



# YUBA COUNTY LOCAL ROADWAY SAFETY PLAN

Prepared for:  
**Yuba County**  
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# EXECUTIVE SUMMARY

Yuba County Local Roadway Safety Plan (LRSP) is a comprehensive plan that creates a framework to systematically identify and analyze traffic safety-related issues, and recommend projects and countermeasures. It aims to reduce collisions through a prioritized list of improvements that can enhance safety on local roadways.

Yuba County LRSP takes a proactive approach to addressing safety needs. It is viewed as a guidance document that can be a source of information and ideas. It is also a living document, one that is routinely reviewed and updated by County staff and their safety partners to reflect evolving collision trends, community needs, and priorities. With the LRSP as a guide, the County will be able to apply for grant funds, such as the Federal Highway Administration's (FHWA) Highway Safety Improvement Program (HSIP) and Safe Street for All (SS4A), etc. This document summarizes the analysis of collisions that occurred in Yuba County, identifies a high-injury network, and recommends countermeasures at these high-risk locations.

The development of Yuba County's LRSP seeks to create a safe, connected, and efficient Countywide active transportation network that also provides safe access to schools. It includes descriptions of policies, infrastructure projects, and supporting programs while identifying funding sources and implementation strategies for projects that enhance bicycling and walking in Yuba.

This LRSP is funded through a grant provided by the California Department of Transportation (Caltrans). This plan was initiated by Caltrans to help local agencies take a more proactive approach to identifying safety improvement projects by completing a system-wide, multi-year data-driven analysis of collisions. This plan intends to assist local agencies in performing a collision analysis, identifying safety issues on their roadway networks, and developing a list of systemic low-cost countermeasures that can be used to prepare future HSIP and other safety program grants.



## GOALS OF THE LRSP

- Goal 1: Identify and analyze road safety issues from a systemic perspective and recommend improvements.
- Goal 2: Improve pedestrian and bicyclist safety through the application of proven effective countermeasures.
- Goal 3: Coordinate the actions of key stakeholders to implement road safety improvements and emergency response in Yuba County.
- Goal 4: Continually seek funding for safety improvements.
- Goal 5: Ensure that all safety improvements are made fairly and equitably for all residents of Yuba County.

## PROCESS

The systemic approach in preparing the LRSP involves the following steps:

- Develop plan goals and objectives
- Analyze collision data
- Engage stakeholders and safety partners
- Determine focus areas and identify crash-reduction strategies
- Prioritize countermeasures and safety projects
- Prepare the LRSP

## COLLISION DATA

Collision data was obtained for 10 years from 2010 to 2020 from the Transportation Injury Mapping System (TIMS) and Statewide Integrated Traffic Records System (SWITRS). Factors such as collision severity, type of collision, primary collision factor, lighting, weather, and time were analyzed. Following this, a detailed analysis was conducted for killed and severe injury (KSI) collisions that have occurred on the County's roadways, including analyzing intersection and roadway segment collisions separately.

## COLLISION TRENDS

Key findings on patterns and trends:

- A total of 2,038 injury collisions occurred between 2010 and 2020.
- 68 collisions resulted in a fatality, 285 collisions resulted in severe injuries, 701 resulted in a visible injury, and 984 resulted in a complaint of pain injury.
- The highest number of injury collisions (620 collisions) were observed in 2017, and the lowest number of injury collisions (238 collisions) were observed in 2020.
- The highest number of injury collisions occurred within 250 feet of an intersection (56%).
- Hit Object and broadside collisions accounted for 36% and 18% of total injury collisions, respectively. 31% of hit object collisions resulted in KSI collisions.
- Improper turning accounted for 30% of all injury collisions, followed by unsafe speed (22%) and automobile right-of-way violation (12%).
- Most of the KSI collisions occurred between 4:00 p.m. to 5:00 p.m. (8.2%).



- 43% of injury collisions were motor vehicles involved with other motor vehicles followed by motor vehicles involved with a fixed object (33%), motor vehicle involved with a non-collision (7%), and parked motor vehicles (5%).
- There were a total of 259 bicycle and pedestrian injury collisions within the study period, of which 136 were pedestrian and 123 were bicycle collisions.

### HIGH-RISK LOCATIONS

The collision rate analysis was performed on all County roads. The high-risk locations were ranked to show the top 10 high-collision intersections and top 10 high-collision roadway segments.

Key findings of identifying high-risk intersections are as follows:

- There were a total of 224 injury collisions that occurred at the intersection.
- A total of 21 collisions led to KSI.
- The intersection of North Beale Road & Feather River Boulevard and North Beale Road at Park Avenue had the highest number of injury collisions, whereas the intersection of North Beale Road & Feather River Boulevard and Powerline Road & Eighth Avenue had the highest number of KSI collisions.

Key findings of identifying high-risk roadway segments are as follows:

- There were a total of 704 injury collisions that occurred on roadway segments.
- A total of 78 collisions led to KSI.
- Marysville Road/Willow Glen Road and North Beale Road/Lindhurst Avenue corridors have the highest number of injury collisions.

### EMPHASIS AREAS

Emphasis areas are focus areas for the LRSP identified through a comprehensive collision analysis of the identified high-injury locations within Yuba County. The seven emphasis areas identified for Yuba County:

- Address hit object collisions
- Improve rear end collisions & unsafe speed
- Mitigate broadside collisions & automobile right-of-way violations
- Reduce nighttime collisions:
  - Collisions occurring in low or no natural lighting conditions
- Address improper turning collisions
- Address DUI collisions
- Reduce overturned collisions

## VIABLE SAFETY PROJECTS

A set of nine safety projects were created for the high-risk intersections and roadway segments.

- **Project 1:** Improve safety on roadway segment: Various locations throughout the County: Install/Upgrade signs with new fluorescent sheeting (regulatory or warning)
- **Project 2:** Improve pedestrian safety at signalized intersections: Improve signal timing: lenses, back- plates with retroreflective borders, mounting, size and number, Install pedestrian countdown signal heads, Modify signal phasing to implement a Leading Pedestrian Interval (LPI)
- **Project 3:** Improve safety at Signalized Intersection: Improve signal timing (coordination, phases, red, yellow or operation), Install raised pavement markers and striping (Through Intersection)
- **Project 4:** Improve safety at Non-Signalized Intersections: Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs, Upgrade intersection pavement markings (NS.I.), Install flashing beacons as advance warning (N.S.I)
- **Project 5:** Improve safety at Non-Signalized Intersections: Install Rectangular Rapid Flashing Beacon (RRFB)
- **Project 6:** Countywide Street Light Inventory: Add intersection lighting (signalized intersection), Add intersection lighting (non-signalized intersection), Add segment lighting (roadway segments)
- **Project 7:** Countywide Rumble Striping: Install edge-line rumble strips/stripes
- **Project 8:** Countywide Installation of Guardrail: Install Guardrail
- **Project 9:** Improve safety on Corridors: Install curve advance warning signs (flashing beacon), Install dynamic/variable speed warning signs, Install delineators, reflectors and/or object markers



## REPORT ORGANIZATION

**Chapter 1** summarizes the project background and study area for the LRSP.

**Chapter 2** summarizes the involvement of safety partners, which is critical to the success of the LRSP. For Yuba County, this included the County Sheriff's Office, County Administration, Community Development, Yuba County Fire Safety Council, Yuba County Office of Education, first responders, schools, residents, and local advocacy groups.

**Chapter 3** summarizes County and regional planning documents and projects relevant to the LRSP. It ensures that the recommendations of the LRSP are in line with existing goals, objectives, policies, and projects.

**Chapter 4** summarizes the data analysis approach and presents preliminary and detailed collision analysis and findings in the study area. This analysis of KSI collisions is performed by facility type (intersection and roadway segment). Collision data was obtained and analyzed for five years from 2010-2020 from the Transportation Injury Mapping System (TIMS) and Statewide Integrated Traffic Records System (SWITRS). This period was chosen because 2021 data were preliminary at the time of the analysis. It should be noted that in many situations where older collisions occur, the safety measures are implemented post-collision, which may result in eliminating or reducing future collisions. For post-2020 collisions, future reviews and updates of the LRSP will capture those collisions.

**Chapter 5** outlines the key emphasis areas that the LRSP focuses on. They are identified through three broad methodologies: analysis of data that identifies where various collisions have occurred within Yuba County, analysis of actual or potential collision locations relative to context, and evaluation of social and behavioral factors that are attributable to an increased risk of collisions.

**Chapter 6** summarizes engineering countermeasures that were selected for each of the high-risk locations and the emphasis areas. These were based on approved countermeasures from the Caltrans Local Roadway Safety Manual (LRSM) used in HSIP-grant calls for projects. The intention is to provide Yuba County with potential countermeasures for each location that can be implemented either in future HSIP calls for projects or using other funding sources, such as the Capital Improvement Program (CIP). Non-engineering countermeasures were also selected and are included in the emphasis areas.

In **Chapter 7**, a set of nine safety projects was created for high-risk intersections and roadway segments, using HSIP-approved countermeasures. Through the collision analysis process, locations were identified as projects of interest including three signalized intersections, seven non-signalized intersections, and 10 roadway segments. These locations were selected by taking into account community feedback on areas of concern in collaboration with County staff and were chosen to represent different situations or conditions that can be observed on the roadways throughout the County. To aid in the preparation of HSIP grant applications, each project is accompanied by a cost estimate and benefit-cost ratio (BCR). This chapter also includes additional funding sources that can

be used to finance safety projects around the County. The funding list includes regional, state, and federal funding programs, along with a description of the program's purpose.

**Chapter 8** summarizes evaluation and implementation strategies. The LRSP is a guidance document that is recommended to be updated every two to five years in coordination with the safety partners. The LRSP document provides engineering, education, enforcement, and emergency medical service-related countermeasures that can be implemented throughout the County to reduce traffic collisions. After implementing countermeasures, the performance measures for each emphasis area should be evaluated annually. The most important measure of success of the LRSP should be reducing collisions throughout the County. If the number of injury collisions does not decrease over time, then the emphasis areas and countermeasures should be re-evaluated.

In addition to the quantitative and geographic data analyzed as part of this project, outreach to stakeholders and the public was performed to collect and understand local safety issues from a qualitative perspective.

## ACKNOWLEDGEMENTS

The County of Yuba developed a plan to evaluate transportation safety for motorists, bicyclists, and pedestrians within the County. The input was sought from several groups consisting of the County Sheriff's Office, County Administration, Community Development, Yuba County Fire Safe Council, Yuba County Office of Education, first responders, schools, residents, and local advocacy groups. Community engagement and stakeholder outreach were held, and opportunities were provided to provide online feedback and solicit input from the community. Stakeholders and representatives also provided feedback through this process. A consulting team led by TJKM Transportation Consultants assisted County staff in preparing the plan.

**Note:** Throughout this plan, reference to the "County" refers to the Yuba County government.

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## GLOSSARY

**4 E's** – Abbreviation for Engineering, Education, Enforcement, Emergency Medical Services: A traffic engineering approach for improving safety on the roadways.

**ACS** – Abbreviation for American Community Survey: A U.S. Census survey that helps local officials, community leaders, and businesses understand the changes taking place in their communities.

**ADT** – Abbreviation for average daily traffic: Refers to vehicle traffic volumes.

**BCR** – Abbreviation for benefit-cost ratio: Indicator used to quantify project benefits in relation to project costs.

**LRSP** – Abbreviation for Local Road Safety Plan. A document that provides a framework for identifying, analyzing, and prioritizing roadway safety improvements on local roads.

**CRF**—Abbreviation for crash reduction factor: The percentage of the expected effect of a countermeasure or safety project on decreasing collisions.

**Collision Severity** – Defined as the intensity of collisions typically in the following categories: killed and severe injury (KSI), other visible injury and complaint of pain (other), and property damage only (PDO).

**EMS** – Abbreviation for emergency medical services.

**EPDO** – Abbreviation for equivalent property damage only.

**FHWA** – Abbreviation for Federal Highway Administration: The federal agency responsible for managing the nation's highway system, including bridges and tunnels.

**HSIP** – Abbreviation for Highway Safety Improvement Program: A roadway safety funding program managed by Caltrans, California State Department of Transportation.

**KSI** – Abbreviation for killed and severe injury collisions.

**LRSM** – Abbreviation for Local Roadway Safety Manual: A Manual for California's Local Road Owners.

**Primary Violation Factor/Primary Collision Factor** – Defined as contributing causes of collisions.

**SWITRS** - Abbreviation for Statewide Integrated Traffic Records System: A database managed by California Highway Patrol that collects and processes data gathered from collision scenes.

**TIMS** - Abbreviation for Transportation Injury Mapping System: A collision database managed by the UC Berkeley SafeTREC system.

**RRFB** - Abbreviation for Rectangular Rapid Flashing Beacon.

# Table of Contents

Executive Summary	1
Report Organization	5
Acknowledgements	7
Glossary	8
1. Project Background	14
What is an LRSP?	14
Study Area	14
2. Safety Projects	17
Safety Goals	19
3. Existing Planning Efforts	19
4. Collision Data and Analysis	24
Data Collection	24
Collision Classification	26
Killed and Severe Injury (KSI) Collisions	33
Geographic Collision Analysis	38
Pedestrian and Bicycle Collisions	42
Collision Severity Weight	45
High Injury Network	47
Intersection Ranking	49
Corridor Ranking	50
5. Emphasis Areas	51
The Four E's of Traffic Safety	51
Factors Considered in the Determination of Emphasis Areas	52
Emphasis Area 1 – Address Hit Object Type Collisions	53
Emphasis Area 2 – Address Rear End Collisions and Unsafe Speed	54
Emphasis Area 3 – Address Broadside Collisions and Automobile Right of Way Violations	55
Emphasis Area 4 – Address Nighttime Collisions	56
Emphasis Area 5 – Address Improper Turning Collision	57

Emphasis Area 6 – Address Driving Under Influence (DUI) Collisions	58
Emphasis Area 7 – Reduce Overtruning of Collisions	59
6. Countermeasure Selection	60
Identification of Countermeasures	60
Countermeasure Toolbox	61
What You’ll See in this Toolbox	61
A. Countermeasures for Signalized Intersections	62
B. Countermeasures for non- Signalized Intersections	63
C. Countermeasures for Roadways	65
Countermeasures ToolBox Criteria	67
7. Viable Safety Projects	68
List of Safety Projects	69
A. HSIP Approved Safety Proejcts	70
B. Safety Projects – Signalized Intersections	71
C. Safety Projects – Non-Signalized Intersections	72
D. Safety Projects – Countywide Projects	73
E. Safety Projects – Corridors	74
HSIP Grant Program	76
8. Implementation and Evaluation	77
Implementation	77
Monitoring and Evaluation	80
LRSP Update	80



# Figures

Figure 1 Study Area: Yuba County	15
Figure 2 Yuba County Local Roadway Safety Plan: Project Website	17
Figure 3 Interactive Map Comment Responses	18
Figure 4 Public Comments on Traffic Safety by Location	18
Figure 5 Countywide Collision Locations	25
Figure 6 Collisions by Severity (2010 -2020)	26
Figure 7 Ten-Year Collision Trend	27
Figure 8 Intersection vs Roadway Collisions - All Injury Collisions	28
Figure 9 Countywide Collision Type	29
Figure 10 Countywide Collision Causes	30
Figure 11 Motor Vehicle Involved with	31
Figure 12 Modes for All Injury Collisions vs. KSI Collisions	31
Figure 13 Lighting Conditions	32
Figure 14 Time of Day	32
Figure 15 Countywide Collisions Outcome	33
Figure 16 Countywide KSI Collisions Outcome	33
Figure 17 Countywide Killed and Severe Injury Collisions	34
Figure 18 KSI Collisions: Collision Type	35
Figure 19 KSI Collisions: Violation Category Type	35
Figure 20 KSI Collisions: Motor Vehicle Involved With	36
Figure 21 KSI Collisions: Lighting	36
Figure 22 KSI Collisions: Time of Day	37
Figure 23 KSI Collisions: Collisions by Gender and Age	37

Figure 24 Countywide Nighttime Collisions	39
Figure 25 Countywide Hit Object Collisions	40
Figure 26 Countywide Improper Turning Violations	41
Figure 27 Pedestrian and Bicycle Collisions	42
Figure 28 Pedestrian and Bicycle Collisions: Collision Type	43
Figure 29 Pedestrian and Bicycle Collisions: Violation Category Type	43
Figure 30 KSI Collisions: Motor Vehicle Involved With	44
Figure 31 KSI Collisions: Lighting	44
Figure 32 Countywide Equivalent Property Damage Only	46
Figure 33 Countywide High Injury Network (HIN)	48

## Tables

Table 1 Yuba County Commute to Work Data	16
Table 2 Overview of Plans and Policies	21
Table 3 Collisions by Severity	27
Table 4 EPDO Score used in HSIP Cycle 12	45
Table 5 High Collision Intersections	49
Table 6 High Injury Corridors	50
Table 7 Emphasis Area 1 Strategies	53
Table 8 Emphasis Area 2 Strategies	54
Table 9 Emphasis Area 3 Strategies	55
Table 10 Emphasis Area 4 Strategies	56
Table 11 Emphasis Area 5 Strategies	57



Table 12 Emphasis Area 6 Strategies	58
Table 13 Emphasis Area 7 Strategies	59
Table 14 List of Viable Safety Projects for Corridors	70
Table 15 List of Viable Safety Projects for Signalized Intersections	70
Table 16 List of Viable Safety Projects for Signalized Intersections	71
Table 17 List of Viable Safety Projects for Non-Signalized Intersections	72
Table 18 List of Viable Countywide Safety Projects	73
Table 19 List of Viable Corridor Safety Projects	74
Table 20 List of Countermeasures	75
Table 21 Summary of Application Categories for HSIP Cycle 12	76
Table 22 List of Potential Funding Sources	78

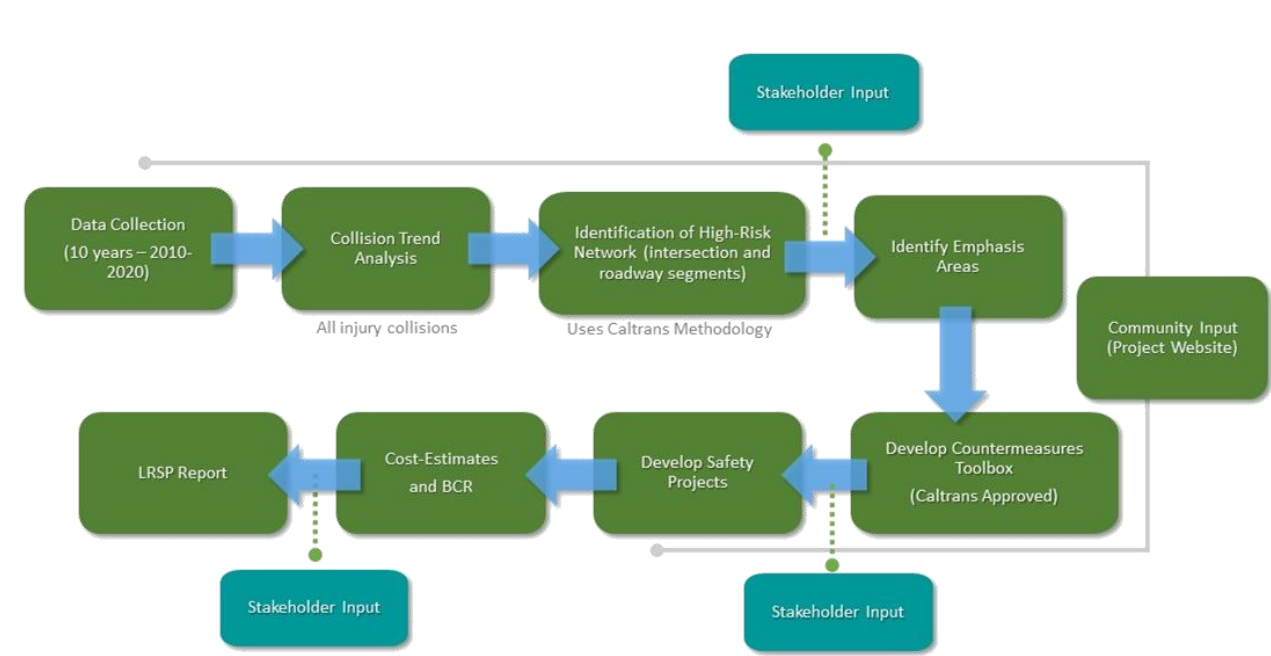
## Appendix

- A:** Public Comments with Map Input Data
- B:** Summary of Planning Documents
- C:** Consolidated High Injury Collision Database
- D:** Countermeasure Toolbox
- E:** LRSM Excerpt
- F:** HSIP Analyzers

# 1 PROJECT BACKGROUND

## WHAT IS AN LRSP?

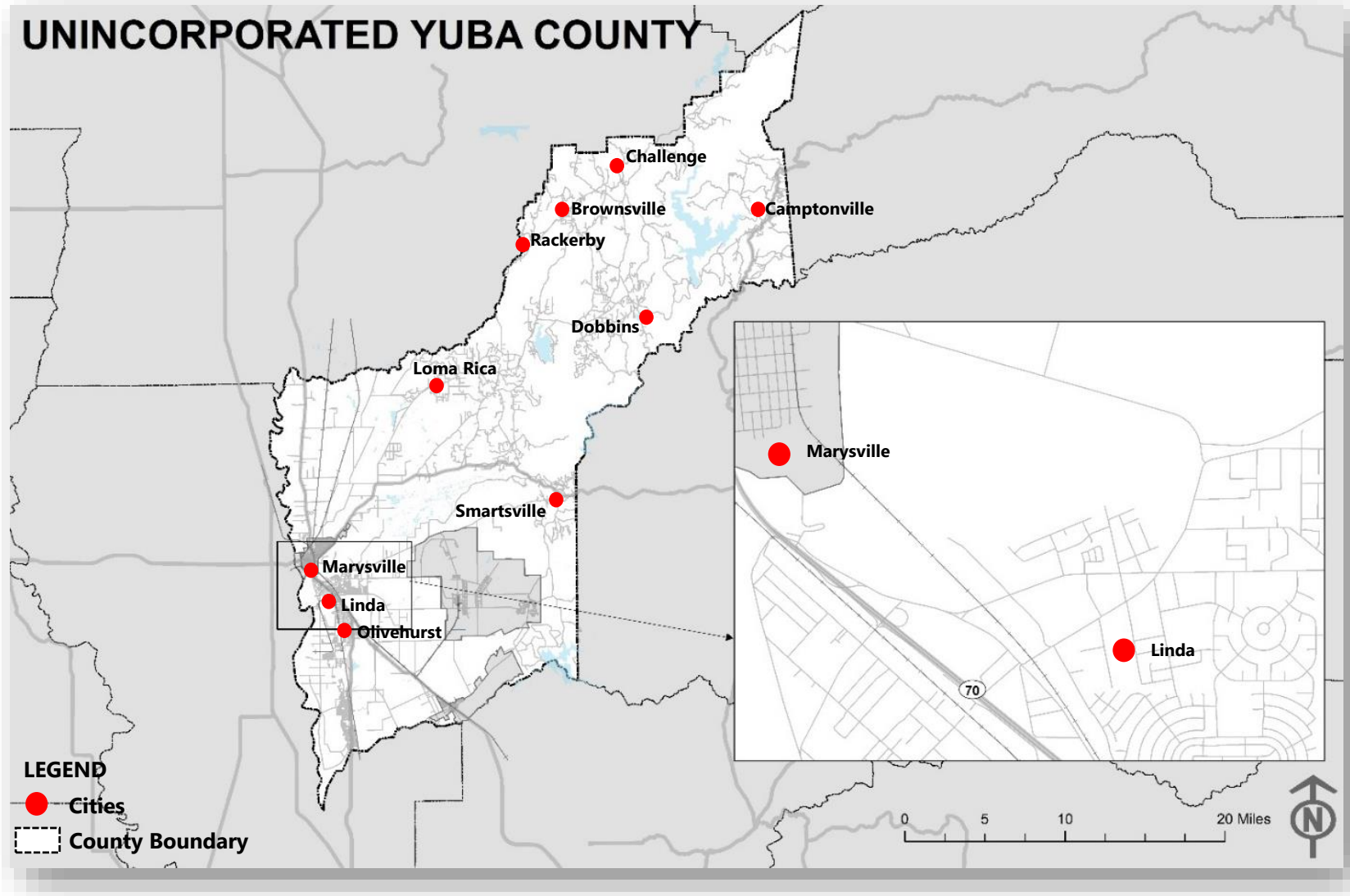
The Local Roadway Safety Plan (LRSP) is a localized data-driven traffic safety plan that provides opportunities to address unique roadway safety needs and reduce the number of collisions. The LRSP creates a framework to systematically identify and analyze traffic safety-related issues, and recommend safety projects and countermeasures. It facilitates the development of local agency partnerships and collaboration, resulting in a prioritized list of improvements that can qualify for HSIP funding. The LRSP is a proactive approach to addressing safety needs and is viewed as a living document that can be constantly reviewed and revised to reflect evolving trends, as well as community needs and priorities.



## STUDY AREA

Yuba County is located in California and covers a total area of 644 square miles and it is located east of Sutter County. The County lies along the western slope of the Sierra Nevada. The County's estimated population is approximately 81,575 (US Census 2020) and its density is 130/square miles (49/square kilometer). The County includes 10 incorporated cities namely Linda, Olivehurst, Wheatland, Plumas Lake, Smartsville, Camptonville, Loma Rica, Dobbins, Rackerby, and Challenge-Brownsville. The City of Marysville is incorporated. The study area is mapped in **Figure 1**.

Figure 1 Study Area: Yuba County



According to 10-year estimates from the American Community Survey (ACS) 2020 from the U.S. Census, 79.9% of Yuba County commuters get to work by driving alone, the County shows statistics of commuters driving alone whereas the State has an 8% lower percentage. The second most common method of commuting to work is carpooling at 10.2%. **Table 1** shows various modes of transportation used by Yuba County residents to commute to work.

**Table 1 Yuba County Commute to Work Data**

Commute to Work	Yuba County	California
Drive Alone	79.9%	78%
Carpool	11.6%	11%
Public Transportation	0.56%	5%
Walked	1.35%	3%
Worked at Home	5.33%	3%

Source: Data from the Census Bureau [ACS 5-year Estimate](#) 2020

## 2 SAFETY PARTNERS

Safety partners are vital to the development and implementation of an LRSP. For Yuba County, these include the County Sheriff's Office, County Administration, Community Development, Yuba County Fire Safe Council, Yuba County Office of Education, first responders, schools, residents, and/or local advocacy groups. The stakeholder and community outreach was supplemented by a project website and an interactive platform. The interactive map was used to solicit feedback from Yuba County residents and stakeholders outside the confines of traditional meetings.

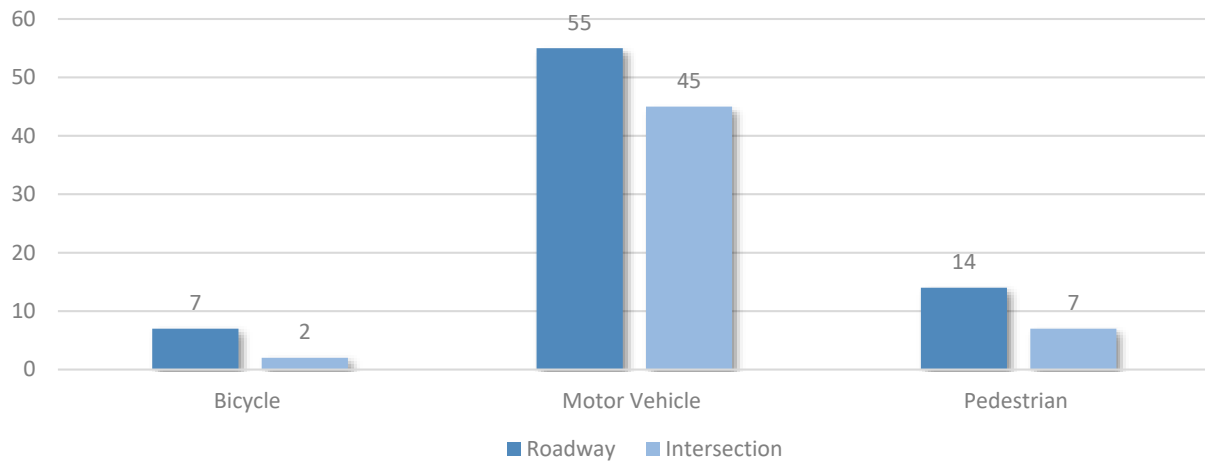
Figure 2 illustrates the landing page design of the Project Website.

**Figure 2 Yuba County Local Roadway Safety Plan: Project Website**

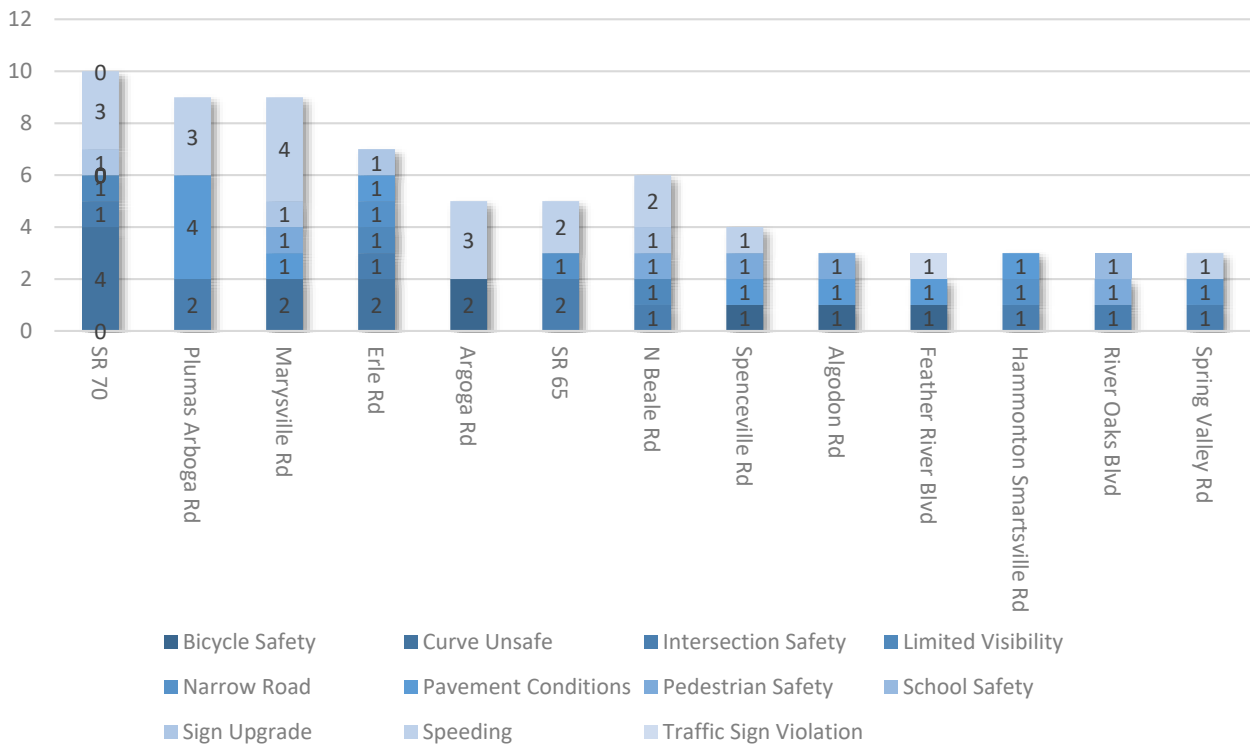


In total, **132 comments** were received through the project website. Most of the comments concerned Plumas Arboga Road, Marysville Road, Erle Road, and Argoga Road. The most common concerns expressed were speeding, poor pavement conditions, pedestrian safety, intersection safety, and concerns about the roads being too narrow. The results of the interactive map are shown below in **Figure 3** and summarized in **Figure 4**.

**Figure 3 Interactive Map Comment Responses**



**Figure 4 Public Comments on Traffic Safety by Location**

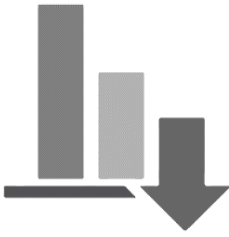


\*This survey was conducted from 12/27/2023 to 01/16/2024.

Note: Corridors with less than two comments are not listed in this summary. The category was chosen based on the primary issue listed in the comment. Each comment was assigned to the major road if at an intersection.

**Appendix A** includes all public comments from the Map Input Tool.

## SAFETY GOALS



### Reducing Injury Collisions

Reducing injury collisions on county roads.

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## Safe Streets

Enhance safety for all roadway users through both roadway design and engineering improvements as well as non-engineering countermeasures such as outreach, education, and enforcement. To support safe travel for people walking and biking, who are especially vulnerable in crashes, special focus should be paid near commercial areas, schools, recreational facilities, areas that are poorly lit at nighttime, and other areas where people walking and biking are present in high numbers or are vulnerable.



### Ongoing Monitoring

Ongoing monitoring of outcomes, including collision trends and project delivery, by empaneling a standing working group and ongoing collaboration between County departments, other local and regional agencies, and other stakeholders.

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## Equity

Commit to equity in all aspects of Safe System, including data analysis that acknowledges and addresses reporting biases, project prioritization efforts that promote projects in historically under-invested communities, and implementation strategies that follow data-driven approaches.



### 3 EXISTING PLANNING EFFORTS

This chapter provides a review of previous and ongoing planning efforts that are relevant to enhancing transportation safety in Yuba County. Yuba County aims to achieve a multimodal roadway system that responds to the evolving transportation landscape and addresses safer mobility for all. The purpose of this chapter is to ensure the LRSP vision, goals, and 4 E's strategies (Engineering, Education, Enforcement, and Emergency Medical Services (EMS)) are aligned with prior planning efforts, planned transportation projects, and non-infrastructure programs for the County. The documents reviewed are listed below:

- Yuba County General Plan- 1995-2010 | (1994)
- Yuba County General Plan 2030 (2011)
- Yuba County Bikeway Master Plan (2012)
- Yuba-Sutter Short Range Transit Plan (2015)
- Transportation Master Plan 2020-2024 (2020)
- South Yuba Transportation Improvement Authority- Comprehensive Implementation Strategy (2021)
- Yuba-Sutter Transit Corridor Enhancement Plan (2018)
- County of Yuba FY 2021-22 Proposed Budget
- SACOG Metropolitan Transportation Plan (2020)

**Table 2** outlines key resources for improving street safety through transportation plans, design guidelines, and area plans. Many of these documents establish goals or visions for the safe movement of people throughout Yuba County, including enhancing the safety of active modes for people of all ages and abilities to help achieve transportation mode shares and environmental targets.

The following sections include brief descriptions of these documents and how they inform the development of the LRSP. A detailed list of relevant policies and projects is listed in **Appendix B**.

**Table 2 Overview of Plans and Policies**

<b>Document/Program</b>	<b>Description</b>	<b>E's Addressed</b>
<p><b>Yuba County General Plan 2030 (2011)</b></p>	<p>The General Plan was adopted in 2011, the General Plan presents a consolidated framework of decisions for guiding where and how development should occur in Yuba County through 2030. The General Plan recognizes that the Circulation Element is crucial to improving the overall quality of life and creating a sustainable and thriving community. It emphasizes the need to revitalize primary transportation corridors and create new transportation infrastructure. The Plan presents standards and policies for roadway networks, bicycle networks and classifications, and transit services aligned to this vision. The Plan also provides a broad mapping of the existing and proposed multimodal facilities. The goals and policies stated in the General Plan will inform the safety countermeasure selection and proposed safety projects for the Yuba County Local Road Safety Plan Report.</p>	<p>Engineering, Education, Enforcement</p>
<p><b>Yuba County Bikeway Master Plan (2012)</b></p>	<p>This master plan was developed with an aim to promote bicycling by laying out an updated vision of connected bikeways that enhance accessibility to neighborhoods, places of employment, parks, and schools. The plan established goals, policies, implementation actions, and priorities for the development of bicycle facilities in Yuba County. The elements comprise maps with existing and proposed bicycle facilities and their proximity to major centers of activity. The plan also details design standards for new bikeways, which have been developed in consistency with the Highway Design Manual (HDM) and Manual on Uniform Traffic Control Devices (MUTCD). The plan includes elements of Regional Plans as well as the Statewide Initiatives and legislation. Furthermore, the bikeway system in the plan is analyzed to be a cost-effective systemic project for the County and also will be consolidated with the proposed and existing bikeway projects.</p>	<p>Engineering, Education</p>
<p><b>Yuba-Sutter Short Range Transit Plan (2015)</b></p>	<p>The Yuba-Sutter Short Range Transit Plan (SRTP) was conducted for the Yuba-Sutter Region to assess the existing conditions and identify issues with the existing transportation services. The SRTP planning period covers 2015 to 2020. The document presents a detailed review of the existing services, and the existing and future trends in transit demand, followed by an evaluation of service alternatives, capital alternatives, management alternatives, and financial alternatives. The plan summarizes the improvements in all these areas in order to enhance the transit services in the region. An implementation plan that will help increase efficiencies lists specific improvements for each fiscal year from 2015 to 2020. This document emphasizes the requirement for improving pedestrian facilities which can help reduce the occurrence of fatal and severe injury collisions in the County.</p>	<p>Engineering, Education</p>

Document/Program	Description	E's Addressed
<b>Transportation Master Plan (2020-2024)   (2017)</b>	<p>The Transportation Master Plan (TMP) provides a comprehensive list of all completed and proposed roadway improvements. TMP is a five-year document focusing on pavement maintenance, and road and bridge construction projects in the near future. The TMP lists ongoing transportation programs and proposed projects from the 2020 to 2024 construction season. In addition to the road maintenance funded by gas tax revenues, this TMP also includes proposed road maintenance projects funded by Measure D, County's resources depletion tax. In addition, the TMP also identifies road improvement projects to be funded through various capital impact fees programs. The plan includes a detailed analysis of all the financial sources and forecasts of transportation revenues necessary to implement the TMP. Projects listed in this plan related to complete streets and road geometry improvements are crucial and will help inform the safety projects to be considered for the LRSP report.</p>	Engineering
<b>South Yuba Transportation Improvement Authority (SYTIA) Comprehensive Implementation Strategy (2021)</b>	<p>The SYTIA was initiated to consider, evaluate, construct, and implement transportation improvements within the southern portion of the County. The study was to initiate refining of the transportation projects scope of several roads and highways, identify potential impacts, and develop cost in order to best strategize the capital generated by SYTIA's traffic impact fee program. This program focuses on road expansion projects with environmental restrictions and encourages alternative modes of transportation like transit, bikes, and pedestrian facilities. SYTIA also focused on long-term implementation goals like regional and infrastructure improvements and establishing local street networking and connection with interchange. The program also includes the use of the VMT model tool to evaluate roadway improvements. The long-term goals stated in plan will inform the safety projects proposed in the Yuba County Local Road Safety Plan Report.</p>	Engineering, Education
<b>Yuba-Sutter Transit Corridor Enhancement Plan (2018)</b>	<p>Yuba-Sutter Transit Corridor Plan provides an analysis of general conditions along the length of the 8-mile corridor and identifies key transit route that links all other routes in the system. The Corridor Enhancement Plan provides analysis and conceptual designs, focused on supporting capital improvements to transit routes and bus facilities. This Plan draws out relevant designs for road improvements using existing conditions data including sidewalk, bicycle passenger facility designs, and bus turning path requirements. A number of sites were identified for improvements facilitated with graphics and conceptual designs. The Corridor Enhancement Plan observed key transfer centers conducted detailed reviews of the existing improvements and formulated recommendations for short and long-term goals. The plan was developed with community, stakeholder, and public agency input throughout its preparation.</p>	Engineering, Education
<b>County of Yuba Capital Improvement Program Fiscal Year (2021-2022)</b>	<p>The County of Yuba's proposed Capital Improvement Program (CIP) is an instrument for long-term fiscal sustainability and to retain the County's financial resources for the expansion of future</p>	Engineering



Document/Program	Description	E's Addressed
	<p>revenues, rehabilitation, or replacement of existing assets. It also identifies investments in the workforce, expanding use of technology and infrastructure, planning for and implementing critical infrastructure projects, and a few from the previous FY 2007-08. The financial plan is developed by Staff and is adopted by the Board of Supervisors as a guide for prioritization of various projects to accomplish community goals. The CIP reflects meeting annual goals and funding availability, prioritized capital projects, and community needs. The budget in the plan will be invested in community services like road improvements, implementing technology- solutions for Yuba County Library, affordable housing, and encouraging multi-modal transportation within the county. The budget also supports improvements to the drainage system and proposes various future infrastructure development for the Sports and Entertainment district. These improvements influence the County's built and natural environment and help guide the trajectory of future growth and change. The improvements identified in this plan will inform the safety improvements and strategies to be recommended in the County's Local Road Safety Plan.</p>	
<p><b>Sacramento Area Council-Govts (SACOG) Metropolitan Transportation Plan (2020)</b></p>	<p>The 2020 MTP plan outlines transportation investment and land use strategies to support transportation options, affordable housing, and economic opportunities. The plan is a 20-year multimodal transportation plan that would achieve transportation infrastructure and services and also expand transportation systems within the community. The vision of the plan includes an integrated, multimodal transportation system that complements regional transportation plans and land use visions. The plan guides the planning and implementation of a low-carbon transportation system that fosters economic vitality, protects the environment and natural resources, and promotes health and well-being equitably for all Californians. The improvements identified in the plan will inform the goals and performance measurement targets to be recommended in the County's Local Road Safety Plan.</p>	<p>Engineering, Education, EMS</p>

## 4 COLLISION DATA AND ANALYSIS

A primary component of the LRSP is the identification of locations with elevated risk of collisions either through their collision histories or their similarities to other locations that have more active collision patterns. A summary of the data utilized and key findings is included in this chapter.

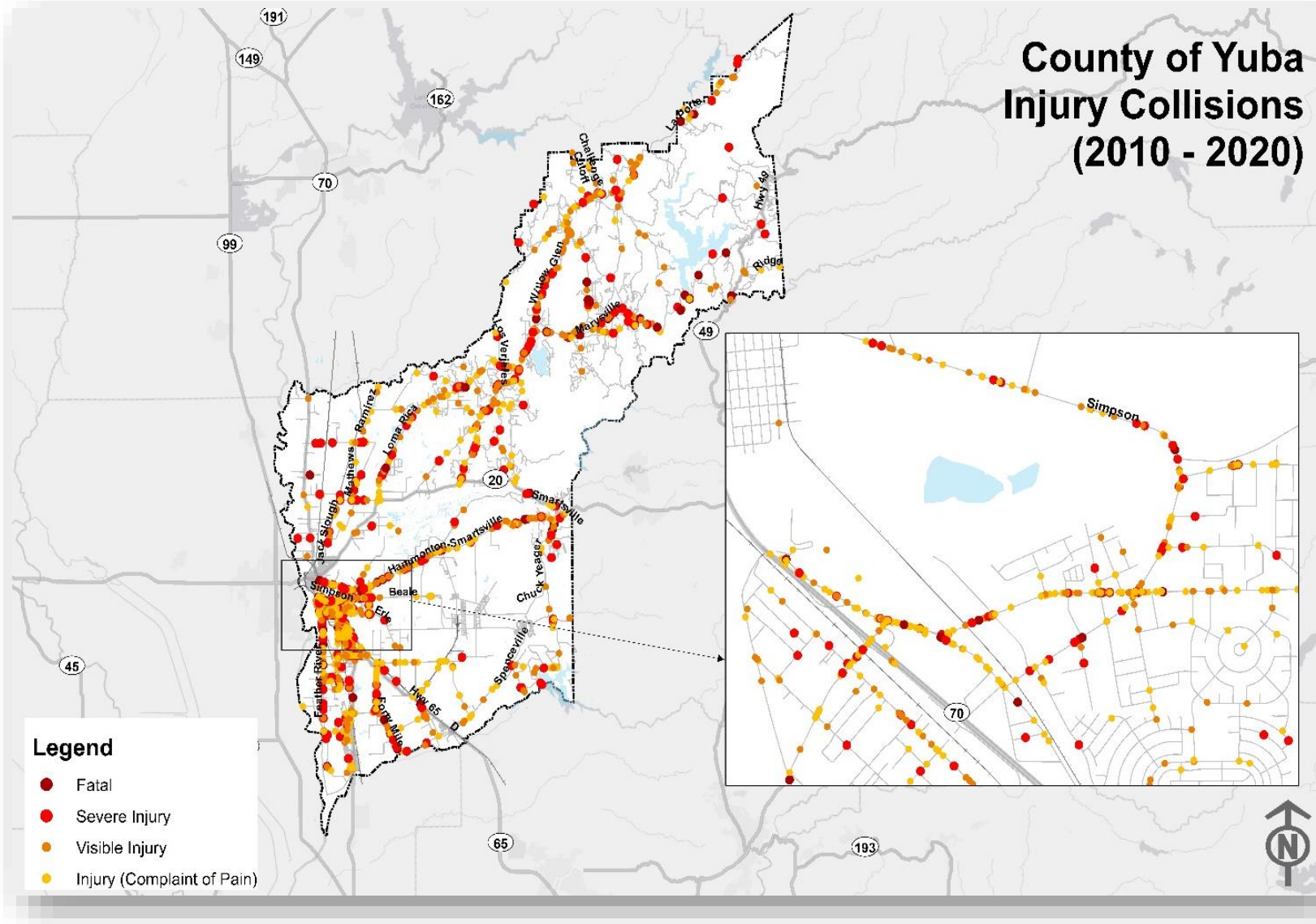
The LRSP focuses on systemically identifying and analyzing traffic safety issues and recommends appropriate safety improvements. The chapter starts with a comprehensive analysis of collisions of all severity types in Yuba County and compares this with the KSI (killed and severe injury) collisions. Factors such as collision severity, type of collision, primary collision factor, lighting, weather, and time were analyzed. Following this, a more detailed analysis was conducted for KSI collisions that have occurred on County roadways, including analyzing intersection and roadway segment collisions separately.

### DATA COLLECTION

Collision data helps understand different factors that might be influencing collision patterns and various factors leading to collisions in a given area. For this analysis, a ten-year jurisdiction-wide collision data, from 2010 to 2020 was retrieved from Transportation Injury Mapping System (TIMS) and Statewide Integrated Traffic Records System (SWITRS). Collisions that occurred on state routes were excluded from this analysis. The collision data was analyzed and plotted in ArcMap to identify high-risk intersections and roadway segments. Each collision was assigned to the nearest intersection within 250 feet or the nearest roadway segment if no intersection was within the range. A raw count of crashes was calculated for each intersection and roadway segment. Intersection collisions were separated as signalized and non-signalized locations.

**Figure 5** illustrates all the injury collisions that have occurred in the County from January 1<sup>st</sup>, 2010 to December 31<sup>st</sup>, 2020.

Figure 5 Countywide Collision Locations

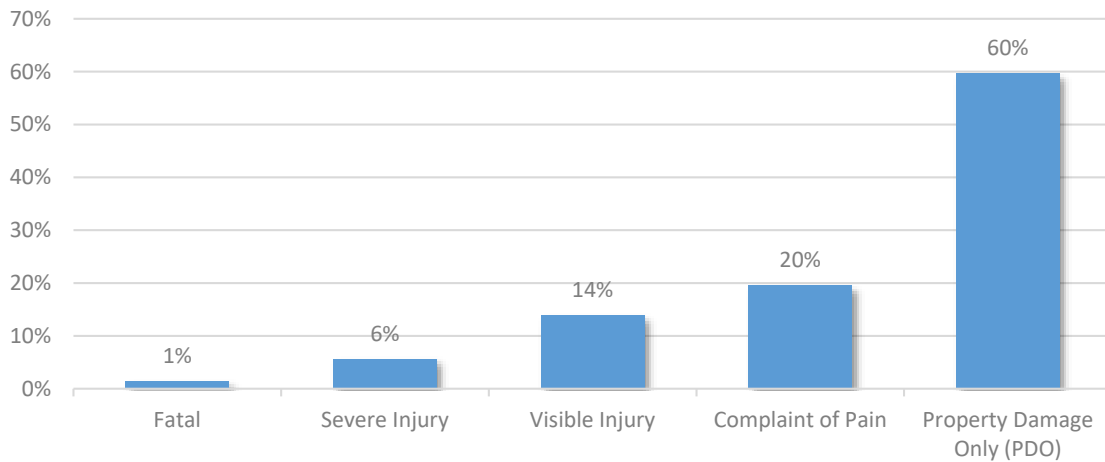


### COLLISION CLASSIFICATION

There were a total of 5,046 collisions reported County-wide from 2010 to 2020. Out of these, 984 collisions (19%) led to complaint of pain and 701 collisions (14%) led to a visible injury. There were 353 KSI collisions, 285 collisions (6%) led to a severe injury and 68 collisions (1.3%) led to a fatality. There were 3,008 collisions which were Property Damage Only (PDO).

Figure 6 illustrates the classification of all collisions based on severity.

**Figure 6 Collisions by Severity (2010 -2020)**



The analysis first includes a comparative evaluation between all injury collisions and KSI collisions, based on various factors including (but not limited to): collision trend, primary collision factor, collision type, facility type, motor vehicle involved with, weather, lighting, and time of the day. Following this, a comprehensive analysis is conducted for only KSI collisions. KSI collisions cause the most damage to those affected and to the infrastructure. Aside from the human toll exacted on the crash victims, emotional impacts are endured by family, friends, witnesses, and first responders. There are also financial burdens endured by victims and their families as well as by the community and society as a whole. The LRSP process thus focuses on these collision locations to proactively identify counter-safety issues leading to these KSI collisions.

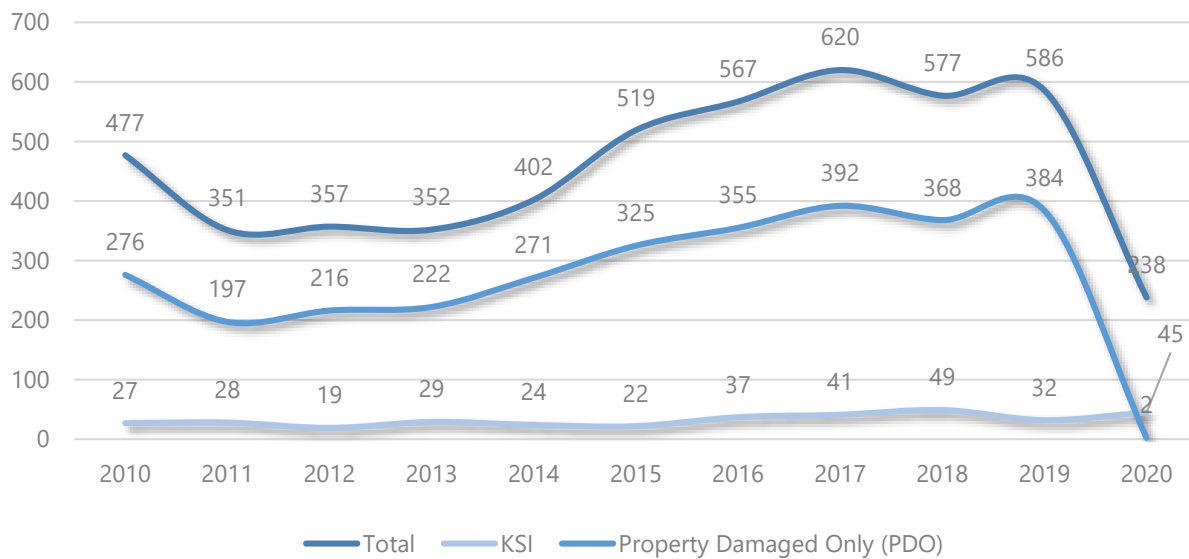
The reported collisions categorized by fatality type and collision severity are presented in **Table 3**.

**Table 3 Collisions by Severity**

Collision Severity	Roadway Segment	Intersection	Total
Fatal	43	25	68
Severe Injury	181	104	285
Visible Injury	357	344	701
Complaint of Pain	380	604	984
Property Damage Only (PDO)	1,247	1,761	3,008
<b>Total</b>	<b>2,208</b>	<b>2,838</b>	<b>5,046</b>

**YEARLY TREND**

**Figure 7 Ten-Year Collision Trend**



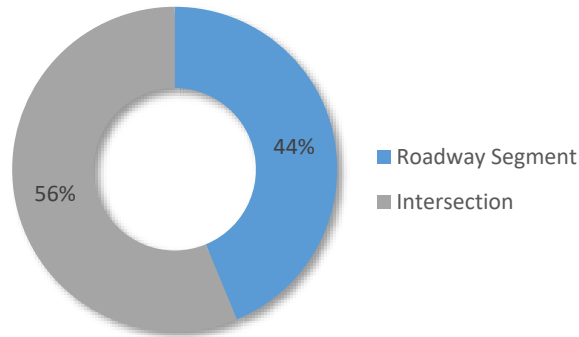
For all collisions, the number of reported collisions decreased from 2010 to 2020. The highest number of collisions (620 collisions) was observed in 2017 and the lowest number of collisions (238 collisions) was observed in 2020. A total of 353 KSI collisions occurred in Yuba County during the study period. They were observed to be the lowest (19 collisions) in 2012, and the highest in 2018 (49 collisions).

Figure 7 illustrates the 10-year collision trend for all injury collisions and KSI collisions.

### ROADWAY SEGMENT VS. INTERSECTION

When evaluating the locations of collisions, most collisions occurred at intersections. In Yuba County, 56% of all collisions (2,838 collisions) occurred at intersections whereas 44% (2,208 collisions) occurred on roadway segments. A slightly stronger trend toward roadway segment collisions is seen when looking only at KSI collisions. This classification by location type can be observed in **Figure 8**.

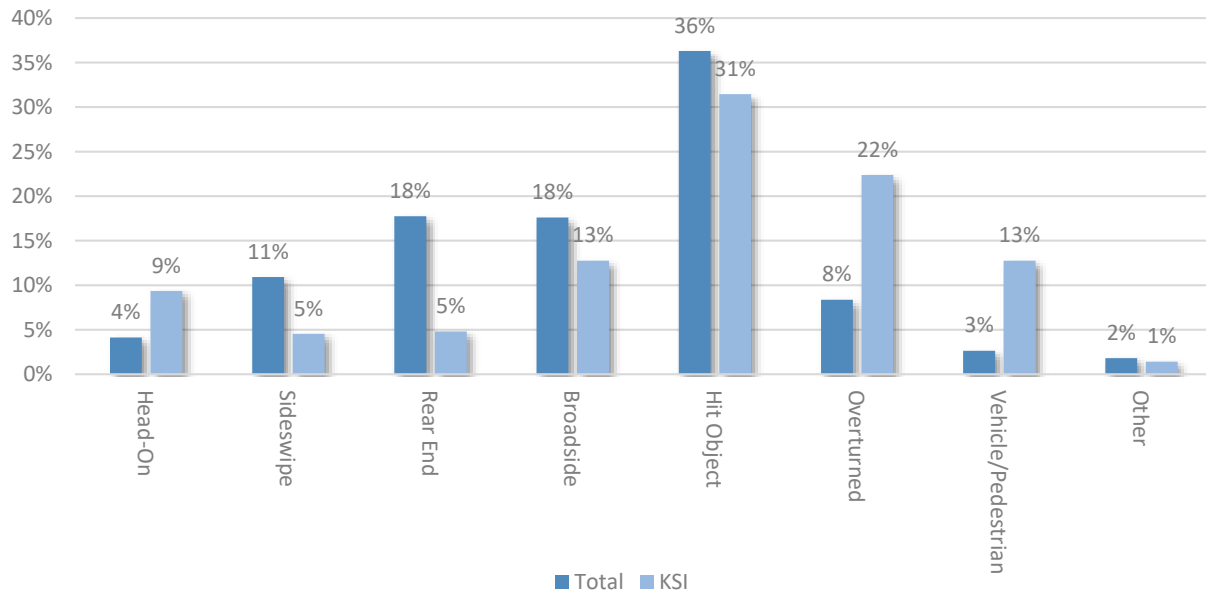
**Figure 8 Intersection vs Roadway Collisions - All Injury Collisions**



### COLLISION TYPE

Among all injury collisions, the most commonly occurring collision type was hit object collisions (36%), broadside collisions (18%), and rear-end collisions (18%). The collision types for KSI collisions follow a slightly different pattern, where the most commonly occurring collision type was hit object collisions (31%), and overturned collisions (22%). **Figure 9** illustrates the collision type for all injury collisions as well as KSI collisions.

**Figure 9 Countywide Collision Type**



**Vehicle-Pedestrian** collisions are any crash involving both a motor vehicle and a pedestrian.

An **Overturned** collision is any type of crash that results in at least one vehicle rotating 90 degrees or more side to-side or end-to-end.

A **Head-on collision** is between two vehicles where the primary point of contact was the front of both vehicles.

**Hit Object** collisions are between a vehicle and non-vehicular object in or near the roadway.

**Sideswipe collisions** are between vehicles, typically traveling the same direction, where the primary point of contact was the side of the vehicles.

A **Rear-end** collision is between two vehicles traveling in the same direction where the front of one vehicle contacts the rear of another.

**Broadside** collisions are between vehicles on conflicting paths where the front of one vehicle contacts the side of another.

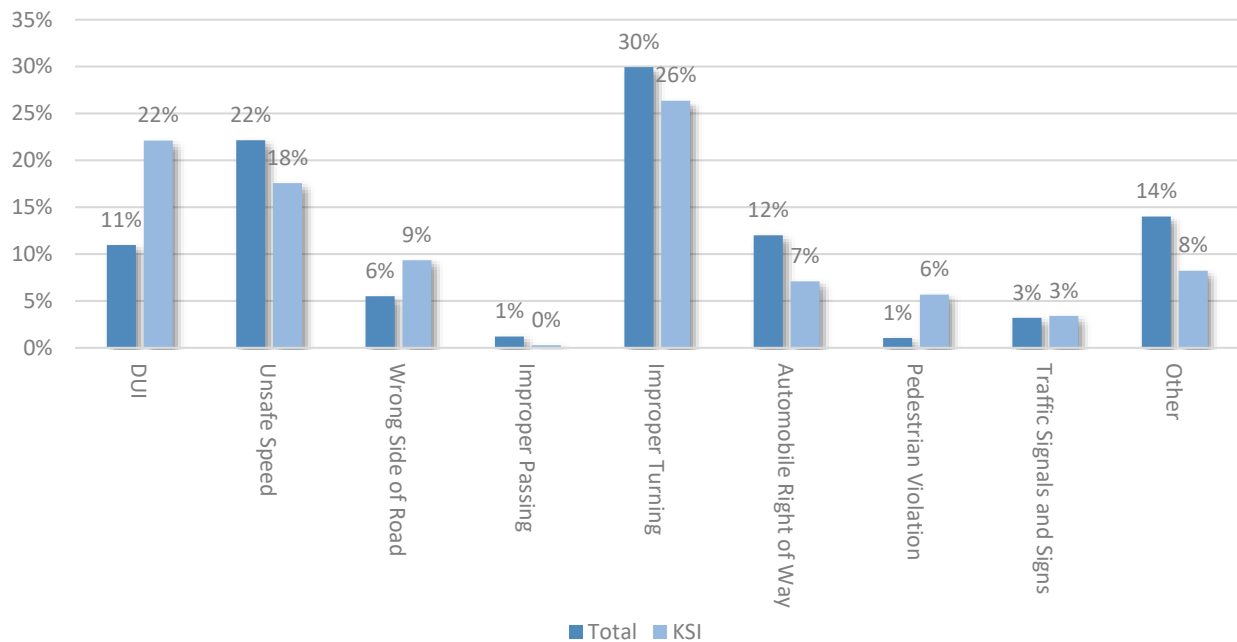
**Unknown/Other** collisions describe any reported collision that was not consistent with one of the primary collision types above or where collision type was not coded into the collision database.



### PRIMARY COLLISION FACTOR

Among all injury collisions, the most common violation categories were improper turning (30%), unsafe speed (22%), and other collisions (14%). The most common primary violation categories for KSI collisions were improper turning violations (26%), driving under the influence (22%), and unsafe speed collisions (18%). **Figure 10** illustrates the violation category for all injury collisions and KSI collisions.

