



SAN JOAQUIN COUNTY LOCAL ROADWAY SAFETY PLAN



December 2022

Contents

Introduction	2
Vision, Mission, & Goals	8
Vision	9
Mission Statement.....	9
Goals	9
Commitments.....	9
Plan Development Process.....	10
Project Development Team (PDT)	12
Existing Safety Conditions	13
Existing Safety Practice and Culture	14
Summary of Countywide Safety Performance	15
Statewide Comparison	30
Safety Performance Network Screening	31
Emphasis Areas	38
Strategies and Recommendations.....	40
Safe Roads and Safe Speeds: Engineering	41
Safe Road Users: Education and Equitable Enforcement	50
Safe Vehicles and Safe Roads: Emerging Technology.....	54
Post-Collision Care: Emergency Response	57
Safety and Equity.....	59
Action Plan	60
Action Items	61
Prioritizing Project Locations and Strategies.....	64
Performance Measures and Plan Evaluation.....	66
Funding	68
Federal Programs.....	69
State Programs.....	71

INTRODUCTION



INTRODUCTION

San Joaquin County is committed to reducing deaths and serious injuries on its roadways. To advance this mission, the County initiated a countywide Local Roadway Safety Plan (LRSP). The LRSP is a framework for developing a comprehensive transportation safety management program to proactively identify potential safety issues in the unincorporated county and apply strategic and proven solutions to address them.

The LRSP process combines stakeholder input with data analysis to produce a data-driven approach to addressing transportation safety performance. Analysis of historic collision data forms the basis for this effort – identifying patterns in collision factors and road user behaviors that may contribute to higher frequency and/or severity collisions. This analysis also develops a high-injury network (HIN) of streets and intersections that historically experience a greater frequency and/or severity of collisions. Increasing understanding of trends in driver behavior, collision characteristics, and locations helps the County advance relevant systemic treatments, strategies, and countermeasures that can be implemented to improve roadway safety throughout the unincorporated County.

San Joaquin County's LRSP should be considered a living document that evolves as the County works toward achieving a safer roadway system. The safety story of the unincorporated County is complex, with a mix of rural and urban communities, a bilingual population, several major state highways crossing, and active agricultural and logistics industries. The LRSP focuses on addressing the diverse needs of the County based on the characteristics and collision history available at the time and is intended to evolve as the unincorporated County changes over time.

What is an LRSP?

An LRSP provides an assessment of roadway safety for the County, identifying locations for improvements and a range of strategies to implement that address safety from engineering countermeasures to educational safety campaigns. An LRSP is a multi-disciplinary approach to traffic safety that creates the opportunity for the County to partner with stakeholders and other agencies who may have a role in implementing recommendations. These stakeholders include representatives from law enforcement, fire department, neighboring jurisdictions, public health services, emergency response providers, community organizations, and the broader community.

LRSPs are one of Federal Highway Administration's (FHWA) proven safety countermeasures that provide crosscutting efforts to prioritize investments. To assist with implementation of engineering strategies, the Highway Safety Improvement Program (HSIP) and Safe Streets and Roads for All (SS4A) are Federal funding programs that support implementation of countermeasures that address road safety challenges on public roads. To pursue HSIP grant funds in California, a local agency must have an LRSP or equivalent planning document. To pursue federal SS4A funding, a local agency must have a safety action plan, equivalent to an LRSP if certain implementation framework associating actions with timing, funding, and leads is included. Access to these funds assists the County in funding engineering-related solutions that make its roads safer for all road users.

The collection of LRSPs across the state complement California's Strategic Highway Safety Plan, providing intentional and continual assessment and improvements to enhance roadway safety.

Alignment with Statewide Efforts

The [2020–2024 California Strategic Highway Safety Plan](#) (SHSP) is a statewide, coordinated safety plan providing a comprehensive framework for reducing highway fatalities and serious injuries on public roads in California. It identifies key safety needs and guides investment decisions toward strategies and countermeasures with the most potential to save lives and prevent injuries.

The SHSP identified California's 16 challenge areas, or areas that should be the focus for roadway safety in California. Of the challenge areas, five were identified as high priority areas, having the greatest opportunity to reduce death and serious injury:

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

Initially, the SHSP approached traffic safety using the five E's: engineering, enforcement, education, emergency services, and emerging technologies. In 2021, state transportation officials shifted focus to adopt guiding principles that integrate social equity, integrate the Safe System Approach (described below), and encourage the use of proven countermeasures and emerging technologies.

SHSP partner agencies have begun to implement strategies to eliminate traffic deaths and serious injuries using their guiding principles and challenge areas. This LRSP builds from the framework created by the SHSP by incorporating ideas that align with the challenge areas and guiding principles established to address safety at the state level.

Safe System Approach

In January 2022, the United States Department of Transportation released its National Roadway Safety Strategy¹ that adopted the Safe System Approach as its core strategy. In February 2022, Caltrans released Director's Policy 36² which commits to adopting the Safe System Approach to achieve its vision to eliminate fatalities and serious injuries on California's roadways by 2050 and provide safer outcomes for all communities. These efforts build from the Federal Highway Administration's education of the Safe System Approach as a strategy to realize a zero deaths vision.

As opposed to traditional road safety practices that attempt to modify human behavior and prevent collisions, the Safe System Approach focuses on modifying transportation system design to anticipate human errors and lessen impact forces to reduce collision severity and save lives. The Safe System Approach also acknowledges that the human body is vulnerable in terms of the amount of kinetic energy transfer it can withstand. This vulnerability is considered when designing and operating a transportation network to minimize serious injuries

¹ National Roadway Safety Strategy, United States Department of Transportation, January 2022

<https://www.transportation.gov/sites/dot.gov/files/2022-02/USDOT-National-Roadway-Safety-Strategy.pdf>

² California Department of Transportation Director's Policy 36, February 15, 2022

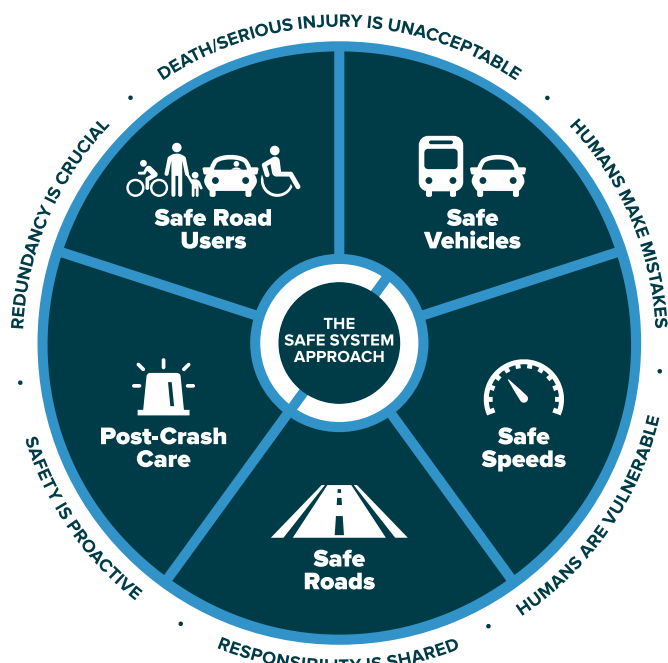
https://dot.ca.gov/-/media/dot-media/programs/safety-programs/documents/policy/dp_36-a11y.pdf

and fatalities. Therefore, it is crucial that the responsibility is shared by those who design and operate the transportation system. In a Safe System, all stakeholders work together who include, but are not limited to, road users, transportation system managers, law enforcement, emergency responders, and vehicle manufacturers.

These important recognitions of changing how we approach traffic safety are being prioritized as traffic deaths continue to be unacceptably high across the country. In 2020, there were 38,824 traffic-related fatalities in the United States³. In California, there were 3,798 fatalities in 2018⁴. These numbers do not include serious injury collisions that also significantly change the lives of people involved and the communities they live in. The Safe System Approach aims to eliminate fatal and serious injuries on roadways and will require change in traffic safety culture, standards, practices, and partnerships.

There are three key components of the Safe System Approach to understand: the Safe System “approach,” “principles,” and “elements.” In addition, the term “Safe System” is singular to depict an overall safe road system rather than individual elements that would be addressed in isolation or separately.

Figure 1: FHWA’s Safe System Approach



The Safe System “**approach**” is the broadest term and describes all aspects of the Safe System which are shown in Figure 1⁵.

Six Safe System “**principles**” encompass the fundamental beliefs that the approach is built on. A successful Safe System approach weaves together all six principles. The six principles are shown around the outside ring of the graphic.

Five Safe System “**elements**” that are conduits through which the Safe System approach must be implemented. These promote a holistic approach to safety across the entire roadway system and acknowledge the shared responsibility principle. Making a commitment to zero deaths means addressing every aspect of collision risks through these five elements that accommodate human mistakes and injury tolerances. The elements are presented in the middle ring of the graphic.

Source: FHWA, 2022
https://safety.fhwa.dot.gov/zerodeaths/zero_deaths_vision.cfm

³ National Highway Traffic Safety Administration Overview of Motor Vehicle Collisions in 2020

<https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/813266>

⁴ Caltrans Strategic Highway Safety Plan Traffic Safety Facts April 2022

<https://dot.ca.gov/-/media/dot-media/programs/safety-programs/documents/shsp/combined-shsp-fact-sheets-april-2022-a11y.pdf>

⁵ https://safety.fhwa.dot.gov/zerodeaths/docs/FHWA_SafeSystem_Brochure_V9_508_200717.pdf

Roadway system managers in the Safe System Approach use a proactive approach to safety to try and address safety concerns before collisions occur, contrasting with traditional road safety practices that are reactive to when collisions occur. This involves using collision data, roadway design characteristics and employing a data-driven approach to identify collision patterns and trends associated with collision risk. Transportation system managers then systemically implement proven safety countermeasures at all locations matching those collision risk factors to mitigate against future collisions.

Finally, redundancy is key in reducing collision occurrence in a transportation system. All parts of the system should be strengthened so that if one part fails, other parts of the system still protect roadway users. A simple implementation of this would be rumble strips that protect people when their own ability to be safe road users is compromised by distractions or drowsiness.

While the California SHSP focuses on statewide issues, the County LRSP brings the focus locally to unincorporated San Joaquin County. The fundamental change to adopting the Safe System Approach locally is to use its elements and principles to help guide decisions and promote collaboration across different roadway responsibilities. The LRSP aligns with the principles and elements of the Safe Systems Approach in the following ways:

Table 1: Safe System Principle Alignment

Safe System Principle	LRSP Recommendations
Death/Serious Injury is Unacceptable	<ul style="list-style-type: none"> Eliminate all preventable fatal and serious injury collisions
Humans Make Mistakes	<ul style="list-style-type: none"> Identify opportunities to improve the roadway network that allows human error to occur without resulting in a fatality or serious injury Support efforts to adopt emerging vehicle technologies that mitigate for driver error
Humans are Vulnerable	<ul style="list-style-type: none"> Prioritize safety over travel time Provide separated facilities for vulnerable users Reduce vehicle speed Remove high-speed conflict points
Responsibility is Shared	<ul style="list-style-type: none"> Formalize a traffic safety task force or forum to meet regularly including partner agencies and organizations
Safety is Proactive	<ul style="list-style-type: none"> Include systemic countermeasures and strategies to proactively address safety Implement proven countermeasures at locations with higher potential collision risk
Redundancy is Crucial	<ul style="list-style-type: none"> Overlap efforts between all roadway safety stakeholders to create a culture of traffic safety

Table 2: Safe System Elements Alignment

Safe System Elements	LRSP-related Recommendations
Safe Road Users	<ul style="list-style-type: none"> • Identify engineering countermeasures to prioritize vulnerable roadway users • Support and develop public education materials, emerging technologies, and enforcement efforts to address safety emphasis areas and priority collision types.
Safe Vehicles	<ul style="list-style-type: none"> • Identify roadway characteristics that could be communicated to vehicle safety features to inform future infrastructure-to-vehicle communication • Support legislation and other implementation strategies to develop safe vehicle technologies
Safe Speeds	<ul style="list-style-type: none"> • Recommend strategies to manage speeds and reduce potential collision kinetic energy • Support and implement policies and standards to reduce unsafe speeds including engineering roadway design, public education, vehicle technology, and enforcement efforts.
Safe Roads	<ul style="list-style-type: none"> • Improve data available to correlate collisions with roadway characteristics that may affect collision risk, such as average daily volume, speed, traffic control, and built environment.
Post-Crash Care	<ul style="list-style-type: none"> • Review post-collision response procedures with emergency responders • Identify opportunities to reduce emergency medical times or improve access to collision sites or medical care • Support on-scene collision incident safety and medical training

The County is the driving force behind implementing engineering-related safety measures such as speed management or roadway design. The County aims to encourage policy and support around safe vehicles and emerging technology, as well as increasing people's access to information on how emerging technology enables safety. Ultimately, the LRSP includes adopting a Safe System Approach and encouraging forward-thinking strategies, addressing the fact that historical approaches to traffic safety have not been effective enough in preventing fatal and serious injuries. Commitment from County staff and road safety partners to prioritize safety in their efforts and implement both proven and innovative ideas are key to the LRSP being impactful and in line with recent commitments at the national and state level. The vision, mission, goals, supporting information, and actions for the LRSP are documented in the following sections.

VISION, MISSION & GOALS



VISION, MISSION, & GOALS

The LRSP's Vision, Mission, and Goals were developed through a collaborative process between County representatives and Project Development Team (PDT) members and reflects short-term and long-term outcomes.

VISION

San Joaquin County envisions a roadway network that provides safe travel throughout the unincorporated County for all road users.

MISSION STATEMENT

Sustain a collaborative effort implementing a data-driven approach to proactively identify and addresses collision risk factors to eliminate all preventable fatalities and serious injury collisions on County roadways.

GOALS

1. **CREATE A CULTURE THAT PROMOTES AND PRIORITIZES ROADWAY SAFETY.**
2. **EDUCATE THE COMMUNITY ABOUT SAFE TRAVEL PRACTICES.**
3. **REDUCE FATAL AND SERIOUS INJURY COLLISIONS FOR ALL ROAD USERS.**
4. **COLLABORATE WITH MULTIDISCIPLINARY PARTNERS TO IMPLEMENT SAFETY STRATEGIES.**
5. **ADDRESS HIGH INJURY NETWORK LOCATIONS USING PROVEN COUNTERMEASURES AND STRATEGIES.**
6. **IMPLEMENT PROVEN SAFETY SOLUTIONS SYSTEMICALLY TO HELP PREVENT COLLISIONS FROM OCCURRING.**
7. **ENABLE INNOVATIVE SAFETY SOLUTIONS TO REDUCE THE RISK OF COLLISIONS.**
8. **ENCOURAGE PARTNERSHIPS IN IMPLEMENTING COUNTERMEASURES AND STRATEGIES.**
9. **SHARE INFORMATION RELATED TO TRAFFIC SAFETY DATA AND STRATEGIES BEING IMPLEMENTED.**

The County's Vision and Mission Statement corroborates well with FHWA's Safe System Approach as well as the Vision Zero and Towards Zero Deaths initiatives, and seeks to eliminate all preventable traffic fatalities and serious injuries in the unincorporated County. These initiatives acknowledge that road users will inevitably make mistakes, and those mistakes lead to collisions. The LRSP aims to reduce the risk of collision occurrence by taking a proactive and preventative approach that prioritizes traffic safety. The goals outlined in this section are important steps to achieve the vision and mission.

COMMITMENTS

To achieve the Vision, Mission and Goals, San Joaquin County is committed to incorporate the Safe System Approach in future efforts related to roadway safety. The County's roadway network is large and complex, but incremental efforts focused on safety that are already occurring and expected to expand in future years aim to reduce collision risk on County roadways. The County is committed to reaching its goal of eliminating all preventable roadway fatalities and serious injuries by 2050.

PLAN DEVELOPMENT PROCESS



PLAN DEVELOPMENT PROCESS

The LRSP was developed consistent with Caltrans requirements and guidance, following the process outlined by FHWA in the *Developing Safety Plans – A Manual for Local Road Rural Owners* (2012) as well as the more recent guidance provided through the previously discussed Safe System Approach adopted by FHWA during the County's LRSP development process. The FHWA LRSP development process is captured in Figure 2, with four primary steps:

1. Establishing Stakeholders
2. Using Safety Data
3. Choosing Proven Solutions
4. Implementing Solutions

The first step of the plan involved convening a diverse group of stakeholders as the PDT to help support and inform the planning process by sharing diverse views on roadway safety and help identify needs. This was followed by a detailed analysis using available roadway and collision history data to understand County collision patterns and trends, potential collision risk factors, and emphasis areas for addressing roadway safety. While data is an important and useful tool to help define safety issues, it is often incomplete for a variety of reasons. These might include inaccurate reporting, an inability to capture safety issues like near-misses, and difficulty pinpointing streets or areas people currently avoid because they feel unsafe. Therefore, the LRSP took a data-informed approach to planning, using data analysis in conjunction with engagement with the PDT to highlight lived experience in addition to data to develop a more comprehensive view of the transportation safety issues in the unincorporated County. The various participants and process for this PDT are described in the following subsection. Following the analysis and with input from the PDT, a selection of proven countermeasures most applicable for the County was developed and refined to form a countermeasure toolbox and inform the implementation plan for the LRSP.

Figure 2: FHWA LRSP Planning Process



Source: FHWA, 2022, https://safety.fhwa.dot.gov/LRSPDIY/downloads/LRSP_FinalBuild_Infographic_508.pdf

PROJECT DEVELOPMENT TEAM (PDT)

The PDT was developed to include representatives from a broad cross section of community, business, educational, and government interests. Each person represents a unique set of experiences, needs, and views on the transportation system in San Joaquin County that helped shape the LRSP. The following were represented in the PDT:

- San Joaquin County Public Works
- San Joaquin County Sheriff's Office
- San Joaquin County Fire Marshall
- San Joaquin County Public Health Services – Safe Kids
- San Joaquin County Public Health Services – Walkability Workgroup
- California Highway Patrol
- American Medical Response
- City of Stockton
- San Joaquin Bike Coalition
- Bike Lodi
- Mothers Against Drunk Driving
- San Joaquin County Farm Bureau

Meeting Dates and Topics

The PDT met three times over the course of the LRSP's development, discussing certain topics as summarized below:

MEETING 1 | OCTOBER 22, 2021

- Define LRSP purpose and scope
- Hear feedback on PDT member experiences and current efforts
- Present and gather feedback on preliminary data analysis

MEETING 2 | JUNE 9, 2022

- Present network screening results
- Discuss potential emphasis areas based on PDT experience and data findings
- Discuss vision of LRSP outcomes and related actions and performance measures

MEETING 3 | AUGUST 31, 2022

- Review Draft LRSP recommendations
- Discuss implementation and responsibilities

EXISTING SAFETY CONDITIONS



EXISTING SAFETY CONDITIONS

The County has been working to improve safety through planning efforts and capital projects. These efforts have informed the development of the LRSP and the strategies which were identified. A summary of relevant efforts is described here.

EXISTING SAFETY PRACTICE AND CULTURE

San Joaquin County Systemic Safety Analysis Report (2020)

The Systemic Safety Analysis Report (SSAR) evaluated the County's roadway network to identify factors associated with increased collision frequency and severity, as well as collision risk. The SSAR identifies four goals for roadway safety within unincorporated San Joaquin County:

1. Identify areas with an elevated risk for collision
2. Develop a systemic process, which can be used to proactively incorporate safety improvements into future maintenance and construction projects
3. Analyze safety data to plan future safety improvements for near-, mid-, and long-term
4. Define safety projects for future HSIP and other program funding consideration

The SSAR also identified four emphasis areas for safety improvement:

1. Eliminate impaired driving collisions
2. Improve driver expectancy
3. Improve safety on rural roadways
4. Implement traffic calming measures

Based on the collision analysis, the SSAR identified systemic treatment strategies as well as seven spot improvement locations. The SSAR also developed a preliminary prioritization process for the County based on the application of crash modification factors (CMFs) and benefit-cost ratios (BCRs). The LRSP builds upon the foundation set by the SSAR, expanding the scope of the analysis, and broadening the stakeholders supporting the plan's development to embrace a safe system approach to safety.

San Joaquin County Bicycle Master Plan Update (2020)

The San Joaquin County Bicycle Master Plan Update was adopted in 2020, building on the previous Bicycle Master Plan (2010). Its goals include improving the safety of bicycling facilities and encouraging bicycling as an alternative to vehicle use. It talks about the diverse needs of recreational and commuter bicyclists, and how a few focused efforts could address the needs of both. The plan highlights the vision of more connected, comfortable, and consistent bike facilities throughout the unincorporated County.

San Joaquin County Council of Governments Regional Bicycle, Pedestrian, and Safe Routes to School Master Plan (2012)

The San Joaquin Council of Government (SJCOG) developed this plan to address mobility needs of people of all ages and abilities in San Joaquin County. In the interest of supporting the diverse needs of San Joaquin County, the Master Plan emphasizes supporting safer and more connected bike and pedestrian facilities to decrease vehicular traffic and improve safety. Attention is given to increasing the number of bikeways, identifying safer school routes, and educating people on how to bike safely.

