City of Willits

Local Roadway Safety Plan

06/15/2022
Final Report

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Executive Summary

The City of Willits'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 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 City staff and their safety partners to reflect evolving collision trends and community needs and priorities. With the LRSP as a guide, the City will be able to ready to apply for grant funds, such as the federal Highway Safety Improvement Program (HSIP).

Chapter 1 – Introduction

The Introduction presents the project, describes how this report is organized, summaries 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 City 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: Willits General Plan Vision 2020 (1992), Willits Safe Routes to School Action Plan (2017), City of Willits Traffic Safety Evaluation (2010), Willits Main Street Corridor Enhancement Plan (2017), City of Willits Bicycle and Pedestrian Specific Plan (2009), Downtown Willits Streets and Alleys Connectivity Study (2017), Willits Circulation and Parking Improvement Plan (2002), Willits Bypass Before and After Study (2017), City of Willits FY 2020-2021 Budget, Mendocino County Rail-with-Trail Corridor Plan (2012)and Mendocino County Regional Active Transportation Plan (2017).

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).

There were a total of 200 collisions reported City-wide from 2015 to 2019. Out of these, 157 collisions (78 percent) were PDO collisions, 24 collisions (12 percent) led to complaint of pain injury and 12 collisions (6 percent) led to a visible injury. There were 7 F+SI high injury collisions (fatal + severe injury collisions) of which all collisions led to a severe injury.

For fatal and severe injury (F+SI) collisions, 43 percent of collisions were pedestrian collisions which have occurred on Main Street. This calls for evaluating pedestrian conditions along the high injury network and throughout the City with similar characteristics that are highly unsafe for pedestrians. Improvements at these locations can include reducing pedestrian crossing distances, installing high visibility crosswalks, installing pedestrian refuge/ median islands, and installing bulb outs. The entire corridor of North and South Main Street were identified as high injury corridors. The pedestrian and other safety improvements identified in this Local Road Safety Plan may be used to provide the basis for a Highway Safety Improvements (HSIP) grant.

About 29 percent of the F+SI collisions have been identified to be hit-object collisions. This calls for evaluating these locations and the fixed objects present that can be improved with delineators, reflectors and object markers. Rear-end collisions, broadside collisions and collisions due to unsafe speed, can be reduced suing dynamic/variable speed warning signs, edgeline/centerline rumble strips and improving signal timing.

Chapter 4 - Emphasis Areas

Emphasis areas are a focus of the LRSP that are identified through the various collision types and factors resulting in fatal and severe injury collisions within the City of Willits. The seven emphasis areas for Willits are:

- Improve Intersection Safety
- Unsafe Speed Collisions
- Improper Turning Violations
- Pedestrian Safety
- Rear-end Collisions
- Broadside Collisions
- Hit-Object 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 City potential countermeasures for each location that can be implemented either in future HSIP

calls for projects, or using other funding sources, such as the City'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 four 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: Pedestrian Improvements at Unsignalized Intersections
- Project 3: Systemic Roadway Segment Improvements
- Project 4: Pedestrian and Other Roadway Segment 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 City to reduce fatal and severe injury 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 fatal and severe injury collisions throughout the City. If the number of fatal and severe injury collisions does not decrease over time, then the emphasis areas and countermeasures should be re-evaluate

1. Introduction

What is a LRSP?

The Local Roadway Safety Plan (LRSP) is a localized data-driven traffic safety plan that provides opportunities to address unique highway safety needs and reduce the number of fatal and severe injury 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 Highway Safety Improvement Program (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.

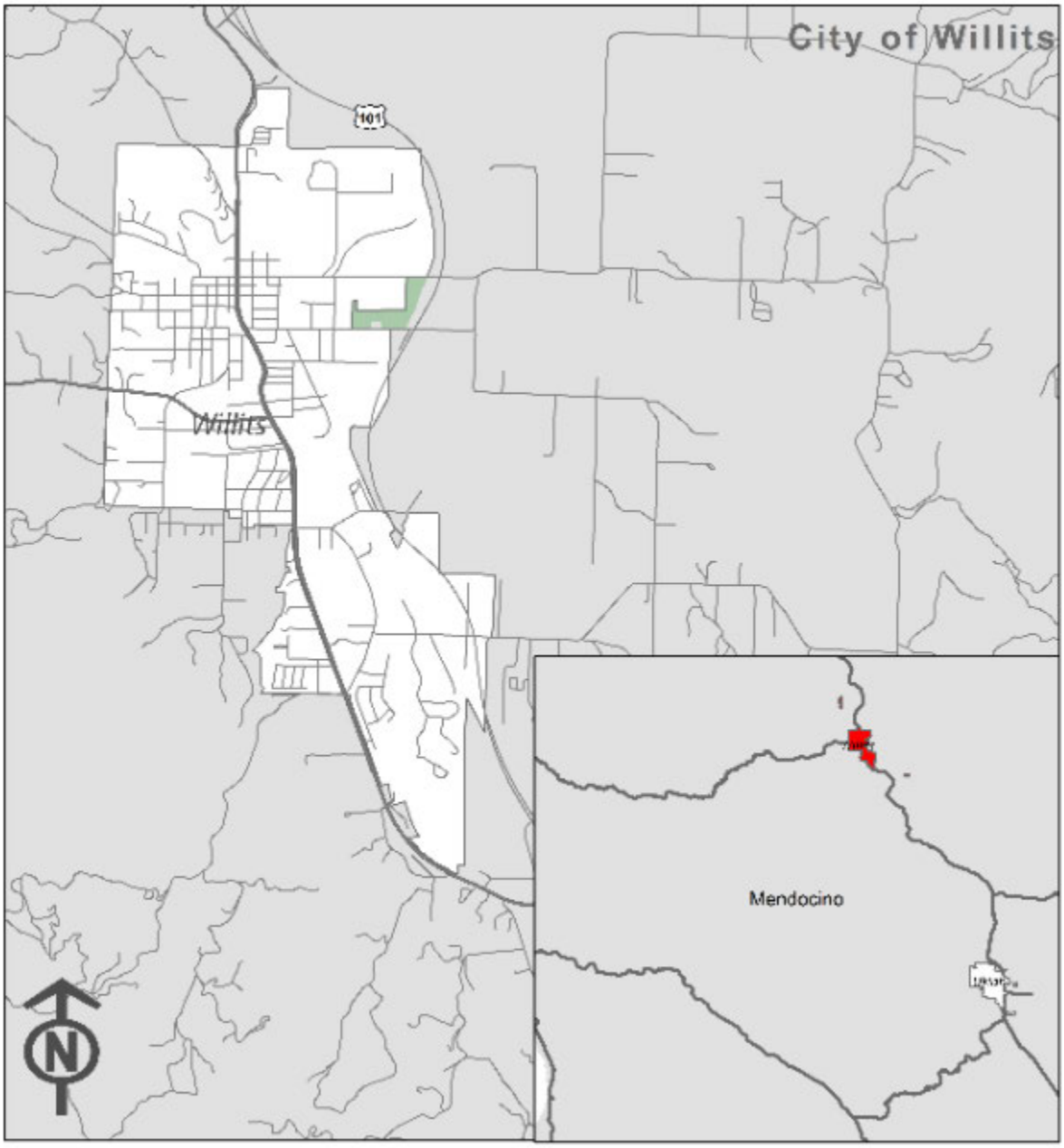
Vision and Goals of the LRSP

- 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 Willits
- 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 Willits residents

Study Area

The City of Willits is located in Mendocino County, California, covering a total area of about 2.819 square miles. It is the located on the coast, 20 miles northwest of the City of Ukiah at an elevation of 1,391 feet.
The City's estimated population is 4,893 (ACS 2019 1-year estimate). **Figure 1** shows the study area.

Figure 1. City of Willits: Study Area Map

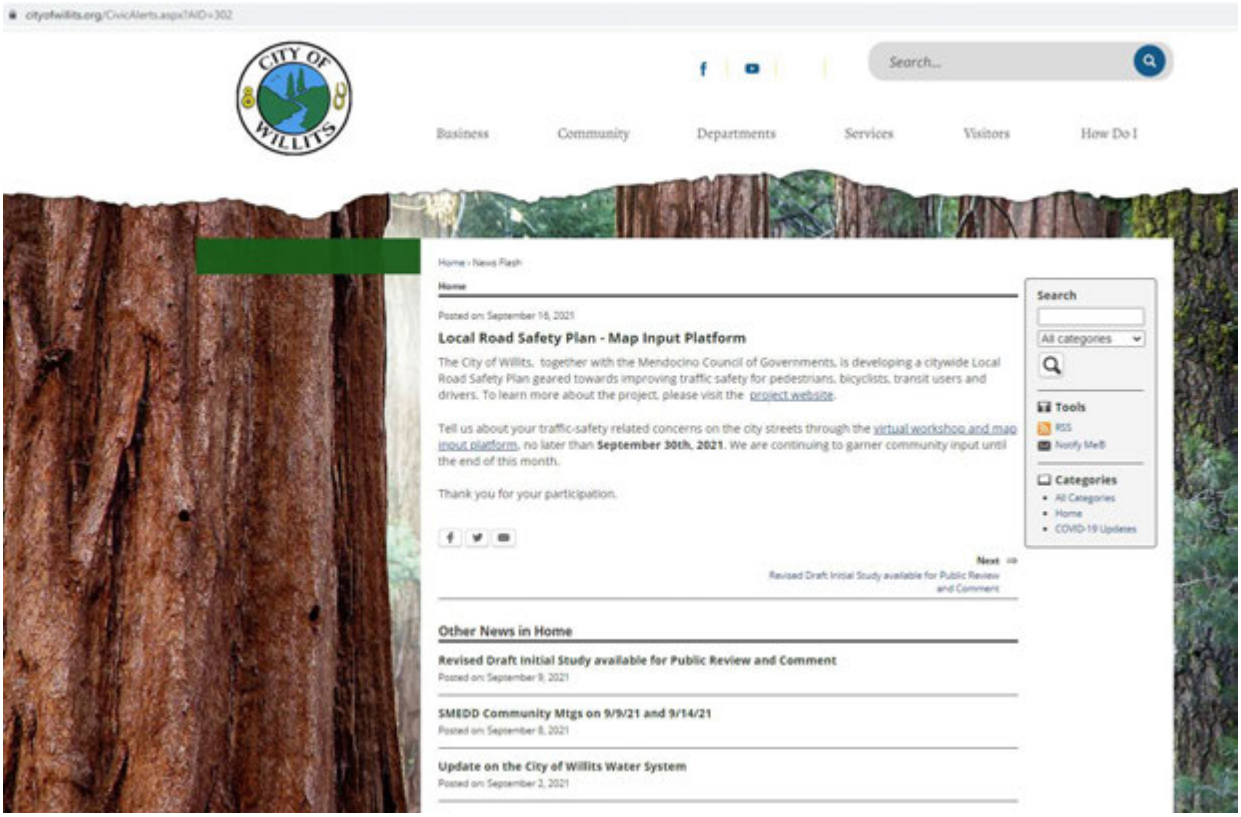


Safety Partners

Safety partners are vital to the development and implementation of an LRSP. For the City of Fort Bragg, these include representatives from Police Department, Public Works Department, Community Development Department, Unified School District, Charter Schools, County Supervisor, Caltrans Planning District 1, Caltrans Local Assistance, CHP, Calfire, EMS and Mendocino Transit Authority. 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 info was also published on the City'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 5th, 2021 and closed on September 31, 2021. During this period 324 comments were submitted, out of which 32 comments were for the City of Willits.

Figure 2. City's website and social media posting



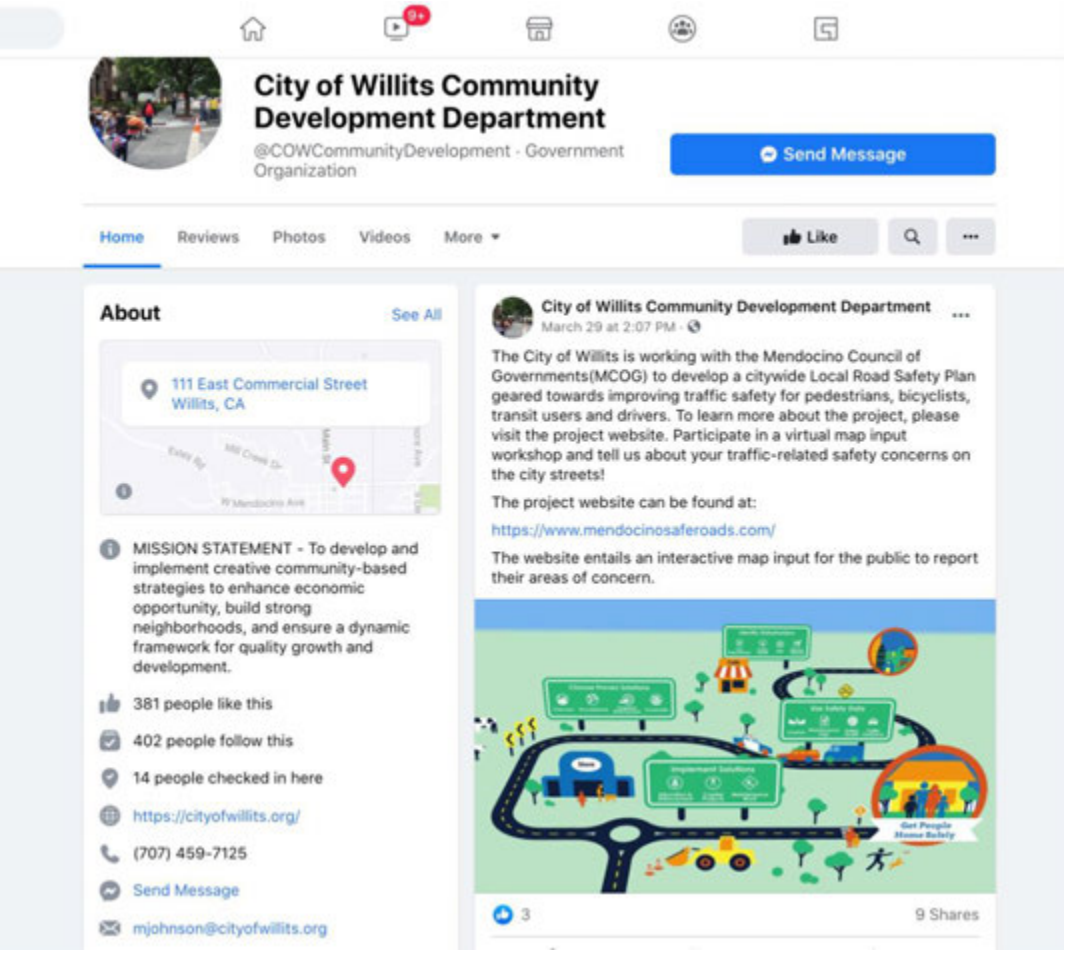
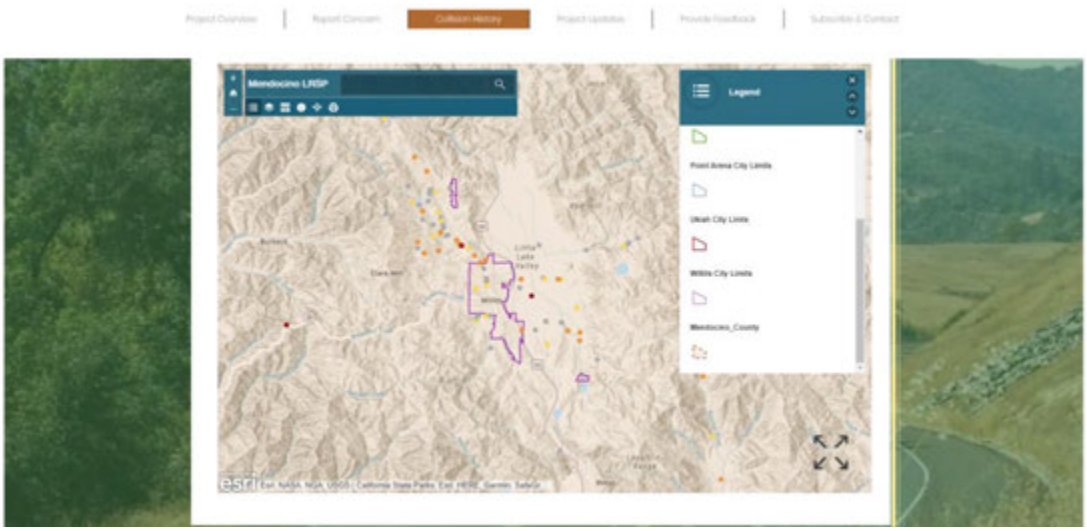
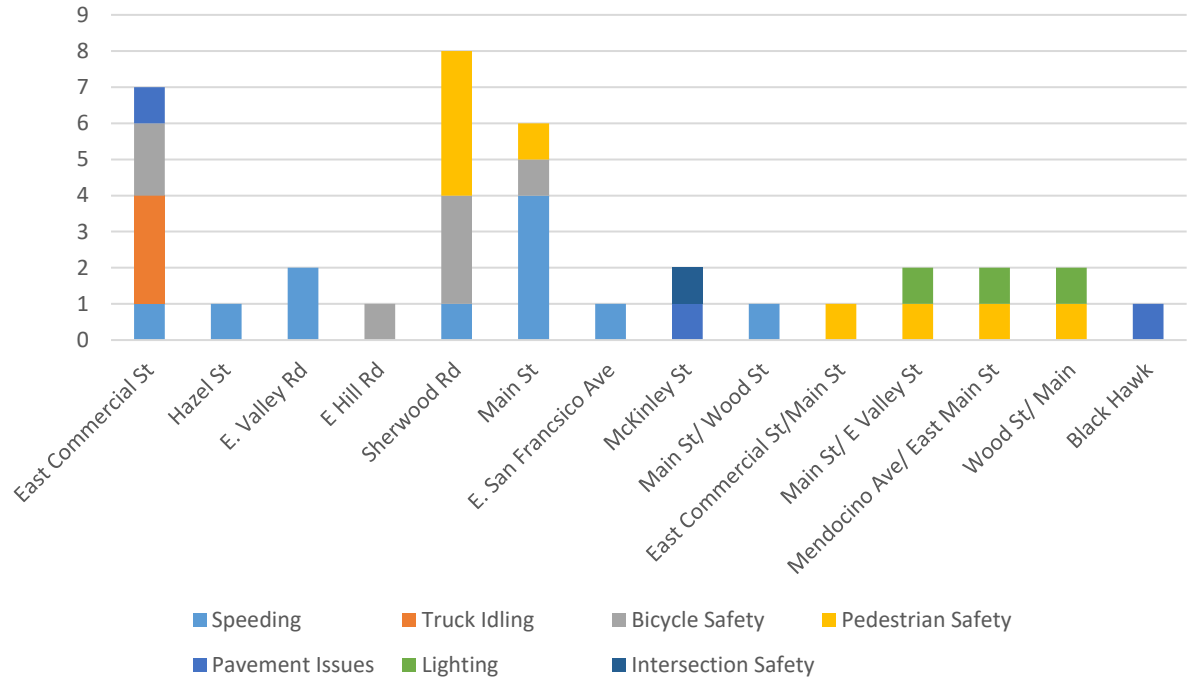


Figure 3. Project Website: www.mendocinosaferoads.com



The City of Willits received 32 public comments regarding traffic safety issues. The most common commented on traffic safety issue was speeding, with a total 11 comments. The most commented on location with speeding issues was Main Street, with 4 comments. East Valley Road, Hazel Street and East Commercial Street also received comments regarding speeding. Pedestrian safety was the second most commented on safety issue, with a total of 9 comments. The most commented on location with pedestrian safety issues was Sherwood Road and Main Street.

Figure 4. City of Willits - Public Comments



2. Existing Planning Efforts

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

- Willits General Plan Vision 2020 (1992)
- Willits Safe Routes to School Action Plan (2017)
- City of Willits Traffic Safety Evaluation (2010)
- Willits Main Street Corridor Enhancement Plan (2017)
- City of Willits Bicycle and Pedestrian Specific Plan (2009)
- Downtown Willits Streets and Alleys Connectivity Study (2017)
- Willits Circulation and Parking Improvement Plan (2002)
- Willits Bypass Before and After Study (2017)
- City of Willits FY 2020-2021 Budget
- Mendocino County Rail-with-Trail Corridor Plan (2012)
- Mendocino County Regional Active Transportation Plan (2017)

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

Table 1. Document Review Summary

Document	Highlights
Willits General Plan Vision 2020 (1992)	Circulation element of the General Plan details long range plans for the City of Willits including bicycle, pedestrian, vehicle and transit policies.
Willits Safe Routes to School Action Plan (2017)	This plan includes recommendations to improve the safety for both walking and biking in areas around all seven of the Willits area schools.
City of Willits Traffic Safety Evaluation (2010)	The primary objective of this TSE is to improve traffic safety in the City of Willits. City staff was particularly interested in improving safety for pedestrians and bicyclists along Main Street.
Willits Main Street Corridor Enhancement Plan (2017)	This plan was prepared in preparation for the opening of the US 101 bypass of Willits and eventual relinquishment of the former stretch of US 101 that serves as Main Street through the City of Willits, north of the intersection with SR 20.
Willits Bicycle and Pedestrian Specific Plan (2009)	This plan was developed with the intent of identifying bicycle and pedestrian facilities within the City of Willits that would serve residents and visitors. Projects within the plan would enhance tourism, promote health, and improve safety.