**Figure 10 Countywide Collision Causes**



**Auto Right-of-Way (R/W) Violation** refers to a driver infringing upon the right-of-way of another party in violation.

**Improper Turning** identifies a collision where a party made a left or right turn in violation.

**Unsafe Speed** refers to a collision where a party is identified to be traveling at a speed in excess of what is deemed reasonable or prudent for conditions.

**Traffic Signals and Signs** describes a party disobeying a traffic control device such as a traffic signal or roadside sign.

**Driving Under Influence** identifies a collision where a driver is found to have been operating a vehicle while impaired by a substance – typically alcohol.

**Unsafe Lane Change** describes a collision where a party moves between two lanes or deviates course in a hazardous manner with or without appropriate signaling.

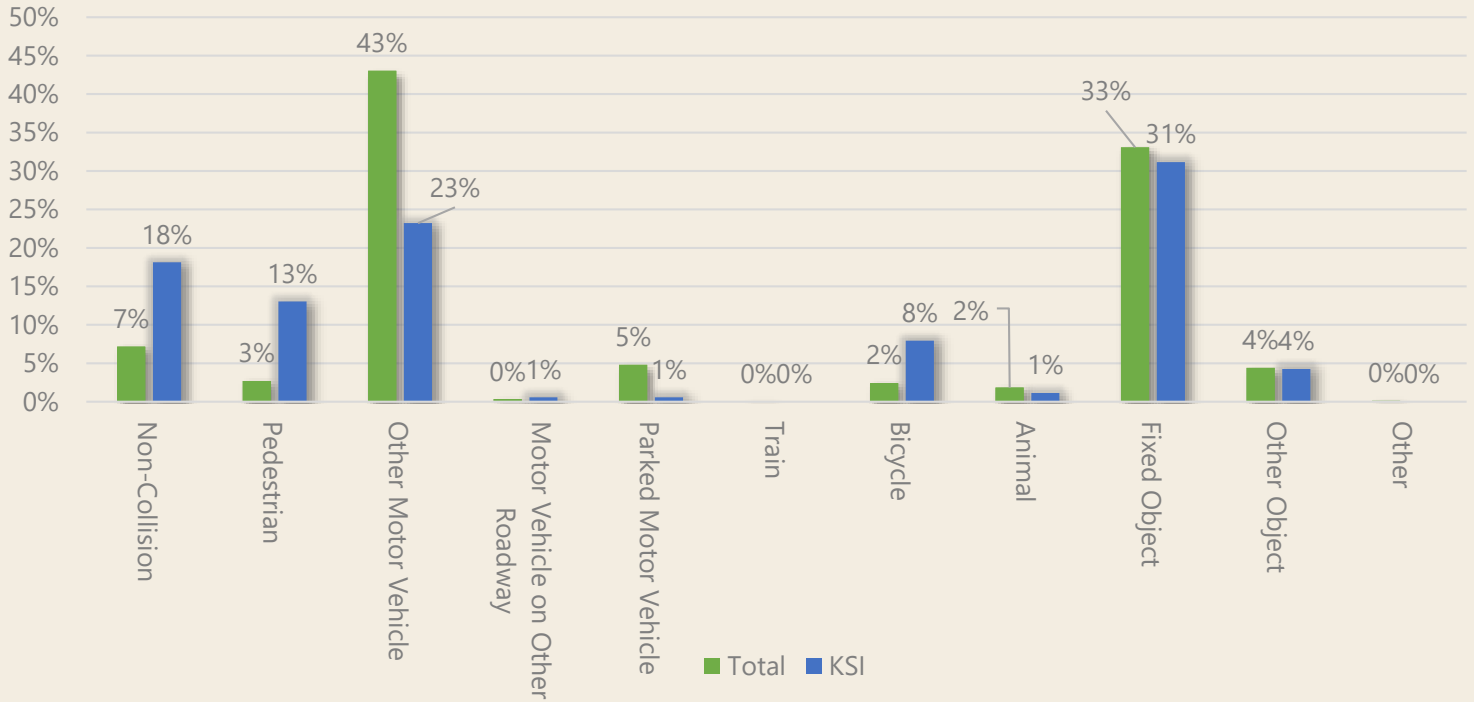
**Following Too Closely** refers to when the driver of a motor vehicle drivers behind another vehicle at distance that is too short to be reasonable or prudent for conditions.

**Pedestrian Violation** refers to a collision where a pedestrian is identified to be at fault or causing violations.



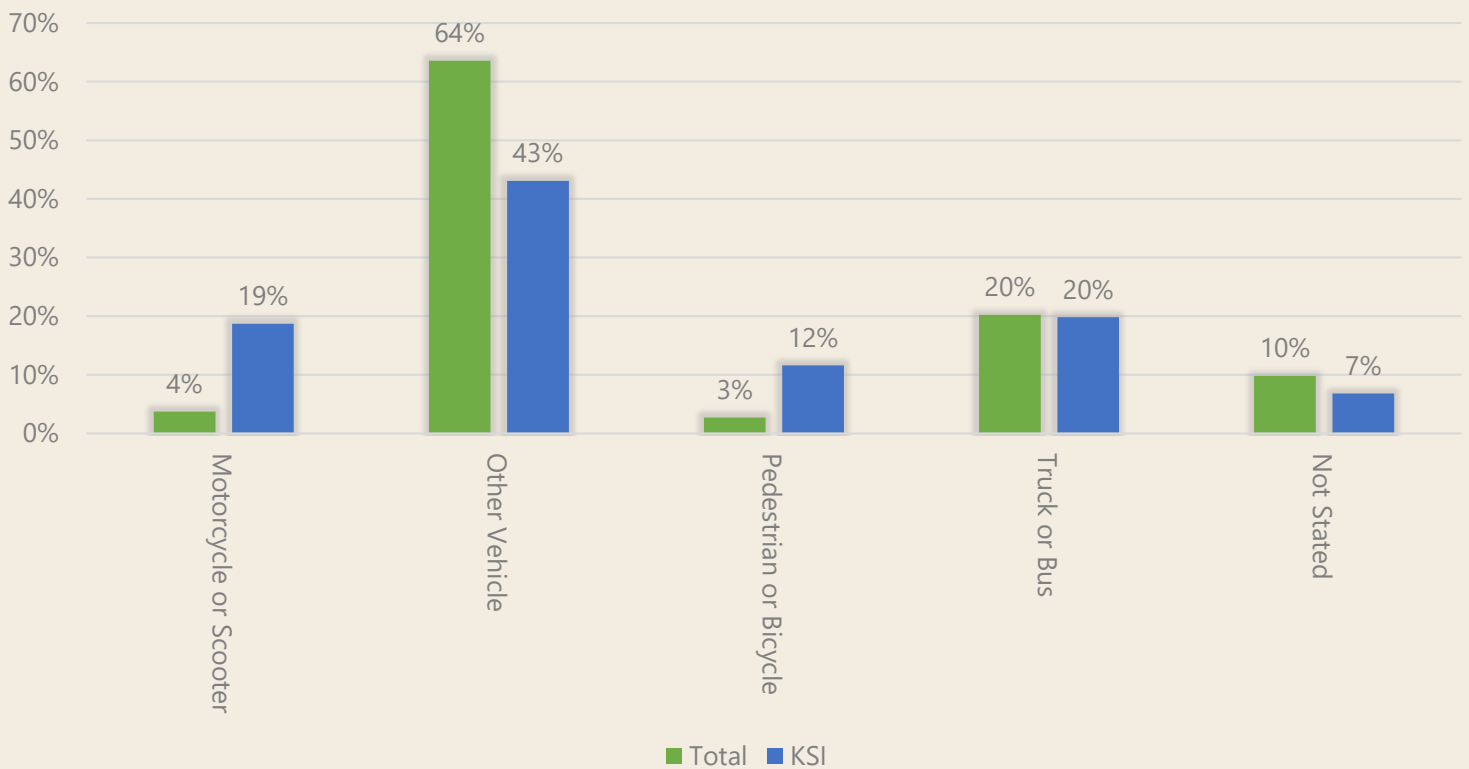
## MOTOR VEHICLE INVOLVED WITH

Figure 11 Motor Vehicle Involved with



## MODES

Figure 12 Modes for All Injury Collisions vs. KSI Collisions



### LIGHTING

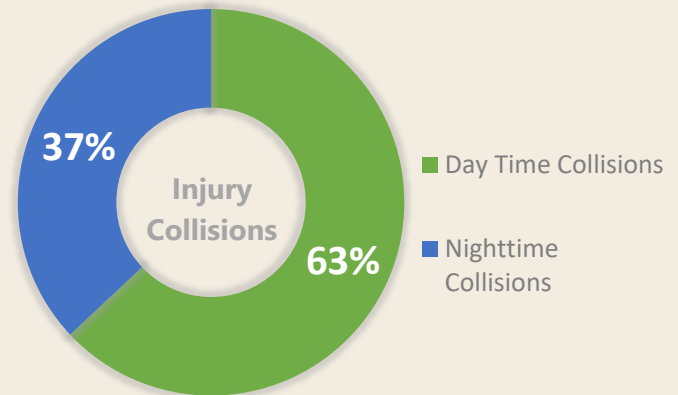
Among all injury collisions, 63% of collisions have occurred in daylight and 20% of collisions have occurred in the dark on streets with no street lights. For KSI collisions, 53% of collisions occurred in daylight, and 31% of collisions occurred in the dark on streets with no street lights. **Figure 13** illustrates the lighting condition for collisions of all severity and KSI collisions.

Factors that negatively contribute to the quality of streetlights include lights being insufficiently bright, placed too widely apart, or poor quality of lighting for people walking on the sidewalk, as streetlights are often designed for vehicles in travel lanes.

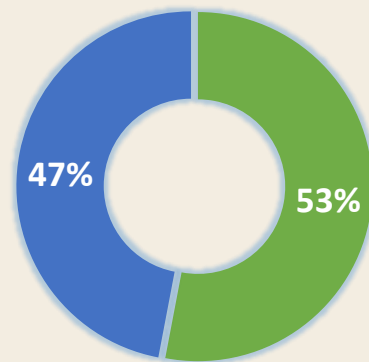
### TIME OF THE DAY

Among all injury collisions, the maximum number of collisions occurred between 4:00 p.m. to 5:00 p.m. (7%). The minimum number of collisions have occurred between 3:00 a.m. to 4:00 a.m. (1.1%). For all KSI collisions, a maximum number of collisions have been observed to occur between 4:00 p.m. to 5:00 p.m. (8.2%). **Figure 14** illustrates the percentage of collisions occurring during each hour of the day for all collisions as well as KSI collisions.

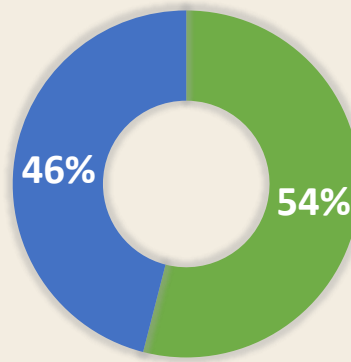
**Figure 13 Lighting Conditions**



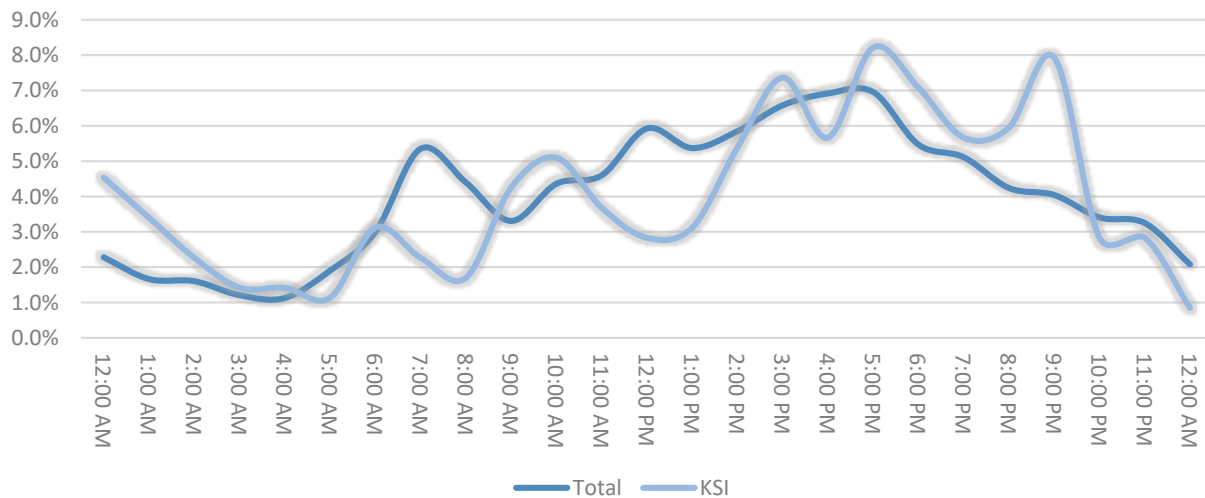
**KSI Collisions**



**Ped/Bike Collisions**



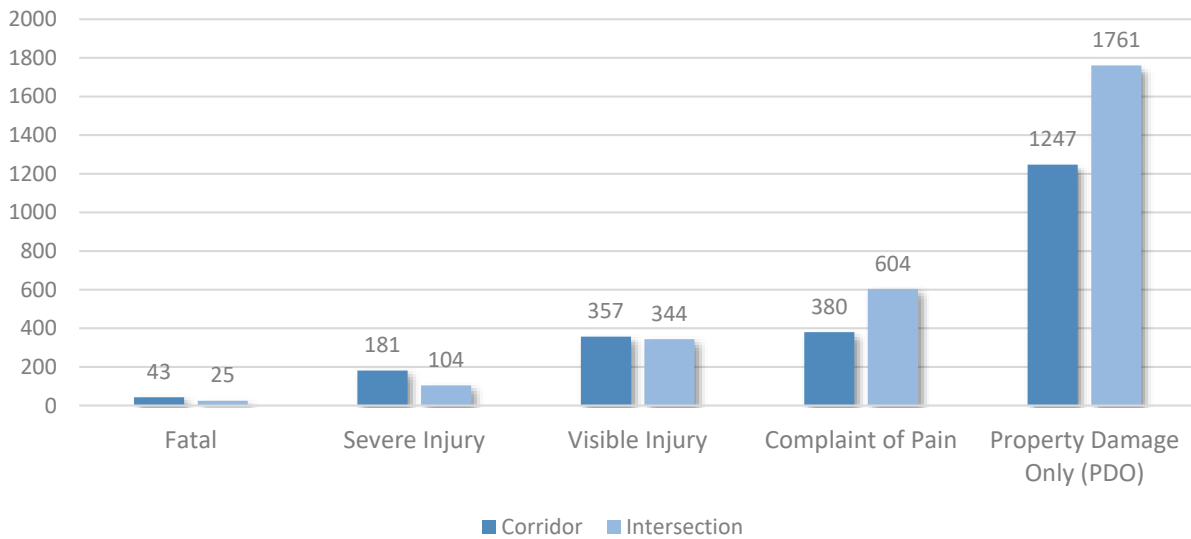
**Figure 14 Time of Day**



### KILLED AND SEVERE INJURY (KSI) COLLISIONS

This section describes a detailed collision analysis performed for KSI collisions occurring at roadway segments and intersections in the County. Of the total 353 KSI collisions that occurred during the study period, **224 collisions (63%)** occurred on roadway segments and **129 collisions (37%)** occurred at intersections. This distribution is illustrated in **Figure 15** whereas, **Figure 16** illustrates the total of KSI collisions per year. **Figure 17** maps the KSI collisions that occurred in the County during the study period.

**Figure 15 Countywide Collisions Outcome**



**Figure 16 Countywide KSI Collisions Outcome**

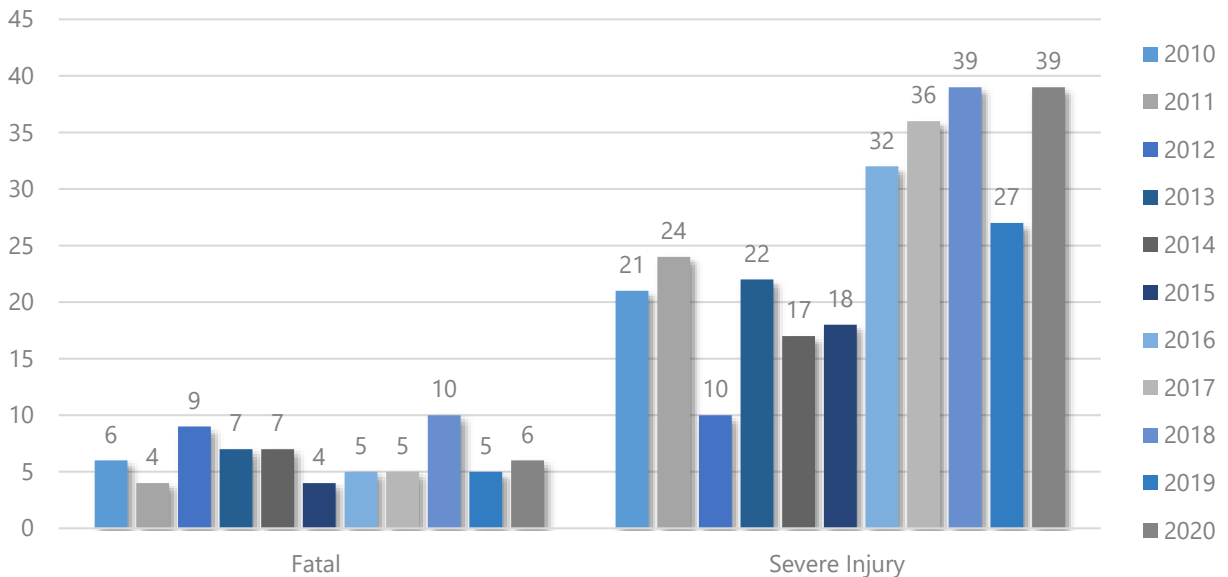
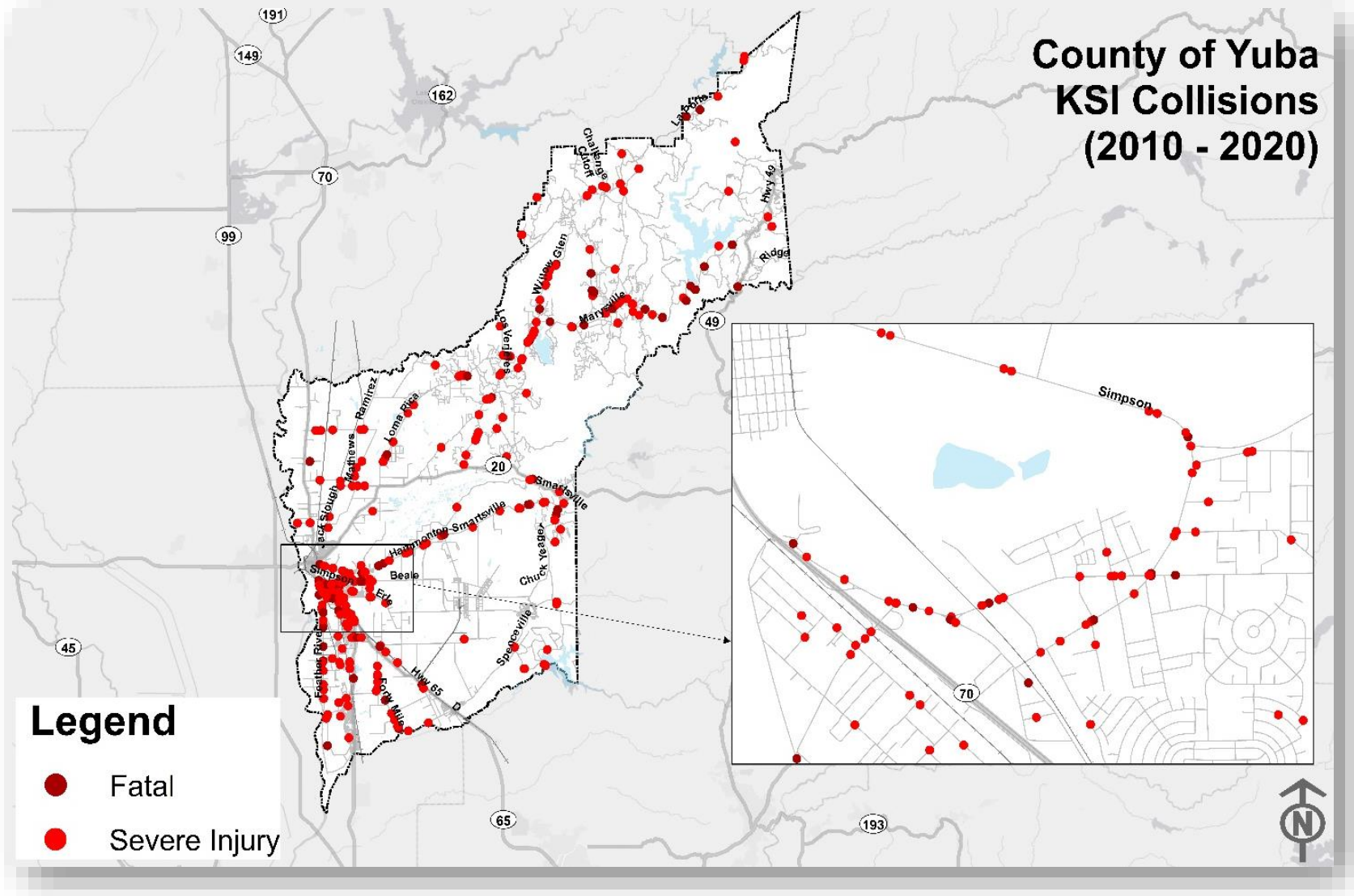
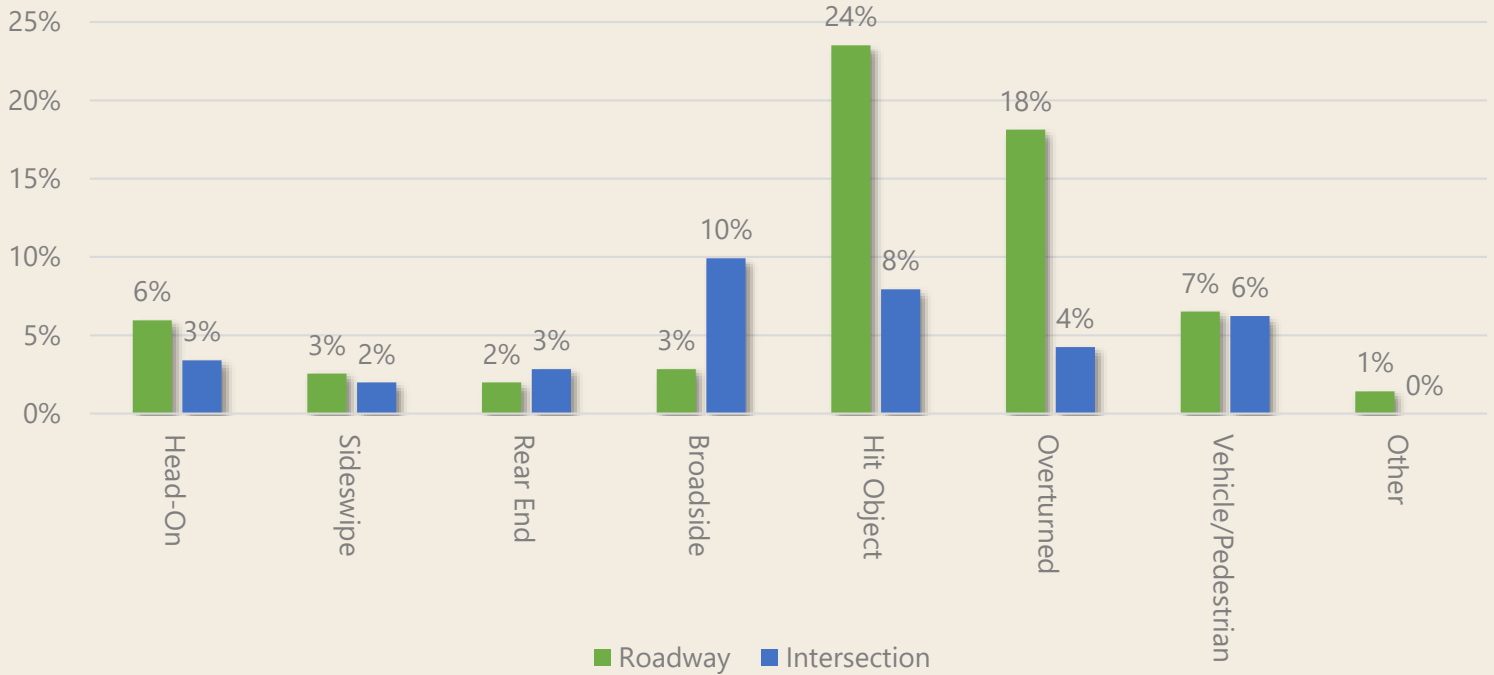


Figure 17 Countywide Killed and Severe Injury Collisions



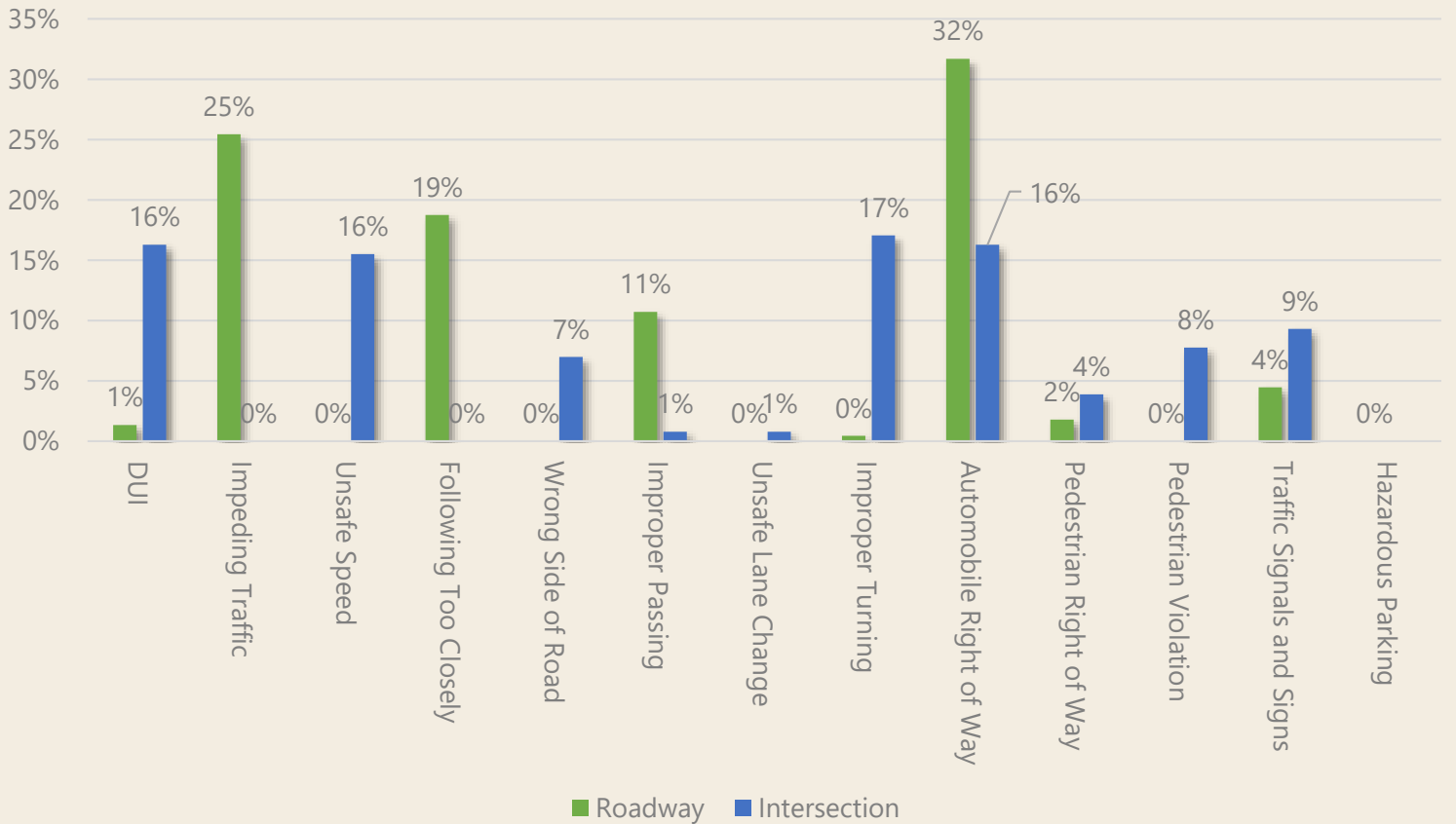
### COLLISION TYPE AND LOCATION TYPE

Figure 18 KSI Collisions: Collision Type



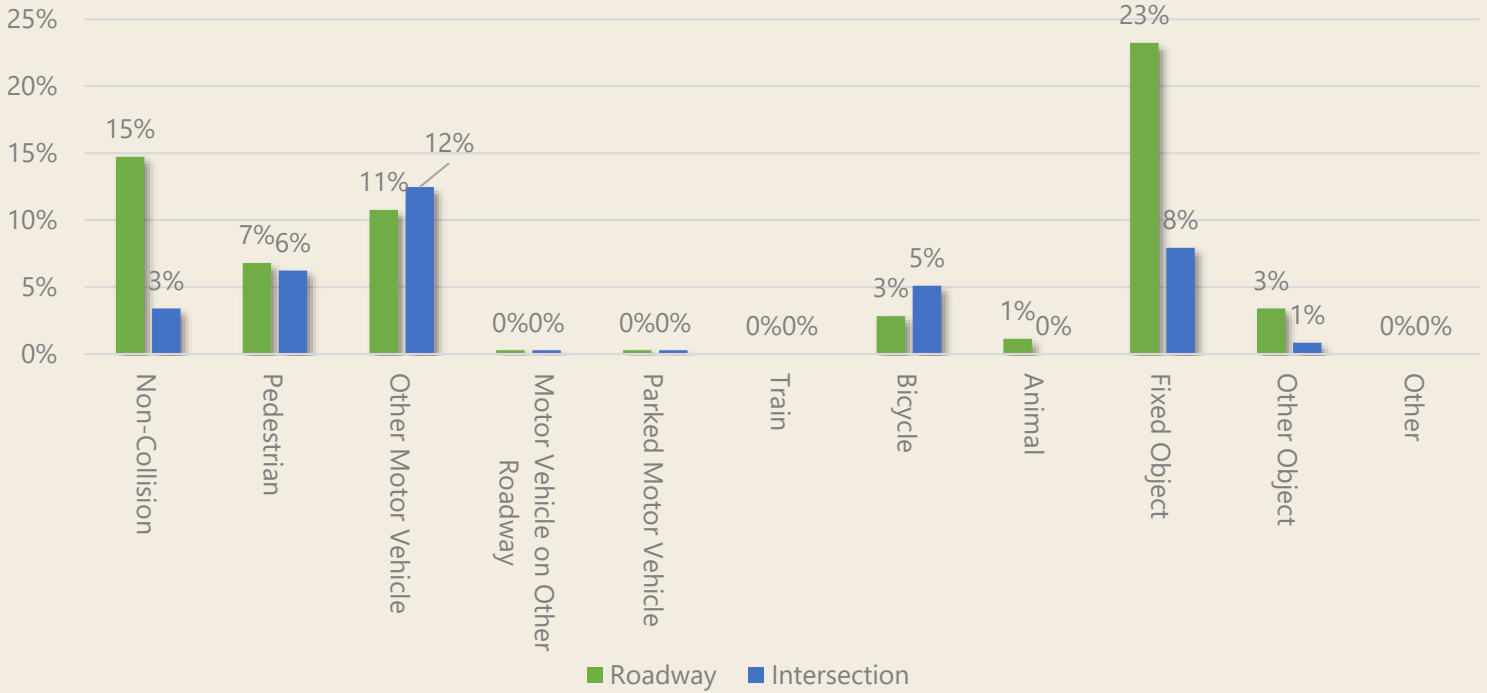
### VIOLATION CATEGORY AND LOCATION TYPE

Figure 19 KSI Collisions: Violation Category Type



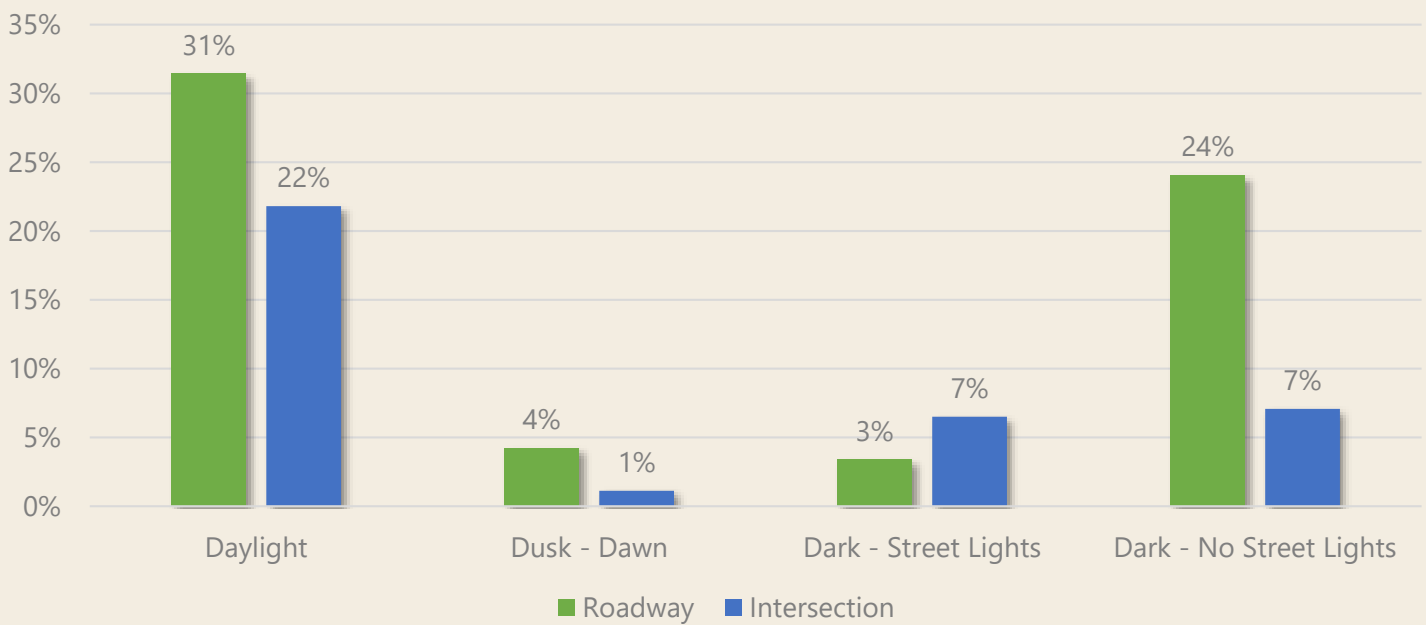
### MOTOR VEHICLE INVOLVED WITH AND LOCATION TYPE

Figure 20 KSI Collisions: Motor Vehicle Involved With



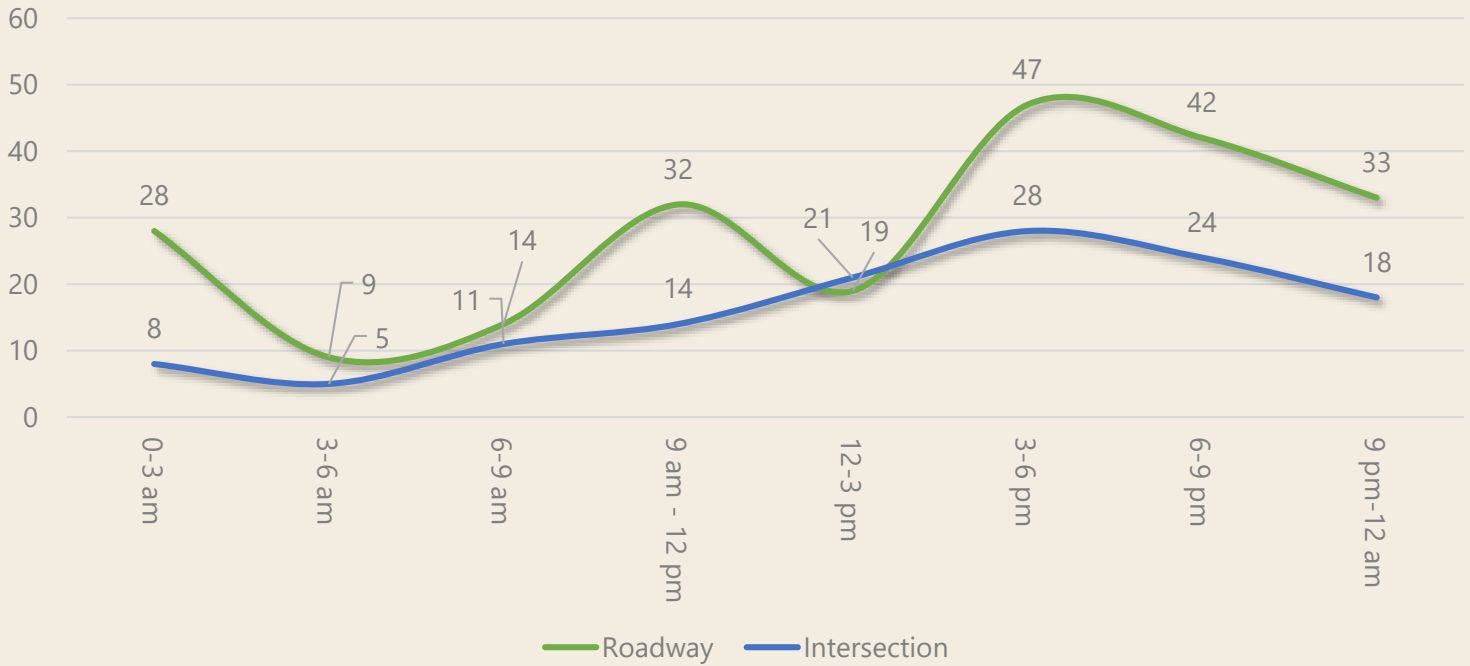
### LIGHTING AND LOCATION TYPE

Figure 21 KSI Collisions: Lighting



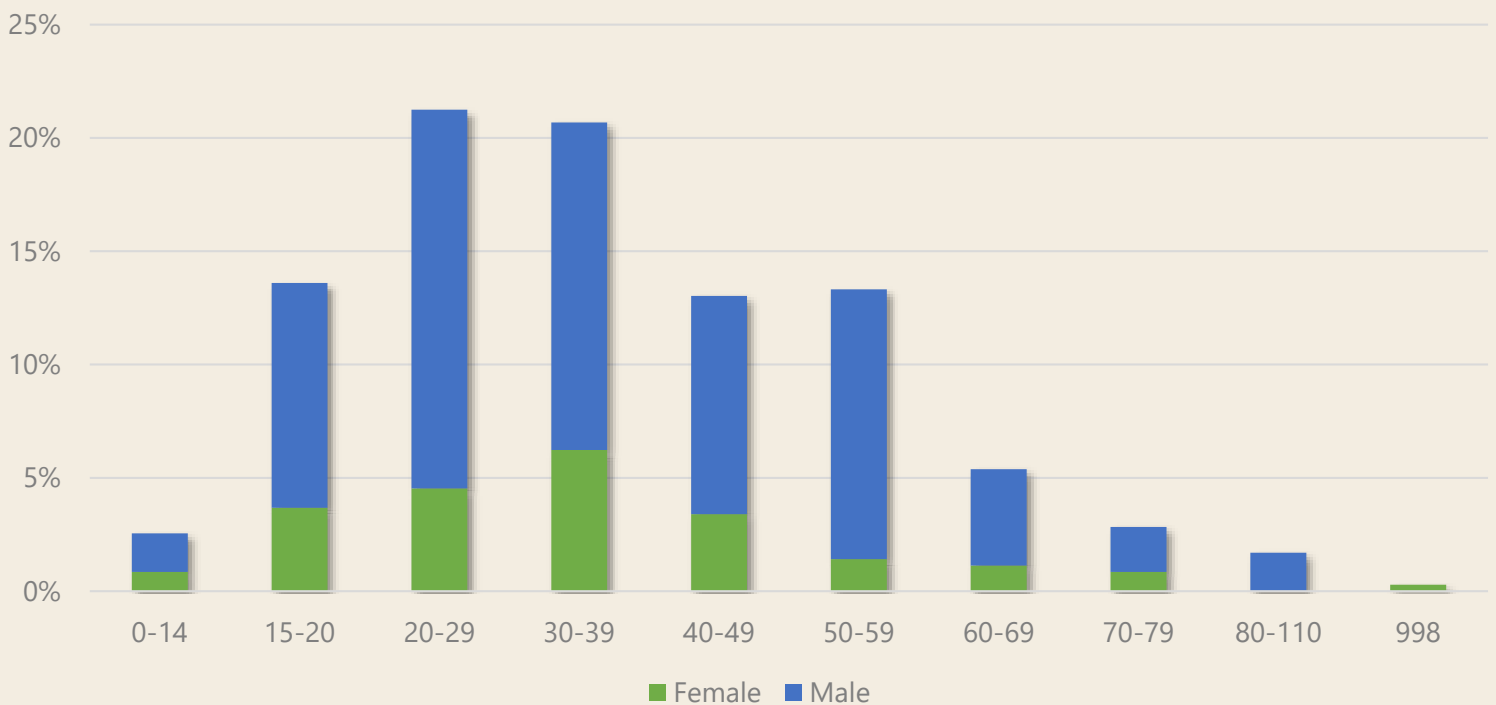
### TIME OF DAY AND LOCATION TYPE

Figure 22 KSI Collisions: Time of Day



### GENDER VS AGE

Figure 23 KSI Collisions: Collisions by Gender and Age



## GEOGRAPHIC COLLISION ANALYSIS

The above collision analysis was used to identify three main collision factors that highlight the top trends among collisions in Yuba County. These three collision factors were identified to be nighttime collisions, hit object collisions, and improper turning type collisions.

### NIGHTTIME COLLISIONS

Collisions occurring at night represented 33% of all injury collisions but rose significantly to 41% when considering KSI collisions only, indicating that lighting may be a factor in those collisions. **Figure 24** shows the distribution of nighttime collisions throughout the Yuba County. Grand Avenue, Feather River Boulevard, and North Beale Road have a higher concentration of nighttime collisions.

### HIT OBJECT COLLISIONS

Hit object collisions resulted in 36% of all injury collisions and 31% of KSI collisions in the County, the highest of any violation type among all injury collisions. **Figure 25** shows the distribution of hit-object collisions throughout the County. Linda Avenue, North Beale Road, and Grove Avenue have a higher concentration of hit-object collisions.

### IMPROPER TURNING VIOLATIONS

Improper turning type collisions accounted for 30% of all injury collisions compared to 26% of KSI collisions. **Figure 26** shows the distribution of improper turning-type collisions throughout the County. Grand Avenue, North Beale Road, and Grove Avenue have a higher concentration of Improper turning collisions.

Figure 24 Countywide Nighttime Collisions

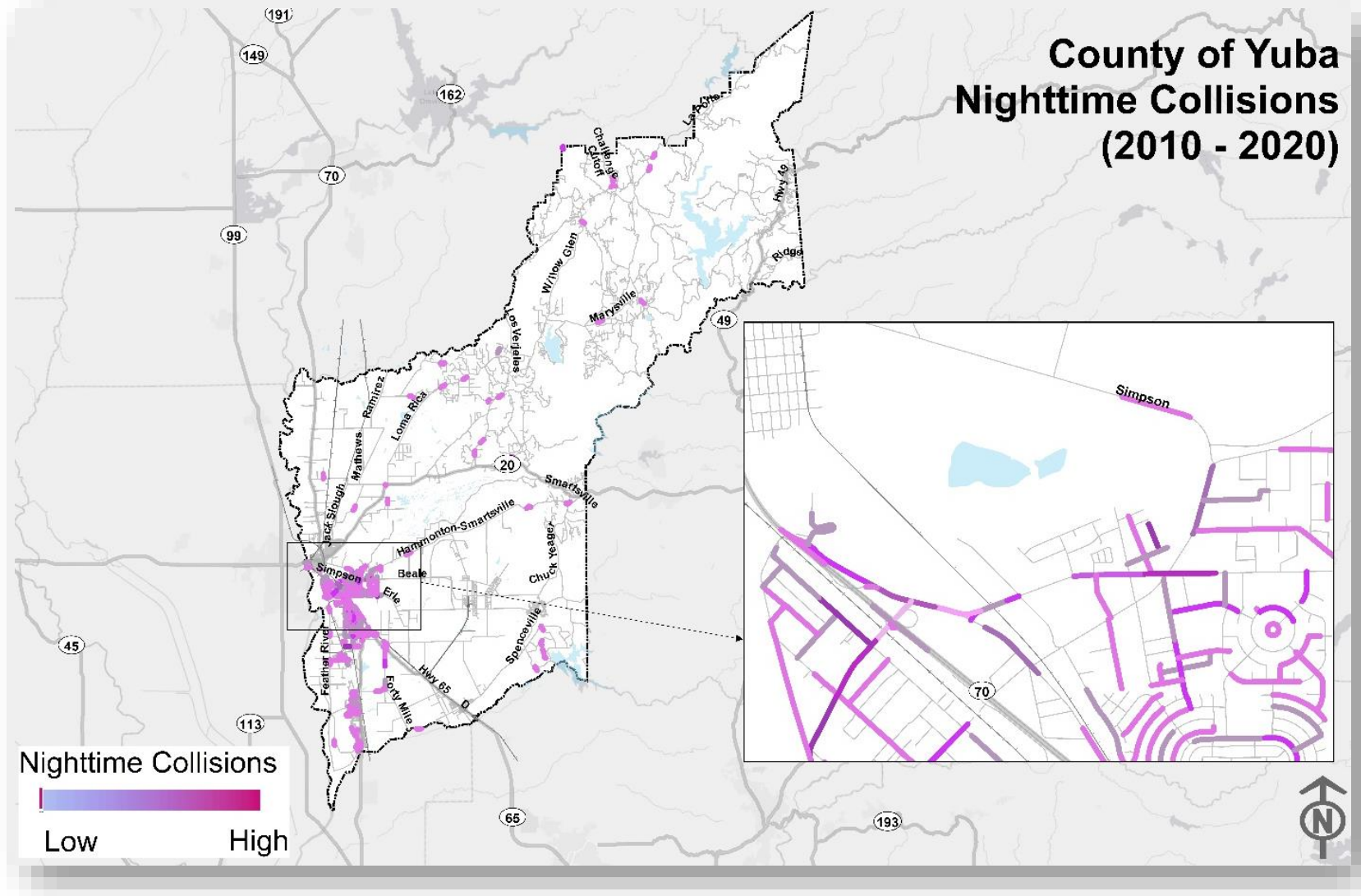


Figure 25 Countywide Hit Object Collisions

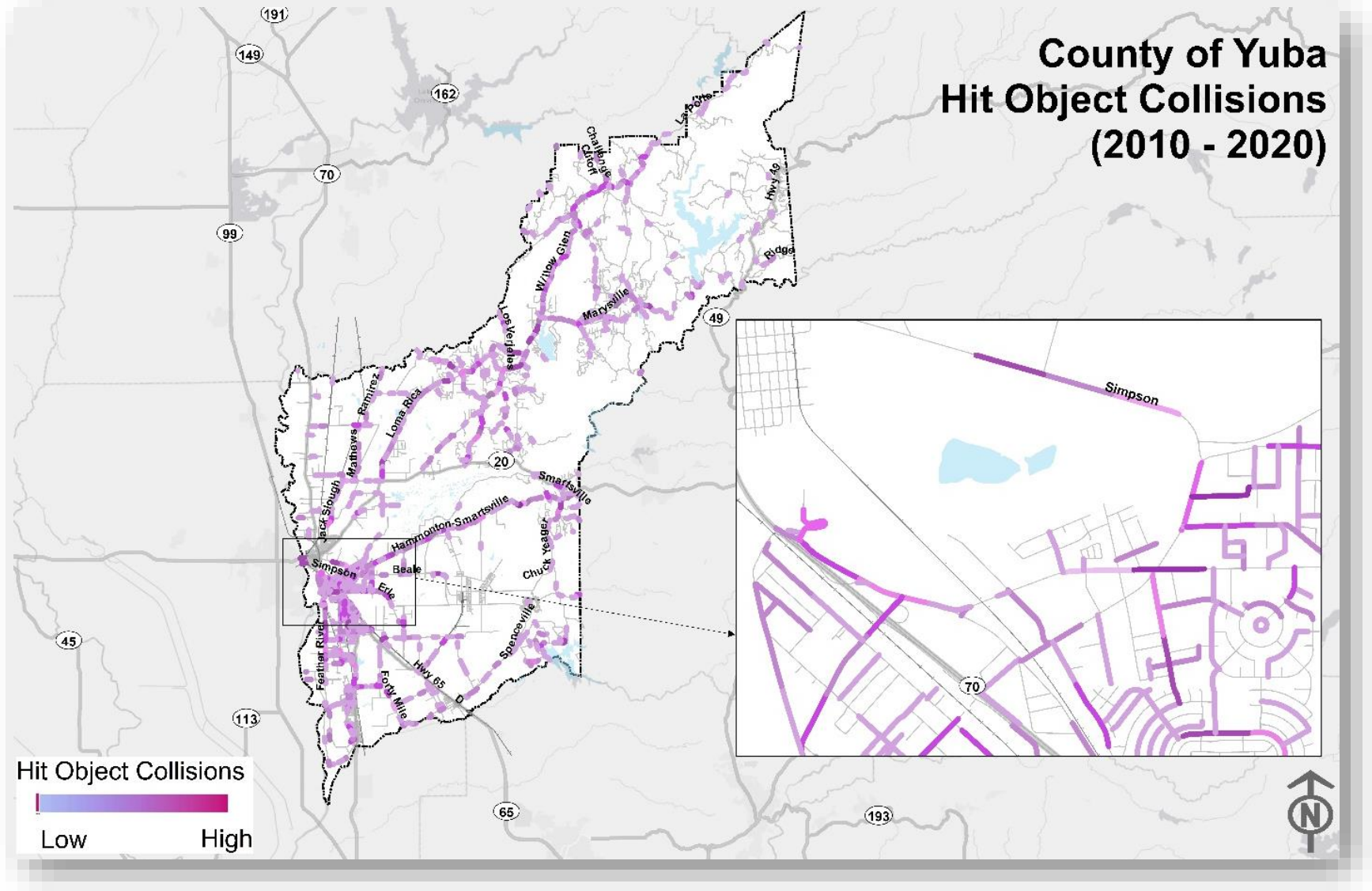
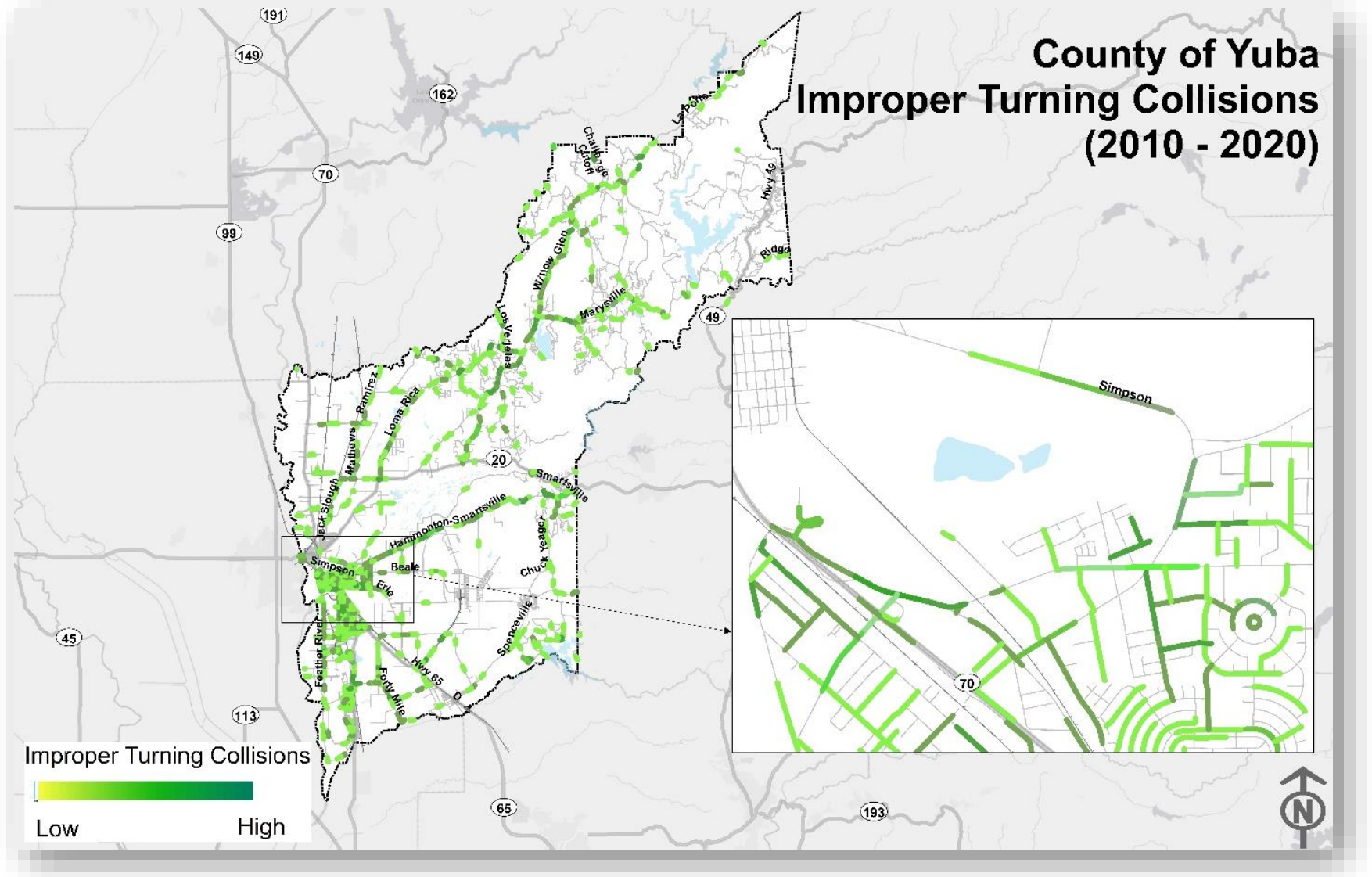


Figure 26 Countywide Improper Turning Violations

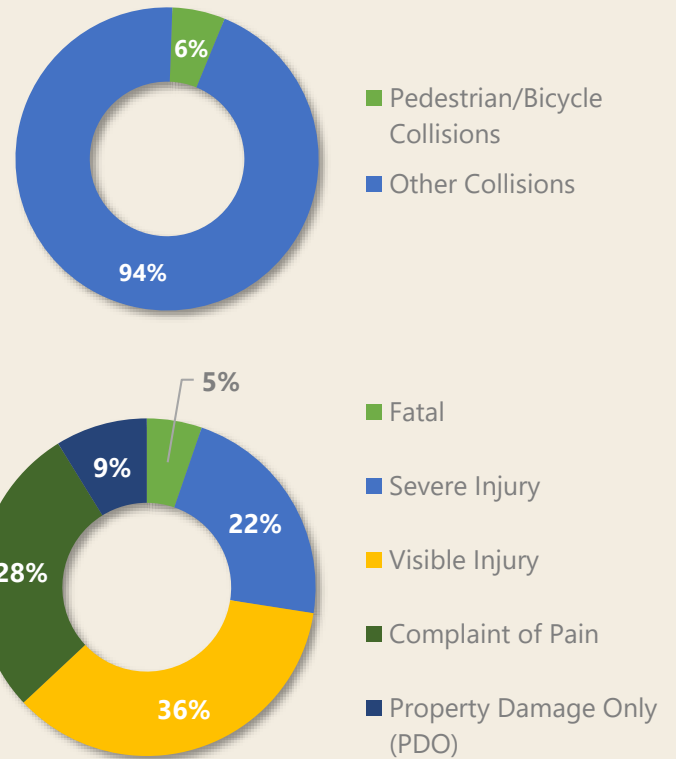


### PEDESTRIAN AND BICYCLE COLLISIONS

Out of 5,046 injury collisions, 284 (6%) involved pedestrian and bicycle collisions. Out of 284 injury collisions, 80 collisions (28%) led to complaint of pain, and 101 collisions (36%) led to visible injury. There were 78 KSI collisions, of which 63 collisions (22%) led to a severe injury, and 15 collisions (5%) led to a fatality. **Figure 27** illustrates the classification of pedestrian and bicycle collisions based on severity on County roads.

People walking or biking are particularly vulnerable in the event of a collision, as they lack the protection afforded to them by being inside a motor vehicle. As a result, collisions involving people walking or biking are more likely to result in injury and fatality.

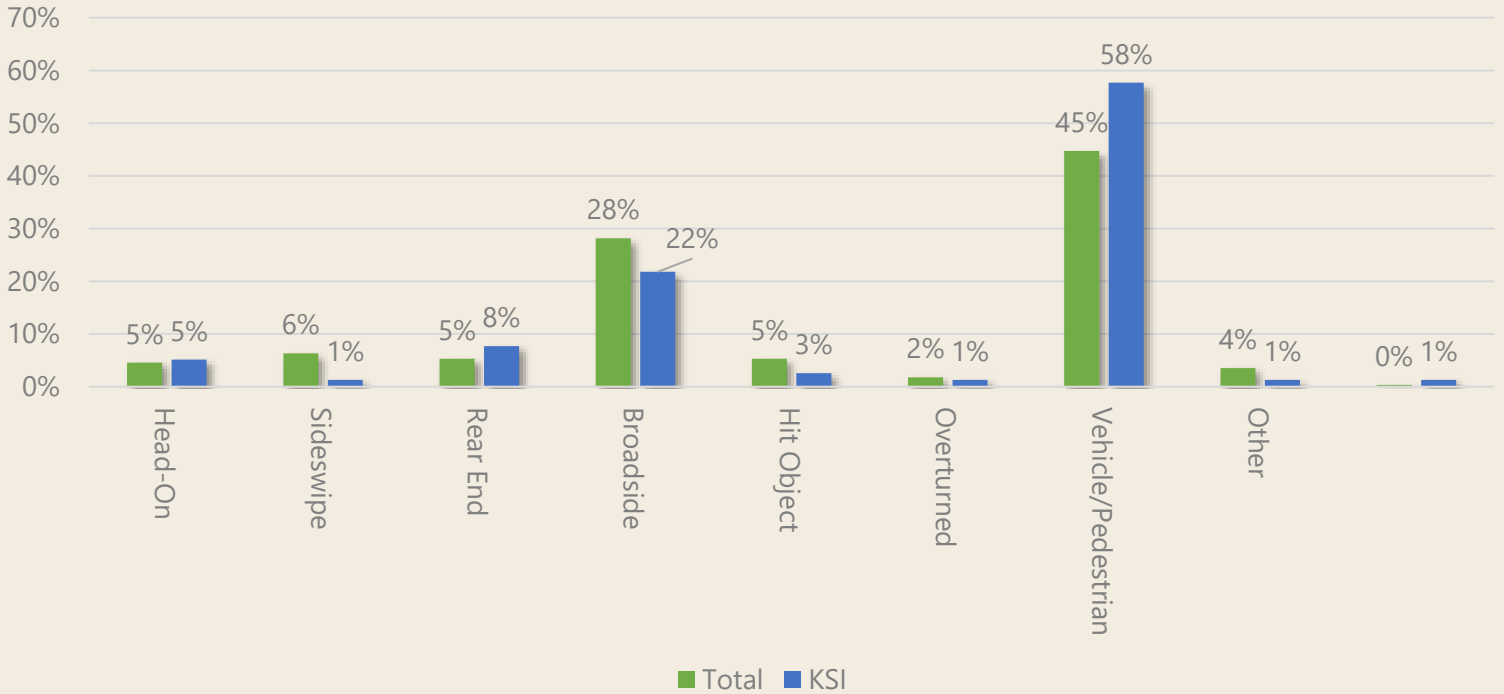
**Figure 27 Pedestrian and Bicycle Collisions**



**Figure 28** and **Figure 29** illustrate all the pedestrian and bicycle collisions that have occurred in the County from January 1<sup>st</sup>, 2015 to December 31<sup>st</sup>, 2019.