SUMMARY OF COUNTYWIDE SAFETY PERFORMANCE

Kittelson developed a database of the most recent five years of reported collisions, representing January 1, 2015, through December 31, 2019⁶. The County provided reported collisions from an internal, County-maintained Crossroads database and Kittelson cross-checked and supplemented the Crossroads information with the California Statewide Integrated Traffic Records System (SWITRS) and UC Berkeley's Transportation Injury Mapping System (TIMS). There were 428 collisions in the Crossroads database not present in the SWITRS and TIMS data, and these were added to the final combined database. There were an additional 47 collisions with mismatched severities between the Crossroads and SWITRS/TIMS databases. County staff assisted in validating the correct severity based on the original police reports and the combined database was modified accordingly. The final dataset includes 12,139 collisions from SWITRS/TIMS and 428 collisions from Crossroads for a total of 12,567 reported collisions over the study period. The 428 collisions from Crossroads were recoded to fit the SWITRS data format. However, the Crossroads database does not contain some of the fields in SWITRS data. Kittelson identified and removed duplicate records if multiple entries appeared to represent the same collision, as identified by inspection of collision details for entries with the same time and date.

Collisions that occurred on grade-separated freeways in the unincorporated County (Interstate 5, Interstate 580, Interstate 205, State Route 99, State Route 120, and portions of State Route 33 and State Route 132) have been excluded from the collision data. However, collisions reported at the ramp terminal intersections that are associated with grade-separated freeways and highways in the County are included in the analysis database.

The following section describes regional roadway safety performance in two ways:

- **Countywide Collision Patterns and Trends**, which identifies relevant collision factors such as collision types, primary collision factors, and users involved.
- **Network Screening**, which spatially locates collisions and identifies intersections and segments with the highest collision frequency and severity to determine locations where improvements may have the highest impact.

⁶ Data from 2020 and 2021 were not used because they were not complete datasets at the time of analysis.



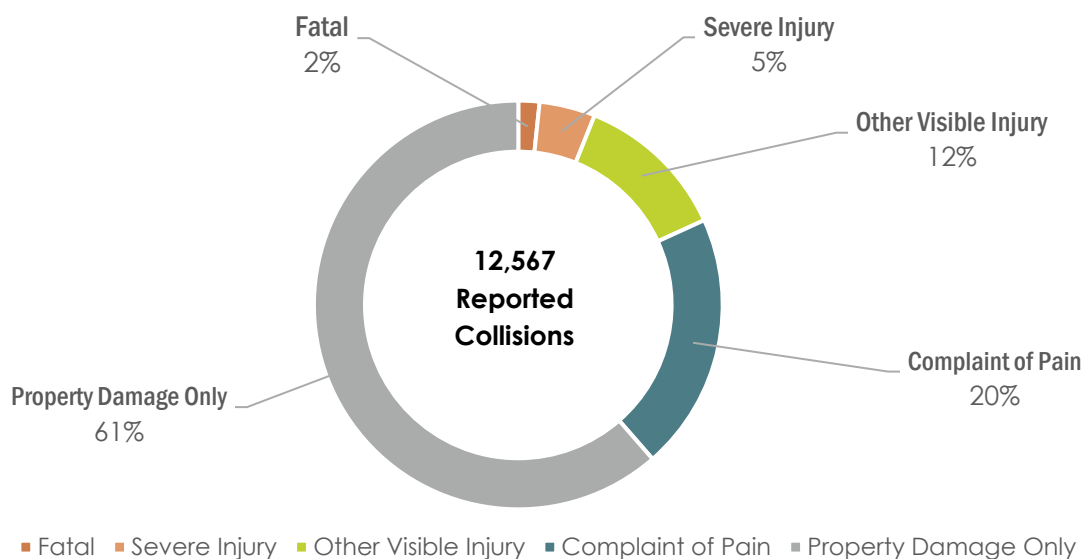
Countywide Collision Patterns and Trends Summary

The following is a summary of key findings from the reported collisions in San Joaquin County based on the data from 2015 to 2019:

- Overall, there were 12,567 reported collisions on County roadways. Collisions resulting in a fatality or serious injury represented about 6 percent of these, with 210 being fatal and 557 being serious injury.
- Pedestrians and bicyclists are overrepresented in fatal and serious injury collisions. Pedestrians and bicyclists are each involved in only 1 percent of reported collisions but are involved in 13 percent and 5 percent of fatal and serious injury collisions, respectively.
- The top three most cited collision types for fatal and serious injury collisions are hit object (28 percent), broadside (21 percent), and head-on (13 percent).
- The three most cited primary collision factors for fatal and serious injury collisions are driving or bicycling under the influence (29 percent), improper turning (23 percent), and unsafe speed (13 percent).
- Fatal/serious injury collisions are disproportionately high in dark – no streetlight conditions (9 percent of dark – no streetlight collisions) as compared to daylight conditions (4 percent of daylight collisions).

Figure 3 and Table 3 summarize the reported collisions by severity in unincorporated San Joaquin County. Table 3 also provides a breakdown of County collisions by road users involved. Additional collision statistics are summarized on the following pages.

Figure 3: San Joaquin County Collisions by Severity (2015-2019)



Source: SWITRS, TIMS, San Joaquin County Crossroads, compiled by Kittelson, 2021.

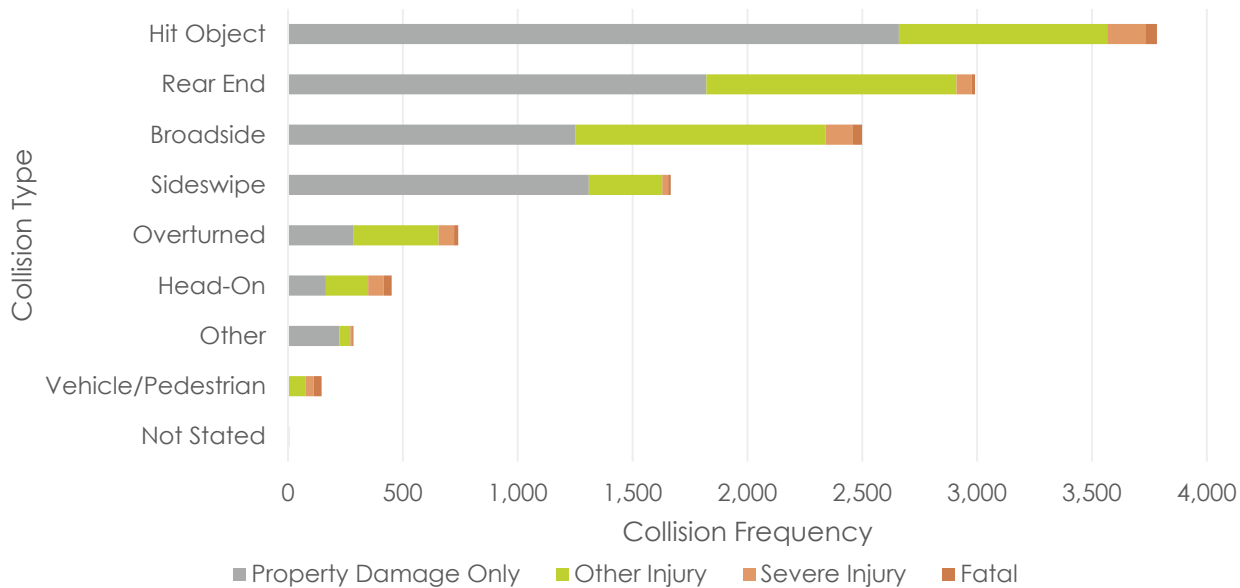
Table 3: Collision Severity by Road User Involved (2015-2019)

Road Users Involved	Fatal (% of column)	Serious Injury (% of column)	Visible Injury (% of column)	Complaint of Pain (% of column)	Property Damage Only (% of column)	Total (% of column)
Pedestrian-Involved	33 (16%)	37 (7%)	52 (3%)	34 (1%)	4 (<1%)	160 (1%)
Bicycle-Involved	10 (5%)	28 (5%)	65 (4%)	34 (1%)	15 (<1%)	152 (1%)
Vehicle Only or Vehicle-Fixed Object	167 (79%)	492 (88%)	1,401 (93%)	2,495 (98%)	7,700 (99%)	12,255 (98%)
Reported Collisions	210 (100%)	557 (100%)	1,518 (100%)	2,563 (100%)	7,719 (100%)	12,567 (100%)
Severity Share of Reported Collisions	2%	5%	12%	20%	61%	100%

Source: SWITRS, TIMS, San Joaquin County Crossroads, compiled by Kittelson, 2021.

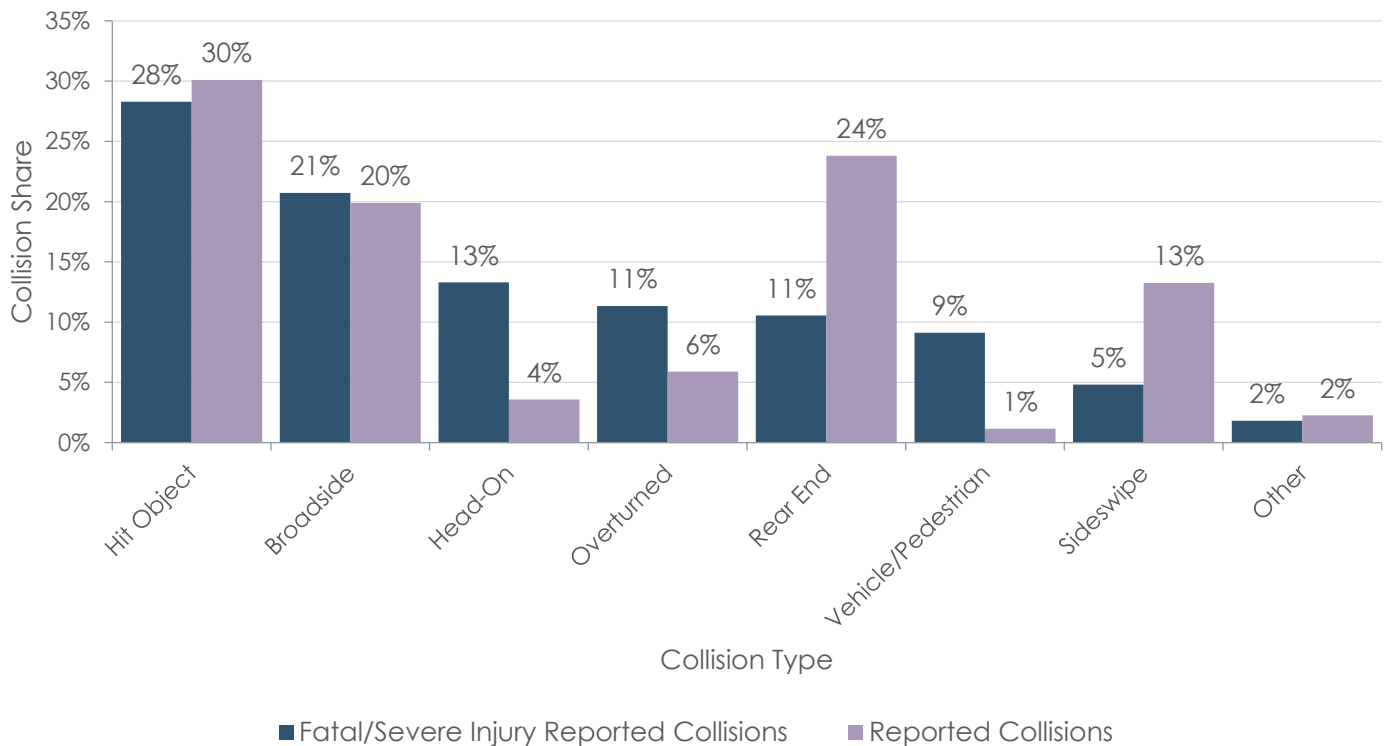
COLLISION TYPES AND FACTORS

Figure 4: Collision Severity by Collision Type (2015-2019)



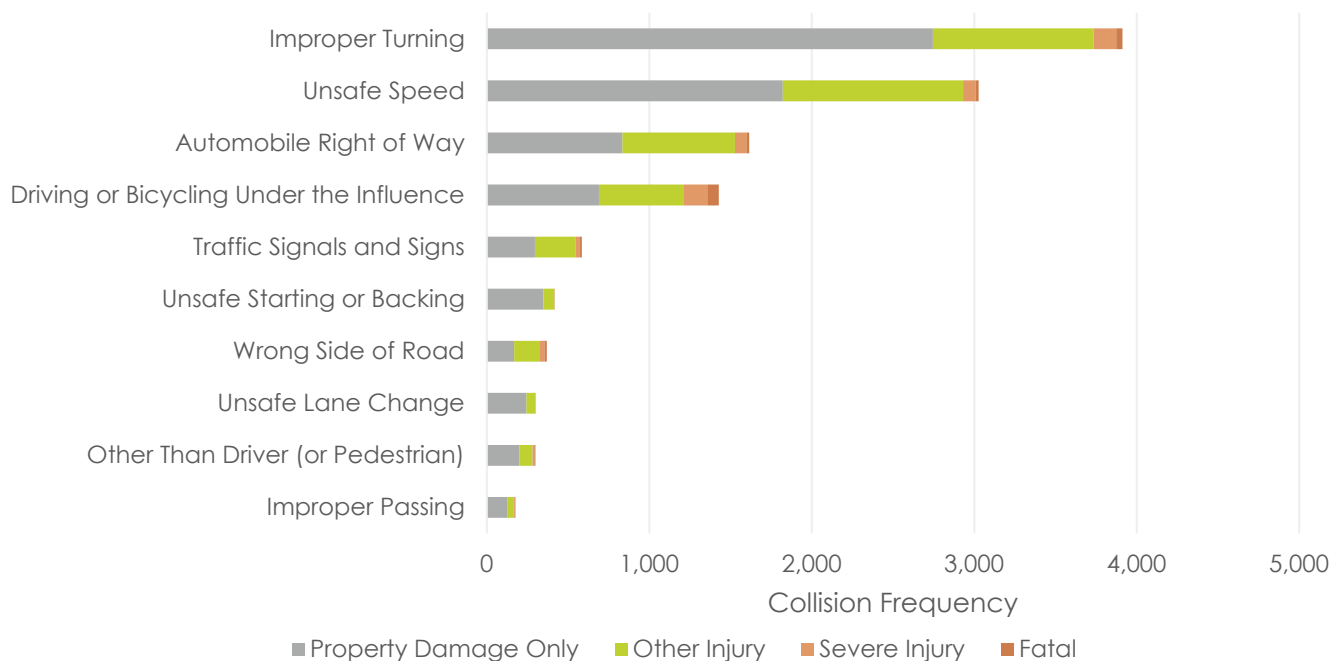
Source: SWITRS, TIMS, San Joaquin County Crossroads, compiled by Kittelson, 2021.

Figure 5: Share of Collisions by Collision Type and Severity (2015-2019)



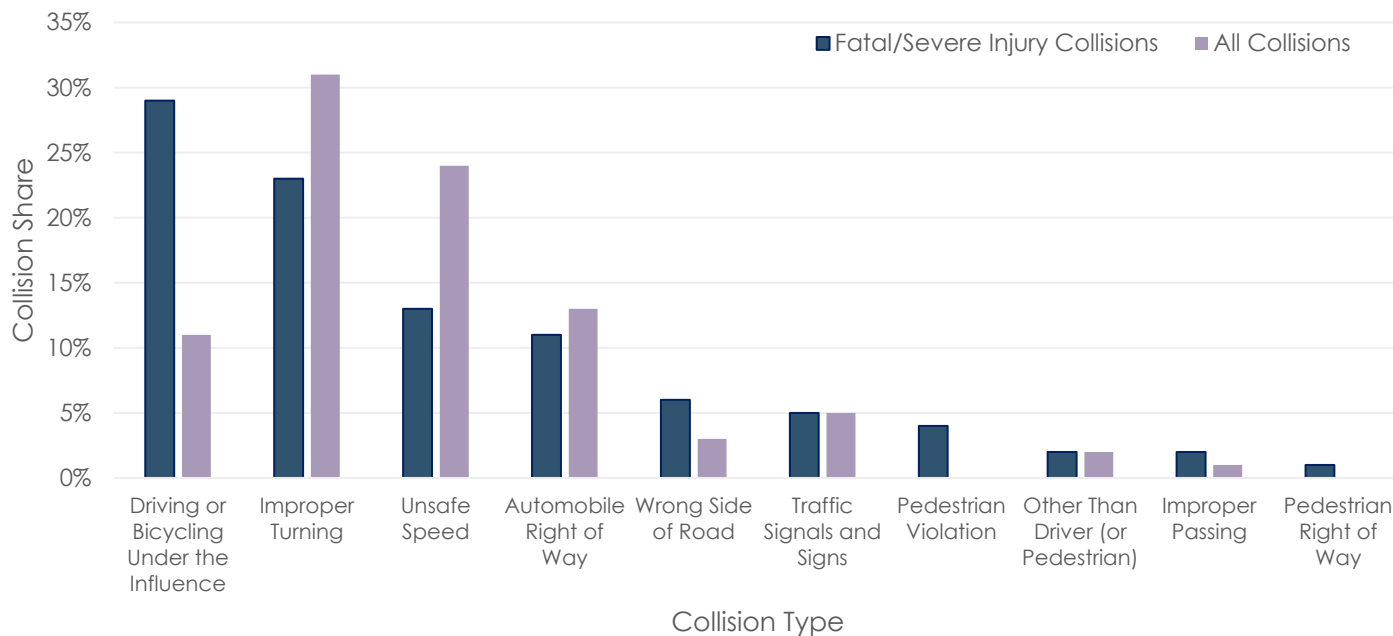
Source: SWITRS, TIMS, San Joaquin County Crossroads, compiled by Kittelson, 2021.

Figure 6: Collision Severity by Most Frequent Primary Collision Factors



Source: SWITRS, TIMS, San Joaquin County Crossroads, compiled by Kittelson, 2021.

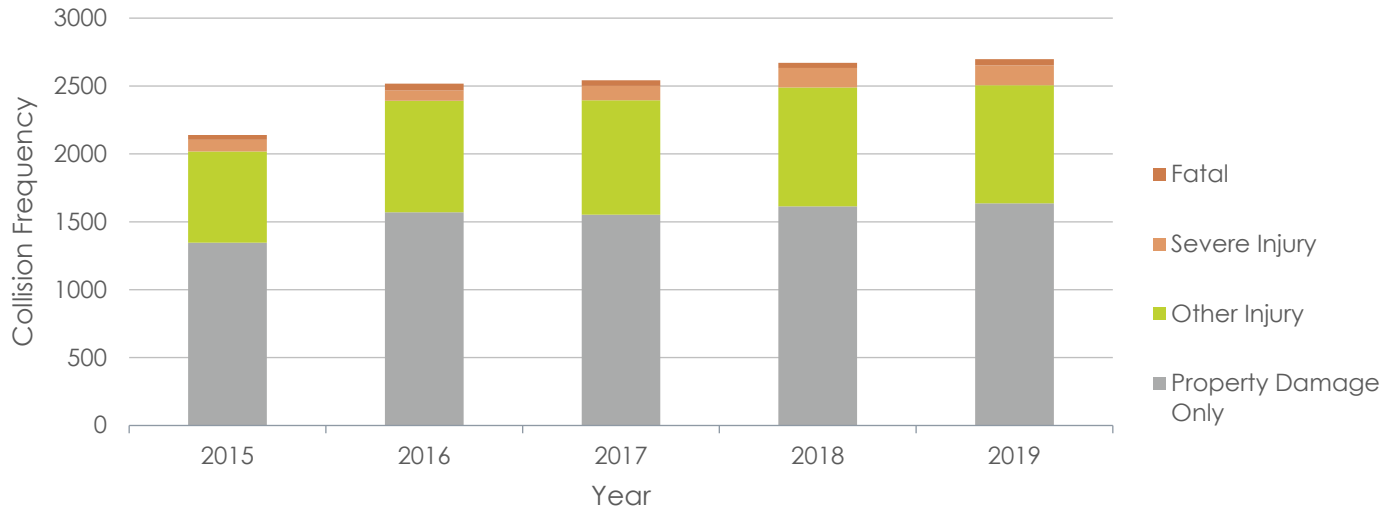
Figure 7: Highest Collision Severity Shares by Primary Collision Factors



Source: SWITRS, TIMS, San Joaquin County Crossroads, compiled by Kittelson, 2021.

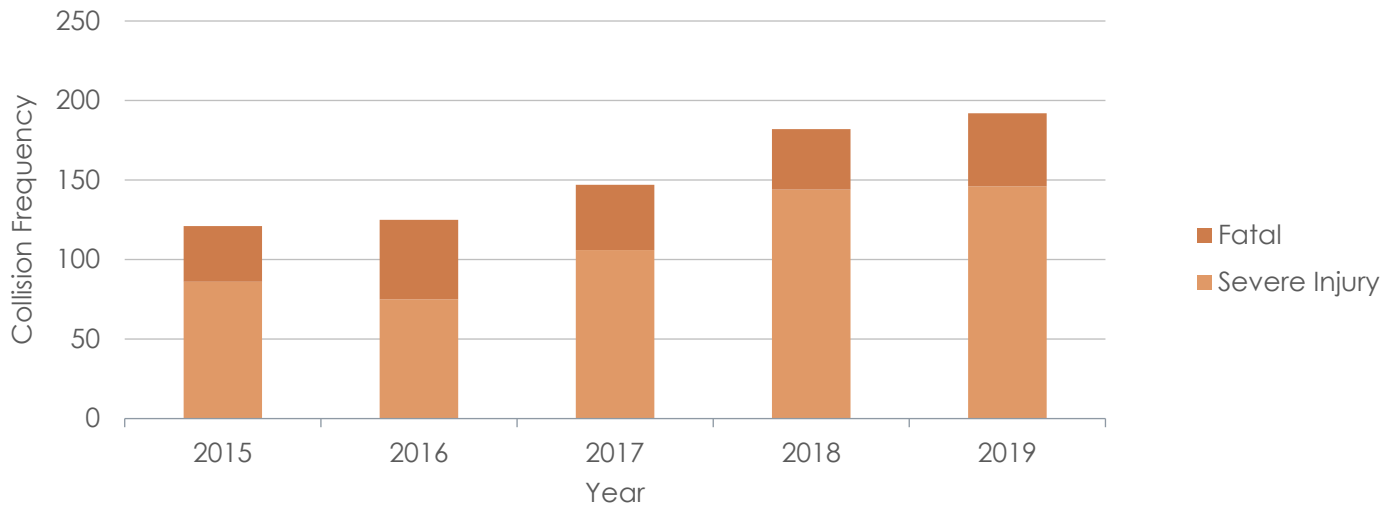
TEMPORAL COLLISION FACTORS

Figure 8: Collision Severity by Year



Source: SWITRS, TIMS, San Joaquin County Crossroads, compiled by Kittelson, 2021.