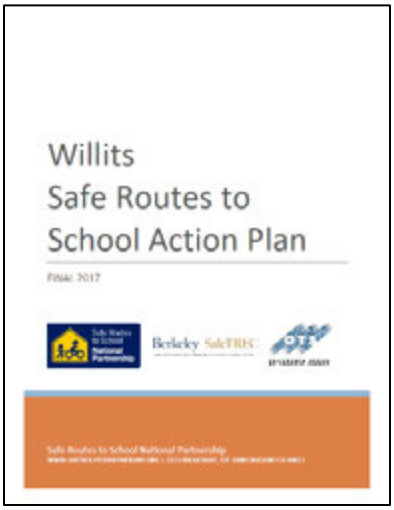
Document	Highlights
Downtown Willits Streets and Alleys Connectivity Study (2017)	This Plan seeks to beautify and enhance connectivity downtown, provide better accessibility for pedestrians and bicyclists, maintain parking and provide loading zones, improve traffic safety, lighting, signage and landscaping.
Willits Circulation and Parking Improvement Plan (2002)	The purpose of this evaluation and plan was to identify traffic issues within the City of Willits related to safety, circulation and downtown parking. Based on the analysis presented, potential solutions are recommended which the City should consider for implementation.
Willits Bypass Before and After Study (2017)	The purpose of this study is to document current conditions on the Willits Bypass and on Old Route 101 through the City of Willits, and to compare various current metrics with prior conditions. The study employed a variety of methods and data sources to compare before and after conditions.
City of Willits FY 2020-2021 Budget	The purpose of this document is to review and update FY 2019-2020 fiscal activity and develop estimates for the following year.
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 County Regional Active Transportation Plan (2017)	Details bicycle and pedestrian improvements on County significant corridors. Includes many detailed priority bike and pedestrian projects.

Willits General Plan Vision 2020 (1992)

The Willits General Plan is a policy document which establishes a framework to guide the long-term development of the community. The General Plan sets forth the City's goals and policies regarding land use, circulation, housing, conservation, open space, public health and safety. The plan also establishes programs for putting these goals and policies into effect.

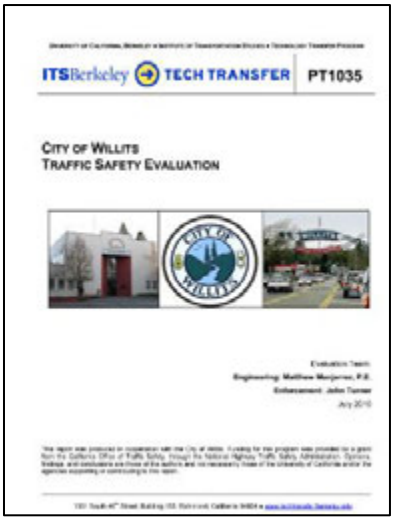
Willits Safe Routes to School Action Plan (2017)

In 2009, the City adopted a Safe Routes to School Plan that inventoried infrastructure for walking, bicycling as well as transit around the schools and serving students traveling to and from school. The plan identified numerous sidewalk gaps. Generally, there are few bike lanes, routes, or paths throughout Willits.



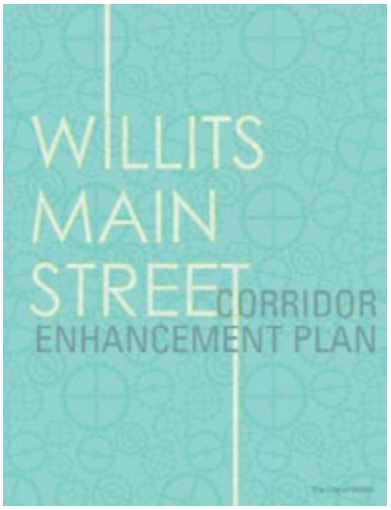
City of Willits Traffic Safety Evaluation (2010)

The primary objective of this TSE is to improve traffic safety in the City of Willits. City staff was particularly interested in improving safety for pedestrians and bicyclists traveling through and crossing the Main Street corridor. The local community has been striving to enhance this corridor for many years, and City staff is now preparing a conceptual layout for the corridor. Consequently, the results of this TSE will be used by City staff as input to their planning process.



Willits Main Street Corridor Enhancement Plan (2016)

The City adopted a Main Street Corridor Plan in 2016. The plan captures community-wide priorities which include improved access and safety for walking and bicycling in Willits. The following elements were highlighted and requested by the public in workshops: buffered bicycle lanes, crossing islands, green streets, wayfinding, and public art. The plan includes improvements at Willits High School designed to create a more accessible route for students and faculty who bike and walk to school as well as recommended improvements to crossings along Main Street through the city.

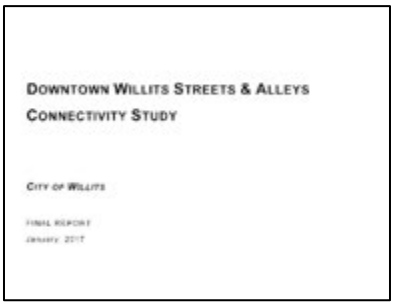


City of Willits Bicycle and Pedestrian Specific Plan (2009)

The City adopted a Bicycle and Pedestrian Specific Plan in 2009. This plan identifies detailed engineering recommendations for transit, sidewalks, and bicycle facilities for all seven school sites included in the 2009 Safe Routes to School Plan. The plan emphasizes expanding and improving school commute improvements for bicyclists and pedestrians. The plan highlights school area pedestrian safety; stating a need to reduce traffic speeds in areas where children and seniors are present. Schools are identified as active centers for walking and bicycling in Willits.

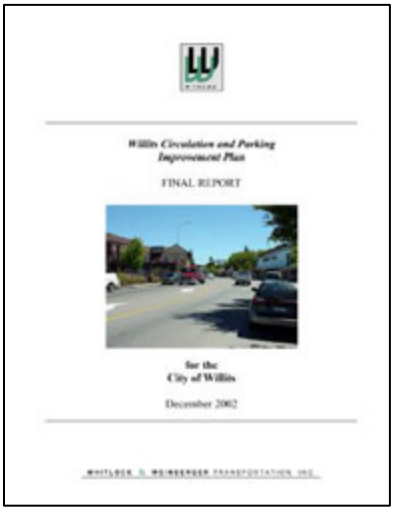
Downtown Willits Street and Alleys Connectivity Study (2017)

In 2018, Caltrans will transfer ownership of the current segment of US Highway 101 that passes through Downtown to the City of Willits. In anticipation of this transition, the City sought services to develop recommendations for improvements to traffic circulation, safety, parking, and aesthetics, as well as proposals for several "shovel-ready" projects. These recommendations and projects were prepared with the expectation they would be implemented in conjunction with the separate but directly-related Willits Main Street Corridor Enhancement Plan.



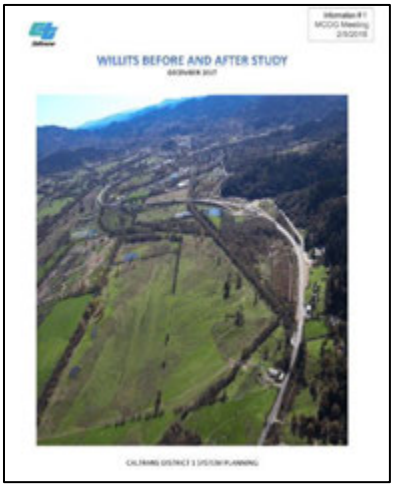
Willits Circulation and Parking Improvement Plan (2002)

This plan identifies traffic issues within the City of Willits related to safety, circulation and downtown parking. In the area of safety, the plan identified high incident collision locations and areas where pedestrian safety is a concern and explored alternative measures that can improve safety within the City of Willits.



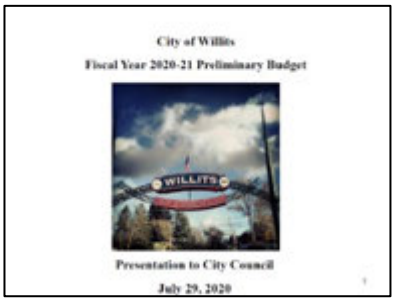
Willits Bypass Before and After Study (2017)

The purpose of this study is to document current conditions on the Willits Bypass and on Old Route 101 through the City of Willits, and to compare various current metrics with prior conditions. The study employed a variety of methods and data sources to compare before and after conditions (described in detail in the body of the report).Focus areas of the study include: safety, travel time, and traffic volumes/congestion. This provides a good background on the history of Willits Caltrans owned roads but will largely not provide future safety recommendations for local roads.



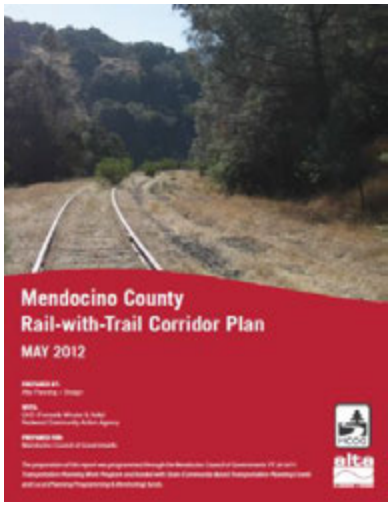
City of Willits FY 2020-2021 Budget

The City of Willits's fiscal year 2020 – 2021 Budget outlines the funds the city has allocated to various departments and project include street and road maintenance and the Willits Downtown Improvement Project.



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

The Mendocino County Rail-with-Trail 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 and 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 (CBTP) 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 (NCRA), and Caltrans.



Mendocino County Regional Active Transportation Plan (2017)

This Plan identifies 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.

3. Collision Data Collection and Analysis

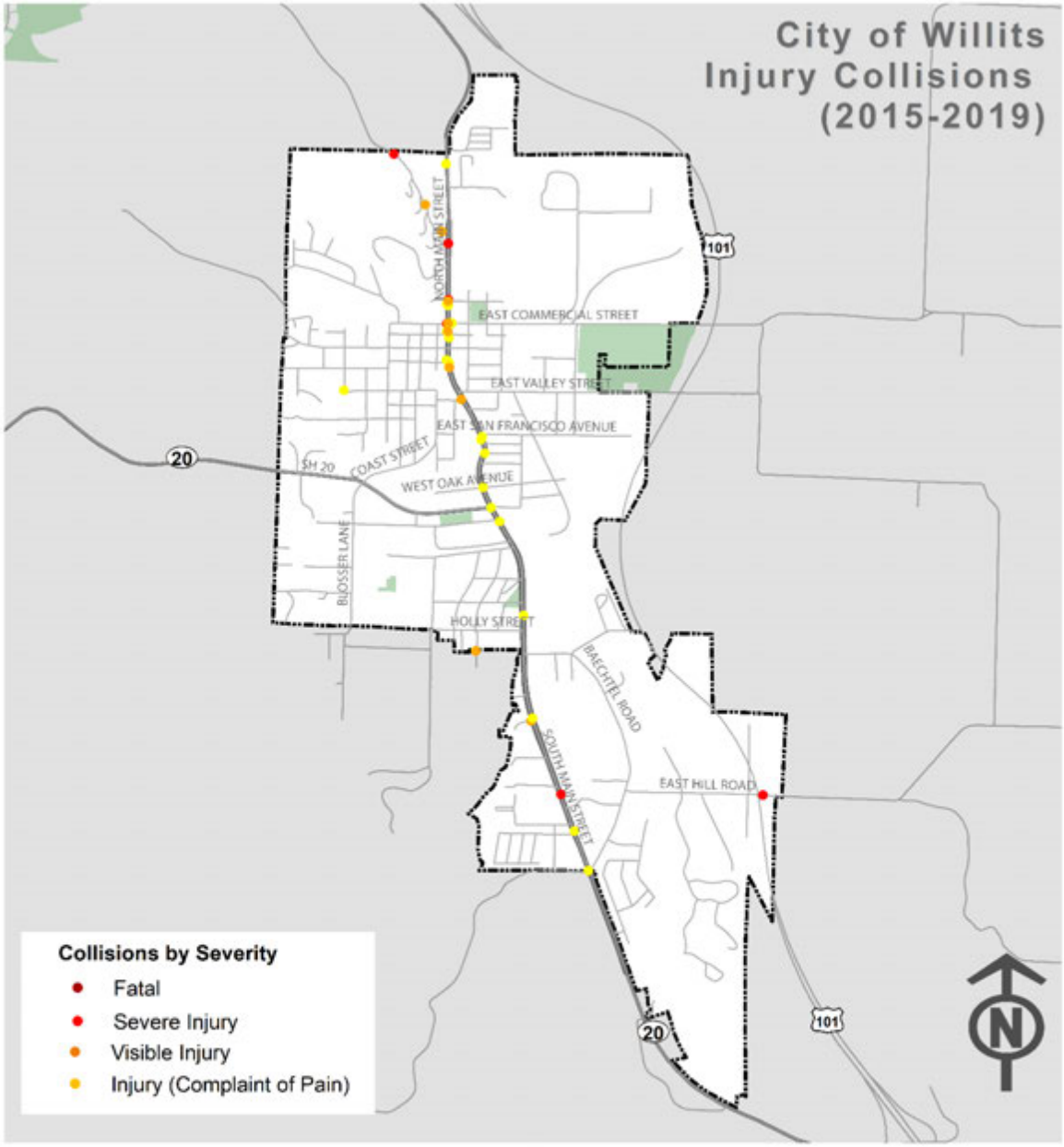
This section summarizes the results of the analysis of the collisions that have occurred in the City of Willits between January 2015 and December 2019, conducted as part of the City's Local Road Safety Plan (LRSP).

The LRSP focuses on systemically identifying and analyzing safety issues and recommends appropriate safety improvements. The chapter starts with an analysis of the collisions of all severity for the City of Willits, including Property Damage Only (PDO) collisions. Further on, a detailed analysis was conducted for fatal and severe injury (F+SI) collisions that have occurred on City's roadways. Further on, 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. The chapter includes the following sections:

- Demographic and Jurisdictional Characteristics
- Data Collection
- Collision Data Analysis
- Fatal and Severe Injury Collision Analysis
- Geographic Collision Analysis
- High Injury Network
- Summary

Figure 5 illustrates all the injury collisions that have occurred in the City from 1/1/2015 to 12/31/2019.

Figure 5. All Injury Collisions: City of Willits (2015-2019)



Demographic and Jurisdictional Characteristics

Demographic data has been collected from the Census in the City of Willits and Mendocino County, a summary of the population, centerline miles of roadway and commute to work characteristics are presented below.

Population

According to the 2015-2019 American Community Service (ACS) 5-year Estimate data, the population of Willits is 4,893, which is 5.6 percent of the county population. The population proportion as well as the centerline miles are shown in **Table 2**.

Table 2. Willits and Mendocino Population and Centerline Miles

	Population	Percent of County Population
Willits	4,893	5.6%
Point Arena	421	0.5%
Fort Bragg	7,302	8.4%
Ukiah	15,943	18.4%
Unincorporated	58,190	67.1%
Total	86,749	

Commute to Work

In the City of Willits, 81 percent of residents travel by cars or vans to work, out of which 70 percent drive alone and 11 percent carpool. About 9 percent of residents walk to work and 2 percent of residents biked. The different modes of transportation used to commute to work for the City as well as the 3 other cities in Mendocino County are shown in **Table 3**.

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, Mendocino County as a whole had 112 fatal traffic collisions, with 0 occurring in Willits, with a traffic fatality rate per 100,000 population of 25.82 for the County. These California average and the United States average is 8.95 and 10.28, respectively. **Table 4** shows the comparison of traffic fatality rates and population.

Table 4. Jurisdiction Ranking

Jurisdiction	Fatal Traffic Collisions (2015-2019)	Population	5 year Fatality Rate per 100,000
Willits	0	4,893	--
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 the City of Willits is provided by the California Office of Traffic Safety (OTS). OTS is designated by the Governor to receive federal traffic safety funds for coordinating California's highway safety programs. The latest available OTS rankings are from the year 2018. The 2018 rankings indicate that the City of Willits has the following ranks as listed in **Table 5**, when compared with 75 similarly sized cities[1]:

Table 5. Office of Traffic Safety Ratings 2018

OTS 2018 Ranking	Willits
Total Fatality and Injury	55/75
Alcohol Involved	55/75
Pedestrian	55/75
Bicycle	31/75
Speed Related	43/75
Nighttime	53/75

[1] https://www.ots.ca.gov/media-and-research/crash-rankings-results/?wpv-wpcf-year=2018&wpv-wpcf-city_county=Willits&wpv_filter_submit=Submit

Data Collection

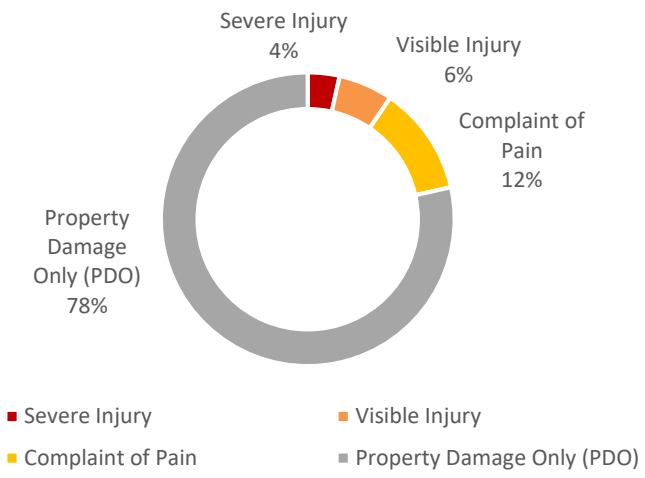
Collision data helps understand different factors that might be influencing collision patterns and various factors leading to collisions in a given area. For the purpose of this analysis, a five-year jurisdiction-wide collision data, from 2015 to 2019 was retrieved from Transportation Injury Mapping System (TIMS) and Statewide Integrated Traffic Records System (SWITRS). For the purpose of this analysis, all collisions occurring on SR-20 in the City of Willits have been taken into account in the analysis. 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 200 collisions reported City-wide from 2015 to 2019. Out of these, 157 collisions (78 percent) were PDO collisions, 24 collisions (12 percent) led to complaint of pain injury and 12 collisions (6 percent) led to a visible injury. There were 7 F+SI high injury collisions (fatal + severe injury collisions) of which all collisions led to a severe injury. **Figure 6** illustrates the classification of all collisions based on severity.

Figure 6. 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 on 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. This plan focuses on these collision locations to proactively identify and counter their respective safety issues.

The collision data was segregated by facility type, i.e. based on collisions occurring on 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 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	0	0	0
Severe Injury	3	4	7
Visible Injury	5	7	12
Complaint of Pain	1	23	24
Property Damage Only (PDO)	21	136	157
Total	**30**	**170**	200

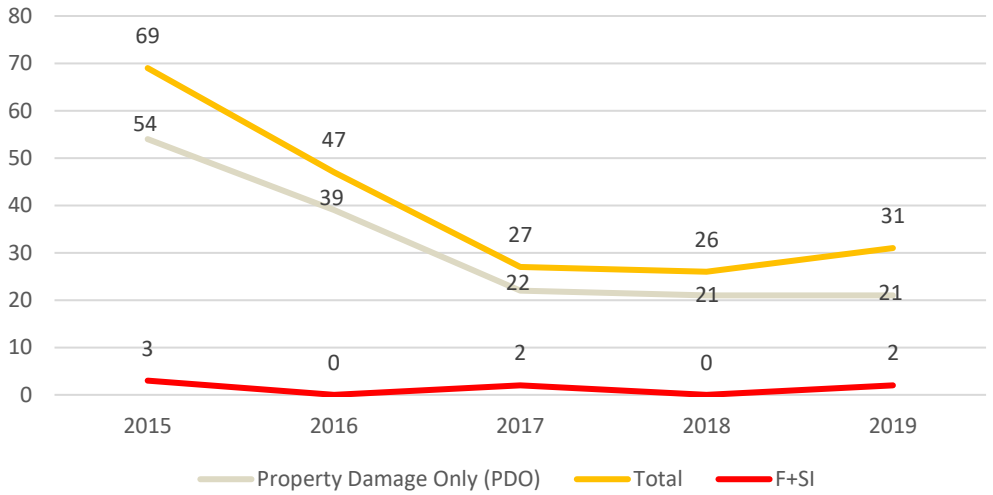
Preliminary Analysis

Collision Severity by Year

For all collisions, the number of collisions have decreased from 2015 to 2019. The highest number of collisions (69 collisions) were observed in 2015 and the lowest number of collisions (26) were observed in 2018.

A total of 7 F+SI collisions occurred in the City of Willits during the study period. The highest number of these high-injury collisions were observed in the year 2015 with 3 collisions that occurred that year, followed by 2 collisions that occurred in the year 2017 and 2019 each. No high-injury collision occurred in the year 2016 and 2018. **Figure 7**Error! Reference source not found. illustrates the five-year collision trend for all collisions, F+SI collisions and also PDO collisions.

