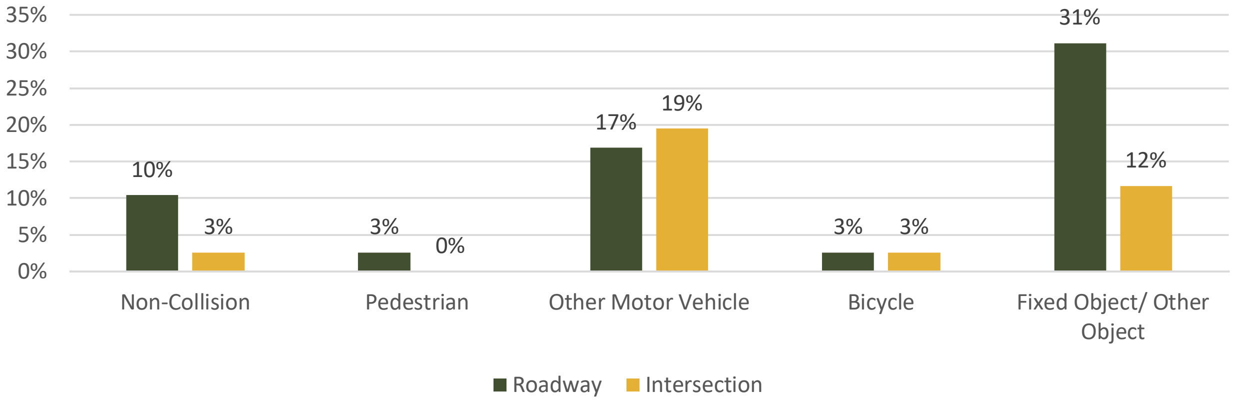


FIGURE 21: F+SI COLLISIONS: MOTOR VEHICLE INVOLVED WITH AND LOCATION TYPE (2016-2020)

LIGHTING AND LOCATION TYPE

Most F+SI collisions occurred in daylight on roadway segments. The second most common lighting for fatal and serve injury collisions was collisions that occurred in the dark with no street lights. **Figure 22** shows F+SI collision locations as well as lighting conditions.

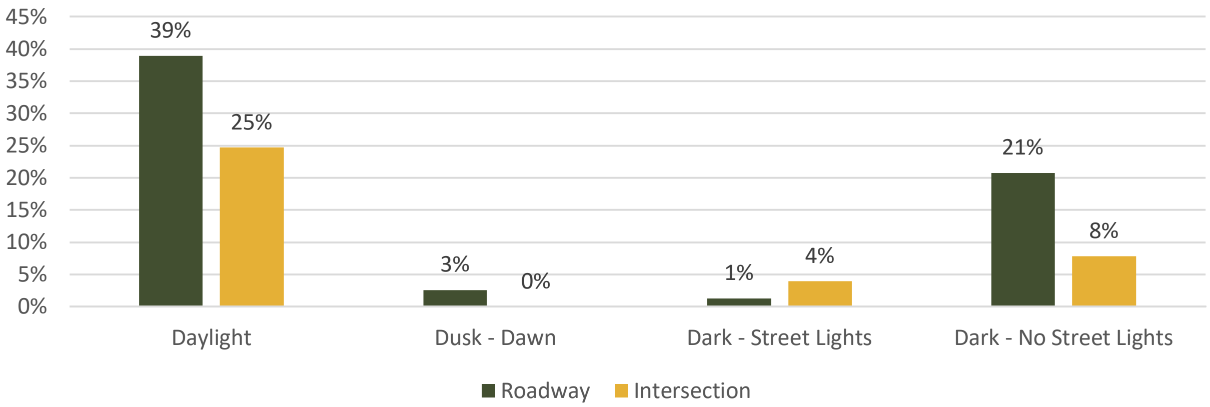


FIGURE 22: F+SI COLLISIONS: LIGHTING AND LOCATION TYPE (2016-2020)

WEATHER AND LOCATION TYPE

The majority of F+SI collisions occurred during clear weather on roadway segments and at intersections. **Figure 23** shows F+SI collision locations as well as weather conditions.

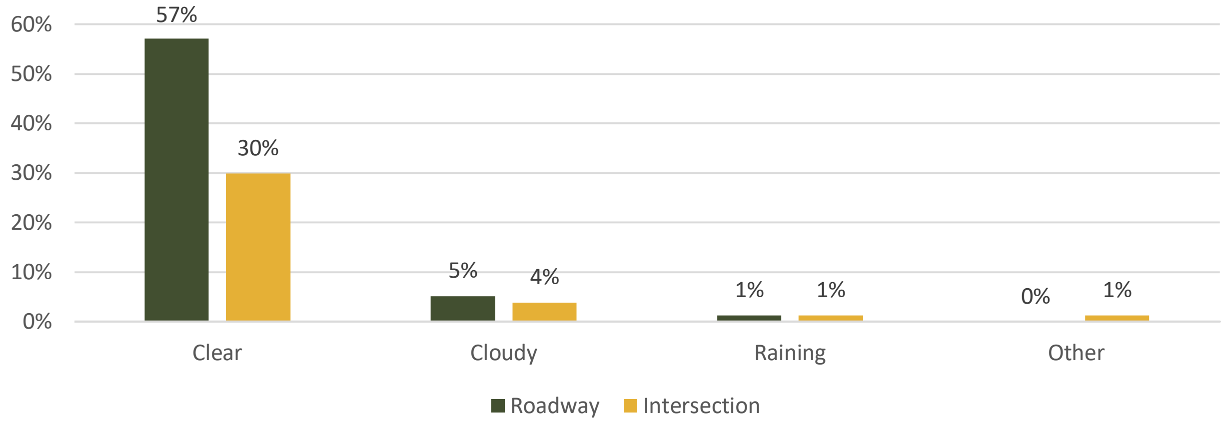


FIGURE 23: F+SI COLLISIONS: WEATHER VS LOCATION TYPE (2016-2020)

TIME OF DAY AND LOCATION TYPE

The time period with the most F+SI collisions was during 12:00 p.m. to 3:00 p.m. For roadway segments, the time period between 9:00 p.m. to 12:00 a.m. had a similar number of collisions, along with 3:00 p.m. to 6:00 p.m. **Figure 24** shows F+SI collisions by location type and time of day.

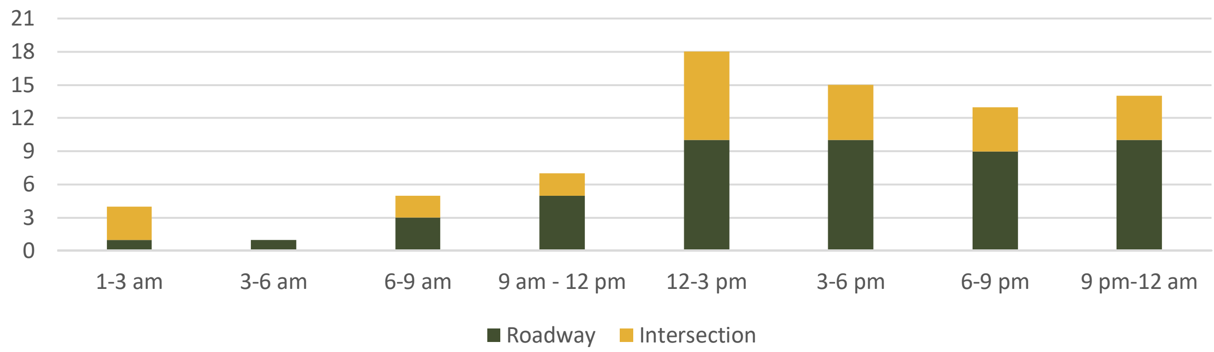


FIGURE 24: F+SI COLLISIONS: TIME OF DAY AND LOCATION TYPE (2016-2020)

GENDER AND AGE

For F+SI collisions, the gender of the party at fault was much more likely to be male than female (75% of F+SI collisions were caused by a male). The party at fault was also slightly more likely to be younger, with the largest age group being 20-29 years (26%). Parties at fault under 40 years of age accounts for just over half (53%) of all F+SI collisions. **Figure 25** illustrates the gender and age of the party at fault for F+SI collisions.

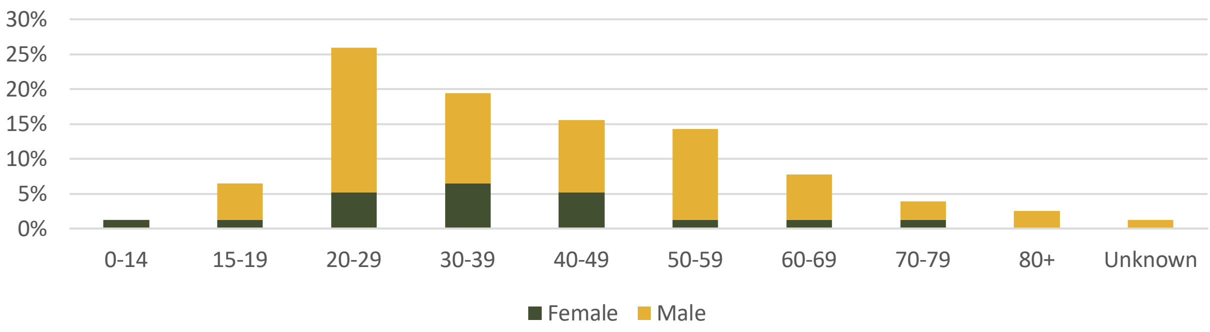


FIGURE 25: F+SI COLLISIONS BY GENDER AND AGE

COLLISION TYPE AND MOVEMENT PRECEDING COLLISION OF PARTY AT FAULT

The most common type of collision for F+SI collisions was hit objects. Of these collisions, other unsafe turning was the most common movement preceding the collision of the party at fault (16%), followed by ran off road (9%), and proceeding straight (9%). **Figure 26** shows this distribution.

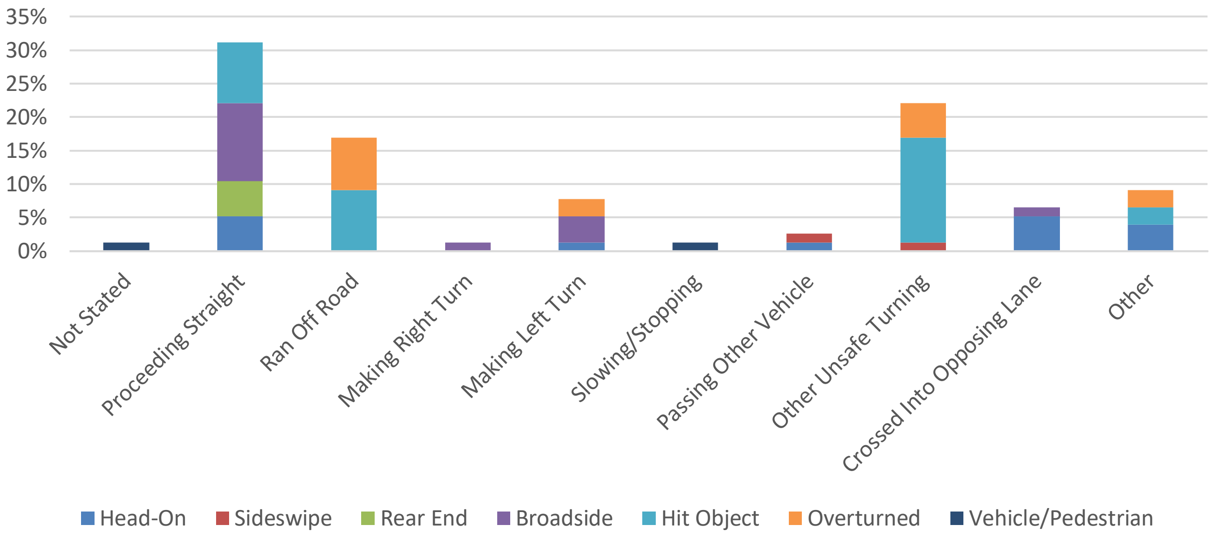


FIGURE 26: F+SI COLLISIONS BY COLLISION TYPE AND MOVEMENT PRECEDING COLLISIONS OF PARTY AT FAULT

GEOGRAPHIC COLLISION ANALYSIS

This section describes a detailed geographic collision analysis performed for injury collisions occurring on roadway segments and at intersections in unincorporated Solano County. The collision analysis was used to identify five main collision factors that highlight the top trends among collisions in unincorporated Solano County. These five collision factors were identified to be hit object collisions, nighttime collisions, DUI collisions, improper turning collisions, and overturned collisions.

HIT OBJECT COLLISIONS

Hit object collisions represented the highest proportion of both collisions of all severity (47%), and F+SI collisions (44%). For F+SI collisions in unincorporated Solano County, 44% of collisions were hit object collisions. **Figure 27** shows the distribution of hit object collisions throughout unincorporated Solano County between 2016 and 2020. Pleasants Valley Road, Suisun Valley Road, Gibson Canyon Road, and Lopes Road have a higher frequency of hit object collisions, compared to other unincorporated Solano County roads.

NIGHTTIME COLLISIONS

Nighttime collisions accounted for 37% of all collisions and 34% of F+SI collisions. The majority of these nighttime collisions occurred in areas without street lights, given the unincorporated county's rural nature. **Figure 28** shows the distribution of nighttime collisions throughout unincorporated Solano County between 2016 and 2020. Midway Road, Putah Creek Road, Suisun Valley Road, and Gibson Canyon Road have a higher frequency of nighttime collisions, compared to other unincorporated Solano County roads. The California Office of Traffic Safety ranked Solano County 18th out of 58 counties in California with high levels of nighttime collisions (one being the highest, or worst)[1].