Figure 9: Fatal and Serious Injury Collisions by Year



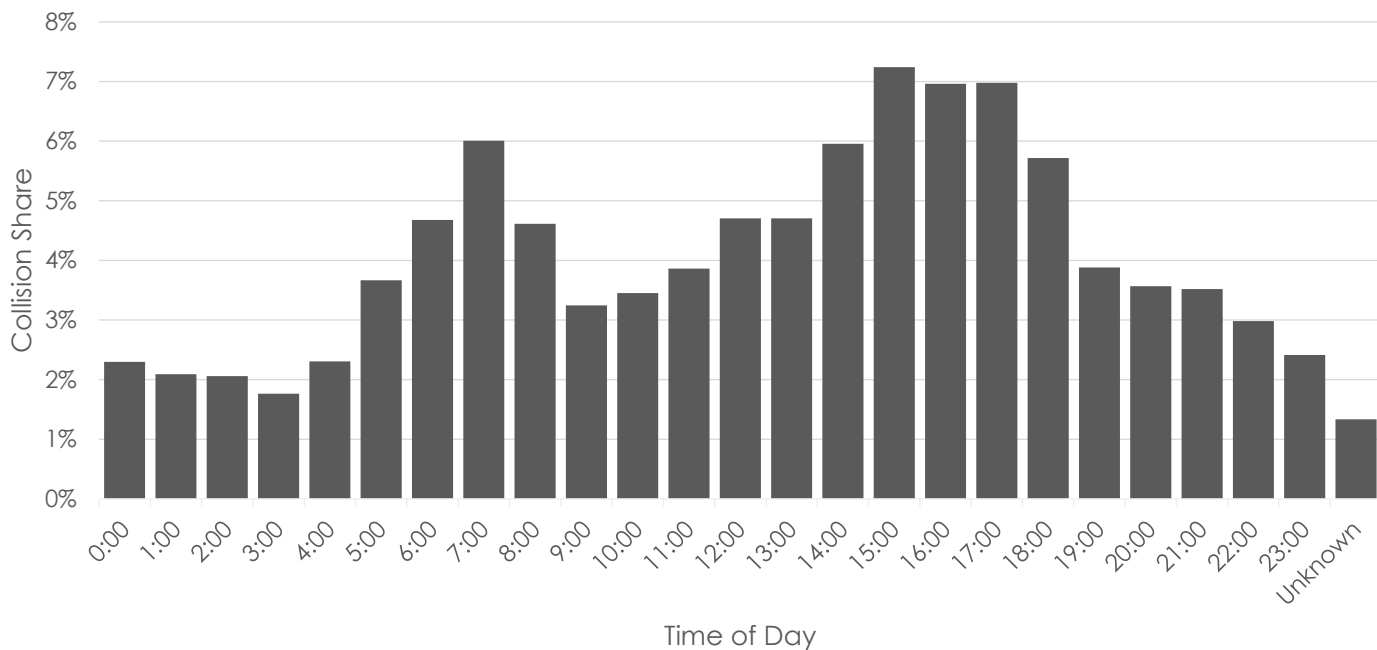
Source: SWITRS, TIMS, San Joaquin County Crossroads, compiled by Kittelson, 2021.

Figure 10: Total Reported Collision Shares by Month



Source: SWITRS, TIMS, San Joaquin County Crossroads, Kittelson, 2021.

Figure 11: Total Reported Collision Shares by Hour of Day



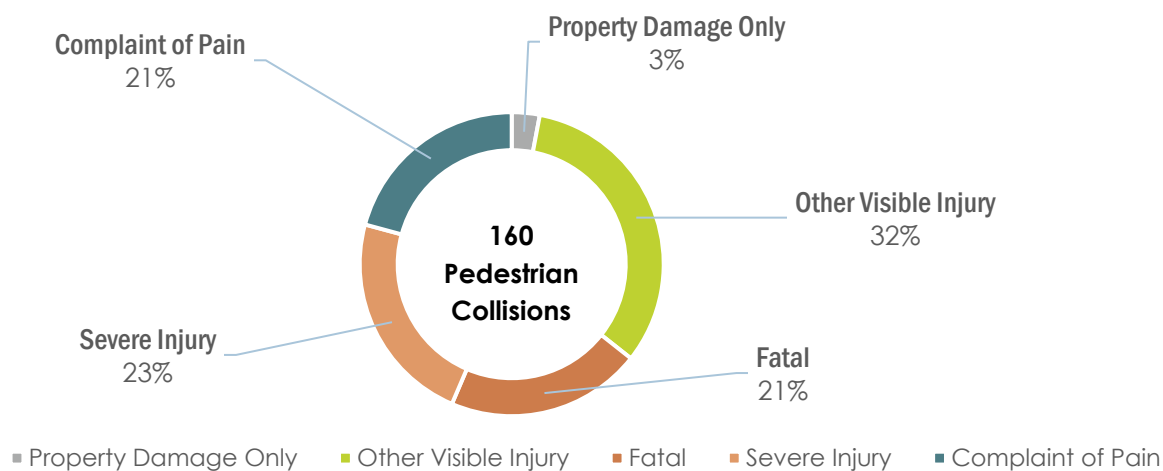
Source: SWITRS, TIMS, San Joaquin County Crossroads, compiled by Kittelson, 2021.

PEDESTRIAN COLLISIONS

Across the five study years (2015-2019) there was a total of 160 pedestrian-involved collisions.

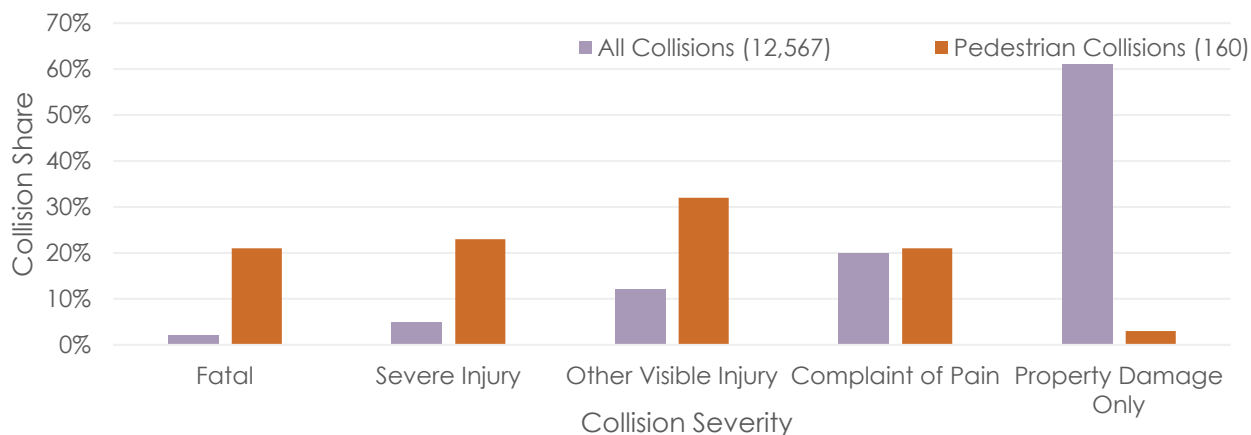
Most pedestrian fatal collision have occurred when the pedestrian is not on a sidewalk or is crossing the road. (61 percent of total reported fatal pedestrian collisions)

Figure 12: Pedestrian-Involved Collisions by Severity



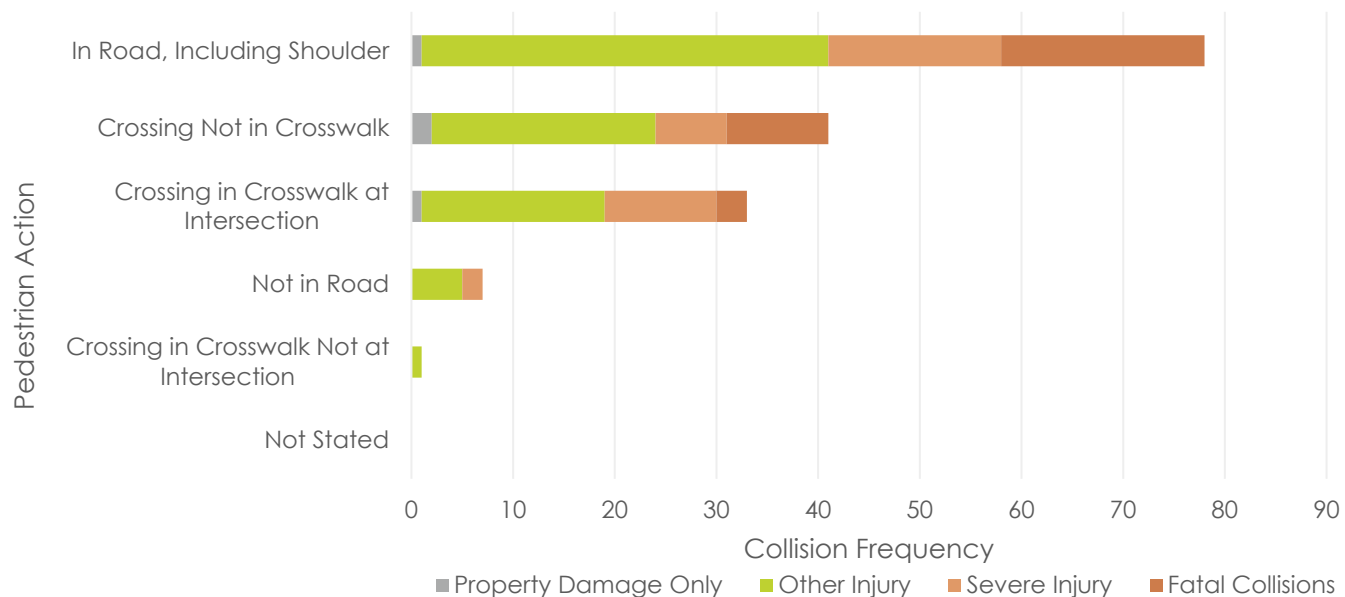
Source: SWITRS, TIMS, San Joaquin County Crossroads, compiled by Kittelson, 2021.

Figure 13: Comparison of Pedestrian-Involved and Total Reported Collision Shares by Severity



Source: SWITRS, TIMS, San Joaquin County Crossroads, compiled by Kittelson, 2021.

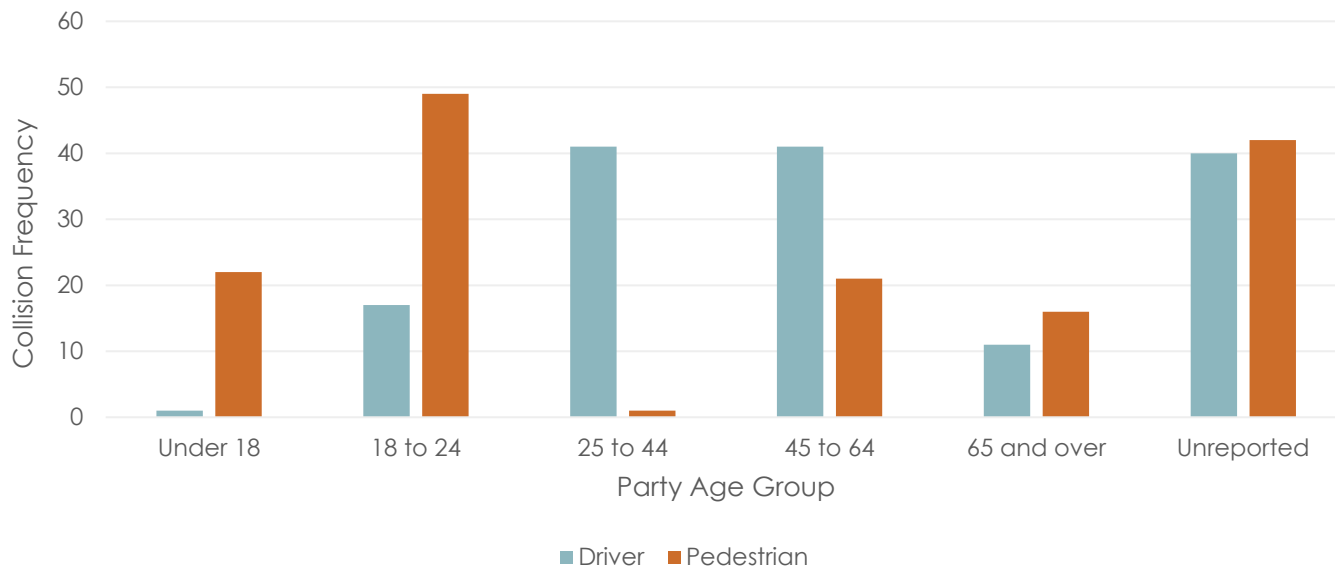
Figure 14: Pedestrian Involved Collisions by Pedestrian Action



Source: SWITRS, TIMS, San Joaquin County Crossroads, compiled by Kittelson, 2021.

Note: "In Road, Including a Shoulder" collisions are those that involve a pedestrian walking **along** a shoulder (paved or unpaved) where no sidewalk is present or in the roadway, **not** crossing the roadway. "Not in Road" collisions are those that involve a pedestrian on a sidewalk or otherwise struck away from the roadway.

Figure 15: Pedestrian-Involved Collision Frequency by Party Age for Each Party Involved

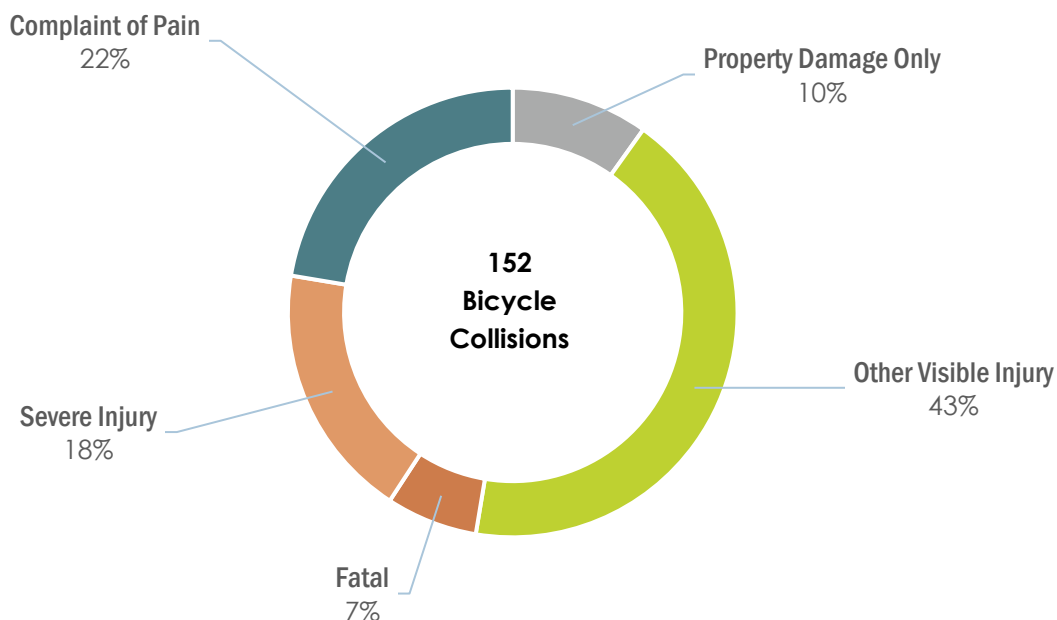


Source: SWITRS, TIMS, San Joaquin County Crossroads, compiled by Kittelson, 2021.

BICYCLIST COLLISIONS

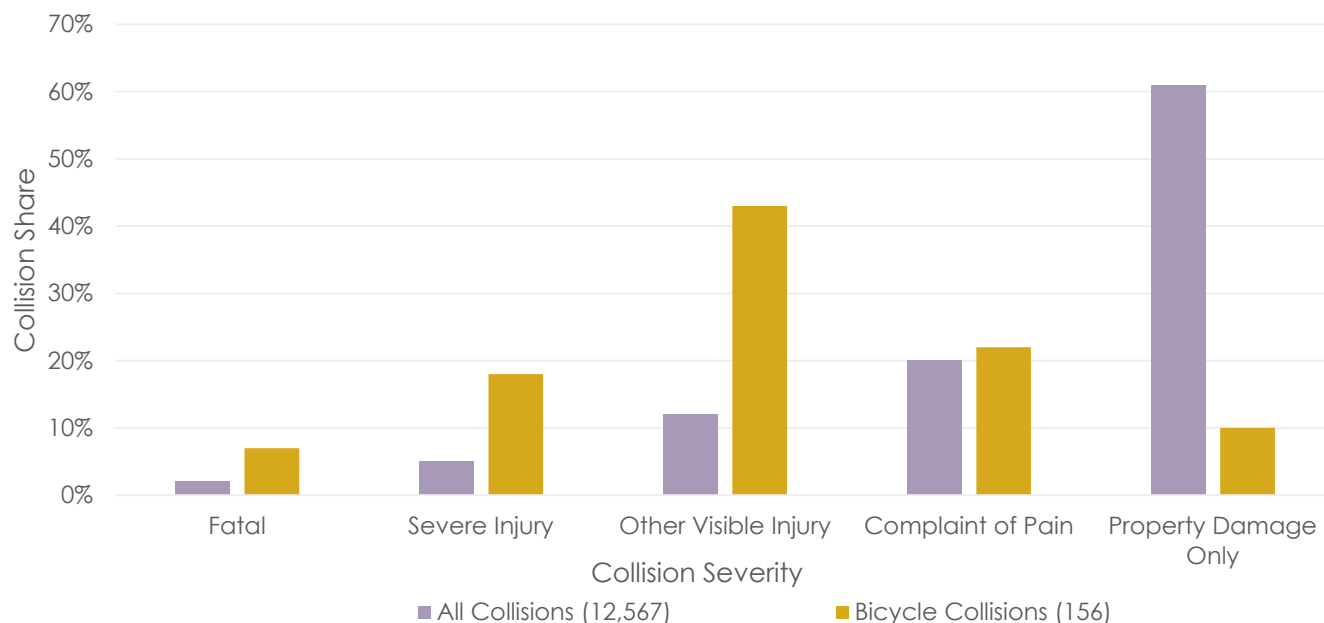
Across the five study years (2015-2019) there was a total of 152 bicycle-involved collisions.

Figure 16: Bicyclist-Involved Collisions by Severity



Source: SWITRS, TIMS, San Joaquin County Crossroads, compiled by Kittelson, 2021.

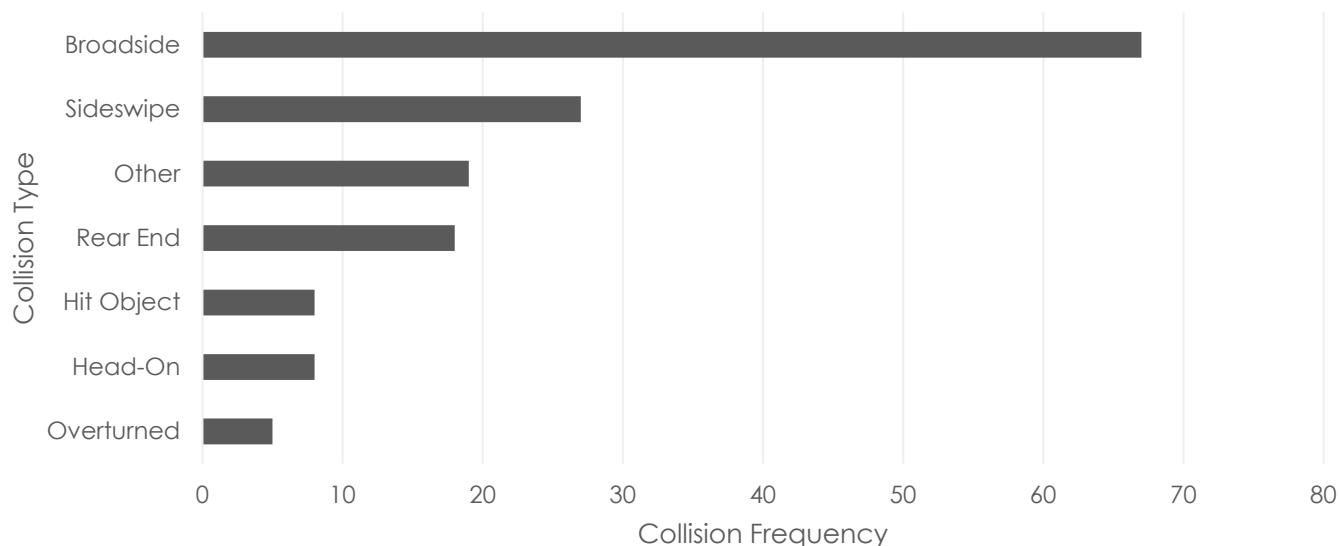
Figure 17: Comparison of Bicyclist-Involved and Total Reported Collision Shares Severity



Source: SWITRS, TIMS, San Joaquin County Crossroads, compiled by Kittelson, 2021.