Figure 7. Five Year Collision Trend



Intersections vs. Roadway Collisions

When evaluating all severity collisions based on the facility type they occurred on, it was observed that 85 percent of collisions occurred at intersections and 15 percent occurred at roadway segment/mid-block locations. For high-severity collisions that occurred in the City of Willits, about 42 percent collisions occurred on roadway segment/mid-block locations and 58 percent collisions occurred at intersections. This classification by facility type can be observed in **Figure 8.**

Figure 8. Intersection vs, Roadway Segment Collisions - All Collisions

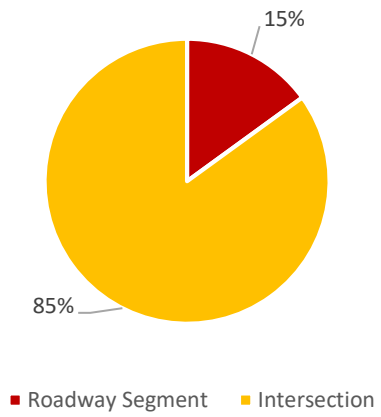
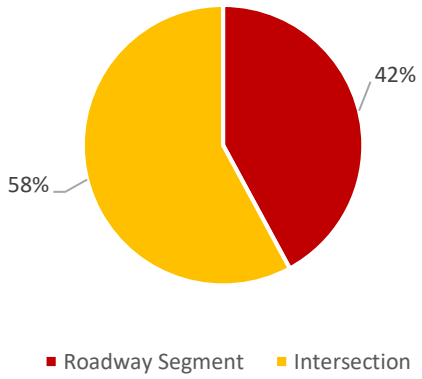


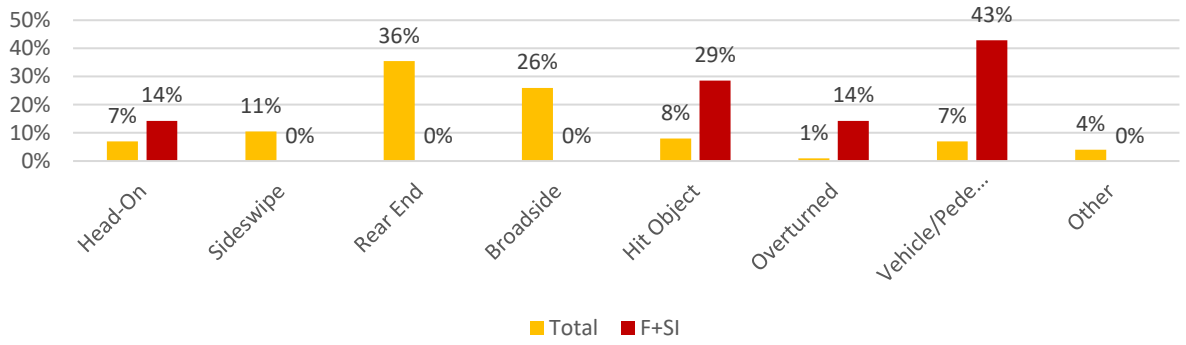
Figure 9. Intersections vs. Roadway Segment Collisions - F+SI Collisions



Collision Type

For collisions of all severity, the most commonly occurring collision type was rear-end collisions (36 percent) and broadside collisions (26 percent). Different type of collisions were observed for the high-injury collisions that occurred in the City. For F+SI collisions, the most commonly occurring collision type was vehicle pedestrian collisions (43 percent) and the second most common was hit-object collisions (29 percent). **Figure 10** illustrates the collision type for all severity collisions as well as F+SI collisions.

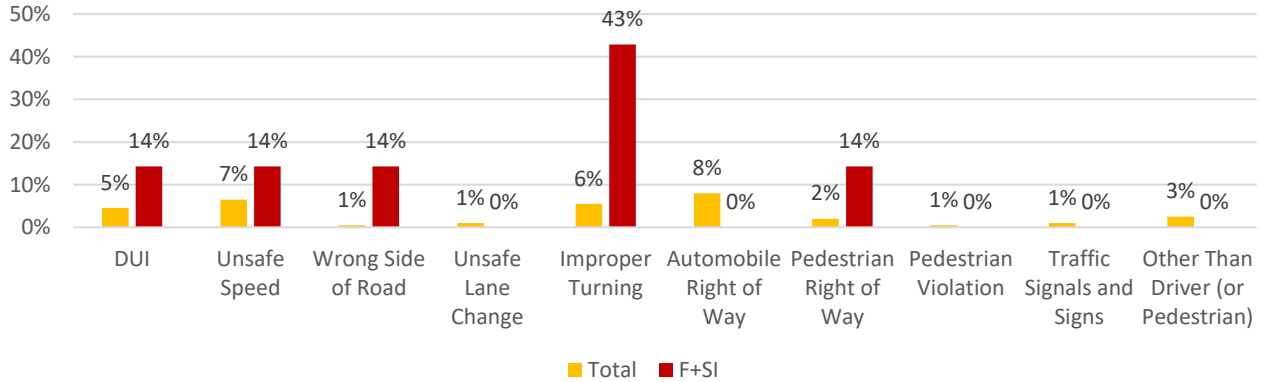
Figure 10. Collision Type: All Collisions vs. F+SI Collisions



Violation Category

For collisions of all severity, the most common violation category was observed to be automobile right of way (8 percent) followed by unsafe speed (7 percent). For F+SI collisions, improper turning (43 percent) was also observed to be the main violation category. Other violation categories observed for high-injury collisions were pedestrian right-of-way, wrong side of road, unsafe speed and DUI. **Figure 11** illustrates the violation category for all collisions and F+SI collisions.

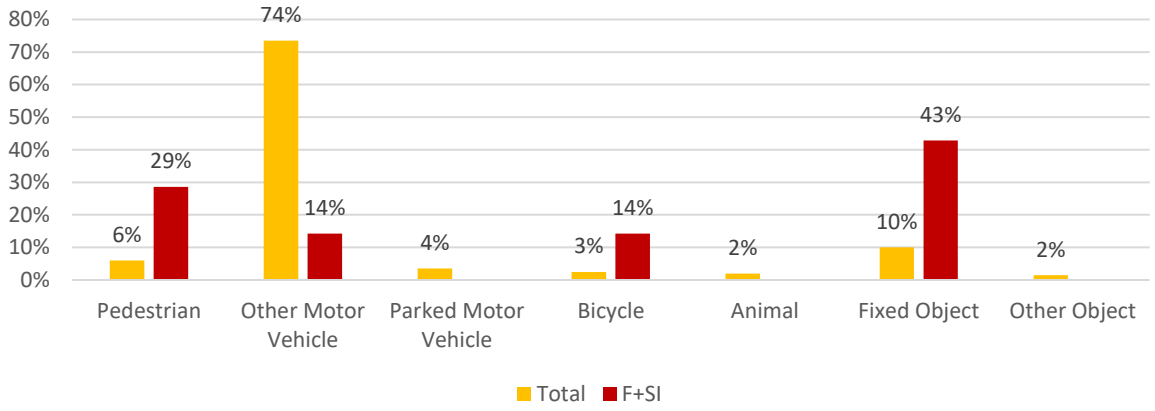
Figure 11. Violation Category: All Collisions vs. F+SI Collisions



Motor Vehicle Involved With

For collisions of all severity, 74 percent of the collisions are motor vehicle involved with another motor vehicle. For F+SI collisions, 43 percent of the collisions involved a fixed object and 29 percent involved a pedestrian with another motor vehicle. **Figure 12** illustrates the percentage of motor vehicle involved with for all collisions as well as F+SI collisions.

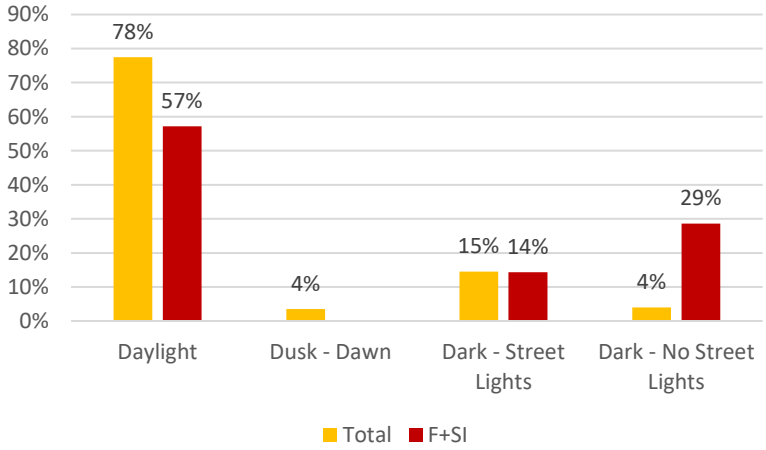
Figure 12. Motor Vehicle Involved With: All Collisions vs. F+SI Collisions



Lighting

For collisions of all severity, 78 percent of collisions have occurred in daylight and 15 percent of collisions have occurred in the dark on streets with street lights. For F+SI collisions, 57 percent of collisions have occurred in daylight and 29 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.

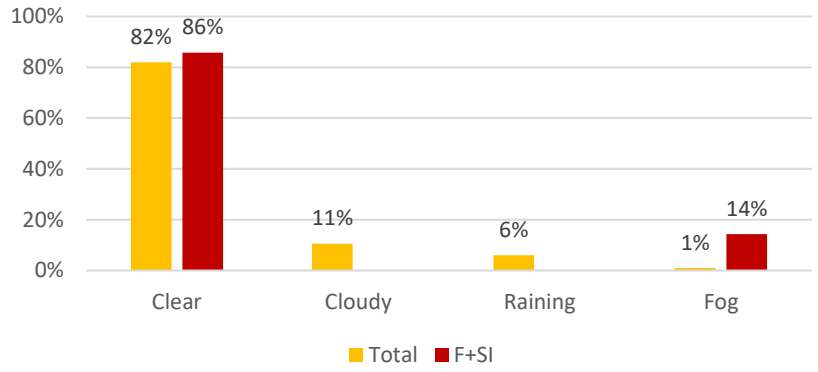
Figure 13. Lighting Conditions: All Collisions vs. F+SI Collisions



Weather

For collisions of all severity, 82 percent of collisions have occurred in clear weather conditions. For high-severity collisions, 86 percent have occurred in clear weather conditions and 14 percent have occurred in foggy conditions. **Figure 14** illustrates the weather conditions for all vs. F+SI collisions.

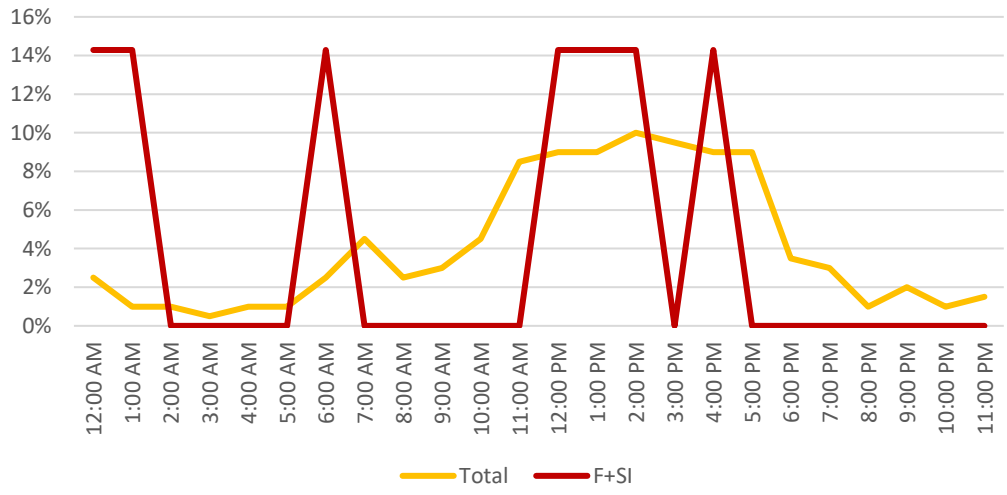
Figure 14. Weather Conditions: All Collisions vs. F+SI Collisions



Time of the Day

For collisions of all severity, the number of collisions have peaked between 12 p.m. and 5 p.m. For all F+SI collisions, the collisions have been observed to have peaked during the same time period. **Figure 15** illustrates the percentage of collisions occurring during the day for all collisions as well as F+SI collisions.

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



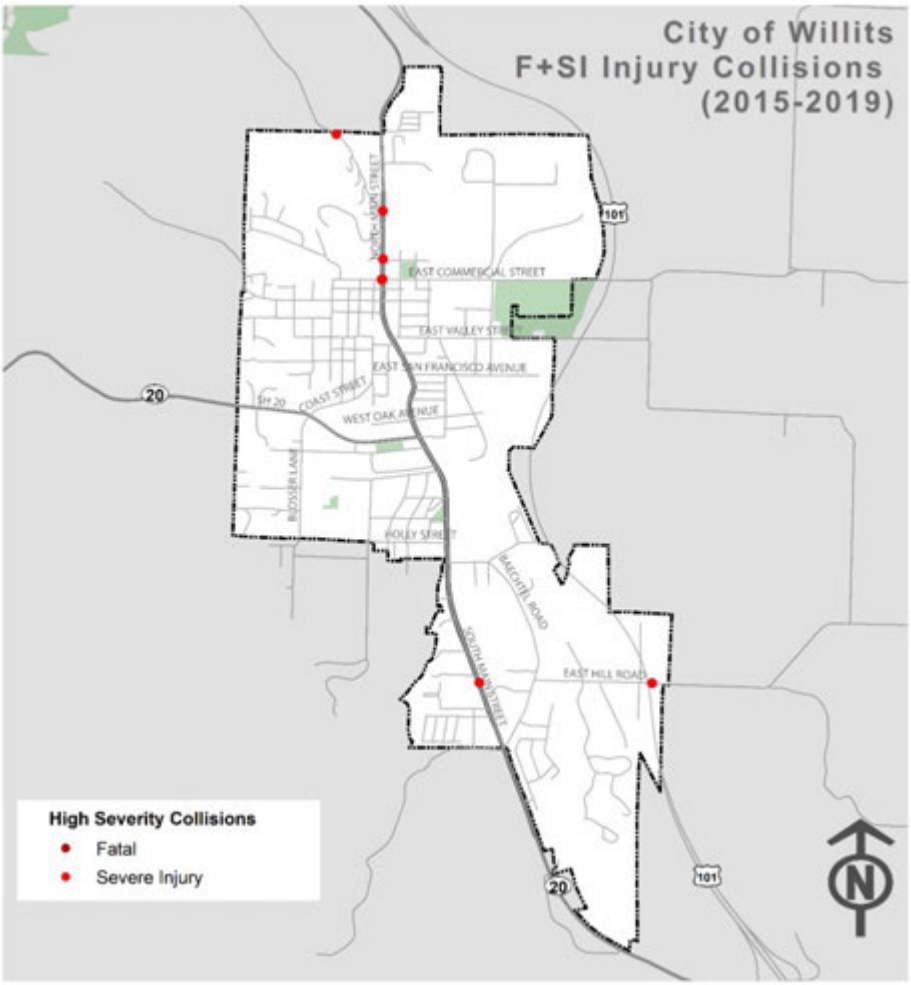
Fatal and Severe Injury Collision Analysis

The detailed collision analysis is effective for identifying high-risk locations by evaluating a shorter list of collisions that have led to a fatality or a severe injury. Collisions have been further analyzed taking into account the following collision attributes:

- Violation Category
- Collision Type vs. Violation Category
- Collision Type vs. Motor Vehicle Involved With
- Motor Vehicle Involved With vs. Violation Category
- Collision Type vs. Lighting Conditions
- Party at Fault: Gender vs. Age

Figure 16 illustrates all the locations of the fatal and severe injury collisions that have occurred in the City from 1/1/2015 to 12/31/2019.

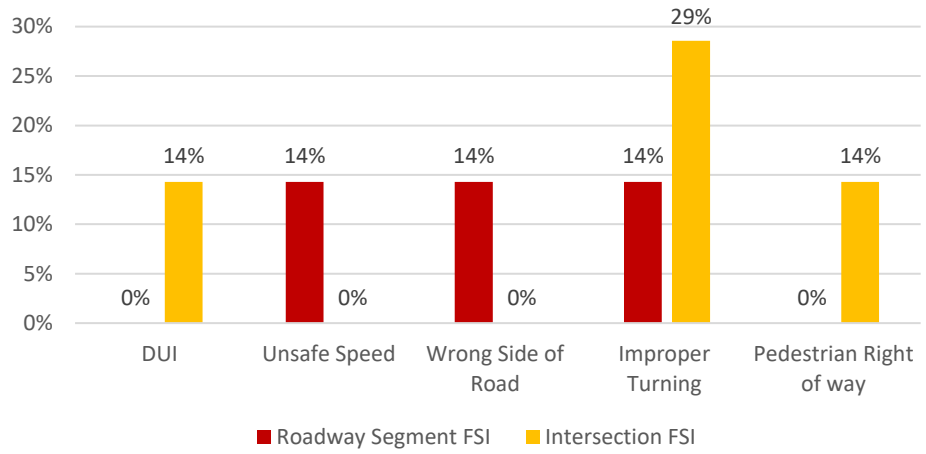
Figure 16. F+SI Collisions, 2015-2019



Violation Category

As illustrated in the **Figure 17** below, high injury intersection collisions were caused due to improper turning, pedestrian right of way, and DUI violations. High-injury roadway segment collisions were caused due to unsafe speed, wrong side of road and improper turning violations.

Figure 17. Violation Category: FSI Roadway Segment vs. Intersection Collisions

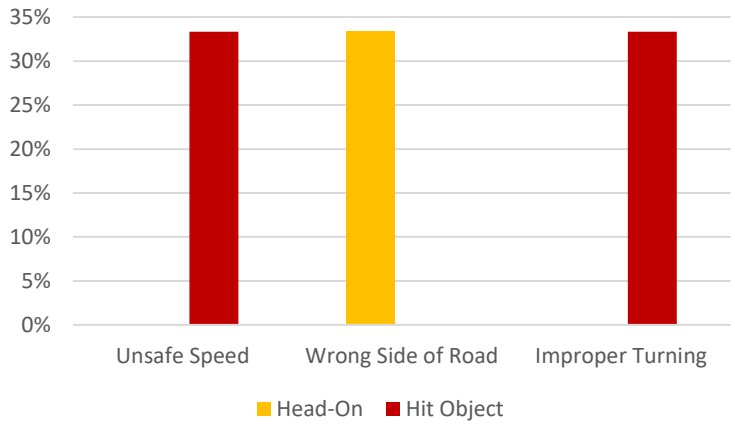


Collision Type vs. Violation Category

Roadway Segment FSI Collisions

For high injury roadway segment collisions, head-on collisions that occurred were caused due to right-of-way violation. The hit-object collisions that occurred on roadway segments were due to improper turning and unsafe speed violations.

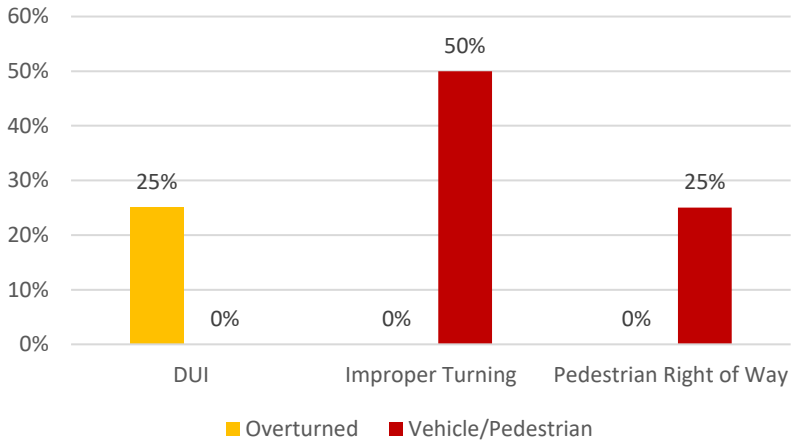
Figure 18. Collision Type vs. Violation Category: Roadway Segment FSI Collisions



Intersection FSI Collisions

For high-injury collisions that occurred on intersections, vehicle-pedestrian collisions were caused due to improper turning and pedestrian right-of-way violations and an overturned collision was caused due to DUI violation.

Figure 19. Collision Type vs. Violation Category: Intersection FSI Collisions

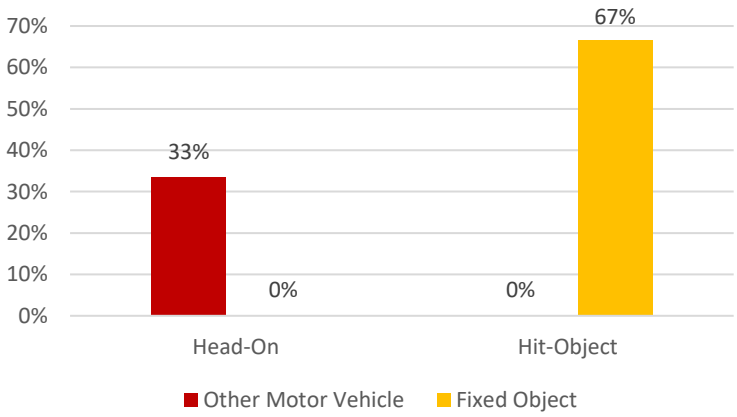


Collision Type vs. Motor Vehicle Involved With

Roadway Segment FSI Collisions

For high-injury collisions that occurred on roadway segments, head-on collision occurred between two motor vehicles and the hit object collisions occurred between the motor vehicle and another fixed object.