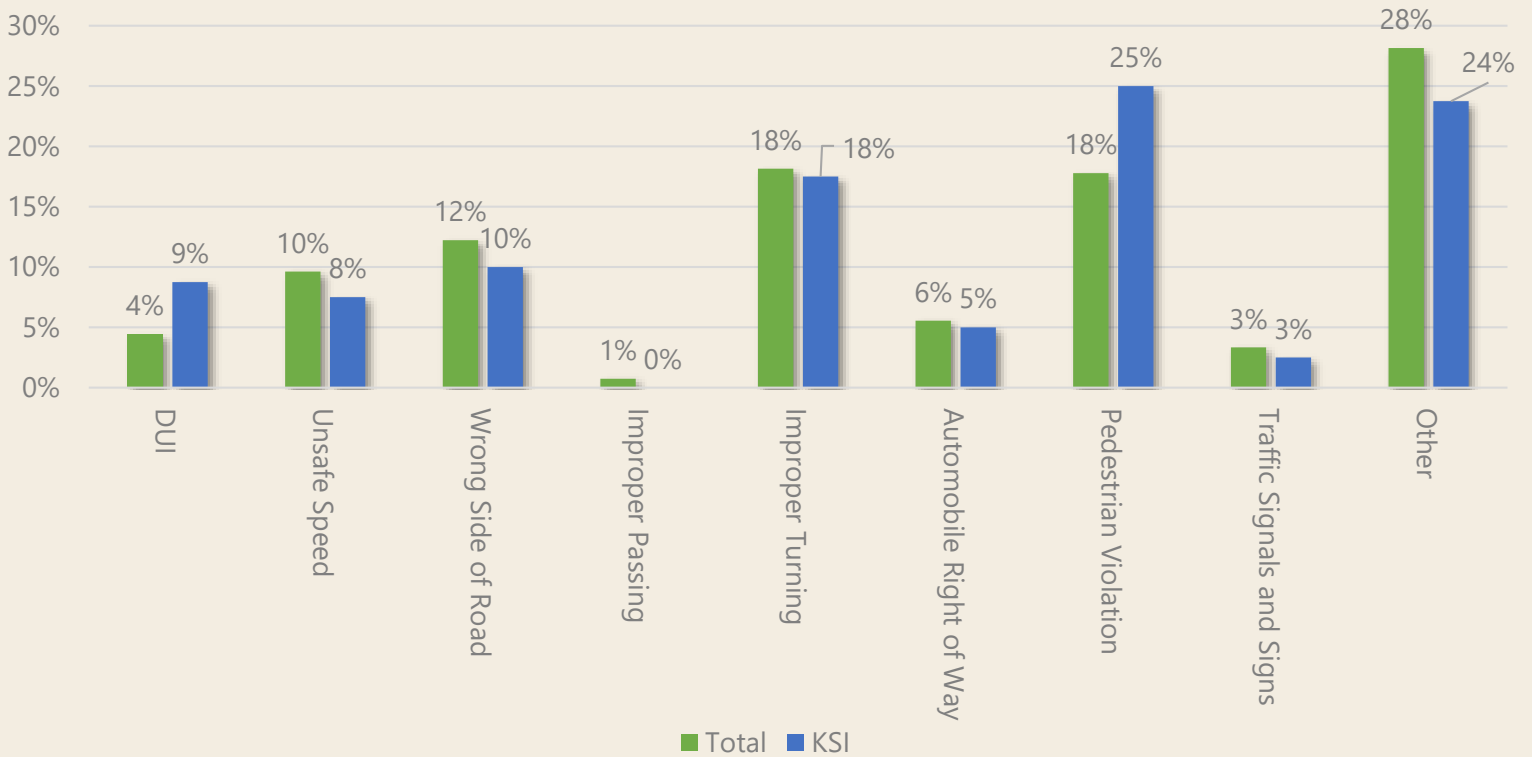
### COLLISION TYPE AND LOCATION TYPE

Figure 28 Pedestrian and Bicycle Collisions: Collision Type



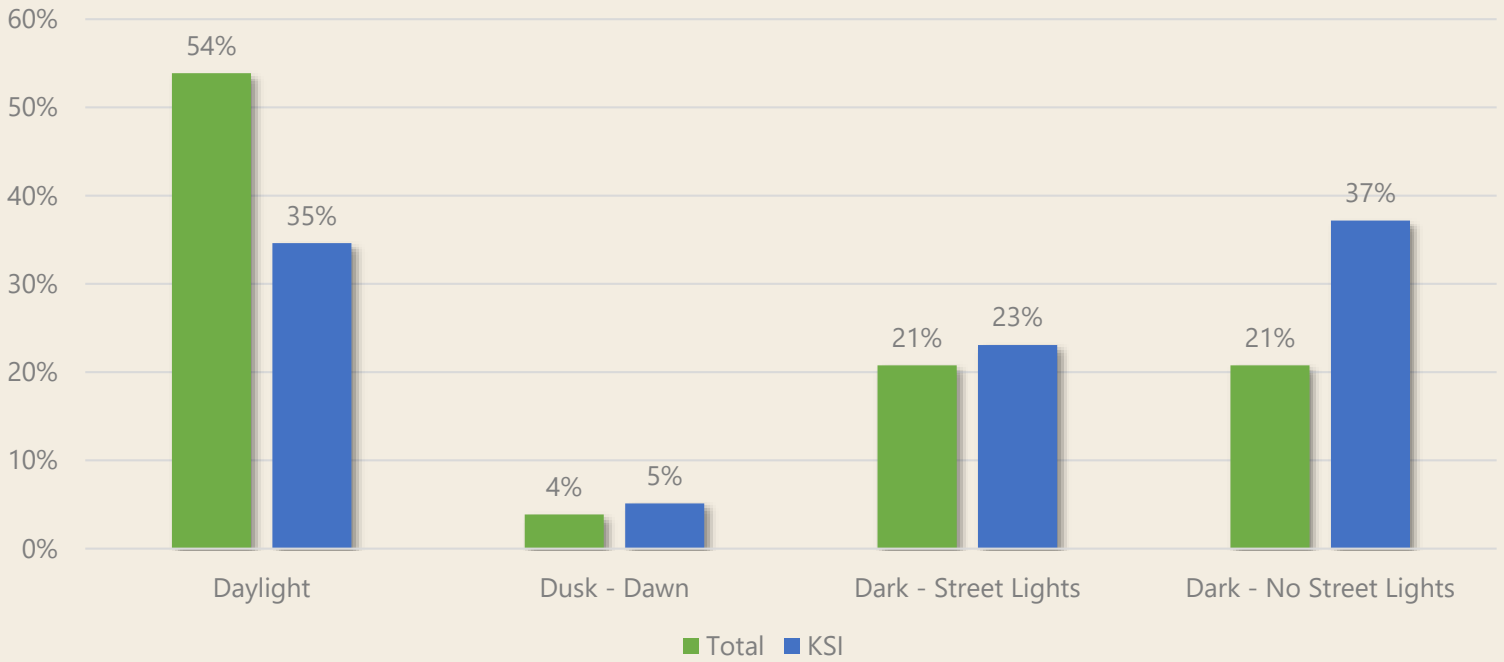
### VIOLATION CATEGORY AND LOCATION TYPE

Figure 29 Pedestrian and Bicycle Collisions: Violation Category Type



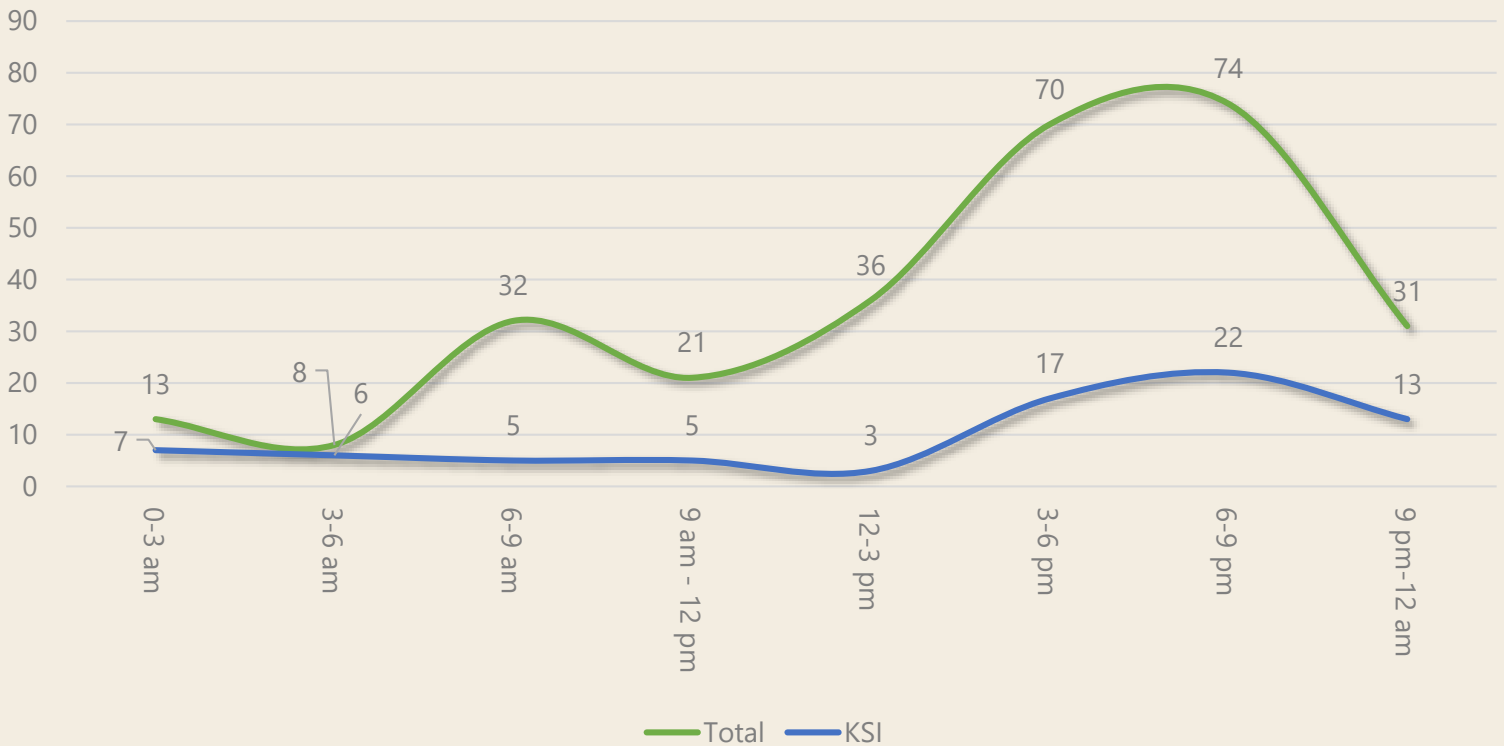
### LIGHTING AND LOCATION TYPE

Figure 30 KSI Collisions: Motor Vehicle Involved With



### TIME OF THE DAY

Figure 31 KSI Collisions: Lighting



### COLLISION SEVERITY WEIGHT

The Equivalent Property Damage Only (EPDO) method was used to identify the high-severity collision network. The EPDO method accounts for both the severity and frequency of collisions by converting each collision to an equivalent number of property damage-only (PDO) collisions. The EPDO method assigns a crash cost and score to each collision according to the severity of the crash weighted by the comprehensive crash cost. These EPDO scores are calculated using a simplified version of the comprehensive crash costs per HSIP Cycle 12 application. The weights used in the analysis are shown below in **Table 4**.

**Table 4 EPDO Score used in HSIP Cycle 12**

Collision Severity	EPDO Score
Fatal and Severe Injury Combined	165*
Visible Injury	11
Possible Injury	6
PDO	1

\*This is the score used in HSIP Cycle 12 for collisions on roadway segments. To simplify the analysis, this study uses the same score for all KSI collisions regardless of location.

EPDO is used because it provides a methodology for the project team to understand the locations in Yuba experiencing the most severe crashes. Because of the high score given to fatal and severe injury crashes, locations that have these types of crashes are more likely to receive a higher EPDO score than other locations that may have more collisions but fewer killed or severe injury collisions. Locations with the highest EPDO scores are selected for inclusion in the high collision network, as shown in the next section. Identified intersections are scored based on collisions occurring at or within 250 feet of the intersection. In contrast, roadway segment locations are identified based on collisions along the segment, except directly at an intersection (0 feet from the intersection per CROSSROADS data). Identifying the locations with the most severe crashes allows the team to focus on recommended solutions and countermeasures at these locations.

The EPDO scores for all injury collisions can then be aggregated in various ways to identify collision patterns, such as location hot spots. The weighted collisions for Yuba County were geolocated onto the County’s road network. GIS is then used to calculate the EPDO score for each roadway segment and intersection Countywide, which is then ranked according to its score.

**Figure 32** shows the location and geographic concentration of collisions by their EPDO score.



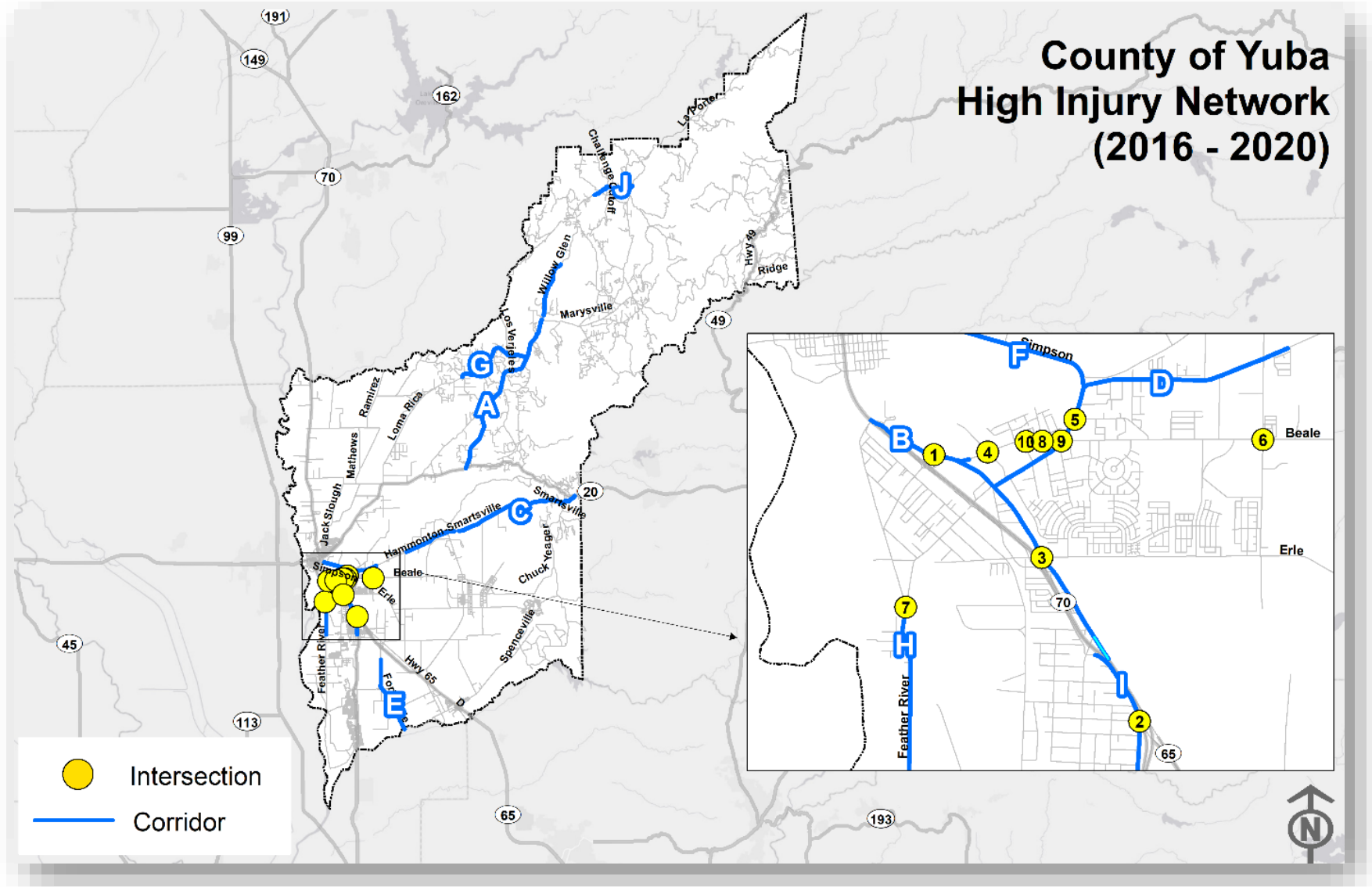
## HIGH INJURY NETWORK

Following the detailed collision analysis, the next step was to identify the high-injury roadway segments and intersections in Yuba County. The methodology for scoring the high-injury locations is the same method as used in the severity weight section. **Figure 33** shows the top 10 high-collision roadway segments and top 10 high-collision intersections.

For the high collision network analysis, intersections include injury collisions that occurred within 250 feet of it, and roadways include all collisions that occurred along the roadway in addition to collisions that occurred directly at an intersection. The weights used in the analysis are shown in **Table 4**.

**Figure 33** illustrates high injury network for intersections and corridors.

Figure 33 Countywide High Injury Network (HIN)



## INTERSECTION RANKING

A total of 10 intersections were identified as high-risk intersections based on high collision severity weight. There were a total of **224 collisions** and **21 KSI collisions** that occurred at these intersections. The intersection of North Beale Road and Feather River Boulevard had the highest number of injury collisions.

**Table 5** lists the collision rate of the top 10 identified high-risk intersections, along with their severity weight and the number of KSI collisions.

**Table 5 High Collision Intersections**

ID	Intersection	Total Injury Collisions	KSI Collisions	Severity Weight
1	N. Beale Rd at Feather River Blvd (Signalized)	79	4	914
2	Powerline Rd at Eighth Ave (Non-Signalized)	11	4	699
3	Erle Rd at Lindhurst Ave (Signalized)	25	2	378
4	N. Beale Rd at Avondale Rd (Non-Signalized)	11	2	364
5	Hammonton-Smartsville Rd at Linda Ave (Non-Signalized)	9	2	370
6	N. Beale Rd at Griffith Rd (Non-Signalized)	14	2	359
7	Feather River Blvd at Grand Ave (Non-Signalized)	5	2	330
8	N. Beale Rd at Park Ave (Non-Signalized)	31	1	269
9	Hammonton-Smartsville Rd at N. Beale Rd (Signalized)	28	1	257
10	N. Beale Rd at Lowe Ave (Non-Signalized)	11	1	211



### CORRIDOR RANKING

A total of 10 corridors were identified as high-collision corridors. There was a total of **704 injury collisions and 78 KSI** collisions on these corridors. The Marysville Road/Willow Glen Road corridor has the highest number of KSI collisions and all injury collisions.

**Table 6** lists the collision rate of the top 10 identified high-collision corridors along with the number of KSI collisions, total collisions, corridor length, and severity weight.

**Table 6 High Injury Corridors**

ID	Corridors	Total	KSI	Length (miles)	Severity Weight
A	Marysville Rd/Willow Glen Rd: SR 20 to 1.1 mi S of Westcott Rd	138	19	15.3	3556
B	N. Beale Rd/Lindhurst Ave: SR 70 (North) to Olivehurst Ave	144	10	3.0	2181
C	Hammonton-Smartsville Rd: 0.1 mi E of Brophy Rd to SR 20	126	11	12.0	2117
D	Hammonton-Smartsville Rd: N. Beale Rd to Wallen Rd	82	7	3.0	1423
E	Forty Mile Rd: 0.6 mi S of SR 65 SB Ramp to Placer County Line	39	7	4.8	1417
F	Simpson Ln: Hammonton-Smartsville Rd to Marysville City Limit	56	6	1.8	1201
G	Loma Rica Rd: Fruitland Rd to Marysville Rd	38	5	5.2	955
H	Feather River Rd: Grand Rd to Murphy Rd	34	5	2.2	918
I	Powerline Rd: 400' E of Olivehurst Rd to McGowan Pkwy	27	5	1.8	882
J	La Porte Rd: Orlando Rd to Old La Porte Rd	20	3	3.0	755



## 5 EMPHASIS AREAS

Emphasis areas are focus areas for the LRSP that are identified through the comprehensive collision analysis of the identified high-injury locations within the County. Emphasis areas help identify appropriate safety strategies and countermeasures with the greatest potential to reduce collisions occurring at these high-injury locations. They can include but are not limited to, specific collision types, human behaviors, facility types, and specific locations or corridors.

This section summarizes the top seven emphasis areas identified for Yuba County. These emphasis areas were derived from the consolidated high-injury collision database (**Appendix C**) where top injury factors were identified from the data. The high-injury collision database contains only collisions occurring at the high-injury intersections or along high-injury corridors. Along with findings from the data analysis, stakeholder input was used to refine the emphasis areas specific to Yuba County.

Based on the systemic safety analysis that helped identify high-injury intersections and roadway segments, the top risk factors and emphasis areas determined for traffic safety in the County are as follows:

- Address hit object collisions
- Address rear end collisions and unsafe speed violations
- Address broadside collisions
- Address nighttime collisions
- Address improper turning collisions
- Address driving under influence collisions
- Reduce overturning collisions

### THE FOUR E'S OF TRAFFIC SAFETY

The LRSP utilizes a comprehensive approach to safety incorporating the “4 E’s of traffic safety”: **E**ngineering, **E**ducation, **E**nforcement, and **E**mergency Medical Services (EMS). This approach recognizes that not all locations can be addressed solely by infrastructure improvements. Incorporating the 4 E’s of traffic safety is often required to ensure the successful implementation of significant safety improvements and reduce the severity and frequency of collisions throughout a jurisdiction.

Some of the common violation types that require a comprehensive approach are speeding, failure to yield to pedestrians, red light running, aggressive driving, failure to wear safety belts, distracted driving, and driving while impaired. When locations are identified as having these types of violations, coordination with the appropriate law enforcement agencies is needed to arrange visible targeted enforcement to reduce the potential for future driving violations and related collisions and injuries.

To improve safety, education efforts can be used to supplement enforcement and improve the efficiency of each strategy. **E**ducation can also be employed in the short term to address high crash locations until the recommended infrastructure project can be implemented. **E**ngineering refers to the design and maintenance of roads, intersections, and other infrastructure elements to maximize safety.

Similarly, **Emergency Medical Services** entails strategies around supporting organizations that provide rapid response and care when responding to collisions causing injury, by stabilizing victims and transporting them to facilities. **Enforcement** involves the implementation and monitoring of traffic laws by law enforcement agencies.

## **FACTORS CONSIDERED IN THE DETERMINATION OF EMPHASIS AREAS**

This section presents collision data analysis of collision type, collision factors, facility type, and roadway geometries, analyzed for the various emphasized areas. Emphasis areas were determined by factors that led to the highest amount of injury collisions, with a specific emphasis on KSI collisions. Yuba County experienced a total of **873** injury collisions at high-injury network locations during the 2010-2020 study period, including **88** KSI collisions. The data presented in each emphasis area is based on these collisions. This section also presents comprehensive programs, policies, and countermeasures to reduce collisions in specific emphasis areas.

Note: Engineering countermeasures are based on the Caltrans Local Roadway Safety Manual (**LRSM**) and are used in HSIP calls for projects. They are categorized as follows:

- S = Signalized Intersections Countermeasures
- NS = Non-Signalized Intersections Countermeasures
- R = Roadway Segments Countermeasures

Each emphasis area is accompanied by comprehensive programs, policies, and countermeasures to reduce collisions on County roads in that specific emphasis area. It will provide the basis by which the countermeasure toolbox is developed for each identified high-injury location.

An excerpt of the LRSM providing additional details on each countermeasure is included in **Appendix D**.

### EMPHASIS AREA 1 – ADDRESS HIT OBJECT TYPE COLLISIONS

In Yuba County, 283 collisions (32%) of high-injury network collisions are categorized as hit object collisions. Out of these, 21 collisions (7%) resulted in KSI collisions. The primary causes of these hit object collisions include driving under the influence at 19%, improper turning at 53%, and nighttime collisions at 40%. To address this issue, 4 E's strategies have been outlined in **Table 7**, offering comprehensive approaches to mitigate the impact of hit object collisions on the high injury network in Yuba County.

**Table 7 Emphasis Area 1 Strategies**

Objective:

**Reduce the number of KSI collisions that occur due to collision with fixed objects.**

	Strategy	Performance Measure	Organizations
Education	Conduct public information and education campaigns on risks that can lead to hit-object collisions, such as unsafe speeds, distracted driving, improper turning, and driving under the influence.	Number of education campaigns or residents reached.	County/Sheriff Department
Enforcement	Targeted enforcement at high-injury locations where hit-object collisions are more common.	Decrease in the number of citations and/or warnings issued over time due to increased driver compliance.	Sheriff Department
Engineering	<ul style="list-style-type: none"> <li>• S10/NS09, Install flashing beacon as advance warning</li> <li>• NS06, Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs</li> <li>• R01, Add Segment Lighting</li> <li>• R02, Remove or relocate fixed objects outside of the Clear Recovery Zone</li> <li>• R04, Install Guardrail</li> <li>• R15, Widen shoulder</li> <li>• R16, Curve shoulder widening (Outside Only)</li> <li>• R17, Improve horizontal alignment (flatten curves)</li> <li>• R21, Improve pavement friction (High Friction Surface Treatments)</li> <li>• R22, Install/Upgrade signs with new fluorescent sheeting (regulatory or warning)</li> <li>• R23, Install chevron signs on horizontal curves</li> <li>• R24 or R25, Install curve advance warning signs</li> <li>• R26, Install dynamic/variable speed warning signs</li> <li>• R27, Install delineators, reflectors, and/or object markers</li> <li>• R28, Install edge-lines and centerlines</li> <li>• R31, Install edge-line rumble strips/strips</li> </ul>	A number of locations improved.	County
EMS	S05, Install emergency vehicle pre-emption systems. Improve resource deployment for emergency responses to collision sites. Ensure emergency routes are clear and well-defined. Increase the number of EMS personnel taking Traffic Incident Management Training.	EMS vehicle response time.	County/Fire Department & EMS Response Teams

## EMPHASIS AREA 2 – ADDRESS REAR END COLLISIONS AND UNSAFE SPEED

Rear end collisions comprised 235 collisions (26%) of high-injury network collisions. Out of these, five collisions resulted in KSI collisions. Unsafe speed violations contributed to 255 collisions (29%) of high injury network collisions. Focusing specifically on rear-end collisions, three key factors emerged, 73% were a result of unsafe speed, 15% occurred on Hammonton Smartville Road, and 22% transpired during nighttime. To address these challenges, **Table 8** outlines 4 E's strategies tailored to mitigate the occurrence and impact of rear-end collisions in high injury network.

**Table 8 Emphasis Area 2 Strategies**

Objective:

Reduce the number of KSI rear end and unsafe speed collisions.

	Strategy	Performance Measure	Organizations
Education	Conduct public information and education campaign for safety laws regarding unsafe speed and its dangers.	Number of education campaigns or residents reached.	County/Sheriff Department
Enforcement	Targeted enforcement at high-injury locations where unsafe speed violations are more common. Deploy a radar trailer at locations where instances of unsafe speed are more prevalent.	Decrease in a number of citations and/or warnings issued over time due to increased driver compliance.	Sheriff Department
Engineering	<ul style="list-style-type: none"> <li>• S02/S03, Improve signal hardware &amp; timing</li> <li>• S16/NS04/NS05, Convert intersection to roundabout</li> <li>• NS01, Add intersection lighting (NS.I.)</li> <li>• NS07, Upgrade intersection pavement markings (NS.I.)</li> <li>• NS08, Install Flashing Beacons at Stop-Controlled Intersections</li> <li>• NS09, Install flashing beacons as advance warning (NS.I.)</li> <li>• NS10, Install transverse rumble strips on approaches</li> <li>• NS12, Improve pavement friction (High Friction Surface Treatments)</li> <li>• R01, Add Segment Lighting</li> <li>• R14, Road Diet (Reduce travel lanes from 4 to 3 and add a two way left-turn and bike lanes)</li> <li>• R21, Improve pavement friction (High Friction Surface Treatments)</li> <li>• R22, Install/Upgrade signs with new fluorescent sheeting (regulatory or warning)</li> <li>• R26, Install dynamic/ variable speed warning signs</li> <li>• R27, Install delineators, reflectors and/or object markers</li> <li>• R28, Install edge-lines and centerlines</li> <li>• Simplify turn configurations.</li> <li>• Decrease curb radius of intersections.</li> <li>• Traffic calming strategies where appropriate.</li> </ul>	Number of locations improved.	County
EMS	S05, Install emergency vehicle pre-emption systems Improve resource of deployment for emergency responses to collision sites. Ensure that emergency routes are clear and well defined.	EMS vehicle response time.	County/Fire Department & EMS Response Teams



### EMPHASIS AREA 3 – ADDRESS BROADSIDE COLLISIONS AND AUTOMOBILE RIGHT OF WAY VIOLATIONS

Broadside collisions contribute to 123 collisions (14%) on the high injury network. Out of these 10 collisions resulted in KSI collisions. Broadside collisions accounted for 8% of all KSI collisions. Focusing specifically on broadside injury collisions, predominant factors include violations of the automobile right of way at 50%, nighttime collisions at 32%, and occurrences at intersections at 45%. Addressing these concerns, **Table 9** outlines 4 E's strategies tailored to mitigate the occurrence and impact of broadside collisions in high-injury network.

**Table 9 Emphasis Area 3 Strategies**

**Objective:**

**Reduce the number of KSI broadside collisions and automobile right-of-way violations**

	Strategy	Performance Measure	Organizations
Education	Conduct public information and education campaigns for intersection safety laws regarding traffic lights, stop signs, and turning left or right.	Number of education campaigns or residents reached.	County/Sheriff Department
Enforcement	Targeted enforcement at high-injury locations where violations that lead to broadside collisions are more common, such as automobile right-of-way and traffic signal/stop sign violations.	Decrease in number of citations and/or warnings issued over time due to increased driver compliance.	Sheriff Department
Engineering	<ul style="list-style-type: none"> <li>S02, Improve signal hardware: lenses, back-plates with retroreflective borders, mounting, size, and number</li> <li>S03, Improve signal timing (coordination, phases, red, yellow, or operation)</li> <li>S09, Install raised pavement markers and striping (Through Intersection)</li> <li>S16/NS04/NS05, Convert intersection to roundabout</li> <li>NS02, Convert to all-way STOP control (from 2-way or Yield control)</li> <li>NS03, Install signals</li> <li>NS06, Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs</li> <li>NS07, Upgrade intersection pavement markings (NS.I.)</li> <li>NS08, Install flashing beacons at stop controlled intersections</li> <li>NS09, Install flashing beacons as advance warning (NS.I.)</li> <li>NS11, Improve sight distance to intersection (Clear Sight Triangles)</li> <li>NS13, add splitter-islands on the minor road approaches</li> <li>NS14, install raised median on approaches</li> <li>NS18, Install left-turn lane (where no left-turn lane exists)</li> </ul>	Number of locations improved to mitigate broadside collisions.	County
EMS	S05, Install emergency vehicle pre-emption systems. Improve resource of deployment for emergency responses to collision sites. Ensure that emergency routes are clear and well defined	EMS vehicle response time.	County/Fire Department & EMS Response Teams

### EMPHASIS AREA 4 – ADDRESS NIGHTTIME COLLISIONS

276 collisions (32%) occurred during nighttime or under low-light conditions. Among these collisions, 88 were classified as KSI collisions. Focusing on nighttime collisions, the primary contributing factors were improper turning at 28%, incidents occurring in the dark without streetlights at 58%, and hit object collisions at 40%. To address these challenges, **Table 10** outlines 4 E's strategies tailored to mitigate the occurrence and impact of nighttime collisions in high injury network.

**Table 10 Emphasis Area 4 Strategies**

Objective:

**Reduce the number of KSI collisions that occur during night or at dawn/dusk.**

	Strategy	Performance Measure	Organizations
Education	Develop an awareness program to inform motorists of safe nighttime driving habits and the dangers of drunk driving, as well as high-injury collision locations and the most common violations/collision types occurring at night.	Number of education campaigns or residents reached.	County/Sheriff Department
Enforcement	Targeted enforcement at high-injury intersections and roadway locations where nighttime collisions are more common.  Establish DUI checkpoints at night where appropriate.	Decrease in number of citations and/or warnings issued over time due to increased driver compliance.	Sheriff Department
Engineering	<ul style="list-style-type: none"> <li>• S01, Add intersection lighting (Signalized Intersection S.I.)</li> <li>• S02, Improve signal hardware</li> <li>• S10, Install flashing beacons as advance warning (S.I.)</li> <li>• NS01, Add intersection lighting</li> <li>• NS06, Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs</li> <li>• NS07, Upgrade intersection pavement markings (NS.I.)</li> <li>• NS08, Install Flashing Beacons at Stop-Controlled Intersections</li> <li>• NS09, Install flashing beacons as advance warning (NS.I.)</li> <li>• NS10, Install transverse rumble strips</li> <li>• NS22PB, Install Rectangular Rapid Flashing Beacon (RRFB)</li> <li>• R01, Add Segment Lighting</li> <li>• R02, Remove or relocate fixed objects outside of Clear Recovery Zone</li> <li>• R22, Install/Upgrade signs with new fluorescent sheeting (regulatory or warning)</li> <li>• R27, Install delineators, reflectors and/or object markers</li> <li>• R28, Install edge-lines and centerlines</li> <li>• R30, Install centerline rumble strips/stripes</li> <li>• R31, Install edge-line rumble strips/stripes</li> </ul>	Number of locations improved.	County
EMS	S05, Install emergency vehicle pre-emption systems Improve resource of deployment for emergency responses to collision sites. Ensure that emergency routes are clear and well defined	EMS vehicle response time.	County/Fire Department & EMS Response Teams



### EMPHASIS AREA 5 – ADDRESS IMPROPER TURNING COLLISION

Within the high-injury network collisions, 246 collisions (28%) stemmed from violations related to improper turning. Among these collisions, 29 were identified as resulting in KSI collisions. Focusing specifically on improper turning collisions, noteworthy details include 57% involving fixed objects, 32% occurring during nighttime, and 68% transpiring on various roadway segments. To address these issues, **Table 11** outlines 4 E's strategies tailored to mitigate the occurrence and impact of improper turning collisions in high-injury network.

**Table 11 Emphasis Area 5 Strategies**

Objective:

**Reduce the number of KSI collisions that occur due to improper turning violations**

	Strategy	Performance Measure	Organizations
Education	Conduct public information and education campaigns for intersection safety laws and the rules of the road.	Number of education campaigns or residents reached.	County/Sheriff Department
Enforcement	Targeted enforcement at high-injury locations where improper turning violations are more common.	Decrease in number of citations and/or warnings issued over time due to increased driver compliance.	Sheriff Department
Engineering	<ul style="list-style-type: none"> <li>• S01/NS01/R01, Add Lighting</li> <li>• S02, Improve signal hardware</li> <li>• S03, Improve signal timing (coordination, phases, red, yellow, or operation)</li> <li>• S09, Install raised pavement markers and striping (Through Intersection)</li> <li>• S12/NS14, Install raised median on approach</li> <li>• S14, Create directional median openings to allow (and restrict) turns</li> <li>• S16/NS04/NS05, Convert intersection to roundabout</li> <li>• NS06, Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs</li> <li>• NS07, Upgrade intersection pavement markings (NS.I.)</li> <li>• NS13, Install splitter islands on minor road approaches</li> <li>• R04, Install guard rail</li> <li>• R15, Widen shoulders</li> <li>• R16, Curve shoulder widening (outside only)</li> <li>• R17, Improve horizontal alignment (flatten curves)</li> <li>• R22, Install/Upgrade signs with new fluorescent sheeting</li> <li>• R27, Install delineators, reflectors and/or object markers</li> <li>• R26, Install dynamic/variable speed warning signs</li> <li>• R28, Install edge-lines and centerlines</li> <li>• R31, Install edge-line rumble strips/stripes</li> </ul>	Number of locations improved.	County
EMS	<p>S05, Install emergency vehicle pre-emption systems.</p> <p>Improve resource of deployment for emergency responses to collision sites.</p> <p>Ensure that emergency routes are clear and well defined.</p>	EMS vehicle response time.	County/Fire Department & EMS Response Teams



### EMPHASIS AREA 6 – ADDRESS DRIVING UNDER INFLUENCE (DUI) COLLISIONS

Within the high-injury network, 92 collisions (10%) were linked to driving under influence (DUI), leading to 20 collisions classified as KSI collisions. DUI related collisions accounted for 23% of the county's overall collisions. Focusing on DUI collisions, predominant factors include 60% involving fixed objects, 56% occurring at nighttime, and 57% transpiring on various roadway segments. Addressing these challenges, **Table 12** outlines 4 E's strategies tailored to mitigate the occurrence and impact of DUI collisions in high injury network.

**Table 12 Emphasis Area 6 Strategies**

Objective:

**Reduce the number of KSI collisions that occur due to driving under the influence.**

	Strategy	Performance Measure	Organizations
Education	Conduct safety campaigns and outreach for safety laws regarding driving under the influence, such as existing CHP campaigns to address drunk driving.	Number of education campaigns	County/CHP
Enforcement	Targeted enforcement at high-risk intersections and roadway locations to monitor violations of driving under influence. Establish DUI checkpoints near high-risk locations as appropriate.	Number of tickets issued.	CHP
Engineering	<ul style="list-style-type: none"> <li>S02, Improve signal hardware: lenses, back-plates with retroreflective borders, mounting, size, and number</li> <li>S09, Install raised pavement markers and striping (Through Intersection)</li> <li>NS06, Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs NS07, Upgrade intersection pavement markings (NS.I.)</li> <li>NS09, Install flashing beacons as advance warning (NS.I.)</li> <li>R01, Add Segment Lighting</li> <li>R02, Remove or relocate fixed objects outside of Clear Recovery Zone</li> <li>R04, Install Guardrail</li> <li>R15, Widen shoulder</li> <li>R22, Install/Upgrade signs with new fluorescent sheeting (regulatory or warning)</li> <li>R27, Install delineators, reflectors and/or object markers</li> </ul>	Number of locations improved.	County
EMS	S05, Install emergency vehicle pre-emption systems. Improve resource deployment and clear routes for emergency responses to collision sites.	EMS vehicle response time.	Fire Districts & EMS Response Teams



## EMPHASIS AREA 7 – REDUCE OVERTRUNING OF COLLISIONS

In the high injury network, 68 collisions (8%) resulted in overturned vehicles, with 17 collisions leading to KSI collisions. Among these collisions, 58% were attributed to improper turning, 73% occurred on various roadway segments, and 25% resulted in KSI collisions. To address these challenges, **Table 13** outlines 4 E's strategies tailored to mitigate the occurrence and impact of overturned collisions in high injury network.

**Table 13 Emphasis Area 7 Strategies**

Objective:

**Reduce the number of KSI collisions that occur due to an overturned vehicle.**

	Strategy	Performance Measure	Organizations
Education	Conduct safety campaigns and outreach to raise awareness of safety needs against roadway departure crashes, such as unsafe speeds, distracted driving, improper turning, and driving under the influence.	Number of education campaigns	County/CHP
	Continue to utilize existing CHP education campaigns/classes, such as Start Smart.		
Enforcement	Targeted enforcement at high-risk intersections and roadway locations to monitor violations that could lead to an overturned collision, such as unsafe speed, distracted driving, or DUI.	Number of tickets issued.	CHP
Engineering	<ul style="list-style-type: none"> <li>S09, Install raised pavement markers and striping (Through Intersection)</li> <li>NS07, Upgrade intersection pavement markings (NS.I.)</li> <li>R01, Add Segment Lighting</li> <li>R04, Install Guardrail</li> <li>R06 or R07, Flatten side slopes</li> <li>R15, Widen shoulder</li> <li>R16, Curve Shoulder widening (Outside only)</li> <li>R17, Improve horizontal alignment (flatten curves)</li> <li>R22, Install/Upgrade signs with new fluorescent sheeting (regulatory or warning)</li> <li>R24 or R25, Install curve advance warning signs</li> <li>R26, Install dynamic/variable speed warning signs</li> <li>R28, Install edge-lines and centerlines</li> <li>R31, Install edge-line rumble strips/stripes</li> </ul>	Number of locations improved.	County
EMS	S05, Install emergency vehicle pre-emption systems. Improve resource deployment and clear routes for emergency responses to collision sites.	EMS vehicle response time.	Fire Districts & EMS Response Teams

## 6 COUNTERMEASURE SECTION



### IDENTIFICATION OF COUNTERMEASURES

Following the identification of high-risk locations and emphasis areas was the identification of appropriate safety countermeasures. The Caltrans LRSM provides 82 countermeasures, of which 21 are eligible in the current HSIP call for signalized intersections, 23 for un-signalized intersections, and 38 for roadway segments. The LRSM guides where to apply the countermeasures including the crash types each countermeasure would address, and a Crash Reduction Factor (CRF) for each countermeasure. [The Federal Highway Administration \(FHWA\) CME Clearinghouse](#) and published research papers were reviewed by the project team to gain additional insight into CRFs and the effectiveness of specific countermeasures.

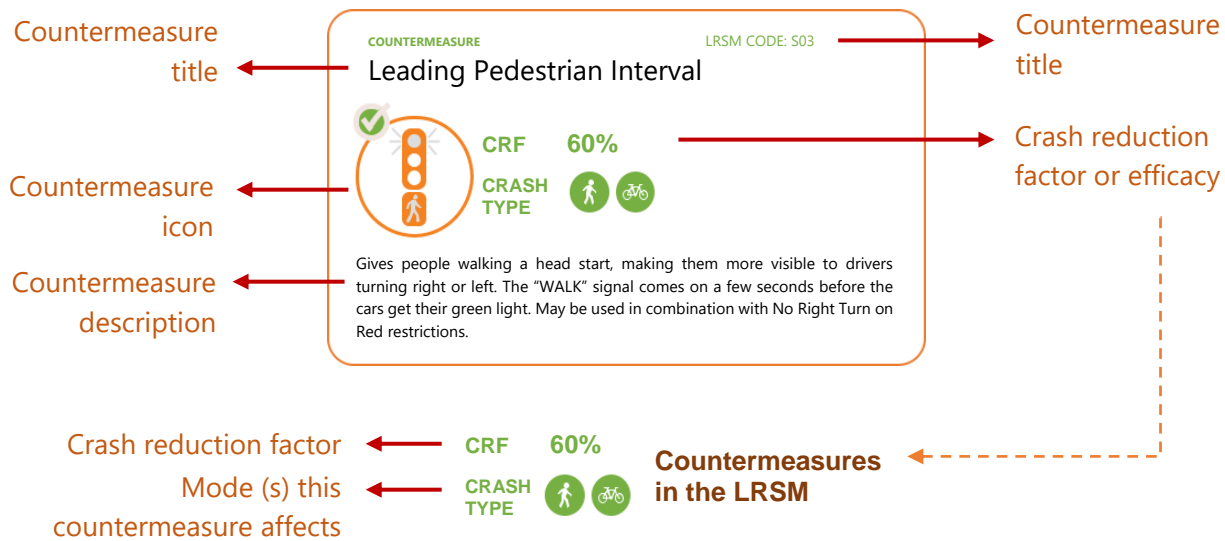
The project team reviewed the high-injury locations (intersections and roadway segments) using aerial photography, Google Maps Street View software, and site visits. Crash characteristics of all injury collisions occurring on the High Injury Network were considered. After combining the physical and collision characteristics, the project team developed a table of preliminary countermeasures that address each of the five identified Emphasis Areas. Below are countermeasures for each high-risk location that were most commonly recommended among all Emphasis Areas. By doing this, the project team was able to identify countermeasures with the most significant opportunity for funding and systemic implementation.

## COUNTERMEASURE TOOLBOX

Engineering countermeasures were selected for each of the high-risk locations and the emphasis areas. These were based on approved countermeasures from the Caltrans LRSM used in HSIP grant calls for projects. The intention is to give the County potential countermeasures for each location that can be funded and implemented either in future HSIP calls for projects or using other funding sources, such as the County’s Capital Improvement Program. Non-engineering countermeasures were also selected using the 4 E’s strategies and are included in the emphasis areas. The countermeasure toolbox in **Appendix D** details the countermeasures for each high-risk location and emphasis area, separated by intersections and roadway segments. While some of these countermeasures might not be ideal for some safety projects, they are included to give the County a toolbox for implementing future safety improvements through other means, such as the Capital Improvement Program (CIP).

The countermeasures listed below are recommended countermeasures for high-injury intersections and corridors. This list below provides a description of each countermeasure along with the CRF, federal funding eligibility, and opportunity for systemic implementation. An excerpt of the LRSM detailing each available HSIP countermeasure referenced in the recommendations tables is included as **Appendix E**.

## WHAT YOU’LL SEE IN THIS TOOLBOX



### Safety Research Sources

Application of Pedestrian Crossing Treatments for Streets and Highways, NCHRP, 2016.  
 California Local Roadway Safety Manual, Caltrans, FHWA & SafeTrec, 2020.  
 Development of Crash Modification Factors for Uncontrolled Pedestrian Crossing Treatments, NCHRP, 2017.  
 Evaluation of Bicycle-Related Roadway Measures, Pedestrian and Bicycle Information Center, 2014.  
 Evaluation of Pedestrian-Related Roadway Measures, Pedestrian and Bicycle Information Center, 2014.

### A. COUNTERMEASURES FOR SIGNALIZED INTERSECTIONS

COUNTERMEASURE LRSM CODE: S01

#### Intersection Lighting



CRF 40%

CRASH TYPE

Providing lighting at the intersection, or both at the intersection and on its approaches improves the safety of an intersection during nighttime conditions.

COUNTERMEASURE LRSM CODE: S07

#### Protected Left Turn Phase



CRF 30%

CRASH TYPE

Signalized intersections (with existing left turns pockets) that currently have a permissive left-turn or no left-turn protection that have a high frequency of angle crashes involving left turning, opposing through vehicles, and non-motorized road users

COUNTERMEASURE LRSM CODE: S02

#### Improve Signal Hardware



CRF 15%

CRASH TYPE

Includes New LED lighting, signal back plates, retro-reflective tape outlining the back plates, or visors to increase signal visibility, larger signal heads, relocation of the signal heads, or additional signal heads.

COUNTERMEASURE LRSM CODE: S09

#### Raised Pavement Marking & Striping



CRF 10%

CRASH TYPE

Adding clear pavement markings can safely guide pedestrian through complex intersections and approaches.

COUNTERMEASURE LRSM CODE: S03

#### Improve Signal Timing



CRF 15%

CRASH TYPE

Includes adding phases, lengthening clearance intervals, eliminating or restricting higher-risk movements, and coordinating signals at multiple locations.

COUNTERMEASURE LRSM CODE: S10

#### Flashing Beacons as advance warning



CRF 30%

CRASH TYPE

Increases driver awareness of an approaching signalized intersection and increases the driver's time to react.

COUNTERMEASURE LRSM CODE: S06

#### Left-Turn Lane and Add Turn Phase



CRF 55%

CRASH TYPE

Install left turn lane or a related left-turn phase that are experiencing a large number of crashes. Many intersection safety problems can be traced to difficulties in accommodating left-turning vehicles or where there is no accommodation for left turning traffic.

COUNTERMEASURE LRSM CODE: S11

#### Install Pavement Friction



CRF 55%

CRASH TYPE

Signalized Intersections noted as having crashes on wet pavements or under dry conditions when the pavement friction available is significantly less than needed for the actual roadway approach speeds.

COUNTERMEASURE LRSB CODE: S12

**Raised Median on Approach**



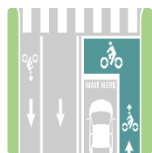
CRF 25%

CRASH TYPE

Raised medians next to left turn lanes at intersections offer a cost-effective means for reducing crashes and improving operations at higher-volume intersections

COUNTERMEASURE LRSB CODE: S20PB

**Advance stop bar before crosswalk**



CRF 15%

CRASH TYPE

Signalized Intersections with a marked crossing, where significant bicycle and/or pedestrian volumes are known to occur.

COUNTERMEASURE LRSB CODE: S21PB

**Leading Pedestrian Interval (LPI)**



CRF 60%

CRASH TYPE

The addition of LPI allows pedestrians to enter an intersection 3-7 seconds before vehicles are given a green indication; only minor signal timing alteration is required.

**B. COUNTERMEASURES FOR NON- SIGNALIZED INTERSECTIONS**

COUNTERMEASURE LRSB CODE: NS01

**Intersection Lighting**



CRF 40%

CRASH TYPE

Intersection lighting improves the ability of drivers to see pedestrians and cyclists, thus decreasing accidents involving them during nighttime. Additionally, it enhances driver awareness and response time.

COUNTERMEASURE LRSB CODE: NS07

**Intersection Pavement Marking**



CRF 25%

CRASH TYPE

The visibility of intersections and, thus, the ability of approaching drivers to perceive them can be enhanced by installing appropriate pavement delineation in advance of and at intersections will provide approaching motorists with additional information at these locations.

COUNTERMEASURE LRSB CODE: NS06

**Large or Additional Stop Signs**



CRF 15%

CRASH TYPE

New stop signs at uncontrolled intersections with patterns of rear-end, right-angle, or turning collisions related to lack of driver awareness of the presence of the intersection.

COUNTERMEASURE LRSB CODE: NS08

**Flashing Beacons at Stop-Controlled Intersection**



CRF 25%

CRASH TYPE

Flashing beacons can reinforce driver awareness of a Non-Signalized intersection control and can help mitigate patterns of right-angle crashes related to stop sign violations

**COUNTERMEASURE** LRSM CODE: NS09

**Flashing Beacons as Advance warning**



CRF 30%

CRASH TYPE

Intersections with patterns of crashes could be related to lack of a driver's awareness of approaching intersections or controls at a downstream intersection.

**COUNTERMEASURE** LRSM CODE: NS14

**Raised Median on Approaches**



CRF 25%

CRASH TYPE

Raised medians with left-turn lanes at intersections offer a cost-effective means for reducing crashes and improving operations at higher volume intersections. The raised medians also prohibit left turns into and out of driveways.

**COUNTERMEASURE** LRSM CODE: NS10

**Transverse Rumble Strips**



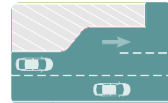
CRF 20%

CRASH TYPE

Transverse rumble strips are installed in the travel lane to provide an auditory and tactile sensation for each motorist approaching the intersection.

**COUNTERMEASURE** LRSM CODE: NS15

**Directional Median Opening to allow left-turns and u-turns**



CRF 50%

CRASH TYPE

If any crash types are an issue at an intersection, restriction or elimination of the turning maneuver- raised medians limit property access to right turns only, they should be used in conjunction with efforts to provide alternative access ways and promote driveway spacing objectives.

**COUNTERMEASURE** LRSM CODE: NS11

**Improve Sight Distance to Intersection**



CRF 20%

CRASH TYPE

Non-signalized intersections with restricted sight distance and patterns of crashes related to lack of sight distance where sight distance can be improved by clearing roadside obstructions without major reconstruction of the roadway.

**COUNTERMEASURE** LRSM CODE: NS17

**Install Right-Turn Lane**



CRF 20%

CRASH TYPE

A key strategy for minimizing collisions is to provide exclusive right-turn lanes, particularly on high-volume and high-speed major-road approaches. When considering new right-turn lanes, potential impacts to non-motorized users should be considered and mitigated as appropriate.

**COUNTERMEASURE** LRSM CODE: NS12PB

**Pavement Friction (High Friction Surface Treatment)**



CRF 55%

CRASH TYPE

This treatment is intended to target locations where skidding and failure to stop is determined to be a problem in wet or dry conditions and the target vehicle is unable to stop due to insufficient skid resistance.

**COUNTERMEASURE** LRSM CODE: NS21PB

**Pedestrian Crossing at Uncontrolled Location**




CRF 35%

CRASH TYPE


Intersections where pedestrians are known to be crossing intersections that involve significant vehicular traffic.



**COUNTERMEASURE** LRSM CODE: NS22PB  
**Rectangular Rapid Flashing Beacon (RRFB)**




**CRF** 35%


**CRASH TYPE** 

These include pedestrian-activated flashing lights and additional signage that enhance the visibility of marked crosswalks and alert motorists to pedestrian crossings.

**COUNTERMEASURE** LRSM CODE: NS23PB  
**Pedestrian Signal (HAWK)**




**CRF** 55%

**CRASH TYPE** 


Pedestrian signal, or a Pedestrian Hybrid Beacon (PHB) (also called High-Intensity Activated crosswalk beacon (HAWK)) are needed to provide an active warning to motorists when a pedestrian is in the crosswalk.

**C. COUNTERMEASURES FOR ROADWAYS**

**COUNTERMEASURE** LRSM CODE: R01  
**Segment Lighting**




**CRF** 35%


**CRASH TYPE** 

Street lighting helps make other road users or hazards more visible to motorists at night, improving driver perception and reaction time and reducing the risk of collision.

**COUNTERMEASURE** LRSM CODE: R21  
**Improve Pavement Friction**




**CRF** 55%


**CRASH TYPE** 

Areas as noted having crashes on wet pavements or under dry conditions when the pavement friction available is significantly less than actual roadway speeds; including but not limited to curves, loop ramps, intersections, and areas with short stopping or weaving distances.

**COUNTERMEASURE** LRSM CODE: R02  
**Relocate Fixed Objects**




**CRF** 35%


**CRASH TYPE** 

A clear recovery zone should be developed on every roadway, as space is available. Relocate fixed objects such as utility poles, drainage structures, trees, and other fixed objects, such as the outside of a curve, end of lane drops, and in traffic islands.

**COUNTERMEASURE** LRSM CODE: R22  
**Signs with New Fluorescent Sheeting**

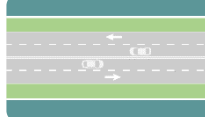


**CRF** 15%


**CRASH TYPE** 

Intended to get the driver's attention and give them a visual warning by using fluorescent yellow sheeting (or other retroreflective material).

**COUNTERMEASURE** LRSM CODE: R15  
**Widen Shoulder**




**CRF** 30%


**CRASH TYPE** 

Roadways that have a frequent incidence of vehicles leaving the travel lane resulting in an unsuccessful attempt to reenter the roadway. The probability of a safe recovery is increased if an errant vehicle is provided with an increased paved area in which to initiate such a recovery.

**COUNTERMEASURE** LRSM CODE: R24  
**Curve Warning Signs**



**CRF** 25%

**CRASH TYPE** 

Addresses problem curves, and serves as a warning of an unexpected or sharp curve. It provides advanced information and gives drivers a visual warning that their added attention is needed.

**COUNTERMEASURE** LRSB CODE: R25

**Curve Advance Warning Signs**



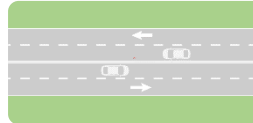
CRF 30%

CRASH TYPE

Roadways that have an unacceptable level of crashes on relatively sharp curves. Flashing beacons in conjunction with warning signs should only be used on horizontal curves that have an established severe crash history to help maintain their effectiveness

**COUNTERMEASURE** LRSB CODE: R30

**Center-line Rumble Strips**



CRF 20%

CRASH TYPE

It is recommended that rumble strips/strips be applied systematically along an entire route instead of only at spot locations. Care should be taken when considering installing rumble strips in locations with residential land uses or in areas with high bicycle volumes.

**COUNTERMEASURE** LRSB CODE: R26

**Dynamic Speed Warning Signs**



CRF 30%

CRASH TYPE

A roadway treatment that uses radar to alert drivers to their actual speed relative to the posted speed limit, encouraging drivers who exceed the speed limit to slow down.

**COUNTERMEASURE** LRSB CODE: R31

**Edge-line Rumble Strips**



CRF 15%

CRASH TYPE

Rumble strips provide an auditory indication and tactile rumble when driven on, alerting drivers that they are drifting out of their travel lane, and giving them time to recover before they depart the roadway or cross the center line.

**COUNTERMEASURE** LRSB CODE: R27

**Reflectors and Object Markers**



CRF 15%

CRASH TYPE

Delineators, reflectors, and/or object markers are intended to warn drivers of an approaching curve or fixed object that cannot easily be removed.

**COUNTERMEASURE** LRSB CODE: R33

**Install Separated Bike Lanes**



CRF 45%

CRASH TYPE

Separated bikeways are most appropriate on streets with high volumes of bike traffic and/or high bike-vehicle collisions, presumably in an urban or suburban area.

**COUNTERMEASURE** LRSB CODE: R28

**Edge-line and Centerline**



CRF 25%

CRASH TYPE

Installing edge lines and centerlines where none exists or making significant upgrades to existing lines.

**COUNTERMEASURE** LRSB CODE: R35PB

**Pedestrian Crossing**




CRF 35%

CRASH TYPE



These include pedestrian-activated flashing lights and additional signage that enhance the visibility of marked crosswalks and alert motorists to pedestrian crossings.

**COUNTERMEASURE** LRSM CODE: R36PB

### Raised Pedestrian Crossing




**CRF** 35%

**CRASH TYPE**  



The crosswalk is elevated to match the sidewalk to make pedestrians more visible to approaching vehicles. Typically located at midblock crossings, they encourage motorists to yield to pedestrians and reduce vehicle speed.

**COUNTERMEASURE** LRSM CODE: R37PB

### Rectangular Rapid Flashing Beacon (RRFB)



**CRF** 35%

**CRASH TYPE**  

Pedestrian-activated flashing lights and additional signage enhance the visibility of marked crosswalks and alert motorists to pedestrian crossings.

## COUNTERMEASURES TOOLBOX CRITERIA

As shown in **Appendix D**, some additional countermeasures that are not included in the 2022 LRSM were provided as part of the Countermeasure Toolbox for several reasons:

- The countermeasures complement or enhance the efficacy of those which are included in the LRSM.
- The countermeasures are emerging tools that are gaining traction throughout California and/or the United States, and may not yet have a history of academic research or efficacy studies, but are likely to be included in future iterations of the LRSM or other safety guidance documents.
- Though the HSIP funding source is based on countermeasure documentation in the LRSM, other funding sources may be more applicable for certain projects or contexts and allow for the inclusion of other countermeasure types.

The availability of research rating for these countermeasures is listed as one of the following in the toolbox:

- Low – No or limited research on safety benefits is available, or safety benefits are modest
- Medium – Research on efficacy is available, but safety benefits are modest
- High – A large body of research is available, and safety benefits are well-documented



## 7 VIABLE SAFETY PROJECTS

This chapter summarizes the process of selecting safety projects as part of the analysis for the County's LRSP.

The next step after the identification of high injury locations, emphasis areas, and applicable countermeasures was to identify systemic and location-specific safety improvements for high-risk networks.

The most applicable and appropriate countermeasures, as identified, have been grouped to form projects that can help make high-risk locations safer. The countermeasures were grouped into safety projects for high-risk intersections and corridors. A total of nine safety projects were developed for both intersections and corridors. Countermeasures and project locations for each safety project were identified based on the technical team's assessment of viability, which consisted of extensive analysis, observations, County staff input, and stakeholder/community input.

**Table 14** lists the viable safety projects for high-risk intersections and roadway segments.



## LIST OF SAFETY PROJECTS

- **Project 1:** Improve safety on roadway segment: Various locations throughout the County: Install/Upgrade signs with new fluorescent sheeting (regulatory or warning)
- **Project 2:** Improve pedestrian safety at signalized intersections: Improve signal timing: lenses, back-plates with retroreflective borders, mounting, size, and number, Install pedestrian countdown signal heads, Modify signal phasing to implement a Leading Pedestrian Interval (LPI)
- **Project 3:** Improve safety at Signalized Intersection: Improve signal timing (coordination, phases, red, yellow, or operation), Install raised pavement markers and striping (Through Intersection)
- **Project 4:** Improve safety at Non-Signalized Intersections: Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs, Upgrade intersection pavement markings (N.S.I.), Install flashing beacons as an advance warning (N.S.I)
- **Project 5:** Improve safety at Non-Signalized Intersections: Install Rectangular Rapid Flashing Beacon (RRFB)
- **Project 6:** Countywide Street Light Inventory: Add intersection lighting (signalized intersection), Add intersection lighting (non-signalized intersection), Add segment lighting (roadway segments)
- **Project 7:** Countywide Rumble Striping: Install edge-line rumble strips/stripes
- **Project 8:** Countywide Installation of Guardrail: Install Guardrail
- **Project 9:** Improve safety on Corridors: Install curve advance warning signs (flashing beacon), Install dynamic/variable speed warning signs, Install delineators, reflectors and/or object markers

**Table 16- Table 19** identified safety projects, with a preliminary cost estimate for each location and the resulting Benefit Cost Ratio (BCR) of the project. **Table 20** shows the lists of all countermeasures used to draft these safety projects.