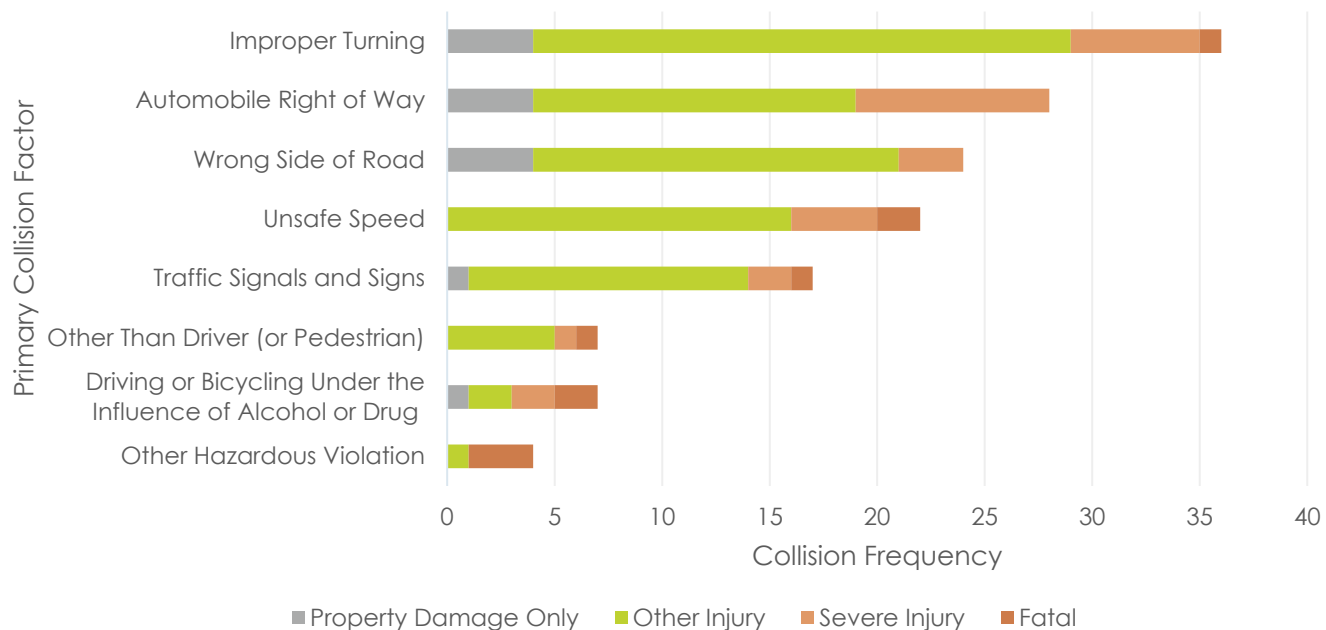
The most common collision type for bicyclist-involved collisions is broadside 44 percent of total reported bicyclist-involved collisions.

Figure 18: Bicyclist-Involved Collisions by Collision Type



Source: SWITRS, TIMS, San Joaquin County Crossroads, compiled by Kittelson, 2021.

Figure 19: Bicyclist-Involved Collisions by Primary Collision Factor



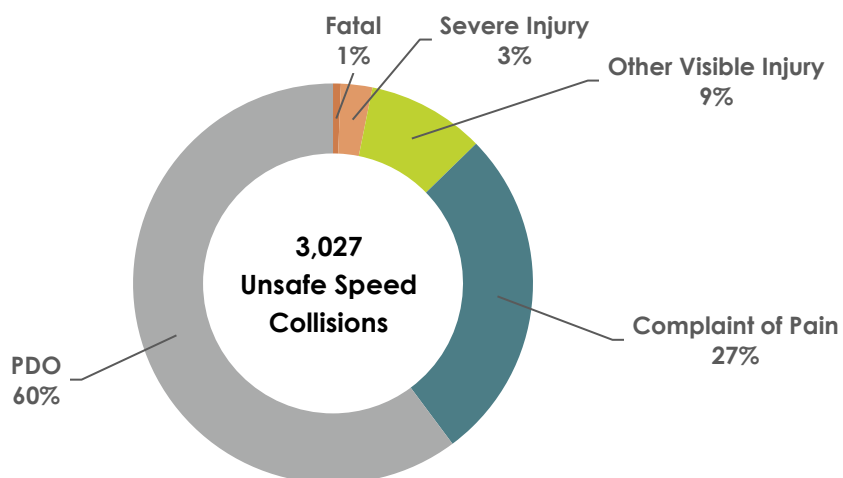
Note: Categories with minimal or no collisions are not shown above for clarity.
 Source: SWITRS, TIMS, San Joaquin County Crossroads, compiled by Kittelson, 2021.

UNSAFE SPEED COLLISIONS

Across the five study years (2015-2019) there was a total of 3,027 unsafe speed collisions. Of these collisions, 179 (4 percent) resulted in a fatal or serious injury outcome.

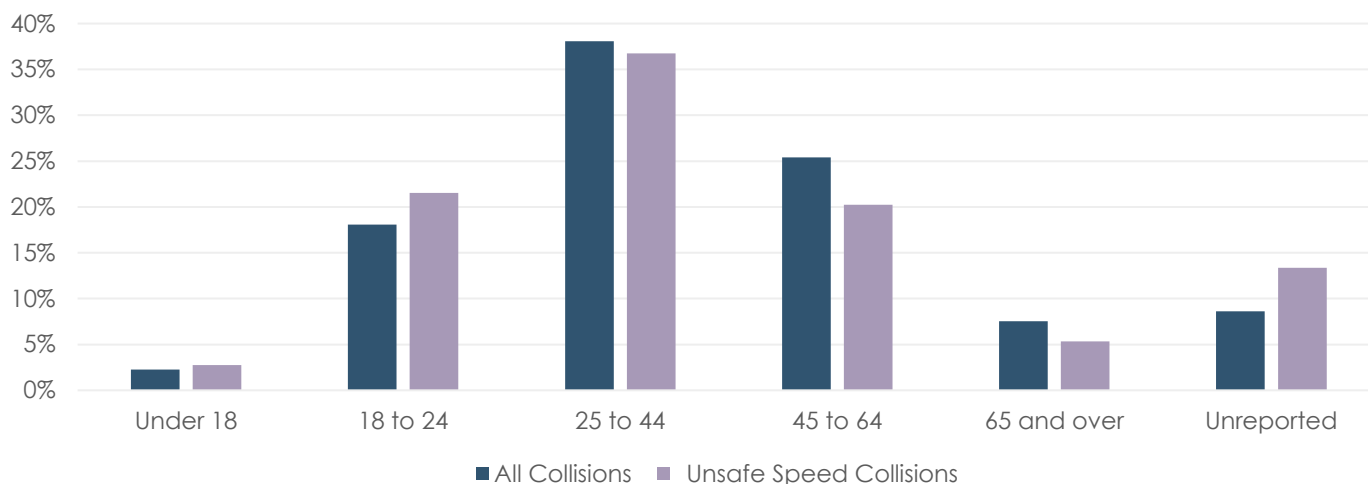
Despite representing 13 percent of total reported fatal and serious injury collisions, unsafe speed collisions result in a proportionately lower share of fatal and serious injury collisions. This may be associated with the use of unsafe speed as the violation associated with rear-end events which often result in lower severity collisions.

Figure 20: Unsafe Speed Collisions by Severity



Source: SWITRS, TIMS, San Joaquin County Crossroads, compiled by Kittelson, 2021.

Figure 21: Unsafe Speed Collisions by Driver Age



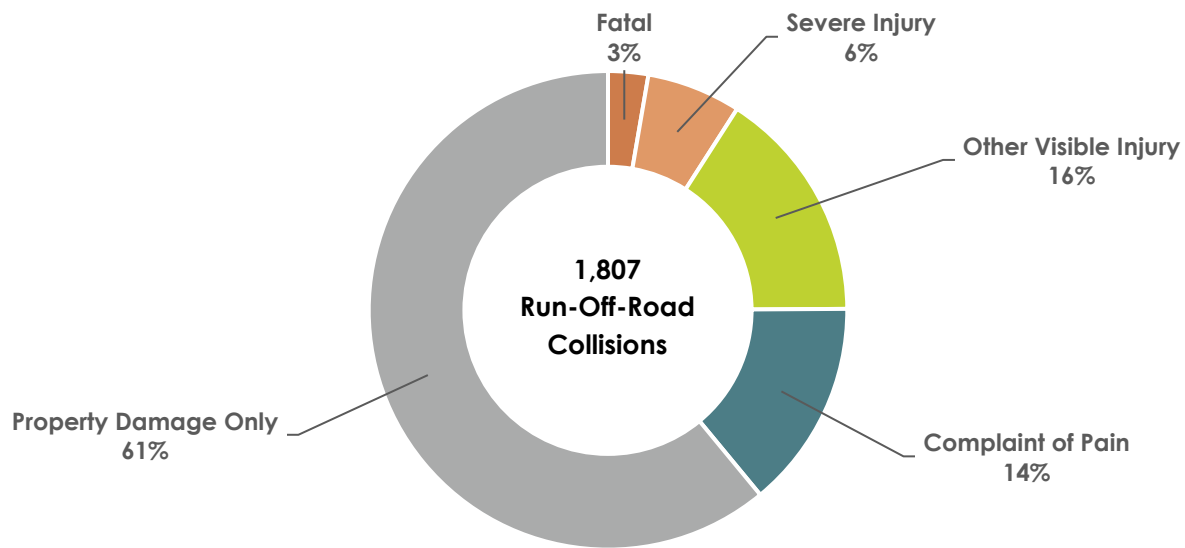
Source: SWITRS, TIMS, San Joaquin County Crossroads, compiled by Kittelson, 2021.

RUN-OFF-ROAD COLLISIONS

Across the five study years (2015-2019), there was a total of 1,807 run-off-road collisions. Of these collisions, 164 (9 percent) resulted in a fatal or serious injury outcome.

42 percent of run-off-road collisions involved a driver under the influence of alcohol and/or drugs.

Figure 22: Run-Off-Road Collisions by Severity

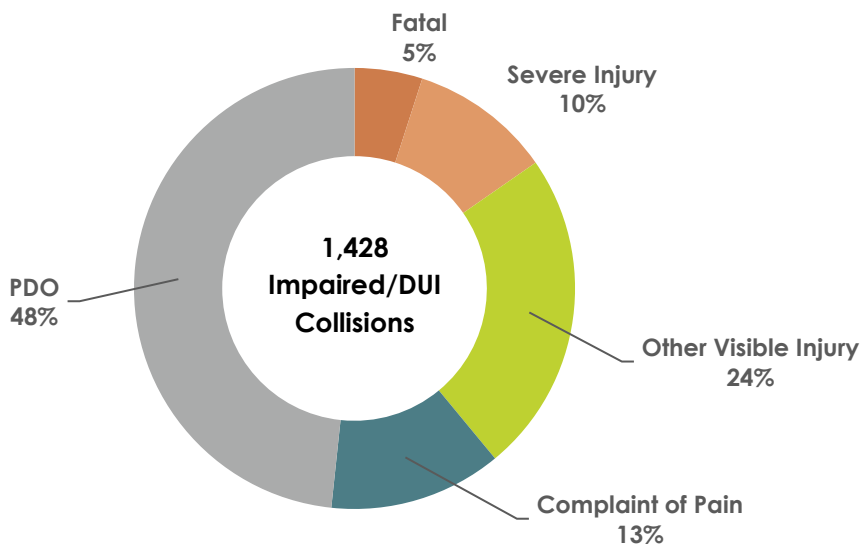


Note: This chart does not consider 428 collisions from San Joaquin County Crossroads database that were not in the SWITRS data because information regarding movements preceding the collision were not available.
 Source: SWITRS, TIMS, San Joaquin County Crossroads, compiled by Kittelson, 2021.

IMPAIRED DRIVING COLLISIONS

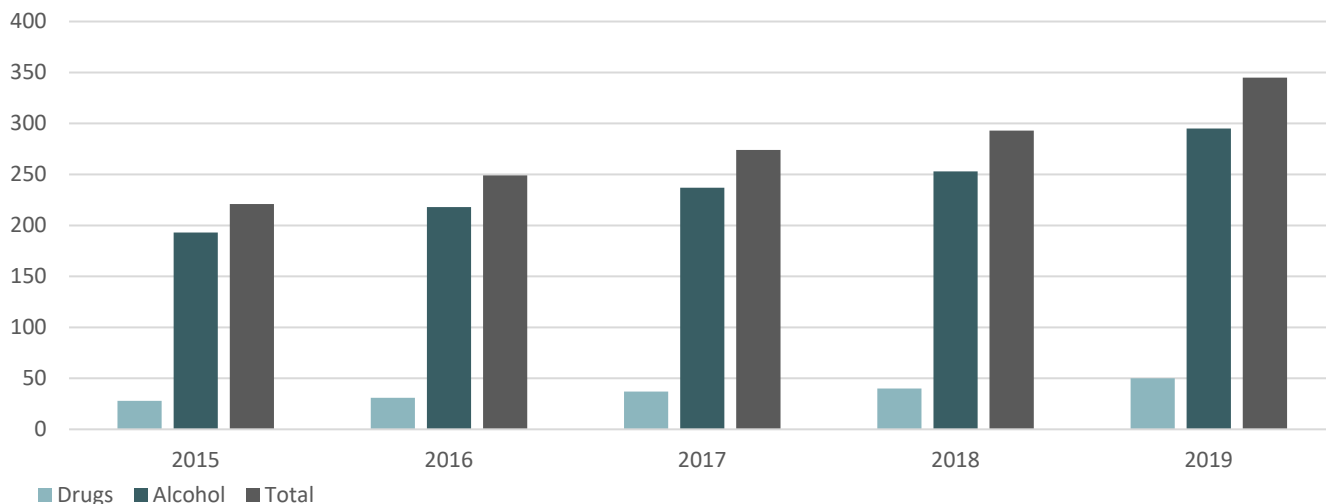
Across the five study years (2015-2019), there was a total of 1,428 Driving or Bicycling Under the Influence (DUI) collisions. Of these collisions, 219 (15 percent) resulted in a fatal or serious injury outcome. According to the reported influences, 86 percent were alcohol-related only, 11 percent were drug-related only, and 3 percent were both alcohol- and drug-related.

Figure 23: Impaired/DUI Collisions by Severity



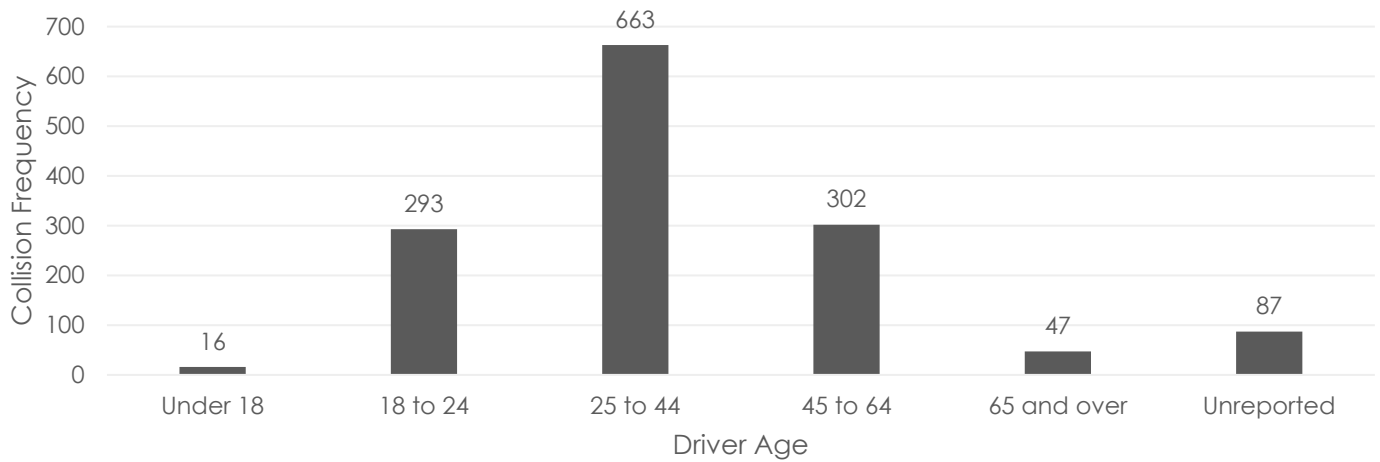
Source: SWITRS, TIMS, San Joaquin County Crossroads, compiled by Kittelson, 2021.

Figure 24: Impaired/DUI Collisions by Type of Impairment and Year



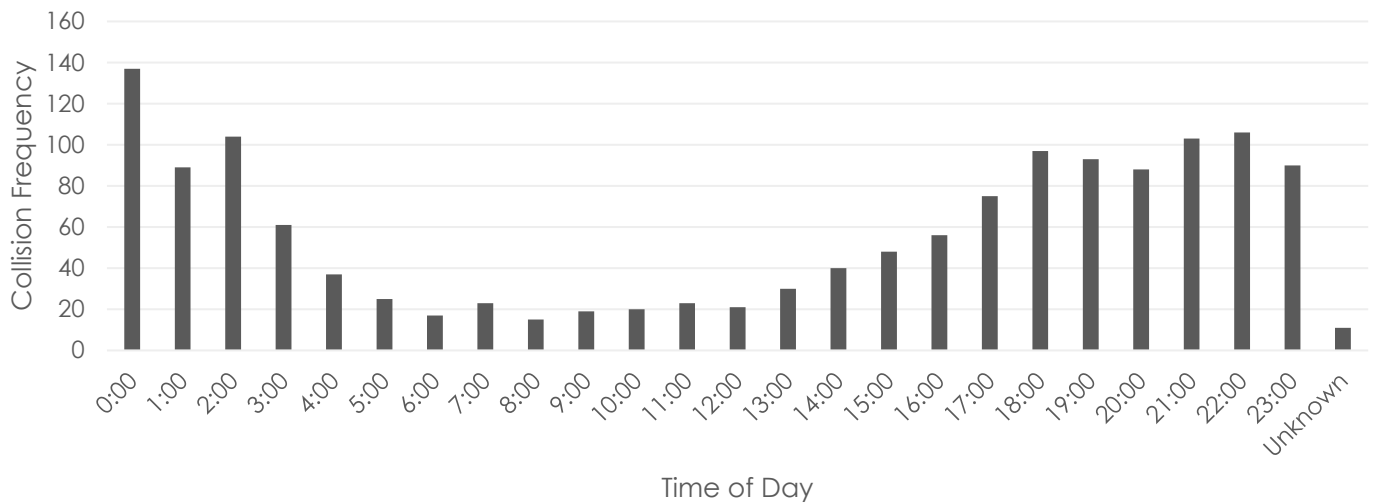
Source: SWITRS, TIMS, San Joaquin County Crossroads, compiled by Kittelson, 2021.

Figure 25: Impaired/DUI Collisions by Driver Age



Source: SWITRS, TIMS, San Joaquin County Crossroads, compiled by Kittelson, 2021.

Figure 26: Impaired/DUI Collisions by Time of Day



Source: SWITRS, TIMS, San Joaquin County Crossroads, compiled by Kittelson, 2021.

STATEWIDE COMPARISON

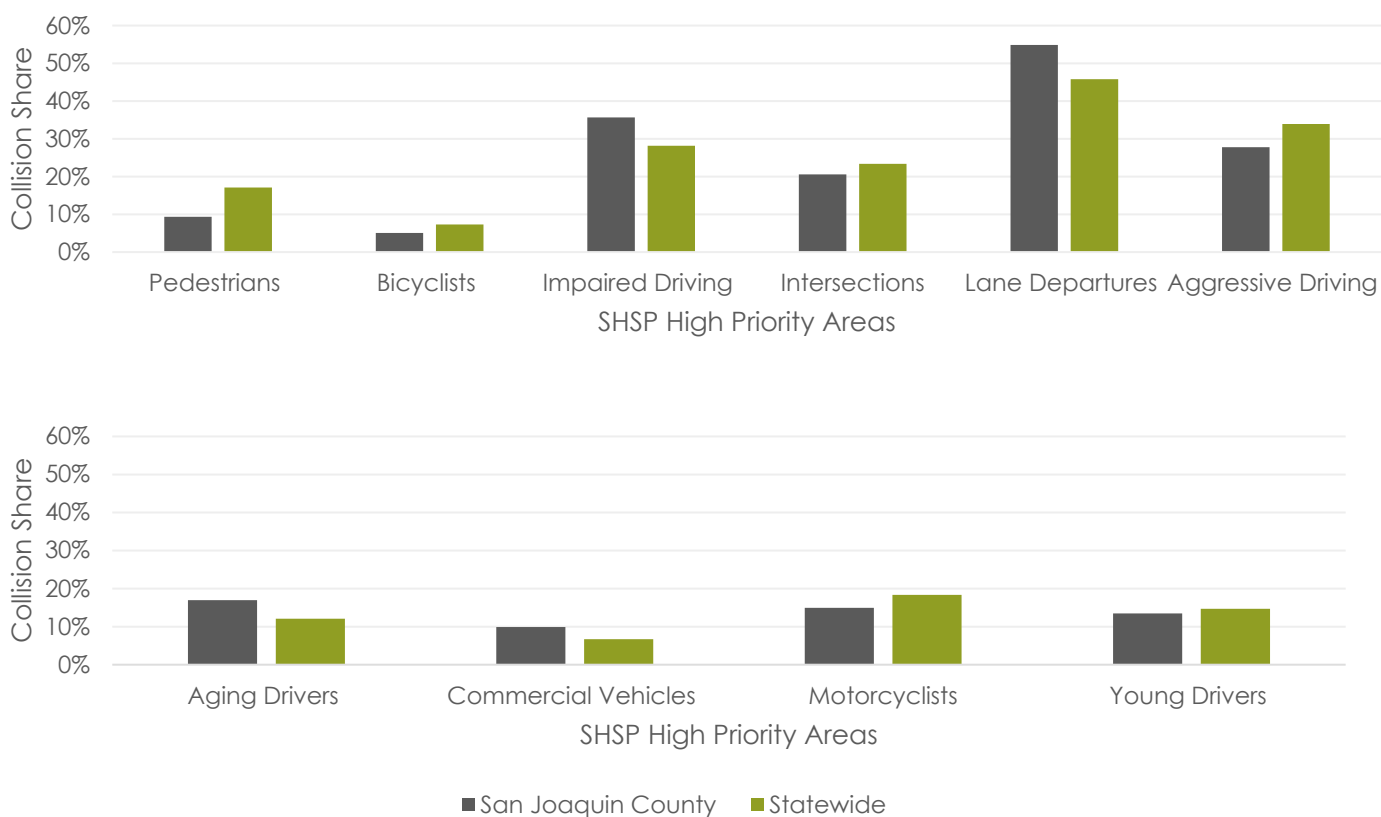
A comparison with statewide averages was conducted using the 2017 Annual Report of Fatal and Injury Motor Vehicle Traffic Collisions prepared by the California Highway Patrol (CHP). The comparison showed:

- Statewide, the primary collision factor that led to death or injury is unsafe speed. In San Joaquin County, the primary collision factor that led to death or injury is **driving under the influence of alcohol**.
- Statewide, rear end collisions are the most frequent collision type, making up 41% of injury collisions. In San Joaquin County, the most common type of collision that leads to death or injury is sideswipe or rear end collisions.