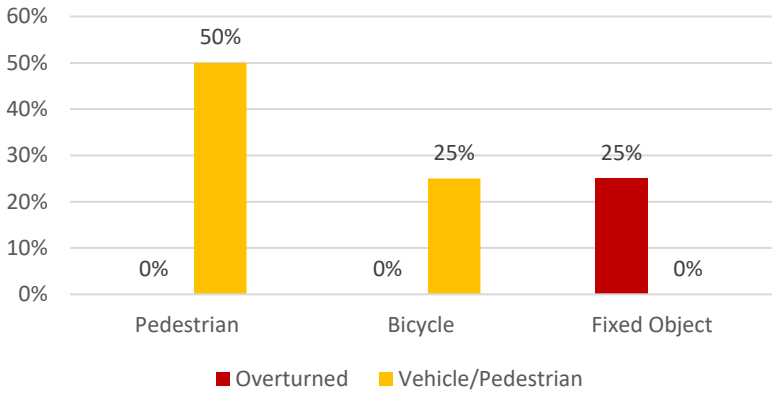
Figure 20. Collision Type vs. Motor Vehicle Involved With: Roadway Segment FSI Collisions



Intersection FSI Collisions

For the intersection high-injury collisions, the overturned collision occurred between a motor vehicle and a fixed object, while the vehicle-pedestrian collisions occurred between a motor vehicle/pedestrian and motor vehicle/bicyclist.

Figure 21. Collision Type vs. Motor Vehicle Involved With: Intersection FSI Collisions

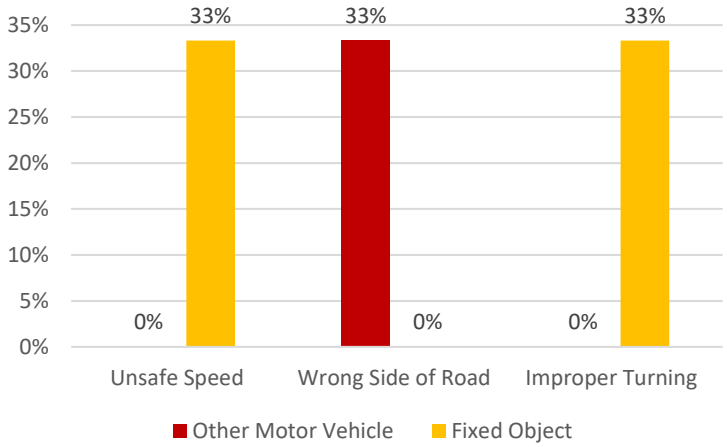


Motor Vehicle Involved With vs. Violation Category

Roadway Segment FSI Collisions

For high injury collisions that occurred on roadway segments, a collision between two motor vehicles occurred due to wrong side of the road violation. Two fixed object collisions occurred due to unsafe speed and improper turning violations.

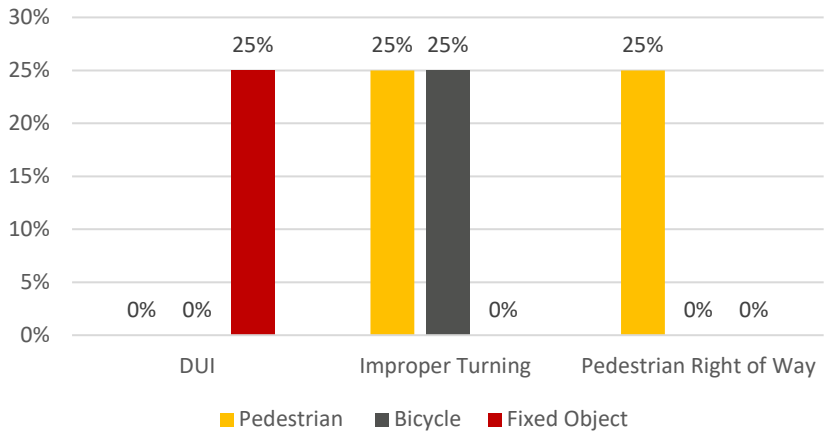
Figure 22. Motor Vehicle Involved with vs. Violation Category: Roadway Segment FSI Collisions



Intersection FSI Collisions

For high-injury collisions that occurred at intersections, the collision that occurred between a motor vehicle and a fixed object was due to a DUI violation. The collision that involved a pedestrian was due to improper turning and pedestrian right-of-way violations and the collision that involved a bicycle was also due to improper turning.

Figure 23. Motor Vehicle Involved with vs. Violation Category: Intersection FSI Collisions

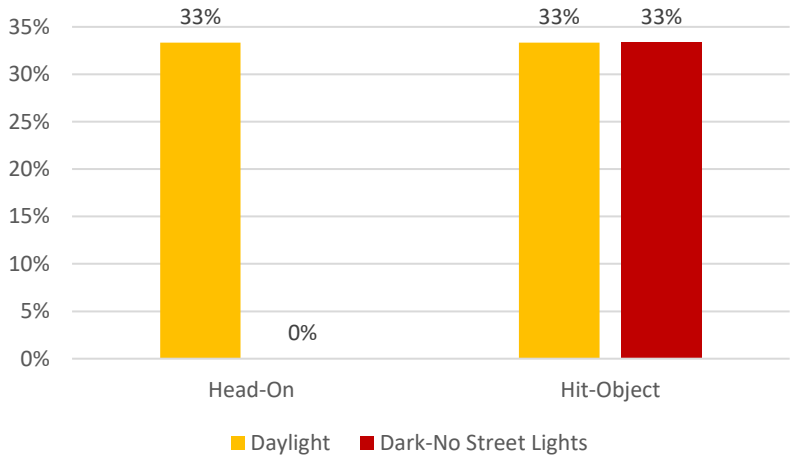


Collision Type vs. Lighting Conditions

Roadway Segment FSI Collisions

For the high-injury collision that occurred on roadway segments, it was observed that the one head-on and one hit-object collision occurred during daylight, and the third hit-object collision occurred in the dark at a location with no street lights.

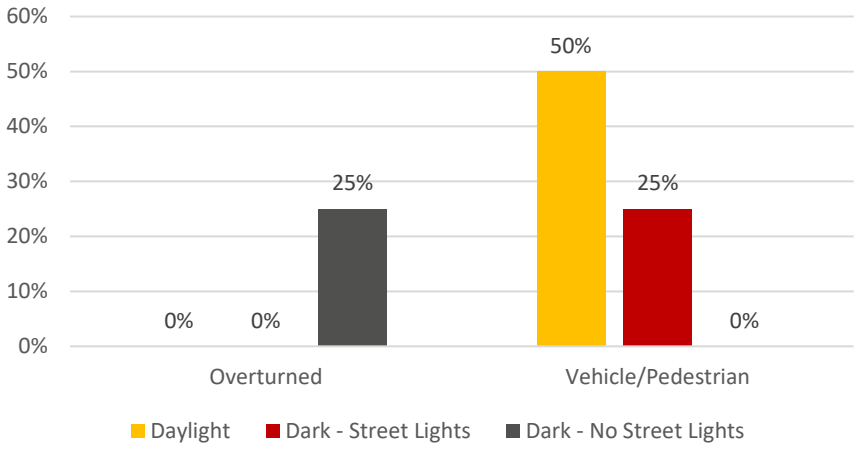
Figure 24. Collision Type vs. Lighting Conditions: Roadway Segment FSI Collisions



Intersection FSI Collisions

For the high injury collisions that occurred at intersections, two vehicle-pedestrian collisions occurred in daylight and one occurred in dark at a location with street lights. The overturned high-injury collision occurred in dark at an intersection with no street light.

Figure 25. Collision Type vs. Lighting Conditions: Intersection FSI Collisions

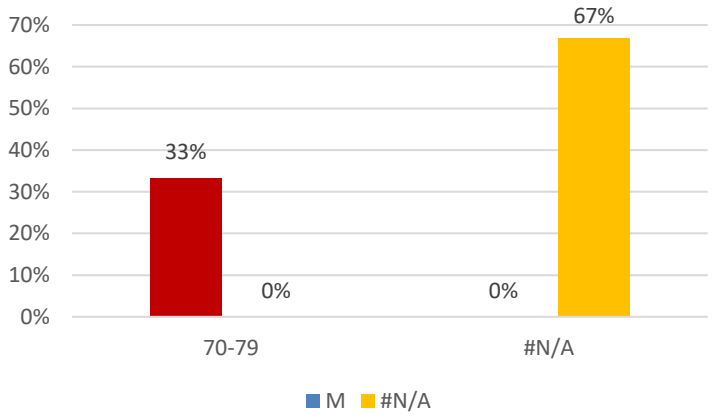


Party at Fault: Gender vs. Age

Roadway Segment FSI Collisions

For the high-injury collision that occurred on a roadway segment, the party at fault was male and in the age group of 70-79 years. Gender and age of the rest of the parties at fault are not known.

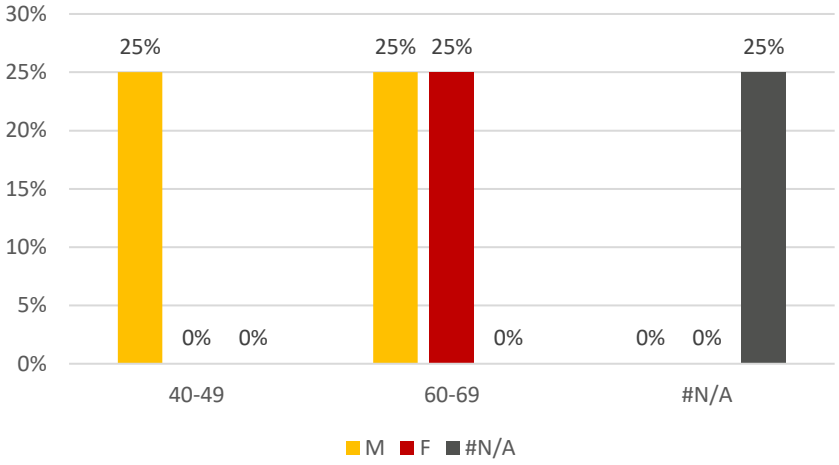
Figure 26. Party at Fault: Gender vs. Age - Roadway Segment FSI Collisions



Intersection FSI Collisions

For the high injury collisions that happened at intersections, the party at fault were a male between the age of 40-49 years and 60-69 years, a female between 60-69 years, and rest were unknown.

Figure 27. Party at Fault: Gender vs. Age - Intersection FSI Collisions



Geographic Collision Analysis

This section describes a detailed geographic collision analysis performed for injury collisions occurring at roadway segments and intersections in the City of Willits. The above collision analysis was used to identify five main collision factors that highlight the top trends among collisions in the City of Willits. These five collision factors were identified to be vehicle-pedestrian collisions, intersection collisions, unsafe speed collisions, improper turning collisions and hit-object collisions.

Vehicle Pedestrian Collisions

For F+SI collisions in the City of Willits, 43 percent of collisions were pedestrian involved collisions, compared to just 7 percent of all severity collisions. **Figure 28** shows the distribution of pedestrian collisions and the hot-spots that are risky for pedestrians throughout the City of Willits. North Main Street, East Commercial Street and West Oak Avenue are locations where vehicle-pedestrian injury collisions have occurred.

Intersection Collisions

For F+SI collisions in the City of Willits, 58 percent of the collisions have occurred at intersections, compared to 85 percent of all severity collisions.

Figure 29 shows the distribution of roadways where intersection collisions have been observed to occur the most. Intersections along, North Main Street, South Main Street, East Commercial Street, West Oak Avenue and East Hill Road have been observed to have injury collisions at intersections.

Unsafe Speed Collisions

For F+SI collisions in the City of Willits, 14 percent occurred due to unsafe speed violations.

Figure 30 shows the distribution of high injury collisions that have occurred due to unsafe speed violations. North and South Main Street and East Commercial Street have been observed to be major hot-spots for unsafe speed collisions.

Improper Turning Collisions

For F+SI collisions in the City of Willits, 43 percent occurred due to improper turning violations.

Figure 31 illustrates the locations where high-injury collisions have occurred due to improper turning violations. North and South Main Street and Sherwood Road are roadways where collisions due to improper turning violation have been observed.

Hit Object Collisions

For the F+SI collisions that occurred in the City of Willits, 29 percent were hit-object collisions.

Figure 32 illustrates the locations where hit object collisions have occurred. North and South Main Street and Sherwood Road are roadways where such collisions have been observed.

