



Mendocino County

Local Roadway Safety Plan

06/15/2022

Final Report

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Executive Summary

The Unincorporated Mendocino County's 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. The LRSP aims to reduce fatal and severe injury (F+SI) collisions through a prioritized list of improvements that can enhance safety on local roadways.

The LRSP takes a proactive approach to addressing safety needs. It is viewed as a guidance document that can be a source of information and ideas. It can also be a living document, one that is routinely reviewed and updated by County staff and their safety partners to reflect evolving collision trends and community needs and priorities. With the LRSP as a guide, the County will be able to apply for grant funds, such as the federal Highway Safety Improvement Program (HSIP).

Chapter 1 – Introduction

The Introduction presents the plan, describes how this report is organized, summarizes the vision and goals, the study area for the LRSP, details how the report is organized and introduces the safety partners.

Chapter 2 – Existing Planning Efforts

This chapter summarizes existing county and regional planning documents and projects that are relevant to the LRSP. It ensures that the recommendations of the LRSP are in line with existing goals, objectives, policies, or projects. This chapter summarized the following documents: County of Mendocino General Plan 2009, Mendocino County Regional Active Transportation Plan (2017), Mendocino County Safe Routes to School Plan (2014), Mendocino County Rail-with-Trail Corridor Plan (2012), Mendocino Council of Governments Transportation Planning Work Program FY 2020/2021, Mendocino Council of Governments 2020 Regional Transportation Improvement Program (2019), 2017 Mendocino County Regional Transportation Plan (2018), Mendocino County Pedestrian Facility Needs Inventory and Engineered Feasibility Study (2019), Mendocino Council of Governments Active Transportation Program Safe Routes to School Non-Infrastructure Grant Report (2018) and County of Mendocino FY 2020-21 Adopted Budget.

Chapter 3 – Collision Data Collection and Analysis

Collision data was obtained and analyzed for a five-year period from 2015 to 2019 from the California Highway Patrol's Statewide Integrated Traffic Records System (SWITRS) and the University of California at Berkeley SafeTREC's Transportation Injury Mapping Service (TIMS).

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There were a total of 1,911 collisions reported jurisdiction-wide from 2015 to 2019. Out of these 1,345 collisions (70 percent) were property damage only (PDO) collisions, 179 collisions (9 percent) led to complaint of pain injury and 243 collisions (13 percent) led to a visible injury. There were 144 F+SI collisions, 21 collisions (7 percent) led to a severe injury and 21 collisions (1 percent) led to a fatality.

For collisions of all severity, including PDO collisions, 53 percent of collisions were hit object collisions, and most of these occurred along roadway segments. This calls for evaluating roadway conditions at the high injury locations and throughout Unincorporated Mendocino County where hit object collisions have been observed. Improvements at these locations may include installing shoulder rumble strips, widening shoulders or installing guard rails. With roadway departure crashes accounting for more than half of the fatal roadway crashes annually in the United States, rumble strips and stripes are designed to address these crashes caused by distracted, drowsy, or otherwise inattentive drivers who drift from their lane. They are most effective when deployed in a systemic application since driver error may occur on all roads (FHWA, 2017).¹ In addition to shoulder rumble strips, adding and widening shoulders can give drivers more recovery area to regain control in the event of a roadway departure. Safety edges, high friction edge treatments and guard rails can also reduce the severity of lane departure crashes.

For F+SI collisions, 26 percent of collisions were improper turning collisions. Intersection improvements that can reduce these collision types may include installing a dedicated left turn lane where applicable, improving sight distance at intersections and installing median splitter islands on the minor road approaches. Median splitter Islands are used to separate opposing lanes of traffic and accommodate a left-side stop sign. This serves to increase awareness of the intersection, guide traffic into the intersection, encourage a reduction in turning vehicle speeds, improve the visibility of the stop sign on the intersection approach, and provide separation between entering and exiting vehicles².

For F+SI collisions, 19 percent of collisions were unsafe speed collisions; most of these occurred along roadway segments. Dynamic variable speed warning signs may be installed along roadways with large amounts of unsafe speed collisions. 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.

¹ FHWA. (2017). Proven Safety Countermeasures 2017. FHWA-SA-17-059. https://safety.fhwa.dot.gov/provencountermeasures/long_rumble_strip/

² ITE. Unsignalized intersection Improvement Guide. Retrieved from: <https://toolkits.ite.org/uiig/treatments/50%20Splitter%20Island.pdf>

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Chapter 4 - Emphasis Areas

Emphasis areas are a focus of the LRSP that are identified through the various collision types and factors resulting in F+SI collisions within the Unincorporated Mendocino County. The eight emphasis areas for Unincorporated Mendocino County are:

- Roadway Safety
- Fixed Object Collisions
- Improper Turning Collisions
- Nighttime Collisions
- DUI Collisions
- Unsafe Speed Collisions
- Motorcycle Collisions
- Younger Adult (Party at Fault) Collisions

Chapter 5 – Countermeasure Identification

Engineering countermeasures were selected for each of the high-risk locations and for the emphasis areas. These were based off of approved countermeasures from the Caltrans Local Roadway Safety Manual (LRSM) used in HSIP grant calls for projects. The intention is to give the County potential countermeasures for each location that can be implemented either in future HSIP calls for projects, or using other funding sources, such as the County's Capital Improvement Program. Non-engineering countermeasures were also selected using the 4 E's strategies, and are included with the emphasis areas.

Chapter 6 – Safety Projects

A set of seven safety projects were created for high-risk intersections and roadway segments, using HSIP approved countermeasures. These safety projects are:

- Project 1: Systemic Improvements at Unsignalized Intersections
- Project 2: Systemic Improvements at Unsignalized Intersections
- Project 3: Systemic Roadway Segment Improvements
- Project 4: Systemic Improvements at Unsignalized Intersections
- Project 5: Systemic Pedestrian Safety Improvements
- Project 6: Roadway Safety Improvements
- Project 7: Roadway Safety Improvements

Chapter 7 – Evaluation and Implementation

The LRSP is a guidance document that is recommended to be updated every two to five years in coordination with the safety partners. The LRSP document provides engineering, education, enforcement, and emergency medical service related countermeasures that can be implemented throughout the County to reduce F+SI 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 F+SI collisions throughout the County. If the number of F+SI collisions does not decrease over time, then the emphasis areas and countermeasures should be re-evaluated.

1. Introduction

What is a LRSP?

The LRSP is a localized data-driven traffic safety plan that provides opportunities to address unique highway safety needs and reduce the number of F+SI collisions. The LRSP creates a framework to systematically identify and analyze traffic safety-related issues, and recommend safety projects and countermeasures. The LRSP facilitates the development of local agency partnerships and collaboration, resulting in the development of a prioritized list of improvements that can qualify for HSIP funding.

The LRSP is a proactive approach to addressing safety needs and is viewed as a living document that can be constantly reviewed and revised to reflect evolving trends, and community needs and priorities.

Vision and Goals of the LRSP

- Goal #1: Systematically identify and analyze roadway safety problems and recommend improvements
- Goal #2: Improve the safety of all road users by using proven effective countermeasures
- Goal #3: Ensure coordination and response of key stakeholders to implement roadway safety improvements within Unincorporated Mendocino County
- Goal #4: Serve as a resource for staff who continually seek funding for safety improvements
- Goal #5: Recommend how safety improvements can be made in a manner that is fair and equitable for all Unincorporated Mendocino County residents

Study Area

Mendocino County is a county located on the North Coast of the state of California, covering a total area of about 3,878 square miles. The population of the unincorporated regions of the County is 58,190 (ACS 2019 1-year estimate). **Figure 1** shows the study area.

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Figure 1. Unincorporated Mendocino County



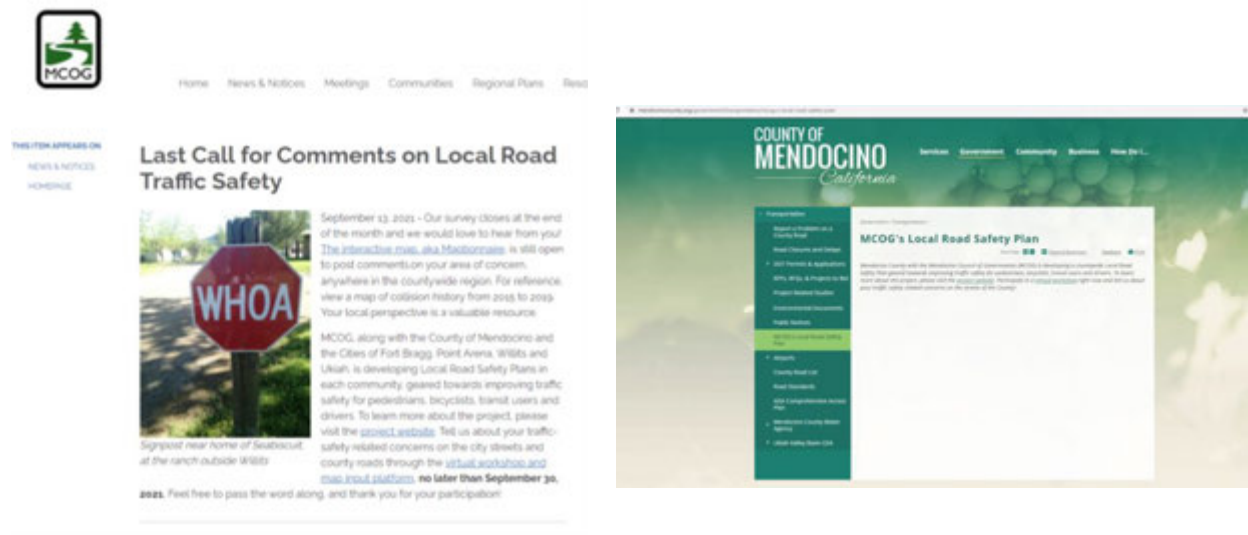
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Safety Partners

Safety partners are vital to the development and implementation of an LRSP. For the unincorporated Mendocino County, these include representatives from Office of Emergency Services, Sheriff's Office, Planning and Building, CHP, CalFire, School Districts, Caltrans Planning - District 1, Caltrans Local Assistance - District 1, Mendocino Transit Authority, and Blue Zones Project. Two stakeholder meetings among these departments/agencies were conducted to review project goals and findings, and to solicit feedback from the group during the project timeline.

This stakeholder outreach was supplemented by a project website (mendocinosaferoads.com), with an interactive map input platform. Project related information was also published on the County's website. As part of the Mendocino County Local Road Safety Plan, a public input platform called mapptionaire was published online and advertised on social media to solicit input public comments regarding traffic safety. The mapptionaire tool was open for public comments starting March 5, 2021 and closed on September 31, 2021. During this period 324 comments were submitted, out of which 192 comments were for Unincorporated Mendocino County.

Figure 2. County Website and Social Media Postings



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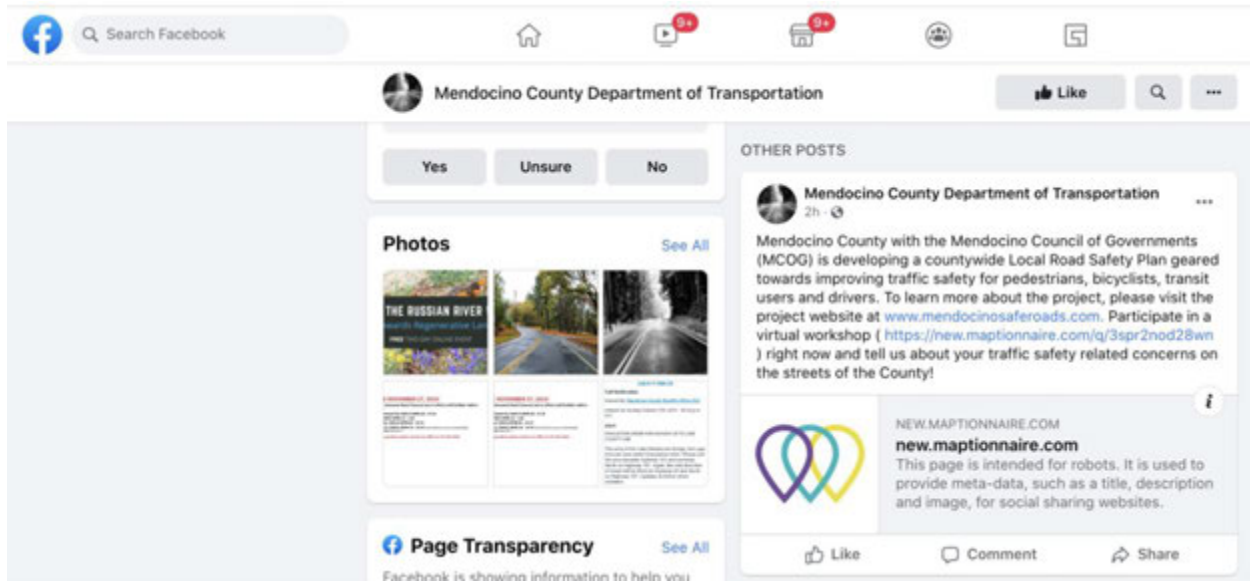
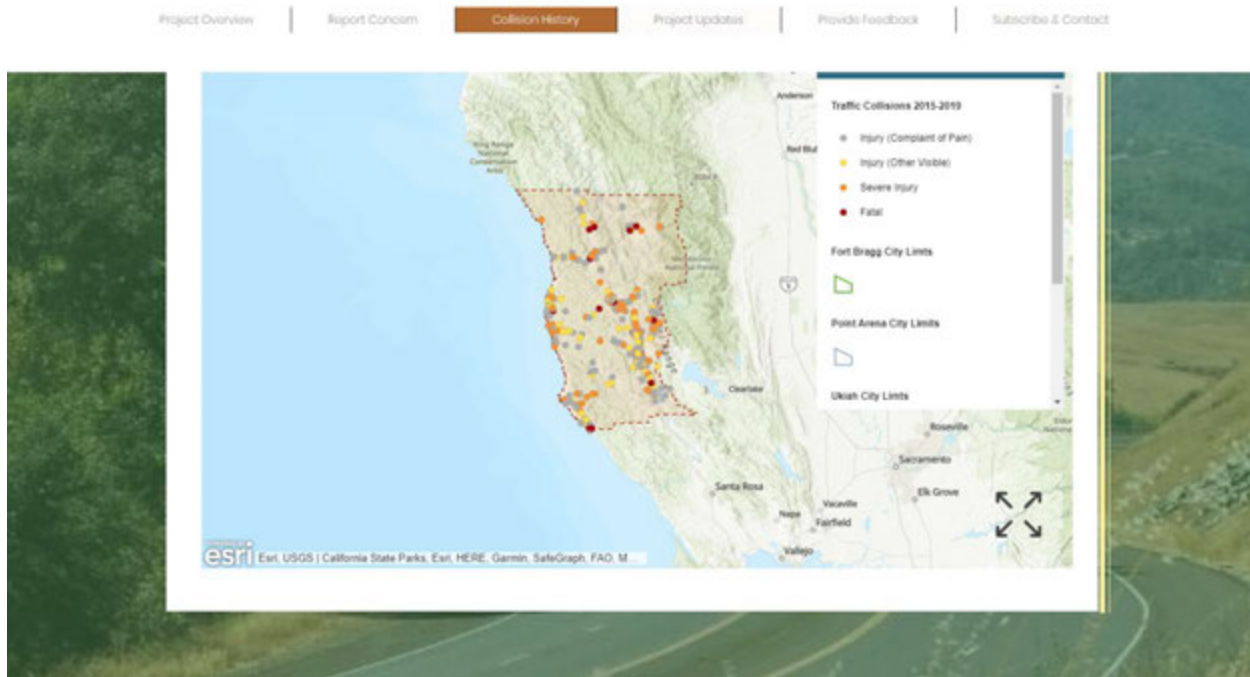
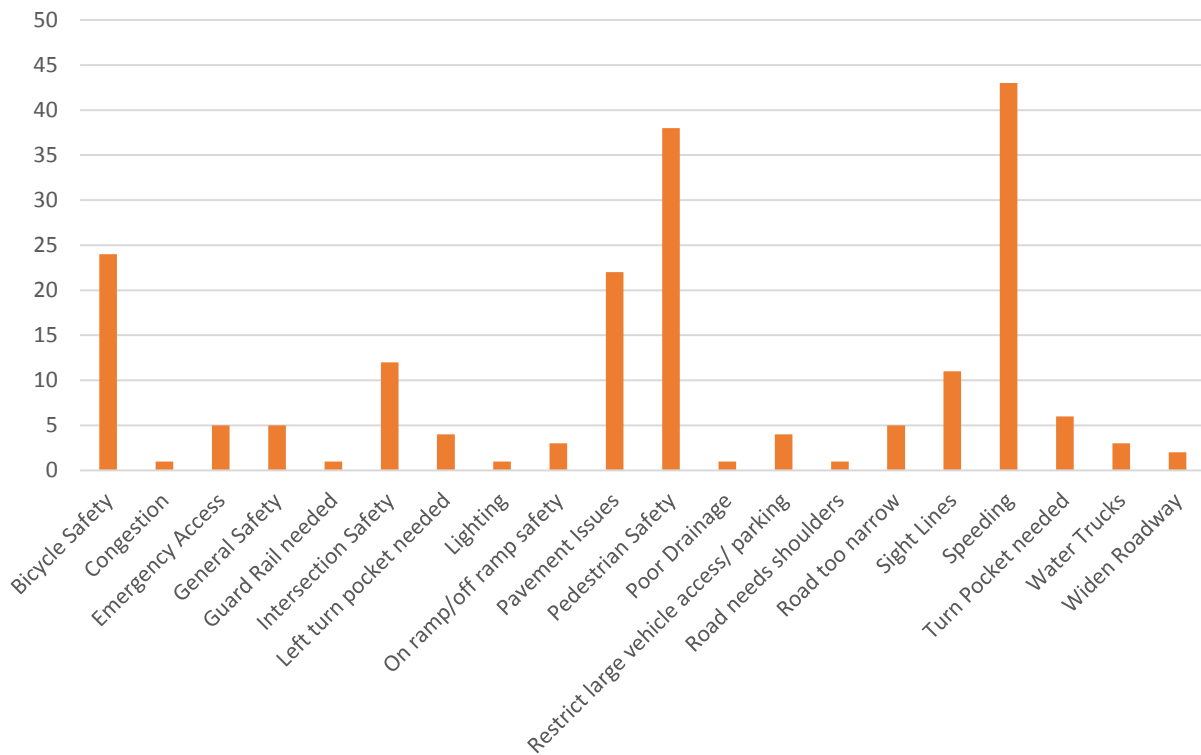


Figure 3. Project Website: mendocinosaferoads.com



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The most commonly commented on traffic safety issue was speeding, with a total of 43 comments. The most commented on location with speeding issues was CA State Route 1, with six comments. Deerwood Drive and Howard Street were also frequently commented on locations with speeding issues. Pedestrian safety was the second most commented on safety issue, with a total of 38 comments. The most commented on location with pedestrian safety issues was CA State Highway 162/Covelo Road with six comments (not a County Road). Sherwood Road, State Street, Howard Street, and Brush Street were also frequently commented on locations with pedestrian safety issues. Pavement maintenance issues, bicycle safety intersection safety, and sight line issues were also frequently commented on issues.



2. Existing Planning Efforts

This chapter summarizes the planning documents, projects underway, and studies reviewed for the Mendocino County LRSP being developed as a part of the Mendocino Council of Governments' (MCOG) LRSPs for local agencies. The purpose of this memorandum is to ensure that the LRSP vision, goals, and E's strategies are aligned with prior planning efforts, planned transportation projects, and non-infrastructure programs for the unincorporated County area. The documents reviewed are listed below:

- County of Mendocino General Plan 2009
- Mendocino County Regional Active Transportation Plan (2017)
- Mendocino County Safe Routes to School Plan (2014)
- Mendocino County Rail-with-Trail Corridor Plan (2012)
- Mendocino Council of Governments Transportation Planning Work Program FY 2020/2021
- Mendocino Council of Governments 2020 Regional Transportation Improvement Program (2019)
- 2017 Mendocino County Regional Transportation Plan (2018)
- Mendocino County Pedestrian Facility Needs Inventory and Engineered Feasibility Study (2019)
- Mendocino Council of Governments Active Transportation Program Safe Routes to School Non-Infrastructure Grant Report (2018)
- County of Mendocino FY 2020-21 Adopted Budget

The following sections include brief descriptions of these documents and how they inform the development of the LRSP. A short summary of each document is listed in Table 1. A detailed list of relevant policies and programs is in **Appendix A**.

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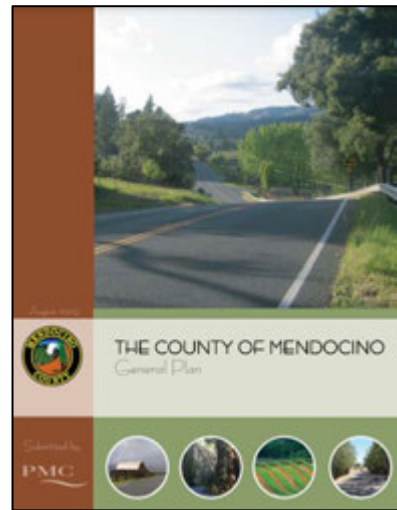
Table 1. Document Summary

Document	Highlights
County of Mendocino General Plan (2009)	Circulation element of the General Plan details long range plans for the County of Mendocino including bicycle, pedestrian, vehicle and transit policies.
Mendocino County Regional Active Transportations Plan (2017)	Details bicycle and pedestrian improvements on County significant corridors. Includes many detailed priority bike and pedestrian projects.
Mendocino County Safe Routes to School Plan (2014)	Safe Routes to School (SRTS) is a program with a simple goal: helping more children get to school by walking and bicycling.
Mendocino County Rail-with-Trail Corridor Plan (2012)	This plan identifies priority improvements for walking and biking facilities along the existing, currently unused, rail line running through Mendocino County.
Mendocino Council of Governments Transportation Planning Work Program FY 2020/2021	Identifies program transportation planning tasks for the coming fiscal year
Mendocino Council of Governments 2020 Regional Transportation Improvement Program (2019)	The Regional Transportation Improvement Program (RTIP) is a program of highway, local road, transit and active transportation projects that a region plans to fund with State and Federal revenue.
2017 Mendocino County Regional Transportation Plan (2018)	The Regional Transportation Plan is a long-range (1-20 year) planning effort that involves federal, state, regional, local and tribal governments, public and private organizations, and individuals working together to plan how future regional transportation needs can be met.
Mendocino County Pedestrian Facility Needs Inventory and Engineered Feasibility Study (2019)	The project's goal is to improve sidewalks, paths, and safe crossings in Mendocino County so it's easier to walk where pedestrians need to travel.
Mendocino Council of Governments Active Transportation Program Safe Routes to School Non-Infrastructure Grant Report (2018)	The project's goal is to encourage increased walking and biking to schools and other locations, by developing and sustaining a wide range of educational and training activities.
County of Mendocino FY 2020-21 Adopted Budget	The County's fiscal year 2020 – 2021 Budget outlines the funds the County has allocated to various departments and project.

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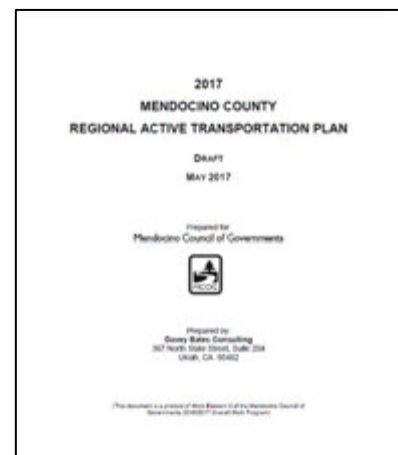
County of Mendocino General Plan (2009)

The General Plan presents a consolidated framework of decisions for guiding where and how development should occur in Mendocino County. The General Plan recognizes that the Circulation Element is crucial to improve Mendocino's quality of life and economic prosperity. Circulation not only covers the movement of automobiles, but the whole range of transportation alternatives: pedestrian, bicycle, air, truck, and rail.



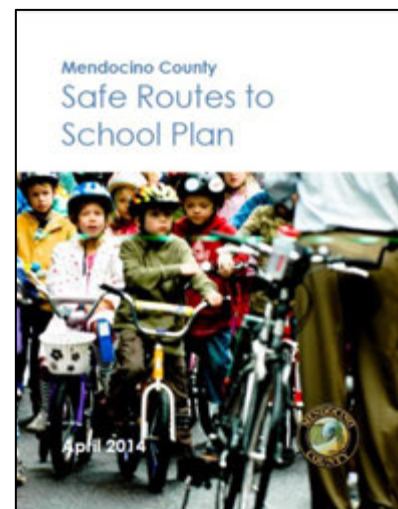
Mendocino County Regional Active Transportation Plan (2017)

This Plan is intended to identify priority bicycle and pedestrian improvements within all jurisdictions of Mendocino County, which include the Cities of Ukiah, Willits, Fort Bragg, and Point Arena and the unincorporated areas of the County of Mendocino. This plan contains a list of the 5 E's and implementation plan.



Mendocino County Safe Routes to School Plan (2014)

The SRTS is a program with a simple goal: helping more children get to school by walking and bicycling. The plan envisions active kids using safe streets, helped by engaged adults (from teachers to parents, engineers, planners, and police officers), surrounded by responsible drivers. The plan is the first area-wide SRTS plan in Mendocino County, designed to serve schools in the unincorporated areas of the County. The plan includes recommendations for a SRTS program that will strive to enhance children's health and well-being, ease traffic congestion near the school to improve safety, increase the number of students getting regular physical activity, improve air quality around schools and community members' overall quality of life, increase the number of students who walk and/or bike to and from school and provide clear projects and programs for implementation.



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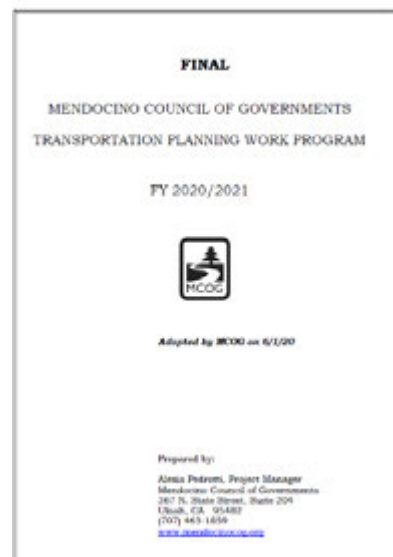
Mendocino County Rail-with-Trail Corridor Plan (2012)

The Mendocino County Rail-with-Trail (RWT) Corridor Plan provides an analysis of general conditions along the length of the 103-mile corridor and identifies priority RWT projects for the Cities of Ukiah, Willits, and the County of Mendocino. The Plan provides jurisdictions along the rail corridor (City of Ukiah, City of Willits, County of Mendocino, and Caltrans) with information to assist with implementation of the RWT. This Plan is funded by Caltrans' Community Based Transportation Planning grant funds and local matching funds. For this Plan, MCOG consulted with representatives from the County of Mendocino, the Cities of Willits and Ukiah, North Coast Railroad Authority, and Caltrans. The Plan was developed with community, stakeholder, and public agency input throughout its preparation.



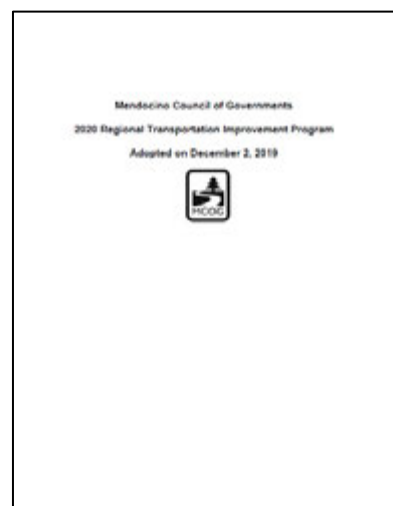
Mendocino Council of Governments Transportation Planning Work Program 2020/2021

The MCOG, as the Regional Transportation Planning Agency (RTPA) for Mendocino County, annually adopts its Transportation Planning Work Program to identify and program transportation planning tasks for the coming fiscal year. The objectives and tasks contained within this 2020/2021 Work Program are developed in accordance with the goals and policies of the 2017 Regional Transportation Plan (RTP).



Mendocino Council of Governments 2020 Regional Transportation Improvement Program (2019)

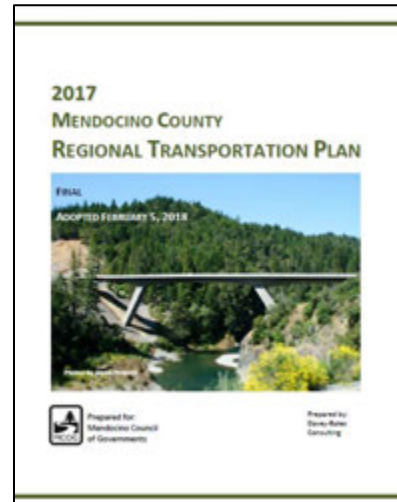
The Regional Transportation Improvement Program (RTIP) is a program of highway, local road, transit and active transportation projects that a region plans to fund with State and Federal revenue programmed by the California Transportation Commission (CTC) in the State Transportation Improvement Program (STIP).