**Appendix F** lists the detailed methodology to calculate the BCR, as well as the complete cost, benefit, and BCR calculation.

**A. HSIP APPROVED SAFETY PROEJCTS**

**Table 14 List of Viable Safety Projects for Corridors**

Location	CM1	CM2	CM3	Total	BCR
<b>Project 1 – Improve safety on roadway segment: Various locations throughout the County: Install/Upgrade signs with new fluorescent sheeting (regulatory or warning)</b>					
Countywide Sign Upgrade	R22			\$4,448,000	69.97

Notes: HSIP Funds Requested: \$4,003,200

**Table 15 List of Viable Safety Projects for Signalized Intersections**

Location	CM1	CM2	CM3	Total	BCR
<b>Project 2 – Improve pedestrian safety at signalized intersections: Improve signal timing: lenses, back- plates with retroreflective borders, mounting, size and number, Install pedestrian countdown signal heads, Modify signal phasing to implement a Leading Pedestrian Interval (LPI)</b>					
River Oaks Blvd & Plumas Lake Blvd	S02	S17PB	S21PB	\$657,700	20.27
Oliverhurst Ave & Mcgowan Pkwy	S02	S17PB	S21PB		
Lindhurst Ave & Erle Rd	S02	S17PB	S21PB		
Lindhurst Ave & N Beale Rd	S02	S17PB	S21PB		
North Beale Rd & Feather River Blvd	S02	S17PB	S21PB		
Linda Ave& N Beale Rd	S02	S17PB	S21PB		
Simpson Ln & Hammonton Smartsville Rd	S02				

Notes: HSIP Funds Requested: \$591,930



**B. SAFETY PROJECTS – SIGNALIZED INTERSECTIONS**

**Table 16 List of Viable Safety Projects for Signalized Intersections**

Location	CM1	CM2	CM3	Cost per Location	Total	BCR
<b>Project 3 – Improve safety at Signalized Intersection: Improve signal timing (coordination, phases, red, yellow or operation), Install raised pavement markers and striping (Through Intersection)</b>						
N. Beale Rd at Feather River Blvd	S03	S09				
Erle Rd at Lindhurst Rd	S03	S09				

Notes: CM – countermeasure. The BCR is the dollar amount of benefits divided by the cost of the countermeasure.

**C. SAFETY PROJECTS – NON-SIGNALIZED INTERSECTIONS**

**Table 17 List of Viable Safety Projects for Non-Signalized Intersections**

Location	CM1	CM2	CM3	Cost per Location	Total	BCR
<b>Project 4 – Improve safety at Non-Signalized Intersections: Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs, Upgrade intersection pavement markings (N.S.I.), Install flashing beacons as advance warning (N.S.I)</b>						
Powerline Rd at Eighth Ave	NS06	NS07	NS09			
N.Beale Rd at Avondale Rd	NS06		NS09			
Hammonton-Smartsville Rd at Linda Ave	NS06	NS07	NS09			
N. Beale Rd at Griffith Rd	NS06	NS07	NS09			
Feather River Blvd at Grand Ave	NS06	NS07	NS09			
N.Beale at Park Ave	NS06		NS09			
N.Beale Rd at Lowe Ave	NS06		NS09			
<b>Project 5 – Improve safety at Non-Signalized Intersections: Install Rectangular Rapid Flashing Beacon (RRFB)</b>						
N.Beale Rd at Lowe Ave	NS22PB					

Notes: CM – countermeasure. The BCR is the dollar amount of benefits divided by the cost of the countermeasure.



**D. SAFETY PROJECTS – COUNTYWIDE PROJECTS**

**Table 18 List of Viable Countywide Safety Projects**

Location	CM1	CM2	CM3	Cost per Location	Total	BCR
<b>Project 6 – Countywide Street Light Inventory: Add intersection lighting (signalized intersection), Add intersection lighting (non-signalized intersection), Add segment lighting (roadway segments)</b>						
Countywide Street Light Inventory	S01	NS01	R01			
<b>Project 7– Countywide Rumble Striping: Install edge-line rumble strips/stripes</b>						
Countywide Rumble Striping	R31					
<b>Project 8 – Countywide Installation of Guardrail: Install Guardrail</b>						
Countywide Installation of Guardrail	R04			\$4,075,000		

Notes: CM – countermeasure. The BCR is the dollar amount of benefits divided by the cost of the countermeasure.

**E. SAFETY PROJECTS – CORRIDORS**

**Table 19 List of Viable Corridor Safety Projects**

Location	CM1	CM2	CM3	Cost per Location	Total	BCR
<b>Project 9: Improve safety on Corridors: Install curve advance warning signs (flashing beacon), Install dynamic/variable speed warning signs, Install delineators, reflectors and/or object markers</b>						
<b>Marysville Rd/Willow Glen Rd:</b> SR 20 to 1.1 mi S of Westcott Rd	R25	R26	R27			
<b>N. Beale Rd/Lindhurst Ave:</b> SR 70 (North) to Olivehurst Avenue	R25	R26	R27			
<b>Hammonton-Smartsville Rd:</b> 0.1 mi E of Brophy Rd to SR 20	R25	R26	R27			
<b>Hammonton-Smartsville Rd:</b> N. Beale Avenue to Wallen Rd		R26	R27			
<b>Forty Mile Rd:</b> 0.6 mi S of SR 65 SB Ramp to Placer County Line		R26	R27			
<b>Simpson Ln:</b> Hammonton-Smartsville Rd to Marysville City Limit			R27			
<b>Loma Rica Rd:</b> Fruitland Rd to Marysville Rd	R25	R26	R27			
<b>Feather River Rd:</b> Grand Rd to Murphy Rd		R26	R27			
<b>Powerline Rd:</b> 400' E of Olivehurst Rd to McGowan Pkwy		R26	R27			
<b>La Porte Rd:</b> Orlando Rd to Old La Porte Rd	R25	R26	R27			

Note: CM – countermeasure. The BCR is the dollar amount of benefits divided by the cost of the countermeasure.



**Table 20 List of Countermeasures**

<b>Countermeasure Name</b>	
S01	Add segment lighting (S.I)
S02	Improve signal hardware: lenses, back-plates with retroreflective borders, mounting, size, and number
S03	Improve signal timing (coordination, phases, red, yellow, or operation)
S10	Install flashing beacons as an advance warning (S.I)
S20PB	Install advance stop bar before crosswalk (Bicycle Box)
S21PB	Modify signal phasing to implement a Leading Pedestrian Interval (LPI)
NS01	Add segment lighting (NS.I)
NS06	Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs
NS09	Install flashing beacons as advance warning (NS.I)
NS22PB	Install Rectangular Rapid Flashing Beacon (RRFB)
R01	Add segment lighting
R04	Install Guardrail
R22	Install/Upgrade signs with new fluorescent sheeting (regulatory or warning)
R26	Install dynamic/variable speed warning signs
R33PB	Install Separated Bike Lanes
R35PB	Install/upgrade pedestrian crossing (with enhanced features)
R37PB	Install Rectangular Rapid Flashing Beacon (RRFB)

Note: S refers to improvements at signalized locations, NS refers to improvements at non-signalized locations, and R refers to improvements at roadway segments.

### HSIP GRANT PROGRAM

The HSIP program in California funds local highway safety improvement projects. The HSIP grant program primarily relies upon BCR analysis to evaluate and rank project selections, and this analysis is based upon the most recent three to five years of historical crash data entered into the Caltrans HSIP Analyzer worksheet. As a result, HSIP applications require sufficient crash history at a project location to justify the proposed safety improvements. A systemic approach to developing HSIP applications would allow the County to group multiple locations that similar characteristics and require have similar countermeasures, aggregating the benefits and costs for those locations. Combining one area that has experienced many collisions with another contextually similar location that has experienced fewer collisions may make it possible for both to be improved through the HSIP program if the resulting aggregate BCR is sufficient for selection. **Table 21** presents the summary of the application categories.

**Table 21 Summary of Application Categories for HSIP Cycle 12**

Application Category	Description	Max Number of Applications per Agency	Max Amount per Agency
Benefit Cost Ratio (BCR)	Benefit Cost Ratio (BCR)	No Limit	\$10 million
	Guardrail Upgrades	1	\$1 million
Funding Set-Asides (SA)	Bike Safety Improvements		
	Pedestrian Crossing Enhancements	1	\$250,000
	Installing Edgelines	1	\$250,000
	Tribes	1	\$250,000

Source: Highway Safety Improvement Program (HSIP) Cycle 12 Application Instructions

Note: A minimum BCR of 3.5 is required for a BCR application to be submitted

There is no limit to the number of applications an agency may submit under the BCR category. However, the maximum HSIP funds that one agency may be awarded under the BCR category is \$10 million.

There are three different categories of locations: Signalized Intersections (SI), Non-Signalized Intersections (NS), and Roadway segments (R). Typically, a BCR application only includes locations of one of the above three categories (S, NS, or R). Multiple categories may be selected if the application proposes corridor safety improvements, uses a systemic approach or if the applicant chooses to bundle various locations in the same vicinity.

## 8 IMPLEMENTATION AND EVALUATION

This chapter describes the steps the County may take to evaluate the success of this plan and the steps needed to update the plan in the future. The LRSP is a guidance document and requires periodic updates to assess its efficacy and re-evaluate potential solutions. It is recommended that the plan be updated every two to five years in coordination with the identified safety partners. This document was developed based on community needs, stakeholder input, and collision analysis conducted to identify priority emphasis areas throughout the County. Implementing strategies under each emphasis area would aim to reduce KSI collisions in the coming years.

### IMPLEMENTATION

The LRSP is a guidance document recommended to be updated every two to five years in coordination with the safety partners. The LRSP document provides engineering, education, enforcement, and emergency medical service-related countermeasures that can be implemented throughout the County to reduce KSI collisions. It is recommended that the County implement the selected projects in high-collision locations in coordination with other projects proposed for the county's infrastructure development in their future Capital Improvement Plan (CIP). After implementing countermeasures, the performance measures for each emphasis area should be evaluated annually. The most critical measure of success of the LRSP should be reducing injury collisions throughout the County. If the number of injury collisions does not decrease over time, then the emphasis areas and countermeasures should be re-evaluated.

Funding is a critical component of implementing any safety project. While the HSIP program is a common source of funding for safety projects, numerous other funding sources could be pursued for such projects (See **Table 22**).

**Table 22 List of Potential Funding Sources**

<b>Funding Source</b>	<b>Funding Agency</b>	<b>Amount Available</b>	<b>Next Call for Projects</b>	<b>Applicable E's</b>	<b>Notes</b>
<b>Active Transportation Program</b>	Caltrans, California Transportation Commission, (CTC) MTC	~\$450 million per cycle (every two years)	2024	Engineering, Education	Can be used for most active transportation-related safety projects as well as education programs: Funding is available through Caltrans or MTC
<b>Highway Safety Improvement Program</b>	Caltrans	Varies	2024	Engineering	The most common grant source for safety projects
<b>Office of Traffic Safety Grants</b>	California Office of Traffic Safety	Varies by grant	Closes January 31 <sup>st</sup> annually	Education, Enforcement, Emergency Response	10 grants available to address various components of traffic safety
<b>Affordable Housing and Sustainable Communities Program</b>	Strategic Growth Council and Dept. of Housing and Community Development	~\$10-15 million per award	TBD; most recent in 2023	Engineering, Education	Must be connected to affordable housing projects; typically focuses on bike/pedestrian infrastructure/ programs
<b>Urban Greening</b>	California Natural Resources Agency	\$28.5 million	TBD; most recent in 2022	Engineering	Focused on bike/pedestrian infrastructure and greening public spaces
<b>Local Street and Road Maintenance and Rehabilitation</b>	CTC (distributed to local agencies)	\$1.5 billion statewide	N/A; distributed by formula	Engineering	Typically pays for road maintenance type projects
<b>RAISE Grant</b>	USDOT	~\$1.5 billion	2023	Engineering	Typically used for larger infrastructure projects
<b>Sustainable Transportation Equity Project</b>	California Air Resources Board	~\$19.5 million	TBD; most recent call in 2023	Engineering, Education	Target projects that will increase transportation equity in disadvantaged communities
<b>Transformative Climate Communities</b>	Strategic Growth Council	~\$105 million	TBD; most recent call in 2022	Engineering	Funds community-led projects that achieve major reductions in greenhouse gas emissions in



					disadvantaged communities
<b>Safe Streets and Roads for All (SS4A)</b>	USDOT	\$200k - \$50 million	2023	Engineering	Two types of SS4A grants are available: Action Plan Grants and Implementation Grants
<b>Clean California Local Grant Program</b>	Caltrans	\$100k – 5 million per award	2023	Engineering	Funding for local communities to beautify and improve local streets and roads, tribal lands, parks, pathways, and transit centers

## MONITORING AND EVALUATION

For the success of the LRSP, it is crucial to monitor and evaluate the 4 **E's** strategies continuously. Monitoring and evaluation help provide accountability, ensure the effectiveness of the countermeasures for each emphasis area, and help make decisions on the need for new strategies. The process would help the County make informed decisions regarding the implementation plan's progress and accordingly, update the goals and objectives of the plan.

After implementing countermeasures, the strategies should be evaluated annually as per their performance measures. The evaluation should be recorded in a before-after study to validate the effectiveness of each countermeasure as per the following observations:

- Number of injury collisions
- Number of police citations
- Number of public comments and concerns

Evaluation should be conducted during similar periods and durations each year. The most important measure of success of the LRSP should be a reduction in injury collisions throughout the County. If the number of injury collisions doesn't decrease initially, then the countermeasures should be evaluated as per the other observations, as mentioned above. The effectiveness of the countermeasures should be compared to the goals for each emphasis area.

## LRSP UPDATE

The LRSP is a guidance document and is recommended to be updated every two to five years after adoption. After monitoring performance measures focused on the status and progress of the 4 E's strategies in each emphasis area, the next LRSP update can be tailored to resolve any continuing safety problems. An annual stakeholder meeting with the safety partners is also recommended to discuss the progress for each emphasis area and oversee the implementation plan. The document should then be updated as per the latest collision data, emerging trends, and the 4 **E's** strategies' progress and implementation.



## APPENDIX A: PUBLIC COMMENTS WITH MAP INPUT DATA

#	Point X	Point Y	Primary St	Secondary St	Intersection	Public Reported Concerns	Mode	Pertinent Issues
3	39.056734	-121.487001	Virginia Rd	Virginia Rd	N	Virginia Rd between Ostrom and Rancho is nearly unusable due to poor road quality.	Motor Vehicle	Pavement Conditions
4	39.113354	-121.562693	Erle Rd	Chestnut Rd	Y	Off-ramp onto Erle can be time consuming and dangerous.	Motor Vehicle	Curve Unsafe
5	39.113697	-121.554295	Erle Rd	Edgewater Cir	Y	Dangerous intersection.	Pedestrian	Intersection Safety
6	39.127786	-121.525089	N Beale Rd	N Beale Rd	N	Trucks and vehicles drive over the speed limit and pedestrians are walking on the side of the road, which don't have a sidewalk	Pedestrian	Pedestrian Safety
7	39.126706	-121.56581	N Beale Rd	N Beale Rd	N	Speeding. Also transients crossing to recycling center.	Motor Vehicle	Speeding
8	39.127358	-121.563057	N Beale Rd	Silverwood St	Y	The power poles, shrubs and billboard sign legs make it difficult to see while pulling out onto	Motor Vehicle	Limited Visibility
9	39.142182	-121.593894	G St	7th St	Y	Cars don't stop at stop sign	Motor Vehicle	Traffic Sign Violation
10	39.169601	-121.438051	Hammonton Smartsville Rd	Hammonton Smartsville Rd	N	Need a westbound left turn lane	Motor Vehicle	Narrow Road
3yv7fky4zbh4	39.385204	-121.208639	Browns Valley School Rd	Browns Valley School Rd	N	Loma Rica Browns Valley speeding is out-of-control people dying people crashing we need help	Pedestrian	Speeding
839gvb9nlu89	39.120066	-121.573904	Arboga Rd	Arboga Rd	N	Speed limit	Motor Vehicle	Speeding
9rw2pjj7w6k9	39.04686	-121.54398	Plumas Arboga Rd	Plumas Arboga Rd	N	Uneven road, dangerous as it throws the car back and forth even when speed is 25mph. Not safe	Motor Vehicle	Pavement Conditions
99gc4vsw6zga	39.124079	-121.577734	SR 70	Feather River Blvd	Y	Really needs a stop light that is timed with other light. Cars can get stuck here trying to exit freeway for upwards of 20 minutes because there is nonstop through traffic or cars turning left onto the freeway entrance that have the right of way. You just get stuck on this exit for a super long time with a long line of cars	Motor Vehicle	Sign Upgrade
239geu9drb93	39.035538	-121.462796	SR 65	SR 65	N	High number of collisions, including fatalities. Hey 65 and Oakley	Bicycle	Speeding
7sh2fae2ld27	39.12608	-121.567128	N Beale Rd	Avondale Ave	Y	Unsafe signage blocking view of oncoming traffic	Motor Vehicle	Sign Upgrade
9389m8oeb4v3	39.054809	-121.362664	Spenceville Rd	Spenceville Rd	N	Many pot holes and low spots for water to puddle causing wrecks and swerving to avoid hitting and no edge for pedestrians or bikes.	Pedestrian	Bicycle Safety
9389m8oeb4v3	39.054809	-121.362664	Spenceville Rd	Spenceville Rd	N	Many pot holes and low spots for water to puddle causing wrecks and swerving to avoid hitting and no edge for pedestrians or bikes.	Pedestrian	Pedestrian Safety

#	Point X	Point Y	Primary St	Secondary St	Intersection	Public Reported Concerns	Mode	Pertinent Issues
9389m8oeb4v3	39.054809	-121.362664	Spenceville Rd	Spenceville Rd	N	Many pot holes and low spots for water to puddle causing wrecks and swerving to avoid hitting and no edge for pedestrians or bikes.	Bicycle	Pavement Conditions
68fa9j4hbl4v	39.067858	-121.559961	Maplehurst St	Maplehurst St	N	I live on the Corner of Eugene. And Maplehurst and it is a straight shot to the end of the street as soon as they turn down our street on maplehurst they fly 50 plus miles per hour. We would like speed bumps because the stop signs don't help inbetween them. Please think about the safety of our community walking, riding, or kids coming and going to bus stop. When they were working on arboga they workers made a few speed home made ones and they worked like a charm. Thanks for taking the time to read this. I'm hoping our street becomes safer for everyone.	Pedestrian	Pedestrian Safety
3se6vxk43u3a	39.169106	-121.439379	Hammonton Smartsville Rd	Doolittle Dr	Y	Need a turn lane going into Doolittle Gate. Many accidents here.	Motor Vehicle	Intersection Safety
8e7gf2syc2v4	39.367978	-121.371756	Los Verjeles Rd	Los Verjeles Rd	N	Need new bridge to Bangor	Motor Vehicle	Pavement Conditions
2jt6w8ya9lb4	39.117376	-121.534198	Goldfields Pkwy	River Bank Dr	Y	Needs the blinking light crosswalk, on low visibility days or if someone is wearing dark clothes it is hard to see them.	Pedestrian	Limited Visibility
2jt6w8ya9lb4	39.113678	-121.541408	Erle Rd	Erle Rd	Y	Erle needs more posted speed limit signs	Motor Vehicle	Limited Visibility
6lc4vob3jvd3	39.177911	-121.590763	SR 70	SR 70	N	We need street lights along Hwy70/Oroville Hwy.	Pedestrian	Limited Visibility
9va36ubr9cx6	39.113503	-121.553421	Erle Rd	Erle Rd	N	Cars using the shoulder during traffic times to pass on the right then turn right on Edgewater circle to cut thru the gas station or just bypass Edgewater circle and cut back in by the gas station	Motor Vehicle	Narrow Road
9ey9kmk44mza	39.452524	-121.298988	Quincy La Porte Rd	Quincy La Porte Rd	N	Road way is disappearing lanes narrow and no gard rails	Motor Vehicle	Narrow Road
9ey9kmk44mza	39.397535	-121.311532	Willow Glen Rd	Willow Glen Rd	N	Replace the guard rails where you have only put traffic signs. After a car hits the rails its never replaced. One person died here last year	Pedestrian	Pedestrian Safety
93avs4mxx2sa	39.395664	-121.313489	Willow Glen Rd	Willow Glen Rd	N	Lack of guardrail in this high accident area	Motor Vehicle	Pavement Conditions
93avs4mxx2sa	39.362833	-121.324155	Marysville Rd	SR 20	Y	Better signage needed to clearly show this is a T intersection. Too many accidents going straight through	Sign Upgade	Sign Upgrade
93avs4mxx2sa	39.382792	-121.258515	French Town Rd	French Town Rd	N	Widen bridge	Motor Vehicle	Pavement Conditions
2xv7md63xoo6	39.113214	-121.559441	Erle Rd	SR 70	Y	Southbound traffic on highway 70 exiting on earl Road,traffic backs up on exit ramp due to the traffic light at earl/olivehurst ave. Therefore a traffic light is needed at both locations.	Motor Vehicle	Sign Upgrade
3sb7pl3ppa36	39.040956	-121.471141	S Beale Rd	SR 65	Y	There needs to be a traffic light at this location. It's so dangerous, especially for our military veterans leaving the base trying to get on 65 in the evening.	Motor Vehicle	Sign Upgrade

#	Point X	Point Y	Primary St	Secondary St	Intersection	Public Reported Concerns	Mode	Pertinent Issues
677vi8m8abp2	39.026367	-121.5452	Plumas Arboga Rd	Plumas Arboga Rd	Y	There are major potholes in the road right after the railroad tracks coming into Plumas Lake.	Motor Vehicle	Pavement Conditions
9rr2h9vtx6a3	39.204411	-121.516289	Browns Valley Rd	Browns Valley Rd	N	People do not slow down for the reduced posted speed. Flashing lights are not timed to coincidence with school hours. Major safety concern for our kids.	Pedestrian	Speeding
64ch4db384hw	39.077395	-121.537593	McGowan Pkway	Evelyn Dr	Y	Speeding on McGowan, high traffic during rush hour and school pick up/drop off times, also during events at the amphitheater or casino. It is very difficult to see turning left off Evelyn. Evelyn has so many potholes it's ridiculous!	Motor Vehicle	Speeding
8mw2cix6cnp9	39.048605	-121.371843	Spenceville Rd	Spenceville Rd	Y	Spenceville Road is getting numerous pot holes and cracks. The rainy weather is making it worse by the day. This road carries a lot of high speed traffic to and from Beale AFB perhaps the federal government can be tapped for a few dollars to fix it as their people put the majority of wear and tear on the road.	Motor Vehicle	Speeding
3bf92b2hvjv26	39.113232	-121.559101	Erle Rd	SR 70	Y	Trying to turn left to go into the Edgewater community from highway 70 onto Earl is terrible!! People illegally turn right and flip a u turn in the middle of the road because the traffic is so congested and you can't get across for so long.	Motor Vehicle	Curve Unsafe
3oop92x8dpp7	39.047558	-121.546396	Plumas Arboga Rd	Plumas Arboga Rd	N	Road is very rough and no room for bicycles or pedestrians on the road.	Pedestrian	Pavement Conditions
3oop92x8dpp7	39.047558	-121.546396	Plumas Arboga Rd	Plumas Arboga Rd	N	Road is very rough and no room for bicycles or pedestrians on the road.	Bicycle	Pavement Conditions
8dk7tnk8abn2	39.159882	-121.579387	E 22ns St	Buchanan St	Y	Buchanan Street and 22nd there are limited sidewalks for students walking down from Ramirez and 22nd down to Covillaud and 22nd. There is no safe way to walk across Sampson.	Pedestrian	Pedestrian Safety
8r2cy4rmt6g7	39.498559	-121.278606	New York Flat Rd	New York Flat Rd	N	Roadway is washing out to road base. Soon to dirt. Very unsafe when it snows.	Motor Vehicle	Pavement Conditions
2rv292474jx8	39.125682	-121.575839	N Beale Rd	Feather River Blvd	Y	Combine this signal with nearby Ramps to SR70 in a 5-leg 2-lane roundabout. It will improve operations and improve safety for pedestrians, improve air quality, and reduce signal maintenance requirements. Roundabouts work when there's no power.	Motor Vehicle	Intersection Safety
2rv292474jx8	39.113325	-121.554717	Erle Rd	Edgewater Cir	Y	The deliniators are getting run over frequently from obstinate drivers. Should be replaced with a curb.	Motor Vehicle	Pavement Conditions
87kpw4bvz729	39.034414	-121.462607	Sr 65	Oakley Ln	Y	Oakley road getting onto hwy 65 should be closed down. This road has had too many accidents!	Motor Vehicle	Intersection Safety
87kpw4bvz729	39.011745	-121.550369	River Oaks Blvd	Zanes Dr	Y	School crossing area, could use a stop light! This stop sign can be dangerous! People run it	Pedestrian	School Safety
6wv3fyz7w6ma	39.129435	-121.558186	Alpine Way	Alpine Way	N	Sidewalk are scary broken in marysville	Pedestrian	Pedestrian Safety

#	Point X	Point Y	Primary St	Secondary St	Intersection	Public Reported Concerns	Mode	Pertinent Issues
4c826amd67d6	39.051844	-121.54794	Plumas Arboga Rd	Plumas Arboga Rd	N	Unsafe speeds due to no speed limit posted. Unsafe passing in front of houses which have almost caused countless accidents when pulling into or out of driveways. Dangerous corners that have caused multiple vehicle accidents. Even a Wheatland Fire Authority engine.	Motor Vehicle	Speeding
2bk9ujd82f17	39.106817	-121.57993	Feather River Blvd	Grand Ave	Y	Traffic does not stop at the stop sign , they fly through, don't look both ways . It's a serious hazard driving down feather River Blvd ! People drive 90 mph through this stop sign and on this road	Motor Vehicle	Traffic Sign Violation
2rm2dsx64gh7	39.113225	-121.560286	SR 70	Erle Rd	Y	Traffic backs up for the cars exiting 70 and for those turning left onto 70. This is at the west side of the overpass on Erle Rd.	Motor Vehicle	Intersection Safety
4lo89obc6al9	39.23255	-121.455219	Spring Valley Rd	Joines Rd	Y	Blind corner when grasses get too high on the southwest area of intersection	Motor Vehicle	Intersection Safety
98ixd6lvw9xa	39.246861	-121.407808	Marysville Rd	Everglade Trail	Y	Speed limit is 35 driving thru town which people do not follow. Traffic picks up speed as they reach Everglads to over 55 mph and makes it extremely dangerous trying to turn in and especially pullout of this road. It is a blind curve. NO sight distance and bank cannot be cutback due to it being private property with a house.	Motor Vehicle	Curve Unsafe
2pxx3jbu7837	39.246459	-121.407064	Marysville Rd	Everglade Trail	Y	Blind Corner. Several wrecks in the same spot over years	Motor Vehicle	Curve Unsafe
2pxx3jbu7837	39.265435	-121.39289	Marysville Rd	Marysville Rd	N	Blind corner & people drive dangerous speeds	Motor Vehicle	Speeding
2pxx3jbu7837	39.362856	-121.323859	Willow Glen Rd	Marysville Rd	Y	Blind corner causes pull out difficult! There's excessive campers, going down and up the hill making dangerous pull out!	Motor Vehicle	Speeding
37ila4nzc428	39.059601	-121.560734	Arboga Rd	Arboga Rd	N	Plumas Arboga rd is like a race track morning and all day. needs to be an inforced speed limit. speed bumps anything to slow people down.	Motor Vehicle	Speeding
9ow6jtk7ntn3	39.014232	-121.431031	SR 65	McDevitt Dr	Y	Traffic often blocks this intersection making it hazardous for traffic turning in and out of mcdevit	Motor Vehicle	Intersection Safety
7sh4zzv2ghx3	39.145987	-121.582121	Ramirez St	Ramirez St	N	It's impossible to get into town because traffic on Simpson Ln and the Highway. Build an overpass to Yuba City.	Motor Vehicle	Narrow Road
8ab4saa2myt4	39.235445	-121.40834	Browns Valley School Rd	Browns Valley School Rd	N	People use this road as a short cut, speed is always an issue here. Speed bumps are needed.	Motor Vehicle	Speeding
8ab4saa2myt4	39.162681	-121.560326	Levee Rd	Levee Rd	N	This entire strip is a joke. People don't know how to use the "suicide " lane to pull out into traffic. At one point it took me 25 min. To trun on this road because people don't know how to drive. This whole strip either needs lights or round abouts.	Motor Vehicle	Limited Visibility

#	Point X	Point Y	Primary St	Secondary St	Intersection	Public Reported Concerns	Mode	Pertinent Issues
8ab4saa2myt4	39.131956	-121.587973	E St	E St	N	Wow!!! This is a no Brainerd. The traffic nightmare that is Marysville. Bye pass put in from Linda towards the outer edge of the city of Marysville next to dump that then connects 70. The road thru Marysville is the ultimate nightmare. The government higher upside are idiots for continuing the nightmare.	Motor Vehicle	Speeding
8ab4saa2myt4	39.310851	-121.364053	Theresse Trail	Penny Way	Y	Pave me!!!! PAVE ME! THE COUNTY DOES NOT TAKE CARE OF ME. ITS BEEN 7 YEARS SINCE ITS BEEN GRADED.. BUT IT WAS CHIPPED ONLY TO A POINT.... PAVE ME!!!	Pedestrian	Pavement Conditions
8ab4saa2myt4	39.282636	-121.39247	Marysville Rd	Spring Valley Rd	Y	Biggest waste of money ever!!! A40 million \$ Bridge for what!!! Idiots!!	Motor Vehicle	Pavement Conditions
7hw4sco6sx89	39.144417	-121.594227	9th St	G St	Y	So many near misses due to the traffic pattern. Either better signage needs to be placed or it probably needs to just be a 4-way stop. I've heard it's not for emergency vehicle purposes, but that's what emergency lights and sirens are for.	Motor Vehicle	Sign Upgrade
9vx6pns3seu6	39.385284	-121.336629	Vierra Rd	Vierra Rd	N	Vierra Rd potholes and large washboarding. Move dumpsters to end of road and keep garbage trucks off this fragile road. More maintenance, gravel and grading.	Motor Vehicle	Pavement Conditions
9rp6xfo9juk6	39.141195	-121.584447	A St	6th St	Y	Continuous pot holes. Every so often someone patches them and in a week they are back. The street needs a complete repavement.	Motor Vehicle	Pavement Conditions
7wh8ffz4wcz6	39.113205	-121.560431	SR 70	Erle Rd	Y	Traffic is a mess here getting on the freeway or getting off the freeway. Tons of backups and at times impossible to make a turn to go onto erle road	Motor Vehicle	Curve Unsafe
7wh8ffz4wcz6	39.111574	-121.556576	SR 70	Lindhurst Ave	Y	Rarely take this exit because at times you can't make the left off the freeway	Motor Vehicle	Curve Unsafe
7wh8ffz4wcz6	39.017939	-121.437569	SR 65	SR 65	N	Need two lanes or a bypass around Wheatland. Traffic can become very stuck in this area due to the one traffic light	Motor Vehicle	Narrow Road
7wh8ffz4wcz6	39.131943	-121.587527	E St	E St	N	Need another way to Marysville, the traffic on the bridge at times takes longer than just going to Lincoln.	Motor Vehicle	Narrow Road
7wh8ffz4wcz6	39.117856	-121.550904	Edgewater Cir	Oakwood Dr	Y	Need bike lanes and need the police to enforce not parking in the bike lane on Edgewater circle. Riding a bike is unsafe due to the cars parking there leading to those who bike to have to ride in the middle of the street.	Bicycle	Bicycle Safety
3flf26y9hot8	39.292118	-121.384329	Marysville Rd	Dry Creek Ln	Y	Speed and wrecks on the S curve	Motor Vehicle	Speeding
2s8ddd4dnm98	39.074622	-121.578658	Feather River Blvd	Feather River Blvd	N	Bike lane/shoulder too narrow and very unsafe	Bicycle	Bicycle Safety
2s8ddd4dnm98	39.064108	-121.561311	Arboga Rd	Arboga Rd	N	Bike lane/shoulder too narrow for safe bicycle riding	Bicycle	Bicycle Safety
6kh4zd7opy99	39.026299	-121.548992	Algodon Rd	Algodon Rd	N	Bridge over the creek is too narrow for safe passage of bicycles and pedestrians.	Bicycle	Bicycle Safety
6kh4zd7opy99	39.026299	-121.548992	Algodon Rd	Algodon Rd	N	Bridge over the creek is too narrow for safe passage of bicycles and pedestrians.	Pedestrian	Pedestrian Safety

#	Point X	Point Y	Primary St	Secondary St	Intersection	Public Reported Concerns	Mode	Pertinent Issues
6kh4zd7opy99	39.008693	-121.551542	River Oaks Blvd	Hidden Creek Way	Y	4-way Stop is not enough. River Oaks has 3 lanes, including left turn, in each direction making it a 5-lane crossing on Hidden Creek. In addition to cars running the Stop Signs, sometimes they just don't look enough to the sides and miss pedestrians in the crosswalk. Have been almost hit several times. Main crossing for students also.	Pedestrian	Pedestrian Safety
6kh4zd7opy99	38.979701	-121.546484	River Oaks Blvd	Orick Way	Y	Because of left turn lanes on River Oaks but no Stop Signs on River Oaks, the intersection is confusing. Some cars stop when they shouldn't and others come out of the store like it is a four-way stop when it is not. They will enter the intersection thinking the River Oaks cars will stop, but they do not.	Motor Vehicle	Intersection Safety
6kh4zd7opy99	39.077303	-121.540601	SR 70	McGowan Pkwy	Y	Northbound exit off Hwy 70 to McGowan, with left turn (West) onto McGowan: Difficult to see cars approaching on McGowan from the West over the Hwy 70 overcrossing, especially with a lot of traffic. Speeding on McGowan makes it worse.	Motor Vehicle	Speeding
99apm4jva734	39.135171	-121.589819	SR 70	SR 71	N	Everyone flies around this section and onto the "shoulder" to get to the upcoming turn lane.	Motor Vehicle	Speeding
4zx4n7x7irb6	39.28618	-121.343677	Township Rd	Lilly Way	Y	As a 40 year foothill resident I have seen the Browns Valley population expand dramatically without a main commuting road , Peoria Rd , widened in some places where it is Unsafe for 2 cars to fit. And the speeds on essentially this one lane road are excessive. Could you please let me know how much longer we have to wait for improvements? Thank you, Diana Moore	Motor Vehicle	Speeding
11.57	(39.077012, 39.055389, 39.055274, 39.048423, 39.04479, 39.029677, 39.025025)	(-121.561512, -121.560249, -121.547847, -121.547662, -121.543639, -121.545976, -121.547291)	Arboga Rd	McGowan Pkwy	Y	Unsafe to bike ride, no bike lane or path	Bicycle	Bicycle Safety

#	Point X	Point Y	Primary St	Secondary St	Intersection	Public Reported Concerns	Mode	Pertinent Issues
11.86	LINestring ( 39.210914, 39.307346, 39.157739)	LINestring (-121.585635, -121.595532, -121.587043)	Noble Rd	Noble Rd	N	<p>Increasing traffic congestion through Marysville. One cannot expect to get through Marysville on SR 70 without being stopped in traffic many, many times, even though traffic lights are green. A bypass must be created, if only for trucks.</p> <p>Most of the city streets are in terrible shape and need to be redone, not just patched.</p> <p>Vehicles on the new 5-lane highway through District 10 is traveling at speeds greater than 65 and drivers are not turning on their headlights, making it difficult to safely enter the highway. Their needs to be more CHP enforcement of the speed limit, and there need to be signs for Daylight Headlight Safety Section.</p>	Motor Vehicle	Limited Visibility
12.57	LINestring ( 39.103285, 39.10478, 39.143956, 39.146656, 39.169326)	LINestring (-121.552599, -121.554294, -121.595849, -121.583784, -121.593065)	SR 70 Off Ramp	SR 70 Off Ramp	N	Traffic gets way too congested on hwy 70 going north especially in marysville including in Downtown Marysville	Motor Vehicle	Narrow Road
14.07	LINestring ( 39.195797, 39.194399, 39.186011, 39.179771, 39.17444, 39.171371, 39.169596, 39.168333)	LINestring (-121.359334, -121.360999, -121.380147, -121.395361, -121.409233, -121.418939, -121.434722, -121.439196)	Hammonton Smartsville Rd	Hammonton Smartsville Rd	N	Bad road conditions-very rough	Motor Vehicle	Pavement Conditions
17.59	LINestring ( 39.122277, 39.122019, 39.121947, 39.121786, 39.121714, 39.12157, 39.121514, 39.121365, 39.121226, 39.121141, 39.12093, 39.120797, 39.120547, 39.120481, 39.120392, 39.120307, 39.120102, 39.119863, 39.119741, 39.119657, 39.119501, 39.119296, 39.119041, 39.118987, 39.118809, 39.118676, 39.118543, 39.118487, 39.118382, 39.118238, 39.11816, 39.118044)	LINestring (-121.576921, -121.577288, -121.57721, -121.576917, -121.576866, -121.576688, -121.576595, -121.576387, -121.576166, -121.575995, -121.575737, -121.575466, -121.575251, -121.575101, -121.574965, -121.574774, -121.574509, -121.57423, -121.574023, -121.573907, -121.573564, -121.573299, -121.573049, -121.572925, -121.572704, -121.572403, -121.572217, -121.572096, -121.571996, -121.571788, -121.57161, -121.571559)	Arboga Rd	Arboga Rd	N	Speed limit	Motor Vehicle	Speeding
14.43	LINestring ( 39.047637, 39.047769)	LINestring (-121.560993, -121.574848)	Broadway St	Broadway St	N	Broadway does not have proper drainage which causes David Lane to flood every heavy rain.	Motor Vehicle	Pavement Conditions

#	Point X	Point Y	Primary St	Secondary St	Intersection	Public Reported Concerns	Mode	Pertinent Issues
13.17	LINestring ( 39.201232, 39.200878, 39.195636, 39.198047, 39.197749, 39.194072, 39.177281, 39.168844)	LINestring (-121.28756 - 121.288018, -121.300089, -121.30997, -121.328792, -121.359243, -121.398602, -121.440776)	Magongal Ln	Magongal Ln	N	Potholes	Motor Vehicle	Pavement Conditions
13.25	LINestring ( 39.367361, 39.367132, 39.333432)	LINestring (-121.371532, -121.371482, -121.365546)	Los Verjeles Rd	Los Verjeles Rd	N	Speeding and passing cars on double yellow	Motor Vehicle	Speeding
16.1	LINestring ( 39.155929, 39.155991, 39.15596, 39.156022, 39.1561, 39.155914, 39.155852, 39.155852, 39.155914, 39.155898)	LINestring (-121.572932, -121.572373, -121.572004, -121.571685, -121.571285, -121.572823, -121.573082, -121.573382, -121.573681, -121.574001)	Harris St	Harris St	N	Roads are too bumpy, kids can barely ride bikes on the rocky roads. This road needs to be paved and concrete, not rocky	Bicycle	Pedestrian Safety
13.44	LINestring ( 39.179213, 39.195725, 39.191008, 39.192875, 39.191696, 39.194939)	LINestring (-121.394842, -121.358574, -121.34995, -121.345892, -121.343102, -121.337142)	Nearle Rd	Nearle Rd	N	Road is desperately in need of repaving. Countless potholes and poorly patched areas	Motor Vehicle	Pavement Conditions
14.02	LINestring ( 39.064263, 39.054428, 39.047149, 39.022553, 39.020585)	LINestring (-121.351989, -121.363726, -121.376308, -121.402485, -121.406791)	Camp Far West Rd	Camp Far West Rd	N	Needs repaving	Motor Vehicle	Pavement Conditions
14.65	LINestring ( 39.168963, 39.170528, 39.170824, 39.175349, 39.19168, 39.195105)	LINestring (-121.438816, -121.434233, -121.420702, -121.405481, -121.368135, -121.358806)	Doolittle Dr	Doolittle Dr	N	Lots of pot holes and bad patches.	Motor Vehicle	Pavement Conditions
15.8	LINestring ( 39.103462, 39.103477, 39.102264, 39.103912, 39.103835)	LINestring (-121.549782, -121.549831, -121.548735, -121.550235, -121.550018)	Olivehurst Ave	Lindhurst Ave	Y	When exiting the freeway northbound, in the mornings or rush hour, the exit ramp becomes congested. This causes a potential opportunity for rear end collisions for vehicles exiting the off ramp because there are some vehicles when exiting, make a left turn onto Olivehurst Ave (traveling northbound on Lindhurst Ave). Highly suggest widening the lane for a designated left turn lane so other traffic can continue northbound on Lindhurst Ave.	Motor Vehicle	Intersection Safety
14.83	LINestring ( 39.114404, 39.115303, 39.113918, 39.113281, 39.112847, 39.11296, 39.112885, 39.113222, 39.113297, 39.113147, 39.113409, 39.113297, 39.113072, 39.113634, 39.113708, 39.113409, 39.113372, 39.113634, 39.113734, 39.11482, 39.115344)	LINestring (-121.564182, -121.564809, -121.56341, -121.562831, -121.561898, -121.560499, -121.557701, -121.554517, -121.553408, -121.551189, -121.549355, -121.546702, -121.545158, -121.542553, -121.541299, -121.53797, -121.535655, -121.533532, -121.533857, -121.553857, -121.554098)	Chestnut Rd	Chestnut Rd	N	Antiquated roads are too small, traffic light can't handle the amount of traffic, off ramp is not safe	Motor Vehicle	Narrow Road

#	Point X	Point Y	Primary St	Secondary St	Intersection	Public Reported Concerns	Mode	Pertinent Issues
14.5	LINestring ( 39.017214, 39.020276, 39.018857, 39.017231, 39.020177)	LINestring (-121.435073, -121.441068, -121.438324, -121.434758, -121.441132)	SR 65	SR 65	N	The speed limit needs to reduce sooner coming into wheatland from the south bound lane. It makes it very dangerous and difficult to get on and off evergreen without having a car barreling 55 MPH towards you when the limit drops to 35 immediately after the street	Motor Vehicle	Speeding
15.18	LINestring ( 39.396806, 39.396454, 39.396748, 39.397893, 39.398685, 39.399155, 39.398421, 39.397951, 39.397394, 39.396777, 39.396689, 39.396278, 39.396307, 39.396072, 39.395838, 39.396454, 39.396836, 39.397247, 39.397658, 39.398039, 39.398039, 39.397452, 39.396924)	LINestring (-121.227342, -121.229622, -121.231407, -121.231711, -121.231711, -121.232015, -121.232357, -121.232737, -121.232851, -121.232927, -121.233573, -121.234067, -121.23475, -121.235586, -121.235928, -121.236726, -121.236726, -121.236878, -121.23665, -121.237068, -121.2376, -121.238132, -121.23836)	Clark Ranch	Indiana School Rd	Y	Extremely eroded and flooded in the winter.	Motor Vehicle	Pavement Conditions
14.12	LINestring ( 39.041315, 39.052005, 39.047889, 39.045309, 39.042482, 39.041868, 39.041868, 39.04279, 39.043281)	LINestring (-121.54577, -121.548223, -121.544821, -121.543397, -121.542211, -121.543555, -121.544505, -121.545454, -121.546245)	Plumas Arboga Rd	Plumas Arboga Rd	N	This road is dangerous to drive on. It throws you back-and-forth.	Motor Vehicle	Intersection Safety
17.8	LINestring ( 39.125421, 39.125455, 39.125439, 39.125353, 39.125315, 39.125267, 39.125176, 39.125214, 39.125281, 39.125343, 39.125449, 39.125482, 39.125563, 39.12563, 39.125668, 39.12575, 39.125802, 39.12597, 39.125881, 39.125877, 39.125843, 39.125858, 39.125786, 39.125719, 39.125704, 39.125661, 39.125594, 39.12554, 39.125492, 39.125425)	LINestring (-121.554519, -121.554433, -121.554879, -121.555101, -121.555274, -121.555324, -121.555311, -121.555083, -121.554744, -121.554367, -121.553861, -121.553596, -121.553287, -121.552806, -121.552437, -121.552011, -121.551659, -121.551709, -121.551762, -121.551941, -121.552145, -121.552496, -121.552755, -121.553015, -121.553292, -121.553619, -121.55394, -121.554067, -121.554444, -121.554419)	Ash Way	Ash Way	N	Too small of road for two way traffic . Cars also speed down the narrow road and a lot of children live on this street . Cars have actually crashed trying to get passed each other on small roadway .	Motor Vehicle	Speeding

#	Point X	Point Y	Primary St	Secondary St	Intersection	Public Reported Concerns	Mode	Pertinent Issues
14.56	LINestring ( 39.298744, 39.293422, 39.284834, 39.27651, 39.272208, 39.269069, 39.266837, 39.263651, 39.260628, 39.259, 39.257093, 39.255566, 39.253822, 39.252171, 39.251438, 39.249926, 39.249042, 39.248346, 39.247831, 39.247557, 39.246185, 39.243599, 39.243192, 39.236972, 39.236279, 39.235062, 39.23407, 39.231185, 39.227939)	LINestring (-121.369541, -121.366057, -121.363839, -121.36504, -121.366272, -121.369215, -121.368855, -121.367083, -121.36477, -121.362638, -121.361616, -121.36037, -121.359289, -121.358238, -121.357847, -121.355955, -121.354904, -121.354723, -121.354435, -121.353416, -121.353505, -121.353992, -121.351838, -121.348113, -121.347284, -121.347167, -121.347284, -121.345538, -121.348971)	Dolan Harding Rd	Peoria Rd	Y	Excessive speeding, narrow roads, blind corners, potholes, no speed limit, wildlife corridor ( many deer kills) farm animals often on road, Did I say Excessive Speeders!!!!?!!	Motor Vehicle	Speeding
12.19	LINestring ( 39.00065, 39.001588, 39.040986, 39.042158)	LINestring (-121.407536, -121.410253, -121.47032, -121.474244)	D St	D St	N	This is the 2 lane highway. Too many accidents. Once lanes are added at S Beale rd accidents decrease significantly. Widen the road or build the bypass.	Motor Vehicle	Intersection Safety
12.83	LINestring ( 39.298474, 39.298089, 39.296711, 39.295335, 39.293929, 39.292137, 39.289112, 39.286474, 39.283623, 39.279727, 39.272494, 39.269855, 39.26912)	LINestring (-121.369446, -121.368893, -121.368544, -121.367616, -121.36643, -121.365718, -121.36511, -121.364427, -121.36367, -121.36439, -121.365977, -121.368191, -121.369631)	Dolan Harding Rd	Peoria Rd	Y	Peoria Rd is VERY narrow. Countless times have almost head on oncoming traffic. Cars have to pull over for oncoming cars to pass. No room for pedestrians to walk safely, although there are Kids walking to and from school bus.	Pedestrian	Narrow Road
15.65	LINestring ( 39.232706, 39.234552, 39.241044, 39.247811, 39.250675, 39.252571, 39.253653, 39.254417, 39.25552, 39.255541, 39.255095, 39.255053, 39.256071, 39.257747, 39.261159, 39.267203, 39.271169, 39.275336, 39.275442, 39.276905, 39.277181, 39.277054)	LINestring (-121.455142, -121.454484, -121.446842, -121.439555, -121.4352, -121.43194, -121.431228, -121.429831, -121.429475, -121.428818, -121.427777, -121.426571, -121.42512, -121.424462, -121.41839, -121.412391, -121.407707, -121.401234, -121.398768, -121.396111, -121.394605, -121.39381)	Spring Valley Rd	Jones Rd	Y	Narrow roadway, no shoulder and speeders using this as a shortcut. No enforcement and no speed controls on through traffic. Very dangerous and lots of wrecks below the rock quarry.	Motor Vehicle	Narrow Road
15.5	LINestring ( 39.096769, 39.095747, 39.093598, 39.090514, 39.087391, 39.08366, 39.084094, 39.080614, 39.079043, 39.078195)	LINestring (-121.546469, -121.546197, -121.546387, -121.546281, -121.546365, -121.546114, -121.546304, -121.546264, -121.545879, -121.546102)	Turpen St	Turpen St	N	All these streets need repaved and sidewalks for the kids. Walking to school isn't always the safest when you are walking on the road along with cars	Pedestrian	Pedestrian Safety

#	Point X	Point Y	Primary St	Secondary St	Intersection	Public Reported Concerns	Mode	Pertinent Issues
12.89	LINestring ( 39.1776, 39.184417, 39.191804, 39.214855, 39.203647, 39.202967, 39.203892, 39.19229, 39.188405, 39.180227, 39.179164)	LINestring (-121.571093, -121.566562, -121.550581, -121.54061, -121.54471, -121.517871, -121.545826, -121.550419, -121.558926, -121.562443, -121.570506)	Jack Slough Rd	Jack Slough Rd	N	This area is used to re-route traffic when major collisions happen on 20 or issues on some of the more well travelled back roads. These roads are standard country roads and if you travel at the speed limit then you will be traveling at a rate of speed completely unsafe for the conditions of the roads. These roads need to be addressed. And the concerned area needs to be fully redone and not just patched. The years of patching are part of the problem.	Motor Vehicle	Speeding
14.58	LINestring ( 39.07023, 39.053277)	LINestring (-121.487062, -121.486833)	Virginia Rd	Ortrom Rd	Y	Terrible road condition	Motor Vehicle	Pavement Conditions
17.07	LINestring ( 39.113377, 39.114601)	LINestring (-121.560484, -121.561365)	Chrestnut Rd	Chrestnut Rd	N	Traffic backs up close to the highway during commuting hours. The light on the overpass doesn't allow for people on the off-ramp to cross traffic many people turn right and then make a U-turn in the middle of the road to gain the right of way. A solution could be to move the off-ramp to the other side of the overpass so people don't have to cross traffic.	Motor Vehicle	Pedestrian Safety
12.21	LINestring ( 39.214593, 39.15462)	LINestring (-121.483254, -121.479013)	Kibbe Rd	Browns Valley Rd	Y	A third Access to and from Highway 20 to Hammonton Smartville Rd is needed to disparte congestion on Simpson Ln and downtown Marysville.	Motor Vehicle	Narrow Road
17.87	LINestring ( 39.156625, 39.156625, 39.154999)	LINestring (-121.571405, -121.571405, -121.571392)	Jacobs St	Huston St	Y	Street has too many pot holes and could damage vehicle tires. Please repair street.	Motor Vehicle	Pavement Conditions
12.47	LINestring ( 39.000757, 39.040197)	LINestring (-121.407788, -121.469585)	D St	D St	N	A lot of accidents going through wheatland due to single lane roads, roads need to be double laned instead. Also prevents congestion through hwy65.	Motor Vehicle	Narrow Road
14.66	LINestring ( 39.055301, 39.055344, 39.048944, 39.045028)	LINestring (-121.554211, -121.547976, -121.54738, -121.544235)	Plumas Arboga Rd	Plumas Arboga Rd	N	Unsafe speeds and passing due to no posted speed limit. Dangerous corners and curves that have caused multiple vehicle accidents, even a Wheatland Fire Authority Vehicle accident. Multiple close calls due to turning into driveways and having to avoid cars that pass unsafe and speed. The ultimate fix would be to make Arboga Rd go through to Algodon Riveroaks Blvd for a better flow off traffic.	Motor Vehicle	Speeding
15.89	LINestring ( 39.246755, 39.239203, 39.238807, 39.237404, 39.236092, 39.234887, 39.234131)	LINestring (-121.40789, -121.409306, -121.408192, -121.408308, -121.408238, -121.408238, -121.408285)	Marysville Rd	Marysville Rd	N	There are no sidewalks/bike lanes/ shoulder. Kids cannot walk to school	Pedestrian	Pedestrian Safety
13.73	LINestring ( 39.125825, 39.125209, 39.125129, 39.122176, 39.118072, 39.114048, 39.111392, 39.108012, 39.105838, 39.103826, 39.102377)	LINestring (-121.574765, -121.574958, -121.57309, -121.566649, -121.562397, -121.557936, -121.556173, -121.552439, -121.55109, -121.549223, -121.54829)	Lindhurst Ave	Lindhurst Ave	N	All of Lindhurst Ave needs to be restriped and reflectors replaced. No fog line from Erle rd till past the extra heading south.	Motor Vehicle	Pavement Conditions

#	Point X	Point Y	Primary St	Secondary St	Intersection	Public Reported Concerns	Mode	Pertinent Issues
17.49	LINestring ( 39.232498, 39.232516, 39.22133)	LINestring (-121.455064, -121.455049, -121.450928)	Spring Valley Rd	Jones Rd	Y	Increased traffic make it unsafe for the frequent walkers on this road. There are several drivers who use it as a speedway and there is limited area to walk off the road.	Motor Vehicle	Speeding
13.51	LINestring ( 39.064752, 39.063744, 39.06131, 39.05869, 39.057005, 39.055133, 39.053448, 39.051857, 39.050266, 39.048394, 39.047271, 39.046147, 39.046334, 39.036158, 39.035034, 39.032319, 39.030447, 39.029604, 39.028387, 39.022723, 39.021412, 39.019914, 39.018509, 39.01472)	LINestring (-121.351718, -121.353645, -121.354007, -121.356538, -121.358346, -121.360395, -121.364252, -121.366181, -121.368591, -121.371725, -121.373533, -121.375703, -121.378475, -121.389096, -121.391145, -121.393917, -121.396207, -121.395243, -121.395725, -121.403268, -121.405317, -121.408089, -121.408692, -121.416277)	Camp Far West Rd	Camp Far West Rd	N	Spenceville Road has not been repaved in over 13 years. There are tons of potholes. When it rains you have to drive less than 35mph to avoid hydroplaning since the road develops huge puddles.	Motor Vehicle	Pavement Conditions
14.09	LINestring ( 39.069962, 39.07061, 39.043552)	LINestring (-121.468295, -121.468306, -121.468387)	Bradsha Wrd	Bradsha Wrd	N	Major potholes	Motor Vehicle	Pavement Conditions
17.03	LINestring ( 39.159651, 39.159765, 39.158998, 39.158932, 39.158655, 39.159857, 39.159996, 39.160151, 39.160233, 39.160315, 39.160421, 39.160531, 39.160596, 39.160551, 39.160624, 39.16069, 39.160698)	LINestring (-121.565999, -121.56614, -121.565139, -121.565027, -121.564718, -121.566313, -121.566598, -121.566851, -121.567051, -121.567431, -121.567757, -121.567977, -121.56822, -121.568545, -121.568819, -121.56903, -121.569325)	E 22nd St	E 22nd St	N	The roundabouts that were recently installed are so dangerous! I don't understand whose idea it was either. It has made East 22nd Street more of a hazard than safe! Someone's parked car is going to be hit while driving around the round about and half the people who drive on 22nd Street just plow right through them like they're not there. I've lived on this road for 20+ years and my parents have lived on it for 30+ years, we know the dangers of this road but adding a round about wasn't a fix for it!!! Please please please look into it. It seems so senseless!	Motor Vehicle	Pedestrian Safety

#	Point X	Point Y	Primary St	Secondary St	Intersection	Public Reported Concerns	Mode	Pertinent Issues
13.11	LINESTRING ( 39.214625, 39.215525, 39.219476, 39.223447, 39.227119, 39.23124, 39.233937, 39.239508, 39.242355, 39.247749, 39.251719, 39.257487, 39.263104, 39.267148, 39.26932, 39.280506, 39.285897, 39.291019, 39.296783, 39.304399, 39.305072, 39.312147, 39.31297, 39.322078, 39.330561, 39.333265, 39.332029, 39.327603, 39.334979, 39.339773, 39.346779, 39.349728, 39.353169, 39.356856, 39.361648)	LINESTRING (-121.510631, -121.51034, -121.509857, -121.511501, -121.510534, -121.510244, -121.507825, -121.503813, -121.501684, -121.498492, -121.4953, -121.492841, -121.488198, -121.48607, -121.484522, -121.476694, -121.472632, -121.465294, -121.457459, -121.437608, -121.431708, -121.41674, -121.414999, -121.39323, -121.383059, -121.378291, -121.364939, -121.341259, -121.334902, -121.335061, -121.32775, -121.325684, -121.325684, -121.326161, -121.323141)	Loma Rica Rd	Browns Valley Rd	Y	People drive entirely too fast out here and there's many many low spots in the road when it rains the road becomes very very dangerous!	Motor Vehicle	Speeding
18.32	LINESTRING ( 39.247297, 39.25461, 39.261606, 39.265249, 39.265561, 39.268506, 39.273908, 39.277341)	LINESTRING (-121.407463, -121.397863, -121.394559, -121.392759, -121.392683, -121.39311, -121.393834, -121.39382)	Marysville Rd	Marysville Rd	N	Excessive speeds. Blind corners near Shadobrook trail and one near 5964, and neighbors making the road very dangerous to pull in and out. There has been 5 wrecks since Sep. One being a fatal near Shadowbrook. 1 on the same day, with no LE show up, and no transportation to the hospital. 2 roll overs near Bald Mountain, and 1 head on near 5964 (since Sept).	Motor Vehicle	Speeding
14.56	LINESTRING ( 39.006613, 39.00616, 39.009514, 39.010488)	LINESTRING (-121.435133, -121.433675, -121.428717, -121.427325 )	Wheatland Rd	Wheatland Rd	N	This road is in very bad shape from all the trucks last year bring dirt for canal improvements	Motor Vehicle	Pavement Conditions
14.61	LINESTRING ( 39.336588, 39.335419, 39.321563)	LINESTRING (-121.406332, -121.406659, -121.39528)	Wolf Trail	Wolf Trail	N	Speeding, uneven road, big bumps, big craters, dirt road that needs to be cemented	Motor Vehicle	Speeding
14.47	LINESTRING ( 39.115524, 39.110075, 39.112864, 39.115588)	LINESTRING (-121.565282, -121.568506, -121.555608, -121.565199)	Chestnut Rd	Chestnut Rd	N	Lane striping, fog lines, and Stop markings are all nearly invisible, especially at night and in the rain. Many times you cannot tell where a lane is or is not.	Motor Vehicle	Pavement Conditions
13.51	LINESTRING ( 39.026836, 39.026649)	LINESTRING (-121.542272, -121.545158)	Plumas Arboga Rd	Plumas Arboga Rd	N	Short section from Plumas-Arboga/ Algodon intersection to the levee is posted as 25 MPH. West of intersection is 40/45 MPH and East of the levee is 55 MPH. Need to make intersection All-way Stop, humps to slow cars, or do away with the 25 MPH speed limit. Intersection and section of road makes no sense.	Motor Vehicle	Intersection Safety

#	Point X	Point Y	Primary St	Secondary St	Intersection	Public Reported Concerns	Mode	Pertinent Issues
12.94	LINestring ( 39.124769, 39.127123, 39.1292, 39.131554)	LINestring (-121.570803, -121.562771, -121.444254, -121.433544)	N Beale Rd	Lindhurst Ave	N	Everyone speeds and doesn't pay attention.	Motor Vehicle	Speeding
13.88	LINestring ( 39.149674, 39.161846, 39.166216, 39.168671, 39.173727, 39.191382, 39.202139)	LINestring (-121.576766, -121.560883, -121.558787, -121.556784, -121.550543, -121.535265, -121.5171)	SR 70	SR 70	N	Speeding.	Motor Vehicle	Speeding