Figure 28. Vehicle-Pedestrian Collisions

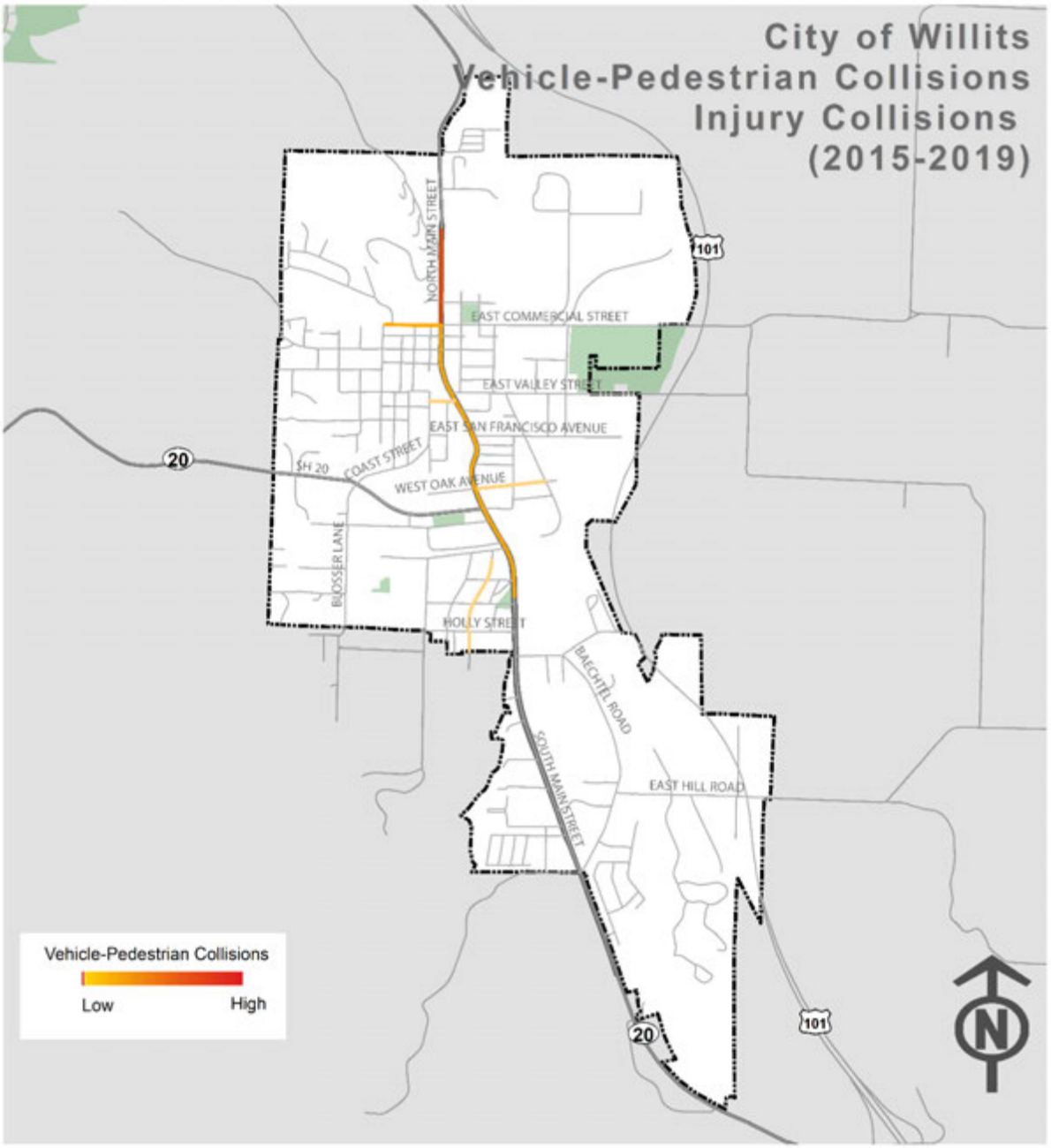


Figure 29. Intersection Collisions

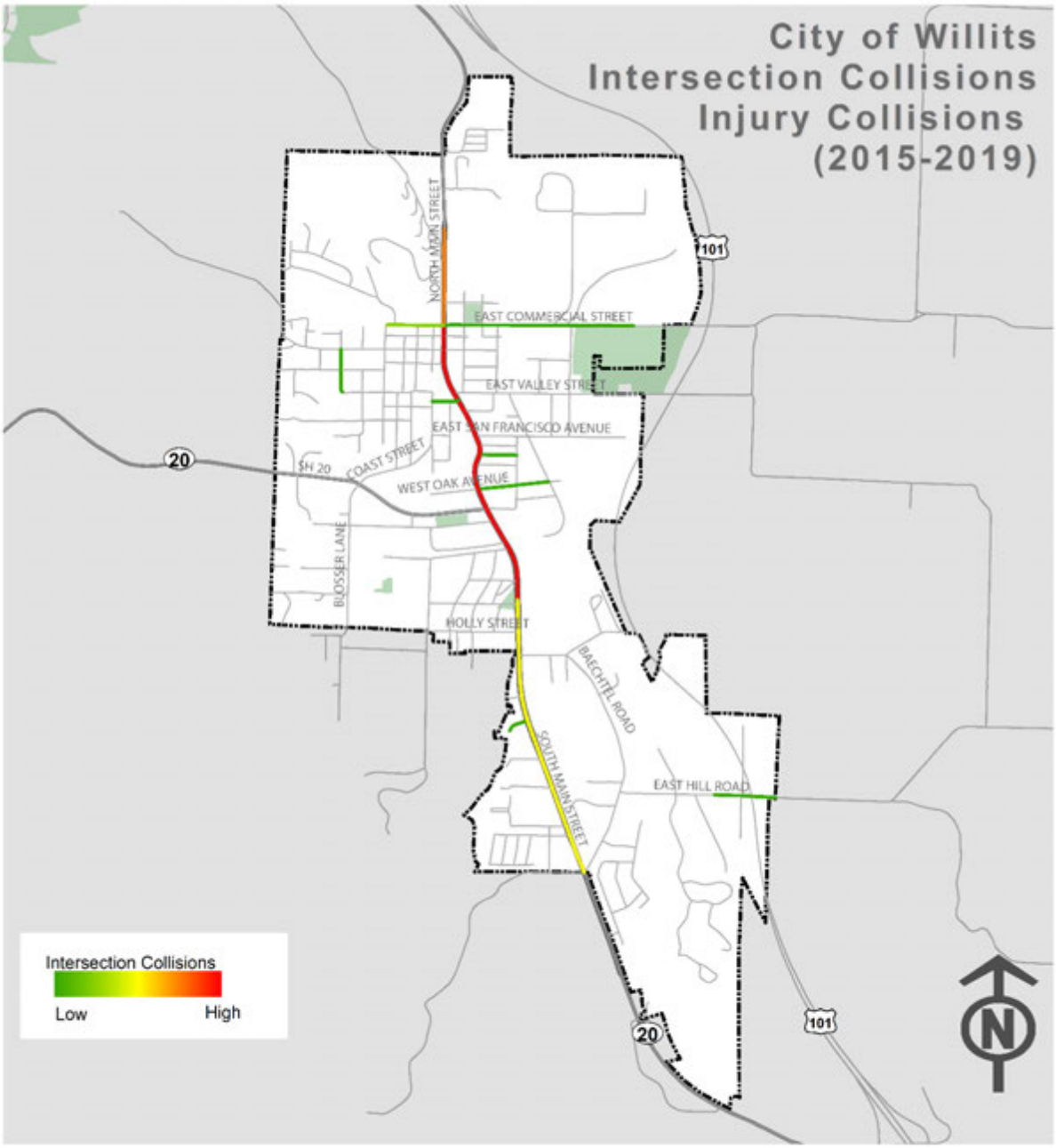


Figure 30. Unsafe Speed Collisions

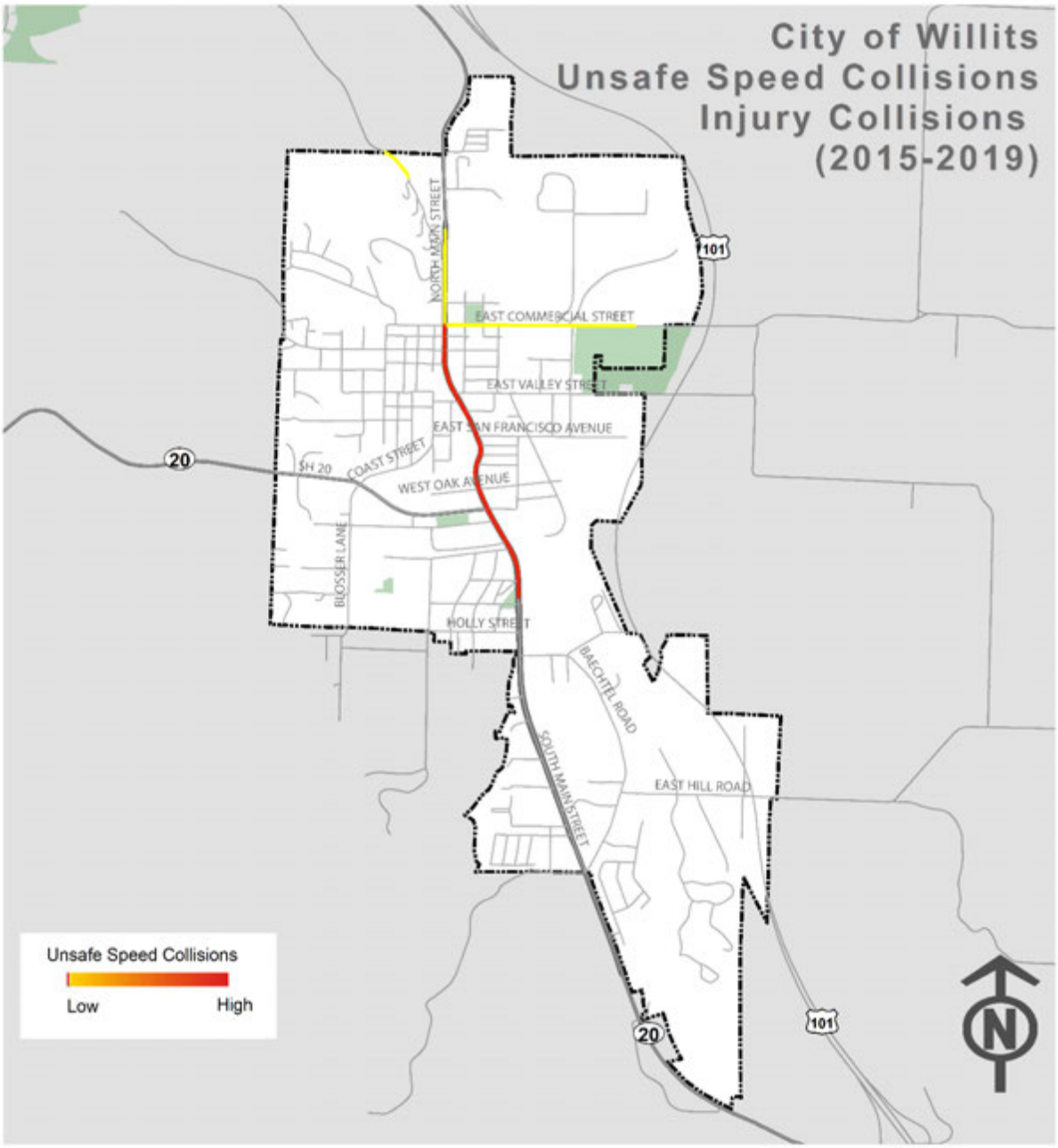


Figure 31. Improper Turning Collisions

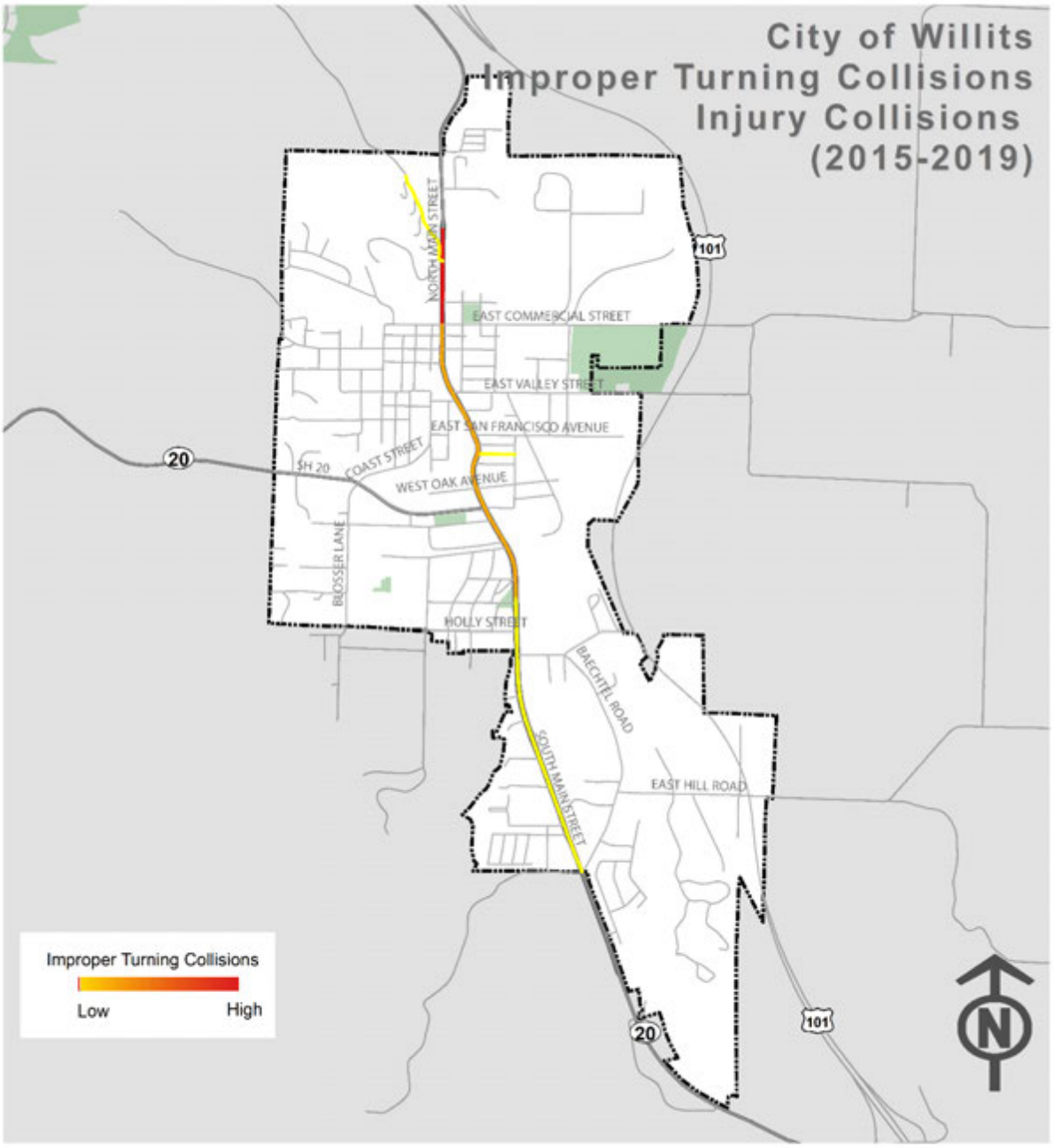
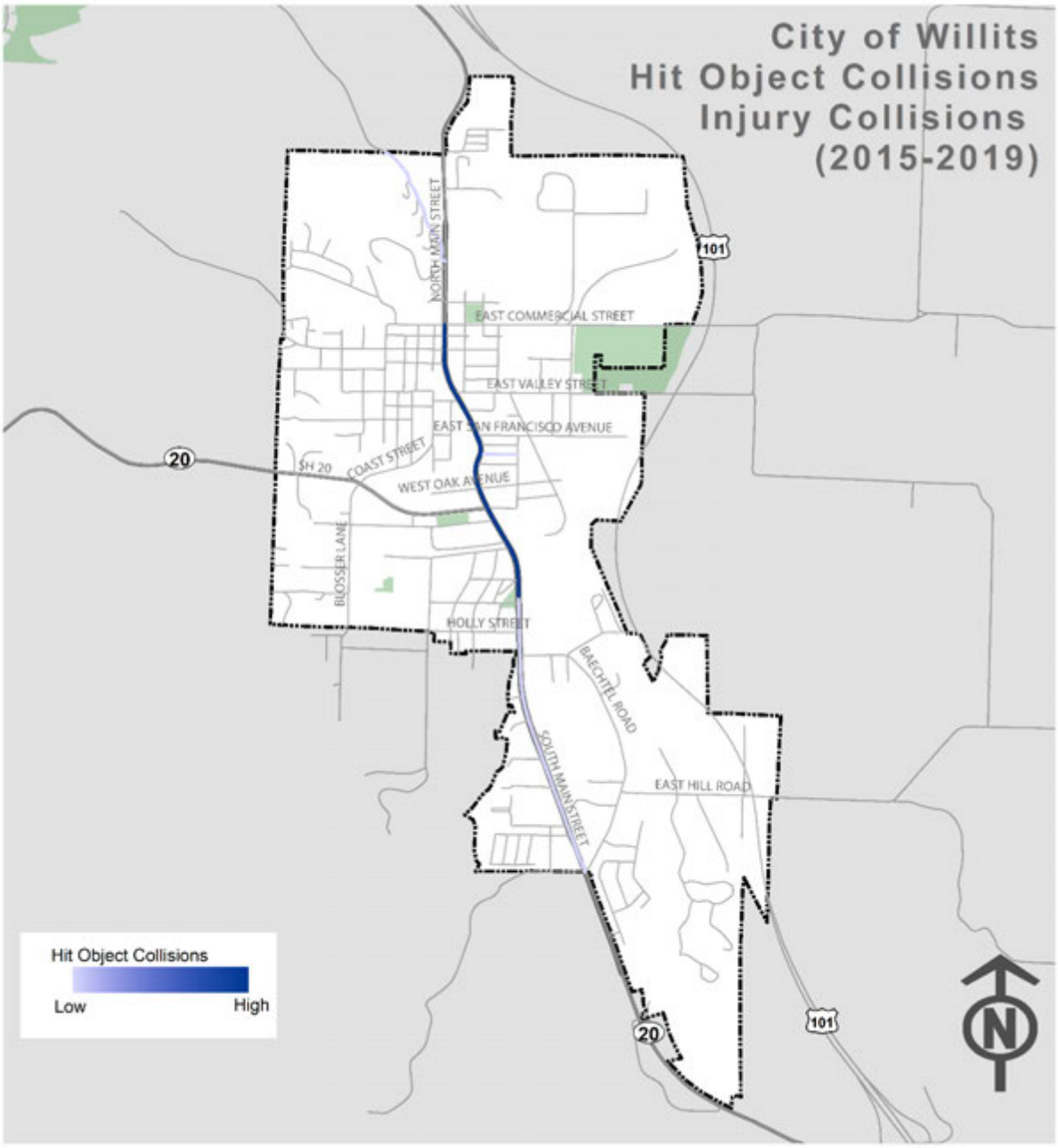


Figure 32. Hit Object Collisions


City of Willits
Hit Object Collisions
Injury Collisions
(2015-2019)
NORTH MAIN STREET
EAST COMMERCIAL STREET
EAST VALLEY STREET
EAST SAN FRANCISCO AVENUE
SH 20
COAST STREET
WEST OAK AVENUE
BLOSSER LANE
HOLLY STREET
BAECHTEL ROAD
SOUTH MAIN STREET
EAST HILL ROAD
101
20
Hit Object Collisions
Low
High
N

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 property damage only (PDO) collisions. The EPDO method assigns a crash cost and score to each collision according to the severity of the crash weighted by the comprehensive crash cost. These EPDO scores are calculated using a simplified version of the comprehensive crash costs per HSIP Cycle 10 application. The weights used in the analysis are shown below in **Table 7**.

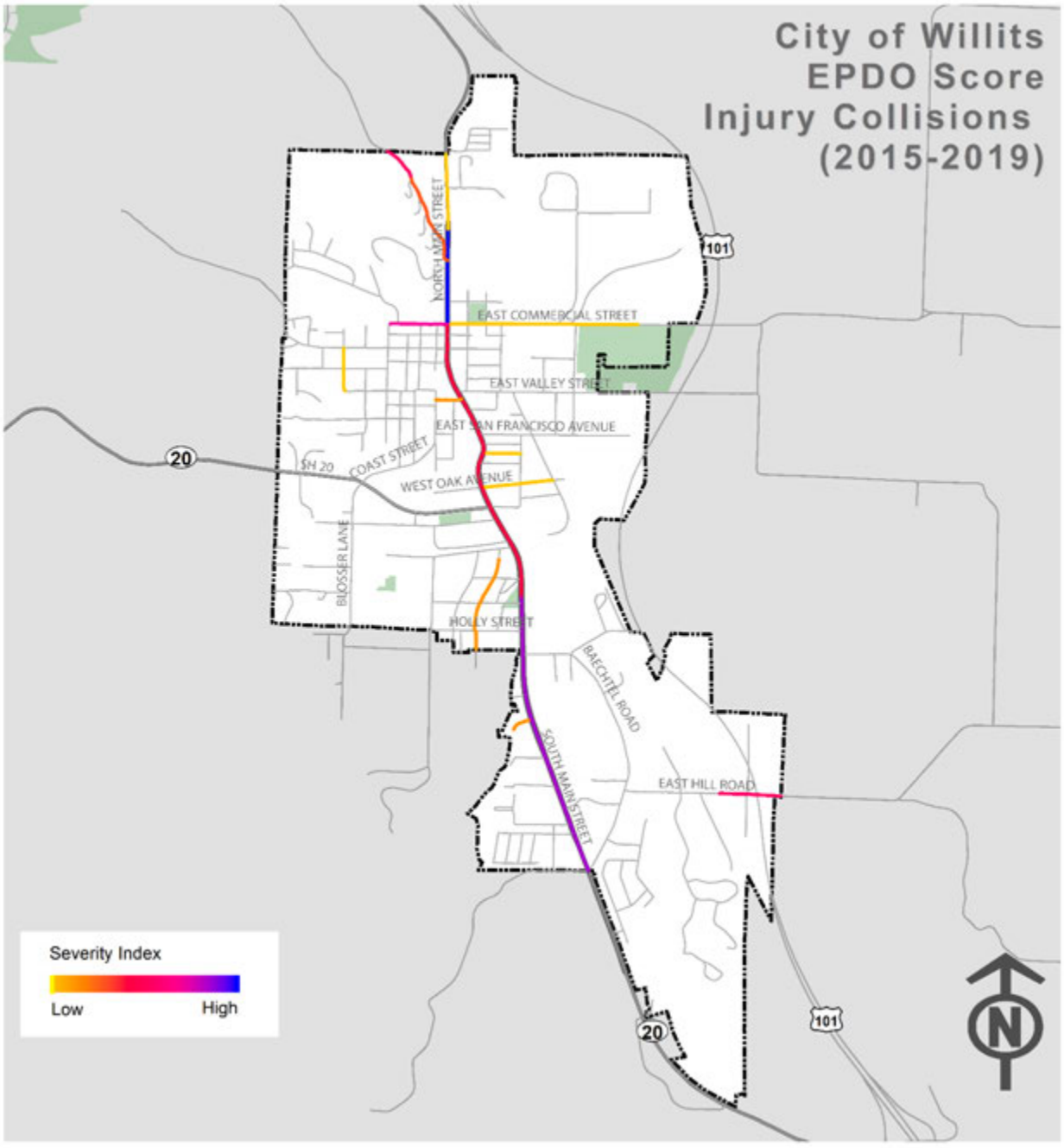
Table 7. EPDO Score used in HSIP Cycle 10

Collision Severity	EPDO Score
Fatal and Severe Injury 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 the City of Willits were geolocated onto Willits's road network. **Figure 33** shows the location and geographic concentration of collisions by their EPDO score.

Figure 33. EPDO Score: City of Willits

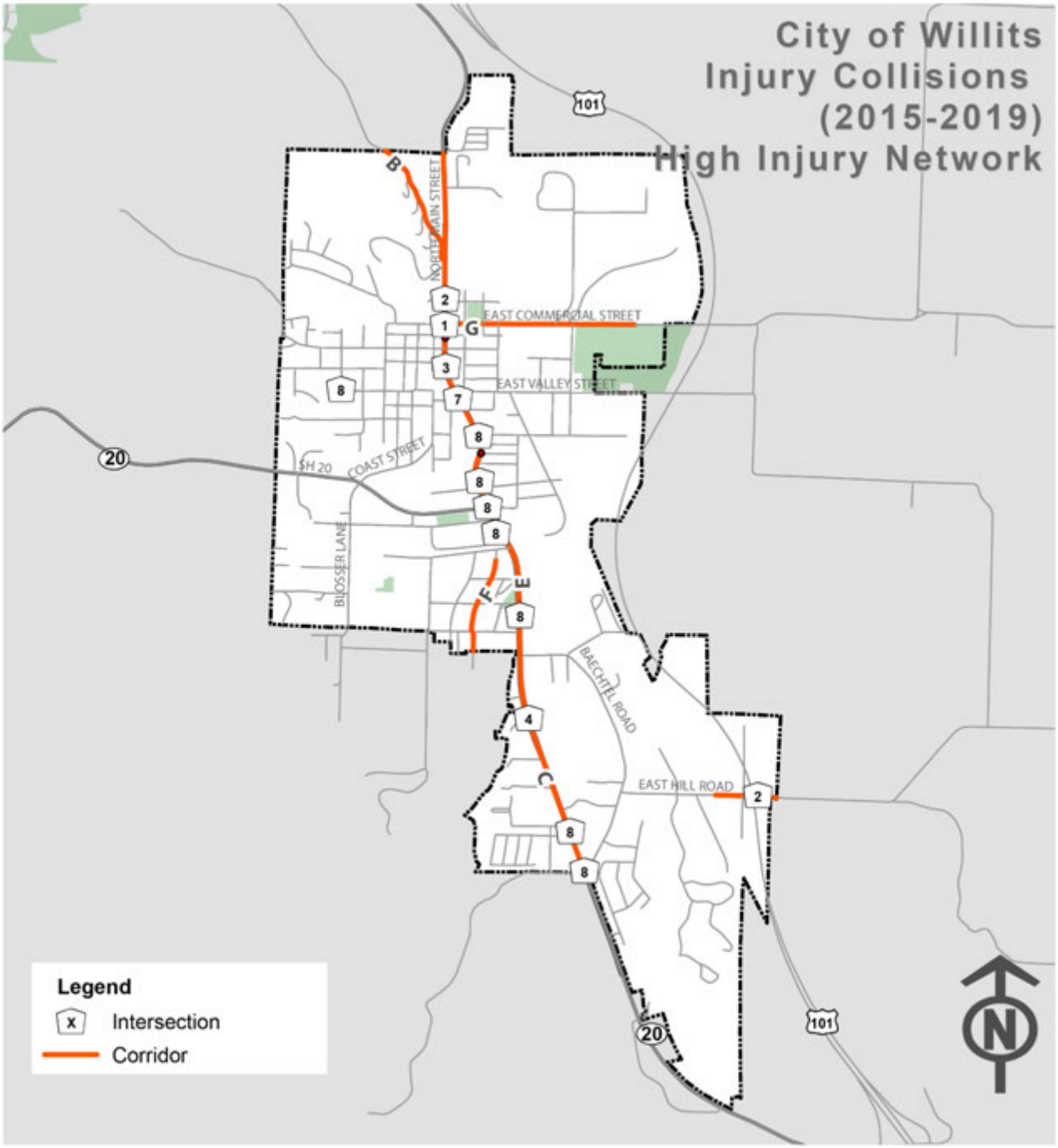


High-Injury Locations

Following the detailed collision analysis in the previous sections, the next step is to identify the high-risk roadway segments and intersections in the City of Fort Willits. The methodology for scoring the high injury locations is methodology used calculating the EPDO Score of roadways in the City. **Figure 34** shows the 8 high-collision corridors and 18 high-collision intersections. This high collision network has a total of 40 injury collisions and 7 F+SI collisions, which represents 100 percent of the injury collisions in the City of Willits on about 12 percent of Willits roadway network.

For the purposes of the identification of the high collision network, 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 occur directly at an intersection, or collisions that occurred at a distance of 0 feet from the primary and secondary road as per the statewide integrated traffic records system (SWITRS).

Figure 34. City of Willits: High Injury Network



High-Injury Intersections

A total of 18 intersections were identified as high-injury intersections. There were a total of 4 F+SI collisions that occurred at these intersections. The intersection of Main Street and Commercial Street has the highest EPDO score and it thus tops the list of high-risk intersections. **Table 8** lists the collision rate of the identified high-collision intersections along with the total number of collisions that occurred at that location.

Table 8. High-injury Intersections

Rank	Intersection	EPDO Score	Total Collisions	F+SI	Unsafe Speed	Improper Turning	Vehicle-Pedestrian	Hit-Object
1	Main St & Commercial St	364	6	2	1	1	5	0
2	East Hill Rd & Us-101	165	1	1	0	0	0	0
2	Rt 101 & State St	165	1	1	0	1	1	0
3	Rt 101 & Wood St	29	4	0	2	1	1	1
4	Rt 101 & Gregory Ln	23	3	0	0	0	0	0
5	Rt 101 & Van Ln	18	3	0	3	0	0	0
6	Rt 101 & State St	12	2	0	1	1	0	0
7	W Valley Rd & Rt 101	11	1	0	0	0	1	0
8	Rt 101 & Muir Mill Rd	6	1	0	0	0	0	0
8	Rt 101 & East San Francisco St	6	1	0	1	0	0	0
8	Rt 101 & Franklin Av	6	1	0	0	0	0	0
8	Rt 101 & Holly St	6	1	0	0	0	0	0
8	Main St & Manor Wy	6	1	0	0	0	0	0
8	Monroe St & Rt 101	6	1	0	0	1	0	1
8	Spruce St & Pine St	6	1	0	0	0	0	0
8	Rt 101 & Rt 20	6	1	0	0	0	0	0
8	Main St & San Francisco Av	6	1	0	0	0	1	0
8	E Oak St & Rt 101	6	1	0	0	0	1	0

High-Injury Corridors

A total of 8 corridors have been identified as high injury corridors. There were a total of 5 F+SI collisions on these corridors. The corridor with the highest number of F+SI collision is North Main Street from Sherwood Road to East Commercial Street, where 6 collisions occurred including 2 F+SI collisions.

