CHAPTER 3 COLLISION DATA COLLECTION AND ANALYSIS

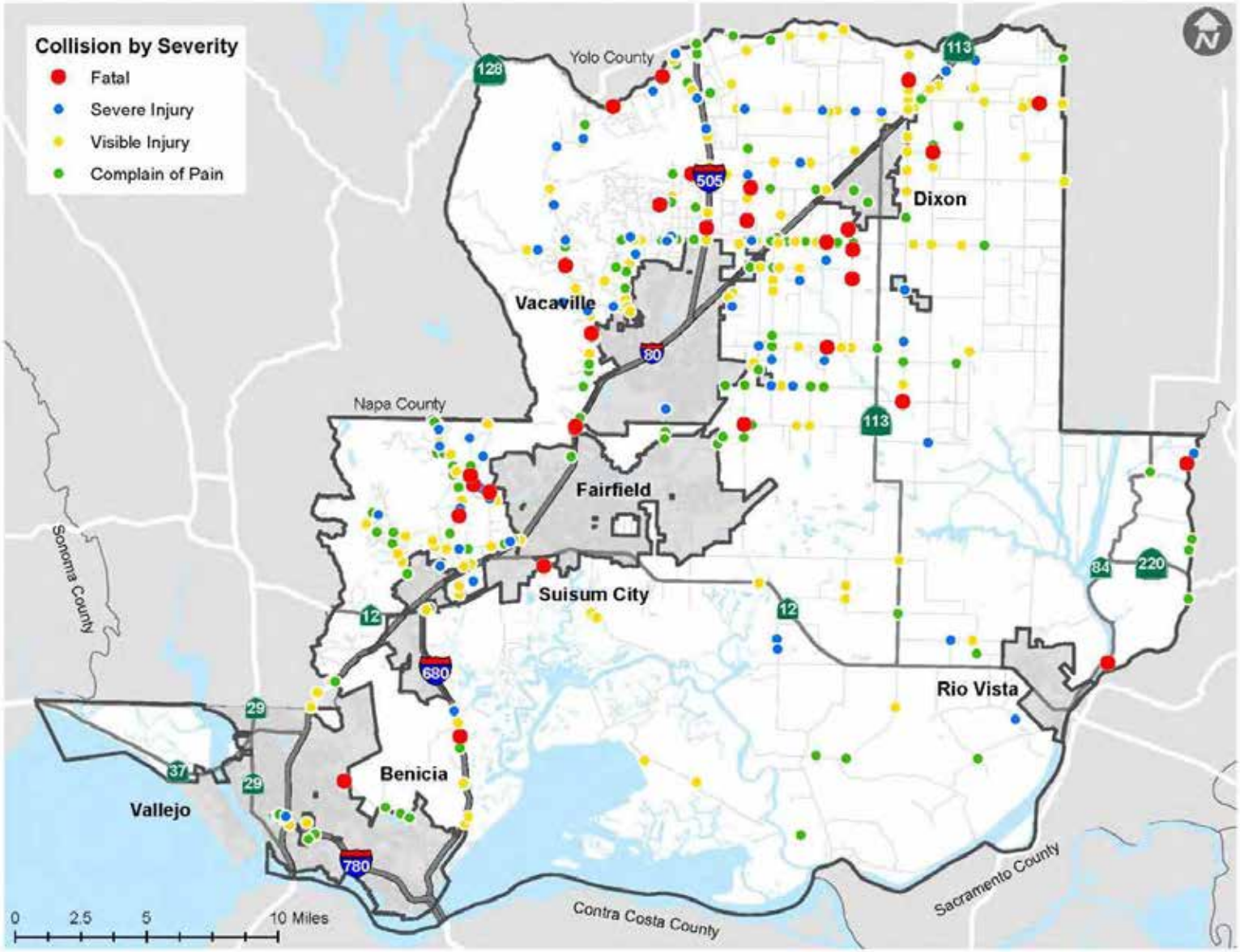
This chapter summarizes the analysis of collisions that occurred in unincorporated Solano County between January 2018 and December 2022, as part of the LRSP. This chapter includes the following sections:

- Data Collection
- Collision Data Analysis
- F+SI Collision Analysis
- Geographic Collision Analysis
- High Injury Network
- Summary

The LRSP focuses on systemically identifying and analyzing traffic safety issues and recommends appropriate safety improvements. The chapter starts with a comprehensive analysis of collisions of all severity in unincorporated Solano County, including with F+SI collisions. Doing so gives a complete picture of collision trends that are occurring among all injury collisions, which can then be compared with trends occurring among only F+SI collisions. Trends such as collision severity, type of collision, primary collision factor, lighting, weather and time of the day were analyzed. Following this, a more detailed analysis was conducted for F+SI collisions that occurred on the County's roadways, including analyzing intersection and roadway segment collisions separately.