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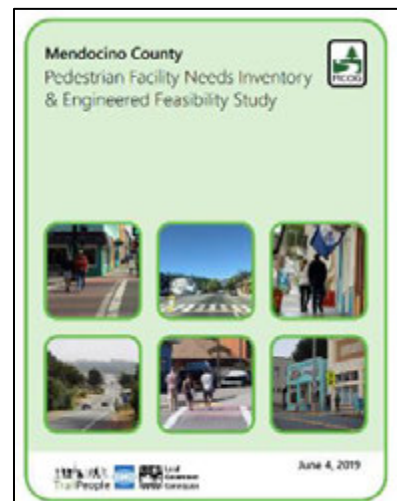
2017 Mendocino County Regional Transportation Plan (2018)

The regional transportation planning process is a long-range (one-20 year) planning effort that involves federal, state, regional, local and tribal governments, public and private organizations, and individuals working together to plan how future regional transportation needs can be met. Regional Transportation Plans are planning documents required by State legislation, and are developed by RTPAs in cooperation with Caltrans and other stakeholders. RTPs are developed to provide a clear vision of the regional transportation goals, policies, objectives, and strategies.



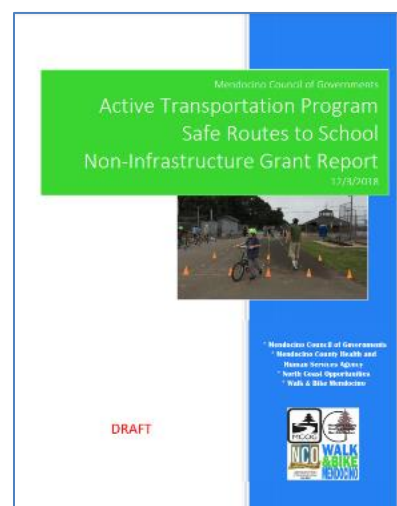
Mendocino County Pedestrian Facility Needs Inventory and Engineered Feasibility Study (2019)

The Mendocino County Pedestrian Facility Needs Inventory and Engineered Feasibility Study has a simple goal: to improve sidewalks, paths, and safe crossings in Mendocino County so it's easier to walk where you need to. This study covers all of Mendocino County; a vast amount of territory and many communities from large to tiny. This report describes all the potential pedestrian access improvement projects identified through the review of past studies, the inventory and analysis of existing conditions for pedestrian access, agency staff input, and the public input from workshops, meetings, and on-line surveys.



Mendocino Council of Governments Active Transportation Program Safe Routes to School Non-Infrastructure Grant Report (2018)

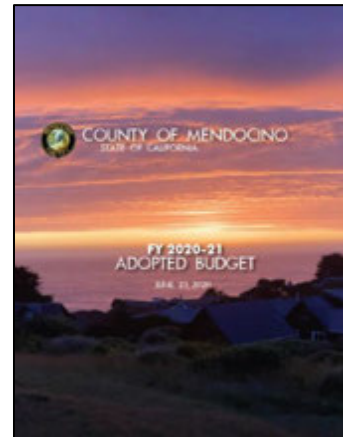
The Mendocino Council of Governments (MCOG), with funding from the Caltrans Active Transportation Program implemented a SRTS Non-Infrastructure Project to encourage increased walking and biking to schools and other locations, by developing and sustaining a wide range of educational and training activities. Two non-infrastructure grants (Countywide+Covelo) were awarded and subsequently combined into one comprehensive project.



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County of Mendocino FY 2020-21 Adopted Budget

The Adopted Budget Book serves as the County's primary policy and budget document. It communicates the Board of Supervisors' priorities and how departments align their program goals and objectives to achieve them. The budget is structured to provide both high-level context and line item detail on Mendocino County's operations and how the County strives to serve the community.



3. Collision Data Collection and Analysis

This chapter summarizes the results of the analysis conducted for the collisions that have occurred in the unincorporated regions of Mendocino County between January 2015 and December 2019 as part of the LRSP.

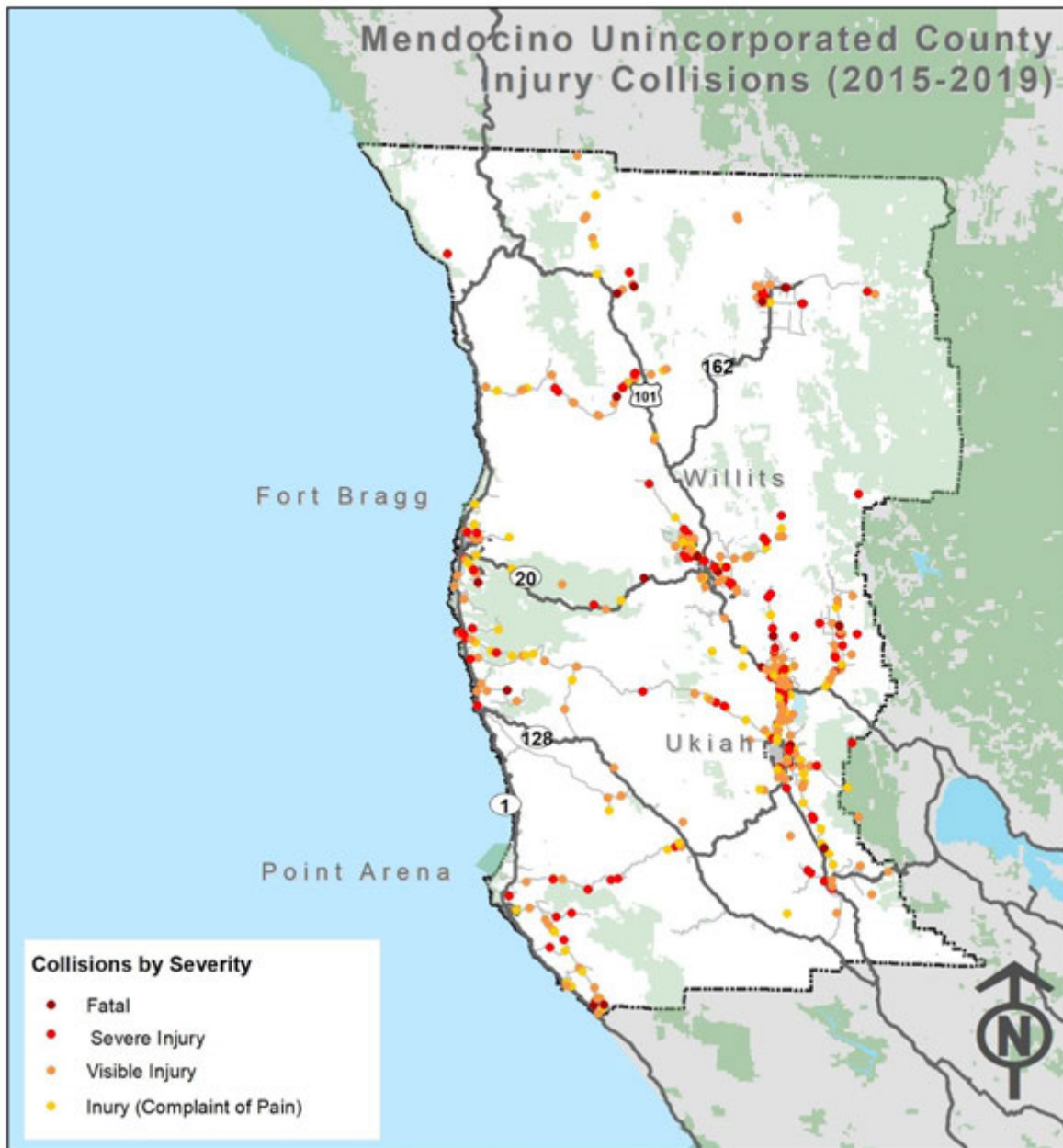
The LRSP focuses on systemically identifying and analyzing safety issues and recommends appropriate safety improvements. The memo starts with an analysis of the collisions of all severity for Unincorporated Mendocino County, including PDO collisions. Further on, a detailed analysis was conducted for F+SI collisions that have occurred on Unincorporated Mendocino County's roadways. After this data was segregated, a comprehensive evaluation was conducted based on factors such as collision severity, type of collision, primary collision factor, lighting, weather and time of the day. This memorandum includes the following sections:

- Demographic and Jurisdiction Characteristics
- Data Collection
- Collision Data Analysis
- F+SI Collision Analysis
- Geographic Collision Analysis
- High Injury Network
- Summary

Figure 4 illustrates all the injury collisions that have occurred in Unincorporated Mendocino County from January 2015 to December 2019.

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Figure 4. All Injury Collisions on Unincorporated Mendocino County Roadways (2015 – 2019)



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Demographic and Jurisdiction Characteristics

This section provides an understanding of the demographics of Mendocino County, including characteristics like the population, centerline miles of roadway, and commute to work. The data was collected from the United States Census Bureau³.

Population

According to the 2015-2019 American Community Service (ACS) five-year estimate data, the population of Unincorporated Areas of Mendocino County is 58,190, which is 67.1 percent of the County population. The population as well as the centerline miles of the County and various other jurisdictions is shown in **Table 2**.

Table 2. Mendocino County: Population and Centerline Miles

Jurisdiction	Population	Percent of County Population	Centerline Miles	Percent of County Centerline Miles
Point Arena	421	0.5%	2.3	0.2%
Willits	4,893	5.6%	20.5	1.8%
Fort Bragg	7,302	8.4%	28.1	2.5%
Ukiah	15,943	18.4%	58.9	5.3%
Unincorporated	58,190	67.1%	1,009.9	90.2%
Total	86,749		1,119.7	

Commute to Work

In Mendocino County, approximately 83 percent of residents travel by cars or vans to work, out of which 73 percent drive alone, and 10 percent carpool. About 6 percent of residents walk to work, 1 percent of resident's bike to work and 0.3 percent of residents take transit. The different modes of transportation used to commute to work for the county as well as the other jurisdictions in Mendocino are shown in **Table 3**.

³ United States Census Bureau. (2021). 2015-2019 American Community Service ACS 5-year Estimate <https://data.census.gov>

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Table 3. Mendocino County Commute to Work Census Data

Commute to Work	Mendocino County	Point Arena	Willits	Fort Bragg	Ukiah
Drive alone	73%	70%	70%	64%	74%
Carpool	10%	9%	11%	14%	11%
Public Transportation	0.3%	0%	0%	1%	1%
Walked	6%	10%	9%	14%	8%
Bicycle	1%	0%	2%	0%	1%
Work from Home	9%	10%	7%	8%	4%
Other	1%	0%	1%	0%	1%

Jurisdiction Rankings

Between the years 2015 and 2019, there were 112 fatal traffic collisions that occurred in Mendocino County, out of which 108 occurred in Unincorporated Mendocino County, with a traffic fatality rate of 25.82 per 100,000 population for the County as a whole, and 37.12 for unincorporated regions of the County. These rates are much higher than the California average and United States average with 8.95 and 10.28, respectively. These statistics are consistent with other rural areas. The National Highway Traffic Safety Administration (NHTSA) found that traffic fatality rate per VMT was two times higher in rural areas than in urban areas (1.68 and 0.86 respectively in 2018)⁴ and the Insurance Institute for Highway Safety (IIHS) found that although 19 percent of people in the U.S. live in rural areas and 30 percent of the VMT occur in rural areas, almost half of crash deaths occur there.⁵

Table 4 shows the comparison of traffic fatality rates and population.

⁴ National Highway Traffic Safety Administration, 2018 Traffic Safety Facts, DOT HS 812 957 Retrieved from: [https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812957#:~:text=However%2C%20rural%20areas%20accounted%20for,all%20traffic%20fatalities%20in%202018.&text=from%202019%2C323%20in%202009%20to,2009%20to%2019%2C498%20in%202018.&text=in%20rural%20areas%20than%20in,1.68%20and%200.86%2C%20respectively\).](https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812957#:~:text=However%2C%20rural%20areas%20accounted%20for,all%20traffic%20fatalities%20in%202018.&text=from%202019%2C323%20in%202009%20to,2009%20to%2019%2C498%20in%202018.&text=in%20rural%20areas%20than%20in,1.68%20and%200.86%2C%20respectively).)

⁵ Insurance Institute for Highway Safety, 2019 Fatality Facts Urban/rural comparison. Retrieved from Retrieved: <https://www.iihs.org/topics/fatality-statistics/detail/urban-rural-comparison>

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Table 4. Jurisdiction Ranking

Jurisdiction	Fatal Traffic Collisions (2015-2019)	Population	5 year Fatality Rate per 100,000
Unincorporated Mendocino County	108*	58,190	37.12
Mendocino County	112*	86,749	25.82
California	17,684	39,512,223	8.95
United States	168,742	328,239,523	10.28

*Note: These numbers include all state route collisions fatalities
Source: TIMS, Census, NHTSA

Office of Traffic Safety Rankings

Additional information on collisions in Mendocino County is provided by the California Office of Traffic Safety (OTS). The OTS is designated by the Governor to receive federal traffic safety funds for coordinating California’s highway safety programs. These rankings take into account fatal and injury crashes per population and per Vehicle Miles Traveled (VMT). Overall Mendocino ranks 38 out of 58 California counties in fatal and injury collisions. **Table 5** provides a summary of the 2018 rankings⁶.

Table 5. Office of Traffic Safety Ratings 2018

OTS 2018 Ranking	Mendocino County
Total Fatality and Injury	38/58
Alcohol Involved	3/58
Pedestrian	5/58
Speed Related	33/58
Night Time	15/58

⁶ California Office of Traffic Safety. (2018). Office of Traffic Safety Rankings 2018. https://www.ots.ca.gov/media-and-research/crash-rankings-results/?wpv-wpcf-year=2018&wpv-wpcf-city_county=Mendocino+County&wpv_filter_submit=Submit

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Collision Data

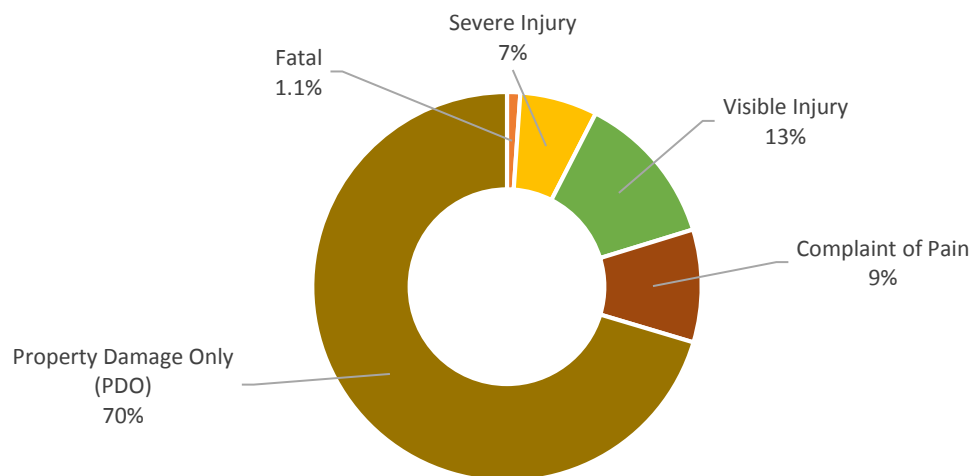
Collision data helps understand different factors that might be influencing collision patterns and various factors leading to collisions in a given area. For the purpose of this analysis, a five-year jurisdiction-wide collision data, from 2015 to 2019 was retrieved from TIMS and SWITRS. Collisions that occurred on state route roadways were excluded from this analysis and safety of local roadways has been the focus. The collision data was analyzed and plotted in ArcMap to identify high-risk intersections and roadways segments.

Collision Data Analysis

Collision Severity

There were a total of 1,911 collisions reported jurisdiction-wide from 2015 to 2019. Out of these 1,345 collisions (70 percent) were PDO collisions, 179 collisions (9 percent) led to complaint of pain injury and 243 collisions (13 percent) led to a visible injury. There were 144 F+SI collisions, 21 collisions (7 percent) led to a severe injury and 21 collisions (1 percent) led to a fatality. **Figure 5** illustrates the classification of all collisions based on severity. This collision analysis does not take into account collisions that occur on state highways.

Figure 5. Collisions by Severity (2015-2019)



The analysis first includes a comparative evaluation between all collisions and F+SI collisions, based on various factors including but not limited to the collision trend, primary collision factor, collision type, facility type, motor vehicle involved with, weather, lighting, and time of the day. Further on, a comprehensive analysis is conducted for only F+SI collisions. F+SI collisions cause the most damage to those affected infrastructure and the aftermath of these collisions lead to great expenses for jurisdiction administration. The LRSP process thus focuses on these collision locations to proactively identify and counter their respective safety issues.

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The collision data was segregated by facility type, i.e. based on collisions occurring at intersections and roadway segments. For the purposes of the analysis, a collision was said to have occurred at an intersection if it occurred within 250 feet radius of it. The reported collisions categorized by facility type and collision severity are presented in **Table 6**.

Table 6. Collisions by Severity and Facility Type

Collision Severity	Roadway Segment	Intersection	Total
Fatal	17	4	21
Severe Injury	99	24	123
Visible Injury	166	77	243
Complaint of Pain	99	80	179
PDO	790	555	1,345
Total	1,171	740	1,911

Preliminary Analysis

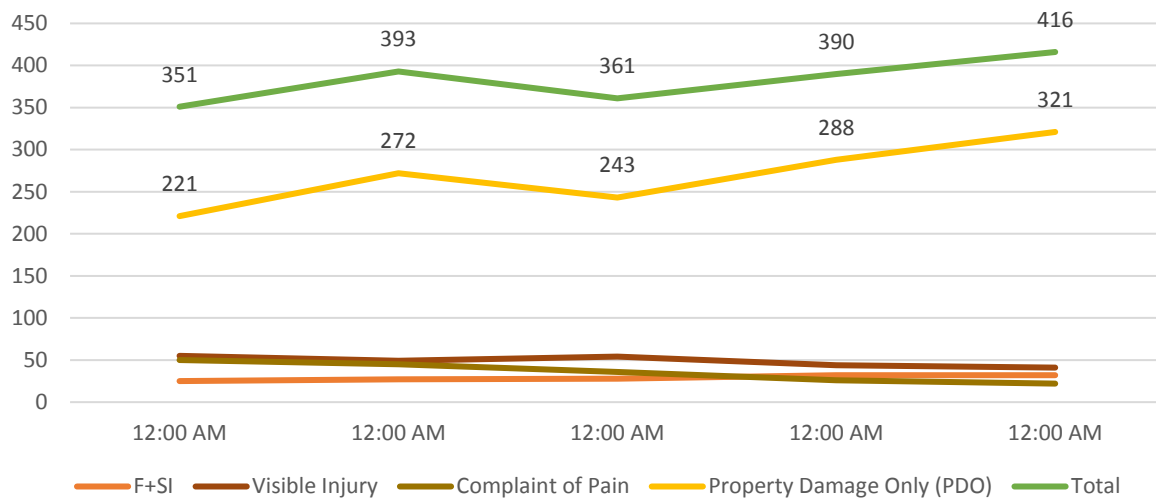
Collision Severity by Year

For collisions of all severity, the number increased from 2015 to 2019. The highest number of collisions (416 collisions) were observed in 2019 and the lowest number of collisions (351) were observed in 2015.

A total of 144 F+SI collisions occurred in Unincorporated Mendocino County during the study period. They were observed to be the lowest (25 collisions) in 2015. Overall, F+SI collisions were observed to rise from 2015 to 2019, with the highest number of F+SI collisions (32 collisions) occurring in the years 2018 and 2019. **Figure 6** illustrates the five-year collision trend for all collisions, F+SI collisions and also PDO collisions.

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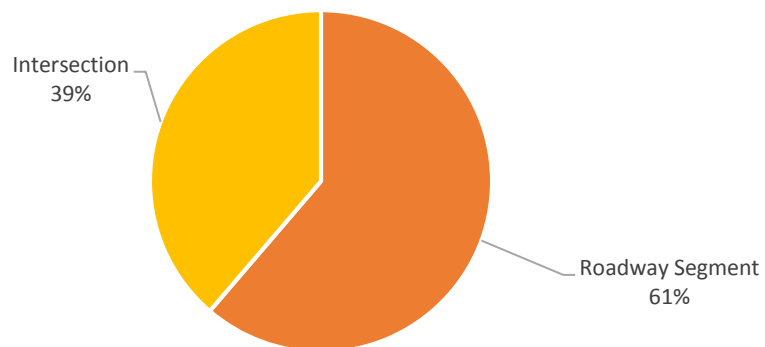
Figure 6. Five-Year Collision Trend



Intersection vs. Roadway Collisions

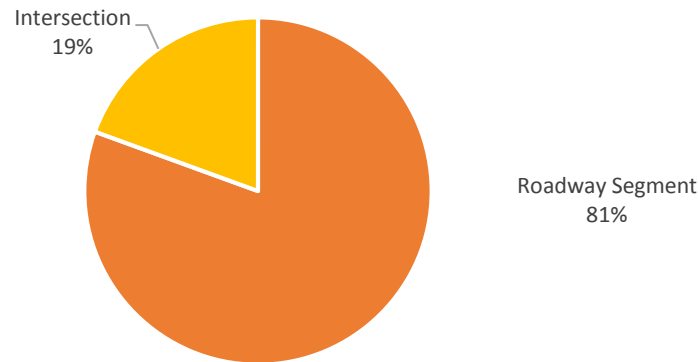
When evaluating roadways vs intersections, it was observed that the majority of collisions occurred on roadways. In Unincorporated Mendocino County, 39% of all collisions (740 collisions) occurred at intersections whereas 61 percent (1171 collisions) occurred on roadway segments. When only F+SI collisions are considered, an even greater portion of collisions occurred on roadway segments, with 19 percent (28 collisions) occurred at intersections whereas 81 percent (116 collisions) occurred on roadway segments. This classification by facility type can be observed in **Figure 7** and **Figure 8**.

Figure 7. Intersection vs. Roadway Collisions - All Collisions



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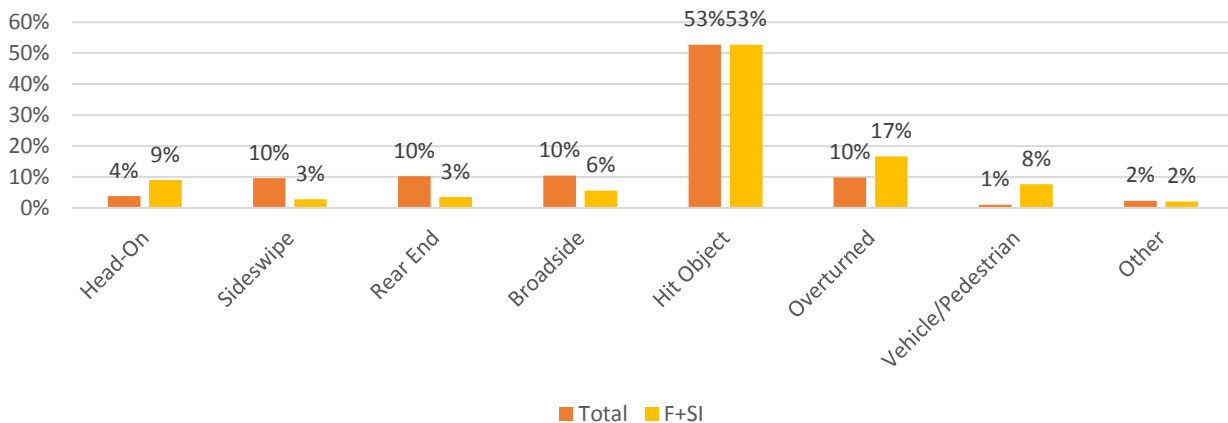
Figure 8. Intersection vs. Roadway Segment Collisions - Fatal and Severe Collisions



Collision Type

Considering collisions of all severity collisions and F+SI collisions, the most commonly occurring collision type was hit-object collisions (53 percent), which account for the majority of all severity as well as F+SI collisions. When only F+SI collisions were considered, the second most commonly occurring collision type was overturned collisions (17 percent). All other collisions types make up less than 10 percent of collisions. **Figure 9** illustrates the collision type for collisions of all severity as well as F+SI collisions.

Figure 9. Collision Type – All Collisions vs. F+SI Collisions

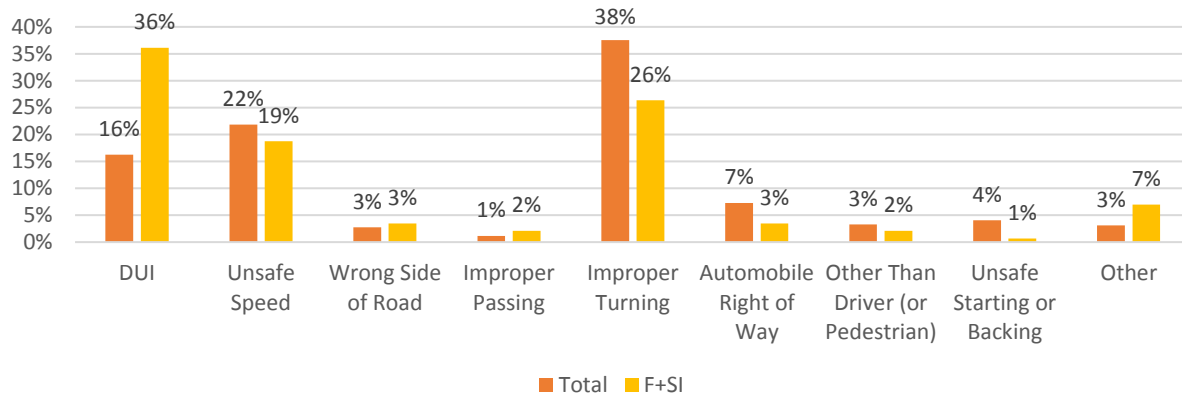


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Violation Category

Considering collisions of all severity, the most common violation category was observed to be improper turning (38 percent) and unsafe speed (22 percent). When only F+SI collisions were considered, driving under the influence (36 percent), improper turning (26 percent) and unsafe speed (19 percent) were observed to be major violation categories. **Figure 10** illustrates the violation category for collisions of all severity and F+SI collisions.

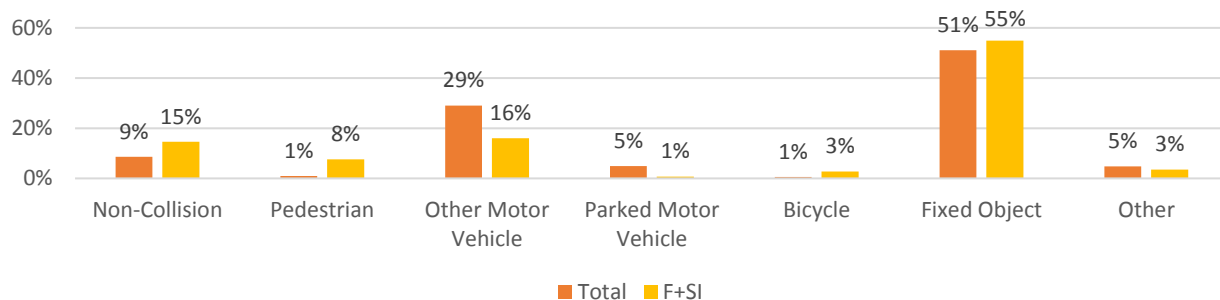
Figure 10. Primary Collision Factor: All Collisions vs. F+SI Collisions



Motor Vehicle Involved With

Considering collisions of all severity, 51 percent of the collisions are motor vehicle involved with fixed objects. The remaining collisions include motor vehicle involved with other motor vehicles (29 percent) and non-collisions (9 percent). Considering only F+SI collisions, 55 percent of the collisions are fixed object collisions, 16 percent are motor vehicle involved with other motor vehicles and 15 percent were non-collisions. F+SI collisions were also more likely to involve a pedestrian (8 percent) or a bicycle (3 percent). **Figure 11** illustrates the percentage for all collisions as well as F+SI collisions.

Figure 11. Motor Vehicle Involved With: All Collisions vs. F+SI Collisions

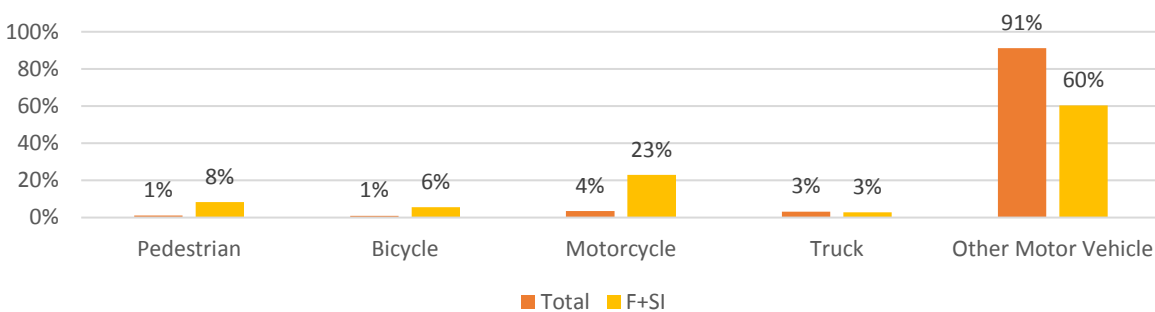


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Mode

In addition to motor vehicle involved with, mode includes a more detailed breakdown of motor vehicles, including truck and motorcycle. Considering collisions of all severity, 91 percent of the collisions are motor vehicle. The remaining collisions include motorcycle collisions (4 percent), pedestrian collisions (1 percent), bicycle collisions (1 percent) and truck collisions (3 percent). Considering only F+SI collisions, 60 percent of the collisions are other motor vehicle collisions. F+SI collisions were more likely to involve a motorcycle (23 percent), pedestrian (8 percent) or a bicycle (6 percent) indicating these modes are more vulnerable to fatalities and severe injuries. **Figure 12** illustrates the percentage for all collisions as well as F+SI collisions by mode.