Table 9 lists the EPDO score of the eight corridors identified as high-injury corridors along with the number of collisions that occurred on these corridors.

Table 9. High Injury Corridors

Rank	Corridor	EPDO Score	Total Collisions	F+SI	Unsafe Speed	Improper Turning	Vehicle-Pedestrian	Hit-Object	Len (mi.)
A	North Main Street, from Sherwood Road to East Commercial Street	364	6	2	1	3	2	0	0.3
B	Sherwood Road, from Main Street to City Boundary	187	3	1	1	1	0	2	0.4
C	South Main Street, from Hazel Street to Muir Mill Road	171	2	1	0	1	0	1	0.9
D	East Hill Road, between 650 feet E of Haehl Creek Drive and the City boundary	165	1	1	0	0	0	0	0.19
E	South Main Street, from Hazel Street to East Commercial Street	70	10	0	6	2	1	2	0.9
F	Poplar Avenue, between Walnut Street and City Boundary	11	1	0	0	0	1	0	0.3
G	East Commercial Street, between South Main Street and 1000 feet E of S Lenore Avenue	6	1	0	1	0	0	0	0.6
H	North Main Street, from Sherwood Road to City Boundary	6	1	0	0	0	0	0	0.23

4. Emphasis Areas

Emphasis areas are focus areas for the local roadway safety plan that are identified through the comprehensive collision analysis of the identified high injury locations within the City of Willits. 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 July 12th, 2021.

This section summarizes the 7 emphasis areas identified for the City of Willits. 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 the City of Willits.

The following are the identified emphasis areas –

- Improve Intersection Safety
    1. Collisions within 250 feet of intersections
- Unsafe Speed Collisions
- Improper Turning Violations
- Pedestrian Safety
- Rear-end Collisions
- Broadside Collisions
- Hit-Object 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. Some of the common violation types that may require a comprehensive approach are speeding, failure-to-yield to pedestrians, red light running, aggressive driving, failure to wear safety belts, distracted driving, and driving while impaired. When locations are identified as having these types of violations, coordination with the appropriate law enforcement agencies is needed to arrange visible targeted enforcement to reduce the potential for future driving violations and related crashes and injuries.

To improve safety, education efforts can 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, Emergency Medical Services entails strategies around supporting organizations that provide rapid response and care when responding to collisions causing injury, by stabilizing victims and transporting them to facilities.

Existing Traffic Safety Efforts in the City of Willits

The City of Willits has already implemented safety strategies corresponding to the 4 E's of traffic safety. The strategies detailed in this chapter can supplement these existing programs and concentrate them on high injury collision locations and crash types. These initiatives are summarized in the table below:

Table 10. Existing Programs Summary

Document	Description	E's Addressed
Willits Safe Routes to School Action Plan (2017)	This plan includes recommendations to improve the safety for both walking and biking in areas around all seven of the Willits area schools.	Engineering Education Enforcement
City of Willits Traffic Safety Evaluation (2010)	The primary objective of this TSE is to improve traffic safety in the City of Willits. City staff was particularly interested in improving safety for pedestrians and bicyclists along Main Street.	Engineering Enforcement
Willits Main Street Corridor Enhancement Plan (2017)	This plan was prepared in preparation for the opening of the US 101 bypass of Willits and eventual relinquishment of the former stretch of US 101 that serves as Main Street through the City of Willits, north of the intersection with SR 20.	Engineering
Willits Bicycle and Pedestrian Specific Plan (2009)	This plan was developed with the intent of identifying bicycle and pedestrian facilities within the City of Willits that would serve residents and visitors. Projects within the plan would enhance tourism, promote health, and improve safety.	Engineering Education
Downtown Willits Streets and Alleys Connectivity Study (2017)	This Plan seeks to beautify and enhance connectivity downtown, provide better accessibility for pedestrians and bicyclists, maintain parking and provide loading zones, improve traffic safety, lighting, signage and landscaping.	Engineering
Mendocino County Safe Routes to School Plan (2014)	In addition to the Citywide program the countywide Safe Routes to School (SRTS) is also a resource to a program with a simple goal: helping more children get to school by walking and bicycling.	Engineering Education

Document	Description	E's Addressed
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
Willits Police Department Ongoing Programs and Resources	The City Police Department has a number of programs and resources to reduce traffic fatalities and an ongoing commitment to enforcing traffic violations at key location in Willits including schools.	Enforcement Education
Walk and Bike Mendocino	Walk and Bike Mendocino promotes safe walking and biking as a primary transportation choice in short distance travel in Mendocino County.	Education

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 fatal and severe (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.

Emphasis Area 1 – Intersection Safety

A total 40 collisions occurred on the high injury network in the City out of which 31 (78 percent) of these collisions occurred at intersection, including 4 fatal and severe injury (F+SI) collisions. The following are major findings based on intersection injury collisions that occurred on the high injury network in the City of Willits followed by strategies to make these locations safer.

81%
Occurred on Main Street

32%
Involved a Pedestrian or Bicyclist

26%
Unsafe Speed Collisions

Table 11. Emphasis Area 1 Strategies

Objective: To reduce the number of injury collisions at intersections.			
	Strategy	**Performance Measure**	**Agencies/Organizations**
Education	Conduct public information and education campaign for intersection safety laws regarding traffic signals, stop signs, and turning left or right.	Number of education campaigns.	City/ School District/ Police Department
Enforcement	Targeted enforcement at high-risk intersections to monitor traffic law violations right-of-way violations, speed limit laws and other violations that occur at intersections.	Number of tickets issued.	Police Department
Engineering	• 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 intersections improved.	City
EMS	S05, Install emergency vehicle pre-emption systems	EMS vehicle response time.	Mendocino County Local Emergency Services Agency

Emphasis Area 2 – Unsafe Speed Collisions

A total 40 collisions occurred on the high injury network out of which 9 (23 percent) of these collisions were unsafe speed collisions, including 1 fatal and severe injury (F+SI) collisions. The following are major findings based on unsafe speed collisions on the high injury network in the City of Willits followed by strategies to make these locations safer:

89%
Rear-end collision

89%
Involved two motor-vehicles

78%
Occurred on Main Street

Table 12. Emphasis Area 2 Strategies

Objective:			
Reduce the number of injury collisions that are due to unsafe speed violations.			
	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.	City/ School District/ Police Department
Enforcement	Targeted enforcement at high-risk locations to monitor unsafe speed.	Number of tickets issued.	Police Department
Engineering	• S16/NS04/NS05, Convert intersection to roundabout • NS07, Upgrade intersection pavement markings (NS.I.) • NS10, Install transverse rumble strips on approaches • 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.	City
EMS	S05, Install emergency vehicle pre-emption systems	EMS vehicle response time.	Mendocino County Local Emergency Services Agency

Emphasis Area 3 – Improper Turning Violations

A total 40 collisions occurred on the high injury network out of which 9 (23 percent) of these collisions were due to improper-turning violations, including 3 fatal and severe injury (F+SI) collisions. The following are major findings of collisions due to improper-turning violations on the high injury network in the City of Willits followed by strategies to make these locations safer:

56%
Hit-object collision

34%
Occurred in dark-lighting conditions

23%
Involved a pedestrian or a bicyclist

Table 13. Emphasis Area 3 Strategies

Objective:			
Reduce the number of injury collisions due to improper turning violation.			
	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.	City/ School District/ Police Department
Enforcement	Targeted enforcement at high-risk locations.	Number of tickets issued.	Police Department
Engineering	• 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.	City
EMS	S05, Install emergency vehicle pre-emption systems	EMS vehicle response time.	Mendocino County Local Emergency Services Agency

Emphasis Area 4 – Vehicle-Pedestrian Collisions

A total 40 collisions occurred on the high injury network out of which 11 (28 percent) of these collisions were vehicle-pedestrian collisions, including 3 fatal and severe injury (F+SI) collisions. The following are major findings based on pedestrian injury collisions on the high injury network in the City of Willits followed by strategies to make these locations safer:

37%
Occurred in dark or low lighting conditions

36%
Pedestrian right of way violations

63%
Occurred on Main Street

Table 14. Emphasis Area 4 Strategies

Objective:			
Reduce the number of pedestrian injury collisions.			
	Strategy	**Performance Measure**	**Agencies/Organizations**
Education	Conduct pedestrian safety campaigns and outreach to raise awareness of pedestrian safety needs through media outlets, social media and Bike and Walk Mendocino. Update pamphlet for crosswalk safety for Willits every 3-5 years.	Number of education campaigns	City/ School District/ Police Department
Enforcement	Targeted enforcement at high-risk locations especially near schools and downtown.	Number of tickets issued.	Police Department
Engineering	• S21PB, Modify signal phasing to implement a Leading Pedestrian Interval (LPI) • NS07, Upgrade intersection pavement markings (NS.I.) • NS19PB, Install raised medians (refuge islands) • NS21PB/R35PB, Install/upgrade pedestrian crossing (with enhanced safety features) • R36PB, Install raised pedestrian crossing • R37PB, Install Rectangular Rapid Flashing Beacons (RRFB) • High-visibility ladder crosswalks • Mid-block curb extension • In-road yield sign for pedestrian crossing at crosswalk • Pedestrian safety improvements at on ramp off/ramps • The City should apply for HSIP pedestrian set aside funds every two years	Number of locations improved.	City
EMS	S05, Install emergency vehicle pre-emption systems	EMS vehicle response time.	Mendocino County Local Emergency Services Agency

Emphasis Area 5 – Rear-end Collisions

A total 40 collisions occurred on the high injury network out of which 8 (20 percent) of these were rear-end collisions. The following are major findings based on rear-end collisions that occurred on the high injury network in the City of Willits followed by strategies to make these locations safer:

100%
Occurred due to Unsafe speed violations

88%
Occurred on Main Street

12%
Occurred on E Commercial Street

Table 15. Emphasis Area 5 Strategies

Objective:			
Reduce the number of rear-end injury collision.			
	Strategy	**Performance Measure**	**Agencies/Organizations**
Education	Conduct public information and education campaign for safety laws regarding and the larger risk of collisions.	Number of education campaigns	City/ Police Department
Enforcement	Targeted enforcement at high-risk locations to monitor collisions that occur at due to unsafe speed violations.	Number of tickets issued.	Police Department
Engineering	• 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.	City
EMS	S05, Install emergency vehicle pre-emption systems	EMS vehicle response time.	Mendocino County Local Emergency Services Agency

Emphasis Area 6 – broadside Collisions

A total 40 collisions occurred on the high injury network out of which 8 (20 percent) of these collisions were broadside collisions. The following are major findings based on broadside collisions that occurred on the high injury network in the City of Willits followed by strategies to make these locations safer:

75%
Occurred due to Automobile right-of-way violation

88%
Occurred between two motor vehicles

88%
Occurred on Main Street

Table 16. Emphasis Area 6 Strategies

Objective:			
Reduce the number of broadside injury collisions.			
	Strategy	**Performance Measure**	**Agencies/Organizations**
Education	Conduct public information and education campaign for intersection safety laws regarding traffic lights, stop signs, and turning left or right.	Number of education campaigns.	School/City/ Police Department
Enforcement	Targeted enforcement at high-risk intersections to monitor traffic law violations right-of-way violations, and traffic signals and signs violations.	Number of citations and/or warning tickets issued.	Police Department
Engineering	• 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 intersections improved.	City
EMS	S05, Install emergency vehicle pre-emption systems	EMS vehicle response time.	Mendocino County Local Emergency Services Agency

Emphasis Area 7 – Hit Object Collisions

A total 40 collisions occurred on the high injury network out of which 6 (15 percent) of these collisions were hit object collisions, including 2 fatal and severe injury (F+SI) collisions. The following are major findings based on hit object collisions on the high injury network in the City of Willits followed by strategies to make these locations safer:

83%
Improper turning collisions

50%
Occurred in dark/low lighting conditions

67%
Occurred on roadway segments/mid-block locations

Table 17. Emphasis Area 7 Strategies

Objective:			
Reduce the number of injury collisions were hit 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	City/ School District/ Police Department
Enforcement	Targeted enforcement at high-risk locations.	Number of tickets issued.	Police Department
Engineering	• 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.	City
EMS	S05, Install emergency vehicle pre-emption systems	EMS vehicle response time.	Mendocino County Local Emergency Services Agency

5. Countermeasure Identification

This section summarizes the process of selecting countermeasures on Willits 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 citywide Emphasis Area.

Countermeasure Selection

In 2010, the Federal Highway Administration (FHWA) published a set of three manuals 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 Local Roadway Safety Manual (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*."[2] 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 City of Chowchilla. This section identifies the different solutions for the City 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 three 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.

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

Draft Countermeasure Toolbox

Appendix D detail 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 City a toolbox for implementing future safety improvements through other means, such as the City's Capital Improvement Program.

Signalized Intersections Countermeasures

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

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

S03 – Improve signal timing (coordination, phases, red, yellow, or operation) Improve signal hardware: lenses, back-plates with retroreflective borders, mounting, size, and number. Includes adding phases, lengthening clearance intervals, eliminating or restricting higher-risk movements, and coordinating signals at multiple locations.

- Crash Reduction Factor – 15%
- Expected Life – 10 years
- Baseline Cost – Approximately $11,000 per intersection

S17PB – Install pedestrian countdown signal heads A pedestrian countdown signal contains a timer display and counts down the number of seconds left to finish crossing the street. Countdown signals can reassure pedestrians who are in the crosswalk when the flashing "DON'T WALK" interval appears that they still have time to finish crossing.

- Crash Reduction Factor – 25%
- Expected Life – 20 years
- Baseline Cost – Approximately $10,000

S20PB - Install advance stop bar before crosswalk Adding advance stop bar before the striped crosswalk has the opportunity to enhance both pedestrian and bicycle safety.

- Crash Reduction Factor – 15%
- Expected Life – 10 years

Baseline Cost – Approximately $4,000 per intersection

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

- Crash Reduction Factor – 15%
- Expected Life – 10 years
- Baseline Cost – Approximately $4,000 per intersection

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

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

NS21 – Install/upgrade pedestrian crossing at uncontrolled locations (with enhanced safety features). Adding pedestrian crossings that include enhances safety features has the opportunity to enhance pedestrian safety at locations noted as being especially problematic. The

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

enhanced safety elements help delineate a portion of the roadway that is designated for pedestrian crossing.

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

- Crash Reduction Factor – 35%
- Expected Life – 20 years
- Baseline Cost – Approximately $40,000

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

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

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

- Crash Reduction Factor – 15%

(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.

- 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

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

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 section summarizes the process of selecting safety projects as part of the analysis for the City of Willits's LRSP. The next step after the identification of high-risk locations, emphasis areas and applicable countermeasures is 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:

- S refers to improvements at signalized locations,
- 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 City 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 18 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 City with materials for up to three 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 city.

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
- City identifies desired intersections
- Apply for various intersections citywide with more generic cost estimates

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 Willits.

For fatal and severe injury (F+SI) collisions, 43 percent of collisions were pedestrian collisions on Main Street has more pedestrian collisions than other roads in the City of Willits. Recommended improvements at these locations include pedestrian countdown signal heads, upgrading pedestrian crossings at uncontrolled locations and installing rectangular rapid flashing beacons.

About 29 percent of the F+SI collisions have been identified to be hit-object collisions. Sherwood Road and East Hill Road have more hit object collisions than other roads in the City of Willits. Recommended improvements at these location include installing delineators, reflectors, object markers, edge-lines and centerlines.

Table 18. List of Viable Safety Projects

Location	CM1	CM2	CM3	Cost per Location	B/C Ratio
Project 1: Systemic Improvements at Signalized Intersections					
Main St & Commercial St	S02	S03	S12	$ 98,140	14.82
Main St & Holly St		S03	S12	$ 106,820	
Main St & Rt 20		S03	S12	$ 208,306	
Project 2: Systemic Improvements at Unsignalized Intersections					
Main St & State St	NS01	NS06		$ 31,480	44.69
Main St & Wood St	NS01			$ 29,490	
Main St & Gregory Ln		NS06		$ 400	
Main St & Van Ln		NS06		$ 1,000	
Main St & Muir Mill Rd		NS06		$ 1,400	
Main St & East San Francisco St		NS06		$ 20,500	
Main St & Franklin Av		NS06	NS07	$ 1,176	
Main St & Manor Wy		NS06	NS07	$ 576	

Location	CM1	CM2	CM3	Cost per Location	B/C Ratio
Monroe St & Main St		NS06	NS07	$ 576	
Spruce St & Pine St	NS01	-		$ 500	
E Oak St & Main St	NS01	NS06		$ 900	
Blosser Lane/Fort Bragg Willits Road/Coast Street		NS06		$ 1,400	
Project 3: Systemic Roadway Segment Improvements					
North Main Street, from Sherwood Road to East Commercial Street	R22			$ 3,150	53.38
Sherwood Road, from Main Street to City Boundary		R26		$ 20,000	
South Main Street, from Hazel Street to Muir Mill Road	R22	R26	R28	$ 39,500	
South Main Street, from Hazel Street to East Commercial Street	R22	R26		$ 24,500	
East Commercial Street, between South Main Street and 1000 feet E of S Lenore Avenue	R22	R26		$ 27,375	
North Main Street, from Sherwood Road to City Boundary	R22	R26		$ 29,890	
McKinley St: entire segment*	R22		R28	$ 10,360	
E San Francisco Ave - Railroad Ave to City Boundary			R28	$ 7,357	
Hazel St: Main Street to Locust St(School Zone)	R22		R28	$ 11,935	
Project 4: Systemic Roadway Segment Improvements					

Location	CM1	CM2	CM3	Cost per Location	B/C Ratio
Sherwood Road, from Main Street to City Boundary	R01	R27		$ 126,336	0.76
East Hill Road, between 650 feet E of Haehl Creek Drive and the City boundary	R01	R27		$ 317,016	
Poplar Avenue, between Walnut Street and City Boundary	R01		R34PB	$ 422,632	
Project 5: Pedestrian Set Aside					
Main St & East San Francisco St		NS21PB	NS22PB	$ 112,722	N/A
W Valley Rd & Main St			NS22PB	$ 105,269	
Main St & Commercial St	S17PB	S20PB		$ 95,984	

Notes: CM – countermeasure. B/C ratio is the dollar amount of benefits divided by the cost of the countermeasure. S02- Improve signal hardware: lenses, back-plates with retroreflective borders, mounting, size, and number, S03- Improve signal timing, S09-Install raised pavement markers and striping, S12- Install raised median on approaches, S17PB- Install pedestrian countdown signal head, NS01- Add intersection lighting (NS.I.), NS03- Install Signals, NS06- Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs, NS07- Upgrade intersection pavement markings (NS.I.), NS21PB- Install/upgrade pedestrian crossing at uncontrolled locations (new signs and markings only), NS22PB – Install rectangular rapid flashing beacon (RRFB), R01- Add segment lighting, R22- Install/Upgrade signs with new fluorescent sheeting (regulatory or warning), R26 - Install dynamic/variable speed warning signs, R27- Install delineators, reflectors and/or object markers, R28- Install edge-lines and centerlines, R34PB – Install sidewalk/pathway

*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 City may submit them for HSIP Cycle 11 funding in 2022. Based on the discussion and recommendation from the City 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 City 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 City. The implementation of strategies under each emphasis area would aim to reduce fatal and severe injury 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 19**.

Table 19. 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	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

Funding Source	Funding Agency	Amount Available	Next Estimated Call for Projects	Applicable E's	Notes
Office of Traffic Safety Grants	California Office of Traffic Safety	Varies by grant	Closes January 31st annually	Education, Enforcement, Emergency Response	10 grants available to address various components of traffic safety
Affordable Housing and Sustainable Communities Program	Strategic Growth Council and Dept. of Housing and Community Development	~$405 million	2022	Engineering, Education	Must be connected to affordable housing projects; typically focuses on bike/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 emergency medical service related countermeasures that can be implemented throughout the City to reduce F+SI collisions. It is recommended that the City of Willits implement the selected projects high-collision locations in coordination with other projects proposed for the City's infrastructure development in their future Capital Improvement Plans.