DUI COLLISIONS

For F+SI collisions in unincorporated Solano County, 31% of collisions were reported as DUI collisions (compared to only 15% of collisions of all severities). **Figure 29** shows the distribution of DUI collisions throughout the Unincorporated Solano County between 2016 and 2020. Putah Creek Road, Fry Road, Gibson Canyon Road, and Lyon Road have a higher frequency of DUI collisions, compared to other unincorporated Solano County roads.

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[1] California Office of Traffic Safety. (2018). Office of Traffic Safety Rankings 2018. https://www.ots.ca.gov/media-and-research/crash-rankings-results/?wpv-wpcf-year=2018&wpv-wpcf-city_county=Solano+County&wpv_filter_submit=Submit

IMPROPER TURNING COLLISIONS

For F+SI collisions in unincorporated Solano County, 23% of collisions were improper turning collisions. It was also the most common violation type among collisions of all severity (34% of all collisions). **Figure 30** shows the distribution of improper turning collisions throughout unincorporated Solano County between 2016 and 2020. Pleasants Valley Road, Suisun Valley Road, Dixon Avenue and Gibson Canyon Road have a higher concentration of improper turning collisions, compared to other unincorporated Solano County roads.

OVERTURNED COLLISIONS

For F+SI collisions in unincorporated Solano County, 22% were overturned vehicles. This is much higher than its share of collisions of all severity (10%). **Figure 31** shows the distribution of overturned collisions throughout unincorporated Solano County between 2016 and 2020. Dixon Avenue, Holland Road, Pleasants Valley Road, and Suisun Valley Road have a higher concentration of overturned collisions, compared to other unincorporated Solano County roads.

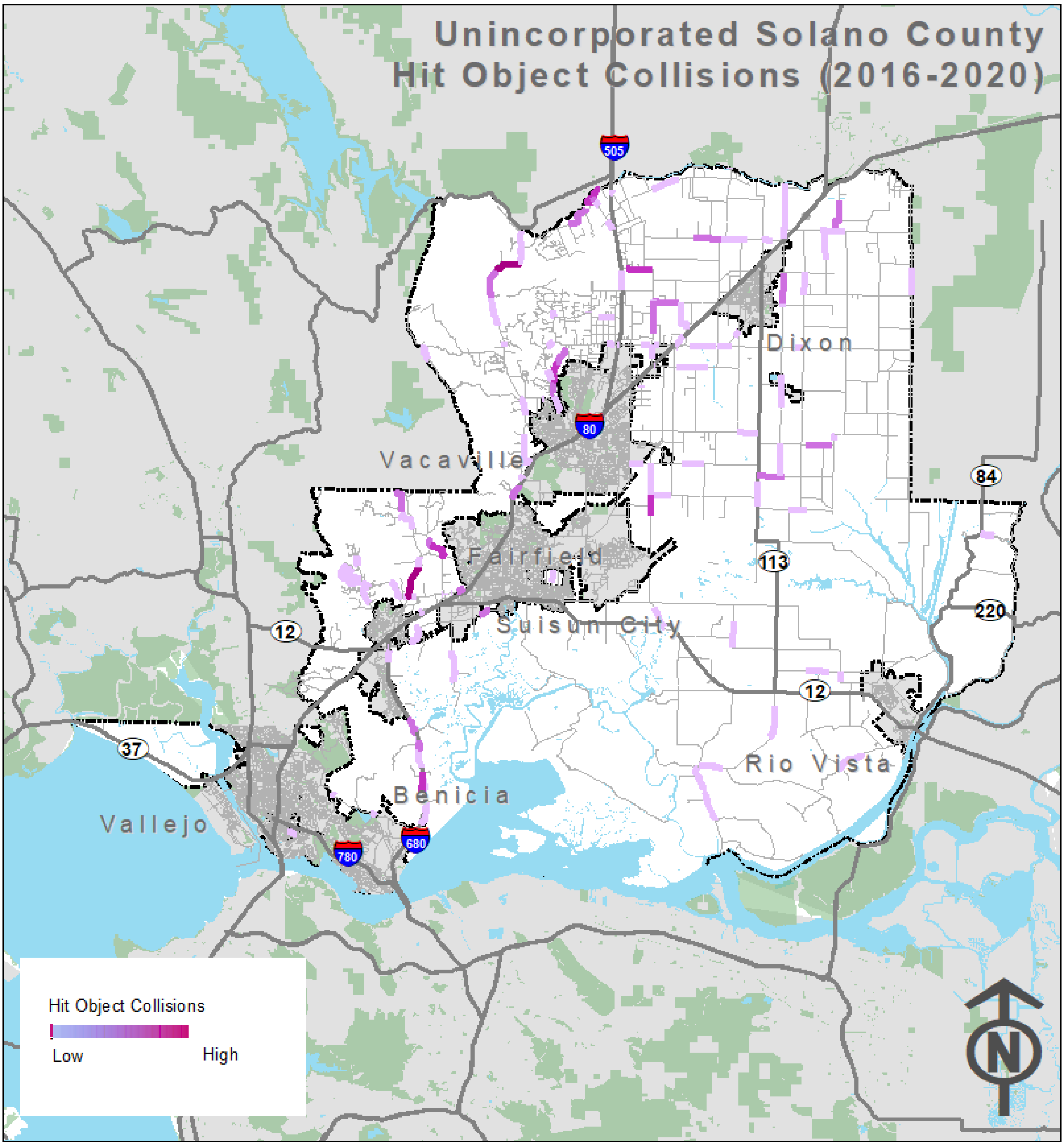

FIGURE 27: SOLANO COUNTY HIT OBJECT COLLISIONS (2016-2020)

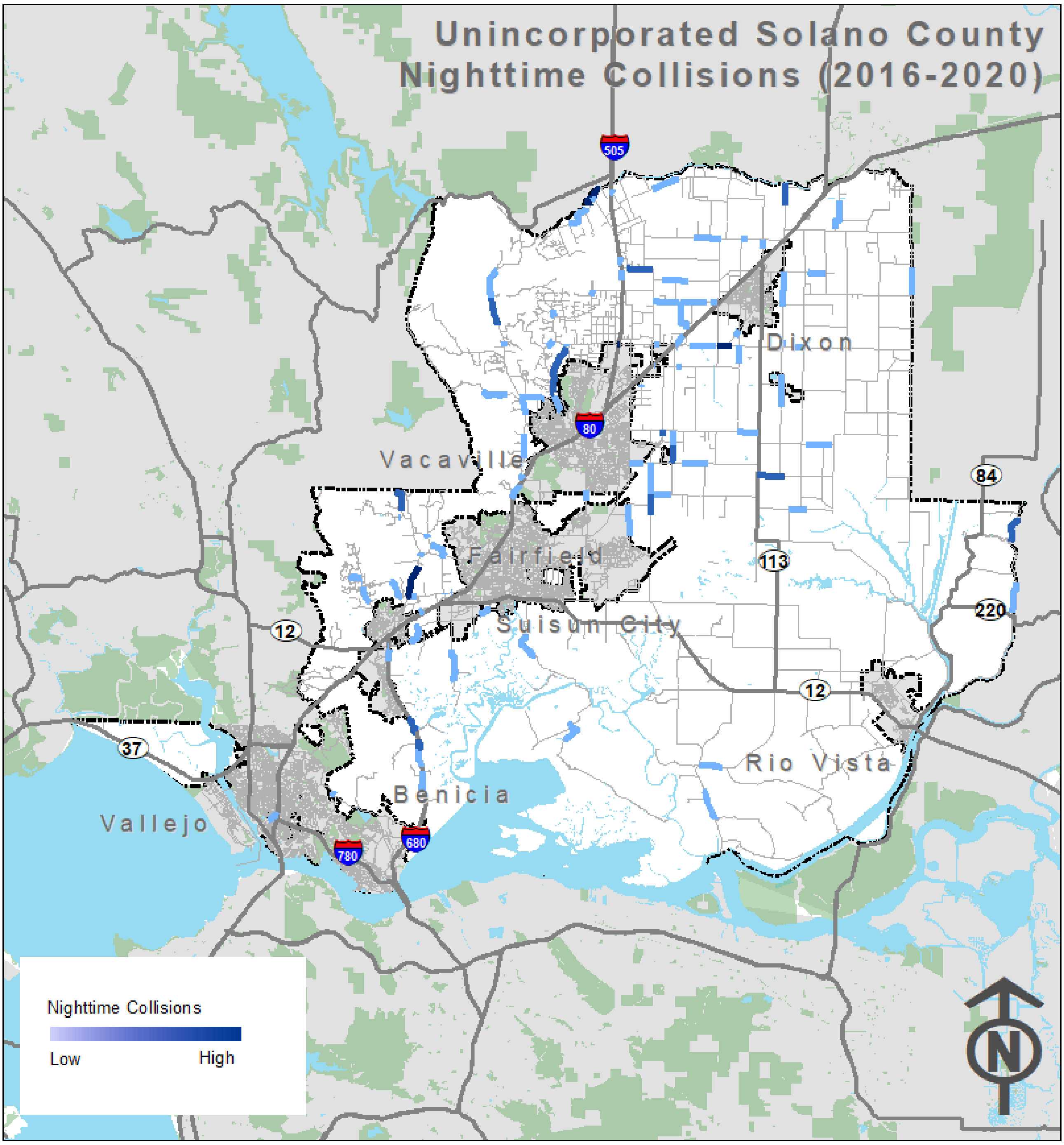

FIGURE 28: SOLANO COUNTY NIGHTTIME COLLISIONS (2016-2020)

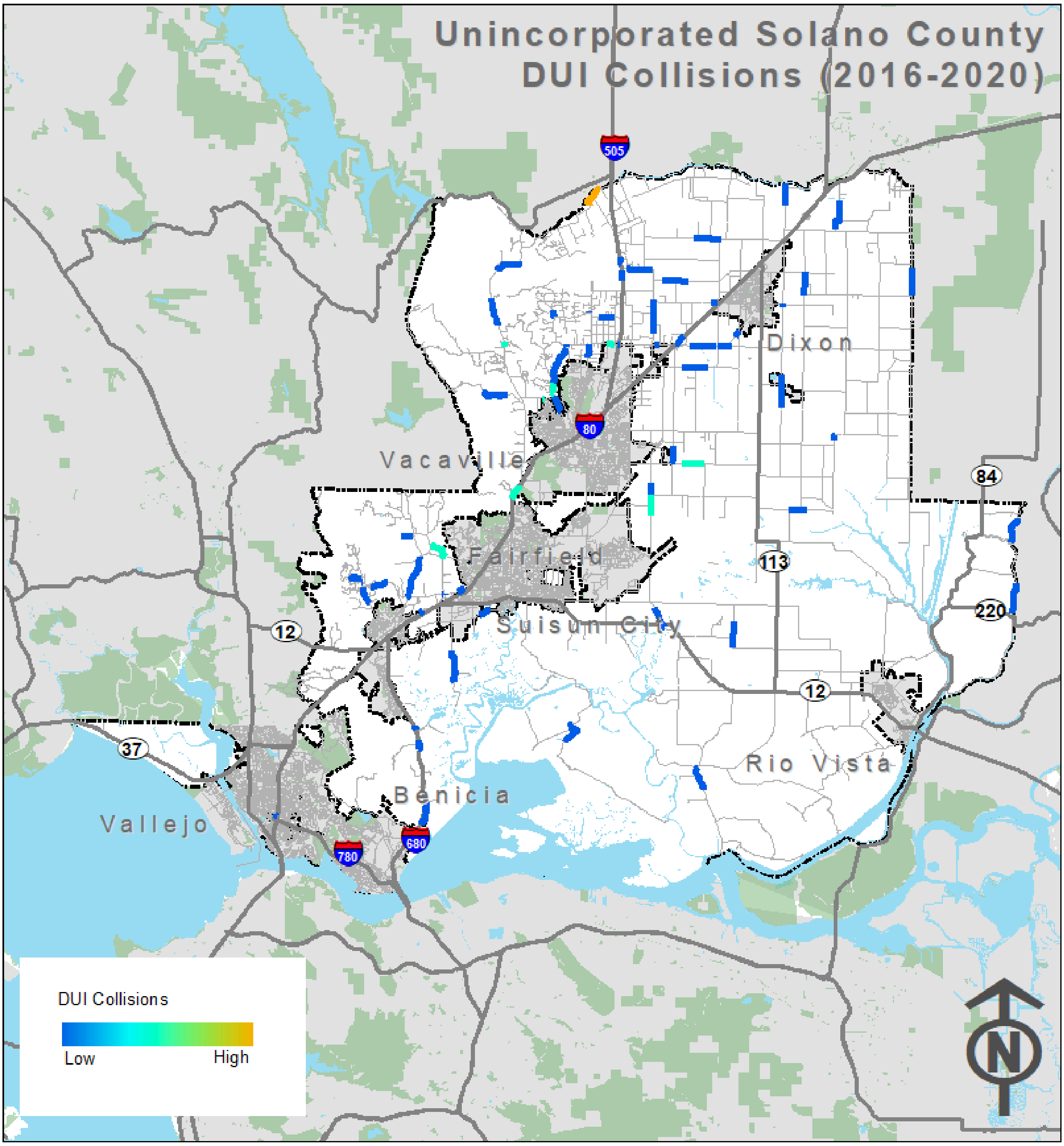

FIGURE 29: SOLANO COUNTY DUI COLLISIONS (2016-2020)