After this data was separated between intersection collisions and roadway segment collisions, a comprehensive evaluation was conducted based on: collision severity, type of collision, primary collision factor, lighting, weather, and time of the day. A list of high-injury intersections and roadway segments were then identified and ranked based on the calculation of the equivalent property damage only (EPDO) scoring system. **Figure 6** illustrates all the F+SI collisions that have occurred in unincorporated Solano County from January 1, 2018 to December 31, 2022.

FIGURE 6: INJURY COLLISIONS UNINCORPORATED SOLANO COUNTY (2018-2022)



Data Collection

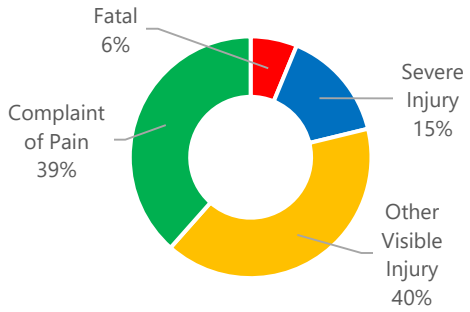
Analysts use collision data to understand different factors that might be leading to collisions and influencing collision patterns in a given area. For the purpose of this analysis, five years of jurisdiction-wide collision data (2018 to 2022) was retrieved from the Transportation Injury Mapping System (TIMS) and the SWITRS. Collisions that occurred on state routes were excluded for this analysis. The data was analyzed and plotted in ArcMap to identify high-risk intersections and roadway segments.

Collision Data Analysis Results

COLLISION CLASSIFICATION

There were a total of 481 injury collisions reported on unincorporated County roads from 2018 to 2022. Out of these, 185 collisions (39%) led to a complaint of pain injury and 194 collisions (40%) led to a visible injury. There were 102 F+SI collisions, of which 72 collisions (15%) led to a severe injury and 30 collisions (6%) led to fatality. **Figure 7** illustrates the classification of collisions based on severity.

FIGURE 7: COLLISIONS BY SEVERITY (2018-2022)



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

The collision data was separated by facility type, i.e. based on collisions occurring on intersections and roadway segments. For the purposes of the analysis and in accordance with HSIP guidelines, a collision was designated to have occurred at an intersection if it occurred within 250 feet of it. The reported collisions categorized by facility type and collision severity are presented in **Table 2**.

TABLE 2: COLLISIONS BY SEVERITY AND FACILITY TYPE

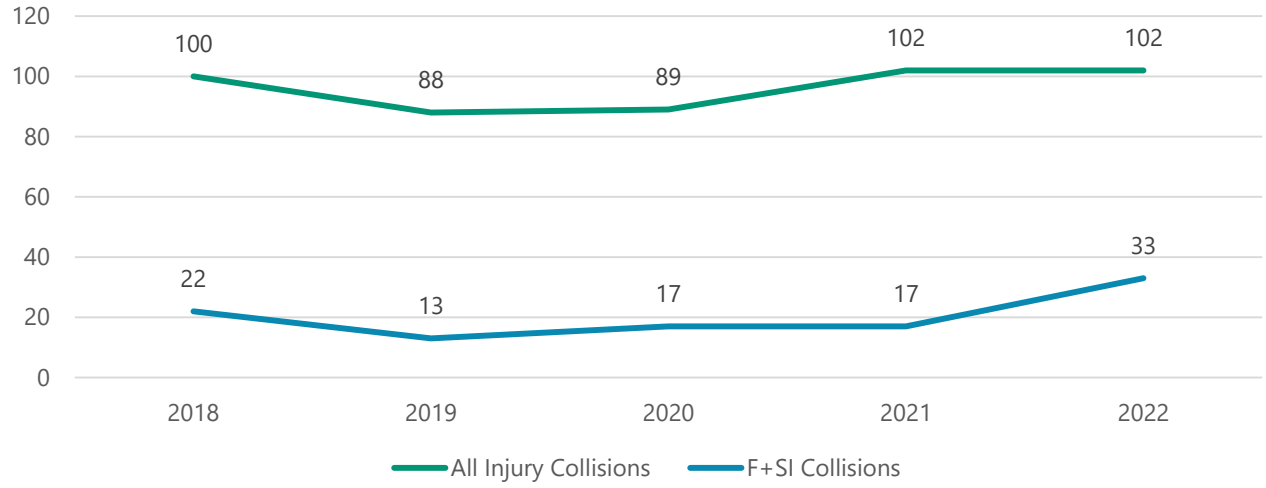
COLLISION SEVERITY	ROADWAY SEGMENT	INTERSECTION	TOTAL
Fatal	24	6	30
Severe Injury	40	32	72
Subtotal F+SI	64	38	102
Visible Injury	103	91	194
Complaint of Pain	91	94	185
Total	**258**	**223**	**481**

Preliminary Analysis

YEARLY TREND

The total number of reported injury collisions decreased from 2018 to 2022. The year with the highest number of collisions was 2021 and 2022 (102 collisions each), while the year with the lowest number of collisions was 2019 (88 collisions). A total of 102 F+SI collisions occurred on County roads in unincorporated Solano County during the study period, increasing from 2018 to 2022. The least number of F+SI collisions occurred in 2019 (13 collisions), while the most occurred in 2022 (33 collisions). **Figure 8** illustrates the five-year collision trend for all injury collisions and F+SI collisions.