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

Monitoring and Evaluation

For the success of the LRSP, it is crucial to monitor and evaluate the four 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 City make informed decisions regarding the implementation plan's progress and accordingly, update the goals and objectives of the plan. After implementing countermeasures, the strategies should be evaluated annually as per their performance measures. The evaluation should be recorded in a before-after study to validate the effectiveness of each countermeasure as per the following observations:

- Number of fatal and severe injury collisions
- Number of 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 fatal and severe injury collisions throughout the City. 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 City of Willits'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:

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

Matrix of Planning Goals, Policies, and Projects

Document	Highlights
Willits General Plan Vision 2020 (1992)	Goal • To design and maintain a fully integrated local network which provides for safe and convenient circulation using a variety of transportation modes. Policies • Promote beautification efforts along the City's roadways. • Enhance the availability and accessibility of alternative modes of transportation, such as walking, bicycling, carpools and buses. Incorporate mass transit facilities· such as bus shelters and park and ride lots into the design of public and private development projects. • Designate a network of bicycle routes providing safe passage throughout the City; establish linkages between schools and the designated bikeway.
Willits Safe Routes to School Action Plan (2017)	• Install crosswalk on North Main Street at Casteel Lane near Willits High School • Install sidewalk along high school Main Street frontage • Install sidewalk near Sanhedrin High School • Install missing sidewalk on streets to the north and east of Brookside Elementary School • Install missing sidewalk on streets to the south and west of Brookside elementary school • Install a Class II bike facility on school street, north street and a portion on laurel street • Install missing sidewalk on the north end of Mill Street, Pine Street, Laurel Street, Redwood Avenue, Spruce Street and Easy Street for Brookside Elementary School. • Install intersection improvements at highway 20/Blosser Lane - Coast Street developed by Caltrans including school zone signs and markings, pedestrian crossing signs, high visibility markings and additional intersection markings. Also install radar feedback signs and other intersection improvements which may include roundabout • Install stop signs on both ends of Harms Lane and West San Francisco Avenue and the west end of Tuttie Lane • Install a bicycle facility, either bike route signing or bike lane signs and markings on Coast Street and Mill Street

Document	Highlights
	• Install a Class bike facility on School Street, North Street and a portion on Laurel Street • Install crosswalks on East Valley Street at pen Street and Madden Street at East Valley Street, and on East San Francisco Avenue at Boscabelle Avenue • Consider creating a class I bike facility along the railroad avenue corridor • Install two crosswalks at the intersection of Sandy lane/Boechtel Road, and missing sidewalks along the north side of Boechtel Road
City of Willits Traffic Safety Evaluation (2010)	**Main Street/Sherwood Road Intersection Improvements** • Consider implementing a Leading Pedestrian Interval (CA MUTCD Section 4E.10) to provide additional separation between the time when pedestrians begin crossing Main Street and vehicles on Sherwood Road receive a green indication. This may improve driver awareness of pedestrians and reduce conflicts between pedestrians and turning vehicles. **Main Street/ Commercial Street Intersection Improvements** • Consider implementing a Leading Pedestrian Interval for each pedestrian crossing to reduce conflicts between pedestrians and turning vehicle **Main Street/ Valley Street Intersection Improvements** • The Circulation Study for the City of Willits Downtown Specific Plan (Fehr & Peers, 2000)identifies several improvements at this intersection that would enhance safety and traffic flow a his intersection. These improvements were reviewed, and they remain reasonable and appropriate; therefore, the City may consider implementing these improvements:• o Signalize the Main Street/East Valley Street intersection. o Prohibit left turn movements from West Valley Street onto Main Street. o Construct a raised median on Main Street between East Valley Street and West Valley Street with provisions for left turns onto West Valley Street **Main Street/ Walnut Street** • Consider constructing a raised median on Main Street that would physically restrict left turn movements from Walnut Street onto Main Street, while permitting left turns onto Walnut Street from Main Street **Main Street/ Baechtel Road (North)** • Monitor the intersection to determine if collisions occur due to the sight distance constraint and/or the creep forward maneuver. If a collision pattern is identified,

Document	Highlights
	consider restricting Baechtel Road to right turns only by installing a raised median on Main Street that would physically restrict left turns from Baechtel Road while permitting left turns onto Baechtel Road from Main Street. **Main Street/ Gregory Lane** • Consider installing a raised pedestrian refuge in the median of Main Street. • Consider replacing the existing crosswalk markings with a "triple-four" crosswalk **Main Street/ Baechtel Road (South)** • A roundabout has been contemplated by the City as part of their overall corridor planning efforts. A roundabout would be an appropriate gateway intersection as long as it is designed tocurrent modern roundabout design standards. A roundabout may only be implemented after theWillits bypass has been constructed, which would keep this intersection from being the firstsignificant intersection that a driver encounters as they travel northbound into Willits. Thebypass interchange would be located south of this location
Willits Main Street Corridor Enhancement Plan (2017)	• Bicycle Circulation: Currently, there are no on-street bicycle facilities on Main Street. However, the bypass improvements present an opportunity to introduce corridor-wide bicycle circulation that is good for the environment, personal health, and that helps to reduce automobile traffic. • Bicycle lanes with painted buffers should be included continuously along Main Street from Browns Corner to the high school. Lane markings should clearly designate the area for cyclists and include green color surfaces at points of conflict with vehicles. • Bicycle parking should be strategically planned on Main Street. Bicycle racks should be installed in front of key businesses in the downtown core, at other important landmarks, and well-used commercial and institutional uses along the corridor. • Pedestrian Safety Measures: In order to create a more walkable Main Street, pedestrian safety interventions are extremely important for this plan. These measures not only protect pedestrians, but also help visibility with bicycles and vehicles, providing opportunities for place making. • Where possible, pedestrian crossing distance should be shortened to minimize conflicts with bicycles and vehicles. This can be accomplished with sidewalk extensions, bulb outs, and mid-block refuges Crosswalks on Main Street should be clearly striped in order to reinforce the

Document	Highlights
	pedestrian right of way. High visibility markings such as continental style banding is recommended. Lighting should be provided at crosswalks for nighttime visibility. • A minimum sidewalk clear zone width of 5 feet should be enforced on all Main Street sidewalks. This is in line with ADA requirements and creates a comfortable environment for pedestrians. "Pinch points" where buildings or planting extends into the sidewalk should be corrected. In all areas, sidewalks of 10-12 feet or more are ideal to allow for trees, furniture, and space for merchants to occupy their immediate frontage. • Midblock crossings should be installed and reinforced where there is a pedestrian desire line. The crosswalk should be striped and components such as medians and rapid flashing beacons should be incorporated as necessary. • Leading pedestrian intervals are critical at some intersections to reduce conflicts between vehicles and pedestrians. This would give pedestrians a 3-7 second.
City of Willits Bicycle and Pedestrian Specific Plan (2009)	• Goal 1- Improve Safety and Education – To make the city's circulation system safer for all pedestrians and bicyclists, and enhance education for bicyclists, pedestrians and motorists • Goal 2- Provide greater access – to provide a system of paths, lanes, routes, and support facilities that enable and encourage convenient pedestrian and bicycle circulation for all transportation needs, including travel to work, school, shopping or recreation activities • Goal 3- Maintain and promote a high quality of life • Goal 4 – Establish an effective implementation strategy – incorporate the needs of bicyclists and pedestrians into the City's existing programs, policies, plans and operations, and involve all aspects of the community and local agencies in planning and implementation improved opportunities for bicycle and pedestrian travel.
Downtown Willits Street and Alleys Connectivity Study (2017)	Projects • **West Commercial Street**: Curb extensions**:** Provide new curb extensions and bulbouts at the following locations: ◦ Southwest intersection corner at Main Street and Commercial Street. ◦ Mid-block crosswalk at Muir Lane and Main Street. ◦ Southeast corner of Commercial Street and School Street. ◦ Existing striped pedestrian refuges, currently buffered by planters, by formalizing them into bulbouts. Study southwest corner of Commercial Street at Main Street

Document	Highlights
	intersection for feasibility of bulbouts in relation to truck turning radius and pedestrian safety. • Main Street/ Commercial street Intersection: • Protected left turn phasing and dedicated left turn lanes on Commercial Street through the removal of on-street parking adjacent to the intersection • Pedestrian bulb outs to shorten crosswalk distances • Eastbound right turns on Commercial Street accommodated via a right turn pocket shared with the bike lane • East Commercial Street **Lane reconfiguration:** The concept, recommends an alternative lane configuration combined with traffic signaling that would reduce traffic queuing times and permit smoother flow of traffic from both directions through the intersection: • New southbound dedicated left-turn lane; and westbound thru·and right-turn lane at Main Street. • Shift westbound bicycle lane at curb west of Fire Department and remove northside on-street parking (loss of four to five spaces}. • Maintain existing eastbound travel lane, shift slightly to accommodate new 2-foot buffer for existing eastbound bicycle lane. • Relocate on-street parking along southside to accommodate new curb extension (loss of three to four spaces). • Relocate four diagonal parking spaces reserved for better bicycle facility and additional public parallel parking spaces (gain of two to three spaces) . • **Curb Extensions / Bulbouts:** Provide new bulbouts at all corners at each intersection. The configuration of each varies and should accommodate turning radii of commercial vehicles, fire engines, and school buses. Provide bulbout along southside from Main Street to slightly past Schmidbauer Lane to accommodate street trees and furnishings and entrance to Schmidbauer. Provide extended bulbouts for transit with improved bus stop facilities at the northeast corner of Commercial and Humboldt Streets intersection. Relocate existing bus stop in front of the Justice Center west of Marin Street to southeast corner of Commercial and Marin Street intersection . • **East of Humboldt Street:** Maintain existing on-street parking and bicycle facilities. Provide new 2-foot buffer for both eastbound and westbound lanes. Provide striping at conflict zones where needed. • **New Pedestrian Crossing:** Provide new pedestrian crossings over Northwest Pacific Railroad tracks along both north and south sides of Commercial Street.

Document	Highlights
Willits Circulation and Parking Improvement Plan (2002)	Policy Improvements • To assist in future evaluations of traffic safety issues, it is recommended that additional information be collected for property damage only (PDO) collisions. The data needed includes party at fault and the primary collision factor. This will assist in future determinations of potential patterns and possible corrective measures. The City Police Chief has indicated that less collision information is now being collected as a result of Police Officer staffing shortages. • The City of Willits should consider an application for grant funding to develop a citywide traffic collision database and Graphical Information System (GIS). Grant applications are typically requested during the winter months. • The City of Willits, together with elementary and secondary schools, should continue and to the extent possible increase educational efforts directed at young pedestrians and bicyclists. A map of the school bus stops were obtained from the Willits Unified School District. The school bus stops are generally allocated on residential street which have low traffic volumes and slower moving traffic which reduce safety issues of boardings. It should be noted that the Willits Unified School District does not have an approved Safe Route to School Plan. It is recommended that the City purpose grants through the State Office of Traffic Safety to complete a Safe Routes to School Plan. • New police officers should be instructed and existing officers reminded through scheduled in-service training sessions of the importance of traffic safety. Special attention should be given to entering Primary Collision Factors (PCF) and Vehicle Code violations which precipitate collisions on collision reports. Emphasis should be given to less glamorous aspects of enforcement such as parking prohibitions, pedestrian violations and violations of pedestrians' rights-of-way. Recommendations • Recommendation: Existing stop, warning and speed limit signs should be replaced where the signs are faded. • The City of Willits should consider a policy for consistent use of STOP pavement legends at all stop-controlled intersections except at the intersection of two local street • Consideration should be given to using a ladder or 'zebra' marking pattern for crosswalks at uncontrolled crossings that merit increased visibility • Pedestrian crossing warning signs should be installed at all marked crosswalks where approaching vehicle traffic is not controlled by a traffic signal or stop sign

Document	Highlights
	• Consideration should be given to using a ladder or 'zebra' marking pattern for crosswalks at uncontrolled crossings that merit increased visibility • Median refuge islands should be installed on Main Street where there is a demonstrated pedestrian crossing demand and the installation would not impact an existing turn lane. • Curb bulbouts should be installed at Main Street intersections within the downtown core to create a more pedestrian friendly environment, provide additional areas for street furniture and reduce crossing distances for pedestrian. • Raised crosswalks or speed tables should be installed at pedestrian crossing locations which have a demonstrated demand. However, this type of measure should not be used on Main Street due to the traffic volumes and high volume of truck traffic. • If in-pavement crosswalk lights are used to enhance driver awareness of pedestrians, they should be used in combination with measures such as signs, medians and/or bulbouts • The City should coordinate with Caltrans to have all pedestrian crossing indications retrofitted with LED's • Because the pedestrian crossing demand in the vicinity of Main Street and the California Western Railroad tracks is readily apparent, it would be appropriate for the City to consider installation of an enhanced mid-block crossing adjacent to the City of Willits arch focal point. The mid-block crossing should include a pedestrian "refuge" area created by the use of short medians within the existing two-way left-turn lane. • The City should consider installation of a modern roundabout at the Highway 20/Coast Street-Blosser Lane intersection in order to improve vehicle and pedestrian safety. The conceptual layout should be submitted to Caltrans for their review and consideration
Mendocino County Rail-with-Trail Plan (2012)	• 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,

Document	Highlights
	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.
Mendocino County Regional Active Transportation Plan (2017)	Goals: • 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.

APPENDIX B. CONSOLIDATED COLLISION DATABASE

FID	Shape	CASE_ID	ACCIDENT_	COLLISION_	PRIMARY_RD	SECONDARY_	DISTANCE	DIRECTION	Int_TJKM	Int_Col	WEATHER_1	STATE_HW	COLLISION	EPDO_Score
0	Point	6836842	2015	2/6/2015	MONROE ST	RT 101	0		Y	1	C	Y	4	6
1	Point	6837982	2015	1/31/2015	MAIN ST	COMMERCIAL ST	0		Y	1	A	Y	4	6
2	Point	6923883	2015	3/16/2015	RT 101	VAN LN	45	N	Y	1	A	Y	4	6
3	Point	6923887	2015	3/17/2015	E OAK ST	RT 101	0		Y	1	A	Y	4	6
4	Point	6923930	2015	3/1/2015	MAIN ST	MANOR WY	0		Y	1	A	Y	4	6
5	Point	6923938	2015	3/26/2015	MAIN ST	COMMERCIAL ST	0		Y	1	A	N	2	165
6	Point	7045670	2015	6/22/2015	RT 101	HOLLY ST	244	N	Y	1	A	Y	4	6
7	Point	7152086	2015	12/30/2015	RT 101	VAN LN	45	S	Y	1	A	Y	4	6
8	Point	7152090	2015	10/20/2015	RT 101	COMMERCIAL ST	0		Y	1	A	Y	2	165
9	Point	7152134	2015	11/12/2015	MAIN ST	SAN FRANCISCO AV	122	S	Y	1	A	Y	4	6
10	Point	7152256	2015	10/26/2015	SOUTH MAIN ST	RT 101	53	E	Y	1	A	N	3	11
11	Point	7168172	2015	9/3/2015	RT 101	EAST SAN FRANCISCO ST	40	W	Y	1	A	Y	4	6
12	Point	7187219	2016	1/27/2016	SPRUCE ST	PINE ST	0		Y	1	B	N	4	6
13	Point	7189241	2015	12/30/2015	RT 101	FRANKLIN AV	35	S	Y	1	A	Y	4	6
14	Point	7189249	2015	10/23/2015	E COMMERCIAL ST	MAIN ST	65	E	Y	1	A	N	4	6
15	Point	8031620	2016	2/16/2016	W VALLEY RD	RT 101	0		Y	1	B	Y	3	11
16	Point	8105705	2016	8/4/2016	RT 101	STATE ST	75	S	Y	1	A	Y	4	6
17	Point	8105709	2016	7/9/2016	RT 101	VAN LN	30	N	Y	1	A	Y	4	6
18	Point	8105713	2016	5/23/2016	RT 101	WOOD ST	5	N	Y	1	A	Y	4	6
19	Point	8105910	2016	7/20/2016	RT 101	WESTWOOD ST	0		Y	1	A	Y	4	6
20	Point	8343247	2016	10/24/2016	RT 101	STATE ST	75	S	Y	1	C	N	4	6
21	Point	8441951	2017	5/8/2017	RT 101	GREGORY LN	0		Y	1	A	Y	4	6
22	Point	8459651	2017	8/13/2017	RT 101	W COMMERCIAL ST	0		Y	1	A	N	3	11
24	Point	8666958	2018	7/7/2018	RT 101	WOOD ALY	78	S	Y	1	A	N	4	6
26	Point	8813759	2018	10/8/2018	RT 101	GREGORY LN	0		Y	1	A	Y	3	11
28	Point	8910332	2019	8/10/2019	RT 101	WOOD ST	82.1	S	Y	1	C	Y	3	11
29	Point	8921269	2019	1/25/2019	RT 101	STATE ST	26	N	Y	1	E	Y	2	165
30	Point	8924275	2019	3/17/2019	RT 101	GREGORY LN	0		Y	1	A	Y	4	6
31	Point	9003641	2019	9/24/2019	RT 101	MUIR MILL RD	0		Y	1	A	Y	4	6
32	Point	9006141	2019	11/10/2019	RT 101	RT 20	0		Y	1	A	Y	4	6
33	Point	91157797	2019	12/21/2019	EAST HILL RD	US-101	53	E	Y	1	A	N	2	165
2	Point	7091686	2015	5/30/2015	RT 101	EVERGREEN SHOPPING CENTE	388		N	0	A	Y	2	165
12	Point	8165621	2016	7/13/2016	RT 101	CASTEEL LN	363	N	N	0	A	Y	4	6
20	Point	90891748	2018	12/22/2018	CITY PROPERTY NORTH	MAIN STREET	424	W	N	0	B	N	3	11
21	Point	91140924	2019	12/2/2019	FURLONG ROAD	POPLAR AVE	428	N	N	0	C	N	3	11
22	Point	90442696	2017	4/14/2017	SHERWOOD ROAD	NORTH MAIN STREET	2112	W	N	0	A	N	2	165
23	Point	90518577	2017	7/15/2017	US-101	N. MAIN STREET	1320	N	N	0	A	Y	2	165
24	Point	90757890	2018	6/8/2018	US 101	N. STATE ST	500	S	N	0	A	Y	3	11
25	Point	91008932	2019	5/31/2019	SHERWOOD ROAD	MAIN STREET	1056	N	N	0	A	N	3	11
26	Point	91045607	2019	7/30/2019	N. STATE ST.	U.S. 101	450	N	N	0	A	N	3	11

FID	Shape	CASE_ID	Coll_Sev1	Coll_Sev2	Coll_Sev3	Coll_Sev4	PCF_	UnsafeSpe	Improper_	TYPE_OF_(	Hit_Object	Vehicle_pe	MVIW	LIGHTING	CONTROL_DE	PEDESTRIAN	BICYCLE_AC	MOTORCYCLE
0	Point	6836842	0	0	0	1	8	0	1	E	1	0	I	A	D			
1	Point	6837982	0	0	0	1	10	0	0	G	0	1	B	A	A	Y		
2	Point	6923883	0	0	0	1	3	1	0	C	0	0	C	C	D	Y		
3	Point	6923887	0	0	0	1	10	0	0	G	0	1	B	C	D	Y		
4	Point	6923930	0	0	0	1	9	0	0	D	0	0	C	A	A			
5	Point	6923938	0	1	0	0	8	0	1	G	0	1	G	A	A		Y	
6	Point	7045670	0	0	0	1	9	0	0	D	0	0	C	A	D			Y
7	Point	7152086	0	0	0	1	3	1	0	C	0	0	C	C	A			
8	Point	7152090	0	1	0	0	10	0	0	G	0	1	B	A	A	Y		
9	Point	7152134	0	0	0	1	18	0	0	G	0	1	J	A	D	Y		
10	Point	7152256	0	0	1	0	18	0	0	G	0	1	B	A	D	Y		
11	Point	7168172	0	0	0	1	3	1	0	C	0	0	C	A	D			
12	Point	7187219	0	0	0	1	1	0	0	F	0	0	I	D	D			
13	Point	7189241	0	0	0	1	9	0	0	A	0	0	C	A	D			
14	Point	7189249	0	0	0	1	3	1	0	C	0	0	C	A	A			
15	Point	8031620	0	0	1	0	10	0	0	G	0	1	B	B	D	Y		
16	Point	8105705	0	0	0	1	8	0	1	B	0	0	C	A	D			
17	Point	8105709	0	0	0	1	3	1	0	C	0	0	C	A	A			
18	Point	8105713	0	0	0	1	3	1	0	C	0	0	C	A	D			
19	Point	8105910	0	0	0	1	1	0	0	G	0	1	B	C	D	Y		
20	Point	8343247	0	0	0	1	3	1	0	C	0	0	C	A	A			
21	Point	8441951	0	0	0	1	12	0	0	D	0	0	C	C	A			
22	Point	8459651	0	0	1	0	11	0	0	G	0	1	B	A	A	Y		
24	Point	8666958	0	0	0	1	3	1	0	C	0	0	C	A	A			
26	Point	8813759	0	0	1	0	9	0	0	D	0	0	G	A	D		Y	
28	Point	8910332	0	0	1	0	8	0	1	E	1	0	I	C	D			
29	Point	8921269	0	1	0	0	8	0	1	G	0	1	B	C	D	Y		
30	Point	8924275	0	0	0	1	9	0	0	D	0	0	C	A	D			
31	Point	9003641	0	0	0	1	9	0	0	D	0	0	C	A	A			
32	Point	9006141	0	0	0	1	12	0	0	-	0	0	-	A	-			
33	Point	91157797	0	1	0	0	1	0	0	F	0	0	I	D	D			
2	Point	7091686	0	1	0	0	8	0	1	E	1	0	I	A	D			
12	Point	8165621	0	0	0	1	9	0	0	D	0	0	C	A	D			
20	Point	90891748	0	0	1	0	1	0	0	H	0	0	A	D	D			
21	Point	91140924	0	0	1	0	13	0	0	G	0	1	B	D	D	Y		
22	Point	90442696	0	1	0	0	3	1	0	E	1	0	I	D	D			
23	Point	90518577	0	1	0	0	5	0	0	A	0	0	C	A	D			
24	Point	90757890	0	0	1	0	8	0	1	E	1	0	I	A	D			
25	Point	91008932	0	0	1	0	8	0	1	E	1	0	I	D	D			
26	Point	91045607	0	0	1	0	8	0	1	D	0	0	C	A	D			