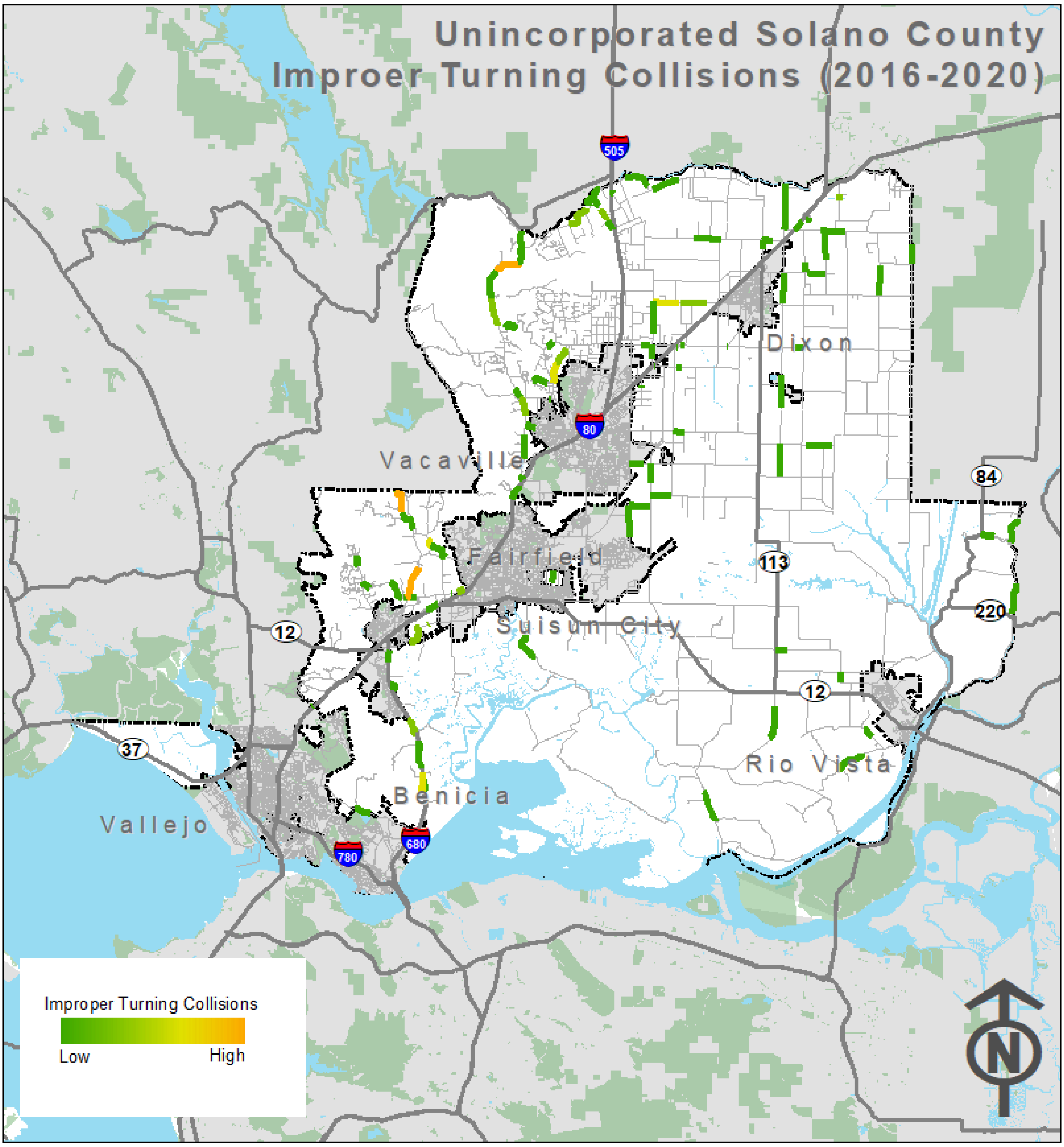

FIGURE 30: SOLANO COUNTY IMPROPER TURNING COLLISIONS (2016-2020)

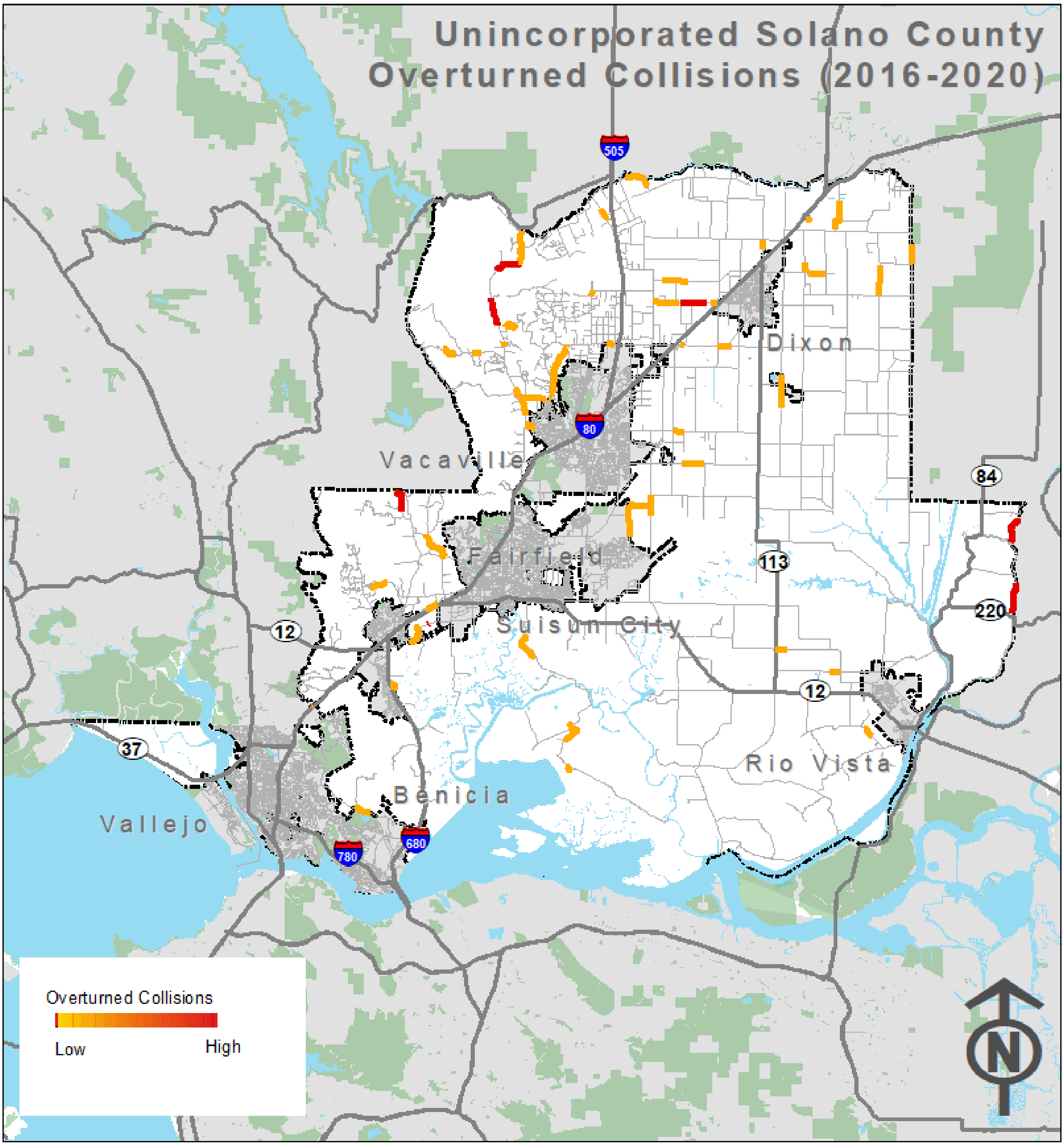

FIGURE 31: SOLANO COUNTY OVERTURNED COLLISIONS (2016-2020)

COLLISION SEVERITY WEIGHT

The California Department of Transportation (Caltrans) uses the cost of a collision as the unit of measurement to compare locations where collisions have occurred. The comparison leads to a prioritized list of roadways and intersections to receive funds for safety improvements. The cost factor is comprehensive in that a fatality and severe injury collision is weighed with a much higher cost than property damage only collision. A collision severity weight was used to identify the high severity collision network, using the EPDO method. The EPDO method accounts for both the severity and frequency of collisions by converting each collision to an equivalent number of PDO collisions. The EPDO method assigns a crash cost and score to each collision according to the severity of the crash weighted by the comprehensive crash cost. These EPDO scores are calculated using a simplified version of the comprehensive crash costs per HSIP Cycle 10 application. The weights used in the analysis are shown below in **Table 3**.

TABLE 3: EPDO SCORE USED IN HIGHWAY SAFETY IMPROVEMENT PROGRAM

COLLISION SEVERITY	EPDO SCORE
F+SI Combined	165*
Visible Injury	11
Possible Injury	6
PDO	1

**This is the score used in HSIP Cycle 10 for collisions on roadway segments, to simplify the analysis this study uses the same score for all F+SI collisions, including those at intersections.*

The EPDO scores for all collisions are aggregated in a variety of ways to identify collision patterns, such as location hot-spots. The weighted collisions were geo-located on to unincorporated Solano County's road network. **Figure 32** shows the location and geographic concentration of collisions by their EPDO score.

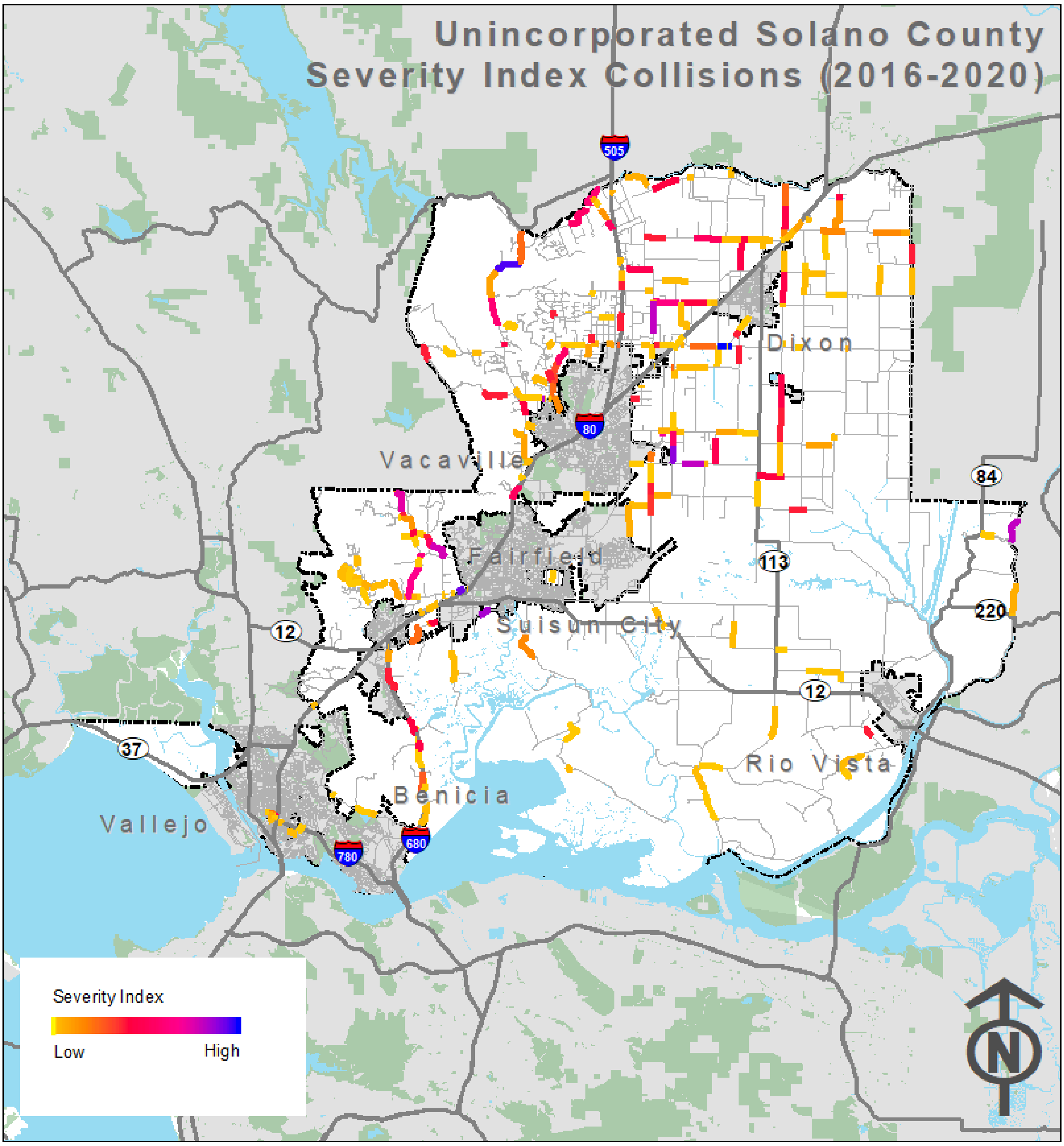

FIGURE 32: SOLANO COUNTY SEVERITY INDEX

HIGH INJURY NETWORK

The next step in the process was to identify high-risk roadway segments and intersections in unincorporated Solano County. The methodology for scoring the high injury locations is the EPDO method; that is, the same method used in the severity weight section. **Figures 33 and 34** show the top 15 high-collision roadway segments and top 16 high-collision intersections.

For the purposes of the high collision network analysis, intersections include collisions that occurred within 250 ft. of it and roadways include all collisions that occurred along the roadway except for collisions that occurred directly at an intersection. Such collisions are assigned a 0 value in distance from intersection value column in the SWITRS.