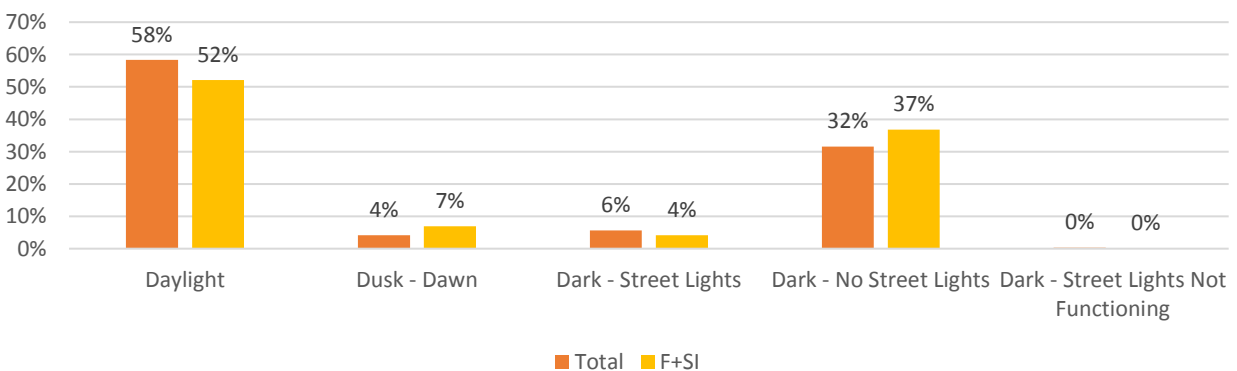
Figure 12. Mode: All Collisions vs. F+SI Collisions



Lighting

For collisions of all severity, 58 percent of collisions have occurred in daylight and 32 percent of collisions have occurred in the dark on streets with no street lights. For F+SI collisions, 52 percent of collisions have occurred in daylight and 37 percent of collisions occurred in the dark on streets with no street lights. **Figure 13** illustrates the lighting condition for all collisions and F+SI collisions.

Figure 13. Lighting Conditions: All Collisions vs. F+SI Collisions

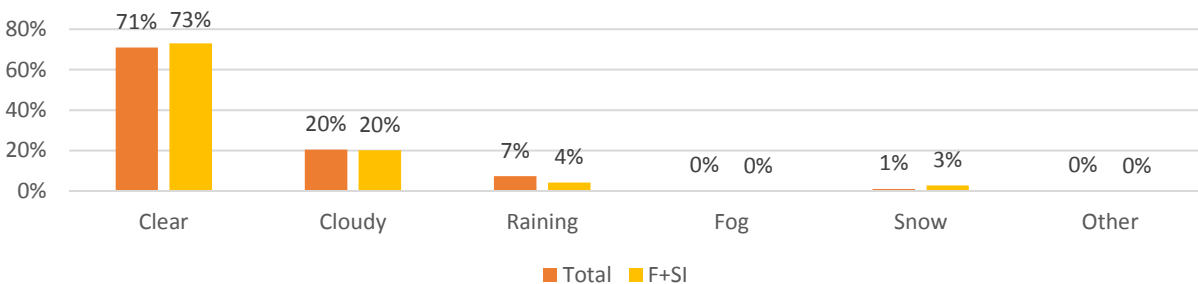


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Weather

For all collisions, 71 percent of the collisions have occurred during clear weather conditions and 20 percent of collisions were observed to occur during cloudy weather conditions. For F+SI collisions, 73 percent of the collisions have occurred during clear weather conditions and 20 percent of collisions occurred during cloudy weather conditions. **Figure 14** illustrates the percentage distribution of weather conditions during occurrence of collisions of all severity as well as F+SI collisions.

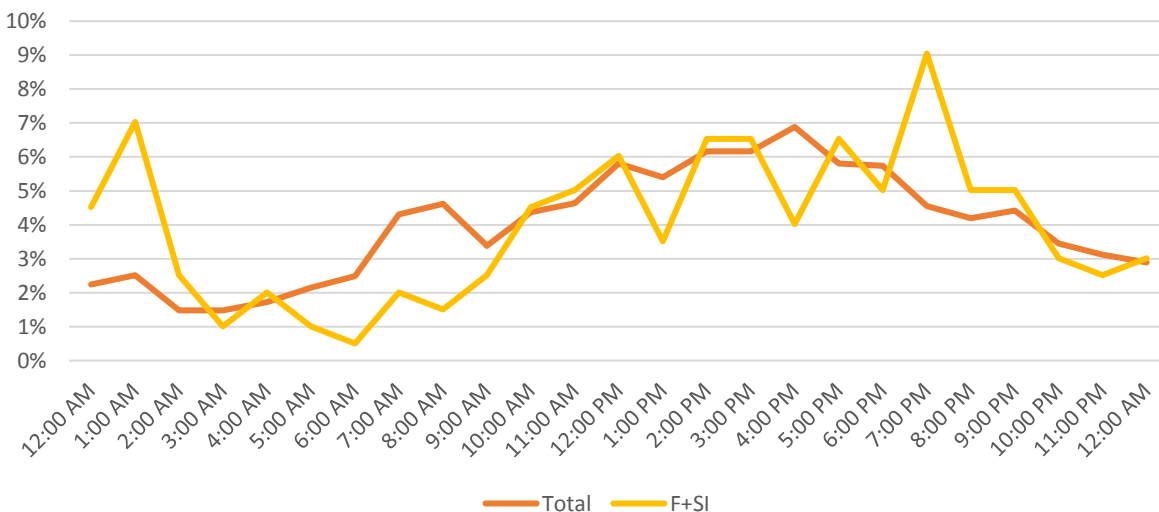
Figure 14. Weather Conditions: All Collisions vs. F+SI Collisions



Time of the Day

For collisions of all severity, maximum number of collisions have occurred between 4:00 p.m. to 5:00 p.m. (7 percent) and the minimum number of collisions have occurred between 2:00 a.m. to 4:00 a.m. (1 percent). For all F+SI collisions, maximum number (9 percent) of collisions have occurred between 7:00 p.m. to 8:00 p.m. **Figure 15** illustrates the percentage of collisions occurring during the day for all collisions as well as F+SI collisions. The high occurrence (9 percent of FSI collisions) of F+SI collisions at 6:00 p.m. to 8:00 p.m. and 12:00 a.m. to 2:00 a.m. compared to all collisions suggests nighttime is a factor in causing high-severity collisions.

Figure 15. Time of the Day: All Collisions vs. F+SI Collisions

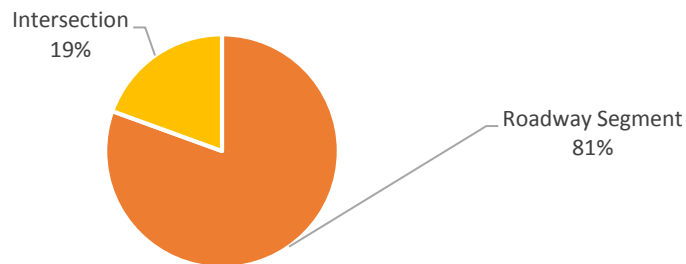


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F+SI Collision Analysis

This section describes a detailed collision analysis performed for F+SI collisions occurring at roadway segments and intersections in the unincorporated regions of Mendocino County. Of the total 144 F+SI collisions that occurred in these regions, 116 collisions (81 percent) occurred on roadway segments and 28 collisions (19 percent) occurred at intersections. This distribution is illustrated in **Figure 16**.

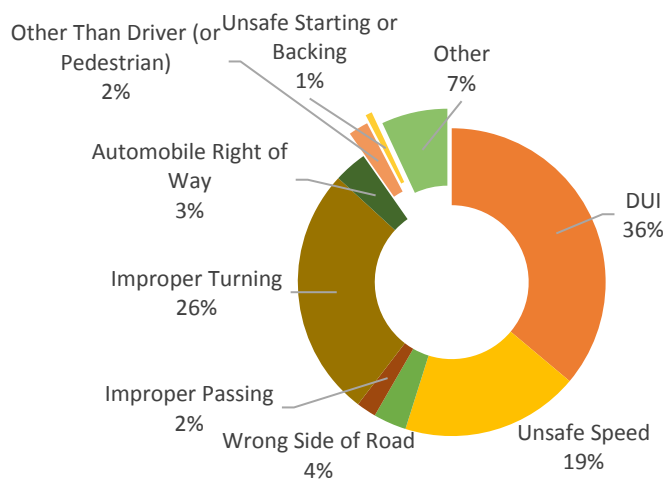
Figure 16. F+SI Collisions: Roadway Segments and Intersections



Violation Category

For F+SI collisions, driving under the influence (36 percent), improper turning (26 percent) and unsafe speed (19 percent) were observed to be major violation categories. **Figure 17** illustrates the violation category for F+SI collisions.

Figure 17. F+SI Collisions by Violation Category

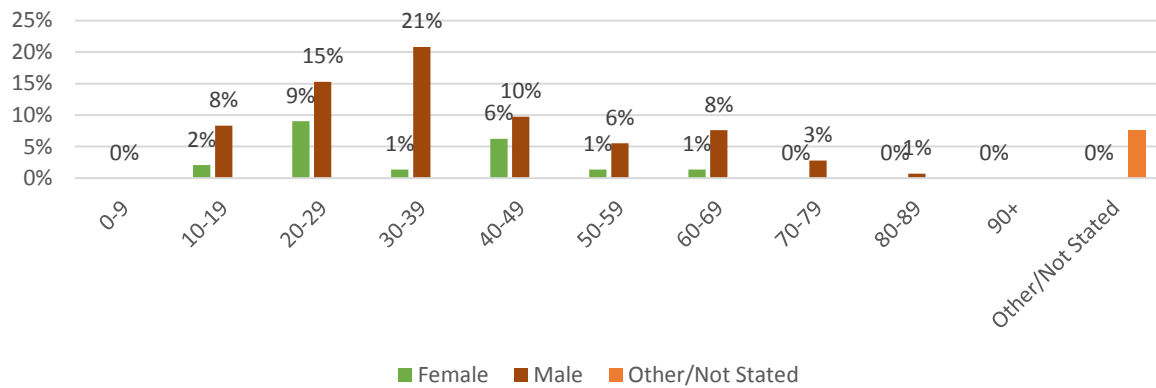


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Gender vs. Age

For F+SI collisions, the gender of the party at fault was much more likely to be male than female (71 percent of F+SI collisions vs 22 percent). The party at fault for F+SI collisions are also more likely to be younger, with the majority age between 20 and 39 (47 percent). **Figure 18** illustrates the gender and age of the party at fault for F+SI collisions.

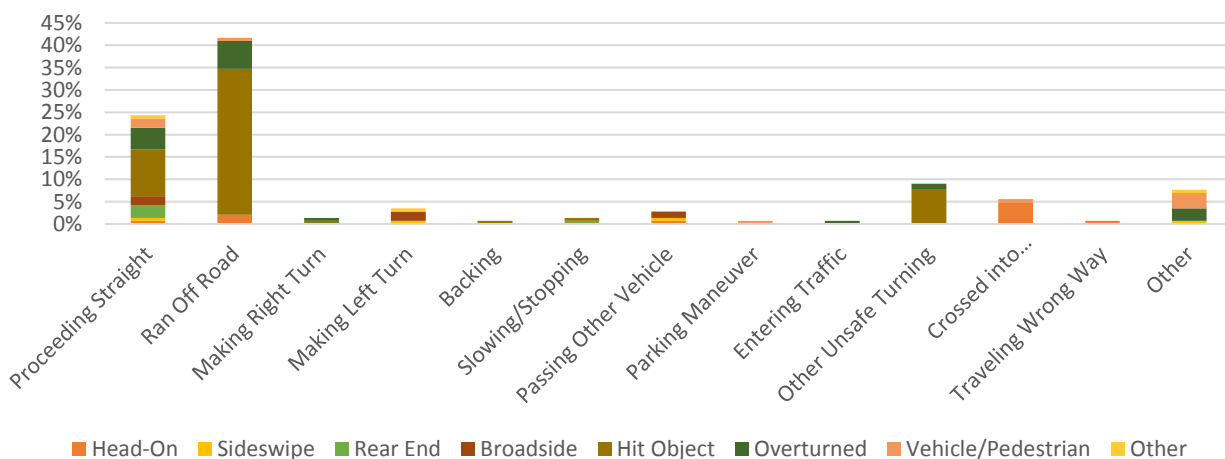
Figure 18. F+SI Collisions by Age vs Sex



Collision Type vs. Movement Preceding Collision of Party at Fault

For F+SI collisions, the most common collision type was hit object collisions. The most common movement of the party at fault preceding the collision of a hit object collisions is a run off road movement, and the second most common is proceeding straight. **Figure 19** illustrates the type of collisions as well as the movement of the party at fault preceding the collision for F+SI collisions.

Figure 19. F+SI Collisions by Collision Type vs. Movement Preceding Collisions of Party at Fault

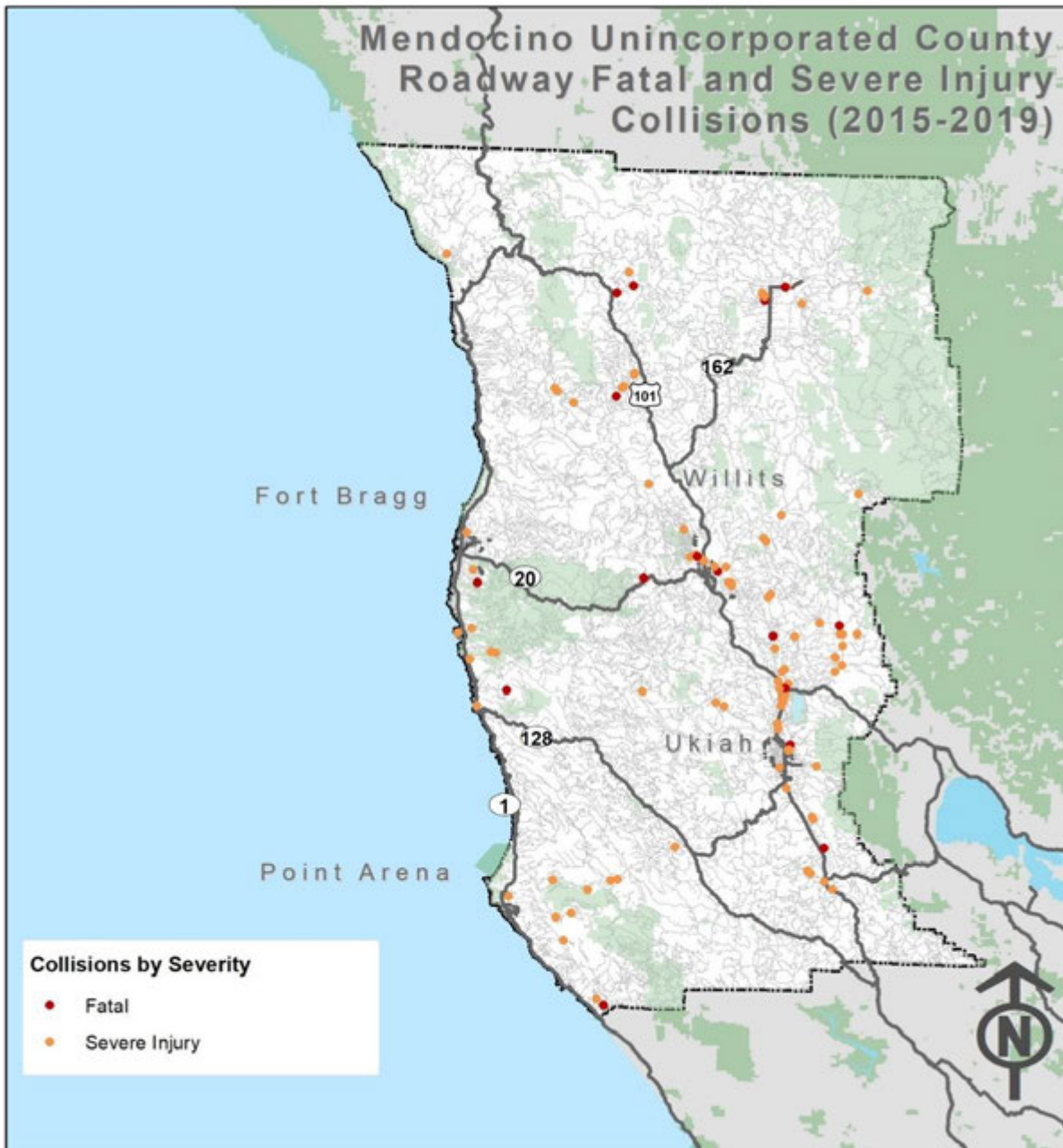


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F+SI Roadway Segment Analysis

A total of 116 F+SI collisions occurred in unincorporated regions of Mendocino County on roadway segments between 2015 and 2019. **Figure 20** illustrates the roadway segment collisions that occurred in the jurisdiction in the study period.

Figure 20. Mendocino Unincorporated County Roadway Segment F+SI Collisions (2015-2019)

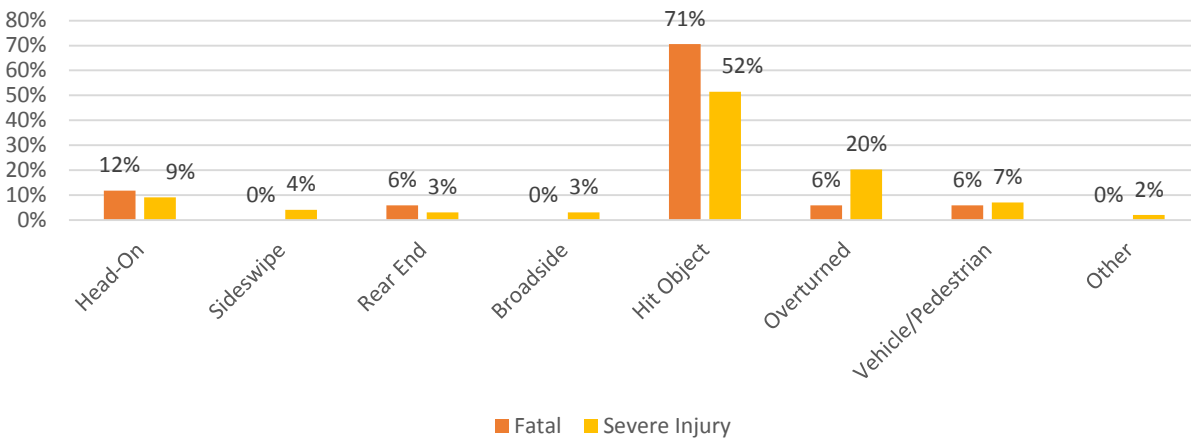


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Collision Type and Severity

For roadway F+SI collisions, the most common collision types were hit object collisions. Hit-object collision and head-on collision types were more likely to be fatal. Overturned and sideswipe were more likely to result in a severe injury. **Figure 21** shows the severity of roadway F+SI collisions as well as the collision type.

Figure 21. F+SI Roadway Collisions Collision Type vs Severity (2015-2019)

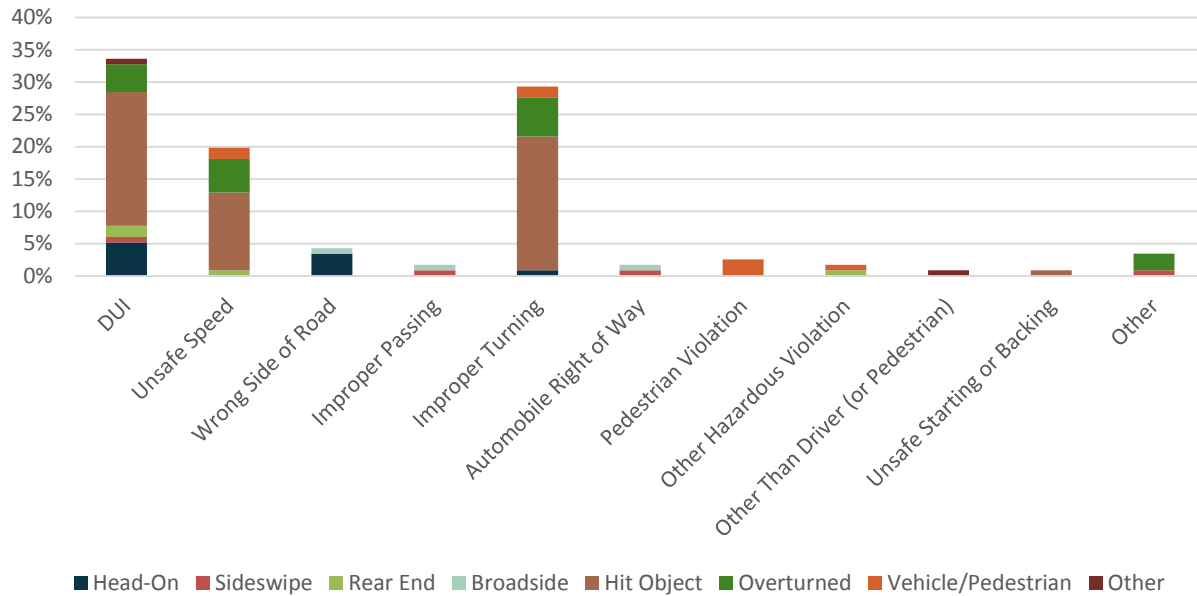


Collision Type and Violation Category

For all the roadway collisions that led to a fatality or severe injury, the most common violation types were DUI, improper turning and unsafe speed collisions that were also hit object collision types. **Figure 22** illustrates the type of collision as well as the violation category for F+SI roadway collisions.

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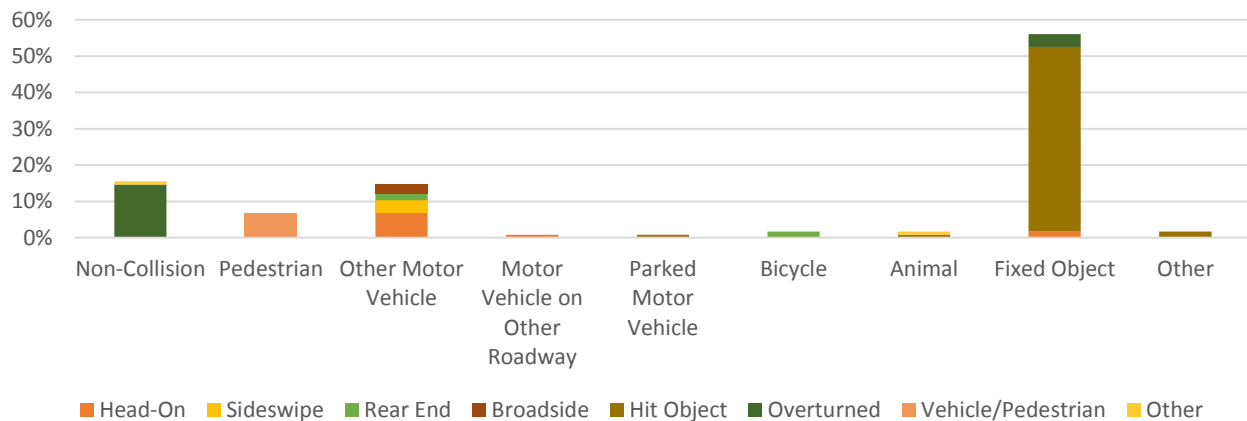
Figure 22. F+SI Roadway Collisions Collision Type vs Violation Category (2015-2019)



Collision Type and Motor Vehicle Involved With

For all roadway collisions that led to a fatality or severe injury, the most common collision types were fixed object collisions and hit object collisions types. Most non collision types were overturned collisions. **Figure 23** illustrates the type of collision as well as the motor vehicle involved with for F+SI roadway collisions.

Figure 23. F+SI Roadway Collisions by Type and Motor Vehicle Involved with

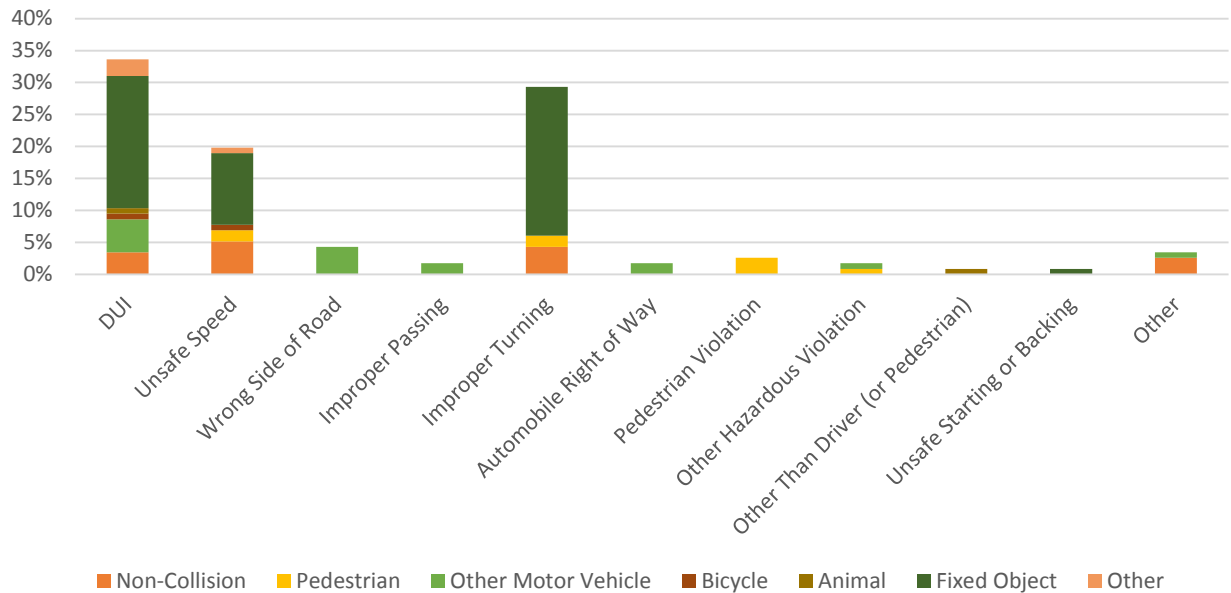


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Motor Vehicle Involved with and Violation Category

For all roadway collisions that led to a fatality or severe injury, the majority of collisions were DUI collisions, unsafe speed collisions, or improper turning collisions. The majority of these collisions were also fixed object collisions. The results, with violation category and motor vehicle involved with, are shown in **Figure 24**.

Figure 24. F+SI Roadway Collisions by Motor Vehicle Involved with vs Violation Category

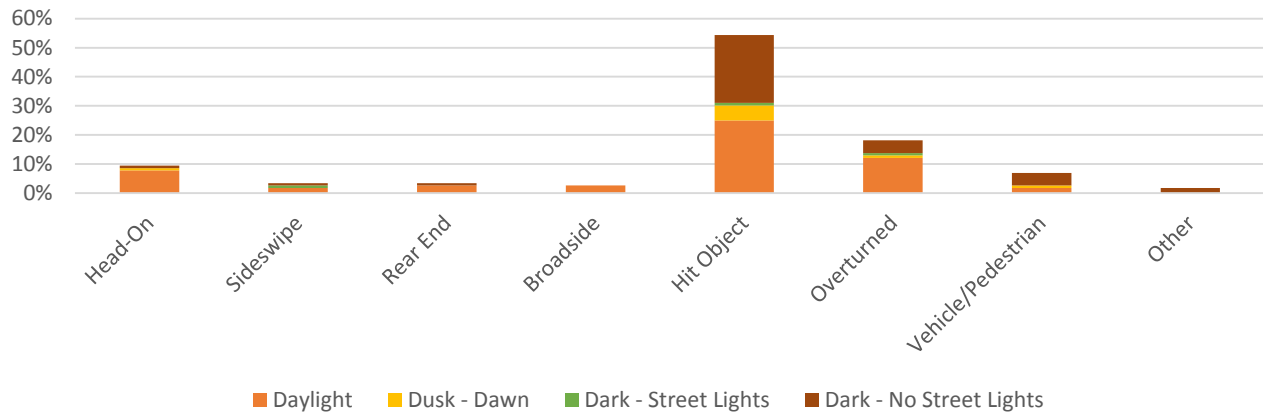


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Collision Type and Lighting Conditions

For all roadway F+SI collisions, most collisions occurred in the daylight or in the dark with no street lights. Head on collisions were more likely to occur in the daylight and vehicle/pedestrian collisions were more likely to occur in the dark with no streetlights. **Figure 25** illustrates the lighting condition and the collision type as observed for F+SI roadway collisions.

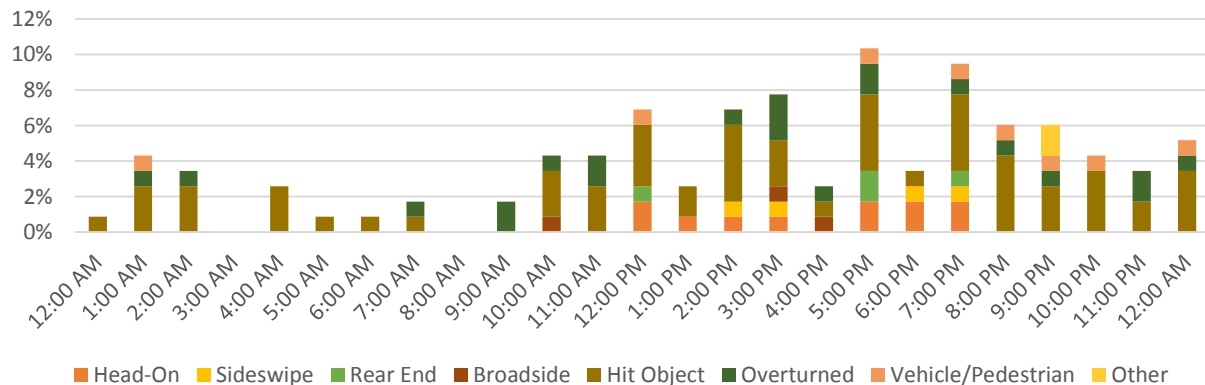
Figure 25. F+SI Collisions by Collision Type vs Lighting Conditions



Collision Type and Time of the Day

For all the F+SI roadway collisions type, the most common collision type was hit object collisions. Hit object collision types were more likely to happen after 10:00 a.m. Head-on collisions were more likely to happen between 12:00 p.m. and 7:00 p.m. Vehicle/pedestrian and overturned collisions happened throughout the day. **Figure 26** illustrates the collision type by the time of the day for all F+SI roadway collisions.