FID	Shape	CASE_ID	TRUCK_AC	COUNTY	CITY	POINT_X	POINT_Y	TJKM_Sou	TJKM_Juris	TJKM_Poir	TJKM_Poi_	TJKM_Notes	NEAR_FID	NEAR_DIST	ranking
0	Point	6836842		MENDOCINO	WILLITS	-123.352	39.40659	TIMS	WILLITS	-123.352	39.40659	TIMS	285	0.000063	8
1	Point	6837982		MENDOCINO	WILLITS	-123.355	39.41242	TIMS	WILLITS	-123.355	39.41242	TIMS	391	0.000059	1
2	Point	6923883		MENDOCINO	WILLITS	-123.355	39.41208	TIMS	WILLITS	-123.355	39.41208	TIMS	382	0.000166	5
3	Point	6923887		MENDOCINO	WILLITS	-123.352	39.40503	TIMS	WILLITS	-123.352	39.40503	TIMS	379	0.000044	8
4	Point	6923930		MENDOCINO	WILLITS	-123.346	39.38953	TIMS	WILLITS	-123.346	39.38953	TIMS	259	0.000095	8
5	Point	6923938		MENDOCINO	WILLITS	-123.355	39.41244	TIMS	WILLITS	-123.355	39.41244	TIMS	391	0.000036	1
6	Point	7045670		MENDOCINO	WILLITS	-123.35	39.39927	TIMS	WILLITS	-123.35	39.39927	TIMS	223	0.000561	8
7	Point	7152086		MENDOCINO	WILLITS	-123.354	39.41179	TIMS	WILLITS	-123.354	39.41179	TIMS	382	0.00015	5
8	Point	7152090		MENDOCINO	WILLITS	-123.355	39.41242	TIMS	WILLITS	-123.355	39.41242	TIMS	391	0.000059	1
9	Point	7152134		MENDOCINO	WILLITS	-123.352	39.40721	TIMS	WILLITS	-123.352	39.40721	TIMS	347	0.000242	8
10	Point	7152256		MENDOCINO	WILLITS	-123.355	39.41244	TIMS	WILLITS	-123.355	39.41244	TIMS	391	0.000036	1
11	Point	7168172		MENDOCINO	WILLITS	-123.352	39.40734	TIMS	WILLITS	-123.352	39.40734	TIMS	173	0.000172	8
12	Point	7187219		MENDOCINO	WILLITS	-123.361	39.40925	TIMS	WILLITS	-123.361	39.40925	TIMS	325	0.000113	8
13	Point	7189241		MENDOCINO	WILLITS	-123.351	39.4035	TIMS	WILLITS	-123.351	39.4035	TIMS	199	0.000172	8
14	Point	7189249		MENDOCINO	WILLITS	-123.354	39.41245	TIMS	WILLITS	-123.354	39.41245	TIMS	391	0.000238	1
15	Point	8031620		MENDOCINO	WILLITS	-123.354	39.409	TIMS	WILLITS	-123.354	39.409	TIMS	351	0.00005	7
16	Point	8105705		MENDOCINO	WILLITS	-123.355	39.41332	TIMS	WILLITS	-123.355	39.41332	TIMS	301	0.000149	6
17	Point	8105709		MENDOCINO	WILLITS	-123.355	39.41208	TIMS	WILLITS	-123.355	39.41208	TIMS	382	0.000166	5
18	Point	8105713		MENDOCINO	WILLITS	-123.355	39.41076	TIMS	WILLITS	-123.355	39.41076	TIMS	353	0.000148	3
19	Point	8105910		MENDOCINO	WILLITS	-123.354	39.41065	TIMS	WILLITS	-123.354	39.41065	TIMS	353	0.000067	3
20	Point	8343247		MENDOCINO	WILLITS	-123.355	39.41324	TIMS	WILLITS	-123.355	39.41324	TIMS	301	0.000208	6
21	Point	8441951		MENDOCINO	WILLITS	0	0	TIMS	WILLITS	-123.349	39.39461	TJKM Coordinates	201	0.000031	4
22	Point	8459651		MENDOCINO	WILLITS	-123.355	39.41244	TIMS	WILLITS	-123.355	39.41244	TIMS	391	0.000036	1
24	Point	8666958		MENDOCINO	WILLITS	-123.354	39.41044	TIMS	WILLITS	-123.354	39.41044	TIMS	353	0.000218	3
26	Point	8813759		MENDOCINO	WILLITS	-123.349	39.39449	TIMS	WILLITS	-123.349	39.39449	TIMS	201	0.00012	4
28	Point	8910332		MENDOCINO	WILLITS	-123.034	38.85592	TIMS	WILLITS	-123.354	39.41043	TIMS	353	0.000233	3
29	Point	8921269		MENDOCINO	WILLITS	-123.034	38.85591	TIMS	WILLITS	-123.355	39.41351	TIMS	225	0.000055	2
30	Point	8924275		MENDOCINO	WILLITS	0	0	TIMS	WILLITS	-123.349	39.39461	TJKM Coordinates	201	0.000031	4
31	Point	9003641		MENDOCINO	WILLITS	0	0	TIMS	WILLITS	-123.345	39.38776	TJKM Coordinates	71	0.000049	8
32	Point	9006141		MENDOCINO	WILLITS	-123.352	39.40412	TIMS	WILLITS	-123.352	39.40412	TIMS	341	0.000011	8
33	Point	91157797		MENDOCINO	UNINCORP	-123.335	39.39143	TIMS	WILLITS	-123.335	39.39143	TIMS	161	0.000301	2
2	Point	7091686		MENDOCINO	WILLITS	-123.347	39.39119	TIMS	WILLITS	-123.347	39.39119	TIMS			
12	Point	8165621		MENDOCINO	WILLITS	-123.355	39.41968	TIMS	WILLITS	-123.355	39.41968	TIMS			
20	Point	90891748		MENDOCINO	WILLITS	0	0	TIMS	WILLITS	-123.355	39.4166	TIMS			
21	Point	91140924		MENDOCINO	WILLITS	-123.352	39.39759	TIMS	WILLITS	-123.352	39.39759	TIMS			
22	Point	90442696		MENDOCINO	UNINCORP	-123.358	39.42006	TIMS	WILLITS	-123.358	39.42006	TIMS			
23	Point	90518577		MENDOCINO	UNINCORP	-123.355	39.41606	TIMS	WILLITS	-123.355	39.41606	TIMS			
24	Point	90757890		MENDOCINO	UNINCORP	-123.355	39.41208	TIMS	WILLITS	-123.355	39.41208	TIMS			
25	Point	91008932		MENDOCINO	UNINCORP	-123.356	39.4178	TIMS	WILLITS	-123.356	39.4178	TIMS			
26	Point	91045607		MENDOCINO	UNINCORP	-123.355	39.41345	TIMS	WILLITS	-123.355	39.41345	TIMS			

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 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:	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 enhances 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 con-version 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/marking 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%

APPENDIX D: COUNTERMEASURE TOOLBOX

City of Willits LRSP

CM Toolbox for Intersections

Sr. No.	Code	Countermeasure Name	CM Description	CRF	Federal Funding	Systemic Approach Opportunity
Signalized						
HSIP/Non-HSIP Code						
1	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
2	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
3	S12	Install raised median on approaches (S.I.)	Addition of raised medians next to left-turn lanes at intersections, directly over existing pavement.	25%	90%	Medium
4	S17PB	Install pedestrian countdown signal heads	A pedestrian countdown signal contains a timer display and counts down the number of seconds left to finish crossing the street. Countdown signals can reassure pedestrians who are in the crosswalk when the flashing "DON'T WALK" interval appears that they still have time to finish crossing.	25%	100%	Very High
5	S20PB	Install advance stop bar before crosswalk	Adding advance stop bar before the striped crosswalk has the opportunity to enhance both pedestrian and bicycle safety.	15%	100%	Very High
6	S21PB	Modify signal phasing to implement a Leading Pedestrian Interval (LPI)	Addition of LPI gives pedestrians the opportunity to enter an intersection 3-7 seconds before vehicles are given a green indication; only minor signal timing alteration is required.	60%	100%	Very High
Unsignalized						
Sr. No.	**Code**	**Countermeasure Name**	**CM Description**	**CRF**	**Federal Funding**	**Systemic Approach Opportunity**
1	NS01	Add intersection lighting (NS.I.)	Provision of lighting at intersection.	40%	100%	Medium
2	NS03	Install Signals	Installation of traffic signals	25%	100%	Low
3	NS05	Convert intersection to roundabout (from stop or yield control on minor road)	Installation of a roundabout	30%	100%	Low
4	NS06	Install/upgrade larger or additional stop signs or other intersection warning/regulatorysigns	Additional regulatory and warning signs at or prior to intersections will help enhance the ability of approaching drivers to percieve them	15%	100%	Very High
5	NS07	Upgrade intersection pavement markings (NS.I.)	Installation of intersection markings to increase 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.	25%	100%	Very High
6	NS09	Install flashing beacons as advance warning (NS.I.)	Installation of advance flashing beacoms to call drivers attention to intersection control signs	30%	100%	High
7	NS14	Install raised median on approaches (NS.I.)	Installation of raised medians with left-turn lanes at intersections	25%	90%	Medium
8	NS21PB	Install/upgrade pedestrian crossing at uncontrolled locations (with enhanced safetyfeatures)	Adding pedestrian crossings that include enhances safety features has	35%	100%	Medium
9	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
10	NS23PB	Install pedestrian signal or HAWK	A pedestrian hybrid beacon is a distinct from pre-timed traffic signals and constant flash warning beacons because it is only activated by pedestrians when needed.	55%	100%	Low

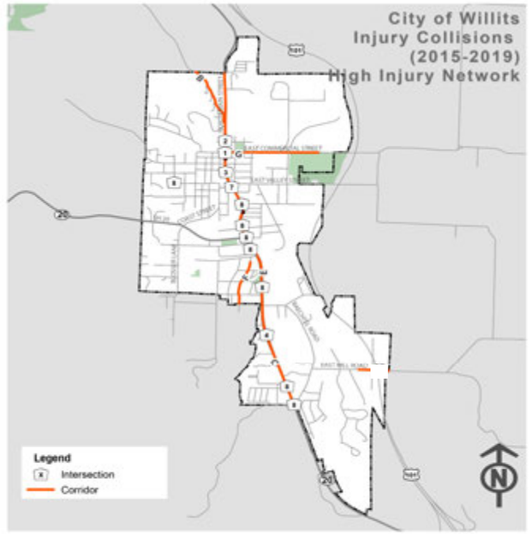
CM Toolbox for Roadway Segments						
Sr. No.	**Code**	**Countermeasure Name**	**CM Description**	**CRF**	**Federal Funding**	**Systemic Approach Opportunity**
1	R01	Add Segment Lighting	Provision of lighting along roadways.	35%	100%	Medium
2	R22	Install/Upgrade signs with new fluorescent sheeting (regulatory or warning)	Additional or new signage can address crashes caused by lack of driver awareness or complaince of roadway signing.	15%	100%	Very High
3	R24	Install curve advance warning signs	Addition of advance curve warning signs; may also include horizontal alignment and/or advisory speed warning signs	25%	100%	Very High
4	R26	Install dynamic/variable speed warning signs	Includes the addition of dynamic speed warning signs (also known as Radar Speed Feedback Signs)	30%	100%	High
5	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
6	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
7	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
8	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
9	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

High-risk Intersections

ID	Intersection	Control	Consolidated CMs (HSIP-Eligible - Refer to LRSM* 2020)				Additional CM (non-HSIP)**	EA - 1 Improve Intersection Safety			EA - 2 Reduce Unsafe Speed Collisions			EA - 3 Reduce Improper Turning Collisions			EA - 4 Improve Pedestrian Safety			EA - 5 Reduce Rear End Collisions			EA - 6 Reduce Broadside Collisons			EA - 7 Reduce Hit Object Collisons		
			CM1	CM2	CM3	CM4		CM1	CM2	CM3	CM1	CM2	CM3	CM1	CM2	CM3	CM1	CM2	CM3	CM1	CM2	CM3	CM1	CM2	CM3	CM1	CM2	CM3
I-1	Main St & Commercial St	Signalized	S03	S12	S17PB	S20PB	Install bulbouts	S03	S17PB	S20PB	S03	S12		S03	S17PB		S17PB	S20PB	S12	S03								
I-2	Main St & State St	Stop Controlled	NS01	NS06			Install bulbouts, yield markings	NS01	NS06		NS06			NS06			NS1	NS06								NS06		
I-3	Main St & Wood St	Uncontrolled	NS01				Install traffic calming measures, reduce lane widths for through lanes, install bulb outs, install radar feedback signs; ladder striping for crosswalk	NS06			NS06			NS06												NS06		
I-4	Main St & Gregory Ln	Stop Controlled	NS06				Install edge lines, install bicycke facilites, install additional traffic calming measures	NS06			NS06			NS06												NS06		
I-5	Main St & Van Ln	Uncontrolled	NS06				Install traffic calming, restict parking near intersection	NS06			NS06			NS06												NS06		
I-6	W Valley Rd & Main St	Stop Controlled		NS22PB				NS01									NS22PB											
I-7	Main St & Muir Mill Rd	Stop Controlled	NS03	NS06	NS09			NS03	NS06	NS09	NS09			NS03	NS06					NS03	NS09		NS03	NS06	NS09	NS06	NS09	
I-8	Main St & East San Francisco St	Stop Controlled	NS06	NS21PB	NS22PB	NS14	Traffic calming measures, radar speed feedback	NS06	NS21PB	NS22PB				NS06	NS14		NS21PB	NS22PB					NS06			NS06		
I-9	Main St & Franklin Av	Uncontrolled	NS06	NS07			Develop alternate route once left turns are resticted	NS06	NS07	NS14				NS06	NS07	NS14							NS06	NS14		NS06		
I-10	Main St & Holly St	Signalized		S03	S12		Signal warning ahead signs	S02	S03	S12	S03	S12		S02	S03	S12				S02	S03		S02	S03				
I-11	Main St & Manor Wy	Uncontrolled	NS06	NS07			Install radar feedback, install traffic calming	NS06			NS06			NS06									NS06			NS06		
I-12	Monroe St & Main St	Stop Controlled	NS06	NS07			Install radar feedback, install traffic calming	NS06			NS06			NS06									NS06			NS06		
I-13	Spruce St & Pine St	Uncontrolled	NS01				Install chevron signs, install object markers, reflectors	NS01	NS06	NS07	NS06			NS06	NS06								NS06			NS06		
I-14	Main St & Rt 20	Signalized		S03	S12		Install signal ahead warning sign	S02	S03	S12	S03	S12		S02	S03	S12				S02	S03		S02	S03				
I-15	E Oak St & Main St	Uncontrolled	NS1	NS6			Install pedestrian crossing ahead signs, in road lighting for ped crossing	NS1	NS6					NS06			NS1	Ns6										
	Identified from Stakeholder Input																											
I-16	Blosser Lane/Fort Bragg Willits Road/Coast Street	Stop Controlled	NS06	NS11				NS06	NS11					NS06			NS06						NS11					

Code	Countermeasure Name
?/Non-HSIP Code	
S02	Improve signal hardware: lenses, back-plates with retroreflective borders, mounting, size, and number
S03	Improve signal timing (coordination, phases, red, yellow, or operation)
S12	Install raised median on approaches (S.I.)
S17PB	Install pedestrian countdown signal heads
S20PB	Install advance stop bar before crosswalk
S21PB	Modify signal phasing to implement a Leading Pedestrian Interval (LPI)

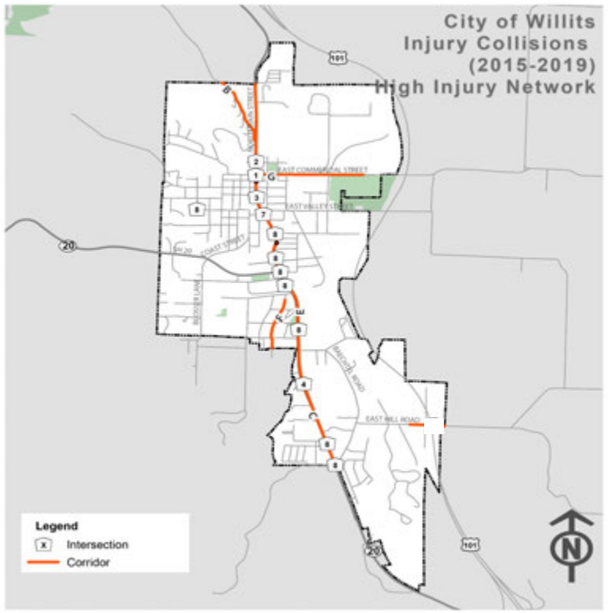
Code	Countermeasure Name
NS01	Add intersection lighting (NS.I.)
NS03	Install Signals
NS05	Convert intersection to roundabout (from stop or yield control on minor road)
NS06	Install/upgrade larger or additional stop signs or other
NS07	Upgrade intersection pavement markings (NS.I.)
NS09	Install flashing beacons as advance warning
NS14	Install raised median on approaches
NS21PB	Install/upgrade pedestrian crossing at uncontrolled locations (with enhanced safetyfeatures)
NS22PB	Install Rectangular Rapid Flashing Beacon (RRFB)
NS23PB	Install pedestrian signal or HAWK



High-risk Roadway Segments

ID	Roadway Segment	Consolidated CMs (HSIP-Eligible - Refer to LRSM* 2020)					Additional CM (non-HSIP)**	EA - 1 Improve Intersection Safety			EA - 2 Reduce Unsafe Speed Collisions			EA - 3 Reduce Improper Turning Collisions			EA - 4 Improve Pedestrian Safety			EA - 5 Reduce Rear End Collisions			EA - 6 Reduce Broadside Collisons			EA - 7 Reduce Hit Object Collisons		
		CM1	CM2	CM3	CM4	CM5		CM1	CM2	CM3	CM1	CM2	CM3	CM1	CM2	CM3	CM1	CM2	CM3	CM1	CM2	CM3	CM1	CM2	CM3	CM1	CM2	CM3
A	North Main Street, from Sherwood Road to East Commercial Street	R22									R22						R22			R22			R22			R22		
B	Sherwood Road, from Main Street to City Boundary	R01	R26	R27							R26	R27								R26						R26	R27	
C	South Main Street, from Hazel Street to Muir Mill Road	R22	R26	R28			Consider installing traffic calming measures				R26	R28		R22						R22	R26		R22			R22	R26	R28
D	East Hill Road, between 650 feet E of Haehl Creek Drive and the City boundary	R01	R27	R31			Repave roadway segment				R27															R27	R31	
E	South Main Street, from Hazel Street to East Commercial Street	R22	R26				Install traffic calming measures, limit street parking nea				R26			R22						R22	R26		R22			R22	R26	
F	Poplar Avenue, between Walnut Street and City Boundary	R01	R22	R34PB										R22			R34PB			R22			R22			R01	R22	
G	East Commercial Street, between South Main Street and 1000 feet E of S Lenore Avenue	R22	R26				Install additional traffic calming measures				R26			R22						R22			R22			R22	R26	
H	North Main Street, from Sherwood Road to City Boundary	R22	R26								R26			R22						R22			R22			R22	R26	

Code	Countermeasure Name
R01	Add Segment Lighting
R22	Install/Upgrade signs with new fluorescent sheeting (regulatory or warning)
R24	Install curve advance warning signs
R26	Install dynamic/variable speed warning signs
R27	Install delineators, reflectors and/or object markers
R28	Install edge-lines and centerlines
R31	Install edgeline rumble strips/stripes
R34PB	Install sidewalk/pathway (to avoid walking along roadway)
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	City/ 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. Update pamphlet for crosswalk safety for Willits every 3-5 years	Number of education campaigns	City/ School District/ Police Department			
	Conduct bicycle safety campaigns and outreach to raise their awareness of bicycle safety needs through media outlets, social media and Bike and Walk Mendocino. Update pamphlet for bicycle safety for Willits every 3-5 years	Number of education campaigns	City/ 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 controll personnel taking Traffic Incident Management Training	number of EMS/fire controll personnel taking Traffic Incident Managmenet Traising	Mendocino County Local Emergency Services Agency			

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

- 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) *Benefit (Life) = Benefit (annual) x Years of service life*

3) Benefit/Cost Ratio (each countermeasure): $Benefit\ \ Cost\ Ratio_{(CM)} = \frac{Benefit\ (Life)_{(CM)}}{Total\ \mathrm{Pr}oject\ Cost_{(CM)}}$

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