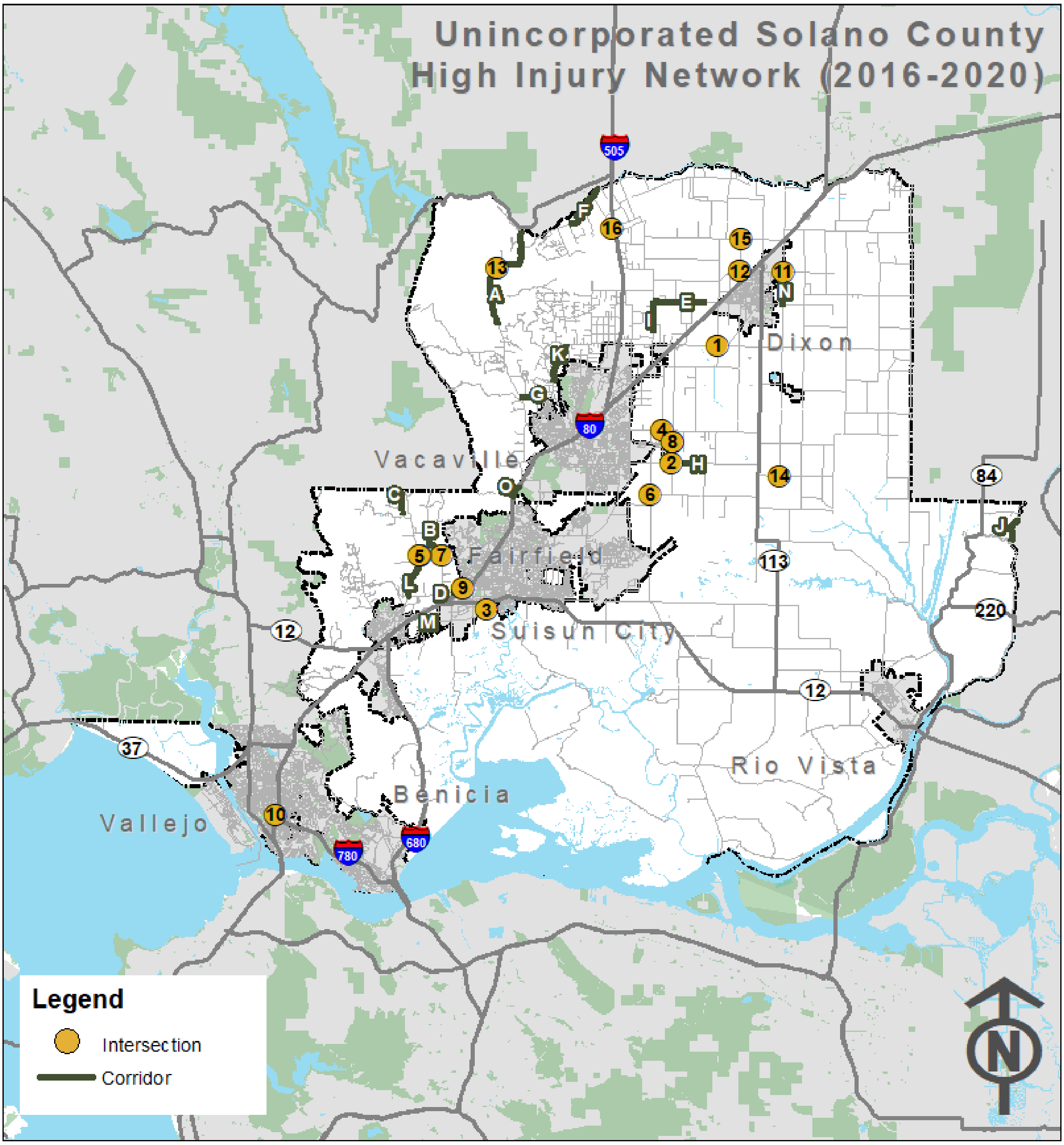

FIGURE 33: SOLANO COUNTY HIGH INJURY NETWORK

Unincorporated Solano County
High Injury Network (2016-2020)

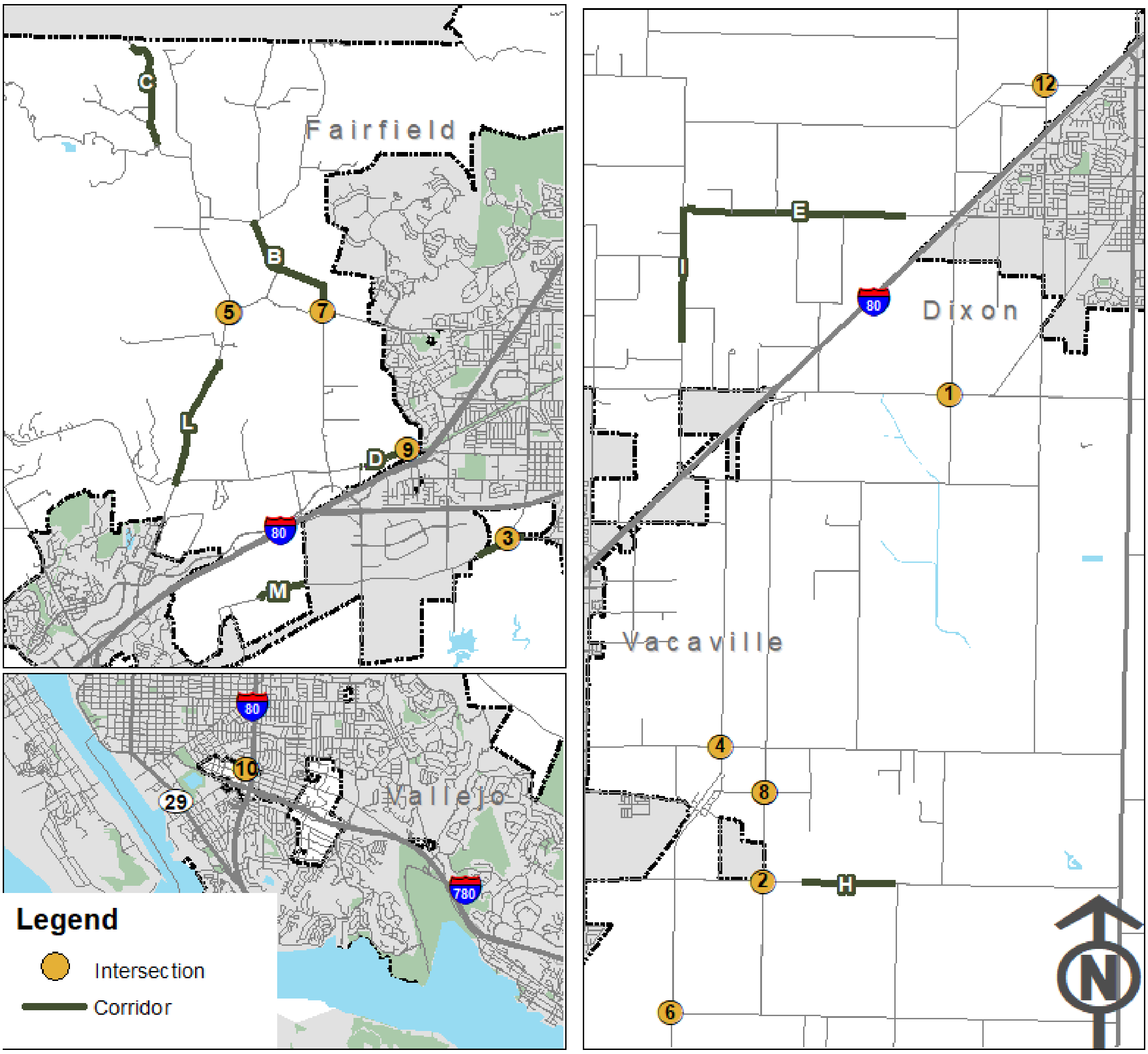

FIGURE 34: SOLANO COUNTY HIGH INJURY NETWORK INSET

INTERSECTION RANKING

A total of 16 intersections were identified as high injury intersections. There were a total of 20 F+SI collisions that occurred at these intersections. The intersection of Batavia Road and Midway Road has the highest EPDO score, indicating the suggested highest priority locations for improvement.

Table 4 lists the EPDO score of the top 16 identified high-collision intersections along with the types of collisions that were shown to lead to the most F+SI collisions and the number of F+SI collisions that occurred at these locations.

TABLE 4: HIGH INJURY INTERSECTIONS

ID	INTERSECTION	TOTAL	F+SI	NIGHT-TIME	HIT OBJECT	DUI	OVER-TURNED	EPDO SCORE
		COLLISIONS						
1	Batavia Road and Midway Road	6	3	0	0	0	0	513
2	Fry Road and Lewis Road	4	2	2	0	1	0	342
3	Cordelia Road and Pennsylvania Avenue	2	2	1	2	1	0	330
4	Byrnes Road and Hawkins Road	9	1	2	0	0	0	218
5	Ledgewood Road and Suisun Valley Road	5	1	1	0	0	0	199
6	Hay Road and Meridian Road	4	1	2	2	3	1	198
7	Abernathy Road and Mankas Corner Road	4	1	1	0	0	0	188
8	Holdener Road and Lewis Road	3	1	1	0	0	0	187
9	Lozano Lane and Rockville Road	3	1	0	1	1	0	177
10	Benicia Road and Lemon Street/Lincoln Road	3	1	1	0	1	0	177
11	Vaughn Road and Pedrick Road	2	1	1	0	0	0	176
12	Silveyville Road and Pitt School Road	2	1	0	0	0	0	176

ID	INTERSECTION	TOTAL	F+SI	NIGHT-TIME	HIT OBJECT	DUI	OVER-TURNED	EPDO SCORE
		COLLISIONS						
13	Quail Canyon Road and Pleasants Valley Road	2	1	0	1	0	1	176
14	Maine Prairie Road and Pedrick Road	2	1	2	2	0	0	171
15	Sievers Road and Pitt School Road	2	1	1	1	0	0	171
16	Winters Road and Wolfskill Road	2	1	0	1	0	0	171

ROADWAY SEGMENT RANKING

A total of 15 corridors were identified as high injury corridors. There were 27 F+SI collisions on these corridors. The corridor with the highest number of F+SI collisions is Pleasants Valley Road with 3 F+SI collisions.

Table 5 lists the collision rate of the top 15 identified high-collision corridors along with the number of F+SI collisions and total collisions.

TABLE 5: HIGH INJURY CORRIDORS

ID	CORRIDORS	TOTAL	F+SI	NIGHT-TIME	HIT OBJECT	DUI	OVER-TURNED	LENGTH (MILES)	EPDO SCORE
		COLLISIONS							
A	Pleasants Valley Road: Yolo County Line to 1,700 ft. north of Cantelow Road	16	3	3	8	2	5	5.4	608
B	Mankas Corner Road: Ledgewood Road to Clayton Road	12	3	2	5	2	3	1.5	569
C	Suisun Valley Road: Twin Sisters Road to Napa County Line	10	2	2	3	0	2	1.3	393
D	Rockville Road: Lozano Lane to Chadbourne Road	8	2	1	3	1	0	0.5	376

ID	CORRIDORS	TOTAL	F+SI	NIGHT-TIME	HIT OBJECT	DUI	OVER-TURNED	LENGTH (MILES)	EPDO SCORE
		COLLISIONS							
E	Dixon Avenue: Meridian Road to 3,800 ft. east of Serpa Lane	7	2	2	2	0	3	2.5	370
F	Putah Creek Road: Holmes Lane to Race Course Lane	6	2	4	5	2	0	3.0	369
G	Vaca Valley: Orchard Avenue to Pleasants Valley Road	3	2	2	1	2	2	1.3	336
H	Fry Road: Dally Road to Lewis Road	2	2	1	1	2	1	1.5	330
I	Meridian Road: Griffin Road to Dixon Avenue	2	2	0	2	1	0	2.0	330
J	Holland Road: Oxford Road to 1 mile south of Oxford Road	2	2	2	0	1	2	1.0	330
K	Gibson Canyon Road: Cantelow Road to Serenity Hills	8	1	5	5	3	3	2.0	237
L	Suisun Valley Road: Rockville Road to Morrison Lane	5	1	3	4	1	0	1.6	204
M	Cordelia Road: Thomasson Lane to Fairfield City Limits	4	1	0	0	0	2	1.0	193
N	Pedrick Road: Vaughn to Dixon Avenue	3	1	2	3	1	0	1.5	187
O	Lyon Road: 2,000 ft. Cherry Glen Road to 2,000 ft. to Rollingwood Drive	3	1	1	2	2	0	1.0	182

ADDITIONAL F+SI LOCATIONS

Additional road sections and intersections locations that experienced fatalities that did not rank as high in the EPDO scoring. These additional areas could be potential future projects. The locations are as follows:

- Putah Creek Road- Boyce Road to McNeill Lane
- Tremont Road- Bulkley Road to Yolo County Line
- Peaceful Glen Road- Acacia Lane to Timm Road
- Meridian Road- Midway Road to Allendale Road (portions of this roadway are in the LRSP)
- Midway Road- Batavia Road to Pitt School Road
- Pitt School Road- Weber Road to Midway Road
- Pleasant Hills Ranch Way
- Maine Prairie Road- Hwy 113 to Robben Road
- Lyon Road- Soda Spring Road to Blue Mountain Drive
- Holland Road- South of Oxford Road
- Benicia Road – Beach Street to Lemon Road

Countermeasures can be selected for each of these locations at a future date depending on funding resources.