A comparison with statewide collision patterns documented in the California SHSP was also conducted. The comparison showed:

- San Joaquin County generally has higher shares than the Statewide shares of Fatal/Serious Injury where **Impaired Driving** and **Lane Departures** are involved.
- San Joaquin County has higher shares than the Statewide shares of Fatal/Severe Injury where **Aging Drivers** and **Commercial Vehicles** are involved.

Figure 27: Fatal and Serious Injury Collision Shares by SHSP High Priority Area Compared to Statewide Statistics



Source: SWITRS, TIMS, San Joaquin County Crossroads, compiled by Kittelson, 2021.

SAFETY PERFORMANCE NETWORK SCREENING

A network screening of collisions on the San Joaquin County roadway network was completed to identify the intersections and roadway segments with the highest collision frequency and severity using a collision severity score consistent with methods described in the AASHTO *Highway Safety Manual* (HSM). Private roads and grade separated highways were excluded from the analysis. Collision severity scores were calculated for each intersection and all roadway segments in unincorporated San Joaquin County including at-grade state highways. Collision severity scores were annualized to identify the locations with the highest average annual collision frequency and severity across the County.

More detail on the network screening analysis and methodology can be found in **Appendix A**.

COLLISION SEVERITY SCORE RESULTS

Figure 28 and Figure 29 show the results of the collision severity scoring by percentiles for intersection and roadway segment locations, respectively. Intersections or segments shown as not falling within one of the quartiles indicates that there were no reported collisions at that location.

For intersection locations, the collision severity scores ranged from zero (no reported collisions during the five years) to 163.66.⁷ A score of 76.0 was used as the priority location cut-off due to the gap in scores below this level. This resulted in the top 41 intersections, which provides a range of location options that may have the largest benefit based on historical collision data.

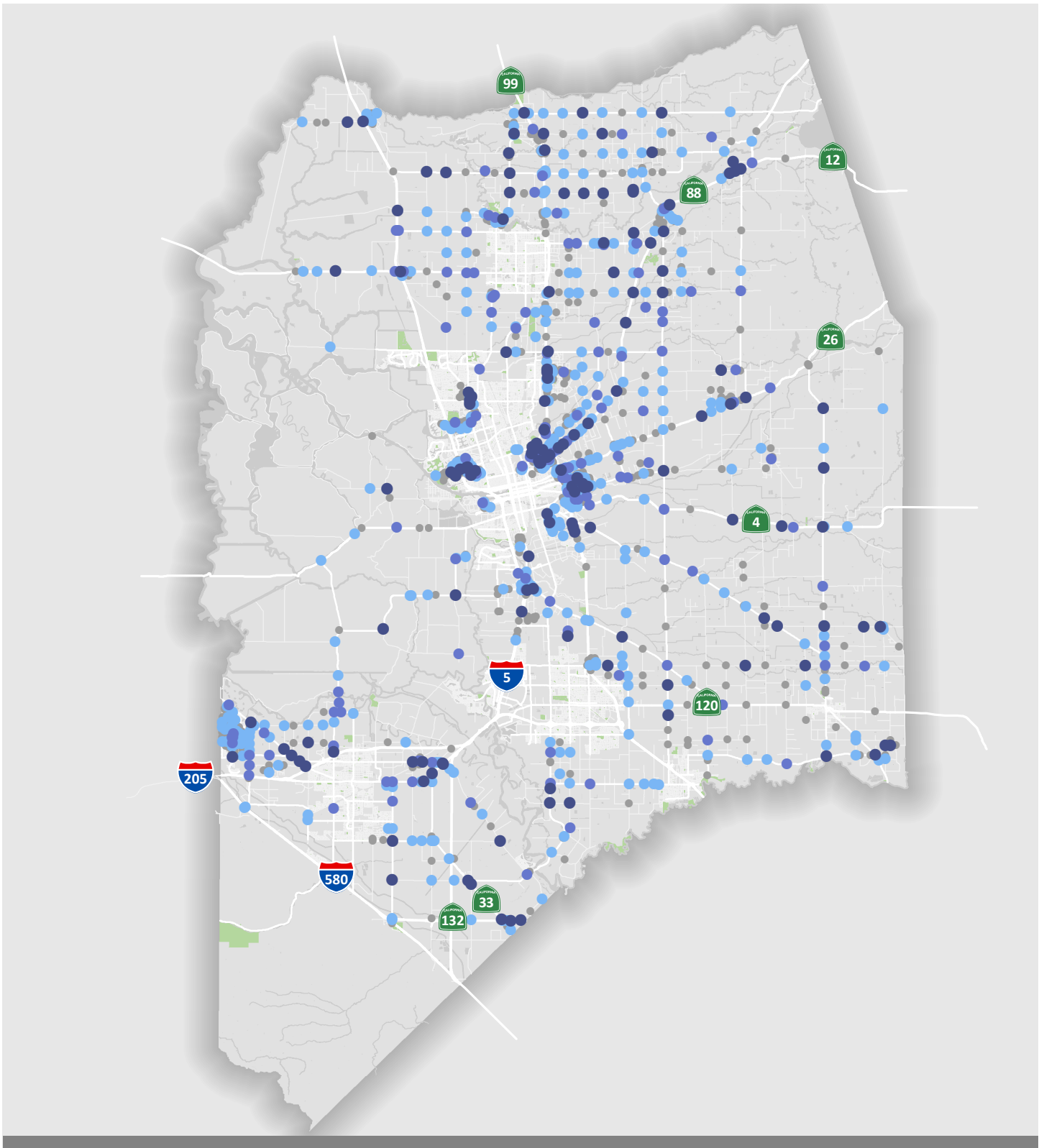
For roadway segments, the collision severity scores ranged from zero to 202.23⁸. Looking at overall roadway segment collision severity scores, the top five overall half-mile roadway segments and top 10 non-state route roadway segments were identified. The top five overall roadways show the highest priority roadways but three of them are state routes that are outside of the County's responsibility for improvements. Thus, the top 10 non-state route roadways provide the highest priority locations within the County's responsibility.

The resulting lists of collision severity score results are provided in Table 4, Table 5, and Table 6, respectively. These locations are mapped in Figure 30. Note that intersections and roadways within Caltrans jurisdiction have been grayed out. These locations are still safety priorities within San Joaquin County but require participation from Caltrans to implement improvements. The County will coordinate with Caltrans to share these priority locations with Caltrans but focus on other priority locations within its jurisdiction.

This method highlights the sites that have high frequencies of fatal and/or serious injury collisions which typically warrant further investigation and countermeasure application. These locations are often the most competitive for HSIP, SS4A, and similar safety-related grant applications.

⁷ For reference, the intersection with a collision severity score of 163.66 was associated with the following outcomes: six fatal or serious injury collisions, five other visible injury collisions, six complaint of pain collisions, and eleven property damage only collisions.

⁸ For reference, the segment with a collision severity score of 202.23 was associated with the following outcomes: five serious injury collisions, eight other visible injury collisions, fifteen complaint of pain collisions, and eleven property damage only collisions.



Collision Severity Scores

- 95th - 100th Percentile (38.451 - 163.66)
- 90th - 94th Percentile (6.301 - 38.45)
- 75th - 89th Percentile (1.221 - 6.3)
- 1st - 74th Percentile (0.001 - 1.220)

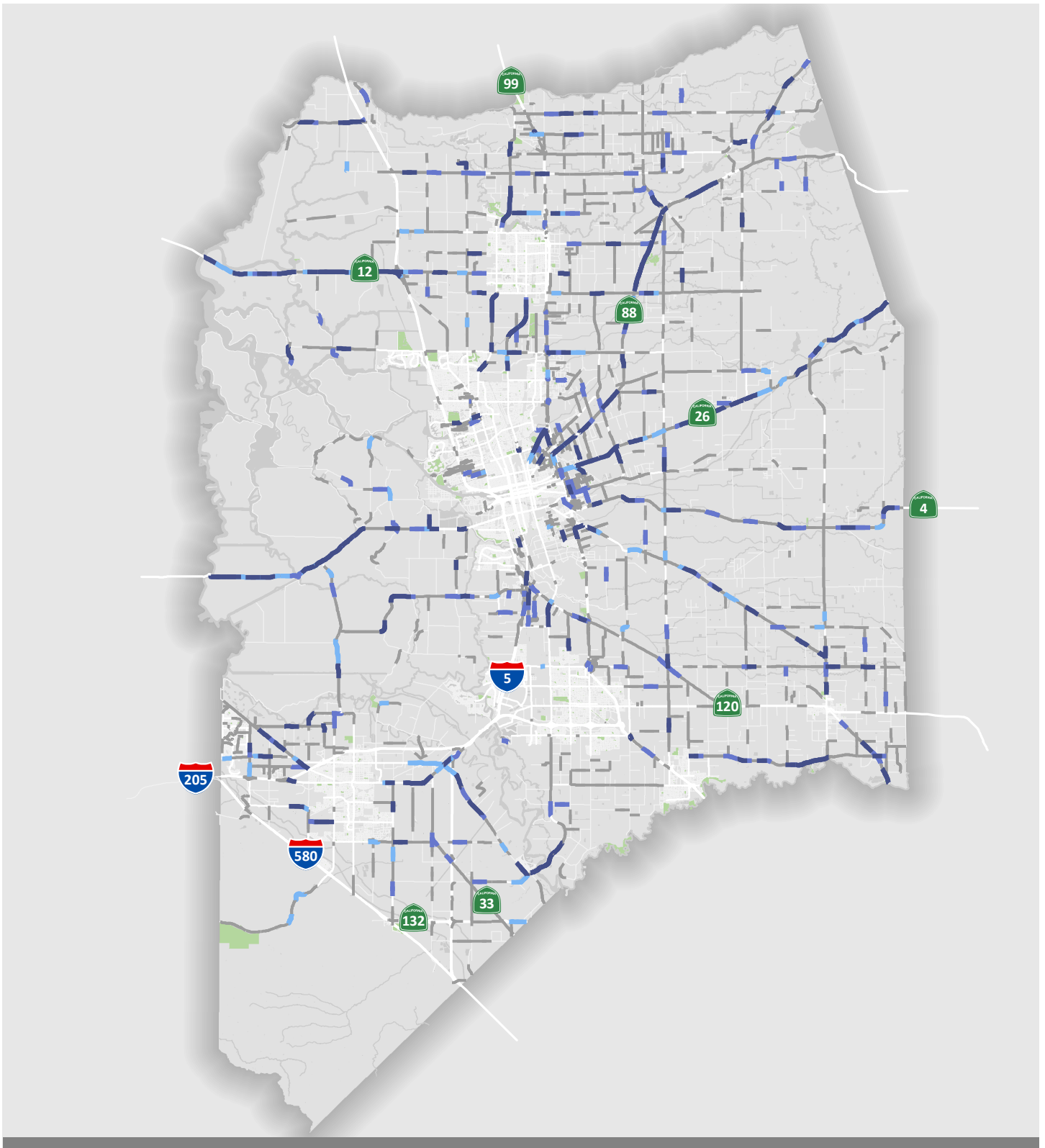
- ✚ Parks
- ⊞ County Limits

0 5 10 Miles



Figure 28

**Intersections
Collision Severity Score Network Screening
San Joaquin County LRSP**



Collision Severity Score

- █ 95th - 100th (35.001 - 202.23)
- █ 92nd - 94th Percentile (18.961 - 35.00)
- █ 90th - 91st Percentile (5.001 - 18.96)
- █ 1st - 89th Percentile (0.01 - 5.00)

- + Parks
- + County Limits

0 5 10 Miles



Figure 29

**Roadway Segments
Collision Severity Score Network Screening
San Joaquin County LRSP**

Table 4. Priority Intersections by Collision Severity Score

Intersection	Traffic Control	Annualized Collision Severity Score	Recent Safety Project (Past 5 Years)
BIRD RD & ELEVENTH ST	Signalized (Rural)	163.66	Safety project planned
GRANT LINE RD & BYRON RD	Roundabout (Rural)	161.03	Roundabout in construction (2022)
NORTH CHEROKEE LN & COLLIER RD	SSSC (Rural)	121.14	
MARIPOSA RD & DODDS RD	SSSC (Rural)	119.09	
GRANT LINE RD, KASSON RD, & ELEVENTH ST	Roundabout (Rural)	107.57	Roundabout restriped (2016)
STATE ROUTE 33 OFF RAMP & VERNALIS RD*	SSSC (Rural)	98.22	
PICCOLI RD & STATE ROUTE 88*	SSSC (Rural)	96.87	
FRENCH CAMP RD & AUSTIN RD	AWSC (Rural)	87.05	Flashing beacons installed (2018)
HOWARD RD & ROBERTS RD	SSSC (Rural)	85.44	
COTTAGE AVE & LATHROP RD	SSSC (Rural)	85.22	Flashing beacon installed (2018)
THORNTON RD & WOODBRIDGE RD	SSSC (Rural)	84.22	
ALPINE AVE & FRANKLIN AVE	SSSC (Urban)	83.9	
PEZZI RD/BAKER RD & STATE ROUTE 88*	SSSC (Rural)	81.76	
LIVE OAK RD & STATE ROUTE 88*	SSSC (Rural)	81.76	
ESCALON-BELLOTA RD & COPPEROPOLIS RD	SSSC (Rural)	81.46	
PELTIER RD & LOWER SACRAMENTO RD	AWSC (Rural)	81.46	
STATE ROUTE 132 & WELTY RD*	SSSC (Rural)	81.46	
RAY RD & PELTIER RD	SSSC (Rural)	81.06	
STATE ROUTE 88 & CLEMENTS RD*	SSSC (Rural)	80.74	
LOOMIS RD & STATE ROUTE 99 W FRONTAGE RD	SSSC (Rural)	80.25	
DODDS RD & ESCALON-BELLOTA RD	SSSC (Rural)	80.05	
CHEROKEE RD & SIERRA LN	SSSC (Urban)	79.45	
FAIRCHILD LN & STATE ROUTE 88*	SSSC (Rural)	79.12	
ACAMPO RD & BRUELLA RD	AWSC (Rural)	78.63	

Intersection	Traffic Control	Annualized Collision Severity Score	Recent Safety Project (Past 5 Years)
LONE TREE RD & BRENNAN AVE	SSSC (Rural)	78.63	
DRAIS AVE & STATE ROUTE 4*	SSSC (Rural)	78.63	
PEATLAND RD & STATE ROUTE 12*	SSSC (Rural)	78.43	
TRETHEWAY RD & ACAMPO RD	SSSC (Rural)	78.43	
E ST & WILSON WAY	SSSC (Urban)	78.23	
LIBERTY RD & DUSTIN RD	AWSC (Rural)	78.11	Flashing beacons installed (2018)
WATERLOO RD & MYRAN AVE	SSSC (Rural)	77.71	
SIXTH ST & STATE ROUTE 88*	SSSC (Rural)	77.71	
THORNTON RD & PALOMA AVE	SSSC (Rural)	77.51	
KETTLEMAN LN & LOCUST TREE RD	SSSC (Rural)	77.51	
MOKELUMNE ST & LOWER SACRAMENTO RD	AWSC (Rural)	77.31	
MACKVILLE RD & MEHRTEN RD	SSSC (Rural)	77.09	
STATE ROUTE 26 & IONE ST*	SSSC (Rural)	76.49	
MURRAY RD & STATE ROUTE 26*	SSSC (Rural)	76.49	
ESCALON-BELLOTA RD & FLOOD RD	SSSC (Rural)	76.29	
AIRPORT WAY & PERRIN RD	SSSC (Rural)	76.09	
STATE ROUTE 4 & HEWITT RD*	SSSC (Rural)	76.09	

Note: SSSC = Side-Street Stop Control, AWSC = All-Way Stop Control, * indicates Caltrans jurisdiction.

Source: Kittelson & Associates, Inc., 2022.

Table 5. Roadway Segments by Collision Severity Score - Top Five Overall Corridors

Location	Segment Length (mi)	Functional Classification	Annualized Collision Severity Score
<i>West State Route 4 from County Line to West 1100' from River</i>	3.39	Arterial	447.83
<i>East State Route 26 from Shelley Road to County Line</i>	1.49	Arterial	256.61
North Wilson Way from McAllen Road to Diverting Canal Levee Road	0.96	Principal Arterial	237.80
<i>East State Route 26 from Baldwin Lane to Alpine Road</i>	1.8	Arterial	214.35
Lower Sacramento Road from Eight Mile Road to Mettler Road	1.24	Major Collector	205.66

Note: * indicates Caltrans jurisdiction.

Source: Kittelson & Associates, Inc., 2022.

Table 6. Roadway Segments by Collision Severity Score - Top Ten Unincorporated County Corridors

Location	Segment Length (mi)	Functional Classification	Annualized Collision Severity Score ⁹
North Wilson Way from McAllen Road to Diverting Canal Levee Road	0.96	Principal Arterial	237.80
Lower Sacramento Road from Eight Mile Road to Mettler Road ¹⁰	1.24	Major Collector	205.66
South Union Road from Shady Pines Street to Lovelace Road	0.72	Major Collector	168.49
East Mariposa Road from Jack Tone Road to Gawne Road	2.15	Major Collector	112.71
North Clements Road from Brandt Road to Stampede Road	1.74	Major Collector	101.63
North Empire Tract Road from Eight Mile Road to 0.78 mi South of Eight Mile Road Intersection	0.78	Local Road	100.41
North Newton Road from Wilson Way to Cherokee Road ¹⁰	0.83	Urban Collector	78.64
West Valpico Road from Lammers Road to Wilkinson Way	1.01	Major Collector	78.04
East Peltier Road from Des Moines Road to Kennefick Road	1.49	Major Collector	76.83
North West Lane from Armstrong Road to Ham Lane	0.97	Principal Arterial	75.3

Source: Kittelson & Associates, Inc., 2022.

⁹ These scores are different from Figure 2 because of the roadway segment extents.

¹⁰ Recent improvements have been made at these corridors.

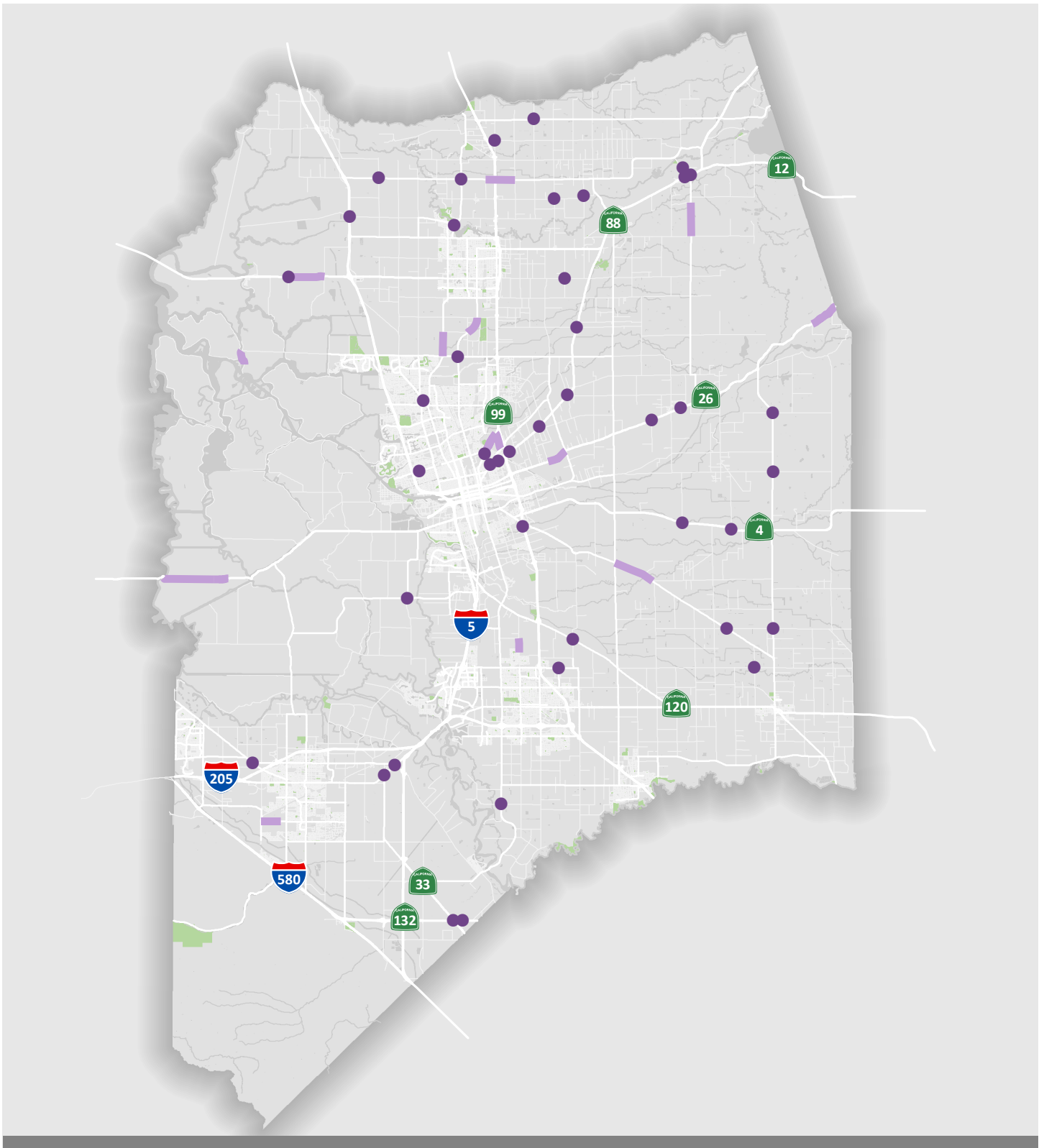


Figure 30

**Priority Intersections and Segments
Collision Severity Score Network
Screening San Joaquin County LRSP**

EMPHASIS AREAS



EMPHASIS AREAS

Based on recurring collision patterns and trends, the greatest opportunity to improve roadway safety in San Joaquin County likely comes through addressing the following **emphasis areas**.