## APPENDIX B: SUMMARY OF PLANNING DOCUMENTS



## Matrix of Planning Goals, Policies, and Projects

Document	Highlights																
<b>Yuba County 2030 General Plan (2011)</b>	<p>The Yuba County General Plan lists out projects, policies and actions to be implemented in the Circulation section of the plan. The Plan addresses the following:</p> <ul style="list-style-type: none"> <li>• <b>Proposed Road Improvements:</b> Improve County roads and State Facilities to serve to unincorporated County area. Improvements are recommended on County roads are:               <ul style="list-style-type: none"> <li>○ Arboga Road (Existing and New Roadway)</li> <li>○ Erle Road</li> <li>○ Lindhurst Avenue</li> <li>○ Links Parkway (Partially Constructed Roadway)</li> <li>○ McGowan Parkway (Existing and New Roadway)</li> <li>○ N. Beale Road</li> <li>○ Plumas Arboga Road</li> <li>○ River Oaks Boulevard</li> <li>○ Goldfields Parkway (New Roadway)</li> <li>○ Wheatland Bypass (New Roadway)</li> <li>○ 5<sup>th</sup> Street (Twin Cities Memorial Bridge)</li> </ul> </li> <li>• <b>Proposed Bicycle Travel ways:</b> The County envisions the following bicycle/pedestrian travel ways along County roadways:               <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>Location</th> <th>Limits</th> </tr> </thead> <tbody> <tr> <td colspan="2" style="text-align: center;"><b>Bicycle / Pedestrian Path</b></td> </tr> <tr> <td>1. Feather River Bikeway</td> <td>Yuba River Bridge to Bear River Bridge</td> </tr> <tr> <td>2. Bear River Bikeway</td> <td>Feather River Bikeway to Camp Far West</td> </tr> <tr> <td>3. North Yuba River Bikeway</td> <td>Marysville to Hallwood (Rural Community)</td> </tr> <tr> <td>4. South Yuba River Bikeway</td> <td>SR 70 Bridge over Yuba to River to Simpson Lane</td> </tr> <tr> <td colspan="2"></td> </tr> <tr> <td colspan="2" style="text-align: center;"><b>Bicycle Lane</b></td> </tr> </tbody> </table> </li> </ul>	Location	Limits	<b>Bicycle / Pedestrian Path</b>		1. Feather River Bikeway	Yuba River Bridge to Bear River Bridge	2. Bear River Bikeway	Feather River Bikeway to Camp Far West	3. North Yuba River Bikeway	Marysville to Hallwood (Rural Community)	4. South Yuba River Bikeway	SR 70 Bridge over Yuba to River to Simpson Lane			<b>Bicycle Lane</b>	
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<b>Bicycle Lane</b>																	



**Document**

**Highlights**

	Document	Highlights	
	1. Marysville Road	Spring Valley Road to Bullards Bar Dam	
	2. Loma Rica Road	SR 20 to Marysville Road	
	3. Los Verjeles Road	Loma Rica Road to Honcut Creek Bridge at Butte County line	
	4. Fruitland Road to Honcut Road	Marysville Road to Honcut Creek Bridge at Butte County line	
	5. Ramirez Road	SR 70 to Butte County line	
	6. Jack Slough Road	City of Marysville to Woodruff Lane	
	7. Matthews Lane	Woodruff Lane to Ramirez Road	
	8. Woodruff Lane	Jack Slough Road to SR 20	
	9. Hammonton-Smartville Road	Simpson Lane to SR 20	
	10. Griffith Avenue	Hammonton-Smartville Road to Erle Road	
	11. Pasado Road to Chestnut Road to Erle Road to Virginia Road to Ostrom Road	Alicia Avenue to Jasper Lane	
	12. Jasper Lane	Ostrom Road to Spenceville Road	
	13. Spenceville Road	Camp Far West to City of Wheatland	
	14. Blackford Road	Camp Far West Road to Placer County Line	
	15. Forty-Mile Road	SR 65 to Bear River Bridge	
	16. Plumas-Arboga Road (and future	Feather River Boulevard to Ostrom Road	



**Document**

**Highlights**

	extension) to South Beale Road	
	17. Algodon Road	Star Bend Levee to SR 70
	18. Simpson Lane	Hammonton-Smartville Road to City of Marysville
	19. North Beale Road	SR 70 to Beale Air Force Base
	20. River Oaks Boulevard	Plumas-Arboga Road to Feather River Boulevard (southern Yuba County)
	21. Chestnut Rd to Olivehurst Avenue	Erle Road to McGowan Parkway
	22. Edgewater Circle	Erle Road to Erle Road
	23. McGowan Parkway	Olive Avenue to Arboga Road
	24. Arboga Road	Erle Road to Plumas-Arboga Road
	25. Feather River Boulevard	Riverside Drive to Arboga Road
	26. Alicia Avenue	Riverside Drive to Pasado Road
	<b>Bicycle Route</b>	
	1. Marysville Road	Bullards Bar Dam to SR 49
	2. Frenchtown Road	Brownsville to Marysville Road
	3. Willow Glen Road	Brownsville to Marysville Road
	4. Spring Valley Road	Marysville Road to SR20
	5. Fruitland Road	Ramirez Road to Honcut Road



**Document**

**Highlights**

	Document	Highlights										
	<table border="1"> <tr> <td>6. Dolan Harding</td> <td>Marysville Road to Marysville Road</td> </tr> <tr> <td>7. Peoria Road</td> <td>Marysville Road to SR20</td> </tr> <tr> <td>8. Timbuctoo-Smartville Road</td> <td>Parks Bar Bridge at SR 20 to Smartville at SR 20</td> </tr> <tr> <td>9. Spenceville Road/Smartville Road</td> <td>Camp Far West Road to Hammonton-Smartville Road</td> </tr> <tr> <td></td> <td></td> </tr> </table>	6. Dolan Harding	Marysville Road to Marysville Road	7. Peoria Road	Marysville Road to SR20	8. Timbuctoo-Smartville Road	Parks Bar Bridge at SR 20 to Smartville at SR 20	9. Spenceville Road/Smartville Road	Camp Far West Road to Hammonton-Smartville Road			<ul style="list-style-type: none"> <li>• <b>Goal for Level of Service:</b> Maintain a roadway system that provides adequate level of service, as funding allows, and that is consistent with the County’s planning, environmental, and economic policies. Policy CD16.1 through Policy CD16.2 help enforce this goal.</li> <li>• <b>Goal for Travel Demand Management:</b> Reduce costs of transportation infrastructure, increase freedom of mode choice, maintain air quality, and improve the local quality of life by managing travel demand. Policies CD17.1 through CD17.7 help enforce this goal.</li> <li>• <b>Goal for Regional Transportation Planning:</b> Improved transportation access throughout the County and surrounding region. Policies CD18.1 through CD18.8 help enforce this goal.</li> <li>• <b>Goal for Freedom of Travel Mode Choice:</b> Roadway design, development patterns, and circulation systems that encourage walking, bicycling, and transit use. Policies CD19.1 through CD19.12 help enforce this goal.</li> <li>• <b>Goal for Connectivity:</b> Multiple connections to promote circulation and emergency access throughout valley and foothill communities. Policies CD20.1 to CD20.8 help enforce this goal.</li> <li>• <b>Goal for Connectivity:</b> Efficient and well-designed parking that considers the convenience of Yuba County’s drivers and the needs of pedestrians, bicyclists, and transit users. Policies CD21.1 through CD21.7 help enforce this goal.</li> <li>• <b>Goal for Goods Movement:</b> Safe and efficient movement of raw materials and finished goods. Policies CD22.1 to CD22.8 help enforce this goal.</li> </ul>
6. Dolan Harding	Marysville Road to Marysville Road											
7. Peoria Road	Marysville Road to SR20											
8. Timbuctoo-Smartville Road	Parks Bar Bridge at SR 20 to Smartville at SR 20											
9. Spenceville Road/Smartville Road	Camp Far West Road to Hammonton-Smartville Road											
<p><b>Yuba County Bikeway Master Plan (2012)</b></p>		<p>The goals, policies and actions build upon the goals and policies identified by the Yuba County General Plan.</p> <ul style="list-style-type: none"> <li>• <b>Goal:</b> A transportation system that is safe for bicycle use, with reduced numbers of bicycle-related collisions</li> </ul>										



**Document**

**Highlights**

Document	Highlights
	<ul style="list-style-type: none"> <li>○ Policy: Encourage bicycling safety education opportunities for bicyclists of all ages as well as for motorists</li> <li>Erle Policy: Encourage enforcement activities that improve bicycle safety</li> <li>● <b>Goal:</b> A well-maintained bikeway system             <ul style="list-style-type: none"> <li>○ Policy: Perform regular maintenance of bicycle facilities, inclusive of pavement conditions, pavement quality, striping, stenciling, and signage</li> </ul> </li> <li>● <b>Goal:</b> Promote the integration of bicycle infrastructure with other forms of transportation, including public transit             <ul style="list-style-type: none"> <li>○ Policy: Facilitate linkages between bicycle infrastructure and other modes of transportation, including transit services provided by Yuba-Sutter Transit</li> </ul> </li> <li>● <b>Goal:</b> Establish educational opportunities aimed at all levels of bicyclists, pedestrians, motorists, and law enforcement personnel that promote safe bicycling and safer driving behaviors among motorists             <ul style="list-style-type: none"> <li>○ Policy: Cooperate with other public agencies, such as the Sheriff's Department, fire department, and school districts to carry out educational programs</li> </ul> </li> <li>● <b>Goal:</b> Maximize funding opportunities to expand the local bikeway system             <ul style="list-style-type: none"> <li>○ <u>Action</u> : Pursue a variety funding sources for bicycle facilities, safety programs, education programs, and encouragement programs</li> <li>○ <u>Action</u>: Schedule bikeway expansion projects to occur with other roadway improvement projects such as maintenance or new roadway construction</li> </ul> </li> <li>● <b>Goal:</b> Integrate the consideration of bicycle travel into planning activities, development review, and design             <ul style="list-style-type: none"> <li>○ Policy: Consider the needs of bicyclists when reviewing development proposals and when completing other transportation planning projects</li> <li>○ Policy: Coordinate with appropriate agencies, including Caltrans, as appropriate through the bikeway planning and design process</li> </ul> </li> <li>● <b>Goal:</b> Increase bicycle mode share to three percent by the year 2025</li> <li>● <b>Proposed Bike Lanes:</b> <ul style="list-style-type: none"> <li><u>Class I Bike Paths</u> <ul style="list-style-type: none"> <li>○ Linda Bike Path</li> <li>○ Yuba River Crossing</li> <li>○ Sacramento Northern Bike Path</li> </ul> </li> <li><u>Class II Bike Paths</u></li> </ul> </li> </ul>



Document	Highlights
	<ul style="list-style-type: none"> <li>○ 7<sup>th</sup> Avenue</li> <li>○ Arboga Road</li> <li>○ Dunning Avenue</li> <li>○ Linda Avenue</li> <li>○ McGowan Parkway</li> <li>○ Olivehurst Avenue</li> <li>○ Powerline Road</li> </ul> <p><u>Class III Bike Paths</u></p> <ul style="list-style-type: none"> <li>○ La Porte Road</li> <li>○ Loma Rica Road</li> <li>○ Marysville Road</li> <li>○ North Beale Road</li> <li>○ Plumas Arboga Road</li> <li>○ Spencevilla Road</li> <li>○ Willow Glen Road</li> </ul>
<p><b>Yuba- Sutter Short Range Transit Plan (2015)</b></p>	<p>One key consideration in the timing of this plan is the upcoming implementation of the Connect Card regionwide fare media program. Following are the improvements as summarized in the implementation plan for Fiscal Year 2015-20:</p> <p><i>Fiscal Year 2015-16</i></p> <ul style="list-style-type: none"> <li>• Revise Route 2 and Route 4A (September), including preparation of new schedules</li> <li>• Expand Live Oak Service to five days per week, and revise Wheatland service to three days per week (July)</li> <li>• Revise Dial-A-Ride program to eliminate general public daytime service, reduce service area, revise age definition of senior, and expand capacity (September)</li> <li>• Conduct passenger surveys and implement earlier SR 99 PM commuter run (September)</li> <li>• Define specific proposal for Yuba College student fee and hold election (Spring)</li> <li>• Implement Connect Card, and closely monitor ridership and fare revenue impacts</li> <li>• Start implementing bus stop and transit center improvements and bus stop sign replacement</li> <li>• Expand road supervision to help address on-time performance issues</li> <li>• Fund the North Beale Road project</li> <li>• Implement the remainder of the on-board and park-and-ride video system</li> </ul> <p><i>Fiscal Year 2016-17</i></p> <ul style="list-style-type: none"> <li>• Assuming a successful Yuba College student fee election, implement Sutter County Center shuttle service and eliminate fares for Yuba College students on local fixed routes, at the beginning of the Fall Semester</li> </ul>



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	<ul style="list-style-type: none"> <li>Extend weekday and Saturday Local Route service by one hour, and trim Evening Dial-A-Ride to start at 7:00 PM</li> <li>Implement peak tripper service on Local Routes to improve on-time performance</li> <li>Continue implementing bus stop and transit center improvements and bus stop sign replacement</li> <li>Implement real-time transit information system</li> <li>Establish and fill additional administrative position</li> <li>Finalize plans for improvements to Routes 1, 3 and 6</li> <li>Review the need for a fare increase</li> <li>Purchase new Supervisor van</li> <li>Conduct a study of a potential new transit center to replace the current stop at Alturas/Shasta</li> </ul> <p><i>Fiscal Year 2017-18</i></p> <ul style="list-style-type: none"> <li>Continue to expand Dial-A-Ride capacity</li> <li>Continue implementing bus stop and transit center improvements</li> <li>Implement 20-minute service frequency on Routes 1 and 3, along with potential realignment of Routes 3 and 6</li> <li>Purchase seven replacement Commuter Service buses</li> <li>Conduct study of a potential new transit center at North Beale Road</li> </ul> <p><i>Fiscal Year 2018-19</i></p> <ul style="list-style-type: none"> <li>Purchase 11 low-floor Dial-A-Ride vans</li> <li>Continue to expand Dial-A-Ride capacity</li> <li>Continue implementing bus stop and transit center improvements</li> </ul> <p><i>Fiscal Year 2019-20</i></p> <ul style="list-style-type: none"> <li>Purchase 13 buses for Local Fixed Route Service</li> <li>Continue to expand Dial-A-Ride capacity</li> </ul> <p>Continue implementing bus stop and transit center improvements.</p>
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**Transportation Master Plan (2020-2024)**

The Transportation Master Plan provides a comprehensive list of all completed and proposed roadway improvements. The projects listed below are the complete streets and geometric roadway projects for the years 2017-2021.

- Federal/State Aid Capital Improvement Projects:**

Road Name	Limits Description of Work	Length (miles)	Funding Source	Cost Estimate
<b>2020</b>				
Eleventh	Curb/gutter/sidewalk/drainage/overlay, Olivehurst Ave to Powerline Rd	0.4	ATP	\$1,505,000



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Erle Road	Edgewater Rd to Arboga Rd	1.0	LPP	\$300,000
Feather River Blvd	Algodon Rd to River Oaks Blvd, fabric/overlay	4.0	RSTP	\$2,080,000
Iowa City Road Rd	Replace covered wood bridge	0.2	HBP	\$2,672,000
Oregon Hill Road	Replace bridge @ Slate Creek	0.2	USFS	\$650,000
Road Striping	Various Roads- Replace Striping		HSIP	\$1,847,000
	<b>2020 Subtotal:</b>	<b>5.8</b>		<b>\$9,054,000</b>
<b>2021</b>				
Alicia Avenue	Curb/gutter/sidewalk/widen/overlay, Alicia Avenue from Feather River	0.4	ATP	\$1,560,000
Cedar Lane	Curb/gutter/sidewalk/widen/overlay, Cedar Lane from Alicia Boulevard to Garden Avenue	0.3	ATP	\$1,169,000
Feather River Blvd Ave	State of Good Repair/sidewalk/widen/bike lane/from Garden Avenue to Alicia Avenue	0.3	RSTP	\$1,701,000
Hammonton-Smartsville Road	Shoulder widening, dig outs, and asphalt overlay from 2.1 miles east of Doolittle Gate to 5.1 miles east of Doolittle Gate.	3.0	LPP	\$750,000
McGowan	Curb/gutter/sidewalk/widen/overlay, Olive Ave. to SR70	0.6	ATP	\$1,246,000
N. Beale	Complete Streets Phase 2, from H-S	0.7	STIP/CMAQ	\$4,670,000
Rices Xing Road	Replace bridge at Oregon House Creek	0.2	HBP	\$4,084,000
Waldo Road	Replace bridge @ Dry Creek	0.2	HBP	\$4,017,000
	<b>2021 Subtotal:</b>	<b>5.7</b>		<b>\$19,197,000</b>

Road Name	Limits Description of Work	Length (miles)	Funding Source	Cost Estimate
<b>2022</b>				
Los Verjeles Road	Replace bridge at Honcut Creek	0.2	HBP	\$6,464,000



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Spring Valley Road	Replace bridge at Little Dry Creek	0.2	HBP	\$2,866,000
	<b>2022 Subtotal:</b>	<b>0.4</b>		<b>\$9,301,000</b>
<b>2023</b>				
Ellis Road	Replace bridge at Simmerly Slough	0.2	HBP	\$650,000
Ninth Avenue	Curb/gutter/sidewalk/bike lane/overlay, Ninth Avenue from Western Avenue to Powerline Avenue	0.8	ATP	\$2,866,000
	<b>2023 Subtotal:</b>	<b>1.0</b>		<b>\$4,476,000</b>
<b>2024</b>				
Plumas	Phase 2 Interchange at Plumas Lake	0.5	STIP	\$10,000,000
	<b>2024 Subtotal:</b>	<b>0.5</b>		<b>\$10,000,000</b>
<b>Total</b>	<b>2020-2024</b>	<b>13.4</b>	<b>Miles</b>	<b>\$52,028,000</b>

• **Locally Funded Capital Improvement Projects:**

Road Name	Limits Description of Work	Length (miles)	Funding Source	Cost Estimate
<b>2020</b>				
Ardmore Avenue	Drainage improvements, 9th to 11th Ave	0.2	YWA,	\$250,000
Eleventh	Curb/gutter/sidewalk/drainage/overlay, Olivehurst Ave to Powerline Rd	Inc.in Fed	State Match (Exchange)	\$196,000
Erle Road	Edgewater Rd to Arboga Rd	Inc.in	Measure D	\$378,000
Feather River	Algodon Rd to River Oaks	Inc. in Fed	Measure D	\$100,000
Lake Francis	Overlay and two curve corrections south	2.8	YWA	\$950,000
Plumas Lake Blvd	Environmental, design, and ROW for Phase 2 of the interchange at Plumas Lake Blvd and SR 70	Inc. in Fed aid	PLSP Road Fee	\$1,600,000
Wiget Avenue	Drainage Improvements	Inc. in Fed	YWA	\$250,000
	<b>2020 Subtotal:</b>	<b>3.2</b>		<b>\$3,724,000</b>
<b>2021</b>				
Alicia Avenue	Curb/gutter/sidewalk/widen/overlay, Alicia Avenue from Feather River	0.4	State Match (Exchange)	\$146000



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Cedar Lane	Curb/gutter/sidewalk/widen/overlay,	0.3	State Match	\$110,000
Goldfields Parkway	N. Beale to Hammonton-Smartsville Rd, Design	N/A	CNTY Cap Fee	\$200,000
Hammonton-Smartsville Road	Shoulder widening, dig outs, and asphalt overlay from 2.1 miles east of Doolittle Gate to 5.1 miles east of Doolittle Gate.	3.0	Measure D	\$1,200,000
McGowan	Curb/gutter/sidewalk/widen/overlay, Olive Ave. to SR70	Inc. in Fed aid	Measure D	\$313,000
N. Beale Road	Complete Streets Phase 2, from H-S Road to Linda Ave	Inc. in Fed aid	YWA	\$900,000
	<b>2021 Subtotal:</b>	<b>3.7</b>		<b>\$2,869,000</b>
<b>2022</b>				
Marysville Rd	Left turn pocket at Brwns Vly School	0.2	Cnty Cap	\$300,000
	<b>2022 Subtotal:</b>	<b>0.2</b>		<b>\$300,000</b>

Road Name	Limits	Length	Funding	Cost
	Description of Work	(miles)	Source	Estimate
<b>2023</b>				
Goldfields	Construct two lanes between N. Beale to	0.5	Cnty Cap Fee	\$2,000,000
Ninth Avenue	Curb/gutter/sidewalk/bike lane/overlay,	<b>0.8</b>	State Match (Exchange)	<b>388,000</b>
	<b>2023 Subtotal:</b>	<b>3.2</b>		\$2,388,000
<b>2024</b>				
Plumas Lake Blvd	Construct Phase 2 of the interchange	0.5	PLSP & Cnty	\$10,000,000
	<b>2024 Subtotal:</b>	<b>0.2</b>		<b>\$10,000,000</b>
<b>Total</b>	<b>2020-2024</b>	<b>7.7</b>	<b>Miles</b>	<b>\$19,281,000</b>

**South Yuba Transportation Improvement Authority-Comprehensive**

- The South Yuba Transportation Improvement Authority, SYTIA was formed by a Joint Powers Authority between Yuba County and City of Wheatland in order to consider, evaluate, construct, and make associated decisions regarding proposed transportation improvements located in the southern portion of the County and within the limits of the City.
- Traffic Impact Fee Program:



Document	Highlights
<p><b>Implementation Strategy</b></p>	<ul style="list-style-type: none"> <li>• The SYTIA Traffic Impact Fee applies to all new development in the unincorporated areas of the County south of the Yuba River as well as within the boundaries of the City of Wheatland.</li> <li>• Fee rates for non-residential uses are converted from p.m. peak hour to equivalent square footage based on the type of non-residential use.</li> <li>• The Study estimated that new development in the area covered by the Fee Program will generate 35,363 new daily p.m. peak hour traffic trips.</li> </ul> <p>Projects:</p> <ul style="list-style-type: none"> <li>• East Wheatland Expressway</li> <li>• SR 65/S Beale Rd Interchange with Extension to Forty Mile Road</li> <li>• Plumas Lake Boulevard Extension /SR 70 Southbound Loop On-Ramp</li> <li>• SR 64 Realignment</li> </ul> <p>Comprehensive Implementation Strategy Goals</p> <ul style="list-style-type: none"> <li>• Create a long-term implementation plan that preserves a viable easterly realignment of SR 65</li> <li>• Develop near term projects with independent utility</li> <li>• Establish a second access to the Sports-Entertainment Complex from SR 65</li> <li>• Establish a local road connection from Riosa Road to Spenceville Road – diverting traffic from SR 65 in Wheatland</li> <li>• Create an implementation plan to complete the State Route 70/Plumas Lake Blvd interchange and connection to Plumas Arboga Road</li> <li>• Consider opportunities to highlight or add project features to attract and leverage funding from additional Sources</li> <li>• Synchronize planned projects in the CIS, Caltrans SHOPP, Caltrans Minor Project Program, and from local developers</li> <li>• Work closely with regional partners to ensure infrastructure improvements are consistent with and included in the SACOG MTP/SCS</li> <li>• Develop a delivery outline with cost, funding, and prioritization recommendations for the projects in the SYTIA program</li> </ul> <p>Methodology</p> <ul style="list-style-type: none"> <li>• To evaluate the three improvement projects, the Yuba County travel demand forecasting model was used. This model provides a detailed roadway network for the study area and has the planned land uses from the approved General Plan.</li> <li>• The model was used to generate the daily volume forecasts for roadways adjacent to the project areas.</li> <li>• The scenarios without and with the projects were modeled to determine the change in traffic volume.</li> </ul>



Document	Highlights
	<ul style="list-style-type: none"> <li>• Additionally, model-wide statistics for vehicle miles traveled (VMT), vehicle hours of travel (VHT), and vehicle hours of delay (VHD) are reported to provide an assessment of how the project affects transportation network efficiency.</li> </ul> <p>Conclusion: This planning level assessment has evaluated the following three projects proposed in south Yuba County.</p> <ul style="list-style-type: none"> <li>• SR 70/Plumas Lake Boulevard Interchange Phase 2</li> <li>• SR 65/South Beale Road Interchange</li> <li>• East Wheatland Expressway</li> </ul>
<p><b>Yuba-Sutter Transit Corridor Enhancement Plan</b></p>	<p>Projects</p> <ul style="list-style-type: none"> <li>• Yuba-Sutter Transit has been awarded a California Department of Transportation (Caltrans) Sustainable Transportation Planning Grant to develop a Corridor Enhancement Plan for Route 1—the eight-mile-long key transit route that links all other routes in the system, and carries 34 percent of the total Local Fixed Route ridership. The Corridor Enhancement Plan (Plan) provides analysis and conceptual site designs, focused on supporting capital improvements to the route’s five key transit centers and other bus facilities along Route 1. The five key transit centers include:             <ol style="list-style-type: none"> <li>a. Walton Terminal</li> <li>b. Alturas &amp; Shasta Terminal</li> <li>c. Yuba County Government Center</li> <li>d. North Beale Transit Center</li> <li>e. Yuba College Transit Center</li> </ol> </li> <li>• The Corridor Enhancement Plan provided analysis and conceptual site designs, focused on supporting capital improvements to the route’s five key transit centers and other facilities along Route 1.</li> <li>• The Plan also recommends analysis and recommendations on Alturas and Shasta Bus Stop with a new transit center and includes site options, a site plan as well as cost estimates.</li> <li>• The plan also talks about recommendations on incremental conversation of the bus fleet to battery electric buses to meet California Air Resources Boards’ direction to change all bus transit fleets to zero emissions.</li> <li>• The plan includes longer-term identifying a larger scale site to accommodate Yuba-shutter Transit operations, bus fleet and battery electric bus infrastructure.</li> </ul>
<p><b>The County of Yuba Fiscal Year 2021-2022</b></p>	<p>This fiscal responsibility resulted in General Fund reserves and contingencies meeting and exceeding adopted policies, investments in our workforce, expanding our technology use and infrastructure, planning for and implementing critical infrastructure projects and</p>



Document	Highlights
<p><b>Proposed Budget</b></p>	<p>accomplishing this with a workforce that is approximately 20% less than back in Fiscal Year 2007/08.</p> <p>Projects 2021:</p> <ul style="list-style-type: none"> <li>• Completed design and financing requirements for the Tri-County Juvenile Rehabilitation Facility – a Yuba County-led three-county (Yuba, Sutter, and Colusa) regional project, and began construction in March 2021.</li> <li>• The Yuba County Library implemented technology-solutions to make more resources easily available to residents during COVID, including digitizing of historical newspaper archives for easy access via the county website.</li> <li>• The County’s Building Department approved a number of commercial construction projects, as well as approved permits for over 500 new homes early indications of what appears of be accelerating growth trends in Yuba County.</li> <li>• Worked with Regional Housing to begin construction of the Cedar Lane Housing Project consisting of 149 affordable housing units, and secured funding for numerous improvements to the west Linda community including the addition of sidewalk, bike paths and drainage.</li> <li>• Yuba County staff continued its contribution to improving Sports and entertainment Zone properties and part if an effort to explore current and future options to develop future opportunities.</li> <li>• The plan also includes establishment of newly build and improvements to new roads and additional work like road stripping safety projects, bridge replacement, Drainage improvements and other projects create safe routes for schools and parks.</li> <li>• The capital would also support local business and community groups to enhance the community services.</li> </ul> <p>Projects proposed 2022:</p> <ul style="list-style-type: none"> <li>• Budget includes new facilities for community like parks and improvements and newly proposed infrastructure around the main library,</li> <li>• Revitalization of roads and parks which also include replacing of play equipment’s and establishing more bike paths.</li> <li>• Identify and provide affordable housing and identify appropriate grants for housing options.</li> <li>• Several proposed road improvements projects are part for the new budget in the year 2022.</li> </ul> <p>Recommendations:</p> <ul style="list-style-type: none"> <li>• Accept and adopt the Proposed Budget for Fiscal Year 2021-2022 as the County’s interim spending plan, including position allocation changes, and direct staff to make available copies for public review.</li> </ul>



Document	Highlights
	<ul style="list-style-type: none"> <li>• Estimated expenditures are balanced with estimated revenues, a carry forward cash balance and one-time revenues;</li> <li>• Although the Proposed Budget is balanced, it is accomplished with the use of limited one-time revenues and, therefore, is not structurally balanced;</li> <li>• Actions by the State of California may require adjustments to the Proposed Budget during Final Budget Hearings; and</li> <li>• Funding additions will require equivalent reductions in funds from other County priorities.</li> </ul>
<p><b>SACOG Metropolitan Transportation Plan (MTP) 2020</b></p>	<p>This plan helps guide the planning and implementation of a low-carbon transportation system that fosters economic vitality, protects the environment and natural resources, and promotes health and well-being equitably for all Californians.</p> <ul style="list-style-type: none"> <li>• Safety Performance Management: Fatalities and Injuries</li> <li>• Pavement and Bridges Condition Performance Management Infrastructure Conditions</li> <li>• System Performance Management: Freight movement, congestion and reliability</li> </ul> <p>The performance outcomes of this plan are dependent on forward-looking policies and strategies that can guide implementation activities over the next one to five years. To achieve our collective vision for the region’s future will require a concerted effort by many agencies and partners, working together to address obstacles and seize opportunities.</p> <ul style="list-style-type: none"> <li>• <b>Build vibrant places for today’s and tomorrow’s residents</b> <ul style="list-style-type: none"> <li>○ This mix of new housing products is critical for housing choice, affordability, walkability, transportation options, and preserving open space and agricultural land.</li> <li>○ Although housing and employment development and physical improvements such as lighting, sidewalks, and increased transit service are positive steps needed to build vibrant communities, they come with the risk of unintended negative consequences. These include displacement, meaning that a neighborhood’s increasing desirability as it is improved leads to rising housing costs that can drive out existing residents.</li> </ul> </li> </ul> <p>Supporting Policies:</p> <ul style="list-style-type: none"> <li>○ <b>Policy 1:</b> Provide incentives, information, tools, technical assistance, and encouragement to support implementation of the Sacramento region’s Sustainable Communities Strategy through.</li> </ul>



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- **Policy 2:** Pursue funding opportunities that support the infrastructure improvements needed to support new housing and employment opportunities in existing urban, suburban, and rural communities.
- **Foster the next generation of mobility solutions**
  - Better travel times, less congestion, improved air quality, and lower greenhouse gas emissions all depend on a variety of mobility options and programs becoming more widely available across all types of communities in the region.
  - These mobility options and programs may include bike or car share, various ride-hailing options like Uber pooling, vanpools, micro transit, transportation demand management, or more traditional services like bus and light rail.
  - A modernized public transit system with good bus and rail service is the backbone of this plan’s shared mobility strategy. Bus and light rail service that offers fast, reliable, and safe travel, and connects with new mobility services, can provide more travel choices to residents throughout the region.

Supporting Policies:

- **Policy 3:** Implement pilot projects aimed at making micro transit and micro mobility (such as bike and scooter share) work for urban, suburban, rural, and low-income areas of the region.
- **Policy 4:** Pursue flexibility in state and federal funding sources to enable testing and implementation of innovative mobility solutions that are affordable, accessible, and reduce greenhouse gas emissions.
- **Policy 5:** Support innovative education and transportation demand management programs covering all parts of the region, to offer a variety of alternatives to driving alone.
- **Policy 6:** Pursue new funding and planning opportunities to support electric vehicle infrastructure and programs for both private vehicles and public transit fleets.
- **Policy 7:** Support transit agencies and local governments looking to secure funds to improve the frequency, hours of service, and coverage of productive bus service (including bus rapid transit, express bus, and more frequent fixed-route service).



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- **Policy 8:** Support more seamless travel through better traveler information for trip planning, reliable service and coordination between operators for transit, shared mobility and other first/last mile connections.
- **Modernize the way we pay for transportation infrastructure**
  - The roadway pricing mechanisms in the MTP/SCS are a critical component of the regional strategy to raise enough revenue to fund our transportation infrastructure, provide mobility benefits to residents, manage traffic, and help to achieve the region’s SB 375 greenhouse gas reduction target.
  - As the fuel tax diminishes in purchasing power and the state and federal governments look at pricing options to replace it, our region will take a leadership role in figuring out how roadway pricing can replace fuel taxes as a primary source of transportation funding.

Supporting Policies:

- **Policy 9:** Pursue new and reformed transportation funding methods and sources to implement the MTP/ SCS that are stable, predictable, flexible, and adequate to operate, maintain, and expand the transportation system. Mileage-based fees/PayGo should replace, not be on top of, existing state fuel taxes.
- **Policy 10:** Find solutions and reliable funding sources to meet the maintenance needs of roads that support rural economies, natural resource-based industries, agriculture, farm-to-market routes, and freight corridors.
- **Policy 11:** Initiate a leadership role in testing and piloting roadway pricing mechanisms, such as facility-based tolling and mileage-based fees, in partnership with the state, federal, and local agencies and private sector organizations.
- **Policy 12:** Take steps to implement tolling or pricing of specific lanes on major facilities, such as freeways, to improve traffic management, reliability, and operations of those facilities and to help raise funding for the cost of building and maintaining large capital investments.
- **Policy 13:** All new major expansion projects on the region’s freeways and expressways should be planned for eventual deployment of pricing options to both manage demand and provide a financing mechanism for capital costs. Any pricing strategy pursued should be sensitive to changes in roadway demand during different parts of the day (peak/off-peak) with the objective of managing demand and providing travel choice.
- **Policy 14:** Revenues generated from facility-based pricing should be used to build and maintain a regional network of paid express lanes and, where surplus



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revenue is available, on strategic transit services (e.g., express buses) or other mobility solutions that can reduce vehicle miles traveled and provide multiple travel options along priced corridors.

- **Policy 15:** New taxes and fees, including mileage-based fees, intended to raise additional funding for transportation purposes should prioritize closing the gap for system maintenance and state-of-good repair needs before investing in system expansion.
- **Policy 16:** When implementing pricing strategies, both paid express lanes and mileage-based fees/ PayGo, the region should make every effort to avoid negatively impacting lower income and rural households. For regional implementation of PayGo, explore innovative options for setting fees, such as including off-setting incentives for non-vehicular travel, off-sets to fees for disadvantaged households, and keying fee rates to maintenance and fix-if-first goals.

- **Build and maintain a safe, reliable and multimodal transportation system**

- To deliver on the priorities of this plan, the region must prioritize near-term investment decisions, align regional and local funding programs with a set of common goals, and be creative and strategic in pursuing state and federal grants. These efforts must be supported by performance measures, data, and strong partnerships among public and private organizations throughout the region.
- Transportation Project List describes all the near- and long-term transportation programs, infrastructure investments, and improvements included in this plan.

Supporting Policies:

- **Policy 17:** Reduce the growing system maintenance funding gap by prioritizing spending flexible revenues on state-of-good repair improvements before investing in system expansion.
- **Policy 18:** System expansion investments that are not directly paid for by new development should be focused on fixing major bottlenecks that exist today, and/or incentivize development opportunities in infill areas.
- **Policy 19:** Transit expansion, particularly light rail and other fixed infrastructure transit options, should be targeted at communities with supportive land use policies and development patterns that will generate transit ridership and improve the cost recovery rates for transit service.
- **Policy 20:** Prioritize cost effective safety improvements that will help the region eliminate fatal transportation related accidents.



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**Policy 21:** Transportation infrastructure investments should be planned and built in a way that makes the system more resilient to extreme weather events and natural disasters.

**Policy 22:** Invest in bicycle and pedestrian infrastructure to encourage healthy, active transportation trips and provide recreational opportunities for residents and visitors.

**Policy 23:** Prioritize and incentivize transportation investments that benefit environmental justice communities.

**Policy 24:** Invest in transportation improvements that improve access to major economic assets and job centers.

**Policy 25:** Prioritize investments in transportation improvements that reduce greenhouse gas emissions and vehicle miles traveled.

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## APPENDIX C: CONSOLIDATED HIGH INJURY COLLISION DATABASE







## SWITRS Codebook

### SWITRS Collision Raw Data

Item Name	Variable Name	Description	Label	Possible Values
Case Id	<b>CASEID</b>	the unique identifier of the collision report (barcode beginning 2002; 19 digit code prior to 2002)		
X-Coordinate Location	<b>POINT_X</b>	The longitude of the geocoded location; uses the World Geodetic System from 1984 (WGS84).		
Y-Coordinate Location	<b>POINT_Y</b>	The latitude of the geocoded location; uses the World Geodetic System from 1984 (WGS84).		
Collision Year	<b>YEAR_</b>	the year when the collision occurred		
County City Location	<b>LOCATION</b>	the location code of where the collision occurred		Data may appear with no leading zero.
CHP Beat Type	<b>CHPTYPE</b>		<b>0 "Not CHP"</b> <b>1 "Interstate"</b> <b>2 "US Highway"</b> <b>3 "State Route"</b> <b>4 "County Road Line"</b> <b>5 "County Road Area"</b> <b>6 "US Highway"</b> <b>7 "State Route"</b> <b>8 "County Road Line"</b> <b>9 "County Road Area"</b> <b>10 "Safety Services Program Beats"</b> <b>11 "Administrative Beats (900's)"</b>	1 - Interstate 2 - US Highway 3 - State Route 4 - County Road Line 5 - County Road Area A - Safety Services Program Beats S - Administrative Beats (900's) 0 - Not CHP Contract City: 6 - US Highway 7 - State Route 8 - County Road Line 9 - County Road Area
Day of Week	<b>DAYWEEK</b>	the code for the day of the week when the collision occurred		1 - Monday 2 - Tuesday 3 - Wednesday 4 - Thursday 5 - Friday 6 - Saturday 7 - Sunday
Collision Severity	<b>CRASHSEV</b>	the injury level severity of the collision		1 - Fatal 2 - Injury (Severe)

		(highest level of injury in collision)		3 - Injury (Other Visible) 4 - Injury (Complaint of Pain) 0 – Property Damage Only (PDO) (PDO collisions not included on TIMS)
PCF Violation Category	<b>VIOLCAT</b>			01 - Driving or Bicycling Under the Influence of Alcohol or Drug 02 - Impeding Traffic 03 - Unsafe Speed 04 - Following Too Closely 05 - Wrong Side of Road 06 - Improper Passing 07 - Unsafe Lane Change 08 - Improper Turning 09 - Automobile Right of Way 10 - Pedestrian Right of Way 11 - Pedestrian Violation 12 - Traffic Signals and Signs 13 - Hazardous Parking 14 - Lights 15 - Brakes 16 - Other Equipment 17 - Other Hazardous Violation 18 - Other Than Driver (or Pedestrian) 19 - 20 - 21 - Unsafe Starting or Backing 22 - Other Improper Driving 23 - Pedestrian or "Other" Under the Influence of Alcohol or Drug 24 - Fell Asleep 00 - Unknown - - Not Stated
Killed victims	<b>KILLED</b>	counts victims in the collision with degree of injury of 1		0 to N for each collision
Injured victims	<b>INJURED</b>	counts victims in the collision with degree of injury of 2, 3, or 4		0 to N for each collision
Weather 1	<b>WEATHER1</b>	the weather condition at the time of the collision		A - Clear B - Cloudy C - Raining D - Snowing E - Fog F - Other G - Wind - - Not Stated
Pedestrian Collision	<b>PEDCOL</b>	indicates whether the collision involved a pedestrian		Y or blank

Bicycle Collision	<b>BICCOL</b>	indicates whether the collision involved a bicycle		Y or blank
Motorcycle Collision	<b>MCCOL</b>	indicates whether the collision involved a motorcycle		Y or blank
Truck Collision	<b>TRUCKCOL</b>	indicates whether the collision involved a big truck		Y or blank
Alcohol Involved	<b>ETOH</b>	indicates whether the collision involved a party that had been drinking		Y or blank
Time Category	<b>TIMECAT</b>	the time of the collision aggregated by 3 hour categories		300 - Time >= 0:00 or Time <= 2:59 600 - Time >= 3:00 or Time <= 5:59 900 - Time >= 6:00 or Time <= 8:59 1200 - Time >= 9:00 or Time <= 11:59 1500 - Time >= 12:00 or Time <= 14:59 1800 - Time >= 15:00 or Time <= 17:59 2100 - Time >= 18:00 or Time <= 20:59 2400 - Time >= 21:00 or Time <= 23:59 2500 - Time = 25:00 (Unknown)
Month	<b>MONTH_</b>	The month of the year		1 - January 2 - February 3 - March 4 - April 5 - May 6 - June 7 - July 8 - August 9 - September 10 - October 11 - November 12 - December
Type of Collision	<b>CRASHTYP</b>			A - Head-On B - Sideswipe C - Rear End

				D - Broadside E - Hit Object F - Overturned G - Vehicle/Pedestrian H - Other - - Not Stated
Motor Vehicle Involved With	<b>INVOLV</b>			A - Non-Collision B - Pedestrian C - Other Motor Vehicle D - Motor Vehicle on Other Roadway E - Parked Motor Vehicle F - Train G - Bicycle H - Animal I - Fixed Object J - Other Object - - Not Stated
Ped Action	<b>PED</b>			A - No Pedestrian Involved B - Crossing in Crosswalk at Intersection C - Crossing in Crosswalk Not at Intersection D - Crossing Not in Crosswalk E - In Road, Including Shoulder F - Not in Road G - Approaching/Leaving School Bus - - Not Stated
Primary Rd	<b>PRIMARYRD</b>	The road the collision occurred on		
Secondary Rd	<b>SECONDRD</b>	A secondary reference road that DISTANCE and DIRECT are measured from		
Distance	<b>DISTANCE</b>	Offset distance from secondary road		distance converted to feet
Direction	<b>DIRECT</b>	Direction of offset distance		N - North E - East S - South W - West - or blank - Not Stated, in Intersection
Intersection	<b>INTERSECT_</b>	Indicates where a collision occurred at an intersection		Y - Intersection N - Not Intersection Blank - Not stated
Processing Date	<b>PROCDATE</b>	Date the record was processed		
Jurisdiction	<b>JURIS</b>	Jurisdiction		
Collision Date	<b>DATE_</b>	the date when the collision occurred		
Collision Time	<b>TIME_</b>	the time when the collision		Data may appear with no leading

		occurred (24 hour time)		zero(s).
Officer Id	<b>BADGE</b>			
Reporting District	<b>JURDIST</b>			
CHP Shift	<b>SHIFT</b>			1 - 0600 thru 1359 2 - 1400 thru 2159 3 - 2200 thru 0559 4 - CHP Not Stated 5 - Not CHP
Population	<b>POP</b>			1 - Incorporated (less than 2500) 2 - Incorporated (2500 - 10000) 3 - Incorporated (10000 - 25000) 4 - Incorporated (25000 - 50000) 5 - Incorporated (50000 - 100000) 6 - Incorporated (100000 - 250000) 7 - Incorporated (over 250000) 9 - Unincorporated (Rural) 0 - University (Private Property) - - Not Stated
Special Condition	<b>SPECIAL</b>			1 - Schoolbus on Public Roadway (CHP Beat or CHP Adm Beat 901) 2 - State University (Also SFIA) 3 - Schoolbus Not on Public Roadway (CHP Adm Beat 903) 4 - Offroad (Unimproved) (CHP Adm Beat 906, 907) 5 - Vista Point or Rest Area (CHP Adm Beat 903) or Scales or Inspection Facility (CHP Com Beat 860-898) 6 - Other Public Access (Improved) (CHP Adm Beat 903) 0 - Not Above - - Not Stated
Beat Type	<b>BEATTYPE</b>			1 - CHP State Highway 2 - CHP County Road Line 3 - CHP County Road Area 4 - Schoolbus on City Roadway (CHP Adm Beat 901) 5 - Schoolbus not on Public Roadway (CHP Adm Beat 903) 6 - Offroad (Unimproved) (CHP Adm Beat 906, 907) 7 - Vista Point or Rest Area (CHP Adm Beat 903) or Scales or Inspection Facility (CHP Com Beat

				860-898) 8 - Other Public Access (Improved) (CHP Adm Beat 903) 0 - Not CHP
City Division LAPD	<b>LAPDDIV</b>			Includes blanks and dashes as not stated.
CHP Beat Class	<b>BEATCLAS</b>			1 - CHP Primary 2 - CHP Other 0 - Not CHP
Beat Number	<b>BEATNUMB</b>			
Weather 2	<b>WEATHER2</b>	the weather condition at the time of the collision, if a second description is necessary		same as weather 1 above
State Highway Indicator	<b>STATEHW</b>	Indicates whether a collision occurred on a state highway		Y - State Highway N - Not State Highway Blank - Not stated
Caltrans County	<b>CALTRANC</b>			Includes blanks and nulls
Caltrans District	<b>CALTRAND</b>			
State Route	<b>STROUTE</b>			0 = Not State Highway
Route Suffix	<b>ROUTESUF</b>			
Postmile Prefix	<b>POSTPRE</b>			
Postmile	<b>POSTMILE</b>			
Location Type	<b>LOCATYPE</b>			H - Highway I - Intersection R - Ramp (or Collector) - or blank - Not State Highway
Ramp Intersection	<b>RAMP</b>			1 - Ramp Exit, Last 50 Feet 2 - Mid-Ramp 3 - Ramp Entry, First 50 Feet 4 - Not State Highway, Ramp-related, Within 100 Feet 5 - Intersection 6 - Not State Highway, Intersection-related, Within 250 Feet 7 - Highway 8 - Not State Highway - - Not Stated
Side Of Highway	<b>SIDEHW</b>	Code provided by Caltrans Coders; applies to divided highway, based on nominal direction of route; for single vehicle is same as nominal direction of travel, overruled by impact with second vehicle after crossing median		N - Northbound S - Southbound E - Eastbound W - Westbound Blank - Not stated/not state highway

Tow Away	<b>TOWAWAY</b>			Y - Yes N - No
Party Count	<b>PARTIES</b>	counts total parties in the collision		1 to N for each collision
Primary Collision Factor	<b>PCF</b>			A - (Vehicle) Code Violation B - Other Improper Driving C - Other Than Driver D - Unknown E - Fell Asleep - - Not Stated
PCF Violation Code	<b>VIOLCODE</b>			B - Business and Professions C - Vehicle H - City Health and Safety I - City Ordinance O - County Ordinance P - Penal S - Streets and Highways W - Welfare and Institutions - - Not Stated
PCF Violation	<b>VIOL</b>			Corresponds to violcat categories and described in vehicle code manual - ( <a href="http://www.dmv.ca.gov/pubs/vctop/vc/vc.htm">http://www.dmv.ca.gov/pubs/vctop/vc/vc.htm</a> )
PCF Violation Subsection	<b>VIOLSUB</b>			Blank if no subsection.
Hit And Run	<b>HITRUN</b>			F - Felony M - Misdemeanor N - Not Hit and Run
Road Surface	<b>ROADSURF</b>			A - Dry B - Wet C - Snowy or Icy D - Slippery (Muddy, Oily, etc.) - - Not Stated
Road Condition 1	<b>RDCOND1</b>			A - Holes, Deep Ruts B - Loose Material on Roadway C - Obstruction on Roadway D - Construction or Repair Zone E - Reduced Roadway Width F - Flooded G - Other H - No Unusual Condition - - Not Stated
Road Condition 2	<b>RDCOND2</b>			same as road condition 1 above
Lighting	<b>LIGHTING</b>			A - Daylight B - Dusk - Dawn C - Dark - Street Lights D - Dark - No Street Lights

				E - Dark - Street Lights Not Functioning - - Not Stated
Control Device	<b>RIGHTWAY</b>			A - Functioning B - Not Functioning C - Obscured D - None - - Not Stated
CHP Road Type	<b>CHPRDTYP</b>			May be blank
Not Private Property	<b>NOTPRIV</b>	indicates whether the collision occurred on private property		Y or blank
Statewide Vehicle Type At Fault	<b>STFAULT</b>	indicates the Statewide Vehicle Type of the party who is at fault		see Party folder Statewide Vehicle Type item
CHP Vehicle Type At Fault	<b>CHPFAULT</b>	indicates the CHP Vehicle Type of the party who is at fault		see Party folder CHP Vehicle Type Towing item
Severe Injury count	<b>SEVINJ</b>	counts victims in the collision with degree of injury of 2		0 to N for each collision
Other Visible Injury count	<b>OTHERINJ</b>	counts victims in the collision with degree of injury of 3		0 to N for each collision
Complaint of Pain Injury count	<b>COP</b>	counts victims in the collision with degree of injury of 4		0 to N for each collision
Pedestrian Killed count	<b>PEDKILL</b>	Counts the victims in the collision with party type of 2 and degree of injury is 1		0 or 1 for each collision
Pedestrian Injured count	<b>PEDINJ</b>	Counts the victims in the collision with party type of 2 and degree of injury is 2, 3, or 4		0 or 1 for each collision
Bicyclist Killed count	<b>BICKILL</b>	Counts the victims in the collision with (((victim role of 2 and statewide vehicle type of 'L') or (victim role of 4)) and (victim degree of injury is 1))		0 to N for each collision
Bicyclist Injured count	<b>BICINJ</b>	Counts the victims in the collision with (((victim role of 2 and statewide vehicle type of 'L') or (victim role of 4)) and (victim degree of injury is 2, 3, or 4))		0 to N for each collision
Motorcyclist Killed count	<b>MCKILL</b>	counts victims in the collision with statewide vehicle type of C or O and degree of injury of 1		0 to N for each collision
Motorcyclist Injured count	<b>MCINJURE</b>	counts victims in the collision with statewide vehicle type of C or O and degree of injury of 2, 3, or 4		0 to N for each collision
Primary Ramp	<b>RAMP1</b>			NO-NB On Ramp, NF-NB Off Ramp, SO-SB On Ramp, SF-SB Off Ramp,

				EO-EB On Ramp, EF-EB Off Ramp, WO-WB On Ramp, WF-WB Off Ramp, To, From, Transition, Collector, Connector & blank
Secondary Ramp	<b>RAMP2</b>			Same as above
City	<b>CITY</b>			
County	<b>COUNTY</b>			
State	<b>STATE</b>			
CHP generated GPS longitude coordinate	<b>CHP_X</b>	The longitude of the GPS position		
CHP generated GPS latitude coordinate	<b>CHP_Y</b>	The latitude of the GPS position		

## SWITRS Party Raw Data

Case Id	<b>caseid</b>	the unique identifier of the collision report (barcode beginning 2002; 19 digit code prior to 2002)	
Party Number	<b>parnum</b>		1 to 999
Party Type	<b>ptype</b>		1 - Driver (including Hit and Run) 2 - Pedestrian 3 - Parked Vehicle 4 - Bicyclist 5 - Other - - Not Stated
At Fault	<b>atfault</b>	indicates whether the party was at fault in the collision	Y
Party Sex	<b>psex</b>	the code of the sex of the party	M - Male F - Female - - Not Stated
Party Age	<b>page</b>	the age of the party at the time of the collision	0 to 125+ (998=UNKNOWN)
Party Sobriety	<b>psober</b>		A - Had Not Been Drinking B - Had Been Drinking, Under Influence C - Had Been Drinking, Not Under Influence D - Had Been Drinking, Impairment Unknown G - Impairment Unknown H - Not Applicable - - Not Stated
Party Drug Physical	<b>pdrug</b>		E - Under Drug Influence F - Impairment - Physical H - Not Applicable I - Sleepy/Fatigued - - Not Stated
Direction Of Travel	<b>pdirect</b>		N - North S - South E - East W - West - - Not Stated
Party Safety Equipment 1	<b>psafety1</b>		A - None in Vehicle B - Unknown C - Lap Belt Used D - Lap Belt Not Used E - Shoulder Harness Used F - Shoulder Harness Not Used

				G - Lap/Shoulder Harness Used H - Lap/Shoulder Harness Not Used J - Passive Restraint Used K - Passive Restraint Not Used L - Air Bag Deployed M - Air Bag Not Deployed N - Other P - Not Required Q - Child Restraint in Vehicle Used R - Child Restraint in Vehicle Not Used S - Child Restraint in Vehicle, Use Unknown T - Child Restraint in Vehicle, Improper Use U - No Child Restraint in Vehicle V - Driver, Motorcycle Helmet Not Used W - Driver, Motorcycle Helmet Used X - Passenger, Motorcycle Helmet Not Used Y - Passenger, Motorcycle Helmet Used - or blank - Not Stated
Party Safety Equipment 2	<b>psafety2</b>			same as Party Safety Equipment 1 above
Financial Responsibility	<b>insured</b>			N - No Proof of Insurance Obtained Y - Yes, Proof of Insurance Obtained O - Not Applicable (used for parked cars, bicyclists, pedestrians, and party type others) E - Used if the officer is called away from the scene of the collision prior to obtaining the insurance information Blank - not stated
Special Information 1	<b>hazard</b>			A - Hazardous Materials - - Not Stated
Special Information 2	<b>cell</b>	CHP555 was revised July 2003 to reflect codes 1,2, & 3. However, collision forms prior to July 2003 will continue to be processed after that date.		B - Cell Phone in Use (4/1/01) C - Cell Phone Not in Use (4/1/01) D - No Cell Phone/Unknown (4/1/01) - - Not Stated (4/1/01) 1 - Cell Phone Handheld in Use (7/1/03) 2 - Cell Phone Hands Free in Use (7/1/03)

				3 - Cell Phone Not in Use (7/1/03)
Special Information 3	<b>sbus</b>			E - School Bus Related (1/1/02) - - Not Stated (1/1/02)
OAF Violation Code	<b>pviolcod</b>			B - Business and Professions C - Vehicle H - City Health and Safety I - City Ordinance O - County Ordinance P - Penal S - Streets and Highways W - Welfare and Institutions - - Not Stated
OAF Violation Category	<b>pviolcat</b>			01 - Under Influence in Public (647F) 02 - County Ordinance 03 - City Ordinance 05 - Business/Professions Code 06 - Felony Penal Code 08 - Controlled Substances (Felony Health and Safety) 09 - Health/Safety Code (Misdemeanor) 10 - Penal Code (Misdemeanor) 11 - Streets/Highways Code 13 - Welfare/Institutions Code 15 - Manslaughter 16 - Non-Vehicle Code Not Specified Above 17 - Fish & Game Code 18 - Agriculture Code 19 - Hit and Run 20 - Driving or Bicycling Under the Influence of Alcohol or Drug 21 - Improper Lane Change 22 - Impeding Traffic 23 - Failure to Heed Stop Signal 24 - Failure to Heed Stop Sign 25 - Unsafe Speed 26 - Reckless Driving 27 - Wrong Side of Road 28 - Unsafe Lane Change 29 - Improper Passing 30 - Following Too Closely 31 - Improper Turning 33 - Automobile Right-of-Way 34 - Pedestrian Right-of-Way 35 - Pedestrian Violation

				37 - 38 - Hazardous Parking 39 - Lights 40 - Brakes 43 - Other Equipment 44 - Other Hazardous Movement 46 - Improper Registration 47 - Other Non-Moving Violation 48 - Excessive Smoke 49 - Excessive Noise 50 - Overweight 51 - Oversize 52 - Over Maximum Speed 53 - Unsafe Starting or Backing 60 - Off-Highway Vehicle Violation 61 - Child Restraint 62 - Seat Belt 63 - Seat Belt (Equipment) 00 or Blank - Not Stated
OAF Violation Section	<b>pviol</b>			
OAF Violation Suffix	<b>pviolsuf</b>			Blank may appear if no suffix.
Other Associated Factor 1	<b>oaf1</b>			A - Violation E - Vision Obscurements F - Inattention (beginning 1/1/01; see Inattention Item Name near end of record for A-K, P values) G - Stop and Go Traffic H - Entering/Leaving Ramp I - Previous Collision J - Unfamiliar With Road K - Defective Vehicle Equipment L - Uninvolved Vehicle M - Other N - None Apparent O - Runaway Vehicle - - Not Stated
Other Associated Factor 2	<b>oaf2</b>			same as OAF 1 above
Party Number Killed	<b>pkilled</b>	counts victims in the party with degree of injury of 1		0 to N for each party
Party Number Injured	<b>pinjured</b>	counts victims in the party with degree of injury of 2, 3, or 4		0 to N for each party
Movement Preceding Collision	<b>movement</b>			A - Stopped B - Proceeding Straight

				C - Ran Off Road D - Making Right Turn E - Making Left Turn F - Making U-Turn G - Backing H - Slowing/Stopping I - Passing Other Vehicle J - Changing Lanes K - Parking Maneuver L - Entering Traffic M - Other Unsafe Turning N - Crossed Into Opposing Lane O - Parked P - Merging Q - Traveling Wrong Way R - Other - - Not Stated
Vehicle Year	<b>vehyear</b>	the model year of the party's vehicle		9999 or blank = not stated
Vehicle Make	<b>vehmake</b>	the full description of the make of the party's vehicle		
Statewide Vehicle Type	<b>vehtype</b>			A - Passenger Car/Station Wagon B - Passenger Car with Trailer C - Motorcycle/Scooter D - Pickup or Panel Truck E - Pickup or Panel Truck with Trailer F - Truck or Truck Tractor G - Truck or Truck Tractor with Trailer H - Schoolbus I - Other Bus J - Emergency Vehicle K - Highway Construction Equipment L - Bicycle M - Other Vehicle N - Pedestrian O - Moped - or blank - Not Stated
CHP Vehicle Type Towing	<b>chptype1</b>			01 - Passenger Car, Station Wagon, or Jeep 02 - Motorcycle 03 - Motor-Driven Cycle (< 15 hp) 04 - Bicycle 05 - Motorized Bicycle 06 - All-Terrain Vehicle (ATV)

				07 - Sport Utility Vehicle 08 - Minivan 09 - Paratransit Bus 10 - Tour Bus 11 - Other Commercial Bus 12 - Non-Commercial Bus 13 - Schoolbus Without Pupil Passengers (prior to 2002) 13 - Schoolbus Public I (eff. 2002) 14 - Schoolbus Public I (prior to 2002) 14 - Schoolbus Public II (eff. 2002) 15 - Schoolbus Public II (prior to 2002) 15 - Schoolbus Private I (eff. 2002) 16 - Schoolbus Private I (prior to 2002) 16 - Schoolbus Private II (eff. 2002) 17 - Schoolbus Private II (prior to 2002) 17 - Schoolbus Contractual I (eff. 2002) 18 - Schoolbus Contractual I (prior to 2002) 18 - Schoolbus Contractual II (eff. 2002) 19 - Schoolbus Contractual II (prior to 2002) 19 - General Public Paratransit Vehicle (eff. 2002) 20 - Public Transit Authority 21 - Two-Axle Tank Truck 22 - Pickup or Panel Truck 23 - Pickup Truck With Camper 24 - Three-Axle Tank Truck 25 - Truck Tractor 26 - Two-Axle Truck 27 - Three-Axle Truck 41 - Ambulance 42 - Dune Buggy 43 - Fire Truck (not rescue) 44 - Forklift 45 - Highway Construction Equipment (only while not in construction area) 46 - Implement of Husbandry
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				<p>47 - Motor Home (40 ft or less)  48 - CHP, Police, or Sheriff Car (emergency service or not)  49 - CHP, Police, or Sheriff Motorcycle (emergency service or not)  50 - Mobile Equipment  51 - Farm Labor Vehicle (certified)  55 - Two-Axle Tow Truck  56 - Three-Axle Tow Truck  57 - Farm Labor Vehicle (non-certified)  58 - Farm Labor Transporter  59 - Motorhome (over 40 ft)  60 - Pedestrian (includes motorized wheelchair)  61 - School Pupil Activity Bus I (prior to 2002)  62 - School Pupil Activity Bus II (prior to 2002)  63 - "Youth" Bus  64 - School Pupil Activity Bus I (eff. 2002)  65 - School Pupil Activity Bus II (eff. 2002)  66 - School Bus Without Pupil Passengers (eff. 2002)  71 - Passenger Car - Hazardous Materials Only  72 - Pickups and Panels - Hazardous Materials Only  73 - Pickups and Campers - Hazardous Materials Only  75 - Truck Tractor - Hazardous Materials Only  76 - Two-Axle Truck - Hazardous Materials Only  77 - Three or More Axle Truck - Hazardous Materials Only  78 - Two-Axle Tank Truck - Hazardous Materials Only  79 - Three-Axle Tank Truck - Hazardous Materials Only  81 - Passenger Car - Hazardous Waste or Waste/Material Combo  82 - Pickups and Panels -</p>
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				<p>Hazardous Waste or Waste/Material Combo</p> <p>83 - Pickups and Campers - Hazardous Waste or Waste/Material Combo</p> <p>85 - Truck Tractor - Hazardous Waste or Waste/Material Combo</p> <p>86 - Two-Axle Truck - Hazardous Waste or Waste/Material Combo</p> <p>87 - Three or More Axle Truck - Hazardous Waste or Waste/Material Combo</p> <p>88 - Two-Axle Tank Truck - Hazardous Waste or Waste/Material Combo</p> <p>89 - Three-Axle Tank Truck - Hazardous Waste or Waste/Material Combo</p> <p>94 - Motorized Transportation Device</p> <p>95 - Miscellaneous Non-Motorized Vehicle (Ridden Animal, Animal-Drawn Conveyance, Train, Or Building) With Victim</p> <p>96 - Miscellaneous Motorized Vehicle (Golf Cart)</p> <p>97 - Low Speed Vehicle</p> <p>99 or dash - Not Stated or Unknown (Hit and Run)</p>
CHP Vehicle Type Towed	<b>chptype2</b>			<p>same as CHP vehicle type towing above with the following additions:</p> <p>28 - Semi-Tank Trailer</p> <p>29 - Pull-Tank Trailer</p> <p>30 - Two-Tank Trailer</p> <p>31 - Semi-Trailer</p> <p>32 - Pull Trailer (includes dolly)</p> <p>33 - Two Trailers (or 31 + 32)</p> <p>34 - Boat Trailer</p> <p>35 - Utility Trailer</p> <p>36 - Trailer Coach</p> <p>37 - Extralegal Permit Load</p> <p>38 - Pole, Pipe, or Logging Dolly</p> <p>39 - Three Trailers (or 31 + 33)</p> <p>40 - Federally Legal Semi-Trailer</p> <p>52 - Federally Legal Double Cargo Combo (over 75 ft)</p> <p>53 - Fifth Wheel Trailer</p>