CUT-THROUGH TRAFFIC

Solano County experiences a high volume of inter-regional traffic between the Bay Area, Sacramento, and other regions due to its location on I-80 between regions. During peak periods and on peak weekend times, motorists on I-80 can experience heavy congestion at locations in Fairfield, Vacaville, and Dixon. As a result, many drivers exit the freeway and travel on unincorporated County roads to avoid the I-80 congestion, which can in turn cause congestion and safety issues on rural roads that, in many cases, were not designed to handle inter-regional traffic. As part of the LRSP process, County staff included seven additional corridors where large amounts of cut through traffic diverted from I-80 is experienced to receive countermeasures that could help address safety concerns. The corridors are as follows:

- Suisun Valley Road (traffic to and from Napa)
- Tremont Road between Dixon and Davis
- Midway Road between Vacaville and Dixon
- Lyon Road between Vacaville and Fairfield
- Sievers Road between Dixon and Davis
- Cherry Glen Road/Pleasants Valley Road
- Weber Road between Vacaville and Dixon

Countermeasures were selected for each of these locations, detailed in the Countermeasures chapter.

CHAPTER 3 SUMMARY

During the study period of 2016-2020, a total of 1,105 collisions occurred on unincorporated Solano County roads, of which 77 resulted in either a fatality or severe injury. The number of collisions occurring each year has been fairly steady, with the most occurring in 2016 (the most F+SI collisions occurred in 2018). A majority of collisions occurred along roadway segments not near intersections. Based on the collision data, five prominent trends emerged: hit object collisions, nighttime collisions, DUI collisions, improper turning collisions, and overturned collisions. Each of these became the focus of analysis because they were prominent factors in causing F+SI collisions on Solano County roadways. A more detailed geographic analysis was conducted for each of the five identified trends.

Hit Object Collisions: This type of collision represented the highest proportion of F+SI collisions (44%), and collisions of all severity (47%). They are most concentrated on Pleasants Valley Road, Suisun Valley Road, Gibson Canyon Road, and Lopes Road.

Nighttime Collisions: 37% of all collisions and 34% of all F+SI collisions occurred at night. The majority of these nighttime collisions occurred in areas without street lights, given the rural nature of unincorporated Solano County. Higher concentrations of nighttime collisions were observed on Midway Road, Putah Creek Road, Suisun Valley Road, and Gibson Canyon Road.

DUI Collisions: 31% of F+SI collisions occurred as a result of motorists driving under the influence (compared to only 15% of collisions of all severities). They were observed to be more concentrated along Putah Creek Road, Fry Road, Gibson Canyon Road, and Lyon Road.

Improper Turning Collisions: This type of violation caused 23% of all F+SI collisions and was the most common violation type among collisions of all severity (34%). They were observed to be more concentrated along Pleasants Valley Road, Suisun Valley Road, Dixon Avenue, and Gibson Canyon Road.

Overturned Collisions: 22% of all F+SI collisions were overturned collisions, much higher than its share of collisions of all severity (10%). They were more concentrated on Dixon Avenue, Holland Road, Pleasants Valley Road, and Suisun Valley Road.

Once a geographic analysis was conducted of prominent collision trends, a collision severity weight was used to identify the high-risk network. 16 intersections and 15 roadway segments across the unincorporated County were identified as high-risk based on their EPDO score, which takes into account the severity of collisions occurring at a particular intersection or on a roadway segment. Pleasants Valley Road from the Yolo County Line to 1,700 ft. north of Cantelow Road was identified as the highest ranking roadway segment, while Batavia Road at Midway Road was the highest ranking intersection and the only intersection with three F+SI collisions.

NEXT STEPS

The next steps include identifying strategies corresponding to the 4 E's of safety (Engineering, Enforcement, Education, and EMS) to comprehensively make the roadways of unincorporated Solano County safer for all modes of transportation.

EMPHASIS AREAS

Emphasis areas are focus areas for the LRSP that are identified through the comprehensive collision analysis of the identified High Injury Network in Solano County. Emphasis areas help in identifying appropriate safety strategies and countermeasures with the greatest potential to reduce collisions occurring at high injury locations. They can include (but not be limited to): specific collision types, human behaviors, facility types, and specific intersections or corridors.

This chapter summarizes the top six emphasis areas identified for unincorporated Solano County. These emphasis areas were derived from the consolidated high injury collision database (**Appendix B**) where top injury factors were identified by combining the data manually. Along with findings from the data analysis, stakeholder input was also considered while identifying emphasis areas.

THE 4 E'S OF TRAFFIC SAFETY

The LRSP utilizes a comprehensive approach to safety incorporating the "4 E's of traffic safety": **E**ngineering, **E**nforcement, **E**ducation, and **E**MS. This approach recognizes that not all locations can be addressed solely by engineering infrastructure improvements. Incorporating the 4 E's of traffic safety is often required to ensure successful implementation of significant safety improvements and reduce the severity and frequency of collisions throughout a jurisdiction.

Some of the common violation types that may require a comprehensive approach are speeding, failure-to-yield to pedestrians, red light running, aggressive driving, failure to wear safety belts, distracted driving, and driving while impaired. When locations are identified as having these types of violations, coordination with the appropriate law enforcement agencies is needed to arrange visible targeted enforcement to reduce the potential for future driving violations and related crashes and injuries.

To improve safety, education efforts can be used to supplement enforcement and improve the efficiency of each strategy. Education can also be employed in the short-term to address high crash locations until the recommended infrastructure project can be implemented. Similarly, EMS entails strategies around supporting organizations that provide rapid response and care when responding to collisions causing injury, by stabilizing victims and transporting them to medical facilities.

EXISTING TRAFFIC SAFETY EFFORTS IN SOLANO COUNTY

The County of Solano and partner agencies have implemented safety strategies corresponding to the 4 E's of traffic safety. The strategies detailed in this section can supplement these existing programs and concentrate ongoing effort on the High Injury Network and crash types. These initiatives are summarized in the following table:

TABLE 6: EXISTING TRAFFIC SAFETY EFFORTS IN SOLANO COUNTY

DOCUMENT / PROGRAM	DESCRIPTION	E'S ADDRESSED
2018 Solano Travel Safety Plan (2018)	This plan identifies the collision trends, such as crash types or violation types which were used to identify specific countermeasures and project lists for each jurisdiction in Solano County, including the unincorporated areas.	Engineering
Regional Traffic Impact Fee (RTIF)	Solano County assesses a Public Facility Fee that is utilized towards roadway and transit improvements throughout the county. 5% of the revenue is utilized for unincorporated County roads, with additional revenue coming from the revenue divided amongst the five RTIF districts. The fee averages $1.4 million in revenue per year countywide (as of FY 2019-20).	Engineering
Highway Safety Improvement Program (HSIP) Projects	The County has been highly successful in obtaining HSIP funding for safety projects on unincorporated County roads. These include guard rail upgrades, shoulder widening, striping, and pedestrian upgrades. The County has been awarded funding most recently in Cycles 5, 6, 8, and 10.	Engineering
California Highway Patrol (CHP)	CHP Solano provides traffic enforcement on all unincorporated Solano County roads, in addition to state highways throughout the county.	Enforcement, EMS
CHP Start Smart Driver Safety Education	CHP Solano offers driver safety education classes, particularly for teens and their parents to teach safe driving habits and the rules of the road.	Education
Solano Active Transportation Plan – Unincorporated County Chapter (2020)	The chapter of Solano ATP includes a summary of the existing pedestrian and bicycle networks and recommends new engineering projects. The collision analysis section of this chapter summarizes the pedestrian and bicycle-involved collision trends and high-risk locations in Unincorporated Solano County.	Engineering
Solano Safe Routes to School Program	This program is established with the goal of increase the number of children walking and biking to school safely, reduce traffic congestion, and improve air quality around schools, increase daily physical activity levels and reduce obesity and other	Engineering Education

DOCUMENT / PROGRAM	DESCRIPTION	E'S ADDRESSED
	health risks, and improve academic performance among children.	
Safe Routes for Seniors	STA, utilizing a grant from the California Office of Traffic Safety, is implementing a program to promote pedestrian safety among older adults in Solano County. The goal is to engage the community, share information, and collaborate with city and county stakeholders to make local roadways safer.	Education, Engineering
Solano Mobility Program	The Solano Mobility Program provides mobility services and programs for commuters, employers, seniors, youth, and people with disabilities in Solano County. The variety of services and programs offer ways to get around the local community and beyond without driving.	Education
Mature Driver Improvement Courses	Solano Mobility offers DMV approved, mature driver courses designed for persons 55 years of age or older. The course focuses on an overview of current traffic laws, defensive driving techniques, and safe vehicle operations.	Education

FACTORS CONSIDERED IN THE DETERMINATION OF EMPHASIS AREAS

This section presents additional collision data analysis of collision type, collision factors, facility type, roadway geometries, and party level data, analyzed for the various emphasized areas. Emphasis areas were determined by factors that led to the highest amount of injury collisions, with a specific emphasis on F+SI collisions. For the purposes of determining the emphasis areas, only injury collisions on the High Injury Network are presented below. There were a total of 139 of these collisions. Doing so allows the project team to drill further down into the most predominant collision trends and specifically identify their causes at the high-risk locations. Three of the emphasis areas selected were also predominant collision trends in the unincorporated County from the 2018 Solano Travel Safety Plan: roadway departure collisions, DUI collisions, and improper turning collisions.

Each emphasis area is accompanied by comprehensive programs, policies and countermeasures to reduce collisions on County roads in that specific emphasis area. It will provide the basis by which the countermeasure toolbox is developed for each identified high-risk location. Additionally, the emphasis areas will be further refined from stakeholder and public input in subsequent stages of the study.

Solano County experienced 139 collisions on its High Injury Network, which consists of all identified high-risk intersections and roadway segments. All statistics presented below are based on these High Injury Network collisions. The identified emphasis areas are as follows:

- Emphasis Area 1 – Address Roadway Segment Collisions
- Emphasis Area 2 – Reduce Hit Object and Roadway Departure Collisions
- Emphasis Area 3 – Reduce Improper Turning Collisions
- Emphasis Area 4 – Address Driving Under the Influence Collisions
- Emphasis Area 5 – Reduce Overturned Collisions
- Emphasis Area 6 – Reduce Nighttime Collisions
- Emphasis Area 7 - Reduce Motorcycle Collisions
- Emphasis Area 8 - Address Younger Adult Party at Fault Collision

EMPHASIS AREA 1 – ADDRESS ROADWAY SEGMENT COLLISIONS

Of the 139 collisions that occurred on the High Injury Network, 72 (52%) of these collisions occurred on a roadway segment, including 24 F+SI collisions. The following collision data is based on only roadway segment injury collisions in the High Injury Network of the unincorporated Solano County, followed by 4 E's strategies selected to address roadway segment collisions.

46% Hit Object	**26% Overturned**	**46% Improper Turning**

TABLE 7: EMPHASIS AREA 1 STRATEGIES

OBJECTIVE REDUCE THE NUMBER OF FATAL AND SEVERE INJURY COLLISIONS ON ROADWAY SEGMENTS			
	STRATEGY	**PERFORMANCE MEASURE**	**AGENCIES/ ORGANIZATIONS**
Education	Conduct public information and education campaign for roadway safety laws regarding speeding, stop signs, and turning left or right.	Number of education campaigns and/or surveys	County/CHP
Enforcement	Targeted enforcement along high-risk roadway segments to monitor traffic law violations right-of-way violations, speed limit laws and other violations that occur along roadway segments.	Number of tickets issued	CHP
Engineering	• R01, Add Segment Lighting • R02, Remove or relocate fixed objects outside of Clear Recovery Zone • R04, Install Guardrail • R15, Widen shoulder • R21, Improve pavement friction (High Friction Surface Treatments) • R22, Install/Upgrade signs with new fluorescent sheeting (regulatory or warning) • R23, Install chevron signs on horizontal curves • R24 or R25, Install curve advance warning signs • R27, Install delineators, reflectors and/or object markers • R28, Install edge-lines and centerlines • R31, Install edge-line rumble strips/stripes	Number of roadways improved	County

EMS	S05, Install emergency vehicle pre-emption systems. Improve resource deployment and clear routes for emergency responses to collision sites.	EMS vehicle response time	Fire districts and EMS response teams

EMPHASIS AREA 2 – REDUCE HIT OBJECT AND ROADWAY DEPARTURE COLLISIONS

49 (35%) of the High Injury Network collisions were hit object collisions, including 16 F+SI collisions. 82% of roadway departure collisions resulted in a fixed object collision. These two are combined due to the strong correlation between roadway departures and hit object collisions. Roadway departure collisions were also identified as a prominent collision trend in the 2018 Solano Travel Safety Plan. The following collision data is based on only hit object injury collisions on the High Injury Network of unincorporated Solano County, followed by 4 E's strategies.