Figure 26. F+SI Collisions on Roadway Segments by Collisions Type vs Time of the Day



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F+SI Intersection Analysis

A total of 28 F+SI collisions occurred in Unincorporated Mendocino County on intersections between 2015 and 2019. **Figure 27** illustrates the intersection collisions that occurred in the jurisdiction in the study period.

Figure 27. Mendocino Unincorporated County Intersection F+SI Collisions (2015-2019)

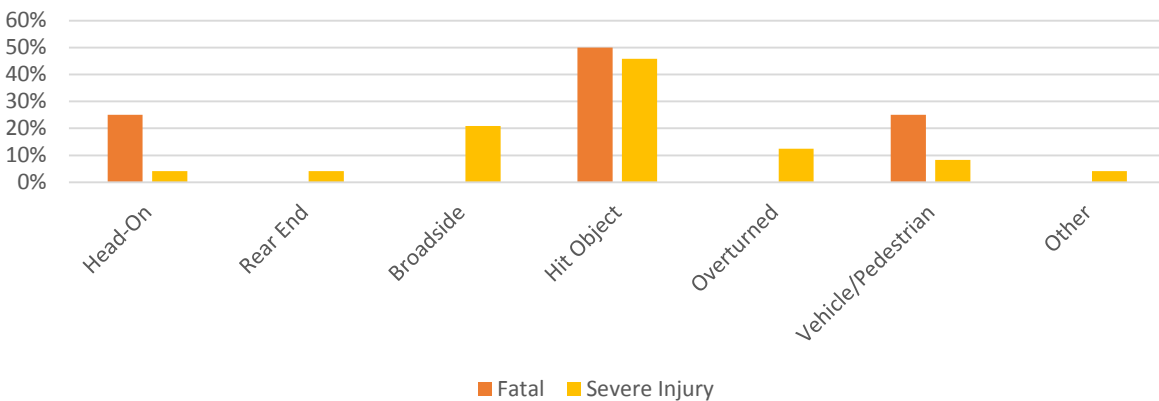


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Collision Type and Severity

For intersection F+SI collisions, the most common collision types were hit object collisions. Hit-object collision, head-on, and vehicle/pedestrian collision types were more likely to result in a fatality. Broadside, overturned, and rear end collision types were more likely to result in a severe injury. **Figure 28** illustrates the severity of intersection F+SI collisions as well as the collision type.

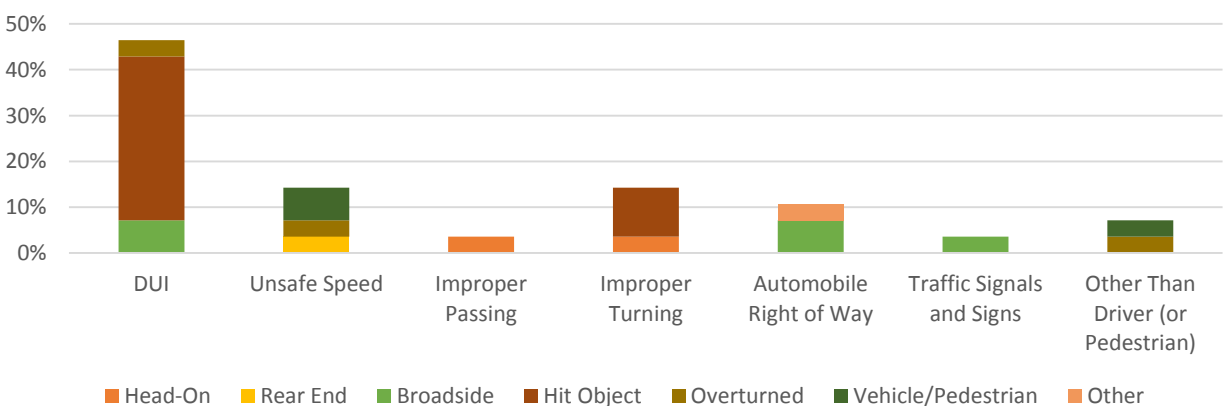
Figure 28. F+SI Intersection Collisions Unincorporated Mendocino County (2015-2019)



Collision Type and Violation Category

For all the intersection collisions that led to a fatality or severe injury, the most common violation types were DUI and improper turning violations that led to hit object collisions. **Figure 29** illustrates the type of collision as well as the motor vehicle involved with for F+SI intersection collisions.

Figure 29. F+SI Collisions Unincorporated Mendocino County (2015-2019)

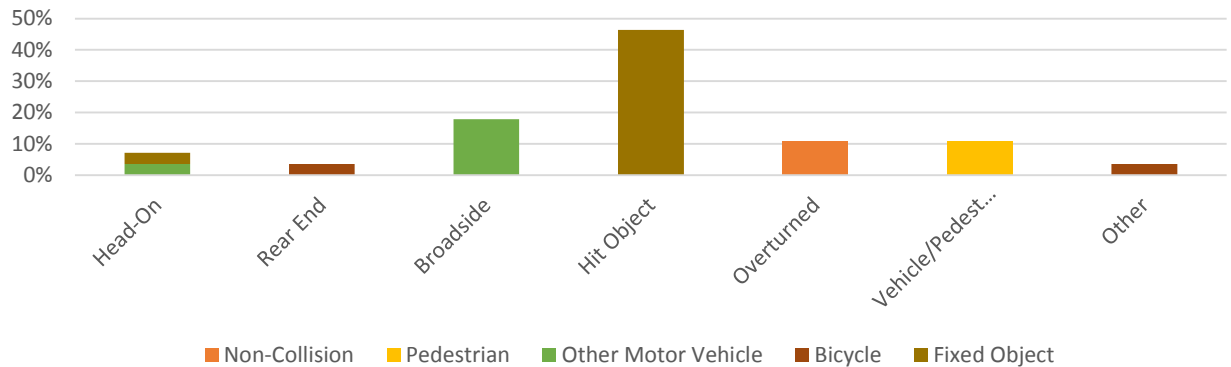


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Collision Type and Motor Vehicle Involved With

For all intersection collisions that led to a fatality or severe injury, the most commonly occurring collision types were fixed object collisions and hit object collisions. 100 percent of non-collision types were also overturned collisions. **Figure 30** illustrates the type of collision as well as the motor vehicle involved with for F+SI intersection collisions.

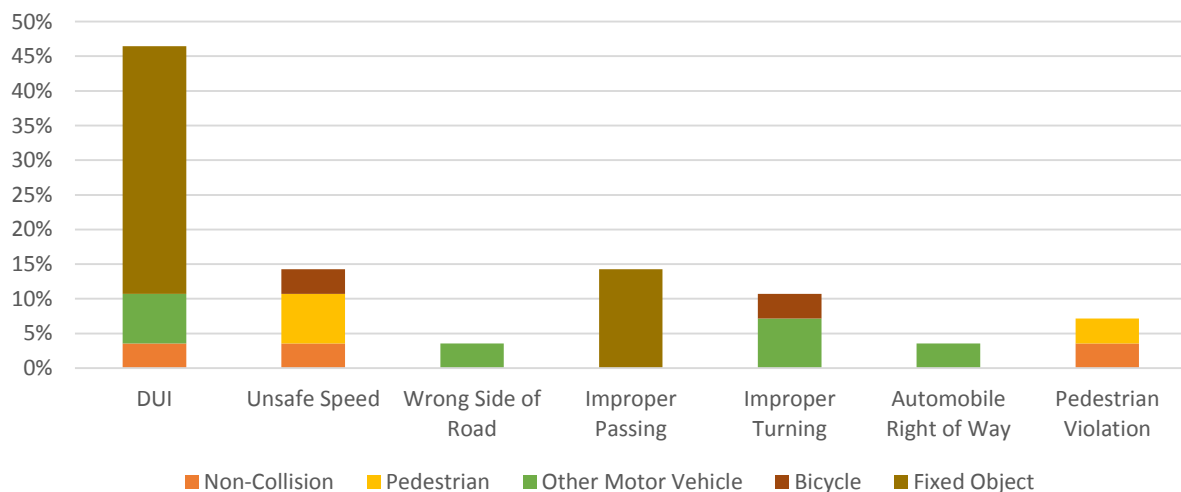
Figure 30. F+SI Intersection Collisions by Type and Motor Vehicle Involved with



Motor Vehicle Involved with and Violation Category

For all intersection collisions that led to a fatality or severe injury, the majority of collisions were DUI collisions in which a motor vehicle was involved with a fixed object. The results, with violation category and motor vehicle involved with, are shown in **Figure 31**.

Figure 31. F+SI Roadway Collisions by Motor Vehicle Involved with vs. Violation Category

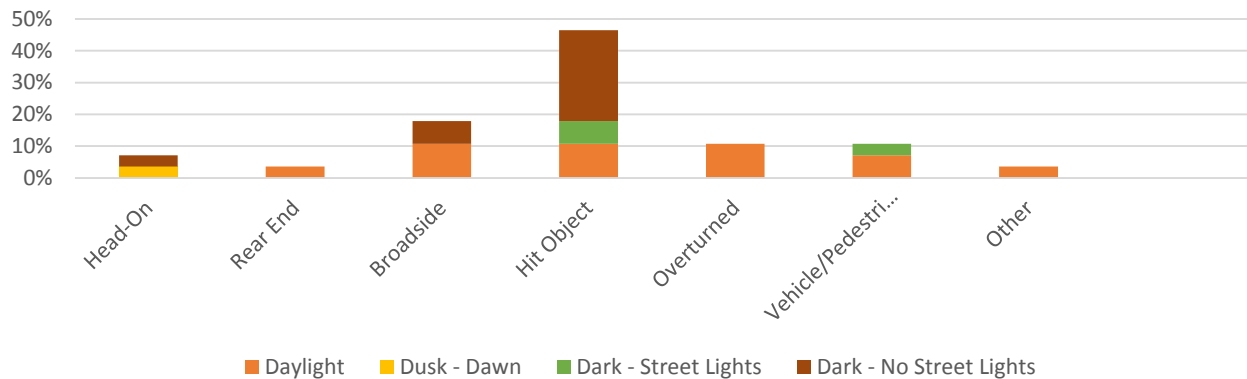


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Collision Type and Lighting Conditions

For all intersection F+SI collisions, 13 collisions occurred in the daylight. Hit object collisions have been observed to occur in the dark with no streetlights and broadside, overturned, and vehicle/pedestrian collisions have been observed to occur in the daylight. **Figure 32** illustrates the lighting condition and the collision type as observed for F+SI collisions that occurred at intersections.

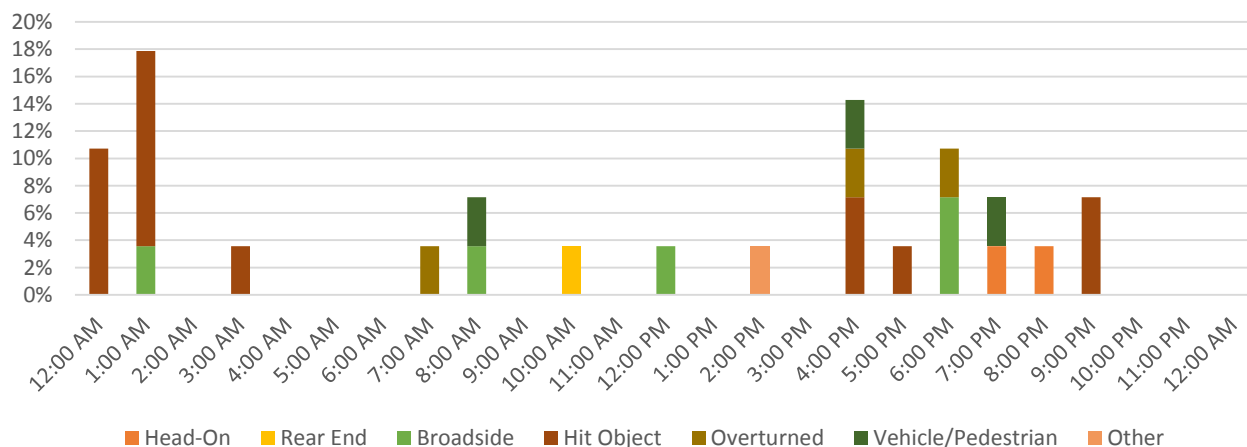
Figure 32. F+SI Intersection Collisions by Collision Type vs. Lighting Conditions



Collision Type and Time of the Day

For all the F+SI intersection collisions, highest number of collisions were hit object collisions. Hit object collision types have been observed to occur between 9:00 p.m. and 1:00 a.m. Head-on collisions were observed to occur between 7:00p.m. and 9:00 p.m. Vehicle/pedestrian and overturned collisions have occurred throughout the day. **Figure 33** illustrates the collision type by the time of the day for all F+SI intersection collisions.

Figure 33. F+SI Collisions on Intersection by Collisions Type vs. Time of the Day



Geographic Collision Analysis

This section describes a detailed geographic collision analysis performed for injury collisions occurring at roadway segments and intersections in Unincorporated Mendocino County. The above collision analysis was used to identify five main collision factors that highlight the top trends among collisions in Unincorporated Mendocino County. These five collision factors were identified to be hit object collisions, DUI collisions, improper turning collisions, unsafe speed collisions, and motorcycle collisions.

Hit Object Collisions

For F+SI collisions in Unincorporated Mendocino County, 53 percent of collisions were hit object collisions. **Figure 34** shows the distribution of hit object collisions throughout Unincorporated Mendocino County between 2015 and 2019. Branscomb Road near the unincorporated community of Branscomb, Comptche Ukiah Road near Mendocino Headlands State Park – Big River Property and Vichy Springs Road near Vichy Springs have a higher concentration of hit object collisions, compared to other Unincorporated Mendocino County roads.

DUI Collisions

For F+SI collisions in Unincorporated Mendocino County, 36 percent of collisions were DUI collisions compared to just 16 percent of all collisions, meaning alcohol involved collisions have shown to result in a fatal or severe injury. **Figure 35** shows the distribution of DUI collisions throughout Unincorporated Mendocino County between 2015 and 2019. Eastside Calpella Road and North State Street near the census-designated place Calpella, Vichy Springs Road near Vichy Springs and Eel River Road near Potter Valley have a higher concentration of DUI collisions, compared to other Unincorporated Mendocino County roads. The OTS ranked Mendocino County third out of 58 California counties with high levels of alcohol involved collisions (one being the highest, or worst)¹.

Improper Turning Collisions

For F+SI collisions in Unincorporated Mendocino County, 26 percent of collisions were improper turning collisions. **Figure 36** shows the distribution of injury from improper turning collisions throughout Unincorporated Mendocino County between 2015 and 2019. Branscomb Road near the unincorporated community of Branscomb, South State Street, south of Ukiah, and Babcock Lane east of Ukiah have a higher concentration of improper turning collisions, compared to other Unincorporated Mendocino County roads.

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Unsafe Speed Collisions

For F+SI collisions in Unincorporated Mendocino County, 19 percent of collisions were unsafe speed collisions. **Figure 37** shows the distribution of unsafe speed collisions throughout Unincorporated Mendocino County between 2015 and 2019. North State Street near The Forks, Hesser Drive near Mendocino Headlands State Park and Branscomb Road near the unincorporated community of Branscomb have a higher concentration of unsafe speed collisions, compared to other Mendocino County roads. The OTS ranked Mendocino County 33rd out of 58 California counties with high levels of unsafe speed collisions (one being the highest, or worst)⁷.

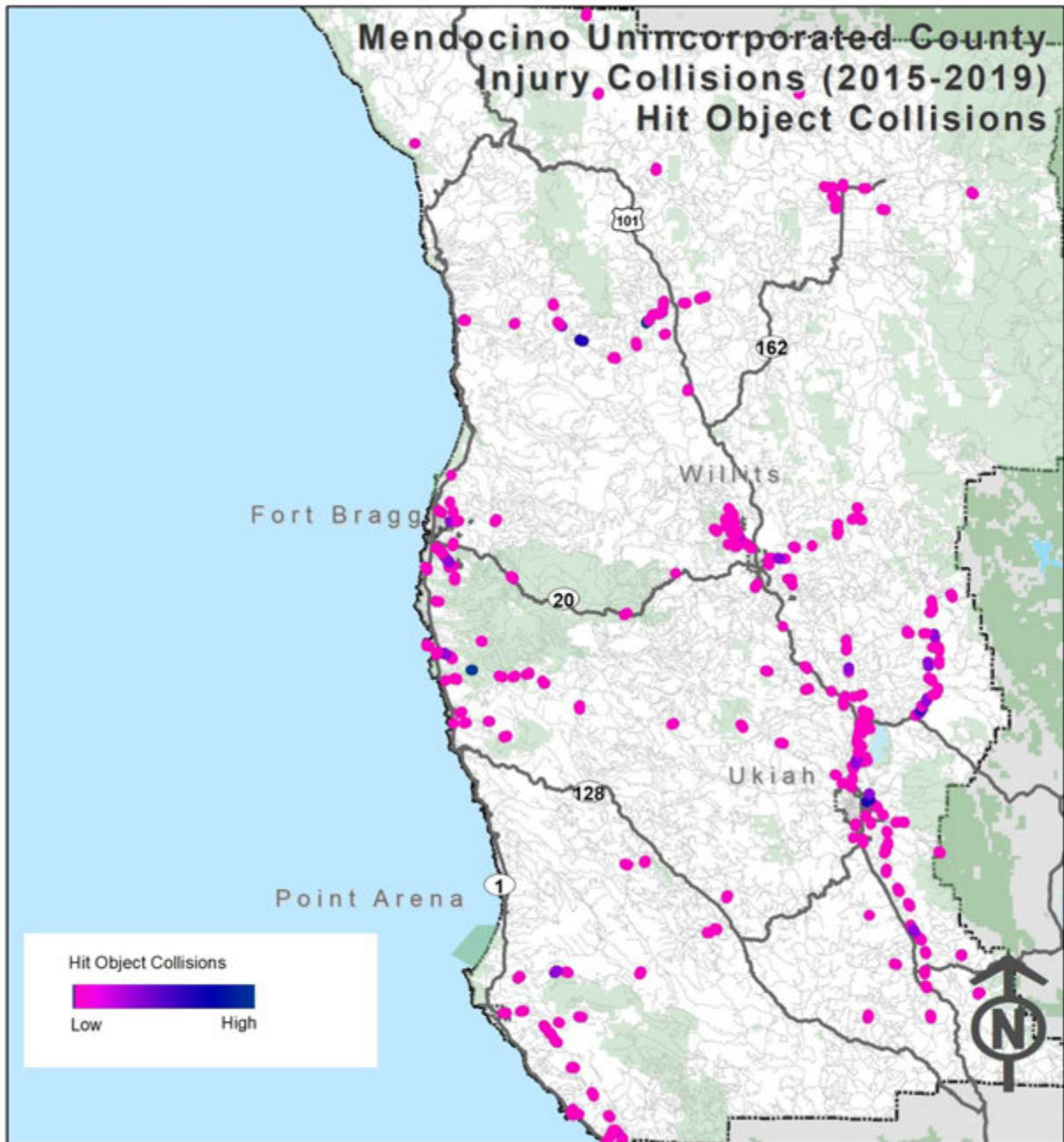
Motorcycle Collisions

For F+SI collisions in Unincorporated Mendocino County, 23 percent of collisions were motorcycle collisions compared to just 4 percent of all severity collisions, meaning motorcycle collisions have shown to result in a fatal or severe injury. **Figure 38** shows the distribution of motorcycle collisions throughout Mendocino County between 2015 and 2019. Eastside Calpella Road and North State Street near the census-designated place Calpella and Valley Road East of Willits have a higher concentration of motorcycle collisions, compared to other Mendocino County roads. The OTS ranked Mendocino County 24th out of 58 California counties with high levels of motorcycle collisions (one being the highest, or worst)².

⁷ California Office of Traffic Safety. (2018). Office of Traffic Safety Rankings 2018. https://www.ots.ca.gov/media-and-research/crash-rankings-results/?wpv-wpcf-year=2018&wpv-wpcf-city_county=Mendocino+County&wpv_filter_submit=Submit

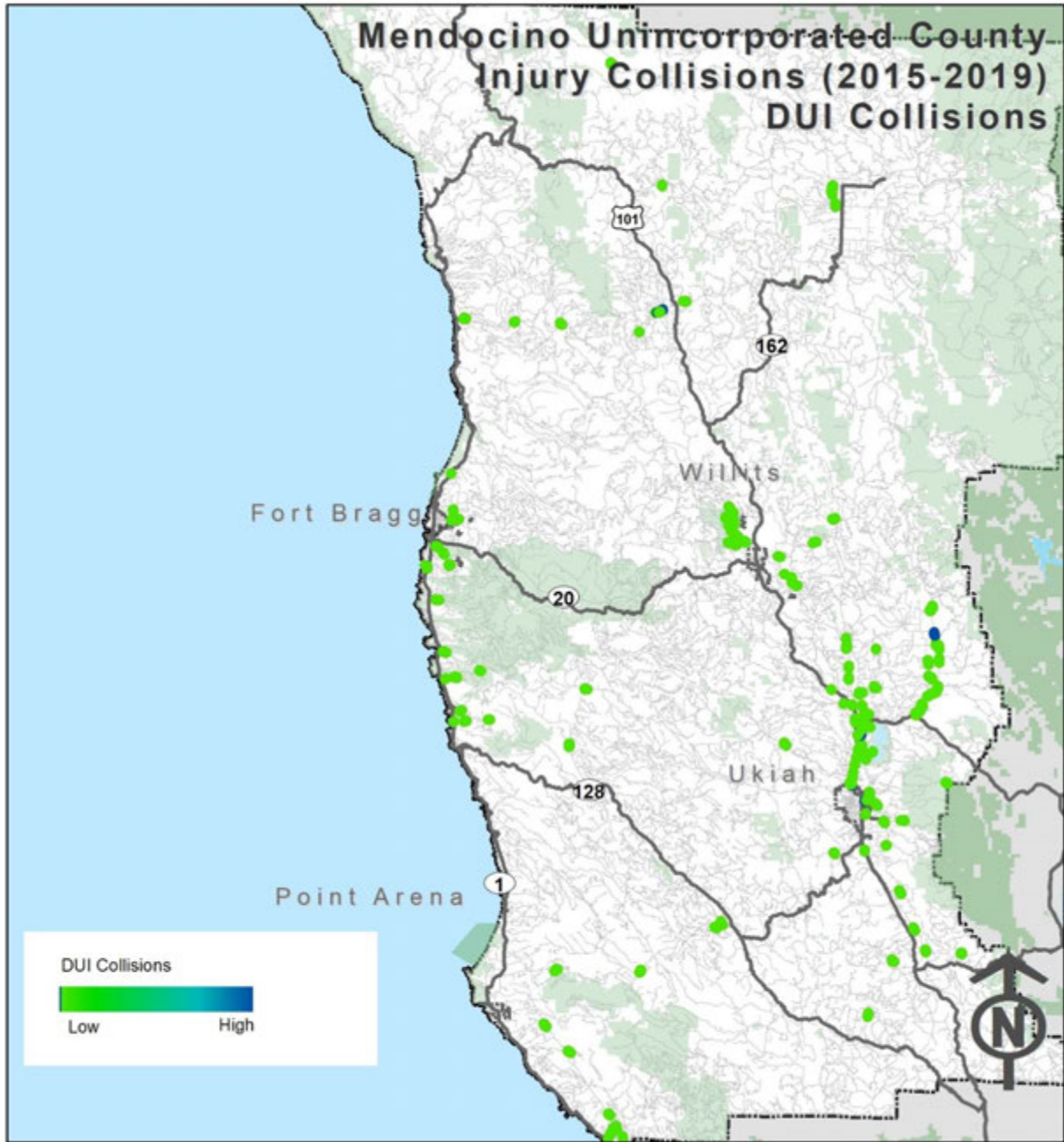
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Figure 34. Hit Object Collisions



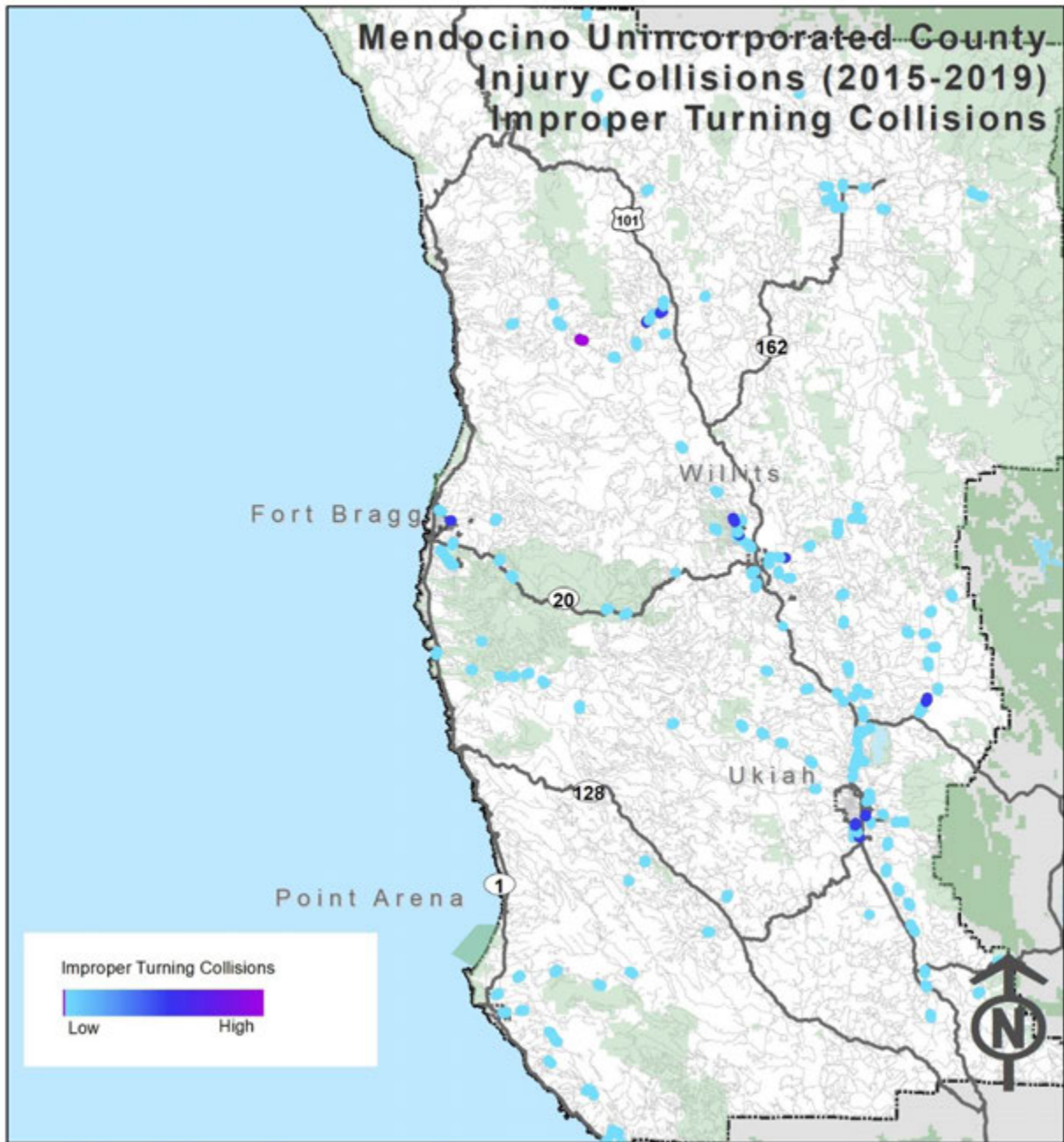
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Figure 35. DUI Collisions