				54 - Container Chassis
Party Race	<b>prace</b>			A - Asian      O - Other B - Black      W - White H - Hispanic    Blank - Not stated Eff. 1/1/2002
Inattention	<b>var31 (SAS) inattention (Stata)</b>	The July 2003 form revision separated 'P' Cell Phone into 'A' Handheld and 'B' Hands Free. All other values 'Q' through 'Y' were converted to 'C' through 'K'.		A - Cell Phone Handheld (7/1/03) B - Cell Phone Hands Free (7/1/03) C - Electronic Equip.(1/1/01) D - Radio/CD (1/1/01) E - Smoking (1/1/01) F - Eating (1/1/01) G - Children (1/1/01) H - Animal (1/1/01) I - Personal Hygiene (1/1/01) J - Reading (1/1/01) K - Other (1/1/01) P - Cell Phone (1/1/01, value prior to 7/03 form revision) - - Not Stated
Special Information F	<b>var32</b>			F - 75 Ft Motortruck Combo (1/1/03) - - Not Stated
Special Information G	<b>var33</b>			G - 32 Ft Trailer Combo (1/1/03) - - Not Stated

## SWITRS Victim Raw Data

Case Id	<b>caseid</b>	the unique identifier of the collision report (barcode beginning 2002; 19 digit code prior to 2002)		
Party Number	<b>parnum</b>			1 to 999
Victim Role	<b>vtype</b>			1 - Driver 2 - Passenger (includes non-operator on bicycle or any victim on/in parked vehicle or multiple victims on/in non-motor vehicle) 3 - Pedestrian 4 - Bicyclist 5 - Other (single victim on/in non-motor vehicle; e.g. ridden animal, horse-drawn carriage, train, or building) 6 - Non-Injured Party
Victim Sex	<b>vsex</b>			M - Male F - Female - - Not Stated
Victim Age	<b>vage</b>	the age of the victim at the time of the collision		0 - 125+ (998=UNKNOWN)
Victim Degree of Injury	<b>vinjury</b>			1 - Killed 2 - Severe Injury 3 - Other Visible Injury 4 - Complaint of Pain 0 - No Injury
Victim Seating Position	<b>vseat</b>			1 - Driver 2 thru 6 - Passengers 7 - Station Wagon Rear 8 - Rear Occupant of Truck or Van 9 - Position Unknown 0 - Other Occupants A thru Z - Bus Occupants - - Not Stated
Victim Safety Equipment 1	<b>vsafety1</b>			A - None in Vehicle B - Unknown C - Lap Belt Used D - Lap Belt Not Used E - Shoulder Harness Used F - Shoulder Harness Not Used G - Lap/Shoulder Harness Used H - Lap/Shoulder Harness Not Used J - Passive Restraint Used

				K - Passive Restraint Not Used L - Air Bag Deployed M - Air Bag Not Deployed N - Other P - Not Required Q - Child Restraint in Vehicle Used R - Child Restraint in Vehicle Not Used S - Child Restraint in Vehicle, Use Unknown T - Child Restraint in Vehicle, Improper Use U - No Child Restraint in Vehicle V - Driver, Motorcycle Helmet Not Used W - Driver, Motorcycle Helmet Used X - Passenger, Motorcycle Helmet Not Used Y - Passenger, Motorcycle Helmet Used - or blank - Not Stated
Victim Safety Equipment 2	<b>vsafety2</b>			same as Victim Safety Equipment 1 above (eff. Jan 2002)
Victim Ejected	<b>vejcted</b>			0 - Not Ejected 1 - Fully Ejected 2 - Partially Ejected 3 - Unknown - - Not Stated

## APPENDIX D: COUNTERMEASURE TOOLBOX

High-risk Intersections

ID	Intersection	Control	Consolidated CMs (HSIP-Eligible - Refer to LRSM* 2020)						Additional CM (non-HSIP)**	EA - 1 Reduce Hit Object Collisions			EA - 2 Reduce Rear End and Unsafe speed Collisions			EA - 3 Reduce Broadside Collisions and automobile right of way violations			EA - 4 Reduce Nighttime Collisions			EA - 5 Reduce Improper Turning Collisions			EA - 6 Reduce DUI Collisions			EA - 7 Reduce Overturning Collisions		
			CM1	CM2	CM3	CM4	CM5	CM6		CM1	CM2	CM3	CM1	CM2	CM3	CM1	CM2	CM3	CM1	CM2	CM3	CM1	CM2	CM3	CM1	CM2	CM3	CM1	CM2	CM3
			1	N. Beale Rd at Feather River Blvd	Signalized	S09	S02	S03		S11	S01					S03	S09	S11	S07	S12	S09	S02	S09		S02	S09		S02	S09	S10
2	Powerline Rd at Eighth Avenue	Non-Signalized	NS06	NS07	NS09		NS11	NS01	Remove existing parked cars, install additional warning signs, refresh pavement, install pedestrian crossing increase curb radii, increase warning devices/signs, reduce speed on approach, improve visibility	NS06	NS10	NS11	NS06	NS07		NS06	NS09	NS10	NS09		NS02	NS07	NS11	NS01			NS06	NS09	NS10	
3	Erle Rd at Lindhurst Rd	Signalized	S02	S09	S10	S03	S07					S03	S02	S06	S07	S12	S02	S02	S09	S10	S09	S02	S03	S09	S02	S10				
4	N. Beale Rd at Avondale Rd	Non-Signalized		NS01	NS06	NS09	NS10	NS17	Advance warning signs				NS03	NS06	NS17	NS06	NS09	NS10	NS01		NS07	NS21PB	NS17				NS06	NS09		
5	Hammonton-Smartsville Rd at Linda Avenue	Non-Signalized	NS06	NS07	NS09	NS10	NS18	NS01	Widen inside shoulders on curve, object markers, lightened stop sign, install pedestrian crosswalk	NS06	NS09		NS06	NS11	NS17	NS09	NS10		NS01	NS07	NS09						NS09	NS10	NS12	
6	N. Beale Rd at Griffith Rd	Non-Signalized	NS06	NS07	NS09	NS10	NS12	NS01	Widen inside shoulder on curve, improve bicycle facility, lightened warning/stop signs							NS09	NS10	NS12	NS01	NS07	NS09	NS06	NS11	NS17						
7	Feather River Blvd at Grand Avenue	Non-Signalized	NS09	NS11	NS06	NS07	NS14	NS15	Refresh pavement, install warning signs, lightened warning or stop signs	NS07	NS09	NS11	NS07	NS11	NS09				NS01	NS06	NS09	NS1	NS14	NS15						
8	N. Beale at Park Avenue	Non-Signalized	NS06	NS09			NS01	NS22PB	Install crosswalk on N Beale Rd, install more lights, warning signs, intersection safety				NS03	NS06	NS17	NS09	NS10	NS12	NS01	NS07		NS12	NS22PB	NS15						
9	Hammonton-Smartsville Rd at N. Beale Rd	Signalized	S02		S09	S10	S01		Improvements reflected				S09	S11	S02	S02	S09	S12	S02	S10	S09	S09	S02	S03	S10					
10	N. Beale Rd at Lowe Ave	Non-Signalized	NS06		NS09		NS22PB	NS01	Advance warning signs for pedestrian crossings, add yielding signs	NS06	NS09	NS10	NS06	NS07		NS09	NS10	NS12	NS01	NS09	NS22PB	NS06	NS07	NS23PB	NS01	NS08	NS10			

Code	Countermeasure Name
HSIP/Non-HSIP Code	
S01	Add intersection lighting
S02	Improve signal hardware: lenses, back-plates with retroreflective borders, mounting, size, and number
S03	Improve signal timing (coordination, phases, red, yellow, or operation)
S05	Install emergency vehicle pre-emption systems
S06	Install left-turn lane and add turn phase (signal has no left-turn lane or phase before)
S07	Provide protected left turn phase (left turn lane already exists)
S08	Convert signal to mast arm (from pedestal-mounted)
S09	Install raised pavement markers and striping (Through Intersection)
S10	Install flashing beacons as advance warning (S.I.)
S11	Improve pavement friction (High Friction Surface Treatments)
S12	Install raised median on approaches (S.I.)
S13PB	Install pedestrian median fencing on approaches
S14	Create directional median openings to allow (and restrict) left-turns and U-turns (S.I.)
S15	Reduced Left-Turn Conflict Intersections (S.I.)
S16	Convert intersection to roundabout (from signal)
S17PB	Install pedestrian countdown signal heads
S18PB	Install pedestrian crossing (S.I.)
S19PB	Pedestrian Scramble
S20PB	Install advance stop bar before crosswalk (Bicycle Box)
S21PB	Modify signal phasing to implement a Leading Pedestrian Interval (LPI)

Code	Countermeasure Name
NS01	Add intersection lighting (NS.I.)
NS02	Convert to all-way STOP control (from 2-way or Yield control)
NS03	Install Signals
NS04	Convert intersection to roundabout (from all way stop)
NS05	Convert intersection to roundabout (from 2-way stop or Yield control)
NS05mr	Convert intersection to mini-roundabout
NS06	Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs
NS07	Upgrade intersection pavement markings (NS.I.)
NS08	Install Flashing Beacons at Stop-Controlled Intersections
NS09	Install flashing beacons as advance warning (NS.I.)
NS10	Install transverse rumble strips on approaches
NS11	Improve sight distance to intersection (Clear Sight Triangles)
NS12	Improve pavement friction (High Friction Surface Treatments)
NS13	Install splitter-islands on the minor road approaches
NS14	Install raised median on approaches (NS.I.)
NS15	Create directional median openings to allow (and restrict) left-turns and u-turns (NS.I.)
NS16	Reduced Left-Turn Conflict Intersections (NS.I.)
NS17	Install right-turn lane (NS.I.)
NS18	Install left-turn lane (where no left-turn lane exists)
NS19PB	Install raised medians (refuge islands)
NS20PB	Install pedestrian crossing at uncontrolled locations (signs and markings only)
NS21PB	Install/upgrade pedestrian crossing at uncontrolled locations (with enhanced safety features)
NS22PB	Install Rectangular Rapid Flashing Beacon (RRFB)
NS23PB	Install Pedestrian Signal (including Pedestrian Hybrid Beacon (HAWK))

High-risk Corridors

ID	Roadway Segments	Consolidated CMs (HSIP-Eligible - Refer to LRSM* 2020)						Additional CM (non-HSIP)**	EA - 1 Reduce Hit Object Collisions			EA - 2 Reduce Rear End and Unsafe speed Collisions			EA - 3 Reduce Broadside Collisions			EA - 4 Reduce Nighttime Collisions			EA - 5 Reduce Improper Turning Collisions			EA - 6 Reduce DUI Collisions			EA - 7 Reduce Overturning Collisions		
		CM1	CM2	CM3	CM4	CM5	CM6		CM1	CM2	CM3	CM1	CM2	CM3	CM1	CM2	CM3	CM1	CM2	CM3	CM1	CM2	CM3	CM1	CM2	CM3	CM1	CM2	CM3
1	Marysville Rd/Willow Glen Rd: SR 20 to 1.1 mi S of Westcott Rd	R22	R25	R26	R27	R31		Widen shoulder for clear recovery and bikes; curve advance warning, speed feedback signs	R21	R27	R31	R21	R22	R27				R22	R27	R34PB	R25	R30	R15	R01	R25	R31	R17	R26	R24
2	N. Beale Ave/Lindhurst Avenue:SR 70 (North) to Olivehurst Avenue	R22	R26	R27	R25	R02		Chevrons on horizontal curves, improve sight distance at numerous driveways, or install sight mirrors	R15	R27	R31	R01	R22	R27				R01	R26	R27	R04	R24	R31	R01	R15	R28	R16	R24	R26
3	Hammonton-Smartsville Rd: 0.1 mi E of Brophy Rd to SR 20	R02	R25	R26	R27	R31	R37PB	Flatten horizontal curves; widen shoulder for clear recovery and bikes; curve advance warning; widen lanes to 12', chevrons, guard rail, and advance warning beacon	R06	R27	R31	R01	R22					R23	R26	R27	R15	R24	R31	R22	R27	R31	R16	R26	R24
4	Hammonton-Smartsville Rd: N.Beale Avenue to Wallen Rd	R02	R26	R27	R31	R32PB	R34PB	Pave Road, remove/trim vegetation in clear recovery zone; add lighting at intersections/ Corridor	R02	R27	R21	R01	R22	R27				R01	R26	R27	R15	R25	R31	R21	R25	R31	R26	R24	R27
5	Forty Mile Rd: 0.6 mi S of SR 65 SB Ramp to Placer County Line	R01	R23	R26	R27		R31	Improvements implemented	R02	R15	R27	R01	R22	R27				R26	R27		R28	R21	R27	R22	R28	R30	R15	R26	R30
6	Simpson Ln: Hammonton- Smartsville Rd to Maryville City Limit	R22	R27	R31	R24		R35PB	Improve pavement, additional warning signs and speed limit posts	R21	R27	R31	R01	R22	R27				R01	R23		R01	R25	R31	R22	R24	R31	R16	R24	
7	Loma Rica Rd: Fruitland Rd to Marysville Rd	R01	R23	R26	R27	R25	R31	improve sight distance at numerous driveways, or install sight mirrors, remove/trim vegetation in clear recovery zone; add lighting at intersections	R02	R15	R31	R01	R27					R01	R23	R26	R23	R25	R31	R21	R27	R30	R16	R21	R26
8	Feather River Rd: Grand Rd to Murphy Rd	R26	R27		R01	R31		improve sight distance at numerous driveways	R21	R27	R31	R01	R21	R27				R27	R26		R04	R30	R24	R01	R25	R27	R16	R21	R26
9	Powerline Rd: 400' E of Olivehurst Rd to McGowan Rd	R22	R23	R26	R27	R31	R35PB	improve pavement at NS intersections, widen shoulder for clear recovery and bikes; curve advance warning; Flashing curve warning and/or flashing chevrons at 90 degree curves (to supplement existing signs)	R02	R27	R31	R01	R22	R27				R01	R26		R21	R22	R31	R22	R27	R31	R21	R26	R27
10	La Porte Rd: Orlando Rd to Old La Porte Rd	R15	R27	R23	R26	R25	R24	improved visibility, install chevrons	R15	R21	27	R22						R23	R26	R01	R23	R25	R30	R22	R30	R31	R16	R24	R26

Code	Countermeasure Name
R01	Add Segment Lighting
R02	Remove or relocate fixed objects outside of Clear Recovery Zone
R03	Install Median Barrier
R04	Install Guardrail
R05	Install impact attenuators
R06	Flatten side slopes
R07	Flatten side slopes and remove guardrail
R08	Install raised median
R09	Install median (flush)
R10PB	Install pedestrian median fencing
R11	Install acceleration/ deceleration lanes
R12	Widen lane (initially less than 10 ft)
R13	Add two-way left-turn lane (without reducing travel lanes)
R14	Road Diet (Reduce travel lanes from 4 to 3 and add a two way left-turn and bike lanes)
R15	Widen shoulder
R16	Curve Shoulder widening (Outside Only)
R17	Improve horizontal alignment (flatten curves)
R18	Flatten crest vertical curve
R19	Improve curve superelevation
R20	Convert from two-way to one-way traffic
R21	Improve pavement friction (High Friction Surface Treatments)
R22	Install/Upgrade signs with new fluorescent sheeting (regulatory or warning)
R23	Install chevron signs on horizontal curves
R24	Install curve advance warning signs
R25	Install curve advance warning signs (flashing beacon)
R26	Install dynamic/variable speed warning signs
R27	Install delineators, reflectors and/or object markers
R28	Install edge-lines and centerlines
R29	Install no-passing line
R30	Install centerline rumble strips/strips
R31	Install edgeline rumble strips/strips
R32PB	Install bike lanes
R33PB	Install Separated Bike Lanes
R34PB	Install sidewalk/pathway (to avoid walking along roadway)
R35PB	Install/upgrade pedestrian crossing (with enhanced safety features)
R36PB	Install raised pedestrian crossing
R37PB	Install Rectangular Rapid Flashing Beacon (RRFB)
R38	Install Animal Fencing

**Non-Engineering Strategies**

	<b>Strategy</b>	<b>Performance Measure</b>	<b>Organizations to be involved</b>
<b>Education</b>	Conduct public information and education campaign for intersection safety laws, unsafe speeds, distracted driving, and driving under the influence.	Number of education campaigns	City/ School District/ Police Department
	Conduct pedestrian safety campaigns and outreach to raise their awareness of pedestrian safety needs through media outlets and social media.	Number of education campaigns	City/ School District/ Police Department
	Conduct bicycle safety campaigns and outreach to raise their awareness of bicycle safety needs through media outlets and social media.	Number of education campaigns	City/ School District/ Police Department
<b>Enforcement</b>	Targeted enforcement at high-risk locations.	Number of tickets issued.	Police Department
	Increase the number of personnel who have completed Advanced Roadside impaired Driving Enforcement (ARIDE) training	Number of personnel who have completed Advanced Roadside impaired Driving Enforcement (ARIDE) training	Police Department
<b>Emergency Medical Services (EMS)</b>	S05, Install emergency vehicle pre-emption systems	EMS vehicle response time.	Local Emergency Services Agency
	Increase the number of EMS/fire controll personnel taking Traffic Incident Managment Training	number of EMS/fire controll personnel taking Traffic Incident Managment Training	Local Emergency Services Agency

CM Toolbox for Intersections

Signalized						
Sr. No.	Code	Countermeasure Name	CM Description	CRF	Federal Funding	Systemic Approach Opportunity
HSIP/Non-HSIP Code						
1	S01	Add intersection lighting	Provision of lighting at intersection	40%	90%	Medium
2	S02	Improve signal hardware: lenses, back-plates with retroreflective borders, mounting, size, and	includes New LED lighting, signal back plates, retro-reflective tape outlining the back plates, or visors to increase signal visibility, larger signal heads, relocation of the signal heads, or additional signal heads.	15%	90%	Very High
3	S03	Improve signal timing (coordination, phases, red, yellow, or operation)	includes adding phases, lengthening clearance intervals, eliminating or restricting higher-risk movements, an coordinating signals at multiple locations.	15%	50%	Very High
5	S05	Install emergency vehicle pre-emption systems	Corridors that have a history of crashes involving emergency response vehicles. The target of this strategy is signalized intersections where normal traffic operations impede emergency vehicles and where traffic conditions create a potential for conflicts between emergency and nonemergency vehicles. These conflicts could lead to almost any type of crash, due to the potential for erratic maneuvers of vehicles moving out of the paths of emergency vehicles	70%	90%	High
6	S06	Install left-turn lane and add turn phase (signal has no left-turn lane or phase before)	Intersections that do not currently have a left turn lane or a related left-turn phase that are experiencing a large number of crashes. Many intersection safety problems can be traced to difficulties in accommodating left-turning vehicles, in particular where there is currently no accommodation for left turning traffic. A key strategy for minimizing collisions related to left-turning vehicles (angle, rear-end, sideswipe) is to provide exclusive left-turn lanes and the appropriate signal phasing, particularly on high-volume and high-speed major-road approaches.	55%	90%	Low
7	S07	Provide protected left turn phase (left turn lane already exists)	Left turns are widely recognized as the highest-risk movements at signalized intersections. Providing Protected left turn phases for signalized intersections with existing left turn pockets significantly improve the safety for left-turn maneuvers by removing the need for the drivers to navigate through gaps in oncoming/opposing through vehicles	30%	90%	High
8	S08	Convert signal to mast arm (from pedestal-mounted)	Providing better visibility of intersection signs and signals aids the drivers' advance perception of the upcoming intersection. Visibility and clarity of the signal should be improved without creating additional confusion or distraction for drivers.	30%	90%	Medium
9	S09	Install raised pavement markers and striping (Through Intersection)	Adding clear pavement markings can guide motorists through complex intersections. When drivers approach and traverse through complex intersections, drivers may be required to perform unusual or unexpected maneuvers	10%	90%	Very High
10	S10	Install flashing beacons as advance warning (S.I.)	Increased driver awareness of an approaching signalized intersection and an increase in the driver's time to react	30%	90%	Medium
11	S11	Improve pavement friction (High Friction Surface Treatments)	Improving the skid resistance at locations with high frequencies of wet road crashes and/or failure to stop crashes	55%	90%	Medium
12	S12	Install raised median on approaches (S.I.)	Raised medians next to left turn lanes at intersections offer a cost effective means for reducing crashes and improving operations at higher volume intersections	25%	90%	Medium
13	S13PB	Install pedestrian median fencing on approaches	Signalized Intersections with high pedestrian-generators nearby (e.g. transit stops) may experience a high volume of pedestrians j-walking across the travel lanes at mid-block locations instead of walking to the intersection and waiting to cross during the walk-phase.	30%	90%	Low
14	S14	Create directional median openings to allow (and restrict) left-turns and U-turns (S.I.)	Crashes related to turning maneuvers include angle, rear-end, pedestrian, and sideswipe (involving opposing left turns) type crashes. If any of these crash types are an issue at an intersection, restriction or elimination of the turning maneuver may be the best way to improve the safety of the intersection	50%	90%	Medium
15	S15	Reduced Left-Turn Conflict Intersections (S.I.)	Reduced left-turn conflict intersections are geometric designs that alter how left-turn movements occur in order to simplify decisions and minimize the potential for related crashes. Two highly effective designs that rely on U-turns to complete certain left-turn movements are known as the restricted crossing U-turn (RCUT) and the median U-turn (MUT).	50%	90%	Medium
16	S16	Convert intersection to roundabout (from signal)	Signalized intersections that have a significant crash problem and the only alternative is to change the nature of the intersection itself. Roundabouts can also be very effective at intersections with complex geometry and intersections with frequent left-turn movements.	Varies	90%	Low
17	S17PB	Install pedestrian countdown signal heads	Signals that have signalized pedestrian crossing with walk/don't walk indicators and where there have been pedestrian vs. vehicle crashes.	25%	90%	Very High
18	S18PB	Install pedestrian crossing (S.I.)	Signalized intersections with no marked crossing and pedestrian signal heads, where pedestrians are known to be crossing intersections that involve significant turning movements. They are especially important at intersections with (1) multiphase traffic signals, such as left-turn arrows and split phases, (2) school crossings, and (3) double-right or double-left turns. At signalized intersections, pedestrian crossings are often safer when the left turns have protected phases that do not overlap the pedestrian walk phase.	25%	90%	High
19	S19PB	Pedestrian Scramble	Pedestrian Scramble is a form of pedestrian "WALK" phase at a signalized intersection in which all vehicular traffic is required to stop, allowing pedestrians/bicyclists to safely cross through the intersection in any direction, including diagonally. Pedestrian Scramble may be considered at signalized intersections with very high pedestrian/bicycle volumes, e.g. in an urban business district.	40%	90%	High
20	S20PB	Install advance stop bar before crosswalk (Bicycle Box)	Signalized Intersections with a marked crossing, where significant bicycle and/or pedestrians volumes are known to occur.	15%	90%	Very High
21	S21PB	Modify signal phasing to implement a Leading Pedestrian Interval (LPI)	Addition of LPI gives pedestrians the opportunity to enter an intersection 3-7 seconds before vehicles are given green indication; only minor signal timing alteration is required.	60%	90%	Very High

Unsignalized						
Sr. No.	Code	Countermeasure Name	CM Description	CRF	Federal Funding	Systemic Approach Opportunity
1	NS01	Add intersection lighting (NS.I.)	Provision of lighting at intersection	40%	90%	Medium
2	NS02	Convert to all-way STOP control (from 2-way or Yield control)	Unsignalized intersection locations that have a crash history and have no controls at the major roadway approaches. However, all-way stop control is suitable only at intersections with moderate and relatively balanced volume levels on the intersection approaches. Under other conditions, the use of all-way stop control may create unnecessary delays and aggressive driver behavior.	50%	90%	High
3	NS03	Install Signals	Installation of traffic signals	25%	90%	Low
4	NS04	Convert intersection to roundabout (from all way stop)	Intersections that have a high frequency of right-angle and left-turn type crashes. Whether such intersections have existing crash patterns or not, a roundabout provides an alternative to signalization. The primary target locations for roundabouts should be moderate-volume unsignalized intersections.	Varies	90%	Low
5	NS05	Convert intersection to roundabout (from 2-way stop or Yield control)	Intersections that have a high frequency of right-angle and left-turn type crashes. Whether such intersections have existing crash patterns or not, a roundabout provides an alternative to signalization. The primary target locations for roundabouts should be moderate-volume unsignalized intersections.	Varies	90%	Low
6	NS05mr	Convert intersection to mini-roundabout	Mini-roundabouts are characterized by a small diameter (45-90 ft) and traversable islands (central island and splitter islands)	30%	90%	High
7	NS06	Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs	Additional regulatory and warning signs at or prior to intersections will help enhance the ability of approaching drivers to perceive them	15%	90%	Very High
8	NS07	Upgrade intersection pavement markings (NS.I.)	Typical improvements include "Stop Ahead" markings and the addition of centerlines and stop bars	25%	90%	Very High
9	NS08	Install Flashing Beacons at Stop-Controlled Intersections	Flashing beacons can reinforce driver awareness of the Non-Signalized intersection control and can help mitigate patterns of right-angle crashes related to stop sign violations. Post-mounted advanced flashing beacons or overhead flashing beacons can be used at stop-controlled intersections to supplement and call driver attention to stop signs.	15%	90%	High
10	NS09	Install flashing beacons as advance warning (NS.I.)	Installation of advance flashing beacons to call drivers attention to intersection control signs	30%	90%	High
11	NS10	Install transverse rumble strips on approaches	Transverse rumble strips are installed in the travel lane for the purposes of providing an auditory and tactile sensation for each motorist approaching the intersection.	20%	90%	High

12	NS11	Improve sight distance to intersection (Clear Sight Triangles)	Unsignalized intersections with restricted sight distance and patterns of crashes related to lack of sight distance where sight distance can be improved by clearing roadside obstructions without major reconstruction of the roadway.	20%	90%	High
13	NS12	Improve pavement friction (High Friction Surface Treatments)	Non-signalized intersections noted as having crashes on wet pavements or under dry conditions when the pavement friction available is significantly less than needed for the actual roadway approach speeds. This treatment is intended to target locations where skidding and failure to stop is determined to be a problem in wet or dry conditions and the target vehicle is unable to stop due to insufficient skid resistance.	55%	90%	Medium
14	NS13	Install splitter-islands on the minor road approaches	The installation of a splitter island allows for the addition of a stop sign in the median to make the intersection more conspicuous.	40%	90%	Medium
15	NS14	Install raised median on approaches (NS.I.)	Effective access management is key to improving safety at, and adjacent to, intersections. The number of intersection access points coupled with the speed differential between vehicles traveling along the roadway often contributes to crashes. Any access points within 250 feet upstream and downstream of an intersection are generally undesirable.	25%	90%	Medium
16	NS15	Create directional median openings to allow (and restrict) left-turns and u-turns (NS.I.)	Crashes related to turning maneuvers include angle, rear-end, pedestrian, and sideswipe (involving opposing left turns) type crashes. If any of these crash types are an issue at an intersection, restriction or elimination of the turning maneuver may be the best way to improve the safety of the intersection.	50%	90%	Medium
17	NS16	Reduced Left-Turn Conflict Intersections (NS.I.)	Reduced left-turn conflict intersections are geometric designs that alter how left-turn movements occur in order to simplify decisions and minimize the potential for related crashes.	50%	90%	Medium
18	NS17	Install right-turn lane (NS.I.)	Many collisions at unsignalized intersections are related to right-turn maneuvers. A key strategy for minimizing such collisions is to provide exclusive right-turn lanes, particularly on high-volume and high-speed major-road approaches. When considering new right-turn lanes, potential impacts to non-motorized users should be considered and mitigated as appropriate.	20%	90%	Low
19	NS18	Install left-turn lane (where no left-turn lane exists)	Many collisions at unsignalized intersections are related to left-turn maneuvers. A key strategy for minimizing such collisions is to provide exclusive left-turn lanes, particularly on high-volume and high-speed major-road approaches. When considering new left-turn lanes, potential impacts to non-motorized users should be considered and mitigated as appropriate.	35%	90%	Low
20	NS19PB	Install raised medians (refuge islands)	Intersections that have a long pedestrian crossing distance, a higher number of pedestrians, or a crash history. Raised medians decrease the level of exposure for pedestrians and allow pedestrians to concentrate on (or cross only one direction of traffic at a time.	45%	90%	Medium
21	NS20PB	Install pedestrian crossing at uncontrolled locations (signs and markings only)	Non-signalized intersections without a marked crossing, where pedestrians are known to be crossing intersections that involve significant vehicular traffic. They are especially important at school crossings and intersections with right and/or left turns pockets. See Zegeer study (Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations) for additional guidance regarding when to install a marked crosswalk.	25%	90%	High
22	NS21PB	Install/upgrade pedestrian crossing at uncontrolled locations (with enhanced safety features)	Non-signalized intersections where pedestrians are known to be crossing intersections that involve significant vehicular traffic. They are especially important at school crossings and intersections with turn pockets, flashing beacons, curb extensions, advanced "stop" or "yield" markings, and other safety features should be added to complement the standard crossing elements.	35%	90%	Medium
23	NS22PB	Install Rectangular Rapid Flashing Beacon (RRFB)	Rectangular Rapid Flashing Beacon (RRFB) includes pedestrian-activated flashing lights and additional signage that enhance the visibility of marked crosswalks and alert motorists to pedestrian crossings. It uses an irregular flash pattern that is similar to emergency flashers on police vehicles. RRFBs are installed at unsignalized intersections and mid-block pedestrian crossings.	35%	90%	Medium
24	NS23PB	Install Pedestrian Signal (including Pedestrian Hybrid Beacon (HAWK))	Intersections noted as having a history of pedestrian vs. vehicle crashes and in areas where the likelihood of the pedestrian presence is high. Corridors should also be assessed to determine if there are adequate safe opportunities for non-motorists to cross and if a pedestrian signal, or a Pedestrian Hybrid Beacon (PHB) (also called High-Intensity Activated crossWalk beacon (HAWK)) are needed to provide an active warning to motorists when a pedestrian is in the crosswalk.	55%	90%	Low

**CM Toolbox for Roadway Segments**

Sr. No.	Code	Countermeasure Name	CM Description	CRF	Federal Funding	Systemic Approach Opportunity
1	R01	Add Segment Lighting	Provision of lighting along roadways	35%	90%	Medium
2	R02	Remove or relocate fixed objects outside of Clear Recovery Zone	Known locations or roadway segments prone to collisions with fixed objects such as utility poles, drainage structures, trees, and other fixed objects, such as the outside of a curve, end of lane drops, and in traffic islands. A clear recovery zone should be developed on every roadway, as space is available. In situations where public right-of-way is limited, steps should be taken to request assistance from property owners, as appropriate.	35%	90%	High
3	R03	Install Median Barrier	Areas where crash history indicates drivers are unintentionally crossing the median and the cross-overs are resulting in high severity crashes. The installation of median barriers can increase the number of PDO and non-severe injuries. The net result in safety from this countermeasure is connected more to reducing the severity of crashes not the number of crashes.	25%	90%	Medium
4	R04	Install Guardrail	Guardrail is installed to reduce the severity of lane departure crashes. However, guardrail can reduce crash severity only for those conditions where striking the guardrail is less severe than going down an embankment or striking a fixed object. Guardrail should only be installed where it is clear that crash severity will be reduced, or there is a history of run-off-the-road crashes at a given location that have resulted in severe crashes.	25%	90%	High
5	R05	Install impact attenuators	Impact attenuators are typically used to shield rigid roadside objects such as concrete barrier ends, steel guardrail ends and bridge pillars from oncoming automobiles. Attenuators should only be installed where it is impractical for the objects to be removed.	25%	90%	High
6	R06	Flatten side slopes	Roadways experiencing frequent lane departure crashes that result in roll-over type crashes as a result of the roadway slope being so severe as to not accommodate a reasonable degree of driver correction. When there is a need to reduce the severity of lane departure crashes without installing a barrier system that could result in increased numbers of crashes.	30%	90%	Medium
7	R07	Flatten side slopes and remove guardrail	Locations where high number of crashes originate as a lane departure and result in collision with guardrail or fixed object located on the side slope shielded by guardrail. The guardrail may or may not meet current standards. Even though guardrails are generally installed to reduce the severity of departure crashes, they still can result in severe crashes in some locations.	40%	90%	Medium
8	R08	Install raised median	Areas experiencing head-on collisions that may be affected by both the number of vehicles that cross the centerline and by the speed of oncoming vehicles. Installing a raised median is a more restrictive approach in that it represents a more rigid barrier between opposing traffic.	25%	90%	Medium
9	R09	Install median (flush)	Areas experiencing head-on collisions that may be affected by both the number of vehicles that cross the centerline and by the speed of oncoming vehicles. Roadways with oversized lanes offer an opportunity to restripe the roadway to reduce the lanes to standard widths and use the extra width for the median.	15%	90%	Medium
10	R10PB	Install pedestrian median fencing	Roadway segments with high pedestrian-generators and pedestrian-destinations nearby (e.g. transit stops) may experience a high volume of pedestrians J-walking across the travel lanes at mid-block locations instead of walking to the nearest intersection or designated mid-block crossing. When this safety issue cannot be mitigated with shoulder, sidewalk and/or crossing treatments, then installing a continuous pedestrian barrier in the median may be a viable solution.	35%	90%	Low
11	R11	Install acceleration/ deceleration lanes	Areas proven to have crashes that are the result of drivers not being able to turn onto a high speed roadway to accelerate until the desired roadway speed is reached and areas that do not provide the opportunity to safely decelerate to negotiate a turning movement.	25%	90%	Low
12	R12	Widen lane (initially less than 10 ft)	Horizontal curves or tangents and low speed or high speed roadways identified as having lane departure crashes sideswipe or head-on crashes that can be attributed to an existing pavement width less than 10 feet.	25%	90%	Medium

13	R13	Add two-way left-turn lane (without reducing travel lanes)	Roadways having a high frequency of drivers being rear-ended while attempting to make a left turn across oncoming traffic. Also can be effective for drivers crossing the centerline of an undivided multilane roadway inadvertently.	30%	90%	Medium
14	R14	Road Diet (Reduce travel lanes from 4 to 3 and add a two way left-turn and bike lanes)	Areas noted as having a higher frequency of head-on, left-turn, and rear-end crashes with traffic volumes that can be handled by only 2 free flowing lanes. Using this strategy in locations with traffic volumes that are too high could result in diversion of traffic to routes less safe than the original four-lane design.	30%	90%	Medium
15	R15	Widen shoulder	Roadways that have a frequent incidence of vehicles leaving the travel lane resulting in an unsuccessful attempt to reenter the roadway. The probability of a safe recovery is increased if an errant vehicle is provided with an increased paved area in which to initiate such a recovery.	30%	90%	Medium
16	R16	Curve Shoulder widening (Outside Only)	Roadway curves noted as having frequent lane departure crashes due to inadequate or no shoulders, resulting in an unsuccessful attempt to reenter the roadway.	45%	90%	Medium
17	R17	Improve horizontal alignment (flatten curves)	Roadways with horizontal curves that have experienced lane departure crashes as a result of a roadway segment having compound curves or a severe radius. This strategy should generally be considered only when less expensive strategies involving clearing of specific sight obstructions or modifying traffic control devices have been tried and have failed to ameliorate the crash patterns.	50%	90%	Low
18	R18	Flatten crest vertical curve	The target for this strategy is usually unsignalized intersections with restricted sight distance due to vertical geometry and with patterns of crashes related to that lack of sight distance that cannot be ameliorated by less expensive methods. This strategy should generally be considered only when less expensive strategies involving clearing of specific sight obstructions or modifying traffic control devices have been tried and have failed to ameliorate the crash patterns.	25%	90%	Low
19	R19	Improve curve superelevation	Roadways noted as having frequent lane departure crashes and inadequate or no superelevation. Safety can be enhanced when the superelevation is improved or restored along curves where the actual superelevation is less than the optimal.	45%	90%	Medium
20	R20	Convert from two-way to one-way traffic	One-way streets can offer improved signal timing and accommodate odd-spaced signals. One-way streets can simplify crossings for pedestrians, who must look for traffic in only one direction. While studies have shown that conversion of two-way streets to one-way generally reduces pedestrian crashes and the number of conflict points one-way streets tend to have higher speeds which creates new problems.	35%	90%	Medium
21	R21	Improve pavement friction (High Friction Surface Treatments)	Improving the skid resistance at locations with high frequencies of wet road crashes and/or failure to stop crashes	55%	90%	High
22	R22	Install/Upgrade signs with new fluorescent sheeting (regulatory or warning)	Additional or new signage can address crashes caused by lack of driver awareness or compliance of roadway signing.	15%	90%	Very High
23	R23	Install chevron signs on horizontal curves	Roadways that have an unacceptable level of crashes on relatively sharp curves during periods of light and darkness.		90%	
24	R24	Install curve advance warning signs	Addition of advance curve warning signs; may also include horizontal alignment and/or advisory speed warning signs	25%	90%	Very High
25	R25	Install curve advance warning signs (flashing beacon)	Roadways that have an unacceptable level of crashes on relatively sharp curves. Flashing beacons in conjunction with warning signs should only be used on horizontal curves that have an established severe crash history to help maintain their effectiveness.		90%	
26	R26	Install dynamic/variable speed warning signs	Includes the addition of dynamic speed warning signs (also known as Radar Speed Feedback Signs)	30%	90%	High
27	R27	Install delineators, reflectors and/or object markers	Installation of delineators, reflectors and/or object markers are intended to warn drivers of an approaching curve or fixed object that cannot easily be removed.	15%	90%	Very High
28	R28	Install edge-lines and centerlines	Any road with a history of run-off-road right, head-on, opposite-direction-sideswipe, or run-off-road-left crashes is a candidate for this treatment - install where the existing lane delineation is not sufficient to assist the motorist in understanding the existing limits of the roadway. Depending on the width of the roadway, various combinations of edge line and/or center line pavement markings may be the most appropriate.	25%	90%	Very High
29	R29	Install no-passing line	Roadways that have a high percentage of head-on crashes suggesting that many head-on crashes may relate to failed passing maneuvers. No-passing lines should be installed where drivers "passing sight distance" is not available due to horizontal or vertical obstructions.	45%	90%	Very High
30	R30	Install centerline rumble strips/stripes	Center Line rumble strips/stripes can be used on virtually any roadway - especially those with a history of head-on crashes.	20%	90%	High
31	R31	Install edgeline rumble strips/stripes	Shoulder and edge line milled rumble strips/stripes should be used on roads with a history of roadway departure crashes.	15%	90%	High
32	R32PB	Install bike lanes	Roadway segments noted as having crashes between bicycles and vehicles or crashes that may be preventable with a buffer/shoulder.	35%	90%	High
33	R33PB	Install Separated Bike Lanes	Separated bikeways are most appropriate on streets with high volumes of bike traffic and/or high bike-vehicle collisions, presumably in an urban or suburban area. Separation types range from simple, painted buffers and flexible delineators, to more substantial separation measures including raised curbs, grade separation, bollards, planters, and parking lanes.	45%	90%	High
34	R34PB	Install sidewalk/pathway (to avoid walking along roadway)	Areas noted as not having adequate or no sidewalks and a history of walking along roadway pedestrian crashes. In rural areas asphalt curbs and/or separated walkways may be appropriate.	80%	90%	Medium
35	R35PB	Install/upgrade pedestrian crossing (with enhanced safety features)	Roadway segments with no controlled crossing for a significant distance in high-use midblock crossing area and/or multilane roads locations, flashing beacons, curb extensions, medians and pedestrian crossing islands and/or other safety features should be added to complement the standard crossing elements.	35%	90%	Medium
36	R36PB	Install raised pedestrian crossing	On lower-speed roadways, where pedestrians are known to be crossing roadways that involve significant vehicular traffic.	35%	90%	Medium
37	R37PB	Install Rectangular Rapid Flashing Beacon (RRFB)	Rectangular Rapid Flashing Beacon (RRFB) includes pedestrian-activated flashing lights and additional signage that enhance the visibility of marked crosswalks and alert motorists to pedestrian crossings. It uses an irregular flash pattern that is similar to emergency flashers on police vehicles. RRFBs are installed at unsignalized intersections and mid-block pedestrian crossings	35%	90%	Medium
38	R38	Install Animal Fencing	At locations with high percent of vehicular/animal crashes (reactive) or where there is a known high percent of animals crossing due to migratory patterns (proactive).	80%	90%	Medium

## **APPENDIX E: LOCAL ROADWAY SAFETY MANUAL (LRSM) EXCERPT**

# Local Roadway Safety

## A Manual for California's Local Road Owners

Version 1.6

April 2022



Created by Caltrans in conjunction with FHWA and SafeTREC  
for the express benefit of California Local Agencies.



U. S. Department of Transportation  
Federal Highway Administration

Safe Transportation  
Research & Education Center

SafeTREC

## Document History

### **Version 1.0: 4/20/2012**

The California Department of Transportation - Division of Local Assistance developed the first version of the Local Roadway Safety Manual (Version 1.0) in 2012 to support the Cycle 5 HSIP call-for-projects.

### **Version 1.1: 4/26/2013**

Based on feedback and lessons learned from Cycle 5, Caltrans updated Appendix B: “Table of Countermeasures and Crash Reduction Factors” to better clarify text in “Where to use”, “Why it works”, and “General Qualities” for several of the countermeasures included in the original manual.

No other changes were made to the Local Roadway Safety Manual as part of Version 1.1

### **Version 1.2: 03/10/2015**

Based on feedback and lessons learned from Cycle 6, Caltrans made minor updates to the text of the document as needed for achieving consistency with overall Caltrans local HSIP guidance documents. The following sections were updated: 1.2, 4.2, 5.1, 6.2, and Appendix B, E, F & G.

### **Version 1.3: 04/29/2016**

Caltrans made updates to the text of the document as needed in the following sections: 4.2, 5.1 and Appendix B.

### **Version 1.4: 06/08/2018**

3/30/18 - Caltrans made updates to the crash costs in Appendix D, some of the website links in Appendix G, and some other texts of the document.

6/8/18 - Countermeasure S22 (“Modify signal phasing to implement a Leading Pedestrian Interval (LPI)”) is added.

### **Version 1.5: April 2020**

Caltrans added a few more countermeasures (e.g. Pedestrian Scramble, Install Separated Bike Lanes, Reduced Left-Turn Conflict Intersections, and Curve Shoulder widening), renumbered the countermeasures and updated the crash costs in Appendix D.

### **Version 1.6: April 2022**

For Cycle 11 Call-for-projects, Countermeasure S04 (Provide Advanced Dilemma Zone Detection for high-speed approaches) was deleted and Countermeasure NS05mr (Convert intersection to mini-roundabout) added. The HSIP Funding Eligibility was changed to 90% except for S03, of which the HSIP Funding Eligibility stays at 50%. The crash costs in Appendix D were updated.

### ***Future Updates:***

*In the future, Caltrans anticipates that additional changes will be needed to keep the Local Roadway Safety Manual consistent with future Calls-for-Projects’ Guidelines and Application Instructions. In addition, new local HSIP programs, improvements to California data on local roadways, data analysis tools, and the latest safety research and methodologies may give rise to the need to make more significant changes to this manual.*

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## Table of Contents

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Foreword.....	1
1. Introduction and Purpose.....	2
1.1 California Local Roadway Safety Challenges and Opportunities .....	3
1.2 Safe System Approach .....	3
1.3 The State’s Role in Local Roadway Safety.....	4
1.4 The Local Roadway Crash Problem .....	5
1.5 Reactive vs. Proactive Safety Issue Identification.....	6
1.6 Implementation Approaches .....	7
1.7 Our “Safety Challenge” for Local Agencies .....	10
1.8 Summary of information in this Document .....	11
2. Identifying Safety Issues .....	15
2.1 State and Local Crash Databases .....	16
2.2 Transportation Injury Mapping System (TIMS).....	18
2.3 Law Enforcement Crash Reports.....	19
2.4 Observational Information.....	19
2.5 Public Notifications .....	20
2.6 Roadway Data and Devices.....	20
2.7 Exposure Data .....	21
2.8 Field Assessments and Road Safety Audits.....	22
3. Safety Data Analysis .....	23
3.1 Quantitative Analysis .....	23
3.2 Qualitative Analysis.....	25
4. Countermeasure Selection .....	28
4.1 Selecting Countermeasures and Crash Modification Factors / Crash Reduction Factors .....	29
4.2 List of Countermeasures .....	30
5. Calculating the B/C Ratio and Comparing Projects .....	36
5.1 Estimate the Benefit of Implementing Proposed Improvements.....	36
5.2 Estimate the Cost of Implementing Proposed Improvements .....	38
5.3 Calculate the B/C Ratio .....	38
5.4 Compare B/C Ratios and Consider the Need to Reevaluate Project Elements .....	39
6. Identifying Funding and Construct Improvements.....	40
6.1 Existing Funding for Low-cost Countermeasures.....	40
6.2 HSIP and Other Funding Sources .....	40
6.3 Project Development and Construction Considerations .....	41
7. Evaluation of Improvements .....	42
Appendix A: HSIP Call-for-Projects Process .....	43
Appendix B: Detailed Tables of Countermeasures .....	44
B.1 Intersection Countermeasures – Signalized .....	47
S01, Add intersection lighting (Signalized Intersection => S.I.) .....	47
S02, Improve signal hardware: lenses, back-plates with retroreflective borders, mounting, size, and number .....	47
S03, Improve signal timing (coordination, phases, red, yellow, or operation) .....	48
S05, Install emergency vehicle pre-emption systems.....	49

S06, Install left-turn lane and add turn phase (signal has no left-turn lane or phase before) .....	49
S07, Provide protected left turn phase (left turn lane already exists).....	50
S08, Convert signal to mast arm (from pedestal-mounted).....	50
S09, Install raised pavement markers and striping (Through Intersection) .....	51
S10, Install flashing beacons as advance warning (S.I.).....	51
S11, Improve pavement friction (High Friction Surface Treatments).....	52
S12, Install raised median on approaches (S.I.) .....	52
S13PB, Install pedestrian median fencing on approaches.....	53
S14, Create directional median openings to allow (and restrict) left-turns and U-turns (S.I.).....	53
S15, Reduced Left-Turn Conflict Intersections (S.I.).....	54
S16, Convert intersection to roundabout (from signal).....	55
S17PB, Install pedestrian countdown signal heads .....	55
S18PB, Install pedestrian crossing (S.I.).....	56
S19PB, Pedestrian Scramble.....	56
S20PB, Install advance stop bar before crosswalk (Bicycle Box).....	57
S21PB, Modify signal phasing to implement a Leading Pedestrian Interval (LPI) .....	57
<b>B.2 Intersection Countermeasures – Non-signalized.....</b>	<b>58</b>
NS01, Add intersection lighting (NS.I.) .....	58
NS02, Convert to all-way STOP control (from 2-way or Yield control) .....	58
NS03, Install signals .....	59
NS04, Convert intersection to roundabout (from all way stop).....	59
NS05, Convert intersection to roundabout (from 2-way stop or Yield control) .....	60
NS05mr, Convert intersection to mini-roundabout.....	60
NS06, Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs.....	61
NS08, Install Flashing Beacons at Stop-Controlled Intersections .....	62
NS09, Install flashing beacons as advance warning (NS.I.) .....	62
NS10, Install transverse rumble strips on approaches.....	63
NS11, Improve sight distance to intersection (Clear Sight Triangles).....	63
NS12, Improve pavement friction (High Friction Surface Treatments) .....	64
NS13, Install splitter-islands on the minor road approaches.....	64
NS14, Install raised median on approaches (NS.I.) .....	65
NS15, Create directional median openings to allow (and restrict) left-turns and u-turns (NS.I.).....	65
NS16, Reduced Left-Turn Conflict Intersections (NS.I.) .....	66
NS17, Install right-turn lane (NS.I.).....	67
NS18, Install left-turn lane (where no left-turn lane exists) .....	67
NS19PB, Install raised medians (refuge islands) .....	68
NS20PB, Install pedestrian crossing at uncontrolled locations (signs and markings only).....	68
NS21PB, Install/upgrade pedestrian crossing at uncontrolled locations (with enhanced safety features) .....	69
NS22PB, Install Rectangular Rapid Flashing Beacon (RRFB).....	69
NS23PB, Install Pedestrian Signal (including Pedestrian Hybrid Beacon (HAWK)) .....	70
<b>B.3 Roadway Countermeasures.....</b>	<b>71</b>
R01, Add Segment Lighting.....	71
R02, Remove or relocate fixed objects outside of Clear Recovery Zone.....	71
R03, Install Median Barrier.....	72
R04, Install Guardrail .....	72
R05, Install impact attenuators .....	73
R06, Flatten side slopes .....	73
R07, Flatten side slopes and remove guardrail.....	74
R08, Install raised median .....	74
R09, Install median (flush) .....	75
R10PB, Install pedestrian median fencing.....	75

R11, Install acceleration/ deceleration lanes .....	76
R12, Widen lane (initially less than 10 ft) .....	76
R13, Add two-way left-turn lane .....	77
R14, Road Diet (Reduce travel lanes and add a two way left-turn and bike lanes) .....	77
R15, Widen shoulder .....	78
R16, Curve Shoulder widening (Outside Only) .....	78
R17, Improve horizontal alignment (flatten curves) .....	79
R18, Flatten crest vertical curve.....	80
R19, Improve curve superelevation .....	80
R20, Convert from two-way to one-way traffic.....	81
R21, Improve pavement friction (High Friction Surface Treatments) .....	81
R22, Install/Upgrade signs with new fluorescent sheeting (regulatory or warning) .....	82
R23, Install chevron signs on horizontal curves .....	83
R24, Install curve advance warning signs.....	83
R25, Install curve advance warning signs (flashing beacon) .....	84
R26, Install dynamic/variable speed warning signs.....	84
R27, Install delineators, reflectors and/or object markers .....	85
R28, Install edge-lines and centerlines .....	86
R29, Install no-passing line.....	87
R30, Install centerline rumble strips/stripes .....	87
R31, Install edgeline rumble strips/stripes.....	88
R32PB, Install bike lanes.....	88
R33PB, Install Separated Bike Lanes .....	89
R34PB, Install sidewalk/pathway (to avoid walking along roadway) .....	89
R35PB, Install/upgrade pedestrian crossing (with enhanced safety features) .....	90
R36PB, Install raised pedestrian crossing.....	91
R37PB, Install Rectangular Rapid Flashing Beacon (RRFB).....	91
R38, Install Animal Fencing.....	92
<b>Appendix C: Summary of “Recommended Actions” .....</b>	<b>93</b>
<b>Appendix D: Benefit Cost Ratio (BCR) Calculations.....</b>	<b>97</b>
<b>Appendix E: Examples of Crash Data Collection and Analysis Techniques using TIMS .....</b>	<b>98</b>
<b>Appendix F: List of Abbreviations .....</b>	<b>99</b>
<b>Appendix G: References.....</b>	<b>100</b>

## B.1 Intersection Countermeasures – Signalized

### S01, Add intersection lighting (Signalized Intersection => S.I.)

For HSIP Cycle 11 Call-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	"night" crashes	40%	20 years
Notes:	This CM only applies to "night" crashes (all types) occurring within limits of the proposed roadway lighting 'engineered' area.		
General information			
<b>Where to use:</b>			
Signalized intersections that have a disproportionate number of night-time crashes and do not currently provide lighting at the intersection or at its approaches. Crash data should be studied to ensure that safety at the intersection could be improved by providing lighting (this strategy would be supported by a significant number of crashes that occur at night).			
<b>Why it works:</b>			
Providing lighting at the intersection itself, or both at the intersection and on its approaches, improves the safety of an intersection during nighttime conditions by (1) making drivers more aware of the surroundings at an intersection, which improves drivers' perception-reaction times, (2) enhancing drivers' available sight distances, and (3) improving the visibility of non-motorists. Intersection lighting is of particular benefit to non-motorized users. Lighting not only helps them navigate the intersection, but also helps drivers see them better.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
A lighting project can usually be completed relatively quickly, but generally requires at least 1 year to implement because the lighting system must be designed and the provision of electrical power must be arranged. The provision of lighting involves both a fixed cost for lighting installation and an ongoing maintenance and power cost which results in a moderate to high cost. Some locations can result in high B/C ratios, but due to higher costs, these projects often result in medium to low B/C ratios.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Night, All	CRF: 20-74%

### S02, Improve signal hardware: lenses, back-plates with retroreflective borders, mounting, size, and number

For HSIP Cycle 11 Call-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	All	15%	10 years
Notes:	This CM only applies to crashes occurring on the approaches / influence area of the upgraded signals. This CM does not apply to improvements like "battery backup systems", which do not provide better intersection/signal visibility or help drivers negotiate the intersection (unless applying past crashes that occurred when the signal lost power). If new signal mast arms are part of the proposed project, CM "S2" should not be used and the signal improvements would be included under CM "S7".		
General information			
<b>Where to use:</b>			
Signalized intersections with a high frequency of right-angle and rear-end crashes occurring because drivers are unable to see traffic signals sufficiently in advance to safely negotiate the intersection being approached. Signal intersection improvements include new LED lighting, signal back plates, retro-reflective tape outlining the back plates, or visors to increase signal visibility, larger signal heads, relocation of the signal heads, or additional signal heads.			
<b>Why it works:</b>			
Providing better visibility of intersection signals aids the drivers' advance perception of the upcoming intersection. Visibility and clarity of the signal should be improved without creating additional confusion for drivers.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
Installation costs and time should be minimal as these type strategies are classified as low cost and implementation does not typically require the approval process normally associated with more complex projects. When considered at a single location, these low cost improvements are usually funded through local funding by local maintenance crews. However, This CM can be effectively and efficiently implemented using a systematic approach with numerous locations, resulting in low to moderate cost projects that are more appropriate to seek state or federal funding.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Rear-End, Angle	CRF: 0-46%

S03, Improve signal timing (coordination, phases, red, yellow, or operation)

For HSIP Cycle 11 Call-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
50%	All	15%	10 years
Notes:	<p>This CM only applies to crashes occurring on the approaches / influence area of the new signal timing. For projects coordination signals along a corridor, the crashes related to side-street movements should not be applied. This CM does not apply to projects that only 'study' the signal network and do not make physical timing changes, including corridor operational studies and improvements to Traffic Operation Centers (TOCs).</p> <p>In Caltrans calls for projects, this CM has a HSIP reimbursement ratio of 50%, considering that it will improve the signal operation rather than merely the safety.</p>		
General information			
<b>Where to use:</b>			
Locations that have a crash history at multiple signalized intersections. Signalization improvements may include adding phases, lengthening clearance intervals, eliminating or restricting higher-risk movements, and coordinating signals at multiple locations. Understanding the corridor or roadway's crash history can provide insight into the most appropriate strategy for improving safety.			
<b>Why it works:</b>			
Certain timing, phasing, and control strategies can produce multiple safety benefits. Sometimes capacity improvements come along with the safety improvements and other times adverse effects on delay or capacity occur. Corridor improvements often have the highest benefit but may take longer to implement. Projects focused on capacity improvements (without a separate focus on signal timing safety needs) may not result in a reduction in future crashes.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
In general, these low-cost improvements to multiple signalized intersections can be implemented in a short time. Typically these low cost improvements are funded through local funding by local maintenance crews. However, some projects requiring new interconnect infrastructure can have moderate to high costs making them more appropriate to seek state or federal funding. The expected effectiveness of this CM must be assessed for each individual project.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	All	CRF: 0 - 41%

S04, Provide Advanced Dilemma-Zone Detection for high speed approaches

For HSIP Cycle 11 Call-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	All	40%	10 years
Notes:	<p>This CM only applies to crashes occurring on the approaches / influence area of the new detection and signal timing.</p>		
General information			
<b>Where to use:</b>			
More rural/remote areas that have a high frequency of right-angle and rear-end crashes. The Advanced Dilemma-Zone Detection system enhances safety at signalized intersections by modifying traffic control signal timing to reduce the number of drivers that may have difficulty deciding whether to stop or proceed during a yellow phase. This may reduce rear-end crashes associated with unsafe stopping and angle crashes due to illegally continuing into the intersection during the red phase.			
<b>Why it works:</b>			
Clearance times provide safe, orderly transitions in ROW assignment between conflicting streams of traffic. An Advanced Dilemma-Zone Detection system has several benefits relative to traditional multiple detector systems, which have upstream detection for vehicles in the dilemma zone but do not take the speed or size of individual vehicles into account. These benefits include: Reducing the frequency of red-light violations; Reducing the frequency of crashes associated with the traffic signal phase change (for example, rear-end and angle crashes); Reducing delay and stop frequency on the major road and a reduction in overall intersection delay.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
Installation costs should be low and the time to implement short. Additional modifications to the traffic signal controller may also be necessary. In general, This CM can be very effective and can be considered on a systematic approach. Video detection equipment is now available for this purpose, making installation and maintenance more efficient.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	All	CRF: 39%

## S05, Install emergency vehicle pre-emption systems

<b>For HSIP Cycle 11 Call-for-projects</b>			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	Emergency Vehicle - only	70%	10 years
Notes:	This CM only applies to "E.V." crashes occurring on the approaches / influence area of the new pre-emption system.		
<b>General information</b>			
<b>Where to use:</b>			
Corridors that have a history of crashes involving emergency response vehicles. The target of this strategy is signalized intersections where normal traffic operations impede emergency vehicles and where traffic conditions create a potential for conflicts between emergency and nonemergency vehicles. These conflicts could lead to almost any type of crash, due to the potential for erratic maneuvers of vehicles moving out of the paths of emergency vehicles			
<b>Why it works:</b>			
Providing emergency vehicle preemption capability at a signal or along a corridor can be a highly effective strategy in two ways; any type of crash could occur as emergency vehicles try to navigate through intersections and as other vehicles try to maneuver out of the path of the emergency vehicles. In addition, a signal preemption system can decrease emergency vehicle response times therefore decreasing the time in receiving emergency medical attention, which is critical in the outcome of any crash. When data is not available for past crashes with emergency vehicles, an agency may consider combining the E.V. pre-emption improvements into a comprehensive project that also makes significant signal hardware and/or signal timing improvements.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
Costs for installation of a signal preemption system will vary from medium to high, based upon the number of signalized intersections at which preemption will be installed and the number of emergency vehicles to be outfitted with the technology. The number of detectors, a requirement for new signal controllers, and the intricacy of the preemption system could increase costs. This CM is considered systemic as it is usually implemented on a corridor-basis.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Emergency Vehicle - only	CRF: 70%

## S06, Install left-turn lane and add turn phase (signal has no left-turn lane or phase before)

<b>For HSIP Cycle 11 Call-for-projects</b>			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	All	55%	20 years
Notes:	This CM only applies to crashes occurring on the approaches / influence area of the new left turn lanes. This CM does NOT apply to converting a single-left into double-left turn.		
<b>General information</b>			
<b>Where to use:</b>			
Intersections that do not currently have a left turn lane or a related left-turn phase that are experiencing a large number of crashes. Many intersection safety problems can be traced to difficulties in accommodating left-turning vehicles, in particular where there is currently no accommodation for left turning traffic. A key strategy for minimizing collisions related to left-turning vehicles (angle, rear-end, sideswipe) is to provide exclusive left-turn lanes and the appropriate signal phasing, particularly on high-volume and high-speed major-road approaches. Agencies need to document their consideration of the MUTCD, Section 4D.19 guidelines; the section on implementing protected left-turn phases.			
<b>Why it works:</b>			
Left-turn lanes allow separation of left-turn and through-traffic streams, thus reducing the potential for rear-end collisions. Left-turn phasing also provides a safer opportunity for drivers to make a left-turn. The combination of left-turn storage and a left turn signal has the potential to reduce many collisions between left-turning vehicles and through vehicles and/or non-motorized road users.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
Implementation time may vary from months to years. At some locations, left-turn lanes can be quickly installed simply by restriping the roadway. At other locations, widening of the roadway, acquisition of additional right-of-way, and extensive environmental processes may be needed. Such projects require a substantial time for development and construction. Costs are highly variable and range from very low to high. Installing a protected left turn lane and phase where none exists results in a high Crash Reduction Factor and is often highly effective.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	All	CRF: 17 - 58 %

S07, Provide protected left turn phase (left turn lane already exists)

For HSIP Cycle 11 Call-for-projects				
Funding Eligibility	Crash Types Addressed	CRF	Expected Life	
90%	All	30%	20 years	
Notes:	This CM only applies to crashes occurring on the approaches / influence area of the new left turn phases. This CM does NOT apply to converting a single-left into double-left turn (unless the single left is unprotected and the proposed double left will be protected).			
General information				
<b>Where to use:</b>				
Signalized intersections (with existing left turns pockets) that currently have a permissive left-turn or no left-turn protection that have a high frequency of angle crashes involving left turning, opposing through vehicles, and non-motorized road users. A properly timed protected left-turn phase can also help reduce rear-end and sideswipe crashes between left-turning vehicles and the through vehicles as well as vehicles behind them. Protected left-turn phases are warranted based on such factors as turning volumes, delay, visibility, opposing vehicle speed, distance to travel through the intersection, presence of non-motorized road users, and safety experience of the intersections. Agencies need to document their consideration of the MUTCD, Section 4D.19 guidelines; the section on implementing protected left-turn phases.				
<b>Why it works:</b>				
Left turns are widely recognized as the highest-risk movements at signalized intersections. Providing Protected left-turn phases (i.e., the provision for a specific phase for a turning movement) for signalized intersections with existing left turn pockets significantly improve the safety for left-turn maneuvers by removing the need for the drivers to navigate through gaps in oncoming/opposing through vehicles. Where left turn pockets are not protected, the pedestrian and bicyclist crossing phase often conflicts with these left turn maneuvers. Drivers focused on navigating the gaps of oncoming cars may not anticipate and/or perceive the non-motorized road users.				
<b>General Qualities (Time, Cost and Effectiveness):</b>				
If the existing traffic signal only requires a minor modification to allow for a protected left-turn phase, then the cost would also be low. The time to implement this countermeasure is short because there is no actual construction that has to take place. In-house signal maintainers can perform this operation once the proper signal phasing is determined so the cost is low. In addition, the countermeasure is tried and proven to be effective. Has the potential of being applied on a systemic/systematic approach.				
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Rear-End, Sideswipe, Broadside	CRF:	16 - 99%

S08, Convert signal to mast arm (from pedestal-mounted)

For HSIP Cycle 11 Call-for-projects				
Funding Eligibility	Crash Types Addressed	CRF	Expected Life	
90%	All	30%	20 years	
Notes:	This CM only applies to crashes occurring on the approaches / influence area of the converted signal heads that are relocated from median and/or outside shoulder pedestals to signal heads on master arms over the travel-lanes. Projects using CM "S7" should not also apply "S2" in the B/C calc.			
General information				
<b>Where to use:</b>				
Intersections currently controlled by pedestal mounted traffic signals (in medians and/or on outside shoulder) that have a high frequency of right-angle and rear-end crashes occurring because drivers are unable to see traffic signals in advance to safely negotiate the intersection. Intersections that have pedestal-mounted signals may have poor visibility and can result in vehicles not being able to stop in time for a signal change. Care should be taken to place the new signal heads (with back plates) as close to directly over the center of the travel lanes as possible.				
<b>Why it works:</b>				
Providing better visibility of intersection signs and signals aids the drivers' advance perception of the upcoming intersection. Visibility and clarity of the signal should be improved without creating additional confusion or distraction for drivers.				
<b>General Qualities (Time, Cost and Effectiveness):</b>				
Dependent on the scope of the project. Costs are generally moderate for this type of project. There is usually no right-of-way costs, minimal roadway reconstruction costs, and a shorter project development timeline. At the same time, new mast arms can be expensive. Some locations can result in high B/C ratios, but due to moderate costs, some locations may result in medium to low B/C ratios.				
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Rear-End, Angle	CRF:	12 - 74%

S09, Install raised pavement markers and striping (Through Intersection)

<b>For HSIP Cycle 11 Call-for-projects</b>			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	All	10%	10 years
Notes:	This CM only applies to crashes occurring in the intersection and influence areas of the new pavement markers and/or markings.		
<b>General information</b>			
<b>Where to use:</b>			
Intersections where the lane designations are not clearly visible to approaching motorists and/or intersections noted as being complex and experiencing crashes that could be attributed to a driver's unsuccessful attempt to navigate the intersection. Driver confusion can exist in regard to choosing the proper turn path or where through-lanes do not line up. This is especially relevant at intersections where the overall pavement area of the intersection is large, and multiple turning lanes are involved or other unfamiliar elements are presented to the driver.			
<b>Why it works:</b>			
Adding clear pavement markings can guide motorists through complex intersections. When drivers approach and traverse through complex intersections, drivers may be required to perform unusual or unexpected maneuvers. Providing more effective guidance through an intersection will minimize the likelihood of a vehicle leaving its appropriate lane and encroaching upon an adjacent lane.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
Costs of implementing this strategy will vary based on the scope and number of applications. Applying raised pavement markers is relatively low cost but can be variable and determined largely by the material used for pavement markings (paint, thermoplastic, epoxy, RPMs etc.). When using this type delineators, an issue of concern is the cost-to-service-life of the material. (Note: When HSIP safety funding is used for these installations in high-wear-locations, the local agency is expected to maintain the improvement for a minimum of 10 years.) When considered at a single location, these low cost improvements are usually funded through local funding by local maintenance crews. However, This CM can be effectively and efficiently implemented using a systematic approach with numerous locations, resulting in moderate cost projects that are more appropriate to seek state or federal funding.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Wet, Night, All	CRF: 10 - 33%

S10, Install flashing beacons as advance warning (S.I.)