45% Improper Turning | **35% DUI Collisions** | **51% Nighttime Collisions**

TABLE 8: EMPHASIS AREA 2 STRATEGIES

OBJECTIVE REDUCE THE NUMBER OF FATAL AND SEVERE INJURY HIT OBJECT AND ROADWAY DEPARTURE COLLISIONS			
	STRATEGY	PERFORMANCE MEASURE	AGENCIES/ ORGANIZATIONS
Education	Conduct safety campaigns and outreach to raise awareness of safety needs against roadway departure crashes, such as unsafe speeds, distracted driving, improper turning, and driving under the influence. Continue to utilize existing CHP education campaigns/classes, such as Start Smart.	Number of education campaigns	County/CHP
Enforcement	Targeted enforcement at high-risk rural roadways where hit object/roadway departure collisions are more common.	Number of tickets issued	CHP
Engineering	• NS06, Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs • R01, Add Segment Lighting • R02, Remove or relocate fixed objects outside of Clear Recovery Zone • R04, Install Guardrail • R06 or R07, Flatten side slopes • R22, Install/Upgrade signs with new fluorescent sheeting (regulatory or warning) • R23, Install chevron signs on horizontal curves	Number of locations improved	County

OBJECTIVE REDUCE THE NUMBER OF FATAL AND SEVERE INJURY HIT OBJECT AND ROADWAY DEPARTURE COLLISIONS			
	• R24 or R25, Install curve advance warning signs • R26, Install dynamic/variable speed warning signs • R27, Install delineators, reflectors and/or object markers • R28, Install edge-lines and centerlines • R31, Install edge-line rumble strips/stripes		
EMS	S05, Install emergency vehicle pre-emption systems. Improve resource deployment and clear routes for emergency responses to collision sites.	EMS vehicle response time	Fire districts and EMS response teams

EMPHASIS AREA 3 – REDUCE IMPROPER TURNING COLLISIONS

44 (32%) of the collisions on the High Injury Network were improper turning collisions, including 13 F+SI collision. Improper turning collisions accounted for 25% of the total EPDO score in unincorporated Solano County from the 2018 Solano Travel Safety Plan. The following collision data is based on only improper turning caused injury collisions on the High Injury Network of unincorporated Solano County, followed by 4 E's strategies selected to address improper turning collisions.

55% Fixed Object Collisions	**31% Nighttime**	**30% Overturned collisions**

TABLE 9: EMPHASIS AREA 3 STRATEGIES

OBJECTIVE REDUCE THE NUMBER OF FATAL AND SEVERE INJURY COLLISIONS ON ROADWAY SEGMENTS AND INTERSECTIONS THAT ARE A RESULT OF IMPROPER TURNING			
	STRATEGY	**PERFORMANCE MEASURE**	**AGENCIES/ ORGANIZATIONS**
Education	Conduct safety campaigns and outreach to raise their awareness of safety needs against improper turning crashes, such as safe driving habits classes offered by CHP or Solano Mobility (a program of the STA).	Number of education campaigns	County/CHP
Enforcement	Targeted enforcement at high-risk intersections and roadway segments to monitor improper turning violations.	Number of tickets issued	CHP
Engineering	• S09, Install raised pavement markers and striping (Through Intersection) • S16/NS04/NS05, Convert intersection to roundabout • NS06, Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs • NS07, Upgrade intersection pavement markings (NS.I.) • NS11, Improve sight distance to intersection (Clear Sight Triangles) • NS14, Install raised median on approaches (NS.I.) • R02, Remove or relocate fixed objects outside of Clear Recovery Zone • R22, Install/Upgrade signs with new fluorescent sheeting (regulatory or warning)	Number of intersections and roadway segments improved	County

OBJECTIVE REDUCE THE NUMBER OF FATAL AND SEVERE INJURY COLLISIONS ON ROADWAY SEGMENTS AND INTERSECTIONS THAT ARE A RESULT OF IMPROPER TURNING			
	STRATEGY	**PERFORMANCE MEASURE**	**AGENCIES/ ORGANIZATIONS**
	• R23, Install chevron signs on horizontal curves • R24 or R25, Install curve advance warning signs • R27, Install delineators, reflectors and/or object markers • R28, Install edge-lines and centerlines • R31, Install edge-line rumble strips/stripes		
EMS	S05, Install emergency vehicle pre-emption systems. Improve resource deployment and clear routes for emergency responses to collision sites.	EMS vehicle response time	Fire districts and EMS response teams

EMPHASIS AREA 4 – ADDRESS DUI COLLISIONS

26 (19%) of the collisions on the High Injury Network were due to driving under the influence of alcohol or drugs, including 13 F+SI collision. DUI collisions accounted for 25% of the unincorporated County's EPDO score in the 2018 Solano Travel Safety Plan. The following collision data is based on only DUI injury collisions on the High Injury Network of unincorporated Solano County, followed by 4 E's strategies selected to address DUI collisions.

73% Fixed/Other Object Collisions	**23% Overturned Collisions**	**54% Nighttime Collisions**

TABLE 10: EMPHASIS AREA 4 STRATEGIES

OBJECTIVE REDUCE THE NUMBER OF FATAL AND SEVERE INJURY COLLISIONS THAT OCCUR DUE TO DRIVING UNDER THE INFLUENCE			
	STRATEGY	PERFORMANCE MEASURE	AGENCIES/ ORGANIZATIONS
Education	Conduct safety campaigns and outreach for safety laws regarding driving under the influence, such as existing CHP campaigns to address drunk driving.	Number of education campaigns	County/CHP
Enforcement	Targeted enforcement at high-risk intersections and roadway locations to monitor violations of driving under influence. Establish DUI check points near high-risk locations as appropriate.	Number of tickets issued	CHP
Engineering	• S02, Improve signal hardware: lenses, back-plates with retroreflective borders, mounting, size, and number • S09, Install raised pavement markers and striping (Through Intersection) • NS06, Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs • NS07, Upgrade intersection pavement markings (NS.I.) • NS09, Install flashing beacons as advance warning (NS.I.) • R01, Add Segment Lighting • R02, Remove or relocate fixed objects outside of Clear Recovery Zone • R04, Install Guardrail • R15, Widen shoulder	Number of locations improved	County

OBJECTIVE REDUCE THE NUMBER OF FATAL AND SEVERE INJURY COLLISIONS THAT OCCUR DUE TO DRIVING UNDER THE INFLUENCE			
	STRATEGY	**PERFORMANCE MEASURE**	**AGENCIES/ ORGANIZATIONS**
	• R22, Install/Upgrade signs with new fluorescent sheeting (regulatory or warning) • R27, Install delineators, reflectors and/or object markers		
EMS	S05, Install emergency vehicle pre-emption systems. Improve resource deployment and clear routes for emergency responses to collision sites.	EMS vehicle response time	Fire districts and EMS response teams

EMPHASIS AREA 5 – REDUCE OVERTURNED COLLISIONS

23 (17%) of the collisions on the High Injury Network resulted in an overturned vehicle, including eight F+SI collisions. Of these overturned collisions, 13 collisions were due to improper turning, 18 were non-collision, and 11 occurred at night. The following collision data is based on only overturned injury collisions on the High Injury Network of unincorporated Solano County, followed by 4 E's strategies selected to address overturned collisions.

57% Improper Turning | **34% F+SI Collision** | **48% Nighttime Collisions**

TABLE 11: EMPHASIS AREA 5 STRATEGIES

OBJECTIVE REDUCE THE NUMBER OF FATAL AND SEVERE INJURY COLLISIONS THAT OCCUR DUE TO AN OVERTURNED VEHICLE			
	STRATEGY	PERFORMANCE MEASURE	AGENCIES/ ORGANIZATIONS
Education	Conduct safety campaigns and outreach to raise awareness of safety needs against roadway departure crashes, such as unsafe speeds, distracted driving, improper turning, and driving under the influence. Continue to utilize existing CHP education campaigns/classes, such as Start Smart.	Number of education campaigns	County/CHP
Enforcement	Targeted enforcement at high-risk intersections and roadway locations to monitor violations that could lead to an overturned collision, such as unsafe speed, distracted driving, or DUI.	Number of tickets issued	CHP
Engineering	• S09, Install raised pavement markers and striping (Through Intersection) • NS07, Upgrade intersection pavement markings (NS.I.) • R01, Add Segment Lighting • R04, Install Guardrail • R06 or R07, Flatten side slopes • R15, Widen shoulder • R16, Curve Shoulder widening (Outside only) • R17, Improve horizontal alignment (flatten curves) • R22, Install/Upgrade signs with new fluorescent sheeting (regulatory or warning) • R24 or R25, Install curve advance warning signs	Number of locations improved	County

	OBJECTIVE REDUCE THE NUMBER OF FATAL AND SEVERE INJURY COLLISIONS THAT OCCUR DUE TO AN OVERTURNED VEHICLE		
	STRATEGY	**PERFORMANCE MEASURE**	**AGENCIES/ ORGANIZATIONS**
	• R26, Install dynamic/variable speed warning signs • R28, Install edge-lines and centerlines • R31, Install edge-line rumble strips/stripes		
EMS	S05, Install emergency vehicle pre-emption systems. Improve resource deployment and clear routes for emergency responses to collision sites.	EMS vehicle response time	Fire districts and EMS response teams

EMPHASIS AREA 6 – REDUCE NIGHTTIME COLLISIONS

44 (32%) of the collisions on the High Injury Network occurred at night, including 14 F+SI collision. Of these nighttime collisions, 13 collisions were due to driving under the influence, 14 were due to improper turning, and 24 were hit object collisions. The following collision data is based on only nighttime injury collisions on the High Injury Network of unincorporated Solano County, followed by 4 E's strategies selected to address nighttime collisions.

30% Collisions due to DUI	**32% Improper Turning**	**55% Hit Object Collisions**

TABLE 12: EMPHASIS AREA 6 STRATEGIES

OBJECTIVE REDUCE THE NUMBER OF FATAL AND SEVERE INJURY COLLISIONS THAT OCCUR DURING NIGHTTIME			
	STRATEGY	PERFORMANCE MEASURE	AGENCIES/ ORGANIZATIONS
Education	Develop awareness program to inform motorists of safe nighttime driving habits, as well as high-risk collision locations and the most common violations/collision types occurring at night. Utilize existing CHP campaigns warning of the dangers of drunk driving.	Number of education campaigns	County/CHP
Enforcement	Targeted enforcement at high-risk intersections and roadway locations where nighttime collisions are more common. Establish DUI check points at night where appropriate.	Number of tickets issued	CHP
Engineering	• S01 or NS01, Install intersection lighting • S02, Improve signal hardware • NS06, Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs • NS07, Upgrade intersection pavement markings (NS.I.) • NS08, Install Flashing Beacons at Stop-Controlled Intersections • NS09, Install flashing beacons as advance warning (NS.I.) • R01, Add Segment Lighting • R02, Remove or relocate fixed objects outside of Clear Recovery Zone • R22, Install/Upgrade signs with new fluorescent sheeting (regulatory or warning)	Number of locations improved	County

OBJECTIVE REDUCE THE NUMBER OF FATAL AND SEVERE INJURY COLLISIONS THAT OCCUR DURING NIGHTTIME			
	STRATEGY	**PERFORMANCE MEASURE**	**AGENCIES/ ORGANIZATIONS**
	• R27, Install delineators, reflectors and/or object markers • R28, Install edge-lines and centerlines • R31, Install edge-line rumble strips/stripes		
EMS	S05, Install emergency vehicle pre-emption systems. Improve resource deployment and clear routes for emergency responses to collision sites.	EMS vehicle response time	Fire districts and EMS response teams

EMPHASIS AREA 7 – REDUCE MOTORCYCLE COLLISIONS

15 (11%) of the collisions on the High Injury Network were motorcycle collisions, including seven F+SI collisions. Of these motorcycle collisions, six were collisions due to improper passing, seven were overturned, and six factored into non-collision. The following collision data is based on only motorcycle injury collisions on the High Injury Network of unincorporated Solano County, followed by 4 E's strategies selected to address motorcycle collisions.

40% Improper Passing **47% Overturned** **40% Non-Collision**

TABLE 13: EMPHASIS AREA 7 STRATEGIES

OBJECTIVE REDUCE THE NUMBER OF FATAL AND SEVERE INJURY MOTORCYCLE COLLISIONS			
	STRATEGY	PERFORMANCE MEASURE	AGENCIES/ ORGANIZATIONS
Education	Conduct public information and education campaign for safety laws regarding motorcycle collisions and motorcyclists' higher risk of fatal and severe injury collisions. Utilize existing CHP programs, such as the Motorcycle Safety Program, to encourage safe motorcycle riding habits.	Number of education campaigns	County/CHP
Enforcement	Targeted enforcement at high-risk locations to monitor motorcycle collisions.	Number of tickets issued	CHP
Engineering	• S16/NS04/NS05, Convert intersection to roundabout • NS06, Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs • NS07, Upgrade intersection pavement markings (NS.I.) • R04, Install Guardrail • R15, Widen shoulder • R22, Install/Upgrade signs with new fluorescent sheeting (regulatory or warning) • R26, Install dynamic/variable speed warning signs • R27, Install delineators, reflectors and/or object markers • R28, Install edge-lines and centerlines	Number of locations improved	County

OBJECTIVE REDUCE THE NUMBER OF FATAL AND SEVERE INJURY MOTORCYCLE COLLISIONS			
	STRATEGY	PERFORMANCE MEASURE	AGENCIES/ ORGANIZATIONS
	• R29, Install no-passing line • R31, Install edge-line rumble strips/stripes		
EMS	S05, Install emergency vehicle pre-emption systems. Improve resource deployment and clear routes for emergency responses to collision sites.	EMS vehicle response time	Fire districts and EMS response teams

EMPHASIS AREA 8 – ADDRESS YOUNGER ADULT PARTY AT FAULT COLLISIONS

Of the 139 reported collisions on the High Injury Network of unincorporated Solano County, 42% were caused by a party at fault under the age of 30. The following is a review of the demographic data provided in the party at fault data of the collisions occurring on the High Injury Network, along with educational strategies to address younger adult party at fault collisions.