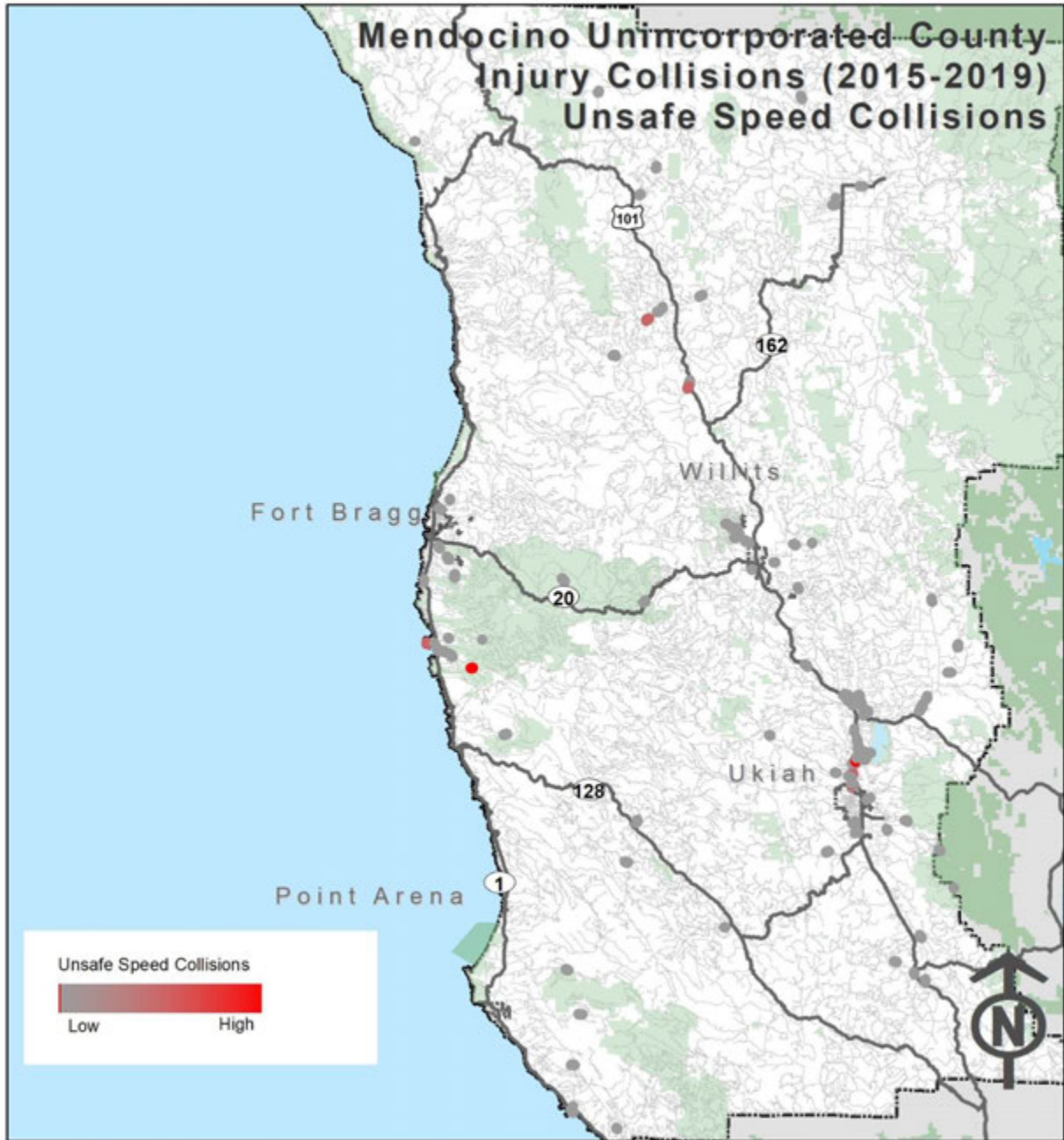
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Figure 36. Improper Turning Collisions



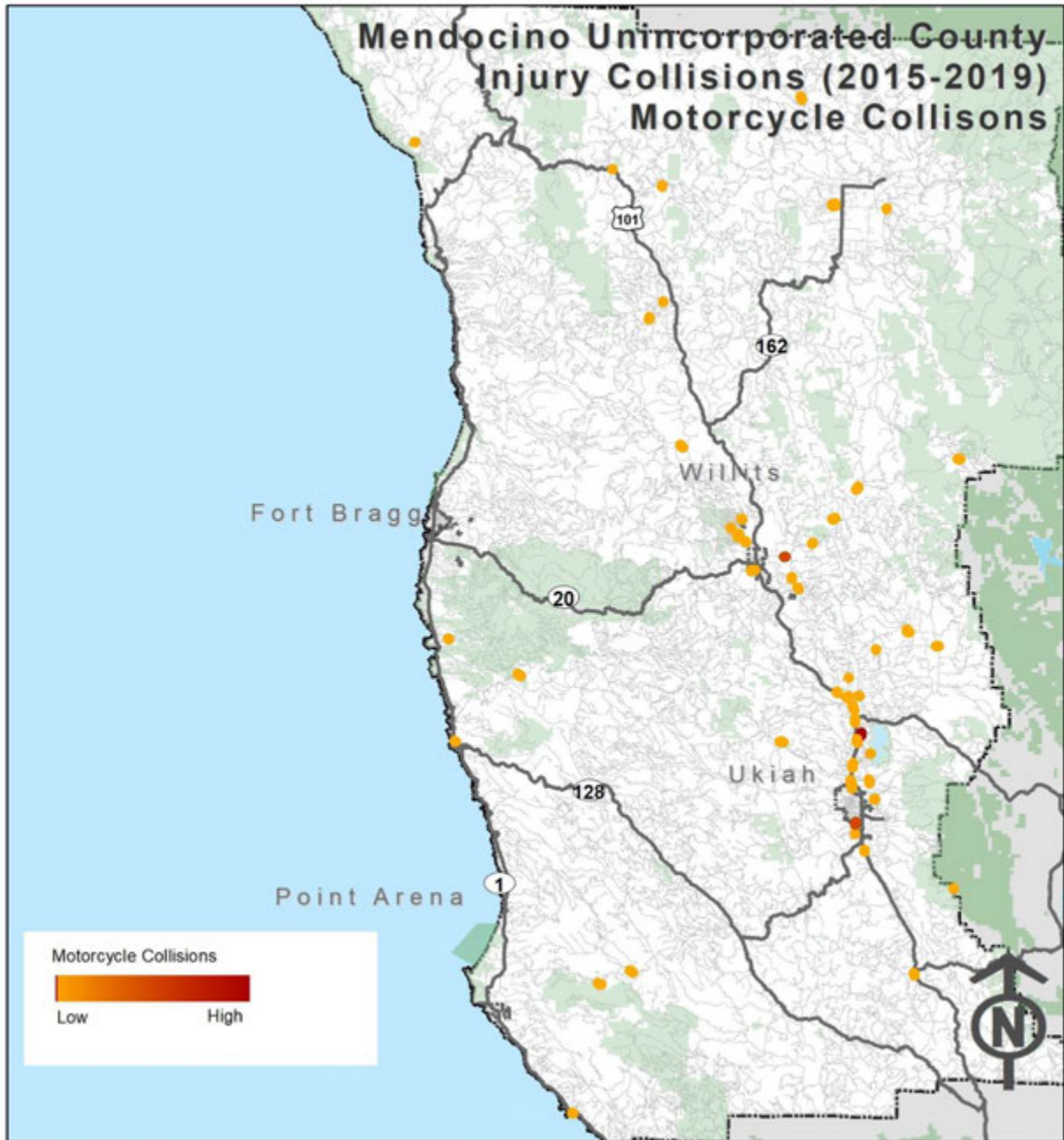
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Figure 37. Unsafe Speed Collisions



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Figure 38. Motorcycle Collisions



Collision Severity Weight

A collision severity weight was used to identify the high severity collision network, using the Equivalent Property Damage Only (EPDO) method. The EPDO method accounts for both the severity and frequency of collisions by converting each collision to an equivalent number of PDO collisions. The EPDO method assigns a crash cost and score to each collision according to the severity of the crash weighted by the comprehensive crash cost. These EPDO scores are calculated using a simplified version of the comprehensive crash costs per HSIP Cycle 10 application. The weights used in the analysis are shown below in **Table 7**.

Table 7. EPDO Score used in HSIP Cycle 10

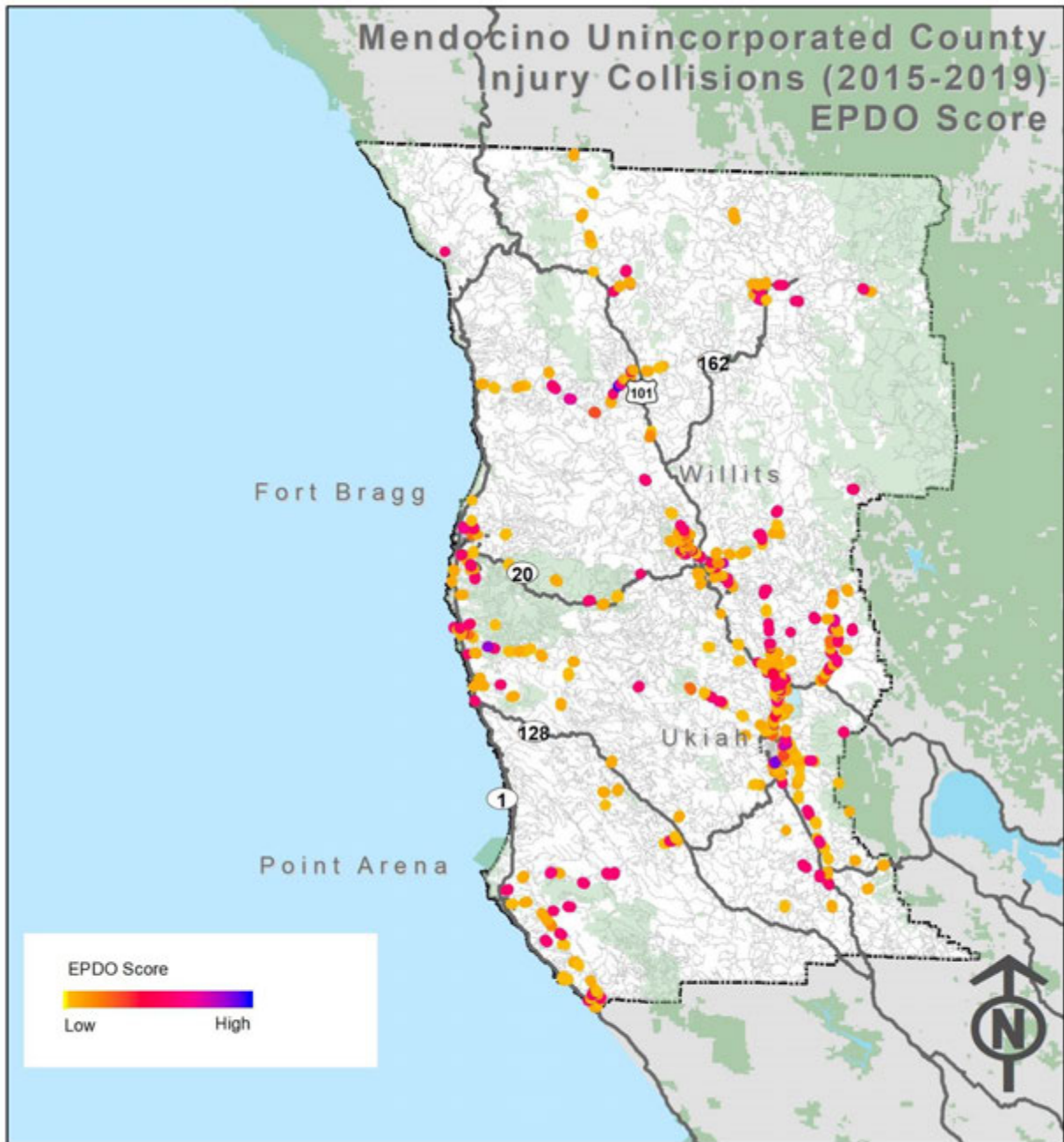
Collision Severity	EPDO Score
F+SI Combined	165*
Visible Injury	11
Possible Injury	6
PDO	1

*This is the score used in HSIP Cycle 10 for collisions on roadways segments, to simplify the analysis this study uses the same score for all F+SI collisions regardless of location

The EPDO scores for all collisions can then be aggregated in a variety of ways to identify collision patterns, such as location hot-spots. The weighted collisions for Unincorporated Mendocino County were geolocated onto Mendocino’s road network. **Figure 39** shows the location and geographic concentration of collisions by their EPDO score.

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Figure 39. Unincorporated Mendocino County EPDO Score



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High-Injury Locations

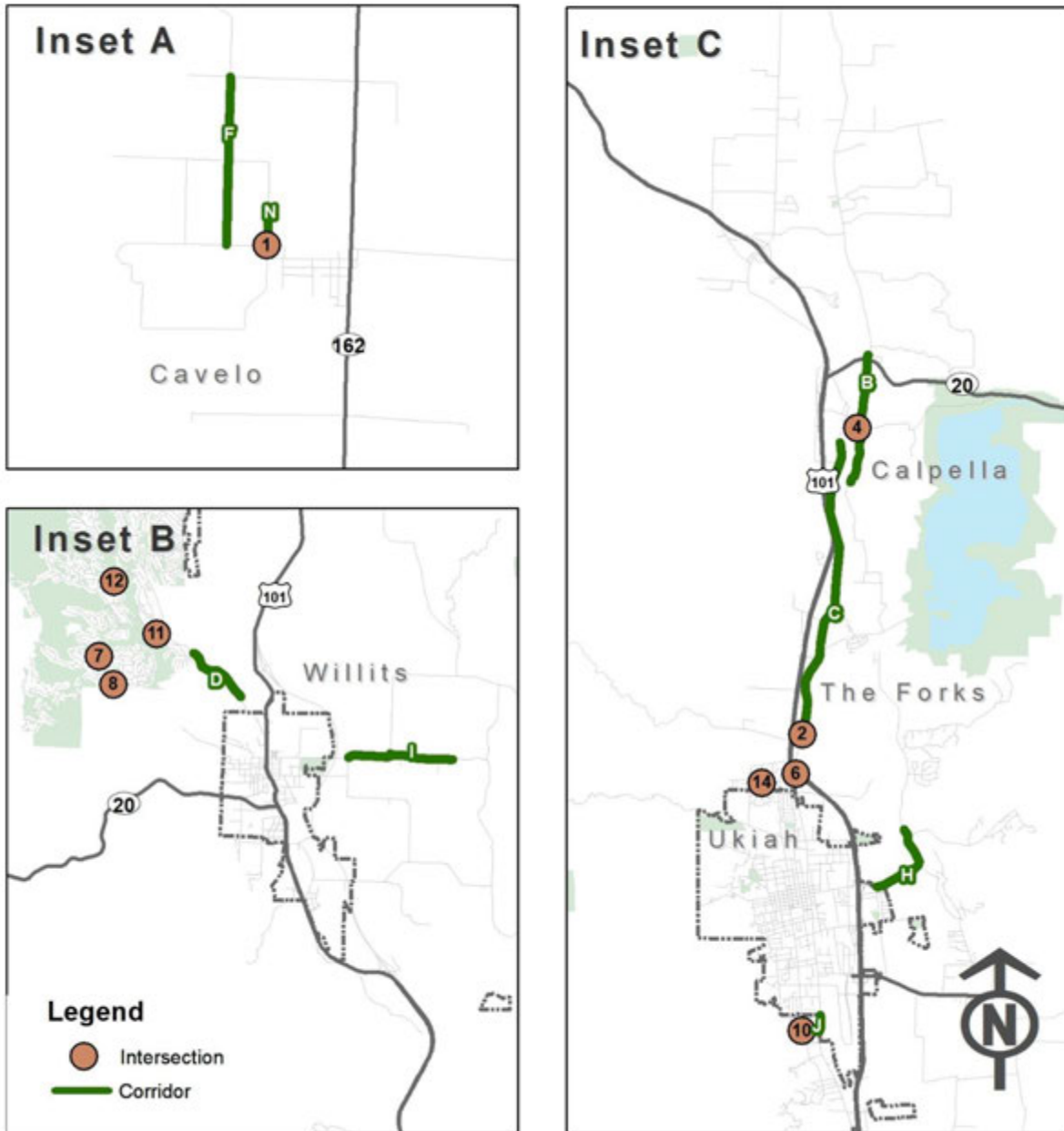
Following the detailed collision analysis in Sections 4 and 5 the next step was to identify the high-risk roadway segments and intersections in Unincorporated Mendocino County. The methodology for scoring the high injury locations is the same method that was used in the collision severity weight section. **Figure 40** and **Figure 41** shows the top 14 high-collision roadway segments, and top 14 high-collision intersections. This high collision network has a total of 145 injury collisions (other visible injury and complaint of pain) and 64 F+SI collisions, which represents 28 percent of injury collisions and 44 percent of F+SI collisions in Unincorporated Mendocino County that have occurred on only about 5 percent of Unincorporated Mendocino County's roadway network.

For the purposes of the high collision network analysis, intersections include collisions that occurred within 250 feet of it and roadways include all collisions that occurred along the roadway except for collisions that occurred directly at an intersection, or collisions that occurred at a distance of 0 feet from the primary and secondary street as listed the SWITRS collision database.

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Figure 41. Unincorporated Mendocino County High Injury Network Insets

Mendocino Unincorporated County
Injury Collisions (2015-2019)
High Injury Network - Insets



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High Injury Intersections

Fourteen intersections were identified as high injury intersections. There were a total of 14 F+SI collisions that occurred at these intersections. The intersection of Foothill Boulevard and Henderson Lane have the highest EPDO score.

Table 8 lists the collision rate of the top 14 identified high-collision intersections along with their collision types and the number of F+SI collisions.

Table 8. High Injury Intersections

ID	Intersection	Total	F+SI	Collisions					EPDO Score
				Hit Object	DUI	Improper Turning	Unsafe Speed	Motor-cycle	
1	Foothill Blvd and Henderson Ln	2	1	1	1	1	0	1	176
2	North State St and Kunzler Ranch Rd ⁸	2	1	1	1	0	0	0	171
3	Pacific Woods Rd and Friendly Ave	2	1	0	1	1	0	0	171
4	Eastside Calpella Rd and Marina Dr	1	1	0	1	0	0	0	165
5	Pacific Woods Rd and Tiger Tail Trail	1	1	1	1	0	0	0	165
6	North State St and 101 On Ramp/Off Ramp	1	1	0	0	0	0	1	165
7	Tulip Dr and Buckeye Dr	1	1	0	0	0	0	0	165
8	Willow Rd and Primrose Dr	1	1	0	0	0	0	0	165
9	Tomki Rd and Fisher Lake Dr	1	1	1	1	0	0	0	165
10	Laws Ave and South Dora St	1	1	0	0	0	1	0	165
11	Birch St and Brooktrails Dr	1	1	1	1	0	0	1	165
12	Primrose Dr and Blue Jay Pl	1	1	0	0	0	1	1	165
13	Lansing St and Ukiah St	1	1	0	0	0	1	0	165
14	Chablis Dr and Carrigan Ln	1	1	0	0	0	0	0	165

⁸ Note: Kunzler Ranch Road is not a County road.

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High Injury Corridors

Fourteen corridors were identified as high injury corridors. There was a total 52 F+SI collisions on these corridors. The corridor with the highest amount of F+SI collisions is on Branscomb Road with 13 F+SI collisions. The corridor with the highest amount of F+SI collisions per mile was Sherwood Road with 5 F+SI collisions in 1.3 miles.

Table 9 lists the EPDO scores of the top 14 identified high-collision corridors along with the number of F+SI collisions and the characteristics of collisions that have occurred.

Table 9. High Injury Corridors

ID	Corridors	Total	F+SI Collisions	Hit Object	DUI	Length (miles)	EPDO Score
A	Branscomb Rd: Willis Ave to Kenny Creek Rd	34	13	26	9	13.3	2197
B	Eastside Calpella Rd: Marina Dr to SR20 On ramp/Off ramp	10	5	4	6	2.3	870
C	North State St: Moore St to Orr Springs Rd	27	4	11	6	4.3	853
D	Sherwood Rd: Birch Terr to Willits City limits	7	5	3	1	1.3	837
E	Comptche Ukiah Rd: Hwy 1 to Mendocino Headlands State Park - Big River Property	9	4	7	2	10.8	702
F	Crawford Rd: Biggar Ln to Foothill Blvd	4	4	1	1	1	660
G	Simpson Ln: Georges Ln to Hills O Home Ln	11	3	5	4	2	552
H	Vichy Springs Rd/Redmeyer Rd: Oak Manor Dr to Redmyer Rd	7	3	5	4	1	529
I	Valley Rd/Hearst Willits Rd: Bray Rd to Live Oak Rd	6	3	4	1	1.3	518
J	South State St: Laws Ave to Beacon Ln	5	2	1	0	0.3	358
K	Mountain View Rd: Between Manchester and Boonville	4	2	3	1	15.3	347
L	Pudding Creek Rd: Tamborini Ln to John Hayman Rd	3	2	2	1	1.3	341
M	Eel River Rd: Gibson Ln to Main St	3	1	2	2	1	187
N	Henderson Ln: Henderson Rd to Foothill Blvd	2	1	1	1	0.5	176

4. 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 Unincorporated Mendocino County. Emphasis areas help in identifying appropriate safety strategies and countermeasures with the greatest potential to reduce collisions occurring at these high injury locations. In addition, traffic safety related concerns were heard at a Stakeholder's Meeting conducted for this plan on June 28, 2021.

This technical memorandum summarizes the top eight emphasis areas identified for Unincorporated Mendocino County. These emphasis areas were derived from the consolidated high injury collision database (**Appendix B**) where top injury factors were identified by combining the data manually. Along with findings from the data analysis, stakeholder input was also considered while identifying emphasis areas specific to Unincorporated Mendocino County.

The following are the identified emphasis areas:

- A. Roadway safety
 - a. Collisions further than 250 feet of intersections
- B. Fixed Object Collisions
- C. Improper Turning Collisions
- D. Nighttime Collisions
- E. DUI Collisions
- F. Unsafe Speed Collisions
- G. Motorcycle Collisions
- H. Younger Adult Party at Fault Collisions

The Four E's OF Traffic Safety

LRSP utilizes a comprehensive approach to safety incorporating "4 E's of traffic safety": **E**ngineering, **E**nforcement, **E**ducation 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 successful implementation of significant safety improvements and reduce the severity and frequency of collisions throughout a jurisdiction.

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

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To improve safety, education efforts can also be used to supplement enforcement. Additionally, education efforts can supplement enforcement to improve the efficiency of each. Education can also be employed in the short-term to address high crash locations until the recommended infrastructure project can be implemented, addressed under Engineering improvements and countermeasures. Similarly, EMS entails strategies around supporting organizations that provide rapid response and care when responding to collisions causing injury, by stabilizing victims and transporting them to facilities.

Existing Traffic Safety Efforts in Mendocino County

Unincorporated Mendocino County has already implemented safety strategies corresponding to the 4 E's of traffic safety. The strategies detailed in this memorandum can supplement these existing programs and concentrate them on high injury collision locations and crash types. These initiatives are summarized in **Table 10** below.

Table 10. Existing Programs Summary

Document/ Program	Description	E's Addressed
Mendocino County Safe Routes to School Plan (2014)	In addition to the Citywide programs, the countywide SRTS is also a resource to a program with a simple goal: helping more children get to school by walking and bicycling.	Engineering Education
Mendocino County Regional Active Transportations Plan (2017)	Details bicycle and pedestrian improvements on County significant corridors. Includes detailed priority bike and pedestrian projects.	Engineering
Mendocino Council of Governments 2020 Regional Transportation Improvement Program (2019)	The Regional Transportation Improvement Program (RTIP) is a program of highway, local road, transit and active transportation projects that a region plans to fund with State and Federal revenue.	Engineering
Sheriff's Department Ongoing Programs and Resources	The Mendocino County Sherriff's Department has an ongoing commitment to enforcing traffic violations at key location throughout the county.	Enforcement
Walk and Bike Mendocino	Walk and Bike Mendocino promotes walking and biking as a primary transportation choice in short distance travel in Mendocino County.	Education
Mendocino County Traffic Safety Review	The Traffic Safety Review program annually collects data and performs special traffic studies to improve the safety of the County maintained road system and cities street system by identifying traffic signing, marking deficiencies and other potential hazards on roads; updating the transportation database; and performing special traffic studies as needed.	Engineering

Factors Considered in the Determination of Emphasis Areas

This section presents collision data analysis of collision type, collision factors, facility type, 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 F+SI injury collisions. In addition to the collision data, emphasis areas were also determined by the feedback received from stakeholders. This section also presents comprehensive programs, policies, and countermeasures to reduce collisions in specific emphasis areas.

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Emphasis Area 1 – Roadway Safety

A total 145 reported collisions occurred on the high injury network of Unincorporated Mendocino County. 132 (91 percent) of these collisions occurred at roadway segment or mid-block locations, including 50 F+SI collisions. The following analysis findings is based on roadway injury collisions on the high injury network in Unincorporated Mendocino County.

64%

Fixed Object collisions

34%

Improper turning

26%

DUI collisions

Table 11. Emphasis Area 1 Strategies

Objective: Reduce the number of F+SI collisions at roadways			
	Strategy	Performance Measure	Agencies/ Organizations
Education	Conduct public information and education campaign for intersection safety laws regarding unsafe speeds, distracted driving, improper turning and driving under the influence.	Number of education campaigns	County/ School District/ Police Department
Enforcement	Targeted enforcement at high-risk roadways to monitor traffic law violations, speed limit laws, DUI checkpoints and other violations that occur along roadways.	Number of tickets issued.	Police Department
Engineering	<ul style="list-style-type: none"> • R01, Add segment lighting • R03, Install median barrier • R04, Install guard rail • R15. Widen shoulder • R21, Improve pavement friction • R22, Install/Upgrade signs with new fluorescent sheeting (regulatory or warning) • R26, Install dynamic / variable speed warnings • R27, Install delineators, reflectors and/or object markers • R28, Install edge lines and centerlines 	Number of roadways improved.	County
EMS	S05, Install emergency vehicle pre-emption systems	EMS vehicle response time.	Mendocino County Local Emergency Services Agency

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Emphasis Area 2 – Fixed Object Collisions

A total 145 reported collisions occurred on the high injury network of Unincorporated Mendocino County. 88 (61 percent) of these collisions were hit object collisions, including 34 F+SI collisions. The following collision analysis findings are based on hit object injury collisions on the high injury network in Unincorporated Mendocino County.

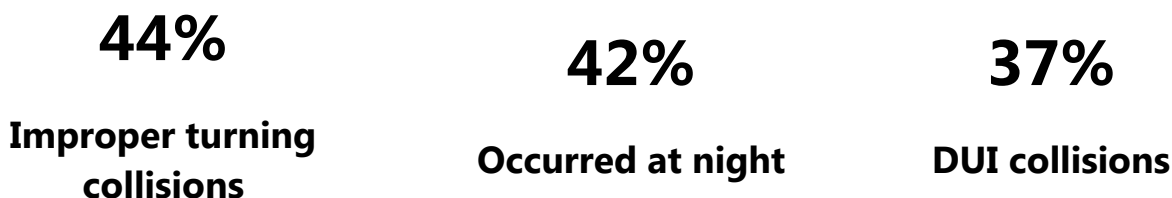


Table 12. Emphasis Area 2 Strategies

Objective: Reduce the number of F+SI collisions that were fixed object collisions			
	Strategy	Performance Measure	Agencies/Organizations
Education	Conduct public information and education campaign for intersection safety laws regarding, unsafe speeds, distracted driving, improper turning and driving under the influence.	Number of education campaigns	County/ School District/ Police Department
Enforcement	Targeted enforcement at high-risk locations.	Number of tickets issued.	Police Department
Engineering	<ul style="list-style-type: none"> R01, Add segment lighting R03, Install median barrier R04, Install guard rail R15, Widen shoulder R21, Improve pavement friction R22, Install/Upgrade signs with new fluorescent sheeting (regulatory or warning) R26, Install dynamic / variable speed warnings R27, Install delineators, reflectors and/or object markers R28, Install edge lines and centerlines 	Number of locations improved.	County
EMS	S05, Install emergency vehicle pre-emption systems	EMS vehicle response time.	Mendocino County Local Emergency Services Agency

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Emphasis Area 3 – Improper Turning Collisions

A total 145 reported collisions occurred on the high injury network of Unincorporated Mendocino County. 47 (32 percent) of these collisions were improper turning collisions, including 16 F+SI collisions. The following collision analysis findings are based on improper turning injury collisions on the high injury network in Unincorporated Mendocino County.

83%

47%

6%

Fixed object collisions

Occurred at night

Overtaken collisions

Table 13. Emphasis Area 3 Strategies

Objective: Reduce the number of fatal and severe improper turning collisions			
	Strategy	Performance Measure	Agencies/ Organizations
Education	Conduct public information and education campaign for safety laws regarding traffic lights, stop signs, and turning left or right.	Number of education campaigns	County/ School District/ Police Department
Enforcement	Targeted enforcement at high-risk locations.	Number of tickets issued.	Police Department
Engineering	<ul style="list-style-type: none"> S02, Improve signal hardware: lenses, back-plates with retroreflective borders, mounting, size, and number S03, Improve signal timing (coordination, phases, red, yellow, or operation) S08, Convert signal to mast arm (from pedestal-mounted) S09, Install raised pavement markers and striping (Through Intersection) S16/NS04/NS05, Convert intersection to roundabout NS06, Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs NS07, Upgrade intersection pavement markings (NS.I.) R01, Add Segment Lighting R22, Install/Upgrade signs with new fluorescent sheeting (regulatory or warning) R27, Install delineators, reflectors and/or object markers 	Number of locations improved.	County
EMS	S05, Install emergency vehicle pre-emption systems	EMS vehicle response time.	Mendocino County Local Emergency Services Agency

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Emphasis Area 4 – Nighttime Collisions

A total 145 reported collisions occurred on the high injury network of Unincorporated Mendocino County. 51 (35 percent) of these collisions were nighttime collisions, including 25 F+SI collisions. The following collision findings are based on nighttime collisions in the high injury network in Unincorporated Mendocino County.