<b>For HSIP Cycle 11 Call-for-projects</b>			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	All	30%	10 years
Notes:	This CM only applies to crashes occurring on the approaches / influence area of the new flashing beacons.		
<b>General information</b>			
<b>Where to use:</b>			
At signalized intersections with crashes that are a result of drivers being unaware of the intersection or are unable to see the traffic control device in time to comply.			
<b>Why it works:</b>			
Increased driver awareness of an approaching signalized intersection and an increase in the driver's time to react. Driver awareness of both downstream intersections and traffic control devices is critical to intersection safety. Crashes often occur when the driver is unable to perceive an intersection, signal head or the back of a stopped queue in time to react. Advance flashing beacons can be used to supplement and call driver attention to intersection control signs. Most advance warning flashing beacons can be powered by solar, thus reducing the issues relating to power source.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
Before choosing this CM, the agency needs to confirm the ability to provide power to the site (solar may be an option). Flashing beacons can be constructed with minimal design, environmental and right-of-way issues and have relatively low costs. This combined with a relatively high CRF, can result in high B/Cs for locations with a history of crashes and lead to a high effectiveness.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Rear End, Angle	CRF: 36 - 62%

S11, Improve pavement friction (High Friction Surface Treatments)

For HSIP Cycle 11 Call-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	All	55%	10 years
Notes:	This CM only applies to crashes occurring within the limits of the improved friction overlay. This CM is not intended to apply to standard chip-seal or open-graded maintenance projects for long segments of corridors or structure repaving projects intended to fix failed pavement.		
General information			
<b>Where to use:</b>			
Nationally, this countermeasure is referred to as "High Friction Surface Treatments" or HFST. Signalized Intersections noted as having crashes on wet pavements or under dry conditions when the pavement friction available is significantly less than needed for the actual roadway approach speeds. This treatment is intended to target locations where skidding and failure to stop is determined to be a problem in wet or dry conditions and the target vehicle is unable to stop due to insufficient skid resistance.			
<b>Why it works:</b>			
Improving the skid resistance at locations with high frequencies of wet-road crashes and/or failure to stop crashes can result in reductions of 50 percent for wet-road crashes and 20 percent for total crashes. Applying HFST can double friction numbers, e.g. low 40s to high 80s. This CM represents a special focus area for both FHWA and Caltrans, which means there are extra resources available for agencies interested in more details on High Friction Surface Treatment projects.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
This strategy can be relatively inexpensive and implemented in a short timeframe. The installation would be done by either agency personnel or contractors and can be done by hand or machine. In general, This CM can be very effective and can be considered on a systematic approach.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Wet, Night, ALL	CRF: 10 - 62 %

S12, Install raised median on approaches (S.I.)

For HSIP Cycle 11 Call-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	All	25%	20 years
Notes:	This CM only applies to crashes occurring on the approaches / influence area of the new raised median. All new raised medians funded with HSIP funding should not include the removal of the existing roadway structural section and should be doweled into the existing roadway surface. This requirement is being implemented to maximize the safety-effectiveness of the limited HSIP funding and to minimize project impacts. Landscaping, if included in the project, is considered non-participating.		
General information			
<b>Where to use:</b>			
Intersections noted as having turning movement crashes near the intersection as a result of insufficient access control. Application of this CM should be based on current crash data and a clearly defined need to restrict or accommodate the movement.			
<b>Why it works:</b>			
Raised medians next to left-turn lanes at intersections offer a cost-effective means for reducing crashes and improving operations at higher volume intersections. The raised medians prohibit left turns into and out of driveways that may be located too close to the functional area of the intersection.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
Raised medians at intersections may be most effective in retrofit situations where high volumes of turning vehicles have degraded operations and safety, and where more extensive CMs would be too expensive because of limited right-of-way and the constraints of the built environment. The result is This CM can be very effective and can be considered on a systematic approach. Raised medians can often be installed directly over the existing pavement. When agencies opt to install landscaping in conjunction with new raised medians, the portion of the cost for landscaping and other non-safety related items that exceeds 10% of the project total cost is not federally participated and must be funded by the applicant.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Angle	CRF: 21 - 55 %

S13PB, Install pedestrian median fencing on approaches

<b>For HSIP Cycle 11 Call-for-projects</b>				
Funding Eligibility	Crash Types Addressed	CRF	Expected Life	
90%	Pedestrian and Bicycle	35%	20 years	
Notes:	This CM only applies to "Ped & Bike" crashes occurring on the approaches/influence area of the new pedestrian median fencing.			
<b>General information</b>				
<b>Where to use:</b>				
Signalized Intersections with high pedestrian-generators nearby (e.g. transit stops) may experience a high volumes of pedestrians J-walking across the travel lanes at mid-block locations instead of walking to the intersection and waiting to cross during the walk-phase. When this safety issue cannot be mitigated with signal timing and shoulder/sidewalk treatments, then installing a continuous pedestrian barrier in the median may be a viable solution.				
<b>Why it works:</b>				
Adding pedestrian median fencing has the opportunity to enhance pedestrian safety at locations noted as being problematic involving pedestrians running/darting across the roadway outside the intersection crossings. Pedestrian median fencing can significantly reduce this safety issue by creating a positive barrier, forcing pedestrians to the designated pedestrian crossing.				
<b>General Qualities (Time, Cost and Effectiveness):</b>				
Costs associated with this strategy will vary widely depending on the type and placement of the median fencing. Impacts to transit and other land uses may need to be considered and controversy can delay the implementation. In general, this CM can be effective as a spot-location approach.				
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Pedestrian, Bicycle	CRF:	25- 40%

S14, Create directional median openings to allow (and restrict) left-turns and U-turns (S.I.)

<b>For HSIP Cycle 11 Call-for-projects</b>				
Funding Eligibility	Crash Types Addressed	CRF	Expected Life	
90%	All	50%	20 years	
Notes:	This CM only applies to crashes occurring in the intersection / influence area of the new directional openings.			
<b>General information</b>				
<b>Where to use:</b>				
Crashes related to turning maneuvers include angle, rear-end, pedestrian, and sideswipe (involving opposing left turns) type crashes. If any of these crash types are an issue at an intersection, restriction or elimination of the turning maneuver may be the best way to improve the safety of the intersection.				
<b>Why it works:</b>				
Restricting turning movement into and out of an intersection can help reduce conflicts between through and turning traffic. The number of access points, coupled with the speed differential between vehicles traveling along the roadway, contributes to crashes. Affecting turning movements by either allowing them or restricting them, based on the application, can ensure safe movement of traffic.				
<b>General Qualities (Time, Cost and Effectiveness):</b>				
Turn prohibitions that are implemented by closing a median opening can be implemented quickly. The cost of this strategy will depend on the treatment. Impacts to businesses and other land uses must be considered and controversy can delay the implementation. In general, This CM can be very effective and can be considered on a systematic approach.				
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	All	CRF:	51%

S15, Reduced Left-Turn Conflict Intersections (S.I.)

<b>For HSIP Cycle 11 Call-for-projects</b>			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	All	50%	20 years
Notes:	This CM only applies to crashes occurring in the intersection / influence area of the new Reduced Left-Turn Conflict.		
<b>General information</b>			
<b>Where to use and Why it works:</b>			
<p>Reduced left-turn conflict intersections are geometric designs that alter how left-turn movements occur in order to simplify decisions and minimize the potential for related crashes. Two highly effective designs that rely on U-turns to complete certain left-turn movements are known as the restricted crossing U-turn (RCUT) and the median U-turn (MUT).</p> <p><b>Restricted Crossing U-turn (RCUT):</b>                      The RCUT intersection modifies the direct left-turn and through movements from cross-street approaches. Minor road traffic makes a right turn followed by a U-turn at a designated location (either signalized or unsignalized) to continue in the desired direction.                      The RCUT is suitable for a variety of circumstances, including along rural, high-speed, four-lane, divided highways or signalized routes. It also can be used as an alternative to signalization or constructing an interchange. RCUTs work well when consistently used along a corridor, but also can be used effectively at individual intersections.</p> <p><b>Median U-turn (MUT)</b>                      The MUT intersection modifies direct left turns from the major approaches. Vehicles proceed through the main intersection, make a U-turn a short distance downstream, followed by a right turn at the main intersection. The U-turns can also be used for modifying the cross-street left turns.                      The MUT is an excellent choice for heavily traveled intersections with moderate left-turn volumes. When implemented at multiple intersections along a corridor, the efficient two-phase signal operation of the MUT can reduce delay, improve travel times, and create more crossing opportunities for pedestrians and bicyclists.</p> <p><i>MUT and RCUT Can Reduce Conflict Points by 50%</i></p> <p>Conflict Points                      ● Crossing ● Merging ○ Diverging</p>			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
Implementing this strategy may take from months to years, depending on whether additional R/W is required. Such projects require a substantial time for development and construction. Costs are highly variable and range from very low to high. The expected effectiveness of this CM must be assessed for each individual location.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Angle/Left-turn/Rear-End/All	CRF: 34.8-100%

S16, Convert intersection to roundabout (from signal)

<b>For HSIP Cycle 11 Call-for-projects</b>			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	All	Varies	20 years
Notes:	This CM only applies to crashes occurring in influence area of the new roundabout. This CM is not intended for mini-roundabouts. The benefit of this CM is calculated using Caltrans procedure. The CRF is dependent on the ADT, project location (Rural/Urban) and the roundabout type (1 lane or 2 lanes). The benefit comes from both the reduction in the number and the severity of the crashes.		
<b>General information</b>			
<b>Where to use:</b>			
Signalized intersections that have a significant crash problem and the only alternative is to change the nature of the intersection itself. Roundabouts can also be very effective at intersections with complex geometry and intersections with frequent left-turn movements.			
<b>Why it works:</b>			
The types of conflicts that occur at roundabouts are different from those occurring at conventional intersections; namely, conflicts from crossing and left-turn movements are not present in a roundabout. The geometry of a roundabout forces drivers to reduce speeds as they proceed through the intersection. This helps keep the range of vehicle speed narrow, which helps reduce the severity of crashes when they do occur. Pedestrians only have to cross one direction of traffic at a time at roundabouts, thus reducing their potential for conflicts.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
Provision of a roundabout requires substantial project development. The need to acquire right-of-way is likely and will vary from site to site and depends upon the geometric design. These activities may require up to 4 years or longer to implement. Costs are variable, but construction of a roundabout to replace an existing signalized intersection are relatively high. The result is this CM may have reduced relative-effectiveness compared to other CMs.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	All	CRF: 35 - 67%

S17PB, Install pedestrian countdown signal heads

<b>For HSIP Cycle 11 Call-for-projects</b>			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	Pedestrian and Bicycle	25%	20 years
Notes:	This CM only applies to "Ped & Bike" crashes occurring in the intersection/crossing with the new countdown heads.		
<b>General information</b>			
<b>Where to use:</b>			
Signals that have signalized pedestrian crossing with walk/don't walk indicators and where there have been pedestrian vs. vehicle crashes.			
<b>Why it works:</b>			
A pedestrian countdown signal contains a timer display and counts down the number of seconds left to finish crossing the street. Countdown signals can reassure pedestrians who are in the crosswalk when the flashing "DON'T WALK" interval appears that they still have time to finish crossing. Countdown signals begin counting down either when the "WALK" or when the flashing "DON'T WALK" interval appears and stop at the beginning of the steady "DON'T WALK" interval. These signals also have been shown to encourage more pedestrians to use the pushbutton rather than jaywalk.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
Costs and time of installation will vary based on the number of intersections included in this strategy and if it requires new signal controllers capable of accommodating the enhancement. When considered at a single location, these low cost improvements are usually funded through local funding by local crews. However, This CM can be effectively and efficiently implemented using a systematic approach with numerous locations, resulting in moderate cost projects that are more appropriate to seek state or federal funding.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Pedestrian, Bicycle	CRF: 25%

S18PB, Install pedestrian crossing (S.I.)

<b>For HSIP Cycle 11 Call-for-projects</b>			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	Pedestrian and Bicycle	25%	20 years
Notes:	This CM only applies to "Ped & Bike" crashes occurring in the intersection/crossing with the new crossing. This CM is not intended to be used for high-cost aesthetic enhancements to intersection crosswalks (i.e. stamped concrete or stamped asphalt).		
<b>General information</b>			
<b>Where to use:</b>			
Signalized Intersections with no marked crossing and pedestrian signal heads, where pedestrians are known to be crossing intersections that involve significant turning movements. They are especially important at intersections with (1) multiphase traffic signals, such as left-turn arrows and split phases, (2) school crossings, and (3) double-right or double-left turns. At signalized intersections, pedestrian crossings are often safer when the left turns have protected phases that do not overlap the pedestrian walk phase.			
<b>Why it works:</b>			
Adding pedestrian crossings has the opportunity to enhance pedestrian safety at locations noted as being problematic. Nearly one-third of all pedestrian-related crashes occur at or within 50 feet of an intersection. Of these, 30 percent may involve a turning vehicle. Another 22 percent of pedestrian crashes involve a pedestrian either running across the intersection or darting out in front of a vehicle whose view was blocked just prior to the impact. Finally, 16 percent of these intersection-related crashes occur because of a driver violation (e.g., failure to yield right-of-way). When agencies opt to install aesthetic enhancement to intersection crosswalks like stamped concrete/asphalt, the project design and construction costs can significantly increase. For HSIP applications, these costs must be accounted for in the B/C calculation, but these costs (over standard crosswalk markings) must be tracked separately and are not federally reimbursable and will increase the agency's local-funding share for the project costs.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
Costs associated with this strategy will vary widely, depending if curb ramps and sidewalk modifications are required with the crossing. When considered at a single location, these low cost improvements may be funded through local funding by local crews. However, This CM can be effectively and efficiently implemented using a systematic approach with numerous locations, resulting in moderate to high cost projects that are appropriate to seek state or federal funding.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Pedestrian, Bicycle	CRF: 25%

S19PB, Pedestrian Scramble

<b>For HSIP Cycle 11 Call-for-projects</b>			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	Pedestrian and Bicycle	40%	20 years
Notes:	This CM only applies to "Ped & Bike" crashes occurring in the intersection with the new pedestrian crossing.		
<b>General information</b>			
<b>Where to use:</b>			
Pedestrian Scramble is a form of pedestrian "WALK" phase at a signalized intersection in which all vehicular traffic is required to stop, allowing pedestrians/bicyclists to safely cross through the intersection in any direction, including diagonally. Pedestrian Scramble may be considered at signalized intersections with very high pedestrian/bicycle volumes, e.g. in an urban business district.			
<b>Why it works:</b>			
Pedestrian Scramble has been shown to reduce injury risk and increase bicycle ridership due to its perceived safety and comfort.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
Not involving any additional R/W, Pedestrian Scramble should not require a long development process and should be implemented reasonably soon. A systemic approach may be used in implementing this CM, resulting in cost efficiency with low to moderate cost.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Pedestrian, Bicycle	CRF: -10% to 51%

S20PB, Install advance stop bar before crosswalk (Bicycle Box)

<b>For HSIP Cycle 11 Call-for-projects</b>			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	Pedestrian and Bicycle	15%	10 years
Notes:	This CM only applies to "Ped & Bike" crashes occurring in the intersection-crossing with the new advanced stop bars.		
<b>General information</b>			
<b>Where to use:</b>			
Signalized Intersections with a marked crossing, where significant bicycle and/or pedestrians volumes are known to occur.			
<b>Why it works:</b>			
Adding advance stop bar before the striped crosswalk has the opportunity to enhance both pedestrian and bicycle safety. Stopping cars well before the crosswalk provides a buffer between the vehicles and the crossing pedestrians. It also allows for a dedicated space for cyclists, making them more visible to drivers (This dedicated space is often referred to as a bike-box.)			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
Costs and time of installation will vary based on the number of intersections included in this strategy and if it requires new signal controllers capable of accommodating the enhancement. When considered at a single location, these low cost improvements are usually funded through local funding by local crews. However, This CM can be effectively and efficiently implemented using a systematic approach with numerous locations, resulting in moderate cost projects that are more appropriate to seek state or federal funding.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Pedestrian, Bicycle	CRF: 35%

S21PB, Modify signal phasing to implement a Leading Pedestrian Interval (LPI)

<b>For HSIP Cycle 11 Call-for-projects</b>			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	Pedestrian and Bicycle	60%	10 years
Notes:	This CM only applies to "Ped & Bike" crashes occurring in the intersections with signalized pedestrian crossing with the newly implemented Leading Pedestrian Interval (LPI).		
<b>General information</b>			
<b>Where to use:</b>			
Intersections with signalized pedestrian crossing that have high turning vehicles volumes and have had pedestrian vs. vehicle crashes.			
<b>Why it works:</b>			
A leading pedestrian interval (LPI) gives pedestrians the opportunity to enter an intersection 3-7 seconds before vehicles are given a green indication. With this head start, pedestrians can better establish their presence in the crosswalk before vehicles have priority to turn left. LPIs provide (1) increased visibility of crossing pedestrians; (2) reduced conflicts between pedestrians and vehicles; (3) Increased likelihood of motorists yielding to pedestrians; and (4) enhanced safety for pedestrians who may be slower to start into the intersection.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
Costs for implementing LPIs are very low, since only minor signal timing alteration is required. This makes it an easy and inexpensive countermeasure that can be incorporated into pedestrian safety action plans or policies and can become routine agency practice. When considered at a single location, the LPI is usually local-funded. However, This CM can be effectively and efficiently implemented using a systematic approach with numerous locations, resulting in moderate cost projects that are more appropriate to seek state or federal funding.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Pedestrian, Bicycle	CRF: 59%

## B.2 Intersection Countermeasures – Non-signalized

### NS01, Add intersection lighting (NS.I.)

For HSIP Cycle 11 Call-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	Night	40%	20 years
Notes:	This CM only applies to "night" crashes (all types) occurring within limits of the proposed roadway lighting 'engineered' area.		
General information			
<b>Where to use:</b>			
Non-signalized intersections that have a disproportionate number of night-time crashes and do not currently provide lighting at the intersection or at its approaches. Crash data should be studied to ensure that safety at the intersection could be improved by providing lighting (this strategy would be supported by a significant number of crashes that occur at night).			
<b>Why it works:</b>			
Providing lighting at the intersection itself, or both at the intersection and on its approaches, improves the safety of an intersection during nighttime conditions by (1) making drivers more aware of the surroundings at an intersection, which improves drivers' perception-reaction times, (2) enhancing drivers' available sight distances, and (3) improving the visibility of non-motorists. Intersection lighting is of particular benefit to non-motorized users as lighting not only helps them navigate the intersection, but also helps drivers see them better.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
A lighting project can usually be completed relatively quickly, but generally requires at least 1 year to implement because the lighting system must be designed and the provision of electrical power must be arranged. The provision of lighting involves both a fixed cost for lighting installation and an ongoing maintenance and power cost. For rural intersections, studies have shown the installation of streetlights reduced nighttime crashes at unlit intersections and can be more effective in reducing nighttime crashes than either rumble strips or overhead flashing beacons. Some locations can result in high B/C ratios, but due to higher costs, these projects often result in medium to low B/C ratios.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Night, All	CRF: 25- 50%

### NS02, Convert to all-way STOP control (from 2-way or Yield control)

For HSIP Cycle 11 Call-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	All	50%	10 years
Notes:	This CM only applies to crashes occurring in the intersection and/or influence area of the new control. CA-MUTCD warrant must be met.		
General information			
<b>Where to use:</b>			
Unsignalized intersection locations that have a crash history and have no controls on the major roadway approaches. However, all-way stop control is suitable only at intersections with moderate and relatively balanced volume levels on the intersection approaches. Under other conditions, the use of all-way stop control may create unnecessary delays and aggressive driver behavior. MUTCD warrants should always be followed.			
<b>Why it works:</b>			
All-way stop control can reduce right-angle and turning collisions at unsignalized intersections by providing more orderly movement at an intersection, reducing through and turning speeds, and minimizing the safety effect of any sight distance restrictions that may be present. Advance public notification of the change is critical in assuring compliance and reducing crashes.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
The costs involved in converting to all-way stop control are relatively low. All-way stop control can normally be implemented at multiple intersections with just a change in signing on intersection approaches, and typically are very quick to implement. When considered at a single location, these low cost improvements are usually funded through local funding by local maintenance crews. However, This CM can be effectively and efficiently implemented using a systematic approach with numerous locations, resulting in moderate cost projects that are more appropriate to seek state or federal funding.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Left-turn, Angle	CRF: 6 - 80%

## NS03, Install signals

For HSIP Cycle 11 Call-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	All	30%	20 years
Notes:	This CM only applies to crashes occurring in the intersection and/or influence area of the new signals. <b>All new signals must meet MUTCD "safety" warrants: 4, 5 or 7.</b> Given the over-arching operational changes that occur when an intersection is signalized, no other intersection CMs can be applied to the intersection crashes in conjunction with this CM.		
General information			
<b>Where to use:</b>			
Traffic signals can be used to prevent the most severe type crashes (right-angle, left-turn). Consideration to signalize an unsignalized intersection should only be given after (1) less restrictive forms of traffic control have been utilized as the installation of a traffic signal often leads to an increased frequency of crashes (rear-end) on major roadways and introduces congestion and (2) signal warrants have been met. Refer to the CA MUTCD, Section 4C.01, Studies and Factors for Justifying Traffic Control Signals.			
<b>Why it works:</b>			
Traffic signals have the potential to reduce the most severe type crashes but will likely cause an increase in rear-end collisions. A reduction in overall injury severity is likely the largest benefit of traffic signal installation.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
Typical traffic signal costs fall in the medium to high category and are affected by application, type of signal and right-of-way considerations. Projects of this magnitude should only be considered after alternate and lesser means of correction have been evaluated. Some locations can result in high B/C ratios, but due to higher costs, these projects often result in medium to low B/C ratios.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	All	CRF: 0 - 74%

## NS04, Convert intersection to roundabout (from all way stop)

For HSIP Cycle 11 Call-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	All	Varies	20 years
Notes:	This CM only applies to crashes occurring in the intersection and/or influence area of the new control. The benefit of this CM is calculated using Caltrans procedure. The CRF is dependent on the ADT, project location (Rural/Urban) and the roundabout type (1 lane or 2 lanes). The benefit comes from both the reduction in the number and the severity of the crashes.		
General information			
<b>Where to use:</b>			
Intersections that have a high frequency of right-angle and left-turn type crashes. Whether such intersections have existing crash patterns or not, a roundabout provides an alternative to signalization. The primary target locations for roundabouts should be moderate-volume unsignalized intersections. Roundabouts may not be a viable alternative in many suburban and urban settings where right-of-way is limited.			
<b>Why it works:</b>			
Roundabouts provide an important alternative to signalized and all-way stop-controlled intersections. Modern roundabouts differ from traditional traffic circles in that they operate in such a manner that traffic entering the roundabout must yield the right-of-way to traffic already in it. Roundabouts can serve moderate traffic volumes with less delay than all-way stop-controlled intersections and provide fewer conflict points. Crashes at roundabouts tend to be less severe because of the speed constraints and elimination of left-turn and right-angle movements.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
Construction of roundabouts are usually relatively costly and major projects, requiring the environmental process, right-of-way acquisition, and implementation under an agency's long-term capital improvement program. (For this reason, roundabouts may not be appropriate for California's Federal Safety Programs that have relatively short delivery requirements.) Even with roundabouts higher costs, they still can have a relatively high effectiveness.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Left-turn, Angle	CRF: 12 - 78 %

## NS05, Convert intersection to roundabout (from 2-way stop or Yield control)

<b>For HSIP Cycle 11 Call-for-projects</b>			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	All	Varies	20 years
Notes:	This CM only applies to crashes occurring in the intersection and/or influence area of the new control. The benefit of this CM is calculated using Caltrans procedure. The CRF is dependent on the ADT, project location (Rural/Urban) and the roundabout type (1 lane or 2 lanes). The benefit comes from both the reduction in the number and the severity of the crashes.		
<b>General information</b>			
<b>Where to use:</b>			
Intersections that have a high frequency of right-angle and left-turn type crashes. Whether such intersections have existing crash patterns or not, a roundabout provides an alternative to signalization. The primary target locations for roundabouts should be moderate-volume unsignalized intersections. Roundabouts may not be a viable alternative in many suburban and urban settings where right-of-way is limited.			
<b>Why it works:</b>			
Roundabouts provide an important alternative to signalized and all-way stop-controlled intersections. Modern roundabouts differ from traditional traffic circles in that they operate in such a manner that traffic entering the roundabout must yield the right-of-way to traffic already in it. Roundabouts can serve moderate traffic volumes with less delay than all-way stop-controlled intersections and provide fewer conflict points. Crashes at roundabouts tend to be less severe because of the speed constraints and elimination of left-turn and right-angle movements.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
Construction of roundabouts are usually relatively costly and major projects, requiring the environmental process, right-of-way acquisition, and implementation under an agency's long-term capital improvement program. (For this reason, roundabouts may not be appropriate for California's Federal Safety Programs that have relatively short delivery requirements.) Even with roundabouts higher costs, they still can have a relatively high effectiveness.			
<b>FHWA CMF Clearinghouse:</b>	<b>Crash Types Addressed:</b>	Left-turn, Angle	<b>CRF:</b> 12 - 78 %

## NS05mr, Convert intersection to mini-roundabout

<b>For HSIP Cycle 11 Call-for-projects</b>			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	All	30%	20 years
Notes:	This CM only applies to crashes occurring in the intersection and/or influence area of the new control.		
<b>General information</b>			
<b>Where to use:</b>			
Mini-roundabouts are characterized by a small diameter (45-90 ft) and traversable islands (central island and splitter islands). Mini-roundabouts offer most of the benefits of regular roundabouts with the added benefit of a smaller footprint. They are best suited to environments where speeds are already low and environmental constraints would preclude the use of a larger roundabout. Mini-roundabouts are most effective in lower speed environments in which all approaching roadways have posted speed of 30 mph or less and an 85th-percentile speed of less than 35 mph near the proposed yield and/or entrance line. For any location with an 85th-percentile speed above 35 mph, the mini-roundabout can be included as part of a broader system of traffic calming measures to achieve an appropriate speed environment.			
<b>Why it works:</b>			
Mini-roundabouts may be an optimal solution for a safety or operational issue at an existing intersection where there is insufficient right-of-way for a standard roundabout installation. The benefits of mini-roundabouts are the Compact size, operational efficiency, traffic safety improvement and traffic Calming.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
Construction costs for mini-roundabouts vary widely depending upon the extent of sidewalk modifications or other geometric improvements and the types of materials used. In most cases, mini-roundabouts have been installed with little or no pavement widening and with only minor changes to curbs and sidewalks. Construction costs can be minimum for an installation consisting entirely of pavement markings and signage or moderate for mini-roundabouts that include raised islands and pedestrian improvements.			
<b>FHWA CMF Clearinghouse:</b>	<b>Crash Types Addressed:</b>	NA	<b>CRF:</b> NA

NS06, Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs

For HSIP Cycle 11 Call-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	All	15%	10 years
Notes:	This CM only applies to crashes occurring in the influence area of the new signs. The influence area must be determined on a location by location basis.		
General information			
<b>Where to use:</b>			
The target for this strategy should be approaches to unsignalized intersections with patterns of rear-end, right-angle, or turning collisions related to lack of driver awareness of the presence of the intersection.			
<b>Why it works:</b>			
The visibility of intersections and, thus, the ability of approaching drivers to perceive them can be enhanced by installing larger regulatory and warning signs at or prior to intersections. A key to success in applying this strategy is to select a combination of regulatory and warning sign techniques appropriate for the conditions on a particular unsignalized intersection approach.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
Signing improvements do not require a long development process and can typically be implemented quickly. Costs for implementing this strategy are nominal and depend on the number of signs. When considered at a single location, these low cost improvements are usually funded through local funding by local maintenance crews. However, This CM can be effectively and efficiently implemented using a systematic approach with numerous locations, resulting in moderate cost projects that are more appropriate to seek state or federal funding.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	All	CRF: 11 - 55%

NS07, Upgrade intersection pavement markings (NS.I.)

For HSIP Cycle 11 Call-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	All	25%	10 years
Notes:	This CM only applies to crashes occurring on the approaches / influence area of the new pavement markings. This CM is not intended to be used for general maintenance activities (i.e. the replacement of existing pavement markings in-kind) and must include upgraded safety features over the existing pavement markings and striping.		
General information			
<b>Where to use:</b>			
Unsignalized intersections that are not clearly visible to approaching motorists, particularly approaching motorists on the major road. The strategy is particularly appropriate for intersections with patterns of rear-end, right-angle, or turning crashes related to lack of driver awareness of the presence of the intersection. Also at minor road approaches where conditions allow the stop bar to be seen by an approaching driver at a significant distance from the intersection. Typical improvements include "Stop Ahead" markings and the addition of Centerlines and Stop Bars.			
<b>Why it works:</b>			
The visibility of intersections and, thus, the ability of approaching drivers to perceive them can be enhanced by installing appropriate pavement delineation in advance of and at intersections will provide approaching motorists with additional information at these locations. Providing visible stop bars on minor road approaches to unsignalized intersections can help direct the attention of drivers to the presence of the intersection. Drivers should be more aware that the intersection is coming up, and therefore make safer decisions as they approach the intersection.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
Pavement marking improvements do not require a long development process and can typically be implemented quickly. Costs for implementing this strategy are nominal and depend on the number of markings. When considered at a single location, these low cost improvements are usually funded through local funding by local maintenance crews. However, This CM can be effectively and efficiently implemented using a systematic approach with numerous locations, resulting in moderate cost projects that are more appropriate to seek state or federal funding. Note: When federal safety funding is used for these installations in high-wear-locations, the local agency is expected to maintain the improvement for a minimum of 10 years.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	All	CRF: 13 - 60%

## NS08, Install Flashing Beacons at Stop-Controlled Intersections

<b>For HSIP Cycle 11 Call-for-projects</b>			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	All	15%	10 years
Notes:	This CM only applies to crashes occurring on the stop-controlled approaches / influence area of the new beacons.		
<b>General information</b>			
<b>Where to use:</b>			
Flashing beacons can reinforce driver awareness of the Non-Signalized intersection control and can help mitigate patterns of right-angle crashes related to stop sign violations. Post-mounted advanced flashing beacons or overhead flashing beacons can be used at stop-controlled intersections to supplement and call driver attention to stop signs.			
<b>Why it works:</b>			
Flashing beacons provide a visible signal to the presence of an intersection and can be very effective in rural areas where there may be long stretches between intersections as well as locations where night-time visibility of intersections is an issue.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
Flashing beacons can be constructed with minimal design, environmental and right-of-way issues and have relatively low costs. Before choosing this CM, the agency needs to confirm the ability to provide power to the site (solar may be an option). In general, This CM can be very effective and can be considered on a systematic approach.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Angle, Rear-End	CRF: 5-34%

## NS09, Install flashing beacons as advance warning (NS.I.)

<b>For HSIP Cycle 11 Call-for-projects</b>			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	All	30%	10 years
Notes:	This CM only applies to crashes occurring on the approaches / influence area of the new beacons placed in advance of the intersection.		
<b>General information</b>			
<b>Where to use:</b>			
Non-Signalized Intersections with patterns of crashes that could be related to lack of a driver's awareness of approaching intersection or controls at a downstream intersection.			
<b>Why it works:</b>			
Advance flashing beacons can be used to supplement and call driver attention to intersection control signs. Flashing beacons are intended to reinforce driver awareness of the stop or yield signs and to help mitigate patterns of crashes related to intersection regulatory sign violations. Most advance warning flashing beacons can be powered by solar, thus reducing the issues relating to power source.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
Use of flashing beacons requires minimal development process, allowing flashing beacons to be installed within a short time period. Before choosing this CM, the agency needs to confirm the ability to provide power to the site (solar may be an option). In general, This CM can be very effective and can be considered on a systematic approach.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Angle, Rear-End	CRF: 36 - 62%

## NS10, Install transverse rumble strips on approaches

<b>For HSIP Cycle 11 Call-for-projects</b>			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	All	20%	10 years
Notes:	This CM only applies to crashes occurring on the approaches / influence area of the new rumble strips.		
<b>General information</b>			
<b>Where to use:</b>			
Transverse rumble strips are installed in the travel lane for the purposes of providing an auditory and tactile sensation for each motorist approaching the intersection. They can be used at any stop or yield approach intersection, often in combination with advance signing to warn of the intersection ahead. Due to the noise generated by vehicles driving over the rumble strips, care must be taken to minimize disruption to nearby residences and businesses.			
<b>Why it works:</b>			
When motorists are traveling along the roadway, they are sometimes unaware they are approaching an intersection. This is especially true on rural roads, as there may be fewer clues indicating an intersection ahead. Transverse rumble strips warn motorists that something unexpected is ahead that they need to pay attention to.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
Use of transverse rumble strips requires minimal development process, allowing transverse rumble strips to be installed within a short time period. In general, This CM can be very effective and can be considered on a systematic approach, although care should be taken to not over-use this CM. Note: When federal safety funding is used for these installations in high-wear-locations, the local agency is expected to maintain the improvement for a minimum of 10 years.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	All	CRF: 0 - 35%

## NS11, Improve sight distance to intersection (Clear Sight Triangles)

<b>For HSIP Cycle 11 Call-for-projects</b>			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	All	20%	10 years
Notes:	This CM only applies to crashes occurring on the approaches / influence area of the significantly improved new sight distance. Minor/incidental improvements to sight distance would not likely result in the CRF shown below.		
<b>General information</b>			
<b>Where to use:</b>			
Unsignalized intersections with restricted sight distance and patterns of crashes related to lack of sight distance where sight distance can be improved by clearing roadside obstructions without major reconstruction of the roadway.			
<b>Why it works:</b>			
Adequate sight distance for drivers at stop or yield-controlled approaches to intersections has long been recognized as among the most important factors contributing to overall safety at unsignalized intersections. By removing sight distance restrictions (e.g., vegetation, parked vehicles, signs, buildings) from the sight triangles at stop or yield-controlled intersection approaches, drivers will be able see approaching vehicles on the main line, without obstruction and therefore make better decisions about entering the intersection safely.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
Projects involving clearing sight obstructions on the highway right-of-way can typically be accomplished quickly, assuming the objects are readily moveable. Clearing sight obstructions on private property requires more time for discussions with the property owner. Costs will generally be low, assuming that in most cases the objects to be removed are within the right-of-way. In general, this CMs can be very effective and can be implemented by agencies' maintenance staff and/or implemented on a systematic approach. Usually only high-cost removals would be good candidates for Caltrans Federal Safety Funding. Note: When federal safety funding is used to remove vegetation that has the potential to grow back, the local agency is expected to maintain the improvement for a minimum of 10 years.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	All	CRF: 11 - 56%

## NS12, Improve pavement friction (High Friction Surface Treatments)

For HSIP Cycle 11 Call-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	All	55%	10 years
Notes:	This CM only applies to crashes occurring within the limits of the improved friction overlay. This CM is not intended to apply to standard chip-seal or open-graded maintenance projects for long segments of corridors or structure repaving projects intended to fix failed pavement.		
General information			
<b>Where to use:</b>			
Nationally, this countermeasure is referred to as "High Friction Surface Treatments" or HFST. Non-signalized Intersections noted as having crashes on wet pavements or under dry conditions when the pavement friction available is significantly less than needed for the actual roadway approach speeds. This treatment is intended to target locations where skidding and failure to stop is determined to be a problem in wet or dry conditions and the target vehicle is unable to stop due to insufficient skid resistance.			
<b>Why it works:</b>			
Improving the skid resistance at locations with high frequencies of wet-road crashes and/or failure to stop crashes can result in reductions of 50 percent for wet-road crashes and 20 percent for total crashes. Applying HFST can double friction numbers, e.g. low 40s to high 80s. This CM represents a special focus area for both FHWA and Caltrans, which means there are extra resources available for agencies interested in more details on High Friction Surface Treatment projects.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
This strategy can be relatively inexpensive and implemented in a short timeframe. The installation would be done by either agency personnel or contractors and can be done by hand or machine. In general, This CM can be very effective and can be considered on a systematic approach.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Wet, Night, ALL	CRF: 10 - 62 %

## NS13, Install splitter-islands on the minor road approaches

For HSIP Cycle 11 Call-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	All	40%	20 years
Notes:	This CM only applies to crashes occurring on the approaches / influence area of <b><u>the new splitter island on the minor road approaches.</u></b>		
General information			
<b>Where to use:</b>			
Minor road approaches to unsignalized intersections where the presence of the intersection or the stop sign is not readily visible to approaching motorists. The strategy is particularly appropriate for intersections where the speeds on the minor road are high. In creation of a splitter island allows for an additional stop sign to be placed in the median for the minor approach.			
<b>Why it works:</b>			
The installation of splitter islands allows for the addition of a stop sign in the median to make the intersection more conspicuous. Additionally, the splitter island on the minor-road provides for a positive separation between turning vehicles on the through road and vehicles stopped on the minor road approach.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
Splitter islands at non-signalized intersections can usually be installed with minimal roadway reconstruction and relatively quickly. In general, This CM can be very effective and can be considered on a systematic approach.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Angle, Rear-End	CRF: 35 - 100 %

### NS14, Install raised median on approaches (NS.I)

For HSIP Cycle 11 Call-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	All	25%	20 years
<b>Notes:</b>	This CM only applies to crashes occurring on the approaches / influence area of the new raised median. All new raised medians funded with federal HSIP funding should not include the removal of the existing roadway structural section and should be doweled into the existing roadway surface. This requirement is being implemented to maximize the safety-effectiveness of the limited HSIP funding and to minimize project impacts. Landscaping, if included in the project, is considered non-participating.		
General information			
<b>Where to use:</b>			
Where related or nearby turning movements affect the safety and operation of an intersection. Effective access management is key to improving safety at, and adjacent to, intersections. The number of intersection access points coupled with the speed differential between vehicles traveling along the roadway often contributes to crashes. Any access points within 250 feet upstream and downstream of an intersection are generally undesirable.			
<b>Why it works:</b>			
Raised medians with left-turn lanes at intersections offer a cost-effective means for reducing crashes and improving operations at higher volume intersections. The raised medians also prohibit left turns into and out of driveways that may be located too close to the functional area of the intersection.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
Raised medians at intersections may be most effective in retrofit situations where high volumes of turning vehicles have degraded operations and safety, and where more extensive approaches would be too expensive because of limited right-of-way and the constraints of the built environment. Because raised medians limit property access to right turns only, the need for providing alternative access ways should be considered. In general, This CM can be very effective and can be considered on a systematic approach. When agencies opt to install landscaping in conjunction with new raised medians, the portion of the cost for landscaping and other non-safety related items that exceeds 10% of the project total cost is not federally participated and must be funded by the applicant.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	All	CRF: 20 - 39 %

### NS15, Create directional median openings to allow (and restrict) left-turns and u-turns (NS.I)

For HSIP Cycle 11 Call-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	All	50%	20 years
<b>Notes:</b>	This CM only applies to crashes occurring in the intersection / influence area of the new directional openings.		
General information			
<b>Where to use:</b>			
Crashes related to turning maneuvers include angle, rear-end, pedestrian, and sideswipe (involving opposing left turns) type crashes. If any of these crash types are an issue at an intersection, restriction or elimination of the turning maneuver may be the best way to improve the safety of the intersection. Because raised medians limit property access to right turns only, they should be used in conjunction with efforts to provide alternative access ways and promote driveway spacing objectives.			
<b>Why it works:</b>			
Agencies are increasingly using access management techniques on urban and suburban arterials to manage the number of conflicts experienced at an intersection. A key element of access management is to restrict certain movements, create directional median openings, or close median openings that are deemed too close to an intersection.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
Turn prohibitions that are implemented by closing a median opening can usually be implemented quickly. Costs are highly variable but in many cases could be considered low. In some cases this strategy may involve acquiring access or constructing replacement access; those actions will significantly increase the cost of the project. Impacts to businesses and other land uses must be considered and controversy can delay the implementation. In general, This CM can be very effective and can be considered on a systematic approach.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	All	CRF: 51%

NS16, Reduced Left-Turn Conflict Intersections (NS.I.)

<b>For HSIP Cycle 11 Call-for-projects</b>			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	All	50%	20 years
Notes:	This CM only applies to crashes occurring in the intersection / influence area of the new Reduced Left-Turn Conflict.		
<b>General information</b>			
<b>Where to use and Why it works:</b>			
<p>Reduced left-turn conflict intersections are geometric designs that alter how left-turn movements occur in order to simplify decisions and minimize the potential for related crashes. Two highly effective designs that rely on U-turns to complete certain left-turn movements are known as the restricted crossing U-turn (RCUT) and the median U-turn (MUT).</p> <p><b>Restricted Crossing U-turn (RCUT):</b>                      The RCUT intersection modifies the direct left-turn and through movements from cross-street approaches. Minor road traffic makes a right turn followed by a U-turn at a designated location (either signalized or unsignalized) to continue in the desired direction.                      The RCUT is suitable for a variety of circumstances, including along rural, high-speed, four-lane, divided highways or signalized routes. It also can be used as an alternative to signalization or constructing an interchange. RCUTs work well when consistently used along a corridor, but also can be used effectively at individual intersections.</p> <p><b>Median U-turn (MUT)</b>                      The MUT intersection modifies direct left turns from the major approaches. Vehicles proceed through the main intersection, make a U-turn a short distance downstream, followed by a right turn at the main intersection. The U-turns can also be used for modifying the cross-street left turns.                      The MUT is an excellent choice for heavily traveled intersections with moderate left-turn volumes. When implemented at multiple intersections along a corridor, the efficient two-phase signal operation of the MUT can reduce delay, improve travel times, and create more crossing opportunities for pedestrians and bicyclists.</p> <p><i>MUT and RCUT Can Reduce Conflict Points by 50%</i></p>			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
Implementing this strategy may take from months to years, depending on whether additional R/W is required. Such projects require a substantial time for development and construction. Costs are highly variable and range from very low to high. The expected effectiveness of this CM must be assessed for each individual location.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Angle/Left-turn/Rear-End/All	CRF: 34.8-100%

### NS17, Install right-turn lane (NS.I.)

For HSIP Cycle 11 Call-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	All	20%	20 years
Notes:	This CM only applies to crashes occurring on the approaches / influence area of the new right-turn lanes. This CM is not eligible for use at existing all-way stop intersections.		
General information			
<b>Where to use:</b>			
Many collisions at unsignalized intersections are related to right-turn maneuvers. A key strategy for minimizing such collisions is to provide exclusive right-turn lanes, particularly on high-volume and high-speed major-road approaches. When considering new right-turn lanes, potential impacts to non-motorized users should be considered and mitigated as appropriate. When considering new right-turn lanes, potential impacts to non-motorized users should be considered and mitigated as appropriate.			
<b>Why it works:</b>			
The strategy is targeted to reduce the frequency of rear-end collisions resulting from conflicts between vehicles turning right and following vehicles and vehicles turning right and through vehicles coming from the left on the cross street. Right-turn lanes also remove slow vehicles that are decelerating to turn right from the through-traffic stream, thus reducing the potential for rear-end collisions. Right-turn lanes can increase the length of the intersection crossing and create an additional potential conflict point for non-motorized users.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
Implementing this strategy may take from months to years. At some locations, right-turn lanes can be quickly and simply installed by restriping the roadway. At other locations, widening of the roadway, acquisition of additional right-of-way, and extensive environmental processes may be needed. Such projects require a substantial time for development and construction. Costs are highly variable and range from very low to high. The expected effectiveness of this CM must be assessed for each individual location.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	All	CRF: 14 - 26 %

### NS18, Install left-turn lane (where no left-turn lane exists)

For HSIP Cycle 11 Call-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	All	35%	20 years
Notes:	This CM only applies to crashes occurring on the approaches / influence area of the new left-turn lanes. This CM does NOT apply to converting a single-left into double-left turn. This CM is not eligible for use at existing all-way stop intersections.		
General information			
<b>Where to use:</b>			
Many collisions at unsignalized intersections are related to left-turn maneuvers. A key strategy for minimizing such collisions is to provide exclusive left-turn lanes, particularly on high-volume and high-speed major-road approaches. When considering new left-turn lanes, potential impacts to non-motorized users should be considered and mitigated as appropriate.			
<b>Why it works:</b>			
Adding left-turn lanes remove vehicles waiting to turn left from the through-traffic stream, thus reducing the potential for rear-end collisions. Because they provide a sheltered location for drivers to wait for a gap in opposing traffic, left-turn lanes may encourage drivers to be more selective in choosing a gap to complete the left-turn maneuver. This strategy may reduce the potential for collisions between left-turn and opposing through vehicles.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
Implementing this strategy may take from months to years. At some locations, left-turn lanes can be quickly and simply installed by restriping the roadway. At other locations, widening of the roadway, acquisition of additional right-of-way, and extensive environmental processes may be needed. Such projects require a substantial time for development and construction. Costs are highly variable and range from very low to high. The expected effectiveness of this CM must be assessed for each individual location.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	All	CRF: 9 -55 %

### NS19PB, Install raised medians (refuge islands)

For HSIP Cycle 11 Call-for-projects					
Funding Eligibility		Crash Types Addressed		CRF	Expected Life
90%		Pedestrian and Bicycle		45%	20 years
Notes:	This CM only applies to "Ped & Bike" crashes occurring in the crossing with the new islands. All new raised medians funded with federal HSIP funding should not include the removal of the existing roadway structural section and should be doweled into the existing roadway surface. This requirement is being implemented to maximize the safety-effectiveness of the limited HSIP funding and to minimize project impacts. Landscaping, if included in the project, is considered non-participating.				
General information					
<b>Where to use:</b>					
Intersections that have a long pedestrian crossing distance, a higher number of pedestrians, or a crash history. Raised medians decrease the level of exposure for pedestrians and allow pedestrians to concentrate on (or cross) only one direction of traffic at a time.					
<b>Why it works:</b>					
Raised pedestrian refuge islands, or medians at crossing locations along roadways, are another strategy to reduce exposure between pedestrians and motor vehicles. Refuge islands and medians that are raised (i.e., not just painted) provide pedestrians more secure places of refuge during the street crossing. They can stop partway across the street and wait for an adequate gap in traffic before completing their crossing.					
<b>General Qualities (Time, Cost and Effectiveness):</b>					
Median and pedestrian refuge areas are a low-cost countermeasure to implement. This cost can be applied to retrofit improvements or if it is a new construction project, implementing this countermeasure is even more cost-effective. In general, This CM can be very effective and can be considered on a systematic approach. When agencies opt to install landscaping in conjunction with new raised medians, the portion of the cost for landscaping and other non-safety related items that exceeds 10% of the project total cost is not federally participated and must be funded by the applicant.					
<b>FHWA CMF Clearinghouse:</b>		<b>Crash Types Addressed:</b>		<b>CRF:</b>	<b>30 - 56 %</b>
		Pedestrian and Bicycle			

### NS20PB, Install pedestrian crossing at uncontrolled locations (signs and markings only)

For HSIP Cycle 11 Call-for-projects					
Funding Eligibility		Crash Types Addressed		CRF	Expected Life
90%		Pedestrian and Bicycle		25%	10 years
Notes:	This CM only applies to "Ped & Bike" crashes occurring in the intersection/crossing with the new crossing. This CM is not intended to be used for high-cost aesthetic enhancements to intersection crosswalks (i.e. stamped concrete or stamped asphalt).				
General information					
<b>Where to use:</b>					
Non-signalized intersections without a marked crossing, where pedestrians are known to be crossing intersections that involve significant vehicular traffic. They are especially important at school crossings and intersections with right and/or left turns pockets. See Zegeer study (Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations) for additional guidance regarding when to install a marked crosswalk.					
<b>Why it works:</b>					
Adding pedestrian crossings has the opportunity to enhance pedestrian safety at locations noted as being problematic. Pavement markings delineate a portion of the roadway that is designated for pedestrian crossing. These markings will often be different for controlled verses uncontrolled locations. The use of "ladder", "zebra" or other enhanced markings at uncontrolled crossings can increase both pedestrian and driver awareness to the increased exposure at the crossing. Incorporating advanced "stop" or "yield" markings provides an extra safety buffer and can be effective in reducing the 'multiple-threat' danger to pedestrians. Nearly one-third of all pedestrian-related crashes occur at or within 50 feet of an intersection. Of these, 30 percent may involve a turning vehicle. There are several types of pedestrian crosswalks, including: continental, ladder, zebra, and standard. When agencies opt to install aesthetic enhancement to intersection crosswalks like stamped concrete/asphalt, the project design and construction costs can significantly increase. For HSIP applications, these costs must be accounted for in the B/C calculation, but these costs (over standard crosswalk markings) must be tracked separately and are not federally reimbursable and will increase the agency's local-funding share for the project costs.					
<b>General Qualities (Time, Cost and Effectiveness):</b>					
Costs associated with this strategy will vary widely, depending upon if curb ramps and sidewalk modifications are required with the crossing. When considered at a single location, these low cost improvements are usually funded through local funding by local crews. However, This CM can be effectively and efficiently implemented using a systematic approach with numerous locations, resulting in moderate cost projects that are more appropriate to seek state or federal funding.					
<b>FHWA CMF Clearinghouse:</b>		<b>Crash Types Addressed:</b>		<b>CRF:</b>	<b>25 %</b>
		Pedestrian and Bicycle			

NS21PB, Install/upgrade pedestrian crossing at uncontrolled locations (with enhanced safety features)

For HSIP Cycle 11 Call-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	Pedestrian and Bicycle	35%	20 years
Notes:	This CM only applies to "Ped & Bike" crashes occurring in the new crossing (influence area) with enhanced safety features. This CM is not intended to be used for high-cost aesthetic enhancements to intersection crosswalks (i.e. stamped concrete or stamped asphalt).		
General information			
<b>Where to use:</b>			
Non-signalized intersections where pedestrians are known to be crossing intersections that involve significant vehicular traffic. They are especially important at school crossings and intersections with turn pockets. Based on the Zegeer study (Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations) at many locations, a marked crosswalk alone may not be sufficient to adequately protect non-motorized users. In these cases, <b>flashing beacons, curb extensions, advanced "stop" or "yield" markings, and other safety features</b> should be added to complement the standard crossing elements.			
<b>Why it works:</b>			
Adding pedestrian crossings that include enhanced safety features has the opportunity to enhance pedestrian safety at locations noted as being especially problematic. The enhanced safety elements help delineate a portion of the roadway that is designated for pedestrian crossing. Incorporating advanced "yield" markings provide an extra safety buffer and can be effective in reducing the 'multiple-threat' danger to pedestrians. Nearly one-third of all pedestrian-related crashes occur at or within 50 feet of an intersection. When agencies opt to install aesthetic enhancement to intersection crosswalks like stamped concrete/asphalt, the project design and construction costs can significantly increase. For HSIP applications, these costs must be accounted for in the B/C calculation, but these costs (over standard crosswalk markings) must be tracked separately and are not federally reimbursable and will increase the agency's local-funding share for the project costs.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
Costs associated with this strategy will vary widely, depending upon the types of enhanced features that will be combined with the standard crossing improvements. The need for new curb ramps and sidewalk modifications will also be a factor. This CM may be effectively and efficiently implemented using a systematic approach with more than one location and can have relatively high B/C ratios based on past non-motorized crash history.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Pedestrian and Bicycle	CRF: 37%

NS22PB, Install Rectangular Rapid Flashing Beacon (RRFB)

For HSIP Cycle 11 Call-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	Pedestrian and Bicycle	35%	20 years
Notes:	This CM only applies to "Ped & Bike" crashes occurring in the influence area (expected to be a maximum of within 250') of the crossing which includes the RRFB.		
General information			
<b>Where to use:</b>			
Rectangular Rapid Flashing Beacon (RRFB) includes pedestrian-activated flashing lights and additional signage that enhance the visibility of marked crosswalks and alert motorists to pedestrian crossings. It uses an irregular flash pattern that is similar to emergency flashers on police vehicles. RRFBs are installed at unsignalized intersections and mid-block pedestrian crossings.			
<b>Why it works:</b>			
RRFBs can enhance safety by increasing driver awareness of potential pedestrian conflicts and reducing crashes between vehicles and pedestrians at unsignalized intersections and mid-block pedestrian crossings. The addition of RRFB may also increase the safety effectiveness of other treatments, such as crossing warning signs and markings.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
RRFBs are a lower cost alternative to traffic signals and hybrid signals. This CM can often be effectively and efficiently implemented using a systematic approach with numerous locations.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Pedestrian, Bicycle	CRF: 7 – 47.4%

NS23PB, Install Pedestrian Signal (including Pedestrian Hybrid Beacon (HAWK))