■ Pedestrians and Bicyclists

- Pedestrians and bicyclists are overrepresented in fatal and serious injury collisions. These vulnerable road users are involved in 2.4 percent of reported collisions but are involved in 14.1 percent of total fatal and serious injury collisions.

■ Unsignalized Intersections

- Unsignalized intersection locations made up all but one of the highest scoring intersections in the collision severity score analysis.

■ Lane Departures

- Hit object was the most commonly cited collision type for fatalities and serious injuries (28 percent). There was a total of 1,807 lane departure collisions, of which, 164 (9 percent) resulted in a fatal or serious injury outcome.

■ Driving Under the Influence

- Driving or biking under the influence was the most commonly cited primary collision factor for fatal and serious injuries (45 percent), higher than the statewide average of 28 percent. There was a total of 1,428 DUI collisions, of which, 219 (5 percent) resulted in a fatal or serious injury outcome.

■ Speed Management

- Unsafe speed was a commonly cited primary collision factor for fatal and serious injuries (13 percent) and is often found as a related factor to each of the above emphasis areas. There was a total of 3,027 unsafe speed collisions, of which, 179 (4 percent) resulted in a fatal or serious injury outcome.

■ Aging Road Users

- Collisions involving drivers 65 and older account for 17 percent of all fatal and serious injury collisions—that is 5 percent more than the statewide average of 12 percent.

These six emphasis areas guide the recommended actions and implementation strategies identified in the LRSP.

STRATEGIES AND RECOMMENDATIONS



STRATEGIES AND RECOMMENDATIONS

Improving roadway safety in San Joaquin County will take a coordinated effort from various partners and viewpoints. This section presents multidisciplinary recommendations for the County to consider as they make investments and advancements in improving roadway safety across the region. Recommendations are organized into the following categories that show the relationship between the Safe System Approach and the historical classification of traffic safety “E’s”. Note that some Safe System principles overlap with multiple “E’s”:

- / **Safe Roads and Safe Speeds:** Engineering
- / **Safe Road Users:** Education and Equitable Enforcement
- / **Safe Vehicles and Safe Roads:** Emerging Technology
- / **Post-Crash Care:** Emergency Response

The recommendations are based on the collision patterns and trends described in the previous section, especially relating to the emphasis areas.

SAFE ROADS AND SAFE SPEEDS: ENGINEERING

This set of countermeasure treatments have been grouped into the following five subcategories to align recommendations that most directly address specific collision patterns and trends or location types:

- Pedestrian-related;
- Bicycle-related;
- Unsignalized intersections;
- Signalized intersections; and,
- Roadway segments.

For each of these groupings, priority countermeasures were identified and summarized based on the collision types addressed, quantitative effectiveness of the treatment document as crash reduction factors (CRFs) and implementation considerations. More detailed information on the treatments can be found in the Collisions and Roadway Data Analysis Technical Memorandum, included in **Appendix A**.

Potential Partners for Implementation:

- San Joaquin County Department of Public Works

Countermeasures: A term used for engineering infrastructure improvements that can be implemented to reduce the risk of collisions.

Strategies: A term used for non-engineering practices that address traffic safety – often related to behavior or components of a Safe System that build a culture of safety.

- Caltrans
- Incorporated City Public Works Departments

Pedestrian-Related

Pedestrian-related treatments, especially the crossing-related enhancements seek to improve the visibility of pedestrians and awareness of drivers approaching a crossing location. The following countermeasures were identified for the County:

Pedestrian-Related Treatment	Planning-Level Cost Range	CRF	Purpose	Brief Description
Sidewalk/ Shared Use Path	Varies	65-89%	Space for pedestrians separate from roadway	Sidewalk or dedicated pathway for pedestrians provide a separated walking environment
Raised Crosswalk	Varies	Varies	Speed reduction, increased accessibility, enhanced visibility of pedestrians	A raised crosswalk is a variation of a flat-topped speed table. A raised crosswalk is marked and signed as a pedestrian crossing.
Crosswalk Visibility Enhancements	\$15,000-\$20,000	25-35%	Indicates where pedestrians should cross, increases visibility of pedestrians, increase driver awareness, requires drivers to yield	This group of treatments include high-visibility crosswalk markings, improved nighttime lighting, advance or in-street warning signage, in conjunction with curb extensions, and parking restrictions.
Rectangular Rapid Flashing Beacons (RRFBs)	\$35,000-\$60,000 per location	47%	Increases driver yielding, reduces pedestrian/vehicle conflicts, increases visibility of pedestrians, reduces pedestrians trapped in roadway	RRFBs are user-actuated amber Light Emitting Diodes (LEDs) that supplement warning signs to improve awareness and safety at unsignalized intersections or mid-block crosswalks.
Pedestrian Hybrid Beacon	\$200,000-\$350,000	55%	Provides active warning to drivers, increases driver yielding	A Pedestrian Hybrid Beacon (PHB) is a beacon used to control traffic that reverts to all dark until a pedestrian activates it via a push button or other form of detection. When activated, the beacon displays a sequence of lights to indicate when vehicles must stop.
Pedestrian Refuge Island	\$2,000-\$40,000	45%	Reduces crossing distance for pedestrians, creates a place where pedestrians can wait while crossing traffic	A pedestrian refuge island is a median with a refuge area that is intended to help protect pedestrians who are crossing the roadway. This treatment is also referred to as a crossing island or pedestrian island.

Pedestrian-Related Treatment	Planning-Level Cost Range	CRF	Purpose	Brief Description
Signalized Intersection Pedestrian Treatments	Leading Pedestrian Interval (LPI) – \$550-\$6,000 No Right Turn on Red (RTOR) – \$200-\$6,000	LPIs – 60% No RTOR – 25%	one direction at a time LPI: increase visibility of pedestrians No RTOR: reduces conflict between pedestrian and vehicles	This group of treatments include implementing leading pedestrian interval and prohibiting right-turns on red to improve drivers' awareness of pedestrians at intersections.
Traffic Calming	\$5,000 - \$25,000 per location	Varies by treatment	Lowers vehicle speeds, alters driver behavior, improves conditions for non-motorized street users	This group of treatments include Speed Hump, Chicane, Bulb-out, Raised intersections, Mid-block Pedestrian Crossing, and Choker/Pinch Point

Bicycle-Related

Bicycle-related treatments at intersections seek to improve the visibility of bicyclists, awareness of drivers approaching the intersections, and increased predictability of bicyclist location. The following countermeasures were identified for the County.

Bicycle-Related Treatment	Planning-Level Cost Range	CRF	Purpose	Brief Description
Bike Lanes	\$55,000 per 100 ft	35-45%	Allows bicyclists ride at preferred speed, less interference from traffic conditions, facilitates more predictable behavior between motorists and bicyclists	This treatment designates a portion of roadway for the preferential or exclusive use of bicyclists through striping, signage, and pavement markings. Bike lanes typically run in the same direction of traffic, though they may be configured in the contra-flow direction on low-traffic corridors for the connectivity of a particular bicycle route.
Bike Lane Extension Through Intersection	\$200- \$5,000 per intersection	39%	Raises awareness for both bicyclists and motorists for potential conflict areas, reinforces through bicycles have priority over turning motor vehicles	Bicycle pavement markings through intersections indicate the intended path of bicyclists through an intersection or across a driveway or ramp.
Bike Boxes	\$ 5,000 per box	35%	Increases visibility of bicyclists, prevents right-hook conflicts with turning vehicles, gives bicyclists priority by allowing them to come to the front of the queue	A designated area at the head of a traffic lane at a signalized intersection that provides bicyclists with a safe and visible way to get ahead of queuing traffic during the red signal phase.
Road Diet	\$20,000- \$40,000 per mile	30%	Improves access management, increases pedestrian and bicycle access, enhances roadway safety	Road diets reduce the number of travel lanes on the roadway and provide space to implement pedestrian and bicyclist related treatments, including adding bike lanes and median crossing islands. The most common road diet configuration involves converting a four-lane roadway into three travel lanes, often supplemented with bike lanes.

Unsignalized Intersections

Stop-controlled intersections along rural roadways and those owned by local road agencies often have characteristics including low traffic volumes, lack of turn lanes and lighting, and skewed angle or limited sight distance. Rural intersection safety can be improved by implementing low-cost improvements that address sight distance, intersection recognition, visibility and conspicuity of traffic control devices, and roadway geometry issues.

- Typical basic **low-cost upgrades** to improve recognition of stop-controlled intersections during day or night include:
- Doubling up oversize warning signs
- Double stop signs
- Traffic island on stop approach
- Street name signs
- Stop bars
- Double warning arrows

These basic treatments can typically be done for \$10,000-20,000 per location and experience a CRF of up to 70%.

In addition to the basic package of countermeasures, **supplemental treatments** that may be considered based on specific site conditions and collision history include:

- **Install Flashing Beacons:** This treatment involves installing either flashing solar powered LED beacons on advance intersection warning signs and stop signs, or flashing overhead intersection beacons. This treatment may be added at spot locations or on a systemic basis where visibility or driver awareness may be limited.
- **Install Dynamic Warning Signs:** This treatment involves installing dynamic warning signs to advise through traffic that a stopped vehicle is present and may enter the intersection or advise high-speed approach traffic that a stopped condition is ahead. This treatment should be applied at intersections with inadequate sight distance from the stop approach and when running STOP signs is a problem.
- **Transverse Rumble Strips:** This treatment involves installing rumble strips as warning devices for drivers approaching an intersection across the stop approach lanes in rural areas where noise is not a concern and running STOP signs is a problem. "Stop Ahead" pavement markings should be used if noise is a concern.
- **Extend the Through Edgeline:** This treatment involves extending the through edgeline using a short skip pattern to assist drivers to stop at the optimum point. This treatment may be implemented at intersections with a wide throat and where observed vehicles tend to stop too far back from the intersection.

- **Install Retroreflective Stripes on Sign Posts:** This treatment involves installing retroreflective strips on sign posts to increase attention to the sign at the stop-controlled intersection, particularly at night. This treatment should be applied where sign visibility is significantly limited.
- **Install Splitter Islands for Minor Street Approaches:** This treatment consists of adding a raised median island at minor street intersection approaches to increase the visibility of the intersection, clarify movements at the intersection, and provide a space for a secondary stop sign on the approach, if desired. These treatments may be considered at any unsignalized intersection where conflicts occur between turning and stopped vehicles at an approach, or where intersection visibility is limited. Each location being considered should have appropriate truck turns evaluated and may require additional outside widening to allow large vehicles and trucks including agricultural vehicles to navigate turns.
- **Upgrade Intersection Pavement Markings:** This treatment involves installing appropriate pavement delineation in advance of and at intersections to provide approaching motorists with additional information at these locations. This treatment may be used at unsignalized intersections that are not clearly visible to approaching motorists, and especially those on the major road. This strategy is particularly appropriate for intersections with patterns of rear-end, right-angle, or turning collisions related to lack of driver awareness of the presence of the intersection.
- **Clear Sight Visibility Triangle:** This treatment involves determining the stopping sight distance from intersection approaches and removing obstacles that prevent a driver from seeing the required distance for oncoming vehicles. This often includes trimming or removing vegetation, relocating signs or other fixed objects, or restricting parking areas. This treatment should be applied at all locations to maximize the reaction time for drivers and reduce potential broadside and rear-end collisions associated with vehicles entering the roadway.

At unsignalized intersections with a high frequency of reported collisions, traffic delays, complex geometry (more than four approach roads), frequent left-turns, and/or relatively balanced traffic flows, installation of a **roundabout** should be considered.

- Roundabout costs range significantly (estimated \$45,000 to over \$1,500,000) depending on size, site conditions, and right-of-way acquisition needs.
- Collision reduction factors can also vary greatly, but roundabouts are particularly helpful in reducing fatal and serious injury collisions.

Signalized Intersections

Treatments at signalized intersections seek to improve the visibility of the intersection, reduce the potential for conflicting movements within the intersection, thereby reducing the number of conflict points within the influence area of the intersection. The following countermeasures were identified for the County.

Signalized Intersection Treatment	Planning-Level Cost Range	CRF	Purpose	Brief Description
Install Street Lighting	\$7,000 to \$10,000 per light	40%	Makes drivers aware of surroundings, improves perception-reaction time, enhances sight distance, improves non-motorists' visibility and navigation	This treatment involves adding intersection lighting to improve safety during nighttime conditions with a documented history of dark condition collisions where lighting is limited.
Improve Signal Hardware	\$1,500 to \$2,000 per signal head	15%	Provides better visibility of intersection signals, aids driver's advanced perception of upcoming intersection	This treatment involves installing new LED lighting, signal back plates, retro-reflective tape outlining the back plates, or additional signal heads to increase signal visibility.
Provide Advanced Dilemma Zone Detection	\$25,000 to \$30,000 per new system; updates are \$5,000 to \$8,000	39%	Provides safe, orderly transition between conflicting streams of traffic, could reduce rear-end collisions, reduces illegal crossing of intersection during red phase	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.

Roadway Treatments

Roadway segment treatments seek to improve the visibility of the roadway, increase pavement friction, enhance delineation along curves, and manage traffic speeds along the roadway. Countermeasures identified for San Joaquin County were divided into the following four subcategories to be applied depending on the safety issue(s) being addressed:

1. Segment Curves
2. Roadside and Delineation
3. Street Lighting
4. Speed Management

Roadway Treatments	Planning-Level Cost Range	CRF	Purpose	Brief Description
1. Segment Curves				
Install or Upgrade Signs for Horizontal Curves	\$4,000-\$20,000 per curve depending on treatment selected	15-40%	Provide drivers with advanced warning, help drivers navigate safely	This treatment consists of adding new or upgrading existing advisory signs along or on the approach to horizontal curves. This may consist of chevron signs, curve warning signs (including flashing warning beacons), fluorescent sheeting, or other advisory signs.
Install High-Friction Surface Treatment (HFST)	\$50 per square yard	17-68%	Higher pavement friction leads to better control in both dry and wet conditions	This treatment involves the application of very high-quality aggregate to the pavement using a polymer binder to restore and/or maintain pavement friction.
2. Roadside and Delineation				
Install Delineators, Reflectors, and/or Object Markers	\$500-\$2,500 per curve	15%	Provide drivers with visual cue of horizontal curvature, help drivers navigate safely	This treatment consists of adding delineators, reflectors, or object markers on the approach and through a horizontal curve.
Widen Shoulder	\$8-\$16 per square foot per side of road	25%	Allows vehicles to pull off road in emergencies, facilitates safer recover for drivers who leave the travel lane	This treatment consists of providing adequate shoulder width minimums which makes it easier for a driver to steer the vehicle back onto the road at a shallower angle.



Roadway Treatments	Planning-Level Cost Range	CRF	Purpose	Brief Description
Install Rumble Strips	\$5-\$10 per foot ¹¹	20%	Alerts drivers when they are drifting out of their lane, gives time to recover	Centerline and edgeline rumble strips/stripes are raised or grooved patterns on the roadway that provide an audible warning (“rumble”) and physical vibration to alert drivers leaving the travel lane or crossing the center line.
Install Edgelines and Centerlines	\$500-\$5,000 depending on extent	20%	Increase visibility of edge of roadway	This treatment consists of installing or widening edge-lines or centerlines.
Remove or Relocate Fixed Object(s) Outside of the Clear Recovery Zone	\$200-\$12,000 per object removal	35%	Reduces severity of roadway departure collisions, allows drivers to regain control of a vehicle that has left the roadway	This treatment involves creating a clear recovery zone adjacent to the traveled way for vehicles that leave the travel lane.
Install Guardrail	\$100 per foot plus \$5,000 per terminal	25%	Reduces severity of roadway departure collisions	A safety barrier intended to shield a motorist who has left the roadway from slopes or fixed objects.

3. Lighting

Street Lighting	\$7,000-\$10,000 per light	35%	Makes drivers aware of surroundings, improves perception-reaction time, enhances sight distance, improves non-motorists' visibility and navigation	This treatment involves adding roadway lighting to improve safety during nighttime conditions.
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4. Speed Management

Install Dynamic Speed Feedback Signs	\$2,000-\$11,000 per display	0-41%	Provides driver with feedback about their speed limit in relation to the posted speed limit	This treatment consists of installing dynamic or variable speed feedback signs on the roadway
Traffic Calming	\$5,000 - \$25,000 per location	Varies by treatment	Lowers vehicle speeds, alters driver behavior, improves conditions for non-motorized street users	This group of treatments include Speed Hump, Chicane, Bulb-out, Raised intersections, Mid-block Pedestrian Crossing, and Choker/Pinch Point

¹¹ If done in coordination with a larger capital improvement or resurfacing project, costs can be as low as \$1 per linear foot.

SAFE ROAD USERS: EDUCATION AND EQUITABLE ENFORCEMENT

Education Strategies

Education strategies are focused on teaching road users the principles of traffic safety. These strategies can be developed to include interactive activities, comprehensive teaching notes and information on road safety messages and concepts that can be taught at school or in other community spaces.

Key topics for education programs usually include:

- Road safety for children
- Young driver safety
- Dangers of impaired driving
- Dangers of distracted driving (e.g., using cell phones and text messaging while driving)
- Dangers of speeding
- Importance of occupant protection devices (seatbelts and car seats)
- Vulnerable road user safety

Potential Partners for Implementation:

- San Joaquin County Public Health Services
- Community Based Organizations (e.g., San Joaquin Bike Coalition, Public Health Advocates, Catholic Charities)
- National Non-Profit Organizations (e.g., AARP, MADD)
- Law Enforcement (e.g., California Highway Patrol, City Police Departments, County Sheriff's Office)

The following education-related strategies were identified for San Joaquin County.

Education Strategies	Brief Description
Road Safety Education to Children	Road safety education to children includes strategies such as safe routes to school, walking school bus, and bicycle trains that promote road safety to all users, particularly for pedestrians and bicyclists. A 'safe routes to school' program would encourage and enable children to walk and bike to school. This can improve their health, well-being, and safety. This also results in less traffic congestion and emissions caused by school-related travel. Walking school buses and bicycle trains encourage groups of children walking or biking to school, with one or more adults. Walking school buses and bicycle trains have been put into practice by some of the schools in Sacramento, California; Chapel Hill, North Carolina; and Duluth, Georgia (SRTS Guide, 2021). These strategies or practices have shown communities and families that walking and biking can be a viable and safe transportation option, and thus can be incorporated into their own daily travel patterns.
Speed Monitoring Awareness Radar Trailer	The speed trailer is an educational device that helps drivers become more aware of their speed in relation to the posted speed. This awareness tool can also help residents survey the traffic speeds in their own neighborhood. This trailer is usually deployed in a street or neighborhood for a few days so the residents can monitor the speeds on their own streets and become aware of their own driving behaviors.
Conspicuity Enhancements and Education	The purpose of enhancing conspicuity for pedestrians is to increase the opportunity for drivers to see and avoid pedestrians, particularly when it is dark. Over 70% of national pedestrian fatalities occur in the dark, and pedestrians who are more visible are less likely to be struck. Educating pedestrians to wear reflective clothing and walk in well-lit areas can be implemented as targeted campaigns. The use of high visibility clothing and protective gear enhances safety. There is some limited evidence to suggest that a program aimed at increasing conspicuous and protective clothing could be successful.
Vulnerable Road User Education	The road safety education regarding vulnerable road users like pedestrians and bicyclists includes strategies involving education from police officers. If the driver encroaches into the bike lane or fails to yield to the pedestrian at the crossing, the police officer pulls the driver over and hands them a flyer that has the information for drivers to adapt their behavior towards all road users; this can be in addition to a citation.
High-Visibility Cell Phone and Text Messaging Media Campaign	The High Visibility Enforcement model combines dedicated law enforcement with paid and earned media supporting the enforcement activity. Paid media includes advertisements on TV, radio, online, and via billboards, while earned media includes things like press events and news releases covering the efforts. Both types of media support enforcement activity are needed to ensure the public is aware of the enforcement activity, and to create the impression that violators will be caught.
DUI Educational Programs	An educational program to reduce driving under the influence of drugs or alcohol may help improve safety throughout the County. A DUI program may involve collaborating with stakeholder partners to identify opportunities to influence driving under the influence behaviors, as well as coordinating with enforcement to identify focus locations for enforcement activities and education opportunities. It may also be beneficial to implement educational programs with local school districts to

Education Strategies	Brief Description
Transportation Safety Campaign	<p>target underage impaired driving.</p> <p>Designed to dovetail with community education efforts, transportation safety campaigns use strategic marketing, advertising, and engagement to foster community awareness of a shared responsibility for road safety. Successful messaging reaches audiences where they are using a variety of approaches. Typically includes a combination of print material and social media messaging. Campaigns should be created in partnership with various community stakeholders, including other planning organizations and jurisdictions.</p>

Equitable Enforcement Strategies

Even when engineering countermeasures are implemented, road users failing to adhere to traffic laws can result in collisions of varying severity. Police enforcement can increase driver awareness and consequently reduce traffic collisions. However, the relationship between enforcement and safety performance improvement is not well understood, and any directed enforcement strategies should be undertaken with great care to avoid inequitable enforcement activities. Research has found that most enforcement strategies have limited long-term impacts for changing road user behavior. Therefore, the most effective enforcement strategies tend to be those that can be done transparently, consistently, and in coordination with education or outreach campaigns such as enforcement in school zones during school hours. This section identifies enforcement strategies that San Joaquin County can explore to provide equitable and successful outcomes.