73%

Hit object collisions

49%

DUI collisions

10%

Vehicle/pedestrian collisions

Table 14. Emphasis Area 4 Strategies

Objective: Reduce the number of F+SI collisions that occur at nighttime			
	Strategy	Performance Measure	Agencies/ Organizations
Education	Conduct public information and education campaign for safety laws regarding the larger risk of collisions during the nighttime.	Number of education campaigns	County/ Police Department
Enforcement	Targeted enforcement at high-risk locations to monitor collisions that occur at nighttime.	Number of tickets issued.	Police Department
Engineering	<ul style="list-style-type: none"> S02, Improve signal hardware: lenses, back-plates with retroreflective borders, mounting, size and number S10, Install flashing beacon as warning NS06, Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs R01, Add segment lighting R22, Install/Upgrade signs with new fluorescent sheeting (regulatory or warning) R27, Install delineators, reflectors and/or object markers R26, Install dynamic/ variable speed warning signs R27, Install delineators, reflectors and/or object markers 	Number of locations improved.	County
EMS	S05, Install emergency vehicle pre-emption systems	EMS vehicle response time.	Mendocino County Local Emergency Services Agency

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Emphasis Area 5 – Driving Under the Influence Collisions

A total 145 reported collisions occurred on the high injury network of Unincorporated Mendocino County. 41 (28 percent) of these collisions were driving under the influence collisions (DUI), including 20 F+SI collisions. The following collision findings are based on DUI collisions on the high injury network in Unincorporated Mendocino County.

85%

12%

7%

Fixed object collisions

Overtaken collisions

Head on collisions

Table 15. Emphasis Area 5 Strategies

Objective: Reduce the number of F+SI collisions that are a result of driving under the influence			
	Strategy	Performance Measure	Agencies/ Organizations
Education	Conduct public information and education campaign for safety laws regarding driving under the influence and publicize alternatives.	Number of education campaigns	County/ School District/ Police Department
Enforcement	Targeted enforcement at high-risk locations to monitor driving under the influence.	Number of tickets issued.	Police Department
Engineering	<ul style="list-style-type: none"> S02, Improve signal hardware: lenses, back-plates with retroreflective borders, mounting, size, and number S08, Convert signal to mast arm (from pedestal-mounted) S09, Install raised pavement markers and striping (Through Intersection) S16/NS04/NS05, Convert intersection to roundabout NS06, Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs NS07, Upgrade intersection pavement markings (NS.I) R01, Add Segment Lighting R04, Install guard rail R15, Widen shoulder R22, Install/Upgrade signs with new fluorescent sheeting (regulatory or warning) R27, Install delineators, reflectors and/or object markers 	Number of locations improved.	County
EMS	S05, Install emergency vehicle pre-emption systems	EMS vehicle response time.	Mendocino County Local Emergency Services Agency

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Emphasis Area 6 – Unsafe Speed Collisions

A total 145 reported collisions occurred on the high injury network of Unincorporated Mendocino County. 33 (23 percent) of these collisions were unsafe speed collisions, including 14 F+SI collisions. The following collision findings is based on unsafe speed collisions on the high injury network in Unincorporated Mendocino County.

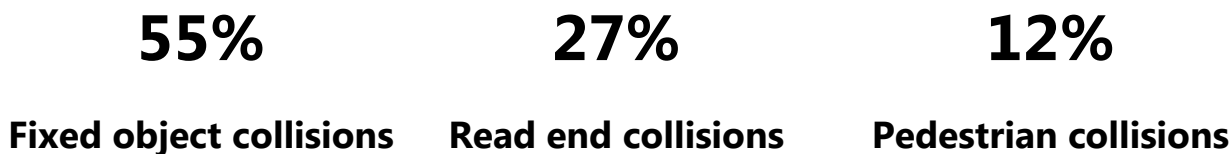


Table 16. Emphasis Area 6 Strategies

Objective: Reduce the number of F+SI collisions that are a result of unsafe speed			
	Strategy	Performance Measure	Agencies/ Organizations
Education	Conduct public information and education campaign for safety laws regarding unsafe speed and its dangers.	Number of education campaigns	County/ School District/ Police Department
Enforcement	Targeted enforcement at high-risk locations to monitor unsafe speed.	Number of tickets issued.	Police Department
Engineering	<ul style="list-style-type: none"> • S16/NS04/NS05, Convert intersection to roundabout • NS06, Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs • NS07, Upgrade intersection pavement markings (NS.I.) • R04, Install guard rail • R15, Widen shoulder • R22, Install/Upgrade signs with new fluorescent sheeting (regulatory or warning) • R27, Install delineators, reflectors and/or object markers • R26, Install dynamic/ variable speed warning signs • R28, Install edge-lines and centerlines • R36PB, Install/upgrade pedestrian crossing (with enhanced safety features) 	Number of locations improved.	County
EMS	S05, Install emergency vehicle pre-emption systems	EMS vehicle response time.	Mendocino County Local Emergency Services Agency

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Emphasis Area 7 – Motorcycle Collisions

A total 145 reported collisions occurred on the high injury network of Unincorporated Mendocino County. 18 (12 percent) of these collisions were motorcycle collisions, including 17 F+SI collisions. The following collision findings are based on motorcycle collisions on the high injury network in Unincorporated Mendocino County.



Table 17. Emphasis Area 7 Strategies

Objective: Reduce the number of F+SI motorcycle collisions			
	Strategy	Performance Measure	Agencies/ Organizations
Education	Conduct public information and education campaign for safety laws regarding motorcycle collisions and motorcyclists' larger risk of F+SI collisions.	Number of education campaigns.	County/ Police Department
Enforcement	Targeted enforcement at high-risk locations to monitor motorcycle collisions.	Number of tickets issued.	Police Department
Engineering	<ul style="list-style-type: none"> • S16/NS04/NS05, Convert intersection to roundabout • NS06, Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs • NS07, Upgrade intersection pavement markings (NS.I.) • R04, Install guard rail • R15, Widen shoulder • R22, Install/Upgrade signs with new fluorescent sheeting (regulatory or warning) • R27, Install delineators, reflectors and/or object markers • R26, Install dynamic/ variable speed warning signs • R28, Install edge-lines and centerlines 	Number of locations improved.	County
EMS	S05, Install emergency vehicle pre-emption systems	EMS vehicle response time.	Mendocino County Local Emergency Services Agency

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Emphasis Area 8 – Younger Adult Party at Fault Collisions

Unincorporated Mendocino County reported a total 145 reported collisions on the high injury network. The following is a review of the demographic data, provided in the party data of the collisions occurring on the high injury network.

62%

Collisions party at fault was aged of 39 or younger

69%

Fatal or severe injury collisions party at fault was a male

Table 18. Emphasis Area 8 Strategies

Objective: Reduce the number of younger adult F+SI collisions.			
	Strategy	Performance Measure	Agencies/Organizations
Education	Target education programs for younger adults. Distribute brochures/fliers with basic red light running, speeding, distracted driving, aggressive driving and stop sign violations information at driver training programs. Include statistics of younger adult larger risks of fatalities.	Number of education campaigns	County/ School District/ Police Department

5. Countermeasure Identification

This section summarizes the process of selecting countermeasures on Unincorporated Mendocino County streets as part of the analysis for the LRSP. Countermeasures were selected for each of the identified high-risk intersections and roadway segments based on extensive review of existing conditions at the site and characteristics of identified collisions on the High Injury Network.

Identified collision factors and existing conditions were cross referenced with the Caltrans LRSM identified countermeasures that are HSIP approved. Countermeasures that best fit the site and had the highest opportunity for systemic implementation were selected. Countermeasures were selected not only for each high-risk location, but also for each identified countywide emphasis area.

Identification of Countermeasures

In 2010, the Federal Highway Administration (FHWA) published a set of three manuals for local and rural road owners to present a simple, data driven safety analysis framework for rural agencies across the country. In conjunction with these documents, California Department of Transportation (Caltrans) developed the LRSM. The goal of this manual is to *“maximize the safety benefits for local roadways by encouraging all local agencies to proactively identify and analyze their safety issues and to position themselves to compete effectively in Caltrans’ statewide, data-driven call-for-projects.”*⁹ Although, the LRSM identifies all of California’s local roadway safety issues and the countermeasures that address them, this document only highlights the issues and countermeasures relevant to the local roads of the Mendocino County. This section identifies the different solutions for the County from HSIP-qualified and non-HSIP countermeasures. It also provides a brief description along with their corresponding crash reduction factors (CRF), expected life and baseline cost. An excerpt of the LRSM, detailing each available HSIP countermeasure referenced in the recommendations tables, is included as **Appendix C**.

The countermeasures have been divided into four categories:

- Signalized (S) – countermeasures only applicable for signalized intersections;
- Non-Signalized (NS) – countermeasures only applicable to stop-controlled, or uncontrolled intersections;
- Roadway Segment (RS) – countermeasures only applicable to roadway segments;
- Other (O) – countermeasures that do not qualify for HSIP funding.

⁹ <https://dot.ca.gov/-/media/dot-media/programs/local-assistance/documents/hsip/2020/lrsm2020.pdf>

Draft Countermeasure Toolbox

Appendix D details the draft countermeasures for each high-risk location and Emphasis Area, separated by intersections and roadway segments. While not all of these countermeasures will be included in the resulting safety projects, they are included to give the County a toolbox for implementing future safety improvements through other means, such as the County's Capital Improvement Program.

Non-Signalized Intersections Countermeasures

- NS01 – Add intersection lighting.** 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).
- Crash Reduction Factor – 40%
 - Expected Life – 20 years
 - Baseline Cost – Approximately \$100,000 per intersection + ongoing cost of electricity
- NS06 – Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs.** 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.
- Crash Reduction Factor – 15%
 - Expected Life – 10 years
 - Baseline Cost – Approximately \$4,200 per intersection
- NS07 – Upgrade intersection pavement markings (NS.I).** 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.
- Crash Reduction Factor – 25%
 - Expected Life – 10 years
 - Baseline Cost – Approximately \$900 per intersection
- NS10 – Install transverse rumble strips on approaches** Provision of 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.
- Crash Reduction Factor – 20%
 - Expected Life – 10 years
 - Baseline Cost – Approximately \$100
- NS11 – Improve sight distance to intersection (Clear Sight Triangles)** 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.
- Crash Reduction Factor – 20%
 - Expected Life – 10 years
 - Baseline Cost – Approximately \$800-5,000

Roadway Countermeasures

R01 – Add segment lighting. 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.

- Crash Reduction Factor – 35%
- Expected Life – 20 years
- Baseline Cost – Approximately \$100,000 + on-going cost of electricity

R02 – Remove or relocate fixed objects outside of Clear Recovery Zone Provisions of a clear zone. A clear zone is an unobstructed, traversable roadside area that allows a driver to stop safely or regain control of a vehicle that has left the roadway. Removing or moving fixed objects, flattening slopes, or providing recovery areas reduces the likelihood of a crash.

- Crash Reduction Factor – 35%
- Expected Life – 20 years
- Baseline Cost – Approximately \$ 15,000-30,000

R22 – Install/Upgrade signs with new fluorescent sheeting (regulatory or warning). The target for this strategy should be on roadway segments with patterns of head on, nighttime, non-intersection, run-off road, and sideswipe crashes related to lack of driver awareness of the presence of a specific roadway feature or regulatory requirement. 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).

- Crash Reduction Factor – 15%
- Expected Life – 10 years
- Baseline Cost – Approximately \$2,000

R23 – Install chevron signs on horizontal curves 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.

- Crash Reduction Factor – 40%
- Expected Life – 10 years
- Baseline Cost – Approximately \$ 15,000

R24 – Install curve advance warning signs 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.

- Crash Reduction Factor – 25%
- Expected Life – 10 years
- Baseline Cost – Approximately \$ 500

R25 – Install curve advance warning signs (flashing beacon) 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.

- Crash Reduction Factor – 30%
- Expected Life – 10 years
- Baseline Cost – Approximately \$ 10,000

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R26 – Install dynamic/variable speed warning signs. 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.

- Crash Reduction Factor – 30%
- Expected Life – 10 years
- Baseline Cost – Approximately \$ 20,000

R27 – Install delineators, reflectors and/or object markers. 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.

- Crash Reduction Factor – 15%
- Expected Life – 10 years
- Baseline Cost – Approximately \$2,000

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.

- Crash Reduction Factor – 25%
- Expected Life – 10 years
- Baseline Cost – Approximately \$10,000

R30 – Install centerline rumble strips/stripes Provisions of rumble strips in the centerline which provide an auditory indication and tactile rumble intended to help drivers who might leave the roadway.

- Crash Reduction Factor – 20%
- Expected Life – 10 years
- Baseline Cost – Approximately \$15,000-20,000

R31 – Install edgeline rumble strips/stripes. Provisions of rumble strips in the edge-line which provide an auditory indication and tactile rumble intended to help drivers who might leave the roadway.

- Crash Reduction Factor – 80%
- Expected Life – 10 years
- Baseline Cost – Approximately \$30,000-80,000

R34PB – Install sidewalk/pathway (to avoid walking along roadway). Sidewalks and walkways provide people with space to travel within the public right-of-way that is separated from roadway vehicles. 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.

- Crash Reduction Factor – 80%
- Expected Life – 20 years
- Baseline Cost – Approximately \$150,000

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R35PB – Install/upgrade pedestrian crossing (with enhanced safety features). 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.

- Crash Reduction Factor – 35%
- Expected Life – 20 years
- Baseline Cost – Approximately \$25,000

Other Countermeasures

Bulb outs/curb extensions. Curb extensions (also called bulb-outs) extend the sidewalk into the parking lane to narrow the roadway and provide additional pedestrian space at key locations; they can be used at corners and at mid-block. Curb extensions enhance pedestrian safety by increasing pedestrian visibility, shortening crossing distances, slowing turning vehicles, and visually narrowing the roadway.

Speed Feedback Signs. Speed feedback signs, also known as dynamic speed displays, provide drivers with feedback about their speed in relationship to the posted speed limit. When appropriately complemented with police enforcement, speed feedback signs can be an effective method for reducing speeds at a desired location.

In Road Yield/stop Signs. In-street pedestrian crossing signs (MUTCD R1-6 or R1-6a) are placed within the roadway, either between travel lanes or in a median. The sign may be used to remind road users of laws regarding right-of-way at an unsignalized pedestrian crossing. This countermeasure is used with other crosswalk visibility enhancements to indicate optimal or preferred locations for people to cross and to help reinforce the driver requirement to yield the right-of-way to pedestrians at crossing locations.

6. Safety Projects

High-Collision Network Projects

This technical memorandum summarizes the process of selecting safety projects as part of the analysis for Unincorporated Mendocino County LRSP. The next step after the identification of high-risk locations, emphasis areas and applicable countermeasures was to identify location specific safety improvements for all high-risk roadway segments and intersections.

Specific countermeasures and improvements were selected from the 2020 LRSM, where:

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

The corresponding number refers to the countermeasure number in the LRSM (2020). The countermeasures were grouped into safety projects for high-risk intersections and roadway segments. A total of eight safety projects were developed. All countermeasures were identified based on the technical teams' assessment of viability that consisted of extensive analysis, observations, and County staff input. The most applicable and appropriate countermeasures as identified have been grouped together to form projects that can help make high-risk locations safer.

Table 19 lists the safety projects for high-risk intersections and roadway segments, along with total base planning level cost (2021 dollar amounts) estimates and the resultant preliminary Benefit-Cost (B/C) Ratio. The "Total Benefit" estimates were calculated for the proposed improvements being evaluated in the proactive safety analysis. This "Total Benefit" is divided by the "Total Cost per Location" estimates for the proposed improvements, giving the resultant B/C Ratio. The B/C Ratio Calculation follows the methodology as mentioned in the LRSM (2020).

Attachment E lists the detailed methodology to calculate B/C Ratio, the complete cost, benefit and B/C Ratio calculation spreadsheet.

The next step in the process will be to prepare grant ready materials for HSIP Cycle 11 applications. TJKM has scoped to provide the County with materials for up to two applications. However, it should be noted that while the LRSP projects were based on high-risk locations, HSIP applications can be expanded to include many locations across the county.

Once the three desired projects are selected, our team recommends three potential options for selecting locations to include in the HSIP applications:

- Select the top projects ranked by crash cost
- County identifies desired intersections
- Apply for various intersections countywide with more generic cost estimates

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These safety projects were chosen based on the previously completed collisions analysis, which was used to identify main collision attributes that were found to be leading factors of fatal and severe collisions in Unincorporated Mendocino County. These collision factors were identified to be hit object collisions, improper turning, and unsafe speed collisions.

For collisions of all severity, including PDO collisions, 53 percent of collisions were hit object collisions, most of these occurred along roadway segments. Locations with higher amounts of hit object collisions include Branscomb Road, North State Street, Comptche Ukiah Road, and Vichy Springs Road. Recommended improvements at these locations include installing shoulder rumble strips, widening shoulders, installing signs with fluorescent sheeting, installing chevron signs at horizontal curves, and installing Install delineators, reflectors and/or object markers.

For F+SI collisions, 26 percent of collisions were improper turning collisions. Locations with higher amounts of improper turning collisions include Foothill Boulevard and Henderson Lane and Pacific Woods Road and Friendly Avenue. Recommended intersection improvements at these locations include installing larger or additional stop signs or other intersection warning/regulatory signs, upgrade intersection pavement markings and install traverse rumble strips on approaches.

For F+SI collisions, 19 percent of collisions were unsafe speed collisions, most of these occurred along roadway segments. Roadways with higher amounts of unsafe speed collisions include North State Street and Comptche Ukiah Road. Recommended improvements at these locations include installing dynamic variable speed warning signs.

Table 19. List of Viable Safety Projects

Location	CM1	CM2	CM3	Cost per Location	B/C Ratio
Project 1: Systemic Improvements at Unsignalized Intersections					
Foothill Blvd and Henderson Ln	NS01	NS06	NS07	\$39,371	158.50
Pacific Woods Rd and Friendly Ave		NS06	NS07	\$1,870	
Eastside Calpella Rd and Marina Dr		NS06		\$980	
Pacific Woods Rd and Tiger Tail Trail		NS06	NS07	\$2,094	
North State St and 101 On Ramp/Off Ramp		NS06		\$2,940	
Tulip Dr and Buckeye Dr	NS01	NS06	NS07	\$35,941	
Willow Rd and Primrose Dr		NS06		\$980	
Tomki Rd and Fisher Lake Dr		NS06	NS07	\$2,339	
Laws Ave and South Dora St	NS01	NS06		\$43,400	
Birch St and Brooktrails Dr		NS06	NS07	\$2,150	
Primrose Dr and Blue Jay Pl		NS06		\$700	
Lansing St and Ukiah St		NS06		\$2,800	

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Location	CM1	CM2	CM3	Cost per Location	B/C Ratio
Chablis Dr and Carrigan Ln		NS06		\$700	
Biggar Ln and Hwy 162 Intersection		NS06	NS07	\$1,042	
Vichy Springs Rd and Redemyer Rd		NS06		\$280	
Mill Creek Rd and Old River Rd		NS06		\$280	
Project 2: Systemic Improvements at Unsignalized Intersections					
Pacific Woods Rd and Friendly Ave	NS10			\$140	65.42
Eastside Calpella Rd and Marina Dr	NS10	NS11		\$7,140	
Pacific Woods Rd and Tiger Tail Trail	NS10			\$1,042	
Primrose Dr and Blue Jay Pl	NS10			\$140	
Mill Creek Rd and Old River Rd	NS10			\$140	
Lansing St and Ukiah St		NS11		\$1,120	
Project 3: Systemic Roadway Segment Improvements					
Branscomb Rd: Willis Ave to Kenny Creek Rd	R22			\$40,500	300
Eastside Calpella Rd: Marina Dr to SR 20 On Ramp/Off Ramp	R22			\$6,300	
North State St: Moore St to Orr Springs Rd	R22			\$6,300	
Sherwood Rd: Birch Terr to Willits City limits	R22			\$15,300	
Comptche Ukiah Rd: Hwy 1 to Mendocino Headlands State Park - Big River Property	R22			\$10,800	
Crawford Rd: Biggar Ln to Foothill Blvd				\$11,100	
Simpson Ln: Georges Ln to Hills O Home Ln	R22			\$10,350	
Vichy Springs Rd/Redmeyer Rd: Oak Manor Dr to Redmyer Rd	R22			\$16,200	
Valley Rd/Hearst Willits Rd: Bray Rd to Live Oak Rd	R22			\$3,650	
South State St: Laws Ave to Beacon Ln	R22			\$29,900	
Mountain View Rd: Between Manchester and Boonville	R22			\$16,250	

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Location	CM1	CM2	CM3	Cost per Location	B/C Ratio
Pudding Creek Rd: Tamborini Ln to John Hayman Rd	R22			\$2,700	
Eel River Rd: Gibson Ln to Main St				\$900	
Henderson Ln: Henderson Rd to Foothill Blvd	R22			\$13,050	
Project 4: Systemic Improvements on Roadway Segments					
Branscomb Rd: Willis Ave to Kenny Creek Rd	R23		R24	\$22,120	1,044.61
Eastside Calpella Rd: Marina Dr to SR 20 On Ramp/Off Ramp	R23		R24	\$2,632	
North State St: Moore St to Orr Springs Rd		R27		\$896	
Sherwood Rd: Birch Terr to Willits City limits	R23			\$2,240	
Comptche Ukiah Rd: Hwy 1 to Mendocino Headlands State Park - Big River Property		R27	R24	\$2,576	
Vichy Springs Rd/Redmeyer Rd: Oak Manor Dr to Redmyer Rd		R27		\$392	
Valley Rd/Hearst Willits Rd: Bray Rd to Live Oak Rd		R27		\$2,240	
Mountain View Rd: Between Manchester and Boonville	R23		R24	\$61,040	
Pudding Creek Rd: Tamborini Ln to John Hayman Rd		R27		\$1,792	
Eel River Rd: Gibson Ln to Main St		R27		\$1,064	
Henderson Ln: Henderson Rd to Foothill Blvd		R27		\$504	
Project 5: Systemic Pedestrian Safety Improvements					
Crawford Rd: Biggar Ln to Foothill Blvd	R34PB			\$1,734,040	15.55
South State St: Laws Ave to Beacon Ln	R34PB	R35PB		\$899,150	
Project 6: Roadway Safety Improvements					
Valley Rd/Hearst Willits Rd: Bray Rd to Live Oak Rd	R02			\$21,000	116.36
Mountain View Rd: Between Manchester and Boonville	R02			\$42,000	
Pudding Creek Rd: Tamborini Ln to John Hayman Rd	R02			\$21,000	

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Location	CM1	CM2	CM3	Cost per Location	B/C Ratio
Eel River Rd: Gibson Ln to Main St		R31		\$116,480	
Project 7: Roadway Safety Improvements					
Branscomb Rd: Willis Ave to Kenny Creek Rd		R25		\$28,000	323.37
Crawford Rd: Biggar Ln to Foothill Blvd	R30			\$29,568	
Henderson Ln: Henderson Rd to Foothill Blvd			R28	\$9,450	

Notes: CM – countermeasure. B/C ratio is the dollar amount of benefits divided by the cost of the countermeasure. NS01- Add intersection lighting (NS.I.), NS06- Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs, NS07- Upgrade intersection pavement markings (NS.I.), NS10 – Install traverse rumble strips on approaches, NS11-Improve sight distance to intersection, R01- Add segment lighting, R02 - Remove or relocate fixed objects outside of Clear Recovery Zone, R22- Install/Upgrade signs with new fluorescent sheeting (regulatory or warning), 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, R30 - Install centerline rumble strips/stripes, R31- Install edge line rumble strips/stripes, R34PB – Install sidewalk/pathway, R35PB- Install/upgrade pedestrian crossing (with enhanced safety features)

Costs include contingency, PS&E, environmental and construction costs

HSIP Applications

The next step will be to prepare HSIP grant ready materials, so that the County may submit them for HSIP Cycle 11 funding in 2022. Based on the discussion and recommendation from the County Staff, the HSIP Application can be a combination of a few projects as identified in this plan.

7. Evaluation and Implementation

This chapter describes the steps the County may take to evaluate the success of this plan and steps needed to update the plan in the future. The LRSP is a guidance document and requires periodic updates to assess its efficacy and re-evaluate potential solutions. It is recommended to update the plan every two to five years in coordination with the 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. The implementation of strategies under each emphasis area would aim to reduce F+SI collisions in the coming years.

Funding is a critical component of implementing any safety project. While the HSIP program is a common source of funding for safety projects, there are numerous other funding sources that could be pursued for such projects. Potential funding sources are listed below in **Table 20**.

Table 20. Potential Funding Sources

Funding Source	Funding Agency	Amount Available	Next Estimated Call for Projects	Applicable E's	Notes
Active Transportation Program	Caltrans, California Transportation Commission	~\$223 million per year	2022	Engineering, Education	Can use used for most active transportation related safety projects as well as education programs
Highway Safety Improvement Program (HSIP)	Caltrans	TBD	Early 2022	Engineering	Most common grant source for safety projects
Surface Transportation Block Group Program	FHWA (Administered through MCTC)	Varies by FY	TBD	Engineering	Typically used for roadway projects
Congestion Mitigation and Air Quality (CMAQ)	FHWA (Administered through MCTC)	Varies by FY	TBD	Engineering	Focused on projects that improve air quality
Office of Traffic Safety Grants	California Office of Traffic Safety	Varies by grant	Closes January 31 st annually	Education, Enforcement, Emergency Response	10 grants available to address various components of traffic safety
Affordable Housing and Sustainable	Strategic Growth Council and Dept. of Housing	~\$405 million	2022	Engineering, Education	Must be connected to affordable housing projects; typically focuses

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Funding Source	Funding Agency	Amount Available	Next Estimated Call for Projects	Applicable E's	Notes
Communities Program	and Community Development				on bike/ped infrastructure/programs
Urban Greening	California Natural Resources Agency	\$28.5 million	2022	Engineering	Focused on bike/pedestrian infrastructure and greening public spaces
Local Streets and Road Maintenance and Rehabilitation	CTC (distributed to local agencies)	\$1.5 billion statewide	N/A; distributed by formula	Engineering	Typically pays for road maintenance type projects
RAISE Grant	USDOT	~\$1 billion	2022	Engineering	Typically used for larger infrastructure projects
Sustainable Transportation Equity Project	California Air Resources Board	~\$19.5 million	TBD; most recent call in 2020	Engineering, Education	Targets projects that will increase transportation equity in disadvantaged communities
Transformative Climate Communities	Strategic Growth Council	~\$90 million	TBD; most recent call in 2020	Engineering	Funds community-led projects that achieve major reductions in greenhouse gas emissions in disadvantaged communities.

Implementation

The LRSP document provides engineering, education, enforcement, and EMS related countermeasures that can be implemented throughout the County to reduce F+SI collisions. It is recommended that the Unincorporated Mendocino County implement the selected projects high-collision locations in coordination with other projects proposed for the County's infrastructure development in their future Capital Improvement Plans.

The success of the LRSP can be achieved by fostering communication among the County and the safety partners.

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Monitoring and Evaluation

For the success of the LRSP, it is crucial to monitor and evaluate the 4 E-strategies continuously. Monitoring and evaluation help provide accountability, ensures the effectiveness of the countermeasures for each emphasis area, and help making 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 F+SI collisions
- Number of police citations
- Number of public comments and concerns

Evaluation should be conducted during similar time periods and durations each year. The most important measure of success of the LRSP should be reduction in F+SI collisions throughout the County. If the number of F+SI 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 E's strategies in each emphasis area, the next LRSP update can be tailored to resolve any continuing safety problems. The Unincorporated Mendocino County's Public Works Department will be accountable for the progress of the plan goals. An annual stakeholder meeting with the safety partners is also recommended to discuss the progress for each emphasis area and oversee the implementation plan. The document should then be updated as per the latest collision data, emerging trends, and the E's strategies' progress and implementation.

Appendices

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**APPENDIX A: TABLE OF POLICIES AND PROJECTS FROM THE
LITERATURE REVIEW**

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Matrix of Planning Goals, Policies, and Projects

Document	Highlights
<p>County of Mendocino General Plan (2009)</p>	<ul style="list-style-type: none"> • Policy DE-123 supports improving the effectiveness of alternative transportation modes within the county by developing inter-modal terminals for both freight and passenger services. • Policy DE-131 supports development of secondary neighborhood routes to alleviate congestion on major streets. • Policy DE-136 supports evaluating alternative transportation and system efficiency options before widening roads. • Policy DE-147 supports the connection of pedestrian, bicycle, and trail routes to form networks and maximize non-motorized transportation. • Policy DE-149 requires pedestrian and bicycle facilities (or in-lieu fees) be installed with new development. • Policy DE-152 promotes the development of trails and bicycle paths along abandoned railroad right-of-way. • Policy DE-154 promotes the use of transit and multi-modal transportation in community areas.
<p>Mendocino County Regional Active Transportation Plan (2017)</p>	<p>Goals</p> <ul style="list-style-type: none"> • To improve our public spaces so the street, road and transportation system meets the needs of all surface transportation modes, including vehicular, bicycle, pedestrian, and transit. • Provide a safe and useable network of bicycle and pedestrian facilities throughout the region as a means to lessen dependence on vehicular travel and improve the health of Mendocino County’s residents. • Maximize investment in non-motorized transportation facilities through maintenance. <p>Evaluation</p> <ul style="list-style-type: none"> • The Five Es—education, encouragement, engineering, enforcement, and evaluation—have been identified as categories that represent essential components of a successful active transportation plans and networks. <p>Short Range Priority Improvements:</p> <ul style="list-style-type: none"> • Branscomb Road Multi Use Bridge: Pre-fab 8’ wide bridge over Ten Mile Creek, alongside vehicular bridge. • SRTS Grace Hudson: Sidewalks on Jefferson between State and school entry; enhanced crosswalk across driveway. • SRTS Laytonville: Enhanced crosswalk across Ramsey Road from parking lot to front of school, with ramp and signs Sidewalk/walkway on east side of Willis Avenue, between Ramsey and existing sidewalk near middle school. • SRTS Covelo: Sidewalk along airport road and south side of Howard, reconfigure the intersection of Howard and Airport Way; Reconfigure parking area w/ped walkway between school and path; Enhanced crossing of northern school driveway connecting with trail. • Anderson Valley Way Class III Bike route/Recreational Trail: Class III bike route along Anderson Valley Way connecting to a recreational trail Bike/Multiuse. <p>Long Range Priority Improvements:</p> <ul style="list-style-type: none"> • SRTS Anderson Valley: Class I multi use path parallel to SR 128 with connection to school. • Brooktrails to Willits – Multi-Use Trail: This is a recognized need, however, no route or details have been developed. • Rail Trail – Brush Street to Lake Mendocino Drive: 10 foot paved multi-use trail along the NWP rail line, 2.1 miles in length.