42% F+SI collisions party at fault was between the ages of 18-30

78% F+SI collisions party at fault was a male

TABLE 14: EMPHASIS AREA 8 STRATEGIES

OBJECTIVE REDUCE THE NUMBER OF FATAL AND SEVERE INJURY COLLISIONS CAUSED BY YOUNG ADULTS			
	STRATEGY	**PERFORMANCE MEASURE**	**AGENCIES/ORGANIZATIONS**
Education	Target educational programs for young adults. Distribute brochures/fliers with basic red light running, speeding, distracted driving, improper turning, aggressive driving and stop sign violations information at driver training programs. Include statistics of young adult larger risks of fatalities. Involve school districts in such campaigns. Utilize existing CHP programs and classes, such as Start Smart.	Number of education campaigns	County/School Districts/CHP

COUNTERMEASURE IDENTIFICATION

Upon the identification of high-risk locations and Emphasis Areas, the next step was to identify appropriate safety countermeasures. The Caltrans LRSM provides 84 countermeasures, of which 22 are eligible in the current HSIP call for signalized intersections, 24 for un-signalized intersections, and 38 for roadway segments. The LRSM provides guidance on where to apply the countermeasures including the crash types each countermeasure would address, and a Crash Reduction Factor (CRF) for each countermeasure. The Federal Highway Administration (FHWA) CMF Clearinghouse and published research papers were reviewed by the project team to gain additional insight on CRFs and effectiveness of specific countermeasures.

The project team conducted a thorough review of the high-risk locations (intersections and roadway segments) using aerial photography, Google Maps Street View software, and in-person site visits in December 2021. Crash characteristics of all collisions occurring on the High Injury Network were considered. After combining the physical and collision characteristics, the project team developed a table of preliminary countermeasures that address each of the eight identified Emphasis Areas. The table was refined by selecting up to four countermeasures for each high-risk location that were most commonly recommended among all Emphasis Areas. By doing this, the project team was able to identify countermeasures with the greatest opportunity for systemic implementation.

COUNTERMEASURE TOOLBOX

Engineering countermeasures were selected for each of the high-risk locations and for the emphasis areas. These were based off of approved countermeasures from the Caltrans LRSM used in HSIP grant calls for projects. The intention is to give the County potential countermeasures for each location that can be funded with federal monies in future HSIP calls for projects, or using other funding sources, such as the County's Capital Improvement Program. Non-engineering countermeasures were also selected using the 4 E's strategies, and are included with the emphasis areas. The countermeasure toolbox in **Appendix C** details the draft countermeasures for each high-risk location and Emphasis Area, separated by intersections and roadway segments. While not all of these countermeasures will be included in the resulting safety projects, they are included to give the County a toolbox for implementing future safety improvements through other means, such as the County's Capital Improvement Program.

Tables 15 and 16 provide a description of each countermeasure along with the CRF, federal funding eligibility, and opportunity for systemic implementation. Each of these factors is weighed in the project team's decision making process to develop the countermeasure toolbox. An excerpt of the LRSM, detailing each available HSIP countermeasure referenced in the recommendations tables, is included as **Appendix D**.

TABLE 15: NON-SIGNALIZED INTERSECTION COUNTERMEASURES

CODE	COUNTERMEASURE NAME	COUNTERMEASURE DESCRIPTION	CRF	FEDERAL FUNDING	SYSTEMIC APPROACH OPPORTUNITY
NS01	Add intersection lighting (NS.I.)	Provision of lighting at the intersection and all its approaches	40%	100%	Medium
NS02	Convert to all-way stop control (from 2-way or yield control)	Conversion of 2-way stop intersection to 4-way stop	50%	100%	High
NS06	Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs	Additional regulatory and warning signs at or prior to intersections will help enhance the ability of approaching drivers to perceive them	15%	100%	Very High
NS07	Upgrade intersection pavement markings	Increase the visibility of an intersection by upgrading pavement markings where none exist or are faded/ cracked	25%	100%	Very High
NS08	Install flashing beacons at stop-controlled intersections	Reinforce driver awareness of an intersection	15%	100%	High
NS09	Install flashing beacons as advance warning (NS.I.)	Installation of an advance flashing beacons can be used to supplement and call driver attention to intersection control signs	30%	100%	High
NS10	Install transverse rumble strips on approaches	Provide an auditory and tactile sensation for a motorist approaching an intersection	20%	90%	High
NS11	Improve sight distance to intersection (clear sight triangles)	Clearing roadside obstructions to improve sight distance at the intersection	20%	90%	High

CODE	COUNTERMEASURE NAME	COUNTERMEASURE DESCRIPTION	CRF	FEDERAL FUNDING	SYSTEMIC APPROACH OPPORTUNITY
NS12	Improve pavement friction (high friction surface treatments)	Improves the friction of the pavement and improves skid resistance	55%	100%	Medium
NS13	Install splitter-islands on the minor road approaches	Splitter islands can provide a positive separation between turning vehicles on a through road and vehicles stopped on the minor road approach Also allows for an extra stop sign at an intersection	40%	90%	Medium
NS14	Install raised medians on approaches	Channels traffic approaching an intersection	25%	90%	Medium
NS19PB	Install raised medians (refuge islands)	Decreases the level of exposure of pedestrians to traffic and allows pedestrians to only cross one direction of traffic at a time	45%	90%	Medium
NS21PB	Install/upgrade pedestrian crossing at uncontrolled locations (with enhanced safety features)	Enhances pedestrian crossings with high visibility patterns, yield lines, pedestrian signage, etc. to warn drivers of the presence of pedestrians	35%	100%	Medium
NS22PB	Install Rectangular Rapid Flashing Beacon (RRFB)	RRFB includes pedestrian-activated flashing lights and additional signage that enhance the visibility of marked crosswalks and alert motorists to pedestrian crossings	35%	100%	Medium

(Note: CRF = Crash Reduction Factor)

TABLE 16: ROADWAY SEGMENT COUNTERMEASURES

CODE	COUNTERMEASURE NAME	COUNTERMEASURE DESCRIPTION	CRF	FEDERAL FUNDING	SYSTEMIC APPROACH OPPORTUNITY
R01	Add segment lighting	Provision of lighting along roadways	35%	100%	Medium
R02	Remove or relocate fixed objects outside of clear recovery zone	Provisions of a 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 Removing or moving fixed objects, flattening slopes, or providing recovery areas reduces the likelihood of a crash	35%	90%	Medium
R04	Install guardrail	Reduces the severity of lane departure crashes	25%	100%	Medium
R08	Install raised median	Provides a rigid barrier between opposing traffic	25%	90%	Medium
R21	Improve pavement friction (high friction surface treatments)	Improves the friction of the pavement and improves skid resistance	55%	100%	High
R22	Install/upgrade signs with new fluorescent sheeting (regulatory or warning)	Additional or new signage can address crashes caused by lack of driver awareness or compliance of roadway signing	15%	100%	Very High
R23	Install chevron signs on horizontal curves	Warns driver of an approaching curve and provides guidance to drivers	40%	100%	Very High
R24	Install curve advance warning signs	Serves as an advance warning of an unexpected or sharp curve	25%	100%	Very High

CODE	COUNTERMEASURE NAME	COUNTERMEASURE DESCRIPTION	CRF	FEDERAL FUNDING	SYSTEMIC APPROACH OPPORTUNITY
R26	Install dynamic/ variable speed warning signs	Includes the addition of dynamic regulatory signs to warn drivers of speed	30%	100%	High
R27	Install delineators, reflectors and/or object markers	Installation of delineators, reflectors and/or object markers are intended to warn drivers of an approaching curve or fixed object that cannot easily be removed	15%	100%	Very High
R28	Install edge lines and centerlines	Provisions of centerlines and edge-lines where none exist or make significant upgrades to existing lines	25%	100%	Very High
R31	Install edge line rumble strips/ stripes	Provision of edge line rumble strips/stripes that create an auditory sound when driven over to mitigate lane departures	15%	100%	High
R32PB	Install bike lanes	Delineates available road space that is exclusive or preferential for use by bicycles	35%	90%	High
R34PB	Install sidewalk/ pathway (to avoid walking along roadway)	Sidewalks and walkways provide people with space to travel within the public right-of-way that is separated from roadway vehicles	80%	90%	Medium
R35PB	Install/upgrade pedestrian crossing (with enhanced safety features)	The enhanced safety elements, which may include curb extensions, medians and pedestrian crossing islands, beacons, and lighting, combined with pavement markings delineating a portion of the roadway that is designated for pedestrian crossing	35%	90%	Medium

(Note: CRF = Crash Reduction Factor)

SAFETY PROJECTS

This chapter summarizes the process of selecting safety projects as part of the analysis for the Solano County's LRSP. The next step after the identification of high-risk locations, emphasis areas and applicable countermeasures was to identify location-specific safety improvements for all high-risk roadway segments and intersections.

Specific countermeasures and improvements were selected from the 2020 Caltrans LRSM, where:

- S refers to improvements at signalized locations,
- NS refers to improvements at non-signalized locations, and
- R refers to improvements on roadway segments.

The corresponding number refers to the countermeasure number in the LRSM (2020). The countermeasures were grouped into safety projects for high-risk intersections and roadway segments. A total of nine safety projects were developed. All countermeasures were identified based on the technical teams' assessment of viability that consisted of extensive analysis, observations, County staff input, and stakeholder/community input. The most applicable and appropriate countermeasures are grouped together to form projects that can help make high-risk locations safer.

Table 1 lists the safety projects for high-risk intersections and roadway segments, along with base planning level cost (2021 dollar amounts) estimates and the resultant preliminary Benefit-Cost (B/C) Ratio. The "Total Benefit" estimates were calculated for the proposed improvements being evaluated in the proactive safety analysis. This "Total Benefit" is divided by the "Total Cost per Location" estimates for the proposed improvements, giving the resultant B/C Ratio. The B/C Ratio calculation follows the methodology as mentioned in the LRSM (2020). **Appendix E** lists the detailed methodology to calculate B/C Ratio, as well as the complete cost, benefit and B/C Ratio calculation spreadsheet.

The safety projects were developed based on the previously completed collision analysis, which was used to identify main collision attributes that were found to be leading factors of fatal and severe collisions in unincorporated Solano County. These collision factors are shown below, as well as viable safety projects that can help address these factors.

Hit Object Collisions: This type of collision represented the highest proportion of F+SI collisions (44%), and collisions of all severity (47%). To address these collisions, viable safety projects include edge line rumble strips/stripes, widen shoulders, installing delineators, reflectors, and object markers, installing curve warning signs, installing chevron signs at horizontal curves, and installing/upgrading signs with new fluorescent sheeting.

Nighttime Collisions: 37% of all collisions and 34% of all F+SI collisions occurred at night. The majority of these nighttime collisions occurred in areas without street lights, given the rural nature of unincorporated Solano County. Viable safety projects to help address these collisions include transverse rumble strips, upgrading intersection pavement markings, installing flashing beacons at stop controlled intersections, installing/upgrading larger or additional stop signs or other intersection regulatory/warning signs, installing flashing beacons as advance warning, installing intersection lighting, installing edge line and centerline rumble strips/stripes, installing flashing curve advance warning signs, installing chevron signs on horizontal curves, installing/upgrading signs with new fluorescent sheeting, and installing delineators, reflectors, and object markers.

DUI Collisions: 31% of F+SI collisions occurred as a result of DUI compared to only 15% of collisions of all severities). In addition to educational measures recommended in the emphasis areas section, viable safety projects have been recommended to increase visibility and alert drivers of upcoming intersections or hazards. These are the same as what is listed for nighttime collision recommendations above.

Improper Turning Collisions: This type of violation caused 23% of all F+SI collisions and was the most common violation type among collisions of all severity (34%). Viable safety projects to help address these include installing edge line rumble strips/stripes, widening shoulders, installing guard rail, improving pavement friction, improving sight distance, installing/upgrading signs with new fluorescent sheeting, installing flashing curve warning signs, and installing chevrons at horizontal curves.

Overturned Collisions: 22% of all F+SI collisions were overturned collisions, much higher than its share of collisions of all severity (10%). Viable safety projects to help address these collisions include installing edge line rumble strips/stripes, widen shoulders, install guard rail, improving pavement friction, installing flashing curve warning signs, installing chevron signs on horizontal curves, and installing flashing beacons as advance warning for intersections (and at intersection).

The next step in the process will be to prepare grant ready materials for HSIP Cycle 11 applications. The County has contracted with TJKM to provide materials for up to two applications. However, it should be noted that while the LRSP projects were based on high-risk locations, HSIP applications can be expanded to include many locations across the county. The County can identify additional locations that may be beneficial to add to the HSIP application and TJKM can calculate the BCR.

Table 17 lists identified projects for the unincorporated areas of Solano County, with a base planning level cost estimate for each location and the resulting B/C Ratio of the project (the title of each countermeasure is located in **Table 18**).