Potential Partners for Implementation:

- California Highway Patrol
- San Joaquin County Sheriff's Office
- Incorporated City Police Departments

The following enforcement-related strategies were identified for San Joaquin County.

Enforcement Strategies	Brief Description
Progressive Ticketing	<p>Progressive ticketing is a method for introducing ticketing through a three-staged process. Issuing tickets is the strongest strategy of an enforcement program and it is usually reserved for changing unsafe behaviors that other strategies failed to change or that pose a real threat to the safety of road users. There are three main steps of an effective progressive ticketing program:</p> <ol style="list-style-type: none"> 1. Educating - Establish community awareness of the problem. The public needs to understand that drivers are speeding and the consequences of for road safety. Raising awareness about the problem will change some behaviors and create public support for the enforcement efforts to follow. 2. Warning - Announce what action will be taken and why. Give the public time to change behaviors before ticketing starts. Fliers, signs, newspaper stories and official warnings from officers can all serve as reminders. 3. Ticketing – After the “warning” period, hold a press conference announcing when and where the police operations will occur. If offenders continue their unsafe behaviors, police officers issue tickets.
Speed Enforcement in School Zones	<p>Strict enforcement of speed laws in school zones is a law enforcement tool to address improve the safety for children walking and bicycling to school as well as drivers. Potential approaches include a 'zero tolerance' policy for speeding in school zones and increases in fines for drivers who violated the posted school zone speed limit.</p>
Red Light Running Cameras	<p>Red light running cameras are an effective way to discourage red light running. These cameras are connected to the traffic signal and capture any vehicles that do not stop during the red phase. Tickets are issued to drivers who run red lights, which helps to discourage similar behavior in the future.</p>
High Visibility Saturation Patrols	<p>A saturation patrol (also called a dedicated DWI patrol) consists of many law enforcement officers patrolling a specific area to look for drivers who may be impaired. These patrols usually take place at times and locations where impaired driving collisions commonly occur. Like publicized sobriety checkpoint programs, the primary purpose of publicized saturation patrol programs is to deter driving after drinking by increasing the perceived risk of arrest.</p>

SAFE VEHICLES AND SAFE ROADS: EMERGING TECHNOLOGY

This section notes innovative approaches to improve roadway safety by accelerating road safety understanding using technology, thereby helping transition to more sustainable and safer transportation systems. The Road Safety Innovation List (2021) identified the following innovative technologies and approaches for safety management that were identified as applicable to San Joaquin County.

Emerging Technologies	Brief Description
Artificial Intelligence and Deep Learning	<p>This technology applies artificial intelligence and deep learning on traffic video feed (such as existing CCTV traffic cameras) to perform automated video analysis of traffic flow for effective and immediate road safety diagnosis and evaluation of conflicts. The combination of artificial intelligence and vehicle-to-everything (V2X) technology is designed to predict vehicles and pedestrians' intent and prevent conflicts that may result in collisions. This technology is now being tested in autonomous vehicles and applications are being developed for use by jurisdictions to apply at intersections or networks (https://trid.trb.org/view/772920).</p>
Big Data	<p>New "Big Data" information measures all kinds of activity in streets including volumes, paths, speeds, and behaviors of pedestrians, bicycles, different types of vehicles, wheelchairs, and scooters on the roadway. These data platforms provide data on curb-level activity and helps engineers and planners design safer and more efficient streets by helping to detect conflicts and address potential road user behaviors and patterns before collisions occur. Mobile phone data and machine learning algorithms are being designed to identify high-risk driver behavior before a collision occurs. Using the smart phone sensors, the behavioral data provides actionable insights that improve safety for all road users.</p>
Fleet Related Technology	<p>Vehicle fleet technology integrates the driver-assisting platooning system to all commercial fleets, and links the active safety systems between freight trucks, detects oncoming vehicles, pedestrians, and bicyclists and alerts drivers in advance to avoid them with real-time warnings.</p>
Touchless Tire Pressure Monitoring	<p>Touchless tire pressure monitoring is a new technology which measures tire pressure in real time. This has been implemented in two locations near the turnpike in Central Florida. Drivers must simply drive over the "Wheel Right" station to learn what their current tire pressure is. This is a safety feature that can help prevent blowouts and accidents on the road by warning drivers ahead of time when they need to maintain their vehicle.</p>
Automated Speed Enforcement	<p>Automated speed enforcement is a system that uses a camera and speed measurement device to enforce speed limits in identified areas. If a vehicle exceeds the posted speed limit in an automated speed enforcement area, the system captures an image which is then reviewed by enforcement officers who issue tickets. This may help to prevent drivers who are issued tickets from similar behavior in the future, as well as prevent all drivers who are aware that this system is in place from speeding. This enforcement approach is not currently legal in California and requires a change to state law to implement this safety</p>

tool which is associated with 20-25% reductions in injury collisions¹². The County can support implementation by supporting legislation to legalize this technology.

INNOVATIVE TECHNOLOGY APPROACHES

As in other areas, technology regarding road safety is rapidly evolving. This technology can help to create more sustainable and safer transportation systems. Emerging technologies can enhance the strategies discussed in the previous sections by implementing dynamic engineering treatments (e.g., operational under specific weather conditions), leveraging social media for education programs, streamlining collision reporting for enforcement, providing automated data enforcement, and improving emergency service dispatch and response.

Technologies that are applicable to roadway safety at the vehicle level can be broken into five categories. While some of the categories listed below are applicable and actionable for San Joaquin County, others are generally out of jurisdictional control and are informational in nature. These categories are discussed below.

Alerting Drivers at Risk

One of the main ways to use emerging technologies to limit collisions is to alert drivers when they are at risk, whether due to their own behavior or the behavior of others. This includes technologies that monitor speed, indicate blind spots, alert drivers to actions of other vehicles, alert drivers to maintenance needs and more. Visual and/or audio alerts, depending on the urgency of a situation, can quickly change the behavior of a driver. Such technologies are being integrated into the national vehicle fleet, although it will take time for them to become widespread. The County can participate in initiatives developing technologies to alert drivers by partnering with researchers and private companies to pilot new alerting technologies as well as supporting the implementation of legislation, research, and testing of new vehicle technologies.

Protecting the Vehicle Occupants

Protecting the vehicle occupants includes physical, in-vehicle protections in the case of a collision. These protections range from seatbelts to vehicle structure, both of which are being continuously developed. In the case that a collision is unavoidable, physical protections can help reduce collision severity and protect lives. The County can support legislation, research, and testing of new protection technologies for future implementation in vehicles.

Communicating with Drivers and the Environment

Communication with drivers and the environment is critical for safety and is a constantly developing field. Communication can come in the form of vehicle-to-driver (blind spot detection), environment-to-driver (signals), vehicle-to-vehicle, and vehicle-to-environment (the latter two methods will likely become more relevant as the fleet of autonomous vehicles develops further). The County can support implementation of these technologies but partnering with researchers and private companies to pilot, test, and promote new

¹² <https://www.sfmta.com/projects/speed-safety-cameras>.

communication technologies. Additionally, the County can develop an implementation plan to identify critical needs to support future vehicle-to-infrastructure and other communication infrastructure.

Vehicle Performing as Designed

Another way to use technology to increase roadway safety is to ensure vehicles are performing as designed. This includes vehicles upkeep, maintenance, and record keeping. Although the County may have a limited ability to enforce these activities, it may consider producing media campaigns encouraging maintenance, provide programs to alleviate maintenance costs, and partner with local organizations, mechanics, and auto shops to promote upkeep.

Mobile Technology and Applications

Many of the currently emerging technologies applicable to roadway safety come in the form of mobile applications. Many of these are used to support Transportation Network Companies (TNCs) such as Uber or Lyft in providing rideshare, bike share, and scooter rental services, which collectively may have significant impacts in reducing impaired driving collisions. Several county sheriffs have partnered with TNCs, particularly during holidays, to reduce the number of impaired drivers on the road. There are also applications that work to restrict drivers' use of mobile devices while driving. Some of these are apps in and of themselves, while others are integrated into existing apps. Encouraging the use of such apps may be useful for the County.

POST-COLLISION CARE: EMERGENCY RESPONSE

Emergency response is critical in reducing the severity of injuries sustained from collisions. The effectiveness of emergency response is tied closely to the time it takes for a person injured in a collision to receive medical care. Research indicates there is a “golden hour”—if pre-hospital time is under 60 minutes, the patient is more likely to live. The following considerations can help lead to more successful outcomes for these strategies.

Potential Partners for Implementation:

- American Medical Response
- San Joaquin County Fire Districts
- Incorporated City Fire Departments
- San Joaquin County Sheriff's Office
- California Highway Patrol
- Incorporated City Police Departments
- San Joaquin County Department of Public Health
- Caltrans

Post-Collision Care Strategies	Brief Description
Implementing New Technology	<p>Technological developments are being applied to improve emergency response. Drones and roadway video are being explored to better understand the details of collisions in real-time to end proper care as soon as possible. This can also maximize resources utilized for care at the collision.</p>
Partner with Local Hospitals or Outreach Groups	<p>Partnering with local hospitals or outreach groups can help provide bystander training courses to the public (i.e., train members of the public to respond to emergencies since they are sometimes the first on the scene at a collision and may be the only one for some time in rural areas). Opportunities for this strategy include:</p> <ul style="list-style-type: none"> ■ Partner with hospitals offering public education courses ■ Promote the Community Emergency Response Team (CERT) program, which trains community members in first responder skills ■ Work with local groups, such as fire departments, to be trainers themselves and then offer training more frequently in their local community ■ Partner with local trauma centers which are required to provide injury

Post-Collision Care Strategies	Brief Description
	<p>prevention programs</p> <ul style="list-style-type: none"> ■ Consider a collaborative media campaign to inform and educate motorists on how to help emergency vehicles move faster by slowing down and moving over
Work with Stakeholders	<p>The County can collaborate with stakeholders such as emergency service groups to:</p> <ul style="list-style-type: none"> ■ Maximize efficiency with urban and rural response times through evidence-based techniques ■ Build advanced education Emergency Medical Services (EMS) personnel capacity in rural areas ■ Identify reasons for delay in transport for both ground EMS (using registry data and EMS records) ■ Identify equipment upgrades, training, or enhancements that would improve patient outcomes ■ Identify barriers, if any to rapid transfer of patients from lower-acuity hospitals to nearby trauma centers
Work with the County 911 team	<p>The County can also improve emergency response time by working with the local 911 team. Priorities in doing so include:</p> <ul style="list-style-type: none"> ■ Involving them in appropriate project planning and design review to identify opportunities to improve EMS access and location identification ■ Involved them in enforcement and EMS grant opportunities ■ Develop and purchase a system that allows local 911 dispatchers to quickly input reported road issues and send the information to the appropriate agency

SAFETY AND EQUITY

Equity within the context of transportation has been defined by several ways as the industry tackles a history of unbalanced investments in mobility options and quality. Furthering the focus on how equity should be considered in transportation, USDOT and FHWA¹³ have defined equity through three aspects of fairness:

- **Transportation Equity:** The primary aim of transportation equity is to help ensure “everyone has access to what they need to thrive – starting with our most vulnerable – no matter their race, socioeconomic status, identify, where they live, or how they travel¹⁴.”
- **Environmental Justice:** Environmental justice focuses on “identifying and addressing disproportionately high and adverse human health or environmental effects¹⁵” of projects, program, policies, or actions on minority and low-income populations. Addressing these disproportionate effects targets achieving an “equitable distribution of benefits and burdens” across the community.
- **Barriers to Opportunity:** Most recently, USDOT and FHWA have introduced racial equity and barriers to opportunity as an additional lens for considering the equity impacts of a project. The barriers to opportunity criteria focus on how projects have completed equity-focused outreach and how a project serves to improve connections to underserved communities to reduce barriers to opportunity and increase access to “job opportunities, quality education, and healthy food¹⁶.”

San Joaquin County has been identified as one of the most disadvantaged communities in California through federal and statewide evaluations like EJSCREEN, CalEnviroScreen 4.0, and the Healthy Places Index. Much of the County is above the 80th percentile for traffic proximity compared to the nation, especially along the SR-4, I-5, SR-99 corridors, and portions of I-205¹⁷. This means that people living in the County experience higher numbers of speeding cars, hazards due to traffic, and air pollution due to traffic than 80 percent of the US.

In addition, most of San Joaquin County has an overall score of less than 50 percent on the Healthy Places Index¹⁸. This index evaluates counties in eight policy action areas: Economic, Education, Social, Transportation, Neighborhood, Housing, Clean Environment, and Healthcare Access. Common policy action challenges in this county lie in education, jobs per acre, access to vehicles, households below poverty, employment, income, and access to health insurance. While Latinos make up 23 percent of the population of California, they make up 35 percent of the fatalities from car collisions in the state of California¹⁹. Many tracts in San Joaquin County are between 35 to 75 percent Hispanic or Latino. Any language barriers to road safety information should be addressed by translating materials for this LRSP into Spanish.

Investments in traffic safety should be implemented with a mindset to achieve equity in the roadway system. This includes the need to address underserved populations and promote safe mobility for all roadway users.

¹³ Equity Statement, Caltrans, December 2020. <https://dot.ca.gov/about-caltrans/equity-statement>

¹⁴ Pursuing Equity in Pedestrian and Bicycle Planning, Pedestrian and Bicycle Information Center, March 2016.

¹⁵ Executive Order 12898: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (1994)

¹⁶ <https://highways.dot.gov/public-roads/julyaugust-2016/climbing-ladders-opportunity>

¹⁷ Environmental Justice Screen 2022. <https://ejscreen.epa.gov/mapper/>

¹⁸ California Healthy Places Index 2022. <https://map.healthylivesindex.org/?redirect=false>

¹⁹ SHSP Fact Sheet 2022. <https://dot.ca.gov/-/media/dot-media/programs/safety-programs/documents/shsp/combined-shsp-fact-sheets-april-2022-a11y.pdf>

PLAN IMPLEMENTATION



ACTION PLAN

Implementation of countermeasures and strategies in San Joaquin County requires commitment and collaboration from various roadway stakeholders. Making meaningful change requires a diverse set of solutions, implementing roadway improvements alongside programs, policy and standard changes, and adopting a safety-first attitude in line with the Safe System approach. Implementation attempts to balance available funding and resources with opportunities to gain additional potential funding through grants or partnerships.

This implementation section of the LRSP focuses on documenting action items identified by the County and the PDT that align with the goals and emphasis areas. There are likely additional actions currently underway and planned that in the County that are looking to improve traffic safety on the roadways. Implementation efforts should continue to evolve as progress is made, innovative ideas or strategies are created, and new information related to collisions or priorities is created.

ACTION ITEMS

The following action items were identified related to each of the goals identified in the LRSP. These ultimately are steps to obtaining the vision and mission of the LRSP.

Create a culture that promotes and prioritizes traffic safety.

Near-Term Actions	Medium-Term Actions	Long-Term Actions
<ul style="list-style-type: none"> ■ Adopt the Safe System Approach ■ Commit to zero preventable fatalities and serious injuries by 2050 ■ Make the LRSP publicly available to implement regional strategies and share best practices. ■ Establish Safety Task Force, building on the plan's PDT ■ Internally develop County staff's roadway safety understanding to establish safety culture ■ Maintain collision data and monitor annual safety performance using the County's GIS database and tools ■ Establish an annual safety performance report and present to the Board of Supervisors ■ Identify opportunities to enhance existing safety databases. 	<ul style="list-style-type: none"> ■ Update the LRSP every three to five years using the latest collision data and performance measures. ■ Consistently evaluate roadway safety performance and track progress towards goals. ■ Revisit and revise LRSP Action Items and priority locations every 3 years ■ Develop tools or forums for cross-organizational data sharing, information sharing, and safety communications ■ Improve data available to correlate collisions with roadway characteristics or behaviors that may affect collision risk, such as average daily volume, speed, or driver expectancy. 	<ul style="list-style-type: none"> ■ Update safety analysis process and approach as new methodologies or approaches are developed in the safety practice ■ Integrate LRSP goals, actions, and priorities into future San Joaquin County General Plan updates and other planning efforts ■ Integrate safety performance measures into long-rang planning and project development processes ■ Compare future collision data to performance measures from this LRSP to provide a clear indication of the impact of the County's efforts.



Educate the community about safe travel practices.

Near-Term Actions

- Make the LRSP publicly available to share collision trends and recommended best practices.
- Partner with Public Health Services and San Joaquin Bike Coalition to promote and expand educational campaigns for roadway safety including walking and biking specific campaigns
- Identify partners to develop safety messaging campaigns to reduce impaired driving
- Partner with local law enforcement and partners to implement education campaigns to address safe speeds and impaired driving

Medium-Term Actions

- Conduct educational trainings at schools on driving under the influence and distracted driving
- Partner with enforcement or other organizations to work with alcohol and marijuana retailers/servers to deter selling to underage customers
- Develop employer-based education materials to help institute distracted driving policies for workplaces
- Establish roadway safety-based messaging to share through County media accounts throughout the year

Long-Term Actions

- Develop multilingual comprehensive roadway safety education programs to develop a safety culture in the County
- Revisit and revise educational campaign opportunities based on collision trends and patterns

Reduce fatal and serious injury collisions for users of all modes.

Near-Term Actions

- Identify opportunities to change standards, policies, and guidelines to prioritize safety over travel time and reduce the kinetic energy of conflicts
- Support state and national legislation to allow automated speed enforcement and education
- Pilot and implement speed management strategies and countermeasures
- Identify and develop opportunities to implement separated and/or enhanced facilities for vulnerable road users
- Review emergency response procedures

Medium-Term Actions

- Update standards, policies, and practices to reduce potential collision severity
- Work with partners to update emergency response procedures to reduce response times
- Support on-scene collision incident safety and medical training
- Regularly update the LRSP emphasis areas and priority locations to reflect progress made and identify new priorities based on current collision risk trends.

Long-Term Actions

- Support state and national legislation to update standards, policies, and practices to prioritize safety over travel time, manage travel speeds, and reduce impaired driving
- Implement high-cost capital improvements to address priority locations
- Develop safety redundancy in the County's roadway network to reduce collision potential



Address high injury network locations using proven countermeasures and strategies.

Near-Term Actions	Medium-Term Actions	Long-Term Actions
<ul style="list-style-type: none"> Identify countermeasures and strategies for additional priority locations based on collision data and quantitative safety benefits. Prioritize implementation of countermeasures to address priority collision factors associated with fatal and serious injuries Test implementation of quick-build safety projects Identify key County and partner agency/organization staff to support implementation efforts. Collaborate with local law enforcement to identify priority locations using collision and enforcement activity data 	<ul style="list-style-type: none"> Implement countermeasures and strategies using available funding. Apply for HSIP, SS4A, and other safety funding to implement high-priority and systemic safety improvements. Regularly coordinate with safety partner agencies to assess progress, identify opportunities to implement countermeasures and strategies and identify opportunities for citizen involvement. 	<ul style="list-style-type: none"> Explore funding opportunities to implement high-cost priority strategies and capital projects. Monitor and evaluate effectiveness of priority safety projects to determine local safety benefits

Implement proven systemic safety solutions

Near-Term Actions	Medium-Term Actions	Long-Term Actions
<ul style="list-style-type: none"> Identify collision risk factors and associated locations that have higher risk of fatal and serious injury collisions Identify low-cost countermeasures and strategies for systemic application for emphasis areas and priority collision factors Identify enforcement strategies to implement and evaluate Develop an internal process to regularly collect data and information around the performance measures that can be used to assess changes countywide and at priority locations 	<ul style="list-style-type: none"> Implement systemic countermeasures and strategies using available funding Integrate systemic safety improvements into maintenance and other project development processes Apply for grant funding to support systemic safety implementation Begin implementation of equitable enforcement strategies and monitoring 	<ul style="list-style-type: none"> Explore funding opportunities to implement priority systemic strategies Evaluate effectiveness of equitable enforcement strategies Monitor and evaluate effectiveness of priority safety projects to determine local safety benefits

Support and pilot innovative safety solutions

Near-Term Actions	Medium-Term Actions	Long-Term Actions
<ul style="list-style-type: none"> ■ Identify emerging technology providers to determine potential pilot implementations to test new technologies or solutions ■ Pilot implementation of new countermeasures or strategies to determine effectiveness ■ Consider how emerging connected and autonomous vehicle technology can be implemented in existing infrastructure (e.g., signal equipment/detection) ■ Implement infrastructure-to-vehicle communication technologies 	<ul style="list-style-type: none"> ■ Identify roadway characteristics that could be communicated to vehicle safety features to inform future infrastructure-to-vehicle communication 	<ul style="list-style-type: none"> ■ Support legislation and other implementation strategies to develop safe vehicle technologies and innovative infrastructure ■ Support safety research and development of new safety technologies by technology or vehicle manufacturers ■ Implement infrastructure-to-vehicle communication

PRIORITIZING PROJECT LOCATIONS AND STRATEGIES

Overall, safety projects will be divided between location-specific projects, systemic projects, and non-infrastructure programs.