For HSIP Cycle 11 Call-for-projects				
Funding Eligibility	Crash Types Addressed		CRF	Expected Life
90%	Pedestrian and Bicycle		55%	20 years
Notes:	This CM only applies to "Ped & Bike" crashes occurring in the intersection/crossing with the new signal. For HAWK or other pedestrian signals, the justification may be Warrant 4, 5 and/or 7, or passing the test in Figure 4F-1/4F-2 in Chapter 4F of CA MUTCD. Please refer to Chapter 4F of CA MUTCD for more details			
General information				
<b>Where to use:</b>				
Intersections noted as having a history of pedestrian vs. vehicle crashes and in areas where the likelihood of the pedestrian presence is high. Corridors should also be assessed to determine if there are adequate safe opportunities for non-motorists to cross and if a pedestrian signal, or a Pedestrian Hybrid Beacon (PHB) (also called High-Intensity Activated crossWalk beacon (HAWK)) are needed to provide an active warning to motorists when a pedestrian is in the crosswalk.				
<b>Why it works:</b>				
Adding a pedestrian signal has the opportunity to greatly enhance pedestrian safety at locations noted as being problematic. Nearly one-third of all pedestrian-related crashes occur at or within 50 feet of an intersection. In combination with this CM, better guidance signs and markings for non-motorized and motorized roadway users should be considered, including: sign and markings directing pedestrians and cyclists on appropriate/legal travel paths and signs and markings warning motorists of non-motorized uses of the roadway that should be expected.				
<b>General Qualities (Time, Cost and Effectiveness):</b>				
The cost of improvements are generally high, but can vary dependent on the type of signal and overall scope of the project. In most cases the project duration can be short. The expected effectiveness of this CM must be assessed for each individual location.				
<b>FHWA CMF Clearinghouse:</b>	<b>Crash Types Addressed:</b>	Pedestrian and Bicycle	<b>CRF:</b>	15 - 69%

## B.3 Roadway Countermeasures

### R01, Add Segment Lighting

For HSIP Cycle 11 Call-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	Night	35%	20 years
Notes:	This CM only applies to "night" crashes (all types) occurring within limits of the proposed roadway lighting 'engineered' area.		
General information			
<b>Where to use:</b>			
Where to use: Noted substantial patterns of nighttime crashes. In particular, patterns of rear-end, right-angle, turning or roadway departure collisions on the roadways may indicate that night-time drivers can be unaware of the roadway characteristics.			
<b>Why it works:</b>			
Providing roadway lighting improves the safety during nighttime conditions by (1) making drivers more aware of the surroundings, which improves drivers' perception-reaction times, (2) enhancing drivers' available sight distances to perceive roadway characteristic in advance of the change, and (3) improving non-motorist's visibility and navigation.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
It expected that projects of this type may be constructed in a year or two and are relatively costly. There are several types of costs associated with providing lighting, including the cost of providing a permanent source of power to the location, the cost for the luminaire supports (i.e., poles), and the cost for routinely replacing the bulbs and maintenance of the luminaire supports. Some locations can result in high B/C ratios, but due to higher costs, these projects often result in medium to low B/C ratios.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Night, All	CRF: 18 - 69 %

### R02, Remove or relocate fixed objects outside of Clear Recovery Zone

For HSIP Cycle 11 Call-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	All	35%	20 years
Notes:	This CM only applies to crashes occurring within the limits of the new clear recovery zone (per Caltrans' HDM).		
General information			
<b>Where to use:</b>			
Known locations or roadway segments prone to collisions with fixed objects such as utility poles, drainage structures, trees, and other fixed objects, such as the outside of a curve, end of lane drops, and in traffic islands. A clear recovery zone should be developed on every roadway, as space is available. In situations where public right-of-way is limited, steps should be taken to request assistance from property owners, as appropriate.			
<b>Why it works:</b>			
While this strategy does not prevent the vehicle leaving the roadway, it does provide a mechanism to reduce the severity of a resulting crash. A clear zone is an unobstructed, traversable roadside area that allows a driver to stop safely or regain control of a vehicle that has left the roadway. Removing or moving fixed objects, flattening slopes, or providing recovery areas reduces the likelihood of a crash.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
Projects involving removing fixed objects from highway right-of-way can typically be accomplished quickly, assuming the objects are readily moveable. Clearing objects on private property requires more time for discussions with the property owner. Costs will generally be low, assuming that in most cases the objects to be removed are within the right-of-way. This CMs can be very effective and can be implemented by agencies' maintenance staff and/or implemented on a systematic approach. High-cost removals or removals implemented using a systematic approach would be good candidates for Caltrans Federal Safety Funding.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Fixed Object	CRF: 17 - 100 %

## R03, Install Median Barrier

For HSIP Cycle 11 Call-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	All	25%	20 years
Notes:	Note: For Caltrans' statewide Calls-for-Projects, this CM only applies to crashes occurring within the limits of the new barrier.		
General information			
<b>Where to use:</b>			
Areas where crash history indicates drivers are unintentionally crossing the median and the cross-overs are resulting in high severity crashes. The installation of median barriers can increase the number of PDO and non-severe injuries. The net result in safety from this countermeasure is connected more to reducing the severity of crashes not the number of crashes. It is recommended to review the warrants as outlined in Chapter 7 of the Caltrans Traffic Manual when considering whether to install median barriers.			
<b>Why it works:</b>			
This strategy is designed to prevent head-on collisions by providing a barrier between opposing lanes of traffic. The variety of median barriers available makes it easier to choose a site-specific solution. The main advantage is the reduction of the severity of the crashes. The key to success would be in selecting an appropriate barrier based on the site, previous crash history, maintenance needs, and median width.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
This strategy would in many cases be possible to implement within a short period after site selection. Costs will vary depending on the type of median barrier selected and whether the strategy is implemented as a stand-alone project or incorporated as part of a reconstruction or resurfacing effort. Maintenance costs and worker exposure will also vary depending on the type of barrier selected. The expected effectiveness of this CM must be assessed for each individual location.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Head-on	CRF: 0 - 94 %

## R04, Install Guardrail

For HSIP Cycle 11 Call-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	All	25%	20 years
Notes:	This CM only applies to crashes occurring within the limits of the new guardrail. This CM is not intended to be used for general maintenance activities (i.e. the replacement of existing damaged rail). For projects proposing to upgrade existing guardrail to current standards, this CM and corresponding CRF should only be applied to locations where past crash data or engineering judgment applied to the existing rail conditions suggests the upgraded guardrail may result in fewer or less severe crashes (justifying the use of the 25% CRF for this CM).		
General information			
<b>Where to use:</b>			
Guardrail is installed to reduce the severity of lane departure crashes. However, guardrail can reduce crash severity only for those conditions where striking the guardrail is less severe than going down an embankment or striking a fixed object. Guardrail should only be installed where it is clear that crash severity will be reduced, or there is a history of run-off-the-road crashes at a given location that have resulted in severe crashes. New and upgraded guardrail and end-treatments must meet current safety standards; see Method for Assessing Safety Hardware (MASH) for more information. Caltrans (or other national accepted guidance) slope/height criteria need to be considered and documented.			
<b>Why it works:</b>			
Guardrail redirects a vehicle away from embankment slopes or fixed objects and dissipates the energy of an errant vehicle.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
Strategies range from relatively inexpensive too costly. Costly projects may include those that upgrade existing guardrail applications to more semi-rigid and rigid barrier systems over extended distances. In general, this CMs can be effective and can be implemented by agencies' maintenance staff and/or implemented on a systematic approach.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Fixed Object, Run-off Road	CRF: 11 - 78 %

## R05, Install impact attenuators

For HSIP Cycle 11 Call-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	All	25%	10 years
Notes:	This CM only applies to crashes occurring within the limits of the new attenuators. This CM is not intended to be used for general maintenance activities (i.e. the replacement of existing damaged attenuators). For projects proposing to upgrade existing attenuators to current standards, this CM and corresponding CRF should only be applied to locations where past crash data or engineering judgment applied to the existing attenuator conditions suggests the upgraded attenuators may result in fewer or less severe crashes (justifying the use of the 25% CRF for this CM).		
General information			
<b>Where to use:</b>			
Impact attenuators are typically used to shield rigid roadside objects such as concrete barrier ends, steel guardrail ends and bridge pillars from oncoming automobiles. Attenuators should only be installed where it is impractical for the objects to be removed. New and upgraded barrier end-treatments must meet current safety standards; see MASH for more information.			
<b>Why it works:</b>			
Attenuators bring an errant vehicle to a more-controlled stop or redirect the vehicle away from a rigid object. Attenuators are effective at absorbing impact energy and increasing occupant safety. They also tend to draw attention to the fixed object, which helps drivers steer clear of the fixed objects.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
Costs depending on the scope of the project, type(s) used, and associated ongoing maintenance costs. Time to install is fairly quick once site is identified.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Fixed Object, Run-off Road	CRF: 5 - 50 %

## R06, Flatten side slopes

For HSIP Cycle 11 Call-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	All	30%	20 years
Notes:	This CM only applies to crashes occurring within the limits of the new side slopes. Minor/incidental flattening of side slopes would not likely result in the CRF shown below and may not be appropriate for use in Caltrans B/C calculations.		
General information			
<b>Where to use:</b>			
Roadways experiencing frequent lane departure crashes that result in roll-over type crashes as a result of the roadway slope being so severe as to not accommodate a reasonable degree of driver correction. When there is a need to reduce the severity of lane departure crashes without installing a barrier system that could result in increased numbers of crashes.			
<b>Why it works:</b>			
Flattened slopes provide a greater area for a driver to regain control of a vehicle. Steep slopes, ditches or unprotected hazardous drops-offs adjacent to a travel lane offer little opportunities to correct an inappropriate action by a driver and can result in severe crashes.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
Roadside modifications range from relatively inexpensive to very costly. Strategies that include creating safer side slopes where none exists can be moderately expensive based on the scope of the project and the associated clearing, grading, etc. The potential for high environmental and right-of-way impacts is high which can take several years to clear. In other cases This CM can be effective and can be implemented by agencies' maintenance staff and/or implemented on a systematic approach.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Fixed Object, Run-off Road	CRF: 5 - 62 %

## R07, Flatten side slopes and remove guardrail

For HSIP Cycle 11 Call-for-projects					
Funding Eligibility		Crash Types Addressed		CRF	Expected Life
90%		All		40%	20 years
Notes:	This CM only applies to crashes occurring within the limits of both the removed guardrail and the new side slopes.				
General information					
<b>Where to use:</b>					
Locations where high number of crashes originate as a lane departure and result in collision with guardrail or a fixed object located on the side slope shielded by guardrail. The guardrail may or may not meet current standards. Even though guardrails are generally installed to reduce the severity of departure crashes, they still can result in severe crashes in some locations.					
<b>Why it works:</b>					
Flattened side slopes and an unobstructed clear zone provide a greater area for a driver to regain control of a vehicle. The existing guardrail may help protect the steep slopes, fixed objects, or unprotected hazardous drops-offs adjacent to a travel lane, but removing all of these obstacles generally improves safety.					
<b>General Qualities (Time, Cost and Effectiveness):</b>					
Roadside modifications range from relatively inexpensive to very costly. Strategies that include creating safer side slopes where none exists can be moderately expensive based on the scope of the project and the associated clearing, grading, etc. The potential for high environmental and right-of-way impacts is high which can take several years to clear.					
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Roll Over, Fixed Object	CRF:	42%	

## R08, Install raised median

For HSIP Cycle 11 Call-for-projects					
Funding Eligibility		Crash Types Addressed		CRF	Expected Life
90%		All		25%	20 years
Notes:	This CM only applies to crashes occurring within the limits of the new raised median. All new raised medians funded with federal HSIP funding should not include the removal of the existing roadway structural section and should be doweled into the existing roadway surface. This requirement is being implemented to maximize the safety-effectiveness of the limited HSIP funding and to minimize project impacts. Landscaping, if included in the project, is considered non-participating.				
General information					
<b>Where to use:</b>					
Areas experiencing head-on collisions that may be affected by both the number of vehicles that cross the centerline and by the speed of oncoming vehicles. Installing a raised median is a more restrictive approach in that it represents a more rigid barrier between opposing traffic. Application of raised medians on roadways with higher speeds is not advised - instead a median barrier should be considered. Including landscaping in new raised medians can be counterproductive to the HSIP safety goals and should only be done in ways that do not increase drivers' exposure to fixed objects and that will maintain driver's sight distance needs throughout the life of the proposed landscaping. <b>Agencies need to consider and document impacts of additional turning movements at nearby intersections.</b>					
<b>Why it works:</b>					
Adding raised medians is a particularly effective strategy as it adds to or reallocates the existing cross section to incorporate a buffer between the opposing travel lanes and reinforces the limits of the travel lane. Raised median may also be used to limit unsafe turning movements along a roadway.					
<b>General Qualities (Time, Cost and Effectiveness):</b>					
In some cases this strategy may be a retrofit into the existing roadway by utilizing a portion of the existing paved shoulder. These raised medians can be installed directly over the existing pavement. Cost and time to implement could significantly increase if the paved area is not sufficient to include a median. The surface treatment of the raised median also significantly affects their cost-effectiveness: standard concrete or other hardscape surfaces are usually more cost effective than landscaped medians. When agencies opt to install landscaping in conjunction with new raised medians, the project design and construction costs can significantly increase due to excavation, backfill/top-soil, water-connection, irrigation, planting, maintenance needed for the landscaping. When agencies opt to install landscaping in conjunction with new raised medians, the portion of the cost for landscaping and other non-safety related items that exceeds 10% of the project total cost is not federally participated and must be funded by the applicant.					
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Head-on	CRF:	20 - 75 %	

## R09, Install median (flush)

For HSIP Cycle 11 Call-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	All	15%	20 years
Notes:	This CM only applies to crashes occurring within the limits of the new flush median. The new median must be a minimum of 4 feet wide (or "wider" if a narrow median exists before the proposed project).		
General information			
<b>Where to use:</b>			
Areas experiencing head-on collisions that may be affected by both the number of vehicles that cross the centerline and by the speed of oncoming vehicles. Roadways with oversized lanes offer an opportunity to restripe the roadway to reduce the lanes to standard widths and use the extra width for the median.			
<b>Why it works:</b>			
Adding medians is a particularly effective strategy as it adds to or reallocates the existing cross section to incorporate a narrow buffer median between opposing flows, thereby providing a greater opportunity to correct an errant maneuver and further reinforce the limits of the travel lane. Application widths can vary based on the available cross section and intended application. Additional safety can be provided by combining this CM with rumble strips.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
In some cases this strategy may be retrofitted into the existing roadway by utilizing a portion of the existing paved shoulder and can ultimately be as simple as restriping the roadway. Costs and time to implement could significantly increase if the paved area is not sufficient to include a median.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	All	CRF: 15 - 78 %

## R10PB, Install pedestrian median fencing

For HSIP Cycle 11 Call-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	Pedestrian and Bicycle	35%	20 years
Notes:	This CM only applies to "Ped & Bike" crashes occurring on the approaches/influence area of the new pedestrian median fencing.		
General information			
<b>Where to use:</b>			
Roadway segments with high pedestrian-generators and pedestrian-destinations nearby (e.g. transit stops) may experience a high volume of pedestrians J-walking across the travel lanes at mid-block locations instead of walking to the nearest intersection or designated mid-block crossing. When this safety issue cannot be mitigated with shoulder, sidewalk and/or crossing treatments, then installing a continuous pedestrian barrier in the median may be a viable solution.			
<b>Why it works:</b>			
Adding pedestrian median fencing has the opportunity to enhance pedestrian safety at locations noted as being problematic involving pedestrians running/darting across the roadway outside designated pedestrian crossings. Pedestrian median fencing can significantly reduce this safety issue by creating a positive barrier, forcing pedestrians to the designated pedestrian crossing.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
Costs associated with this strategy will vary widely depending on the type and placement of the median fencing. Impacts to transit and other land uses may need to be considered and controversy can delay the implementation. In general, this CM can be effective as a spot-location approach.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Pedestrian, Bicycle	CRF: 25 - 40%

## R11, Install acceleration/ deceleration lanes

For HSIP Cycle 11 Call-for-projects					
Funding Eligibility		Crash Types Addressed		CRF	Expected Life
90%		All		25%	20 years
Notes:	This CM only applies to crashes occurring within the limits of the new accel/decel lanes on high speed roadways. Significant improvements to the merge length for lane-drop locations is also an acceptable use of this CM.				
General information					
<b>Where to use:</b>					
Areas proven to have crashes that are the result of drivers not being able to turn onto a high speed roadway to accelerate until the desired roadway speed is reached and areas that do not provide the opportunity to safely decelerate to negotiate a turning movement. This CM can also be used to improve the safety of merging vehicles at a lane-drop location.					
<b>Why it works:</b>					
A lane that does not provide enough deceleration length and storage space for turning traffic may cause the turn queue to back up into the adjacent through lane. This can contribute to rear-end and sideswipe crashes. An acceleration lane is an auxiliary or speed-change lane that allows vehicles to accelerate to highway speeds (high speed roadways) before entering the through-traffic lanes of a highway. Additionally, if acceleration by entering traffic takes place directly on the traveled way, it may disrupt the flow of through-traffic and cause rear-end and sideswipe collisions.					
<b>General Qualities (Time, Cost and Effectiveness):</b>					
Costs are highly variable. Where sufficient median or shoulder space exists it may be possible to provide acceleration/deceleration lanes at a moderate cost. Where the roadway must be widened and additional right-of-way must be acquired, higher costs and a lengthy time-to-construct are likely. The expected effectiveness of this CM must be assessed for each individual location.					
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Sideswipe, Rear-End	CRF:	10 - 75 %	

## R12, Widen lane (initially less than 10 ft)

For HSIP Cycle 11 Call-for-projects					
Funding Eligibility		Crash Types Addressed		CRF	Expected Life
90%		All		25%	20 years
Notes:	Note: For Caltrans' statewide Calls-for-Projects, this CM only applies to crashes occurring within the limits of the widened lanes. Widening must a minimum of 1 foot.				
General information					
<b>Where to use:</b>					
Horizontal curves or tangents and low speed or high speed roadways identified as having lane departure crashes, sideswipe or head-on crashes that can be attributed to an existing pavement width less than 10 feet.					
<b>Why it works:</b>					
Increasing pavement width can affect almost all crash types. A common practice is to widen the traveled way on horizontal curves to make operating conditions on curves comparable to those on tangents. Speed is a primary consideration when evaluating potential adverse impacts of lane width on safety. On high-speed, rural two-lane highways, an increased risk of cross-centerline head-on or cross-centerline sideswipe crashes is a concern because drivers may have more difficulty staying within the travel lane.					
<b>General Qualities (Time, Cost and Effectiveness):</b>					
Costs will depend on the amount of reconstruction necessary and on whether additional right-of-way is required. In general, this is one of the higher-cost strategies recommended, but it can also be very beneficial. Since this is a relatively expensive treatment, one of the keys to creating a cost effective project with at least a medium B/C ratio is targeting higher-hazard roadways.					
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	All	CRF:	5 - 70 %	

### R13, Add two-way left-turn lane

For HSIP Cycle 11 Call-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	All	30%	20 years
Notes:	This CM only applies to crashes occurring within the limits of the new lane, where an existing median did not already exist.		
General information			
<b>Where to use:</b>			
Roadways having a high frequency of drivers being rear-ended while attempting to make a left turn across oncoming traffic. Also can be effective for drivers crossing the centerline of an undivided multilane roadway inadvertently.			
<b>Why it works:</b>			
Two-way left-turn lanes provide a buffer between opposing directions of travel and separate left turning traffic from through traffic. They can also help to allow vehicles to begin to accelerate before entering the through-traffic lanes. They reduce the disruption of flow of through-traffic and reducing rear-end and sideswipe collisions. For some roadways the option of converting a four-lane undivided arterials to two-vehicle-lane roadways with a center left-turn lane and bike lanes should be considered (see "Road Diet" CM.)			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
In some cases this strategy may be retrofitted into the existing roadway by utilizing a portion of the existing paved shoulder and can ultimately be as simple as restriping the roadway. Costs and time to implement could significantly increase if the paved area is not sufficient to include a median, requiring new right-of-way, and having significant environmental impacts. The expected effectiveness of this CM must be assessed for each individual location as the B/C ratios will vary from low to high.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	All	CRF: 8 - 50 %

### R14, Road Diet (Reduce travel lanes and add a two way left-turn and bike lanes)

For HSIP Cycle 11 Call-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	All	35%	20 years
Notes:	This CM only applies to crashes occurring within the limits of the new lane striping. "Intersection" crashes can only be applied when they resulted from turning movements that had no designated turn lanes/phases in the existing condition and the Road Diet will provide turn lanes/phases for these movements. This CM does not apply to roadway sections that already included left turn lanes or two way left turn lanes before the lane reductions. New bike lanes are also expected to be part of these projects. If any pavement is planned to be removed for the purpose of adding landscaping, planter-boxes, or other non-roadway user features, the cost should be non-participating.		
General information			
<b>Where to use:</b>			
Areas noted as having a higher frequency of head-on, left-turn, and rear-end crashes with traffic volumes that can be handled by only 2 free flowing lanes. Using this strategy in locations with traffic volumes that are too high could result in diversion of traffic to routes less safe than the original four-lane design. It may also result in congestion levels that contribute to other crashes.			
<b>Why it works:</b>			
The application of this strategy usually reduces the roadway segment speeds and serious head-on crashes. In many cases the extra pavement width can be used for the installation of bike lanes. In addition to increasing bicycle safety, these bike lanes can improve the safety of on-street parking.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
Implementation would require more time than in other low-cost treatments to complete environmental analyses, traffic studies and public input. Projects that only require new lane markings and minor signalization modifications will have relatively low cost and can be very effective and can be considered on a systematic approach. These striping and signal modification costs should be considered part of this CM and not an additional CM. (If additional signal hardware improvements are being made, over what is needed for the road diet, then the Improve Signal Hardware CM may also be used.) Often road diet projects need a seal-coat placed on the roadway to fully remove the old striping. These seal coats are considered part of the proper installation of this CM. In contrast, structural-overlays should not be considered part of this CM and are not considered eligible for funding in the California Local HSIP.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	All	CRF: 26 - 43 %

## R15, Widen shoulder

For HSIP Cycle 11 Call-for-projects					
Funding Eligibility		Crash Types Addressed		CRF	Expected Life
90%		All		30%	20 years
Notes:	This CM only applies to crashes occurring within the limits of the new paved shoulder. A minimum of 2 feet width must be added and the new/resulting shoulders must be a minimum of 4 feet wide. This CM is not eligible unless it is done as the last step of an "incremental approach", for which the agency documents that: 1) they have already pursued and installed lower cost and lower impact CMs (i.e. signing/stripping upgrades to MUTCD standards/recommendations, rumble strips, etc.), 2) they have already monitored the crash occurrences after these improvements were installed, and 3) the 'after' crash rate is still unacceptably high. This 'incremental approach' (or a special exception from the HSIP program manager) must be documented in the Narrative Questions in the application and a summary of the 'before' and 'after' crash analysis must be attached to the application.				
General information					
<b>Where to use:</b>					
Roadways that have a frequent incidence of vehicles leaving the travel lane resulting in an unsuccessful attempt to reenter the roadway. The probability of a safe recovery is increased if an errant vehicle is provided with an increased paved area in which to initiate such a recovery.					
<b>Why it works:</b>					
Based on the best available research, adding shoulder or widening an existing shoulder provides a greater area to regain control of a vehicle, as well as lateral clearance to roadside objects such as guardrail, signs and poles. They may also provide space for disabled vehicles to stop or drive slowly, provide increased sight distance for through vehicles and for vehicles entering the roadway, and in some cases reduce passing conflicts between motor vehicles and bicyclists and pedestrians. The likely safety benefits for adding or widening an existing shoulder generally increase as the widening width increases - practitioners should refer to NCHRP Report 500 Series, the CMF Clearinghouse or other references for more details.					
<b>General Qualities (Time, Cost and Effectiveness):</b>					
Shoulder widening costs would depend on whether new right-of-way is required and whether extensive roadside modification is needed. Since shoulder widening can be a relatively expensive treatment, one of the keys to creating a cost effective project with at least a medium B/C ratio is targeting higher-hazard roadways.					
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Fixed Object, Run-off Road, Sideswipe	CRF:	15 - 75 %	

## R16, Curve Shoulder widening (Outside Only)

For HSIP Cycle 11 Call-for-projects					
Funding Eligibility		Crash Types Addressed		CRF	Expected Life
90%		All		45%	20 years
Notes:	This CM only applies to crashes occurring within the limits (or influence area) of the new shoulder widening at curves. A minimum of 2-4 feet width must be added to the outside of horizontal curves and the new traversable shoulder must be a minimum of 4 feet wide.				
General information					
<b>Where to use:</b>					
Roadway curves noted as having frequent lane departure crashes due to inadequate or no shoulders, resulting in an unsuccessful attempt to reenter the roadway.					
<b>Why it works:</b>					
Adding shoulders (outside only) creates a recovery area in which a driver can regain control of a vehicle, as well as lateral clearance to roadside objects.					
<b>General Qualities (Time, Cost and Effectiveness):</b>					
To minimize the R/W needs and the cost, only outside shoulder at curves is to be widened. This CM can be implemented in a relatively short timeframe.					
<b>FHWA CMF Clearinghouse:</b>	NA				

R17, Improve horizontal alignment (flatten curves)

For HSIP Cycle 11 Call-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	All	50%	20 years
Notes:	This CM only applies to crashes occurring within the limits (or influence area) of the improved alignment. <b>This CM is not eligible unless</b> it is done as the last step of an "incremental approach", including: the agency documents that: 1) they have already pursued and installed lower cost and lower impact CMs (i.e. signing/stripping upgrades to MUTCD standards/recommendations, rumble strips, etc.), 2) they have already monitored the crash occurrences after these improvements were installed, and 3) the 'after' crash rate is still unacceptably high. This 'incremental approach' (or a special exception from the HSIP program manager) must be documented in the Narrative Questions in the application and a summary of the agency's 'before' and 'after' crash analysis must be attached to the application.		
General information			
<b>Where to use:</b>			
Roadways with horizontal curves that have experienced lane departure crashes as a result of a roadway segment having compound curves or a severe radius. This strategy should generally be considered only when less expensive strategies involving clearing of specific sight obstructions or modifying traffic control devices have been tried and have failed to ameliorate the crash patterns.			
<b>Why it works:</b>			
Increasing the radius of a horizontal curve can be very effective in improving the safety performance of the curve. Curve modification reduces the likelihood of a vehicle leaving its lane, crossing the roadway centerline, or leaving the roadway at a horizontal curve; and minimizes the adverse consequences of leaving the roadway. Horizontal alignment improvement projects are expected to include standard/improved superelevation elements, which should be considered part of this CM and not an additional CM.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
This strategy is a long-term, higher-cost alternative for improving the safety of a horizontal curve because it usually involves total reconstruction of the roadway. It may also require acquisition of additional right-of-way and an environmental review. This strategy, albeit costly, has shown that increasing the radius of curvature can significantly reduce total curve-related crashes by up to 80 percent. The expected effectiveness of this CM must be assessed for each individual location.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	All	CRF: 24 - 90%

### R18, Flatten crest vertical curve

For HSIP Cycle 11 Call-for-projects					
Funding Eligibility		Crash Types Addressed		CRF	Expected Life
90%		All		25%	20 years
Notes:	This CM only applies to crashes occurring within the limits (or influence area) of the improved alignment. This CM is not eligible unless it is done as the last step of an "incremental approach", including: the agency documents that: 1) they have already pursued and installed lower cost and lower impact CMs (i.e. signing/stripping upgrades to MUTCD standards/recommendations, rumble strips, etc.), 2) they have already monitored the crash occurrences after these improvements were installed, and 3) the 'after' crash rate is still unacceptably high. This 'incremental approach' (or a special exception from the HSIP program manager) must be documented in the Narrative Questions in the application and a summary of the agency's 'before' and 'after' crash analysis must be attached to the application.				
General information					
<b>Where to use:</b>					
The target for this strategy is usually unsignalized intersections with restricted sight distance due to vertical geometry and with patterns of crashes related to that lack of sight distance that cannot be ameliorated by less expensive methods. This strategy should generally be considered only when less expensive strategies involving clearing of specific sight obstructions or modifying traffic control devices have been tried and have failed to ameliorate the crash patterns.					
<b>Why it works:</b>					
Adequate sight distance for drivers at stopped approaches to intersections has long been recognized as among the most important factors contributing to overall intersection safety. Vertical alignment improvement projects are expected to include standard/improved superelevation elements, which should be considered part of this CM and not an additional CM.					
<b>General Qualities (Time, Cost and Effectiveness):</b>					
Projects involving changing the horizontal and/or vertical alignment to provide more sight distance are quite extensive and usually take several years to accomplish. If additional right-of-way is required or environmental impacts are expected, these projects will require a substantial period of time. Since this is usually an expensive treatment, one of the keys to creating a cost effective project with at least a medium B/C ratio is targeting higher-hazard locations.					
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	All	CRF:	20 - 51 %	

### R19, Improve curve superelevation

For HSIP Cycle 11 Call-for-projects					
Funding Eligibility		Crash Types Addressed		CRF	Expected Life
90%		All		45%	20 years
Notes:	This CM only applies to crashes occurring within the limits (or influence area) of the improved superelevation. This CM does not apply to sections of roadways where the horizontal or vertical alignments are changing via another CM.				
General information					
<b>Where to use:</b>					
Roadways noted as having frequent lane departure crashes and inadequate or no superelevation. Safety can be enhanced when the superelevation is improved or restored along curves where the actual superelevation is less than the optimal.					
<b>Why it works:</b>					
Superelevation works with friction between the tires and pavement to counteract the forces on the vehicle associated with cornering. Many curves may have inadequate superelevation because of vehicles traveling at higher speeds than were originally designed for, because of loss of effective superelevation after resurfacing, or because of changes in design policy after the curve was originally constructed.					
<b>General Qualities (Time, Cost and Effectiveness):</b>					
This strategy can be a higher-cost alternative for improving the safety of a curve because it involves reconstruction to some degree. Other projects may be able to be constructed by simple overlays and minimal reconstruction of roadway features. When simple overlay fixes are pursued, a systematic installation approach may be appropriate. The expected effectiveness of this CM must be assessed for each individual location.					
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Run-off Road, All	CRF:	40 - 50 %	

## R20, Convert from two-way to one-way traffic

For HSIP Cycle 11 Call-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	All	35%	20 years
Notes:	This CM only applies to crashes occurring within the limits of the new one-way sections.		
General information			
<b>Where to use:</b>			
One-way streets can offer improved signal timing and accommodate odd-spaced signals. One-way streets can simplify crossings for pedestrians, who must look for traffic in only one direction. While studies have shown that conversion of two-way streets to one-way generally reduces pedestrian crashes and the number of conflict points, one-way streets tend to have higher speeds which creates new problems. Care must be taken not to create conditions that cause driver confusion and erratic maneuvers.			
<b>Why it works:</b>			
Studies have shown a 10 to 50-percent reduction in total crashes after conversion of a two-way street to one-way operation. While studies have shown that conversion of two-way streets to one-way generally reduces pedestrian crashes, one-way streets tend to have higher speeds which creates new problems. At the same time, this strategy (1) increases capacity significantly and (2) can have safety-related drawbacks including pedestrian confusion and minor sideswipe crashes.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
The costs will vary depending on length of treatment and if the conversion requires modification to signals. Conversion costs can be high to build "crossovers" where the one-way streets convert back to two-way streets and to rebuild traffic signals. It's also likely that these types of modifications will require public involvement and could significantly add to the time it takes to complete the project. The expected effectiveness of this CM must be assessed for each individual location.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	All	CRF: 26 - 43 %

## R21, Improve pavement friction (High Friction Surface Treatments)

For HSIP Cycle 11 Call-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	All	55%	10 years
Notes:	This CM only applies to crashes occurring within the limits of the improved friction overlay. This CM is not intended to apply to standard chip-seal or open-graded <b>maintenance</b> projects for long segments of corridors or structure repaving projects intended to fix failed pavement.		
General information			
<b>Where to use:</b>			
Nationally, this countermeasure is referred to as "High Friction Surface Treatments" or HFST. Areas as noted having crashes on wet pavements or under dry conditions when the pavement friction available is significantly less than actual roadway speeds; including but not limited to curves, loop ramps, intersections, and areas with short stopping or weaving distances. This treatment is intended to target locations where skidding is determined to be a problem, in wet or dry conditions and the target vehicle is one that runs (skids) off the road or is unable to stop due to insufficient skid resistance.			
<b>Why it works:</b>			
Improving the skid resistance at locations with high frequencies of wet-road crashes and/or failure to stop crashes can result in a reduction of 50 percent for wet-road crashes and 20 percent for total crashes. Applying HFST can double friction numbers, e.g. low 40s to high 80s. This CM represents a special focus area for both FHWA and Caltrans, which means there are extra resources available for agencies interested in more details on High Friction Surface Treatment projects.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
This strategy can be relatively inexpensive and implemented in a short timeframe. The installation would be done by either agency personnel or contractors and can be done by hand or machine. In general, This CM can be very effective and can be considered on a systematic approach.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Wet, Rear-End, All	CRF: 17 - 68 %

R22, Install/Upgrade signs with new fluorescent sheeting (regulatory or warning)

For HSIP Cycle 11 Call-for-projects				
Funding Eligibility	Crash Types Addressed		CRF	Expected Life
90%	All		15%	10 years
Notes:	This CM only applies to crashes occurring within the influence area of the new/upgraded signs. This CM is not intended for maintenance upgrades of street-name, parking, guide, or any other signs without a primary focus on roadway safety. <b>This CM is not eligible unless</b> it is done as part of a larger sign audit project, including the study of: 1) the existing signs' locations, sizes and information per MUTCD standards, 2) missing signs per MUTCD standards, and 3) sign retroreflectivity. The overall sign audit scope (or a special exception from the HSIP program manager) must be documented in the Narrative Questions in the application. Based on the scope of the project/audit, it may be appropriate to combine other CMs in the B/C calculation.			
General information				
<b>Where to use:</b>				
The target for this strategy should be on roadway segments with patterns of head on, nighttime, non-intersection, run-off road, and sideswipe crashes related to lack of driver awareness of the presence of a specific roadway feature or regulatory requirement. Ideally this type of safety CM would be combined with other sign evaluations and upgrades (install chevrons, warning signs, delineators, markers, beacons, and relocation of existing signs per MUTCD standards.)				
<b>Why it works:</b>				
This strategy primarily addresses crashes caused by lack of driver awareness (or compliance) roadway signing. It is intended to get the drivers attention and give them a visual warning by using fluorescent yellow sheeting (or other retroreflective material).				
<b>General Qualities (Time, Cost and Effectiveness):</b>				
Signing improvements do not require a long development process and can typically be implemented quickly. Costs for implementing this strategy are nominal and depend on the number of signs. When considered at a single location, these low cost improvements are usually funded through local funding by local maintenance crews. However, This CM can be effectively and efficiently implemented using a systematic approach with numerous locations, resulting in moderate cost projects that are more appropriate to seek state or federal funding. When considering any type of federally funded sign upgrade project, California local agencies are encouraged to consider "Roadway Safety Signing Audit (RSSA) and Upgrade Projects". Including RSSAs in the development phase of sign projects are expected to identify non-standard (per MUTCD) sign features and missing signs that may otherwise go unnoticed. More information on RSSA is available on the Local Assistance HSIP webpage.				
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Head on, Run-off road, Sideswipe, Night	CRF:	18 - 35%

## R23, Install chevron signs on horizontal curves

For HSIP Cycle 11 Call-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	All	40%	10 years
Notes:	This CM only applies to crashes occurring within the influence area of the new signs. (i.e. only through the curve).		
General information			
<b>Where to use:</b>			
Roadways that have an unacceptable level of crashes on relatively sharp curves during periods of light and darkness. Ideally this type of safety CM would be combined with other sign evaluations and upgrades (install warning signs, delineators, markers, beacons, and relocation of existing signs per MUTCD standards.)			
<b>Why it works:</b>			
Post-mounted chevrons are intended to warn drivers of an approaching curve and provide tracking information and guidance to the drivers. While they are intended to act as a warning, it should also be remembered that the posts, placed along the roadside, represent a possible object with which an errant vehicle can crash into. Design of posts to minimize damage and injury is an important part of the considerations to be made when selecting these treatments.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
Signing improvements do not require a long development process and can typically be implemented quickly. Costs for implementing this strategy are nominal and depend on the number of signs. When considered at a single location, these low cost improvements are usually funded through local funding by local maintenance crews. However, This CM can be effectively and efficiently implemented using a systematic approach with numerous locations, resulting in moderate cost projects that are more appropriate to seek state or federal funding. When considering any type of federally funded sign upgrade project, California local agencies are encouraged to consider "Roadway Safety Signing Audit (RSSA) and Upgrade Projects". Including RSSAs in the development phase of sign projects are expected to identify non-standard (per MUTCD) sign features and missing signs that may otherwise go unnoticed. More information on RSSA is available on the Local Assistance HSIP webpage.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Run-off Road, All	CRF: 6 - 64 %

## R24, Install curve advance warning signs

For HSIP Cycle 11 Call-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	All	25%	10 years
Notes:	This CM only applies to crashes occurring within the influence area of the new signs. (i.e. only through the curve)		
General information			
<b>Where to use:</b>			
Roadways that have an unacceptable level of crashes on relatively sharp curves during periods of light and darkness. This countermeasure may also include horizontal alignment and/or advisory speed warning signs. Ideally this type of safety CM would be combined with other sign evaluations and upgrades (install warning signs, chevrons, delineators, markers, beacons, and relocation of existing signs per MUTCD standards.)			
<b>Why it works:</b>			
This strategy primarily addresses problem curves, and serves as an advance warning of an unexpected or sharp curve. It provides advance information and gives drivers a visual warning that their added attention is needed.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
Signing improvements do not require a long development process and can typically be implemented quickly. Costs for implementing this strategy are nominal and depend on the number of signs. When considered at a single location, these low cost improvements are usually funded through local funding by local maintenance crews. However, This CM can be effectively and efficiently implemented using a systematic approach with numerous locations, resulting in moderate cost projects that are more appropriate to seek state or federal funding. When considering any type of federally funded sign upgrade project, California local agencies are encouraged to consider "Roadway Safety Signing Audit (RSSA) and Upgrade Projects". Including RSSAs in the development phase of sign projects are expected to identify non-standard (per MUTCD) sign features and missing signs that may otherwise go unnoticed. More information on RSSA is available on the Local Assistance HSIP webpage.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Run-off Road, All	CRF: 20 - 30 %

## R25, Install curve advance warning signs (flashing beacon)

For HSIP Cycle 11 Call-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	All	30%	10 years
Notes:	This CM only applies to crashes occurring within the influence area of the new signs. (i.e. only through the curve)		
General information			
<b>Where to use:</b>			
Roadways that have an unacceptable level of crashes on relatively sharp curves. Flashing beacons in conjunction with warning signs should only be used on horizontal curves that have an established severe crash history to help maintain their effectiveness.			
<b>Why it works:</b>			
This strategy primarily addresses problem curves, and serves as an enhanced advance warning of an unexpected or sharp curve. It provides advance information and gives drivers a visual warning that their added attention is needed. Flashing beacons are an added indication that a curve may be particularly challenging.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
Use of flashing beacons requires minimal development process, allowing flashing beacons to be installed within a short time period. Before choosing this CM, the agency needs to confirm the ability to provide power to the site (solar may be an option). In general, This CM can be very effective and can be considered on a systematic approach.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	All	CRF: 30 %

## R26, Install dynamic/variable speed warning signs

For HSIP Cycle 11 Call-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	All	30%	10 years
Notes:	This CM only applies to crashes occurring within the influence area of the new signs. (i.e. through the curve) <b>{This CM does not apply to dynamic regulatory speed warning signs.</b> There are currently no nationally accepted CRFs for dynamic regulatory signs (also known as Radar Speed Feedback Signs). CRFs are being developed and Caltrans hopes to include these CMs and CRFs in future calls for projects.}		
General information			
<b>Where to use:</b>			
Curvilinear roadways that have an unacceptable level of crashes due to excessive speeds on relatively sharp curves.			
<b>Why it works:</b>			
This strategy primarily addresses crashes caused by motorists traveling too fast around sharp curves. It is intended to get the drivers attention and give them a visual warning that they may be traveling over the recommended speed for the approaching curve. Care should be taken to limit the placement of these signs to help maintain their effectiveness.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
Use of dynamic speed warning signs requires minimal development process, allowing them to be installed within a short time period. Before choosing this CM, the agency needs to confirm the ability to provide power to the site (solar may be an option). In general, This CM can be very effective and can be considered on a systematic approach.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	All	CRF: 0 - 41 %

R27, Install delineators, reflectors and/or object markers

For HSIP Cycle 11 Call-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	All	15%	10 years
Notes:	This CM only applies to crashes occurring within the limits / influence area of the new features. <b><u>{This is not a striping-related CM}</u></b>		
General information			
<b>Where to use:</b>			
Roadways that have an unacceptable level of crashes on curves (relatively flat to sharp) during periods of light and darkness. Any road with a history of fixed object crashes is a candidate for this treatment, as are roadways with similar fixed objects along the roadside that have yet to experience crashes. If a fixed object cannot be relocated or made break-away, placing an object marker can provide additional information to motorists. Ideally this type of safety CM would be combined with other sign evaluations and upgrades (install warning signs, chevrons, beacons, and relocation of existing signs per MUTCD standards.)			
<b>Why it works:</b>			
Delineators, reflectors and/or object markers are intended to warn drivers of an approaching curve or fixed object that cannot easily be removed. They are intended to provide tracking information and guidance to the drivers. They are generally less costly than Chevron Signs as they don't require posts to place along the roadside, avoiding an additional object with which an errant vehicle can crash into.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
These improvements do not require a long development process and can typically be implemented quickly. Costs for implementing this strategy are nominal and depend on the number of locations. When considered at a single location, these low cost improvements are usually funded through local funding by local maintenance crews. However, This CM can be effectively and efficiently implemented using a systematic approach with numerous locations, resulting in low to moderate cost projects that are more appropriate to seek state or federal funding. When considering any type of federally funded sign upgrade project, California local agencies are encouraged to consider "Roadway Safety Signing Audit (RSSA) and Upgrade Projects". Including RSSAs in the development phase of sign projects are expected to identify non-standard (per MUTCD) sign features and missing signs that may otherwise go unnoticed. More information on RSSA is available on the Local Assistance HSIP webpage.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	All	CRF: 0 - 30 %

## R28, Install edge-lines and centerlines

For HSIP Cycle 11 Call-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	All	25%	10 years
<b>Notes:</b>	This CM only applies to crashes occurring within the limits of the new centerlines and/or edge-lines. This CM is not intended to be used for general maintenance activities (i.e. the replacement of existing striping and RPMs in-kind) and must include upgraded safety features over the existing striping. For two lane roadways allowing passing, a striping audit must be done to ensure the passing limits meeting the MUTCD standards. Both the centerline and edge-lines are expected to be upgraded, unless prior approval is granted by Caltrans staff in writing and attached to application.		
General information			
<b>Where to use:</b>			
Any road with a history of run-off-road right, head-on, opposite-direction-sideswipe, or run-off-road-left crashes is a candidate for this treatment - install where the existing lane delineation is not sufficient to assist the motorist in understanding the existing limits of the roadway. Depending on the width of the roadway, various combinations of edge line and/or center line pavement markings may be the most appropriate. Incorporating raised/reflective pavement markers (RPMs) into centerlines (and edge-lines) should be considered as it has been shown to improve safety.			
<b>Why it works:</b>			
Installing edge-lines and centerlines where none exists or making significant upgrades to existing lines (paint to thermoplastic, adding audible disks/bumps in the thermoplastic stripes, or adding RPMs) are intended/designed to help drivers who might leave the roadway because of their inability to see the edge of the roadway along the horizontal edge of the pavement or cross-over the centerline of the roadway into oncoming traffic. New pavement marking products tend to be more durable, are all-weather, more visible, and have a higher retroreflectivity than traditional pavement markings.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
These improvements do not require a long development process and can typically be implemented quickly. Costs for implementing this strategy are nominal and depend on the number and length of locations. This CM can be effectively and efficiently implemented using a systematic approach with numerous and long locations, resulting in low to moderate cost projects that are more appropriate to seek state or federal funding. When considering any type of federally funded striping upgrade project, California local agencies are encouraged to consider "Roadway Safety Striping Audit and Upgrade Projects". Including wide-scale striping audits in the development phase of striping projects are expected to identify non-standard (per MUTCD) striping/markings features, no-passing zone limits needing adjustment, and missing striping/markings that may otherwise go unnoticed. More information on this concepts is available on the Local Assistance HSIP webpage under an RSSA example document. Note: When federal safety funding is used for these installations in high-wear-locations, the local agency is expected to maintain the improvement for a minimum of 10 years.			
<b>FHWA CMF Clearinghouse:</b>	<b>Crash Types Addressed:</b>	Head-on, Run-off Road, All	<b>CRF:</b> 0 - 44 %

## R29, Install no-passing line

For HSIP Cycle 11 Call-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	All	45%	10 years
Notes:	This CM only applies to crashes occurring within the limits of the new or extended no-passing zones.		
General information			
<b>Where to use:</b>			
Roadways that have a high percentage of head-on crashes suggesting that many head-on crashes may relate to failed passing maneuvers. No-passing lines should be installed where drivers "passing sight distance" is not available due to horizontal or vertical obstructions. General restriping projects can be good opportunities to reevaluate and incorporate new no-passing zones limits. The incorporation 'No Passing Zone' pennants should also be considered when reevaluating the limits of no-passing zones. Installing no-passing limits in areas that are not warranted may reduce the overall safety of the corridor as drivers may become frustrated and attempt passing maneuvers at other locations without the necessary sight distance.			
<b>Why it works:</b>			
When the centerline markings do not differentiate between passing and no-passing areas, drivers may have difficulty determining where passing maneuvers can be completed safely. Providing clear and engineered passing and no-passing areas can encourage drivers to wait patiently for safe passing areas and avoid aggressively looking for passing opportunities.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
These improvements do not require a long development process and can typically be implemented quickly. Costs for implementing this strategy are nominal and depend on the number and length of locations. When considered at a single location, these low cost improvements are usually funded through local funding by local maintenance crews. However, This CM can be effectively and efficiently implemented using a systematic approach with numerous and long locations, resulting in low to moderate cost projects that are more appropriate to seek state or federal funding.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Head-on, Side-swipe	CRF: 40 - 53%

## R30, Install centerline rumble strips/stripes

For HSIP Cycle 11 Call-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	All	20%	10 years
Notes:	This CM only applies to crashes occurring within the limits of the new rumble strips/stripes.		
General information			
<b>Where to use:</b>			
Center Line rumble strips/stripes can be used on virtually any roadway – especially those with a history of head-on crashes. It is recommended that rumble strips/stripes be applied systematically along an entire route instead of only at spot locations. For all rumble strips/stripes, pavement condition should be sufficient to accept milled rumble strips. Care should be taken when considering installing rumble strips in locations with residential land uses or in areas with high bicycle volumes.			
<b>Why it works:</b>			
Rumble strips provide an auditory indication and tactile rumble when driven on, alerting drivers that they are drifting out of their travel lane, giving them time to recover before they depart the roadway or cross the center line. Additionally, rumble strips (pavement marking in the rumble itself) provide an enhanced marking, especially in wet dark conditions.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
These improvements do not require a long development process and can typically be implemented quickly. Costs for implementing this strategy are nominal and depend on the number and length of locations. This CM can be effectively and efficiently implemented using a systematic approach with numerous and long locations, resulting in moderate cost projects that are more appropriate to seek state or federal funding.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Head-on, Side-swipe, All	CRF: 15 - 68%

### R31, Install edgeline rumble strips/stripes

For HSIP Cycle 11 Call-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	All	15%	10 years
Notes:	This CM only applies to crashes occurring within the limits of the new rumble strips/stripes.		
General information			
<b>Where to use:</b>			
Shoulder and edge line milled rumble strips/stripes should be used on roads with a history of roadway departure crashes. It is recommended that rumble strips/stripes be applied systematically along an entire route instead of only at spot locations. For all rumble strips/stripes, pavement condition should be sufficient to accept milled rumble strips. Special requirements may apply and care should be taken when considering installing rumble strips in locations with residential land uses or in areas with high bicycle volumes.			
<b>Why it works:</b>			
Rumble strips provide an auditory indication and tactile rumble when driven on, alerting drivers that they are drifting out of their travel lane, giving them time to recover before they depart the roadway or cross the center line. Additionally, rumble stripes (pavement marking in the rumble itself) provide an enhanced marking, especially in wet dark conditions.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
These improvements do not require a long development process and can typically be implemented quickly. Costs for implementing this strategy are nominal and depend on the number and length of locations. This CM can be effectively and efficiently implemented using a systematic approach with numerous and long locations, resulting in moderate cost projects that are more appropriate to seek state or federal funding.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Run-off Road	CRF: 10 - 41%

### R32PB, Install bike lanes

For HSIP Cycle 11 Call-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	Pedestrian and Bicycle	35%	20 years
Notes:	This CM only applies to "Ped & Bike" crashes occurring within the limits of the Class II (not Class III) bike lanes. When an off-street bike-path is proposed that is not adjacent to the roadway, the applicant must document the engineering judgment used to determine which "Ped & Bike" crashes to apply.		
General information			
<b>Where to use:</b>			
Roadway segments noted as having crashes between bicycles and vehicles or crashes that may be preventable with a buffer/shoulder. Most studies suggest that bicycle lanes may provide protection against bicycle/motor vehicle collisions. Striped bike lanes can be incorporated into a roadway when is desirable to delineate which available road space is for exclusive or preferential use by bicyclists.			
<b>Why it works:</b>			
Most studies present evidence that bicycle lanes provide protection against bicycle/motor vehicle collisions. Bicycle lanes provide marked areas for bicyclist to travel along the roadway and provide for more predictable movements for both bicyclist and motorist. Evidence also shows that riding with the flow of vehicular traffic reduces bicyclists' chances of collision with a motor vehicle. Locations with bicycle lanes have lower rates of wrong-way riding. In combination with this CM, better guidance signs and markings for non-motorized and motorized roadway users should be considered, including: sign and markings directing cyclists on appropriate/legal travel paths and signs and markings warning motorists of non-motorized uses of the roadway that should be expected.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
Adding striped bicycle lanes can range from the simply restriping the roadway and minor signing to projects that require roadway widening, right-of-way, and environmental impacts. It is most cost efficient to create bike lanes during street reconstruction, street resurfacing, or at the time of original construction. The expected effectiveness of this CM must be assessed for each individual location. For simple installation scenarios, This CM can be very effective and can be considered on a systematic approach.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Pedestrian, Bicycle	CRF: 0 - 53 %

### R33PB, Install Separated Bike Lanes

For HSIP Cycle 11 Call-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	Pedestrian and Bicycle	45%	20 years
Notes:	This CM only applies to "Ped & Bike" crashes occurring within the limits of the separated bike lanes. When an off-street bike-path is proposed that is not adjacent to the roadway, the applicant must document the engineering judgment used to determine which "Ped & Bike" crashes to apply.		
General information			
<b>Where to use:</b>			
Separated bikeways are most appropriate on streets with high volumes of bike traffic and/or high bike-vehicle collisions, presumably in an urban or suburban area. Separation types range from simple, painted buffers and flexible delineators, to more substantial separation measures including raised curbs, grade separation, bollards, planters, and parking lanes. These options range in feasibility due to roadway characteristics, available space, and cost. In some cases, it may be possible to provide additional space in areas where pedestrian and bicyclists may interact, such as the parking buffer, or loading zones, or extra bike lane width for cyclists to pass one another.			
<b>Why it works:</b>			
Separated bike lanes provide increased safety and comfort for bicyclists beyond conventional bicycle lanes. By separating bicyclists from motor traffic, "protected" or physically separated bike lanes can offer a higher level of comfort and are attractive to a wider spectrum of the public. Intersections and approaches must be carefully designed to promote safety and facilitate left-turns for bicyclists from the primary corridor to cross street. In combination with this CM, better guidance signs and markings for non-motorized and motorized roadway users should be considered, including: sign and markings directing cyclists on appropriate/legal travel paths and signs and markings warning motorists of non-motorized uses of the roadway that should be expected.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
The cost of Installing separated bike lanes can be low to medium or high, depending on whether roadway widening, right-of-way and environmental impacts are involved. It is most cost efficient to create bike lanes during street reconstruction, street resurfacing, or at the time of original construction. The expected effectiveness of this CM must be assessed for each individual location.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Pedestrian, Bicycle	CRF: 3.7 - 100 %

### R34PB, Install sidewalk/pathway (to avoid walking along roadway)

For HSIP Cycle 11 Call-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	Pedestrian and Bicycle	80%	20 years
Notes:	This CM only applies to "Ped & Bike" crashes occurring within the limits of the new walkway. This CM is not intended to be used where an existing sidewalk is being replaced with a wider one, unless prior Caltrans approval is included in the application. When an off-street multi-use path is proposed that is not adjacent to the roadway, the applicant must document the engineering judgment used to determine which "Ped & Bike" crashes to apply.		
General information			
<b>Where to use:</b>			
Areas noted as not having adequate or no sidewalks and a history of walking along roadway pedestrian crashes. In rural areas asphalt curbs and/or separated walkways may be appropriate.			
<b>Why it works:</b>			
Sidewalks and walkways provide people with space to travel within the public right-of-way that is separated from roadway vehicles. The presence of sidewalks on both sides of the street has been found to be related to significant reductions in the "walking along roadway" pedestrian crash risk compared to locations where no sidewalks or walkways exist. Reductions of 50 to 90 percent of these types of pedestrian crashes. In combination with this CM, better guidance signs and markings for non-motorized and motorized roadway users should be considered, including: sign and markings directing pedestrians and cyclists on appropriate/legal travel paths and signs and markings warning motorists of non-motorized uses of the roadway that should be expected.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			

Costs for sidewalks will vary, depending upon factors such as width, materials, and existing of curb, gutter and drainage. Asphalt curbs and walkways are less expensive, but require more maintenance. The expected effectiveness of this CM must be assessed for each individual location. These projects can be very effective in areas of high-pedestrian volumes with a past history of crashes involving pedestrians.

<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Pedestrian, Bicycle	CRF:	65 - 89 %
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**R35PB, Install/upgrade pedestrian crossing (with enhanced safety features)**

**For HSIP Cycle 11 Call-for-projects**

Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	Pedestrian and Bicycle	35%	20 years
<b>Notes:</b>	This CM only applies to "Ped & Bike" crashes occurring in the influence area (expected to be a maximum of within 250') of the new crossing which includes new enhanced safety features. Note: This CM is not intended to be combined with the "Install raised pedestrian crossing" when calculating the improvement's B/C ratio. This CM is not intended to be used for high-cost aesthetic enhancements (i.e. stamped concrete or stamped asphalt).		

**General information**

**Where to use:**

Roadway segments with no controlled crossing for a significant distance in high-use midblock crossing areas and/or multilane roads locations. Based on the Zegeer study (Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations) at many locations, a marked crosswalk alone may not be sufficient to adequately protect non-motorized users. In these cases, flashing beacons, curb extensions, medians and pedestrian crossing islands and/or other safety features should be added to complement the standard crossing elements. For multi-lane roadways, advance "yield" markings can be effective in reducing the 'multiple-threat' danger to pedestrians.

**Why it works:**

Adding pedestrian crossings has the opportunity to greatly enhance pedestrian safety at locations noted as being problematic. The enhanced safety elements, which may include curb extensions, medians and pedestrian crossing islands, beacons, and lighting, combined with pavement markings delineating a portion of the roadway that is designated for pedestrian crossing. Care must be taken to warn drivers of the potential for pedestrians crossing the roadway and enhanced improvements added to the crossing increase the likelihood of pedestrians crossing in a safe manner. In combination with this CM, better guidance signs and markings for non-motorized and motorized roadway users should be considered, including: sign and markings directing pedestrians and cyclists on appropriate/legal travel paths and signs. When agencies opt to install aesthetic enhancement to crossing like stamped concrete/asphalt, the project design and construction costs can significantly increase. For HSIP applications, these costs must be accounted for in the B/C calculation, but these costs (over standard crosswalk markings) must be tracked separately and are not federally reimbursable and will increase the agency's local-funding share for the project costs.

**General Qualities (Time, Cost and Effectiveness):**

Costs associated with this strategy will vary widely, depending on the extent of the curb extensions, raised medians, flashing beacons, and other pedestrian safety elements that are needed with the crossing. When considered at a single location, these improvements can sometimes be low cost and funded through local funding by local crews. This CM can often be effectively and efficiently implemented using a systematic approach with numerous locations, resulting in moderate to high cost projects that are appropriate to seek state or federal funding.

<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Pedestrian, Bicycle	CRF:	8 - 56%
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### R36PB, Install raised pedestrian crossing

For HSIP Cycle 11 Call-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	Pedestrian and Bicycle	35%	20 years
Notes:	This CM only applies to "Ped & Bike" crashes occurring in the area with the new raised crossing. Note: This CM is not intended to be combined with the "Install pedestrian crossing (with enhanced safety features)" when calculating the improvement's B/C ratio.		
General information			
<b>Where to use:</b>			
On lower-speed roadways, where pedestrians are known to be crossing roadways that involve significant vehicular traffic. Based on the Zegeer study (Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations) at many locations, a marked crosswalk alone, may not be sufficient to adequately protect non-motorized users. In these cases, raised crossings can be added to complement the standard crossing elements. Special requirements may apply and extra care should be taken when considering installing raised crossings to ensure unintended safety issues are not created, such as: emergency vehicle access or truck route issues.			
<b>Why it works:</b>			
Adding a raised pedestrian crossing has the opportunity to enhance pedestrian safety at locations noted as being especially problematic. The raised crossing encourages motorists to reduce their speed and provides improved delineation for the portion of the roadway that is designated for pedestrian crossing. In combination with this CM, better guidance signs and markings for non-motorized and motorized roadway users should be considered, including: sign and markings directing pedestrians and cyclists on appropriate/legal travel paths.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
Costs associated with this strategy will vary widely, depending upon the elements of the raised crossing and the need for new curb ramps and sidewalk modifications. This CM may be effectively and efficiently implemented using a systematic approach with more than one location and can have medium to high B/C ratios based on past non-motorized crash history.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Pedestrian, Bicycle	CRF: 30 - 46%

### R37PB, Install Rectangular Rapid Flashing Beacon (RRFB)

For HSIP Cycle 11 Call-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	Pedestrian and Bicycle	35%	20 years
Notes:	This CM only applies to "Ped & Bike" crashes occurring in the influence area (expected to be a maximum of within 250') of the crossing which includes the RRFB.		
General information			
<b>Where to use:</b>			
Rectangular Rapid Flashing Beacon (RRFB) includes pedestrian-activated flashing lights and additional signage that enhance the visibility of marked crosswalks and alert motorists to pedestrian crossings. It uses an irregular flash pattern that is similar to emergency flashers on police vehicles. RRFBs are installed at unsignalized intersections and mid-block pedestrian crossings.			
<b>Why it works:</b>			
RRFBs can enhance safety by increasing driver awareness of potential pedestrian conflicts and reducing crashes between vehicles and pedestrians at unsignalized intersections and mid-block pedestrian crossings. The addition of RRFB may also increase the safety effectiveness of other treatments, such as crossing warning signs and markings.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
RRFBs are a lower cost alternative to traffic signals and hybrid signals. This CM can often be effectively and efficiently implemented using a systematic approach with numerous locations.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Pedestrian, Bicycle	CRF: 7 - 47.4%

## R38, Install Animal Fencing

For HSIP Cycle 11 Call-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
90%	Animal	80%	20 years
Notes:	This CM only applies to "animal" crashes occurring within the limits of the new fencing.		
General information			
<b>Where to use:</b>			
At locations with high percent of vehicular/animal crashes (reactive) or where there is a known high percent of animals crossing due to migratory patterns (proactive).			
<b>Why it works:</b>			
Animal fencing helps to channelize the identified animals to a natural or man-made crossing, eliminating the conflict between vehicles and animals on the same place. Animal fencing is typically installed at a bridge location with its "run of need" dependent on the surrounding terrain.			
<b>General Qualities (Time, Cost and Effectiveness):</b>			
Time to install fencing can be moderate to lengthy depending on the environmental commitments and agreed upon solution to mitigating project impacts. Costs will be fairly low and depend on the "run of need" length. There will be minimal reoccurring maintenance costs on keeping the fence intact. The expected effectiveness of this CM must be assessed for each individual location.			
<b>FHWA CMF Clearinghouse:</b>	Crash Types Addressed:	Animal	CRF: 70 - 90 %

## APPENDIX F: HSIP ANALYZERS