TABLE 17: LIST OF VIABLE SAFETY PROJECTS

LOCATION	CM1	CM2	CM3	COST PER LOCATION	TOTAL COST	B/C RATIO
Project 1 – Unsignalized Intersections: Transverse Rumble Strips, Upgraded Intersection Pavement Markings, and Flashing Beacon at Intersection						
Byrnes Road and Hawkins Road*	NS10	NS08	NS07	$31,927	$317,754	83.32
Hay Road and Meridian Road	NS10	NS08	NS07	$18,572		
Abernathy Road and Mankas Corner Road	NS10	NS08	NS07	$54,940		
Holdener Road and Lewis Road	NS10	NS08	NS07	$34,902		
Vaughn Road and Pedrick Road	NS10	NS08	NS07	$72,254		
Silveyville Road and Pitt School Road	NS10	NS08	NS07	$36,964		
Maine Prairie Road and Pedrick Road	NS10	NS08	NS07	$16,485		
Sievers Road and Pitt School Road	NS10	NS08	NS07	$16,512		
Winters Road and Wolfskill Road	NS10	NS08	NS07	$17,658		
Pleasants Valley Road and Putah Creek Road	NS10	NS08	NS07	$17,539		
Project 2: Unsignalized Intersections: Install/Upgrade Larger or Additional Stop Signs or Other Intersection Warning/Regulatory Signs, and Flashing Beacons as Advance Warning*						
Ledgewood Road and Suisun Valley Road	NS06	NS09		$14,630	$86,485	140.29
Cordelia Road and Pennsylvania Road	NS06	NS09		$30,065		
Quail Canyon Road and Pleasants Valley Road	NS06	NS09		$20,930		
Lozano Lane and Rockville Road	NS06	NS09		$20,860		

LOCATION	CM1	CM2	CM3	COST PER LOCATION	TOTAL COST	B/C RATIO
Project 3: Lighting Improvements at Unsignalized Intersections						
Batavia Road and Midway Road	NS01			$110,915	$710,738	30.21
Byrnes Road and Hawkins Road	NS01			$101,220		
Fry Road and Lewis Road	NS01			$116,970		
Hay Road and Meridian Road	NS01			$100,457		
Maine Prairie Road and Pedrick Road	NS01			$92,582		
Sievers Road and Pitt School Road	NS01			$85,512		
Cordelia Road and Pennsylvania Avenue	NS01			$103,082		
Project 4: Unsignalized Intersections: Improve Pavement Friction and Improve Sight Distance						
Batavia Road and Midway Road	NS12			$71,302	$802,575	53.67
Ledgewood Road and Suisun Valley Road	NS12	NS11		$118,328		
Lozano Lane and Rockville Road	NS12	NS11		$65,233		
Silveyville Road and Pitt School Road	NS12	NS11		$155,540		
Quail Canyon Road and Pleasants Valley Road	NS12	NS11		$94,430		
Cordelia Road and Pennsylvania Avenue	NS12	NS11		$111,136		
Hay Road and Meridian Road	NS12			$71,876		
Abernathy Road and Mankas Corner Road	NS12	NS11		$71,988		
Sievers Road and Pitt School Road	NS12			$42,742		

LOCATION	CM1	CM2	CM3	COST PER LOCATION	TOTAL COST	B/C RATIO
Project 5: Roadway Segments: Install Edge line and Centerline Rumble Strips/Stripes						
Mankas Corner Road: Ledgewood Road to Clayton Road	R31	R30		$55,650		
Rockville Road: Lozano Lane to Chadbourne Road	R31	R30		$49,847		
Dixon Avenue: 1,500 ft. East to Meridian Road to I-80	R31	R30		$84,322		
Fry Road: Vacaville City Limits to SR 113	R31	R30		$77,098	$634,935	32.53
Suisun Valley Road: Rockville Road to Morrison Lane	R31	R30		$145,964		
Cordelia Road: Thomasson Lane to Fairfield City Limits	R31	R30		$140,154		
Putah Creek Road: Winters Road to Race Course Lane	R31	R30		$81,900		
Project 6: Roadway Segments: Install Chevron Signs on Horizontal Curves, and Install Curve Advance Warning Signs with Flashing Beacons						
Suisun Valley Road: Twin Sisters Road to Napa County Line	R23	R25		$35,140		
Dixon Avenue: Meridian Road to 1,500 ft. east of Meridian Road	R23	R25		$17,780		
Putah Creek Road: Holmes Lane to Race Course Lane	R23	R25		$61,180	$281,575	89.34
Vaca Valley: Pleasants Valley Road to Vacaville City Limits	R23	R25		$25,970		
Gibson Canyon Road: Farrel Road to Cantelow Road	R23	R25		$25,480		
Suisun Valley Road: Rockville Road to Morrison Lane	R23	R25		$45,675		

LOCATION	CM1	CM2	CM3	COST PER LOCATION	TOTAL COST	B/C RATIO
Cordelia Road: Thomasson Lane to Fairfield City Limits	R23	R25		$46,060		
Lyon Road: Fairfield City Limits to Cherry Glen Road	R23	R25		$24,290		
Project 7: Roadway Segments: Install Delineators/Reflectors/Object Markers, and Install/Upgrade Signs with New Fluorescent Sheeting						
Rockville Road: Lozano Lane to Chadbourne Road	R27	R22		$17,675	$503,755	55.14
Pleasants Valley Road: Cantelow Road to Yolo County Line	R27	R22		$142,275		
Dixon Avenue: Meridian Road to I-80	R27	R22		$51,065		
Putah Creek Road: Holmes Lane to Race Course Lane	R27	R22		$96,180		
Vaca Valley: Pleasants Valley Road to Vacaville City Limits	R27	R22		$24,220		
Fry Road: Vacaville City Limits to SR 113	R27	R22		$15,785		
Meridian Road: Midway Road to Silveyville Road	R27	R22		$29,785		
Holland Road: Oxford Road to 1 mile south of Oxford Road	R27	R22		$11,900		
Pedrick Road: Dixon Avenue to Dixon City Limits	R27	R22		$26,040		
Lyon Road: Fairfield City Limits to Cherry Glen Road	R27	R22		$16,730		
Cordelia Road: Thomasson Lane to Fairfield City Limits	R27	R22		$72,100		
Project 8: Roadway Segments: Install Guard Rail and Improve Pavement Friction (on curves)						
Putah Creek Road: Holmes Lane to Race Course Lane	R04	R21		$616,980	$1,511,335	28.40

LOCATION	CM1	CM2	CM3	COST PER LOCATION	TOTAL COST	B/C RATIO
Vaca Valley: Pleasants Valley Road to City Limits	R04	R21		$198,856		
Holland Road: Oxford Road to 1 mile south of Oxford Road	R04			$59,150		
Cordelia Road: Thomasson Lane to Fairfield City Limits		R21		$248,360		
Pleasants Valley Road: Cantelow Road to Yolo County Line	R04	R21		$233,485		
Gibson Canyon Road: Farrel Road to Cantelow Road	R04	R21		$200,004		
**Project 9: Install Edge line and Centerline Rumble Strips/Stripes, and Widen Shoulders ** **						
Pleasants Valley Road: 1,000 ft. south of Quail Canyon Road to Putah Creek Road	R31	R15	R30	$637,378	$2,715,202	35.97
Suisun Valley Road: Twin Sisters Road to 3,300 ft. north of Joyce Lane	R31	R15	R30	$466,858		18.81
Dixon Avenue: Meridian Road to 1500 ft. east of Meridian Road***	R31	R15	R30	$132,692		33.40
Putah Creek Road: Holmes Lane to Winters Road	R31	R15	R30	$644,420		13.57
Suisun Valley Road: Morrison Lane to 0.5 mi south of Morrison Lane	R31		R30	$288,652		60.83
Lyon Road: Fairfield City Limits to Cherry Glen Road	R31	R15	R30	$608,216		7.79
Pedrick Road: Dixon Avenue to Dixon City Limits	R31	R15	R30	$171,962		28.91

Notes: CM – countermeasure. B/C Ratio is the dollar amount of benefits divided by the cost of the countermeasure.

**Minimum HSIP grant request is $100,000, so it's recommended to include locations beyond the high-risk network if this application is pursued.*

***R15 countermeasure (CM) is required to be the last step of an incremental approach; that is, lower cost CMs must be implemented first. Further analysis of segments that received edge line striping treatments on County roads to determine effectiveness will be conducted should the County wish to pursue this application in the HSIP Cycle 11 call for projects. Additionally, per request of County staff, B/C ratios for Project 9 are broken down for each location, rather than the project as a whole.*

****Per County staff, Dixon Avenue from Meridian Road to 1,500' East of Meridian Road will require future curve realignment.*

TABLE 18: LIST OF COUNTERMEASURES

COUNTERMEASURE NAME
NS01 - Add Intersection Lighting (Non-Signalized Intersection (NS.I.)
NS06 - Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs
NS07 - Upgrade intersection pavement markings
NS08 - Install Flashing Beacons at Stop-Controlled Intersections
NS09 - Install flashing beacons as advance warning (NS.I.)
NS10 - Install transverse rumble strips on approaches
NS11- Improve sight distance to intersection (Clear Sight Triangles)
NS12 - Improve pavement friction (High Friction Surface Treatment)
R04 - Install guard rail
R15 - Widen shoulder
R21 - Improve pavement friction (High Friction Surface Treatment)
R22 - Install/Upgrade signs with new fluorescent sheeting (regulatory or warning signs)
R23 - Install chevron signs on horizontal curves
R25 - Install curve warning signs (flashing beacon)
R27 - Install delineators, reflectors, and/or object markers
R28 - Install edge-lines and centerlines
R30 - Install centerline rumble strips/stripes
R31 - Install edge line rumble strips/stripes

EVALUATION AND IMPLEMENTATION

This chapter describes the steps the County may take to evaluate the success of this Plan and steps needed to update the Plan in the future. The LRSP is a guidance document and requires periodic updates to assess its efficacy and re-evaluate potential solutions. It is recommended to update the Plan every two to five years in coordination with the safety partners. This document was developed based on community needs, stakeholder input, and collision analysis conducted to identify priority emphasis areas throughout the County. The implementation of strategies under each emphasis area would aim to reduce F+SI collisions.

IMPLEMENTATION

The LRSP is a guidance document that is recommended to be updated every two to five years in coordination with the safety partners. The LRSP document provides engineering, education, enforcement, and EMS-related countermeasures that can be implemented throughout the County to reduce F+SI collisions. It is recommended that Solano County implement the selected projects in high-collision locations in coordination with other projects proposed for the County's infrastructure development in their future Capital Improvement Plans. After implementing countermeasures, the performance measures for each emphasis area should be evaluated annually. The most important measure of success of the LRSP should be reducing F+SI collisions throughout the City. If the number of F+SI collisions does not decrease over time, then the emphasis areas and countermeasures should be re-evaluated.

Funding is a critical component of implementing any safety project. While the HSIP program is a common source of funding for safety projects, there are numerous other funding sources that could be pursued for such projects. (See **Table 19** below).

TABLE 199: LIST OF POTENTIAL FUNDING SOURCES

FUNDING SOURCE	FUNDING AGENCY	AMOUNT AVAILABLE	NEXT ESTIMATED CALL FOR PROJECTS	APPLICABLE E'S	NOTES
Active Transportation Program	Caltrans, California Transportation Commission, MTC	~$450 million per cycle (every two years)	Month, 2022	Engineering, Education	Can use used for most active transportation related safety projects as well as education programs. Funding available through Caltrans or MTC
HSIP	Caltrans		April 2022	Engineering	Most common grant source for safety projects
One Bay Area Grant (OBAG) County and Local Program	MTC (Combines various federal funds)	$375 million for 2023-2026	Mid-2022	Engineering	Implement cost effective projects that support MTP/ SCS performance outcomes, including Fix-it-First and system modernization
Office of Traffic Safety Grants	California Office of Traffic Safety	Varies by grant	Closes January 31st annually	Education, Enforcement, Emergency Response	10 grants available to address various components of traffic safety
Affordable Housing and Sustainable Communities Program	Strategic Growth Council and Dept. of Housing and Community Development	~$405 million	2022	Engineering, Education	Must be connected to affordable housing projects; typically focuses on bike/pedestrian infrastructure/ programs
Urban Greening	California Natural Resources Agency	$28.5 million	2022	Engineering	Focused on bike/pedestrian infrastructure and greening public spaces

FUNDING SOURCE	FUNDING AGENCY	AMOUNT AVAILABLE	NEXT ESTIMATED CALL FOR PROJECTS	APPLICABLE E'S	NOTES
Local Streets and Road Maintenance and Rehabilitation	CTC (distributed to local agencies)	$1.5 billion statewide	N/A; distributed by formula	Engineering	Typically pays for road maintenance type projects
RAISE Grant	USDOT	~$1 billion	2022	Engineering	Typically used for larger infrastructure projects
Sustainable Transportation Equity Project	California Air Resources Board	~$19.5 million	TBD; most recent call in 2020	Engineering, Education	Targets projects that will increase transportation equity in disadvantaged communities
Transformative Climate Communities	Strategic Growth Council	~$90 million	TBD; most recent call in 2020	Engineering	Funds community-led projects that achieve major reductions in greenhouse gas emissions in disadvantaged communities

MONITORING AND EVALUATION

For the success of the LRSP, it is crucial to monitor and evaluate the 4 E-strategies continuously. Monitoring and evaluation creates accountability, ensures the effectiveness of the countermeasures for each emphasis area, and helps making decisions on the need for new strategies. Currently, County staff periodically monitor collision data gathered by the CHP. The LRSP process would help the County make informed decisions regarding the implementation plan's progress and accordingly, update the goals and objectives of the plan.

After implementing countermeasures, the strategies should be evaluated annually as per their performance measures. The evaluation should be recorded in a before-after study to validate the effectiveness of each countermeasure as per the following observations:

- Number of F+SI collisions
- Number of law enforcement citations
- Number of public comments and concerns

Evaluation should be conducted during similar time periods each year. The most important measure of success of the LRSP should be reductions in F+SI collisions throughout the County. If the number of F+SI collisions doesn't decrease, then the countermeasures should be evaluated as per the other observations, as mentioned above. The effectiveness of the countermeasures should be compared to the goals for each emphasis area.

LRSP UPDATE

The LRSP is a guidance document and is recommended to be updated every two to five years after adoption. After monitoring performance measures focused on the status and progress of the E's strategies in each emphasis area, the next LRSP update can be tailored to resolve any continuing safety problems. An annual stakeholder meeting with the safety partners is also recommended to discuss the progress for each emphasis area and oversee the implementation plan. The document should then be updated as per the latest collision data, emerging trends, and the E's strategies' progress and implementation.