Location-Specific Safety Projects

These projects are identified based on collision history and road or traffic data at individual sites to identify and prioritize countermeasures for sites that have a high frequency of fatal and/or serious injury collisions. The priority location list identified in the Summary of Countywide Safety Performance provides the LRSP's initial location-specific project locations. This list will be updated at an interval determined appropriate by the County based on implementation (e.g., annually) using the collision severity score (equivalent property damage only), critical collision rates, or similar safety performance measure consistent with the AASHTO *Highway Safety Manual*. Projects associated with location-specific safety projects focus on reducing historic collision severity or frequency and may include projects such as:

- Pedestrian and bicycle facilities or crossings
- Road diets
- Intersection control changes or realignments
- Roadway shoulder widening or roadway realignments

In addition to the priority locations identified through the LRSP's data-driven process, the County may identify additional locations for safety improvements based on data or feedback received from the public or partners,

or may be identified through other planning or project development processes. The process and methods used to develop the Location-Specific Safety Projects documented in the LRSP is documented in **Appendix A**.

Strategies may also focus on certain locations near schools, where unsafe speeding regularly occurs, or other specific road characteristics that are therefore prioritized. A complete collision database will be provided to the County as part of the LRSP. This will allow the County to review additional details of collisions at specific locations, search for certain factors among the collision data, or apply an alternative approach for prioritizing locations as needed.

Systemic Safety Treatments

The systemic safety approach to roadway safety involves selecting locations for countermeasures based on roadway characteristics that may be correlated with severe collision types rather than identify locations based on collision history. Identified sites may or may not have a history of frequent or severe collisions but will have roadway characteristics associated with collision risk factors. By selecting locations based on roadway characteristics instead of collision history, systemic treatments may help to proactively reduce the risk of fatal and serious injury collisions.

The County intends to deploy systemic countermeasures to address the following:

- Unsignalized Intersections
- Bicycle and Pedestrian Infrastructure
- Speed Management
- Roadway Departures
- Other Opportunities

These first four areas were identified through the data-driven analysis documented in the Summary of Countywide Safety Performance and Emphasis Areas sections of the LRSP. The final grouping recognizes that other opportunities may arise to implement low-cost countermeasures that may not directly address one of the other three emphasis areas (e.g., low-cost improvements from RSAs). The following describes the process for developing systemic safety improvement projects.

SYSTEMIC SAFETY IMPROVEMENT PROJECT DEVELOPMENT AND PRIORITIZATION PROCESS

Step 1: Identify Criteria – Use geometric, traffic, and collision data to determine factors correlated with priority collision types and assign a point scale for each criterion. For example, for roadway departure collisions, characteristics such as two lanes, rural areas, narrow shoulders (< 4 feet), and speeds of 45 miles-per-hour (MPH) or greater could be used for screening criteria. Functional classification, traffic volumes, and sign inventories can also be analyzed to inform site selection/prioritization.

Step 2: Prioritize Locations – Select up to five criteria from Step 1 to identify and prioritize locations for treatment by evaluating the road network against each criterion and ranking sites based on their scores.

Step 3: Review Locations – Review a predetermined number of locations from Step 2 (e.g., the top 20 locations) to form potential projects on corridors. Where potential locations overlap with existing or upcoming capital improvement projects, review whether the planned project may address the priority collision types and how additional countermeasures may be incorporated. Work with project development staff to identify whether safety-focused funds could be used to raise the priority of the previously planned project. Where no project is planned, corridors and identified strategies should be prioritized based on expected cost (“high” vs. “low”)

Step 4: Prioritize Corridors – Prioritize corridors with low-cost treatments (high-cost treatments may be deferred or prioritized in the Location-Specific Projects) for implementation based on prioritization criteria and estimated cost (if available).

Step 5: Implement – Program the countermeasures determined in Step 4 for funding and design and construct them. In some cases, projects may be implemented as part of routine maintenance projects.

Step 6: Evaluate – After the countermeasure is implemented, monitor results to determine whether implementation has improved safety outcomes.

Non-Infrastructure Programs

Non-infrastructure programs such as educational activities, trainings, or enforcement activities can take a variety of forms and may require additional partners to implement. Non-infrastructure projects and programs should be prioritized based on the LRSP’s emphasis areas, Action Items, the frequency and/or severity of collisions associated with the collision type or road user behavior addressed, and the availability of funding to implement the program or strategy.

PERFORMANCE MEASURES AND PLAN EVALUATION

A series of performance measures have been identified to help evaluate and understand the changes that implementing the LRSP actions and priority projects over time has on roadway safety performance in San Joaquin County. These performance measures will help the County judge the success of the LRSP and identify evaluation steps for future updates of the plan. The success of the plan will ultimately be judged on its results in improving roadway safety and reducing fatal and serious injury collisions. The plan will also only be successful through the development of cross-agency and organization partnerships and data sharing. Additional performance measures may be identified by the County and its partners over time to evaluate and implement the LRSP more effectively.

Outcome Measures

Measures the County can use to evaluate the ongoing success of the plan toward achieving its goals include:

- Total and per capita County fatal and serious injury collisions
- County total and per capita fatal and serious injury collisions by emphasis areas

Implementation Measures

Measures the County can use to evaluate progress in implementing the plan include:

- Number of Action Items implemented
- Number of Action Items continued from prior year
- Number of sites with implemented safety improvement projects by type (capital, systemic, quick-build, other)
- Number of safety evaluations conducted at priority or potential systemic safety locations
- Number of new or innovative safety countermeasures or strategies piloted
- Total grant funding received for safety improvement projects
- Annual expenditures on safety improvement projects
- Number of safety educational activities hosted, sponsored, or supported by the County
- Frequency of communication with safety partners
- Number of changes to guidance, policies, practices, or standards to support the Safe System
- Summary of safety-related feedback received (quantity, type, location)
- Completion of annual safety report and safety analysis update

Plan Updates and Evaluation

This plan expands on the 2018 SSAR to bring the County's safety plan in line with the Safe System Approach, and federal and state safety guidance. Updates to the LRSP should be every three to five years. County staff will create and implement a process to report on the performance measures listed above annually. As collision and other data are available, the County can evaluate the plan's progress (i.e., about 5-7 years) and effectiveness. The County and its partners should take a holistic look at current data trends and technologies, and implementation progress to determine whether the plan should be updated and to what extent (e.g., to incorporate innovative technologies or practices, to modify action items based on what is and is not working, to address emerging collision trends).

Evaluation should be included as part of each activity so that actions, projects, and partnerships can be modified as needed. The ability to adjust the plan will better help build a road to success and, ultimately, help the County achieve its long-term goal of eliminating preventable fatal and serious injury collisions by 2050.

FUNDING



FUNDING

Funding for regional and local transportation projects, policies, and programs is available from various federal and state sources. The County may also choose to identify or develop regional programs that could be used by local agencies to enhance roadway safety. As funding changes over time, the information provided in this LRSP should be updated.

FEDERAL PROGRAMS

USDOT: Infrastructure Investments and Jobs Act (2022-2026)

Managing Agency: USDOT

This program provides funding for several types of projects, including significant funding for active transportation projects and programs. This program increases opportunities for funding Safe Routes to School (SR2S) funds through the transportation alternatives program. The latest federal funding program will provide funds from 2022-2026. New programs under the law focus on rehabilitating bridges in critical need of repair, reducing carbon emissions, increasing system resilience, removing barriers to connecting communities, and improving mobility and access to economic opportunity. Many of the new programs include eligibility for local governments, Metropolitan Planning Organizations (MPOs), Tribes, and other public authorities.

One program, the Safe Streets for All (SS4A) Grant Program, has appropriated \$5 billion over the next five years, with up to \$1 billion available in fiscal year 2022. Funding is available for the following activities:

- Comprehensive safety action plans
- Planning, design, and development activities in support of an Action Plan (like this LRSP)
- Projects and strategies identified in an Action Plan (like this LRSP)

Website: <https://transportation.house.gov/committee-activity/issue/infrastructure-investment-and-jobs-act>

SS4A Website: <https://www.transportation.gov/grants/SS4A>

Congestion Management and Air Quality (CMAQ)

Managing Agency: Federal Highway Administration

The Congestion Mitigation and Air Quality Improvement (CMAQ) program is a flexible funding source for state and local governments to fund transportation projects and programs to help meet the requirements of the Clean Air Act (CAA) and its amendments. CMAQ money supports transportation projects that reduce mobile source emissions in areas designated by the U.S. Environmental Protection Agency (EPA) to be in nonattainment or maintenance of the national ambient air quality standards. See MTC's One Bay Area Grant (OBAG) program for how CMAQ funding is distributed within the nine-county Bay Area. OBAG disburses federal funds in accordance with MTC's regional transportation priorities and associated land-use and housing goals.

Website: https://www.fhwa.dot.gov/environment/air_quality/cmaq/

Surface Transportation Block Grant Program (STBG)

Managing Agency: Federal Highway Administration

The Fixing America's Surface Transportation (FAST) Act converts the long-standing Surface Transportation Program (STP) into the Surface Transportation Block Grant Program (STBG) acknowledging that this program has the most flexible eligibilities among all federal-aid highway programs and aligning the program's name with how the Federal Highway Administration (FHWA) has historically administered it. The STBG promotes flexibility in State and local transportation decisions and provides flexible funding to best address State and local transportation needs. STBG funding may be used for projects to preserve and improve the conditions and performance on any Federal-aid highway, bridge and tunnel projects on qualifying public roads, pedestrian and bicycle infrastructure, and transit capital projects, including intercity bus terminals. OBAG disburses federal funds in accordance with MTC's regional transportation priorities and associated land-use and housing goals.

Website: <https://www.fhwa.dot.gov/specialfunding/stp/>

Better Utilizing Investments to Leverage Development (BUILD) Grant

Managing Agency: United States Department of Transportation (USDOT)

The Better Utilizing Investments to Leverage Development (BUILD) Transportation Discretionary Grant program provides a unique opportunity for USDOT to invest in road, rail, transit, and port projects that promise to achieve national objectives. Previously known as Transportation Investment Generating Economic Recovery (TIGER) Discretionary Grants, Congress has dedicated nearly \$5.6 billion for nine rounds of national infrastructure investments to fund projects that have a significant local or regional impact. The eligibility requirements of BUILD allow project sponsors at the state and local levels to obtain funding for multimodal, multijurisdictional projects that are more difficult to support through traditional department of transportation programs. BUILD can fund port and freight rail projects, for example, which play a critical role in the ability to move freight but have limited sources of federal funds.

Website: <https://www.transportation.gov/BUILDgrants>

Infrastructure for Rebuilding America (INFRA) Grant

Managing Agency: USDOT

The INFRA Grants program funds transportation projects with a focus on rebuilding existing infrastructure. To be eligible, projects must be on the National Highway System, a railway/highway grade separation project, or a freight project that is rail or intermodal, or improves freight movement within an intermodal facility. Most governmental bodies are eligible applicants (e.g., unit of local government, port authority, groups of jurisdictions). Minimum awards for large projects are \$25 million and \$5 million for small projects.

Website: <https://www.transportation.gov/buildamerica/infragrants>

Community Change Grants

Managing Agency: America Walks

This program supports the growing network of advocates, organizations, and agencies working to advance walkability. Grants are awarded to innovative, engaging, and inclusive programs and projects that create change and opportunity for walking and movement at the community level. Applications for grants open in the fall and are awarded for the full calendar year.

Website: <https://americawalks.org/programs/community-change-grants-2021/>

Community Development Block Grant Program

Managing Agency: United States Department of Housing and Urban Development

This program provides annual grants to cities and counties to develop viable urban communities by providing decent housing and a suitable living environment, and by expanding economic opportunities, principally for low- and moderate-income persons. Grant applications open about every two years. Eligible transportation improvements include installing sidewalks, curb and gutter, as well as maintenance activities (e.g., repairing streets and sidewalks) serving low- and moderate-income persons.

Website: https://www.hud.gov/program_offices/comm_planning/cdbg

STATE PROGRAMS

Senate Bill 1

Managing Agency: Caltrans

Senate Bill 1 (SB 1) was passed in 2017 as a long-term transportation reform and funding package. The bill includes new revenues that address a wide variety of transportation projects, such as road safety improvements, street repair, transit, and roadway and bridge construction. SB 1 provides \$5.2 billion per year to fund transportation projects throughout California. The programs listed below are funded through SB 1.

Website: <http://rebuildingca.ca.gov/>

Highway Safety Improvement Program (HSIP) Grant

Managing Agency: Caltrans

The Highway Safety Improvement Program (HSIP) is one of the core federal-aid programs in the federal surface transportation act, Fixing America's Surface Transportation Act (FAST). The purpose of the HSIP program is to achieve a significant reduction in traffic fatalities and serious injuries on all public roads, including non-State-owned public roads and roads on tribal land. Example safety projects include but are not limited to crosswalk markings, rapid flashing beacons, curb extensions, speed feedback signs, guard rails, pedestrian refuge islands, slurry seal, and other pavement markings.

Website: <http://dot.ca.gov/hq/LocalPrograms/hsip.html>

Office of Traffic Safety (OTS) Grants

Managing Agency: Office of Traffic Safety

The California Office of Traffic Safety (OTS) strives to eliminate traffic deaths and injuries. It does this by making grants available to local and state public agencies for programs that help them enforce traffic laws, educate the public in traffic safety, and provide varied and effective means of reducing fatalities, injuries, and economic losses from collisions.

Website: <https://www.ots.ca.gov/>

Active Transportation Program (ATP) Grants

Managing Agency: California Transportation Commission (CTC)

The Active Transportation Program (ATP) consolidates existing federal and State transportation programs, including the Transportation Alternatives Program (TAP), Bicycle Transportation Account (BTA), and State Safe Routes to School (SR2S), into a single discretionary grant program with a focus to make California a national leader in active transportation. The purpose of the ATP is to encourage increased use of active transportation modes by increasing the proportion of trips made by bicycle or on foot and increasing non-motorized user safety; reduce greenhouse gases; enhance public health; and ensure that disadvantaged communities fully share in the benefits of the program.

Website: <http://www.dot.ca.gov/hq/LocalPrograms/atp/>

State-Local Partnership Program (LPP)

Managing Agency: CTC

The Road Repair and Accountability Act of 2017 (Senate Bill 1) created the Local Partnership Program (LPP), which is modeled closely on the Proposition 1B State Local Partnership Program. The purpose of the Senate Bill 1 LPP program is to provide local and regional transportation agencies that have passed sales tax measures, developer fees, or other imposed transportation fees with a continuous appropriation of \$200 million annually from the Road Maintenance and Rehabilitation Account to fund road maintenance and rehabilitation, sound walls, and other transportation improvement projects. Consistent with the intent behind Senate Bill 1, the CTC intends this program to balance the need to direct increased revenue to the State's highest transportation needs while fairly distributing the economic impact of increased funding. LPP provides funding to local and regional agencies to improve aging infrastructure, road conditions, active transportation, and health and safety benefits.

Website: <http://www.catc.ca.gov/programs/sb1/lpp/>

Sustainable Communities Grants

Managing Agency: Caltrans

The Sustainable Transportation Planning Grant Program was created to support the Caltrans mission: provide a safe, sustainable, integrated, and efficient transportation system to enhance California's economy and livability. Eligible planning projects must have a transportation nexus ideally demonstrating that planning projects directly benefit the multimodal transportation system. Sustainable Communities Grants will also improve public health, social equity, environmental justice, the environment, and provide other important community benefits.

Website: <http://www.dot.ca.gov/hq/tpp/offices/orip/Grants/grants.html>

Adaptation Planning Grants

Managing Agency: Caltrans

Climate change adaptation aims to anticipate and prepare for impacts to reduce the damage from extreme weather events. Adaptation is distinct from, but complements, climate change mitigation, which aims to reduce greenhouse gas (GHG) emissions. This funding is intended to advance adaptation planning on California's transportation infrastructure, including but not limited to roads, railways, bikeways, trails, bridges, ports, and airports. Adaptation efforts will enhance the transportation system's resiliency to help protect against climate impacts. The overarching goal of this grant program is to support planning actions at local and regional levels that advance climate change adaptation efforts on the transportation system, especially efforts that serve the communities most vulnerable to climate change impacts. Adaptation Planning Grants are funded through California Senate Bill (SB) 1 under the Public Transportation Account (PTA).

Website: <http://www.dot.ca.gov/hq/tpp/grants.html>

State Highway Operation and Protection Program (SHOPP)

Managing Agency: Caltrans

The State Highway Operation and Protection Program (SHOPP) is the State Highway System's (SHS) "fix-it-first" program. It funds repair and preservation, emergency repairs, safety improvements, and some highway operational improvements on the SHS. Although SHOPP is intended for projects on statutorily designated State-owned roads, highways (including the interstate system) and bridges, it can be used for associated bicycle and pedestrian facilities. Revenues for the SHOPP are generated by federal and State gas taxes and are fiscally constrained by the State Transportation Improvement Program Fund Estimate that is produced by Caltrans and adopted by the California Transportation Commission.

Website: <http://www.dot.ca.gov/hq/transprog/shopp.htm>

State Transportation Improvement Program (STIP)

Managing Agency: CTC

The State Transportation Improvement Program (STIP) is a biennial five-year plan adopted by the CTC for future allocations of certain state transportation funds for state highway improvements, intercity rail, and regional highway and transit improvements. State law requires the CTC to update the STIP biennially, in even-numbered years, with each new STIP adding two new years to prior programming commitments. CTC staff recommendations are based on the combined programming capacity for the Public Transportation Account (PTA) and State Highway Account (SHA) as identified in the fund estimate adopted by the CTC. Projects must first be nominated by the Metropolitan Transportation Commission in its Regional Transportation Improvement Program (RTIP), or by Caltrans in its Interregional Transportation Improvement Program (ITIP) to be included in the STIP that is adopted by the CTC.

Website: <http://www.catc.ca.gov/programs/stip/>

Affordable Housing and Sustainable Communities (AHSC) Program

Managing Agency: California Strategic Growth Council

The purpose of the AHSC Program is to reduce GHG emissions through projects that implement land-use, housing, transportation, and agricultural land preservation practices to support infill and compact development, and that support related and coordinated public policy objectives. The AHSC program includes transportation focuses related to reducing air pollution, improving conditions in disadvantaged communities, supporting or improving public health, improving connectivity and access to jobs, increasing options for mobility, and increasing transit ridership. Funding for the AHSC Program is provided from the Greenhouse Gas Reduction Fund (GGRF), an account established to receive cap-and-trade auction proceeds.

Website: <http://www.sgc.ca.gov/programs/ahsc/>

Transformative Climate Communities (TCC) Program

Managing Agency: California Strategic Growth Council

The Transformative Climate Communities Program was established by Assembly Bill (AB) 2722 to fund development and implementation of neighborhood-level transformative climate community plans that include GHG emissions reduction projects that provide local economic, environmental, and health benefits to disadvantaged communities. The TCC Program is also an opportunity to realize the State's vision of Vibrant Communities and Landscapes, demonstrating how meaningful community engagement coupled with strategic investments in transportation, housing, food, energy, natural resources, and waste can reduce GHG emissions and other pollution, while also advancing social and health equity and enhancing economic opportunity and community resilience. The TCC Program funds both implementation and planning grants. Transportation-related projects funded by the TCC Program can include, but are not limited to: developing active transportation and public transit projects; support transit ridership programs and transit passes for low-income riders; expanding first/last mile connections; building safe and accessible biking and walking routes; and encouraging education and planning activities to promote increased use of active transportation modes.

Website: <http://www.sgc.ca.gov/programs/tcc/>

Urban Greening Grant Program

Managing Agency: California Natural Resources Agency

As part of the California State Senate Bill (SB) 859, the California Natural Resources Agency's Urban Greening Program was created and is funded by the Greenhouse Gas Reduction Fund (GGRF) to support the development of green infrastructure projects that reduce GHG emissions and provide multiple benefits. Projects should be focused in disadvantaged communities to maximize economic, environmental, and public benefits. The Urban Greening Program will fund projects that reduce greenhouse gases by sequestering carbon, decreasing energy consumption, and reducing vehicle miles traveled, while also transforming the built environment into places that are more sustainable, enjoyable, and effective in creating healthy and vibrant communities. These projects will establish and enhance parks and open space, using natural solutions to improve air and water quality and reducing energy consumption, and creating more walkable and bikeable trails.

Website: <http://resources.ca.gov/grants/urban-greening/>

Environmental Justice (EJ) Small Grants Program

Managing Agency: California Environmental Protection Agency

The Environmental Justice (EJ) Small Grants Program offers funding opportunities to assist eligible non-profit community organizations and federally recognized tribal governments to address environmental justice issues in areas disproportionately affected by environmental pollution and hazards. The EJ Small Grants are awarded on a competitive basis with a maximum amount \$50,000 per grant. EJ Small Grants can be used for a variety of environmental purposes but can also be used to augment community engagement, health, trainings, and programmatic opportunities in underserved communities.

Website: https://calepa.ca.gov/EnvJustice/Funding/?mc_cid=b68bc95390&mc_eid=b4c201d657