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Document	Highlights
<p>Mendocino County Safe Routes to School Plan (2014)</p>	<p>Goal 1: Improve the health of Mendocino County children by focusing attention on and increasing active travel to school.</p> <p><i>Objective A: Increase the number of students walking and bicycling to school</i></p> <p><i>Objective B: Annually increase the number of children exposed to SRTS education and encouragement activities</i></p> <p><i>Objective C: Increase the number of county residents that are familiar with SRTS and resources available</i></p> <p>Goal 2: Support school travel routes that are accommodating, safe, convenient, and “complete” for all modes.</p> <p><i>Objective A: Increase funding for walking, bicycling and transit investments near schools</i></p> <p><i>Objective B: Review school connections and potential SRTS needs during project development for all county roads</i></p> <p><i>Objective C: Incorporate SRTS policies, priorities, and design guidance into future county general plan updates</i></p> <p><i>Objective D: Limit traffic speeds and volumes along key routes to schools</i></p> <p>Goal 3: Maximize interagency cooperation in all SRTS project and programs in an effort to build a sustainable program.</p> <p><i>Objective A: Establish an ongoing countywide SRTS program that serves all interested schools in Mendocino County.</i></p> <p><i>Objective B: Seek and secure outside grant funding for SRTS programs and activities, and leverage local funding for school area improvements</i></p>
<p>Mendocino County Rail-with-Trail Corridor Plan (2012)</p>	<ul style="list-style-type: none"> • GOAL 1: Improve Non-Motorized Mobility and Accessibility - Expand and enhance non-motorized mobility for persons living in, working in, and visiting Mendocino County, including access to and connections with other transportation modes. • GOAL 2: Preserve the Transportation System - Design a RWT that will efficiently utilize the NWP corridor, support the region's current blueprint planning efforts which calls for improved options for bicycling, walking, and equestrians, and allow for future rail service along the NWP line. • GOAL 3: Enhance Public Safety and Security - Design the RWT segments to respond to safety and security needs as well as neighborhood privacy concerns. • GOAL 4: Reflect Community Values - Promote community values and identity, including use by multiple user groups, such as bicyclists, pedestrians, and equestrians (where feasible) and incorporate public involvement in decision making processes. • GOAL 5: Enhance the Environment - Assist in greenhouse gas reduction by encouraging and facilitating non-motorized vehicle trips. • GOAL 6: Allow for Regional Connections- Provide non-motorized connections to adjacent streets and land uses including transit, shopping, institutional, office, and residential areas. • GOAL 7: Implementation Funding - Develop a funding, financing, and implementation strategy identifying eligible grant sources and/or potential development requirements supporting construction. • Priority Project • Bush Street to Lake Mendocino Drive
<p>Mendocino Council of Governments Transportation</p>	<ul style="list-style-type: none"> • Work Element 4 - Sustainable Transportation Planning: is a work element to support the goals of SB 375 and AB 32 to reduce greenhouse gas emission and respond and conduct sustainable transportation planning.

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Document	Highlights
Planning Work Program FY 2020/2021	<ul style="list-style-type: none"> • Work Element 9 – Regional and Active Transportation Plans Update: This element will allow staff to begin the planning and public outreach process to the Regional and Active Transportation Plans. • Work Element 16 – Multi-Modal Transportation Planning: Covers day to day bicycle, pedestrian, rail and transit planning activities.
Mendocino Council of Governments 2020 Regional Transportation Improvement Program (2019)	<p>Projects</p> <ul style="list-style-type: none"> • Gualala Downtown Streetscape - Construct new pedestrian walkways and Class II bike lanes on SR 1 through downtown Gualala. The 64' wide streetscape will have two 12' travel lanes, two 5' bike lanes, two 1' buffers between the bike lanes, two 8' parking lanes, and two 6' sidewalks. • North State Street Intersection and Interchange Improvements - Construction of a roundabout will reduce vehicle idling at the intersection. The project will improve operation at the US 101 off ramp that feeds into it. The STIP funded project will complete improvements to the location that will be partially funded through other sources. • Ukiah Downtown Streetscape, Phase 2 • S. Main St Bicycle and Pedestrian Access Project – Fort Bragg • North Bush and Low Gap Road Roundabout
2017 Mendocino County Regional Transportation Plan (2018)	<p>State Highway System Improvements:</p> <p>Long Range Improvements:</p> <ul style="list-style-type: none"> • Project to address closure of SR 1 during flooding of the Garcia River • Operational and/or safety improvements at US 101 interchanges in the Ukiah area • Pedestrian safety enhancements on US 101 through Laytonville • Gualala Downtown Streetscape Bicycle and Pedestrian Improvements on SR 1 <p>Long Range Improvements</p> <ul style="list-style-type: none"> • Construction of the Willits Bypass, Phase II • Construction of interchange improvements on US 101 in the Ukiah area • Various safety improvements along SR 1 <p>County Roads and City Street:</p> <p>Short Range Improvements:</p> <ul style="list-style-type: none"> • Construction of the East Side Potter Valley Road reconstruction • Gobbi Street/Waugh Lane Intersection Signalization • Ukiah Downtown Streetscape Improvements • North State Street Intersection Improvements • East Perkins Widening • Various Rehabilitation and Maintenance, including Bridge Rehabilitation <p>Long Range improvements:</p> <ul style="list-style-type: none"> • North State Street Roundabouts, Phase II • East Side Potter Valley Road Widening, Phase II (MP 4.70 to 6.40) • Orchard Avenue Extension • Circulation improvements in Willits to deal with post-bypass needs • Development of route parallel to Main Street in Fort Bragg, through the Georgia-Pacific property to meet future development needs • Roundabout at Lake Street and SR 1 in Point Arena

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Document	Highlights
<p>Mendocino County Pedestrian Facility Needs Inventory and Engineered Feasibility Study (2019)</p>	<p>Projects</p> <p>Tier 1 Unincorporated South Coast Communities</p> <ul style="list-style-type: none"> • Gualala North Downtown Sidewalk and Crossing Improvements Project – State Highway • Central Elk Pedestrian Improvements – State Highway <p>Tier 1 Unincorporated North Cost/Inland Areas</p> <ul style="list-style-type: none"> • Laytonville Highway 101 Pedestrian Improvements • Southern Highway 162 Pedestrian Improvements • Laytonville Elementary School Pedestrian Improvements • Hopland Highway 101 Complete Street Improvements
<p>Mendocino Council of Governments Active Transportation Program Safe Routes to School Non-Infrastructure Grant Report (2018)</p>	<p>Programs</p> <ul style="list-style-type: none"> • Implement SRTS Activities • Develop SRTS Task Force • Revise School Wellness Policies • Provide technical assistance to institutionalize and sustain SRTS activities • Train crossing guards as needed • Increase Student Participation in SRTS Activities • Coordinate contests – e.g., mileage tracking • Increase access to bikes/helmets • Provide school-based safety education • Develop walk/bike maps for each site • Work with high school students to assist with and provide role models at events • Increase enforcement • Advocate for increased enforcement during school drop-off and pick-up hours • Advocate with Animal Control /law enforcement for enforcement of dog leash laws
<p>County of Mendocino FY 2020-21 Adopted Budget</p>	<ul style="list-style-type: none"> • Complete construction of the pavement rehabilitation project. • Completed design and engineering for pavement rehabilitation project and secured funding for construction.

Unincorporated Mendocino County
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APPENDIX B. CONSOLIDATED COLLISION DATABASE

Case ID	Accident Year	Collision Date	Primary Road	Secondary Road	Distance	Direction	Collision Severity
6792166	2015	1/20/2015	LAWS AV	SOUTH STATE ST	405	W	4
6804825	2015	1/17/2015	BRANSCOMB RD	CAHTO PEAK RD	2808	W	2
6805281	2015	1/14/2015	VICHY HILLS DR	WATSON RD	464	N	4
6806188	2015	1/20/2015	COUNTY ROAD 309	HEARST/WILLITS RD	1056	E	2
6817690	2015	2/11/2015	BRANSCOMB RD	NORTH RD	281	E	3
6849446	2015	1/15/2015	EAST CALPELLA RD	COUNTY ROAD 144	279	S	2
6856782	2015	3/14/2015	BRANSCOMB RD	MULLIGAN LN	500	W	3
6861245	2015	3/22/2015	MOUNTAIN VIEW RD	RANCHERIA RD	17424	E	4
6928289	2015	5/19/2015	COMPTCHE UKIAH RD	RT 1	3696	E	3
6928301	2015	5/14/2015	NORTH STATE ST	PARDUCCI RD	528	N	4
6928906	2015	5/12/2015	PACIFIC WOODS RD	TIGER TAIL TR	0		2
6957682	2015	5/23/2015	LAKE MENDOCINO DR	RT 101	528	E	2
6958311	2015	5/9/2015	NORTH STATE ST	AGNES LN	1056	S	2
6964444	2015	6/2/2015	BRANSCOMB RD	BAUER RD	254	W	2
6968967	2015	6/1/2015	COUNTY ROAD A	EAST RD	317	E	3
6972133	2015	5/29/2015	VALLEY RD	DAVIDSON RD	360	E	3
6980299	2015	6/10/2015	VICHY SPRINGS RD	OAK MANOR DR	528	E	3
6980303	2015	6/8/2015	EEL RIVER RD	GIBSON LN	1056	S	3
90015171	2015	8/25/2015	COUNTY ROAD A	DUSTY RD	790	E	3
90020445	2015	8/14/2015	COMPTCHE UKIAH RD	SR-1	1848	W	3
90023590	2015	9/15/2015	EEL RIVER ROAD	GIBSON LN	1077	S	3
90024829	2015	9/27/2015	LOVERS LN	KUKI RD	528	N	3
90025941	2015	9/28/2015	VAN ARSDALE RD	TODD RD	1824	N	4
90027742	2015	9/29/2015	SHERWOOD ROAD	NORTH MAIN STREET	3696	N	2
90027818	2015	9/26/2015	MOUNTAIN VIEW RD.	SR-1	46306	E	2
90032876	2015	10/11/2015	MOUNTAIN VIEW RD	RANCHERIA RD	22704	E	3
90034919	2015	10/12/2015	N STATE STREET	POMO DR	528	N	4
90039289	2015	10/19/2015	BRANSCOMB RD	WEST WINCHESTER SUBDI	7392	W	3
90042599	2015	10/25/2015	VICHEY SPRINGS RD	OAK MANOR DR	1056	E	4
90044069	2015	10/21/2015	NORTH STATE STREET	EAST HOPKINS STREET	608	S	3
90048930	2015	10/29/2015	NORTH STATE STREET	KUNZLER RANCH ROAD	648	N	4
90049232	2015	8/31/2015	N. STATE STREET	3RD STREET	580	S	3
90051622	2015	11/1/2015	N. STATE ST.	CENTRAL AVE.	528	N	2
90054097	2015	11/3/2015	VICHY SPRINGS RD	OAK MANOR DR.	1056	E	2
90069386	2015	10/25/2015	BRANSCOMB ROAD	CAHTO TROUT FARM	1056	E	1
90072445	2015	12/7/2015	VALLEY ROAD	DAVIDSON ROAD	530	E	4
90088769	2016	1/2/2016	SIMPSON LN	REDWOOD SPRINGS DR.	870	W	3
90089201	2015	12/8/2015	CENTER VALLEY RD	SAWYERS LN	870	W	1
90092004	2015	12/13/2015	N. STATE ST	CENTRAL AVE	1054	S	3
90093180	2016	1/7/2016	COMPTCHE UKIAH RD	SR-1	19008	E	3
90113408	2016	2/5/2016	COMPTCHE UKIAH RD	SR-1	19008	E	2
90128909	2016	2/28/2016	N. STATE ST.	LAKE MENDOCINO DR	413	N	4
90131661	2016	2/24/2016	BRANSCOMB ROAD	CR 429 B	23760	W	3
90142725	2016	3/7/2016	HENDERSON LANE	FOOTHILL BLVD	34	N	3
90158986	2016	4/2/2016	SIMPSON LN	ELLISON WAY	3696	E	3
90158990	2016	3/16/2016	MARINA DR	EASTSIDE CALPELLA RD	438	E	2
90164275	2016	4/4/2016	PUDDING CREEK RD.	JOHN HYMAN RD.	1056	E	2
90178863	2016	4/30/2016	PACIFIC WOODS RD	FRIENDLY AVE	234	E	4
90185737	2016	5/15/2016	COUNTY ROAD 429 (BRANSC	E. PROLONGATION EDGE (291	E	4
90191221	2016	4/23/2016	N. STATE ST.	KUNZLER RANCH ROAD	137	S	2
90194867	2016	5/19/2016	EASTSIDE CALPELLA ROAD	DEGHI LANE	2112	N	3
90204829	2016	2/26/2016	VICHY SPRINGS ROAD	REDEMEYER RD	567	W	1
90216384	2016	6/20/2016	FORT BRAGG-SHERWOOD RI	DENNISON LN	394	E	3
90216388	2016	6/20/2016	FORT BRAGG-SHERWOOD RI	DENNISON LN	410	E	3
90227184	2016	7/11/2016	SHERWOOD ROAD	BIRCH TERRACE	3696	S	4
90238860	2016	7/28/2016	EAST CALPELLA RD	COUNTY ROAD A	1584	N	3

Case ID	Accident Year	Collision					Severity
		Date	Primary Road	Secondary Road	Distance	Direction	
90239119	2016	7/1/2016	EASTSIDE CALPELLA RD	MARINA DR	3168	S	3
90257153	2016	8/18/2016	SOUTH STATE ST	BEACON LN	503	S	2
90273195	2016	9/10/2016	N. STATE ST.	ELLIS LN	259	N	2
90290161	2016	9/11/2016	AIRPORT ROAD	FOOTHILL BOULEVARD	60	S	2
90292067	2016	9/20/2016	BRANSCOMB ROAD	CAHTO PEAK ROAD	1584	S	2
90308122	2016	10/23/2016	ORR SPRINGS RD	N. STATE ST	11088	W	3
90311443	2016	10/31/2016	NORTH STATE ST	HENSLEY CREEK RD	998	N	4
90341534	2016	11/25/2016	MOUNTAIN VIEW RD.	RANCHERIA RD.	16896	E	2
90345510	2016	12/9/2016	NORTH STATE STREET	LAKE MENDOCINO DR	1056	S	4
90378209	2016	11/24/2016	HENDERSON LANE	FOOTHILL BOULEVARD	930	N	1
90394291	2017	2/6/2017	PACIFIC WOODS RD.	FRIENDLY AVE.	16	W	1
90400645	2017	2/8/2017	HENSLEY CREEK RD.	N. STATE ST.	2640	W	3
90404421	2017	2/17/2017	N. STATE STREET	PARDUCCI RD	260	S	3
90410711	2017	3/2/2017	COMPTCHE UKIAH RD	SR 1	6758	E	4
90426985	2017	3/27/2017	EASTSIDE CALPELLA RD	MARINA DR	875	S	4
90448186	2017	4/19/2017	NORTH STATE STREET	MOORE STREET	700	N	3
90453540	2017	4/25/2017	SIMPSON LANE	ELLISON WAY	530	E	4
90466941	2017	5/15/2017	NORTH STATE STREET	POMO LANE	610	S	4
90480437	2017	6/8/2017	SHERWOOD ROAD	BIRCH STREET	2112	S	2
90488739	2017	6/15/2017	ORR SPRINGS RD	NORTH STATE STREET	300	W	4
90499697	2017	7/5/2017	BRANSCOMB ROAD	TAYLOR CREEK	620	W	2
90506490	2017	7/15/2017	BRANSCOMB ROAD	SR-1	63360	E	3
90519939	2017	8/8/2017	N. STATE ST	CAROUSEL LN.	441	S	3
90524883	2017	8/5/2017	BRANSCOMB ROAD	CAHTO PEAK ROAD	2640	W	2
90540687	2017	9/1/2017	BIRCH STREET	SHERWOOD ROAD	528	W	3
90556402	2017	9/14/2017	N. STATE STREET	S/B US-101 N. STATE OFF IO			2
90581022	2017	10/20/2017	BRANSCOMB ROAD	RESERVATION ROAD	528	W	3
90583468	2017	10/21/2017	BRANSCOMB ROAD	MULLIGAN LANE	459	W	3
90583780	2017	10/22/2017	BRANSCOMB ROAD	TAYLOR CREEK ROAD	1584	W	3
90591792	2017	11/2/2017	EEL RIVER ROAD	MAIN ST	1320	N	3
90591917	2017	11/1/2017	SOUTH STATE STREET	BEACON LN	374	S	3
90593861	2017	11/2/2017	BRANSCOMB ROAD (CR 429)	CAHTO PEAK ROAD	2112	W	2
90600218	2017	11/12/2017	TULIP DRIVE	BUCKEYE DRIVE	0		2
90610608	2017	11/23/2017	COMPTCHE UKIAH RD	SR-1	35482	E	2
90615117	2017	11/30/2017	COMPTCHE UKIAH RD	SR-1	24288	E	4
90617784	2017	11/25/2017	CR 311 (SHERWOOD ROAD)	BIRCH TERRACE	2270	S	2
90636894	2017	12/27/2017	DIGGER CREEK	SIMPSON LANE	560	S	3
90643940	2018	1/10/2018	BRANSCOMB ROAD	TAYLOR CREEK ROAD	792	W	3
90652309	2018	1/20/2018	VICHY SPRINGS RD	OAK MANOR DR	670	E	3
90665263	2018	2/11/2018	SHERWOOD ROAD	BIRCH STREET	1320	S	2
90665643	2018	2/11/2018	COUNTY ROAD 429 (BRANSC	KINNEY CREEK ROAD	1584	W	2
90671029	2018	2/22/2018	N. STATE STREET	KUNZLER RANCH ROAD	0		4
90682660	2018	2/28/2018	COMPTCHE UKIAH RD	SR-1	3696	E	3
90684085	2018	3/10/2018	CHABLIS DR.	CARRIGAN LN.	0		2
90690150	2018	3/20/2018	LANSING STREET	UKIAH ST	122	N	2
90713799	2018	4/17/2018	BRANSCOMB RD	RODNEY WAY	15312	W	3
90716560	2018	4/23/2018	SIMPSON LN.	CR 450	733	W	4
90721844	2018	5/1/2018	CRAWFORD ROAD	BIGGAR LANE	1056	S	2
90724500	2018	5/2/2018	151 W. MOORE ST.	CENTRAL AVE	826	E	4
90730695	2018	5/19/2018	HENDERSON LANE	PRATHER COURT	1700	N	2
90741205	2018	5/25/2018	SIMPSON LN	GEORGES LANE	381	E	3
90745416	2018	5/16/2018	N STATE STREET	KUNZLER RANCH ROAD	528	N	4
90760771	2018	6/24/2018	EASTSIDE CALPELLA RD.	MARINA DR.	422	S	4
90771922	2018	7/15/2018	PRIMROSE DRIVE	BLUE JAY PLACE	48	W	2
90779906	2018	7/20/2018	SIMPSON LN.	ELLISON WAY	528	W	4
90786797	2018	7/27/2018	NORTH STATE ST	KUNZLER RANCH ROAD	750	N	3

Collision							Collision
Case ID	Accident Year	Date	Primary Road	Secondary Road	Distance	Direction	Severity
90796803	2018	8/14/2018	CRAWFORD ROAD (CR337H)	BIGGAR LANE	1320	S	2
90814299	2018	8/28/2018	EASTSIDE CALPELLA RD	MARINA DR	2112	S	3
90828587	2018	9/22/2018	EASTSIDE CALPELLA RD	MARINA DR	2640	S	2
90828718	2018	9/22/2018	EASTSIDE CALPELLA RD	MARINA DR	2640	S	2
90842815	2018	10/15/2018	COUNTY ROAD 429 (BRANSCOMB)	NORTH ROAD	2112	E	3
90846789	2018	9/9/2018	EASTSIDE CALPELLA RD	RT 20	750	S	1
90853722	2018	10/11/2018	COMPTCHE UKIAH RD	LITTLE RIVER-AIRPORT RD	11088	W	2
90854328	2018	10/25/2018	EAST SIDE CALPELLA RD	MARINA DR	141	N	2
90860925	2018	11/7/2018	FOOTHILL BLVD	HENDERSON LANE	528	W	4
90862179	2018	9/13/2018	EEL RIVER RD.	GIBSON LN	1056	S	1
90901195	2019	1/1/2019	COUNTY ROAD 311 (SHERWOOD)	UTILITY POLE # 581	323	W	4
90902338	2019	1/1/2019	COUNTY ROAD 309 (VALLEY)	EASTSIDE ROAD	2112	W	4
90944483	2019	3/3/2019	SOUTH STATE ST	BEACON LN	300	S	2
90946201	2019	3/8/2019	VICHY SPRINGS RD	OAK MANOR DR	1320	E	2
90948927	2019	3/15/2019	BRANSCOMB ROAD	CAHTO PEAK ROAD	2112	W	3
90952705	2019	3/17/2019	BIRCH STREET	BROOKTRAILS PAR COURS	206	E	2
90954042	2019	3/14/2019	COUNTY ROAD 311 (SHERWOOD)	BIRCH STREET	316	W	3
90960519	2019	2/22/2019	LAWS AVE	DORA AVE	150	S	2
90963238	2019	3/24/2019	TOMKI RD	FISHER LAKE DR	30	S	2
90980423	2019	4/16/2019	CRAWFORD ROAD	HENDERSON LANE	1000	N	2
90984826	2019	4/27/2019	BRANSCOMB ROAD (CR-429)	CAHTO MEADOWS ROAD	6336	E	3
90998577	2019	5/17/2019	BRANSCOMB ROAD	MUD CREEK SPRINGS ROAD	9979	W	2
90998922	2019	5/10/2019	VALLEY ROAD	DAVIS LANE	290	E	2
91018506	2019	6/5/2019	NORTH MAIN STREET	CASTEEL LANE	990	N	2
91044521	2019	7/4/2019	BRANSCOMB ROAD	RODNEY WAY	3696	E	1
91046299	2019	8/1/2019	N. STATE ST.	AGNES LN	500	S	3
91054396	2019	8/10/2019	SIMPSON LN	HILLS O HOME LN	341	W	2
91055798	2019	8/10/2019	BRANSCOMB RD	BRAGDON ROAD	260	W	2
91056235	2019	8/4/2019	REFUSE ROAD	CRAWFORD ROAD	1848	N	3
91056413	2019	8/14/2019	HEARST WILLITS ROAD	BRAY ROAD	260	E	2
91067483	2019	8/30/2019	N. STATE ST	LAKE MENDOCINO DR	600	N	3
91088145	2019	9/25/2019	BRANSCOMB ROAD	CAHTO PEAK RD	3168	W	2
91090696	2019	9/25/2019	NORTH STATE ST	CAROUSEL LN	1056	N	3
91125118	2019	11/10/2019	VALLEY ROAD	DAVIS LANE	300	E	2
91126077	2019	11/8/2019	WILLOW LANE	PRIMROSE DRIVE	0		2
91131186	2019	9/24/2019	SHERWOOD ROAD (COUNTY)	BIRCH STREET	2640	S	1
91158875	2019	12/24/2019	CENTRAL AVE	SB US 101 FROM CENTRAL	1200	S	4

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APPENDIX C: HSIP ELIGIBLE COUNTERMEASURES

B.1 Intersection Countermeasures – Signalized

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

For HSIP Calls-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
100%	"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			
Where to use:			
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).			
Why it works:			
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.			
General Qualities (Time, Cost and Effectiveness):			
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.			
FHWA CMF Clearinghouse:	Crash Types Addressed:	Night, All	CRF: 20-74%

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

For HSIP Calls-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
100%	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			
Where to use:			
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.			
Why it works:			
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.			
General Qualities (Time, Cost and Effectiveness):			
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.			
FHWA CMF Clearinghouse:	Crash Types Addressed:	Rear-End, Angle	CRF: 0-46%

S13PB, Install pedestrian median fencing on approaches

For HSIP Calls-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			
Where to use:			
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.			
Why it works:			
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.			
General Qualities (Time, Cost and Effectiveness):			
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.			
FHWA CMF Clearinghouse:	Crash Types Addressed:	Pedestrian, Bicycle	CRF: 25- 40%

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

For HSIP Calls-for-projects			
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.		
General information			
Where to use:			
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.			
Why it works:			
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.			
General Qualities (Time, Cost and Effectiveness):			
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.			
FHWA CMF Clearinghouse:	Crash Types Addressed:	All	CRF: 51%

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

For HSIP Calls-for-projects				
Funding Eligibility	Crash Types Addressed	CRF	Expected Life	
100%	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.			
General information				
Where to use:				
Signalized Intersections with a marked crossing, where significant bicycle and/or pedestrians volumes are known to occur.				
Why it works:				
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.)				
General Qualities (Time, Cost and Effectiveness):				
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.				
FHWA CMF Clearinghouse:	Crash Types Addressed:	Pedestrian, Bicycle	CRF:	35%

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

For HSIP Calls-for-projects				
Funding Eligibility	Crash Types Addressed	CRF	Expected Life	
100%	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).			
General information				
Where to use:				
Intersections with signalized pedestrian crossing that have high turning vehicles volumes and have had pedestrian vs. vehicle crashes.				
Why it works:				
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.				
General Qualities (Time, Cost and Effectiveness):				
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.				
FHWA CMF Clearinghouse:	Crash Types Addressed:	Pedestrian, Bicycle	CRF:	59%

B.2 Intersection Countermeasures – Non-signalized

NS01, Add intersection lighting (NS.I.)

For HSIP Calls-for-projects				
Funding Eligibility	Crash Types Addressed		CRF	Expected Life
100%	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				
Where to use:				
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).				
Why it works:				
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.				
General Qualities (Time, Cost and Effectiveness):				
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.				
FHWA CMF Clearinghouse:	Crash Types Addressed:	Night, All	CRF:	25- 50%

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

For HSIP Calls-for-projects				
Funding Eligibility	Crash Types Addressed		CRF	Expected Life
100%	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				
Where to use:				
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.				
Why it works:				
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.				
General Qualities (Time, Cost and Effectiveness):				
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 implemented using a systematic approach with numerous locations, resulting in moderate cost projects that are more appropriate to seek state or federal funding.				
FHWA CMF Clearinghouse:	Crash Types Addressed:	Left-turn, Angle	CRF:	6 - 80%

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

For HSIP Calls-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
100%	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			
Where to use:			
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.			
Why it works:			
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.			
General Qualities (Time, Cost and Effectiveness):			
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.			
FHWA CMF Clearinghouse:	Crash Types Addressed:	Left-turn, Angle	CRF: 12 - 78 %

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

For HSIP Calls-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
100%	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			
Where to use:			
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.			
Why it works:			
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.			
General Qualities (Time, Cost and Effectiveness):			
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.			
FHWA CMF Clearinghouse:	Crash Types Addressed:	All	CRF: 11 - 55%

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

For HSIP Calls-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
100%	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			
Where to use:			
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.			
Why it works:			
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.			
General Qualities (Time, Cost and Effectiveness):			
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.			
FHWA CMF Clearinghouse:	Crash Types Addressed:	All	CRF: 13 - 60%

NS08, Install Flashing Beacons at Stop-Controlled Intersections

For HSIP Calls-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
100%	All	15%	10 years
Notes:	This CM only applies to crashes occurring on the stop-controlled approaches / influence area of the new beacons.		
General information			
Where to use:			
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.			
Why it works:			
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.			
General Qualities (Time, Cost and Effectiveness):			
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.			
FHWA CMF Clearinghouse:	Crash Types Addressed:	Angle, Rear-End	CRF: 5-34%

NS19PB, Install raised medians (refuge islands)

For HSIP Calls-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 must not include the removal of the existing roadway structural section and must be doweled into the existing roadway surface. This new requirement is being implemented to maximize the safety-effectiveness of the limited HSIP funding and to minimize project impacts.				
General information					
Where to use:					
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.					
Why it works:					
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.					
General Qualities (Time, Cost and Effectiveness):					
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.					
FHWA CMF Clearinghouse:	Crash Types Addressed:	Pedestrian and Bicycle	CRF:	30 - 56 %	

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

For HSIP Calls-for-projects					
Funding Eligibility		Crash Types Addressed		CRF	Expected Life
100%		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					
Where to use:					
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.					
Why it works:					
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.					
General Qualities (Time, Cost and Effectiveness):					
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.					
FHWA CMF Clearinghouse:	Crash Types Addressed:	Pedestrian and Bicycle	CRF:	25 %	

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

For HSIP Calls-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
100%	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			
Where to use:			
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, flashing beacons, curb extensions, advanced "stop" or "yield" markings, and other safety features should be added to complement the standard crossing elements.			
Why it works:			
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.			
General Qualities (Time, Cost and Effectiveness):			
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.			
FHWA CMF Clearinghouse:	Crash Types Addressed:	Pedestrian and Bicycle	CRF: 37%

NS22PB, Install Rectangular Rapid Flashing Beacon (RRFB)

For HSIP Calls-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
100%	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			
Where to use:			
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.			
Why it works:			
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.			
General Qualities (Time, Cost and Effectiveness):			
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.			
FHWA CMF Clearinghouse:	Crash Types Addressed:	Pedestrian, Bicycle	CRF: 7 – 47.4%

B.3 Roadway Countermeasures

R01, Add Segment Lighting

For HSIP Calls-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
100%	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			
Where to use:			
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.			
Why it works:			
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.			
General Qualities (Time, Cost and Effectiveness):			
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.			
FHWA CMF Clearinghouse:	Crash Types Addressed:	Night, All	CRF: 18 - 69 %

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

For HSIP Calls-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			
Where to use:			
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.			
Why it works:			
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.			
General Qualities (Time, Cost and Effectiveness):			
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.			
FHWA CMF Clearinghouse:	Crash Types Addressed:	Fixed Object	CRF: 17 - 100 %

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

For HSIP Calls-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			
Where to use:			
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.			
Why it works:			
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.			
General Qualities (Time, Cost and Effectiveness):			
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.			
FHWA CMF Clearinghouse:	Crash Types Addressed:	All	CRF: 26 - 43 %

R21, Improve pavement friction (High Friction Surface Treatments)

For HSIP Calls-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
100%	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			
Where to use:			
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.			
Why it works:			
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.			
General Qualities (Time, Cost and Effectiveness):			
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.			
FHWA CMF Clearinghouse:	Crash Types Addressed:	Wet, Rear-End, All	CRF: 17 - 68 %

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

For HSIP Calls-for-projects				
Funding Eligibility	Crash Types Addressed		CRF	Expected Life
100%	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. This CM is not eligible unless it is done as part of a larger sign audit project, including the study of: 1) the existing signs' locations, sizes and information per MUTCD standards, 2) missing signs per MUTCD standards, and 3) sign retroreflectivity. The overall sign audit scope (or a special exception from the HSIP program manager) must be documented in the Narrative Questions in the application. Based on the scope of the project/audit, it may be appropriate to combine other CMs in the B/C calculation.			
General information				
Where to use:				
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.)				
Why it works:				
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).				
General Qualities (Time, Cost and Effectiveness):				
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.				
FHWA CMF Clearinghouse:	Crash Types Addressed:	Head on, Run-off road, Sideswipe, Night	CRF:	18 - 35%

R27, Install delineators, reflectors and/or object markers

For HSIP Calls-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
100%	All	15%	10 years
Notes:	This CM only applies to crashes occurring within the limits / influence area of the new features. {This is not a striping-related CM}		
General information			
Where to use:			
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.)			
Why it works:			
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.			
General Qualities (Time, Cost and Effectiveness):			
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.			
FHWA CMF Clearinghouse:	Crash Types Addressed:	All	CRF: 0 - 30 %

R28, Install edge-lines and centerlines

For HSIP Calls-for-projects			
Funding Eligibility	Crash Types Addressed	CRF	Expected Life
100%	All	25%	10 years
Notes:	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			
Where to use:			
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.			
Why it works:			
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.			
General Qualities (Time, Cost and Effectiveness):			
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.			
FHWA CMF Clearinghouse:	Crash Types Addressed:	Head-on, Run-off Road, All	CRF: 0 - 44 %

R33PB, Install Separated Bike Lanes

For HSIP Calls-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					
Where to use:					
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.					
Why it works:					
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.					
General Qualities (Time, Cost and Effectiveness):					
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.					
FHWA CMF Clearinghouse:	Crash Types Addressed:	Pedestrian, Bicycle	CRF:	3.7 - 100 %	

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

For HSIP Calls-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					
Where to use:					
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.					
Why it works:					
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.					
General Qualities (Time, Cost and Effectiveness):					
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.					
FHWA CMF Clearinghouse:	Crash Types Addressed:	Pedestrian, Bicycle	CRF:	65 - 89 %	

R35PB, Install/upgrade pedestrian crossing (with enhanced safety features)

For HSIP Calls-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 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.			
FHWA CMF Clearinghouse:	Crash Types Addressed:	Pedestrian, Bicycle	CRF: 8 - 56%

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APPENDIX D: COUNTERMEASURE TOOLBOX

CM Toolbox for Intersections

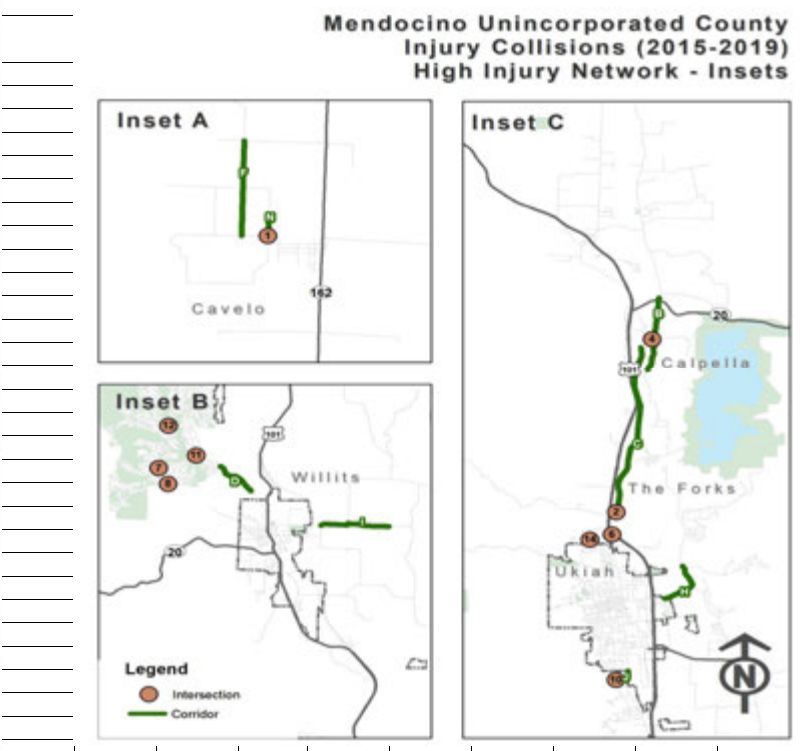
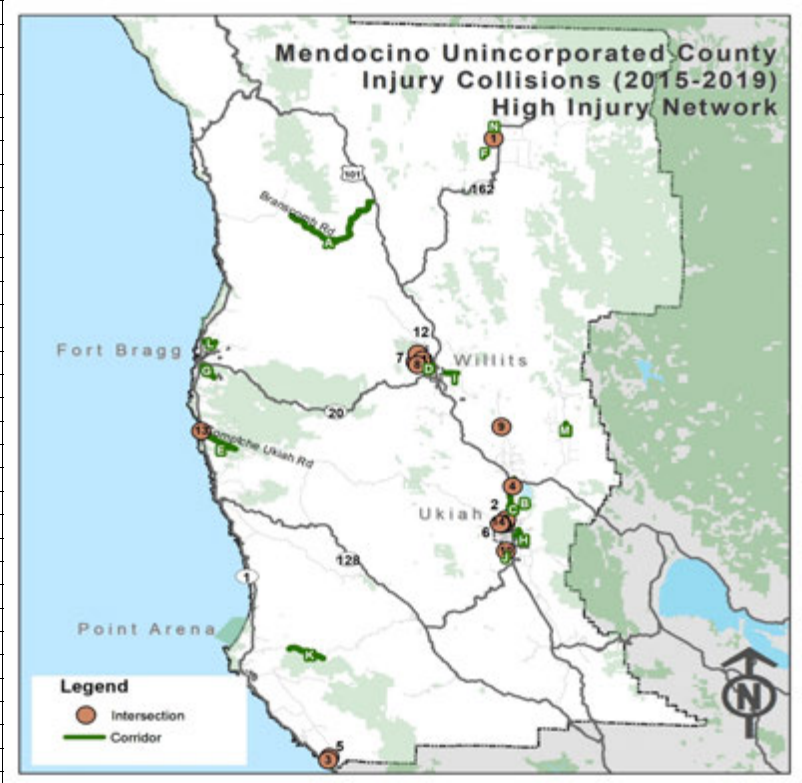
Signalized						
Sr. No.	Code	Countermeasure Name	CM Description	CRF	Federal Funding	Systemic Approach Opportunity
	HSIP/Non-HSIP Code					
1	S01	Add intersection lighting (NS.I.)	Provision of lighting at an intersection.	40%	100%	Medium
2	S02	Improve signal hardware: lenses, back-plates with retroreflective borders, mounting, size, and number	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%	100%	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, and coordinating signals at multiple locations.	15%	50%	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 an intersection.	40%	100%	Medium
2	NS04	Convert intersection to roundabout (from all way stop)	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.	varries	100%	Low
3	NS06	Install/upgrade larger or additional stop signs or other	intersections will help enhance the ability of	15%	100%	Very High
4	NS07	Upgrade intersection pavement markings (NS.I.)	visibility of intersections and, thus, the ability of	25%	100%	Very High
5	NS10	Install transverse rumble strips on approaches	the travel lane for the purposes of providing an	20%	90%	Medium
6	NS11	Improve sight distance to intersection (Clear Sight	stop or yield-controlled approaches to intersections	20%	90%	Medium

7	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	35%	100%	Medium
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%	100%	Medium
2	R02	Remove or relocate fixed objects outside of Clear Recovery Zone	Provisions of a clear zone. A clear zone is an unobstructed, traversable roadside area that allows a driver to stop safely or regain control of a vehicle that has left the roadway. Removing or moving fixed objects, flattening slopes, or providing recovery areas reduces the likelihood of a crash.	35%	90%	High
3	R04	Install Guardrail	Guardrail is installed to reduce the severity of lane departure crashes	25%	100%	High
4	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
5	R22	Install/Upgrade signs with new fluorescent sheeting (regulatory or warning)	Additional or new signage can address crashes caused by lack of driver awareness or compliance of roadway signing.	15%	100%	Very High
6	R23	Install chevron signs on horizontal curves	Installation of post-mounted chevrons, which are intended to warn drivers of an approaching curve and provide tracking information and guidance to the drivers.	40%	100%	Very High
7	R24	Install curve advance warning signs	Provisions of signage in advanced of curves which could include horizontal alignment warning signs or advisory speed warning signs	25%	100%	Very High
8	R25	Install curve advance warning signs (flashing beacon)	Provisions of a flashing beacon in advanced of a curve	30%	100%	High
9	R26	Install dynamic/variable speed warning signs	Includes the addition of dynamic regulatory signs (also known as Radar Speed Feedback Signs)	30%	100%	High
10	R27	Install delineators, reflectors and/or object markers	Installation of delineators, reflectors and/or object markers are intended to warn drivers of an approaching curve or fixed object that cannot easily be removed.	15%	100%	Very High
11	R28	Install edge-lines and centerlines	Provisions of centerlines and edge-lines where non exist or make significant upgrades to existing lines	25%	100%	Very High

12	R30	Install centerline rumble strips/stripes	Provisions of rumble strips in the centerline which provide an auditory indication and tactile rumble intended to help drivers who might leave the roadway	20%	100%	High
13	R31	Install edgeline rumble strips/stripes	Provisions of rumble strips in the edge-line which provide an auditory indication and tactile rumble intended to help drivers who might leave the roadway	15%	100%	High
14	R34PB	Install sidewalk/pathway (to avoid walking along roadway)	Sidewalks and walkways provide people with space to travel within the public right-of-way that is separated from roadway vehicles.	80%	90%	Medium
15	R35PB	Install/upgrade pedestrian crossing (with enhanced safety features)	The enhanced safety elements, which may include curb extensions, medians and pedestrian crossing islands, beacons, and lighting, combined with pavement markings delineating a portion of the roadway that is designated for pedestrian crossing.	35%	90%	Medium
16	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.	35%	100%	Medium

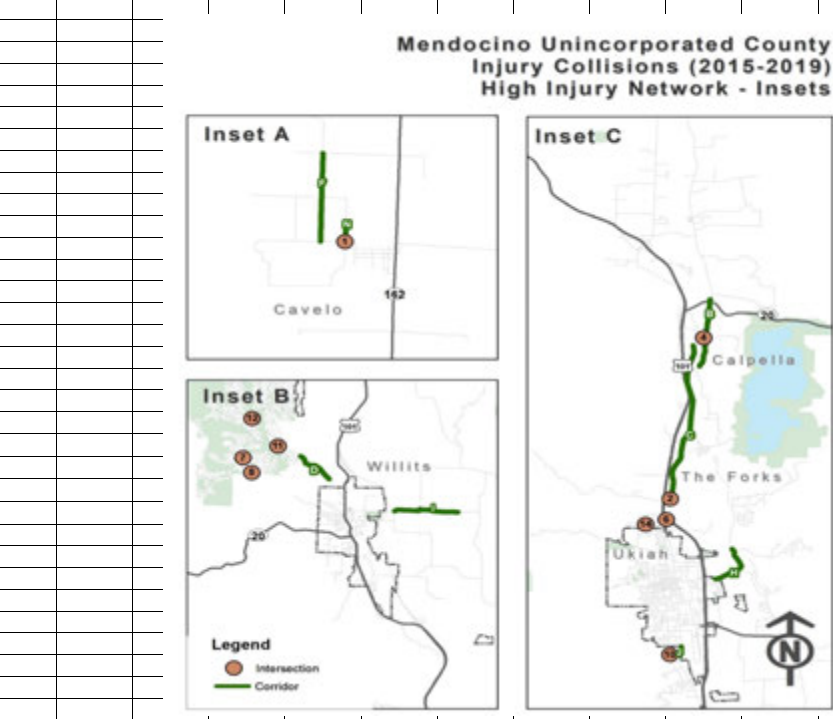
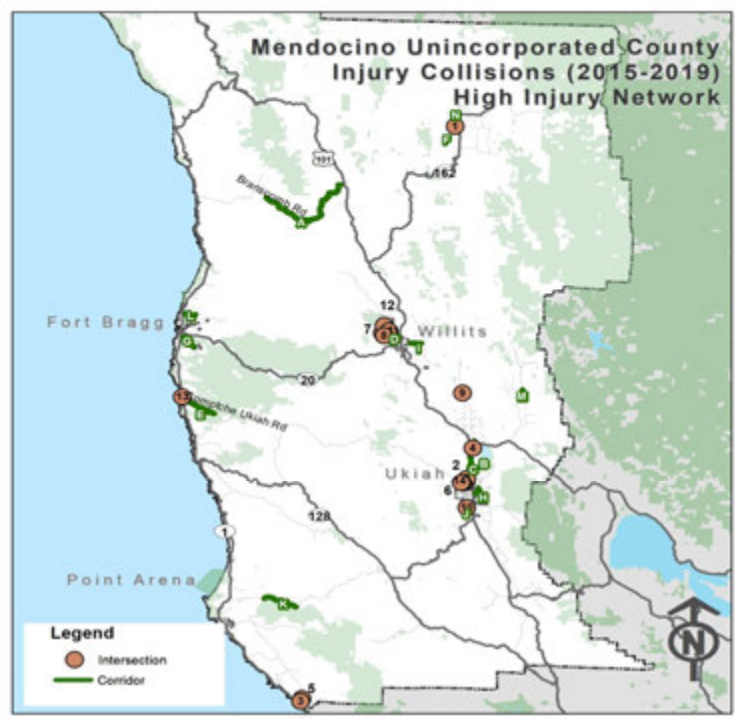
ID	Intersection	Control	Consolidated CMs (HSIP-Eligible - Refer to LRSM* 2020)			Additional CM (non-HSIP)**	EA - 1 Improve Roadway Safety			EA - 2 Reduce Fixed Object Collisions			EA - 3 Reduce Improper Turning Collisions			EA - 4 Reduce Nighttime Collisions			EA - 5 Reduce DUI Collisions			EA - 6 Reduce Unsafe Speed Collisions			EA - 7 Reduce Motorcycle Collisions				
			CM1	CM2	CM3		CM1	CM2	CM3	CM1	CM2	CM3	CM1	CM2	CM3	CM1	CM2	CM3	CM1	CM2	CM3	CM1	CM2	CM3	CM1	CM2	CM3		
			I-1	Foothill Blvd and Henderson Ln	One way stop controlled		NS01	NS06	NS07	Add speed limit signs, realignment of intersection, install chevron signs				NS06	NS07		NS06	NS07		NS01	NS06		NS06	NS07	NS01	NS06			NS06
I-3	Pacific Woods Rd and Friendly Ave	Uncontrolled	NS06	NS07	NS10	Reduce width of SB lane from Friendly turning onto Pacific Woods; new striping at intersection				NS06	NS07	NS10	NS06	NS07	NS10	NS06			NS06	NS07	NS10	NS06	NS10			NS06	NS07	NS10	
I-4	Eastside Calpella Rd and Marina Dr	One way stop controlled	NS06	NS10	NS11	Move stop bar back so vehicles do no encroach intersection				NS06	NS07	NS11	NS06	NS07	NS11	NS06			NS06	NS07	NS11	NS06	NS10			NS06	NS07	NS11	
I-5	Pacific Woods Rd and Tiger Tail Tr	Uncontrolled	NS06	NS07	NS10	improved sight distance when traveling downhill on Pacific Woods Rd				NS06	NS07	NS10	NS06	NS07	NS10	NS06			NS06	NS07	NS10	NS06	NS10			NS06	NS07	NS10	
I-6	North State St and 101 On Ramp/Off Ramp	One way stop controlled	NS06	NS04					NS06	NS04		NS06	NS04		NS06			NS06	NS04		NS06	NS04			NS06	NS04		NS06	
I-7	Tulip Dr and Buckeye Dr	Stop controlled	NS01	NS06	NS07	Repave intersection				NS06	NS07		NS06	NS07		NS01	NS06		NS06	NS07	NS01	NS06			NS06	NS07		NS06	
I-8	Willow Rd and Primrose Dr	One way stop controlled	NS06			Install bicycle facility				NS06			NS06			NS06			NS06			NS06			NS06			NS06	
I-9	Tomki Rd and Fisher Lake Dr	One way stop controlled	NS06	NS07		Center and edge rumble stripe, radar speed feedback signs				NS06	NS07		NS06	NS07		NS06			NS06	NS07		NS06			NS06	NS07		NS06	
I-10	Laws Ave and South Dora St	All way stop controlled	NS01	NS06		Restrict parking near intersection (red curb), install crosswalks and curb ramps				NS06			NS06			NS01	NS06		NS06	NS01		NS06			NS06			NS06	
I-11	Birch St and Brooktrails Dr	One way stop controlled	NS06	NS07		Realign intersection to reduce skew, radar speed feedback sign				NS06	NS07		NS06	NS07		NS06			NS06	NS07		NS06			NS06	NS07		NS06	
I-12	Primrose Dr and Blue Jay Pl	One way stop controlled	NS06	NS10		Radar speed feedback sign				NS06	NS10		NS06	NS10		NS06			NS06	NS10		NS06			NS06	NS10		NS06	
I-13	Lansing St and Ukiah St	All way stop controlled	NS06	NS22PB		Restripe with hi visibility crosswalks, install bulb-outs, restrict parking near intersection				NS06			NS06			NS06	NS22PB		NS06	NS22PB		NS06			NS06			NS06	
I-14	Chablis Dr and Carrigan Ln	Two way stop	NS06						NS06			NS06			NS06			NS06			NS06			NS06			NS06		NS06
I-15	Biggar Lane and Highway 162 Intersection	Two way stop	NS06	NS07		Radar speed feedback sign				NS06	NS07		NS06	NS07		NS06			NS06	NS07		NS06			NS06	NS07		NS06	
I-16	Vichy Springs Road and Redemyer Road	One way stop controlled	NS06	NS09		Reduce radius for southeast corner				NS06			NS06			NS06			NS06			NS06			NS06			NS06	
I-17	Mill Creek Road and Old River Road	One way stop controlled	NS06	NS10					NS06	NS10		NS06	NS10		NS06			NS06	NS10		NS06			NS06	NS10		NS06	NS10	

Code	Countermeasure Name
NS01	Add intersection lighting (NS.I.)
NS04	Convert intersection to roundabout (from all way stop)
NS06	Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs
NS07	Upgrade intersection pavement markings (NS.I.)
NS10	Install transverse rumble strips on approaches
NS11	Improve sight distance to intersection (Clear Sight Triangles)
NS22PB	Install Rectangular Rapid Flashing Beacon (RRFB)



High-risk Roadway Segments																															
ID	Roadway Segment	Consolidated CMs (HSIP-Eligible - Refer to LRSM* 2020)								Additional CM (non-HSIP)**	EA - 1 Improve Roadway Safety			EA - 2 Reduce Fixed Object Collisions			EA - 3 Reduce Improper Turning Collisions			EA - 4 Reduce Nighttime Collisions			EA - 5 Reduce DUI Collisions			EA - 6 Reduce Unsafe Speed Collisions			EA - 7 Reduce Motorcycle Collisions		
		CM1	CM2	CM3	CM4	CM5	CM6	CM7	CM8		CM1	CM2	CM3	CM1	CM2	CM3	CM1	CM2	CM3	CM1	CM2	CM3	CM1	CM2	CM3	CM1	CM2	CM3	CM1	CM2	CM3
A	Branscomb Rd: Willis Ave to Kenny Creek Road	R22	R23	R24	R25	R26	R27	R30	R31	rumble strips should not be installed near residential areas	R26	R30	R31	R22	R30	R31	R22	R23		R22	R23	R24	R22	R23	R24	R23	R26	R30	R22	R30	R31
B	Eastside Calpella Rd: Marina Dr to SR20 On ramp/off ramp	R22	R23	R24	R26	R30	R31				R26	R30	R31	R22	R30	R31	R22	R23		R22	R23	R24	R22	R23	R24	R23	R26	R30	R22	R30	R31
C	North State St: Moore St to Orr Springs Rd	R01	R22	R26	R27	R31				Conduct speed survey to justify reduction in speed limit, traffic calming measures, reduce lane widths	R22	R27	R31	R27	R31		R27	R31		R01	R22	R27	R01	R22	R27	R26	R27	R31	R27	R31	
D	Sherwood Rd: Birch Terr to Willits City limits	R15	R22	R26	R23	R24	R30	R31		Repave roadway segment	R22	R30	R31	R22	R23	R31	R22	R31		R22	R23	R24	R22	R23	R24	R26	R30	R31	R22	R23	R31
E	Comptche Ukiah Rd: Hwy 1 to Mendocino Headlands State Park - Bi	R22	R24	R26	R27	R30	R31			Install Class III bike route or signage	R22	R30	R31	R22	R27	R30	R22	R30	R31	R22	R24	R27	R22	R24	R27	R26	R30	R31	R22	R27	R30
F	Crawford Rd: Biggar Ln to Foothill Blvd	R01	R26	R30	R34PB					Traffic calming measures	R26	R30	R34PB	R26	R30		R30			R01	R30		R01	R30		R26	R30		R26	R30	
G	Simpson Ln: Georges Ln to Hills O Home Ln	R01	R15	R22	R26	R27	R31			Pedestrians warning signs	R15	R26	R27	R26	R27	R31	R22	R31		R01	R27	R31	R01	R27	R31	R26	R27	R31	R26	R27	R31
H	Vichy Springs Rd/ Redmeyer Rd: Oak Manor Dr to Redmyer Rd	R01	R22	R26	R27	R31				chevron signs needed	R25	R27	R31	R26	R27	R31	R22	R31		R01	R27	R31	R01	R27	R31	R26	R27	R31	R26	R27	R31
I	Valley Rd/ Hearst Willits Rd: Bray Rd to Live Oak Rd	R02	R22	R26	R27	R31					R22	R27	R31	R02	R27	R31	R22	R31		R27	R31		R27	R31		R26	R27	R31	R02	R27	R31
J	South State St: Laws Ave to Beacon Ln	R01	R22	R34PB	R35PB	R37PB				Other traffic calming measures	R01	R22		R22			R22			R01	R22		R01	R22					R22		
K	Mountain View Rd: Btwn Manchester and Boonville	R02	R22	R23	R24	R25	R26	R27	R31		R22	R26	R27	R02	R26	R27	R22	R27	R31	R22	R27	R31	R22	R27	R31	R23	R26	R31	R02	R26	R27
L	Pudding Creek Rd: Tamborini Ln to John Hayman Rd	R02	R22	R25	R27	R31				Traffic calming measures	R22	R26	R27	R02	R26	R27	R22	R27	R31	R22	R27	R31	R22	R27	R31	R25	R27	R31	R02	R26	R27
M	Eel River Rd: Gibson Ln to Main St	R01	R26	R27	R31						R01	R26	R27	R26	R27	R31	R27	R31		R01	R27	R31	R01	R27	R31	R26	R27	R31	R26	R27	R31
N	Henderson Ln: Henderson Rd to Foothill Blvd	R22	R27	R28							R22	R27	R28	R22	R27	R28	R22	R27		R22	R27		R22	R27		R27	R28		R22	R27	R28
Identified from Stakeholder Input																															
O	Highway 128	R22	R23	R27	R31						R22	R27	R31	R22	R27	R31	R22	R27	R31	R22	R27	R31	R22	R27	R31	R23	R27	R31	R22	R27	R31
P	Highway 162, approaching Covelo	R04	R22	R23	R27	R31	R26				R11	R26	R27	R22	R27	R31	R22	R27	R31	R22	R26	R27	R22	R26	R27	R22	R26	R31	R22	R27	R31

Code	Countermeasure Name
R01	Add Segment Lighting
R02	Remove or relocate fixed objects outside of Clear Recovery Zone
R04	Install Guard rail
R15	Widen shoulder
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
R30	Install centerline rumble strips/stripes
R31	Install edgeline rumble strips/stripes
R34PB	Install sidewalk/pathway (to avoid walking along roadway)
R35PB	Install/upgrade pedestrian crossing (with enhanced safety features)
R37PB	Install Rectangular Rapid Flashing Beacon (RRFB)



	Strategy	Performance Measure	Organizations to be involved
Education	Conduct public information and education campaign for intersection safety laws, unsafe speeds, distracted driving, improper turning and driving under the influence.	Number of education campaigns	County/ School District/ Police Department
	Conduct pedestrian safety campaigns and outreach to raise their awareness of pedestrian safety needs through media outlets, social media and Bike and Walk Mendocino. Create a pamphlet for crosswalk safety	Number of education campaigns	County/ School District/ Police Department
	Conduct bicycle safety campaigns and outreach to raise their awareness of bicycle safety needs through media outlets, social media and Bike and Walk Mendocino. Create a pamphlet for bicycle safety	Number of education campaigns	County/ School District/ Police Department
Enforcement	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
Emergency Medical Services (EMS)	S05, Install emergency vehicle pre-emption systems	EMS vehicle response time.	Mendocino County Local Emergency Services Agency
	Increase the number of EMS/fire control personnel taking Traffic Incident Management Training	number of EMS/fire control personnel taking Traffic Incident Management Training	Mendocino County Local Emergency Services Agency

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APPENDIX E: B/C RATIO CALCULATION - LRSM (2020)

Benefit/Cost Ratio Calculations

This appendix includes the Benefit/Cost methodology used in the Caltrans calls-for-projects in the HSIP programs. The HSM, Part B - Chapter 7, includes more details on conducting Economic Appraisal for roadway safety projects. Local agencies will be required to utilize the HSIP Analyzer to calculate the B/C ratio as part of their application for HSIP funding. Starting in Cycle 7 call for projects, the fatality and severe injury costs have been combined for calculating the benefit. Because fatality figures are small and are a matter of randomness, this change is being made to reduce the possibility of selecting an improvement project on the basis of randomness.

$$1) \text{ Benefit (Annual)} = \sum_{s=0}^3 \frac{CRF \times N \times CC_{ave}}{Y}$$

- CRF : Crash reduction factor in each countermeasure.
- S : Severity (0: PDO, 1: Minor Injury, 2: Injury, 3: Severe Injury/Fatal). See the below table.
- N : Number of Crashes, in severity levels, related to selected countermeasure.
- Y : Crash data time period (Year).
- CC_{ave} : Crash costs in severity levels.

Severity (S)	Crash Severity *	Location Type	Crash Cost ***
3	**Fatality and Severe Injury Combined (KA)	Signalized Intersection	\$1,590,000
3		Non Signalized Intersection	\$2,530,000
3		Roadway	\$2,190,000
2	Evident Injury – Other Visible (B)		\$142,300
1	Possible Injury–Complaint of Pain (C)		\$80,900
0	Property Damage Only (O)		\$13,300

* The letters in parenthesis (K, A, B, C and O) refer to the KABCO scale; it is commonly used by law enforcement agencies in their crash reporting efforts and is further documented in the HSM.

** Figures were calculated based on an average Fatality (K) / Severe Injury (A) ratio for each area type, a crash cost for a Fatality (K) of \$7,219,800, and a crash cost of a Severe/Disabling Injury (A) of \$389,000. These costs are used in the HSIP Analyzer.

*** Based on Table 7-1, Highway Safety Manual (HSM), First Edition, 2010. Adjusted to 2020 Dollars.

$$2) \text{ Benefit (Life)} = \text{Benefit (annual)} \times \text{Years of service life}$$

$$3) \text{ Benefit/Cost Ratio (each countermeasure): } \text{Benefit Cost Ratio}_{(CM)} = \frac{\text{Benefit (Life)}_{(CM)}}{\text{Total Project Cost}_{(CM)}}$$

$$4) \text{ Benefit/Cost Ratio (project): } \text{Benefit/Cost Ratio (Project)} = \frac{\sum_{CM=1}^3 \text{Benefit (Life)}_{(CM)}}{\text{Total Project Cost}}$$



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