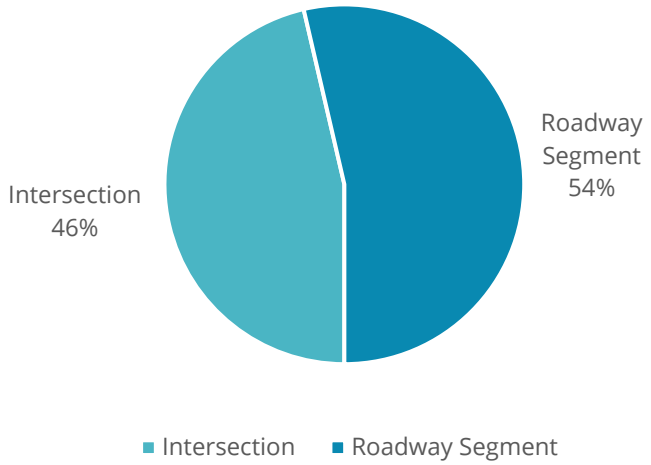
FIGURE 8: FIVE YEAR COLLISION TREND



ROADWAY SEGMENTS AND INTERSECTIONS

When evaluating location, the majority of collisions occurred along roadway segments rather than at intersections. In unincorporated Solano County, 54% of all collisions (258 collisions) occurred on roadway segments whereas 46% (223 collisions) occurred at intersections. A slightly stronger trend towards roadway segment collisions (63%) is seen when looking only at F+SI collisions. This classification by facility type can be observed in **Figure 9.**

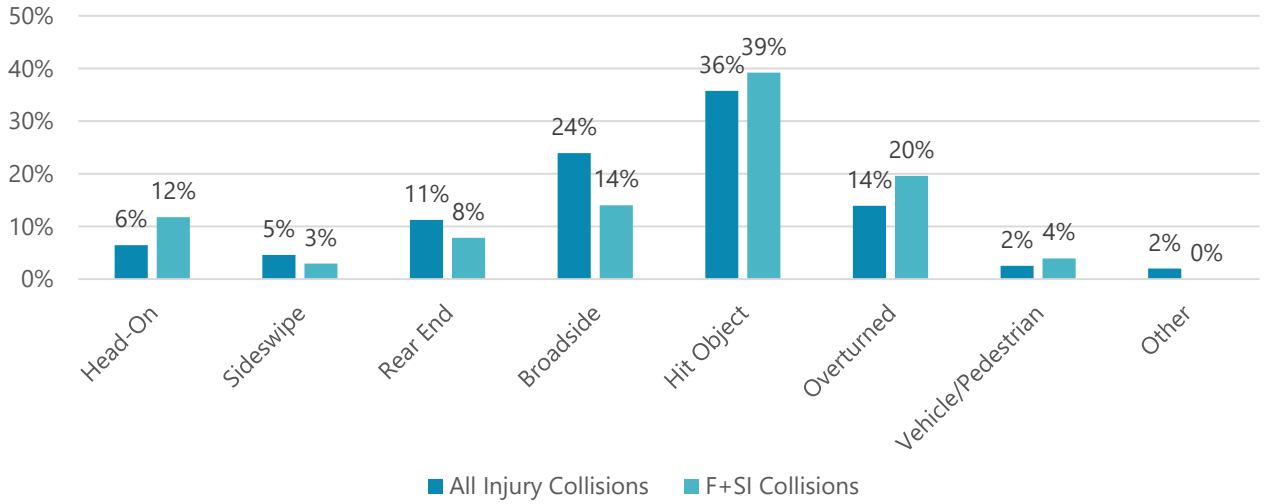
FIGURE 9: INTERSECTION AND ROADWAY COLLISIONS – ALL INJURY COLLISIONS



COLLISION TYPE

The most commonly occurring all injury collision types were hit object (36%) and broadside (24%). The collision types for F+SI collisions follow a slightly different pattern, where the most commonly occurring collision types were hit object (36%), overturned vehicle (20%), and broadside (14%). **Figure 10** illustrates the collision type for all injury collisions as well as F+SI collisions.

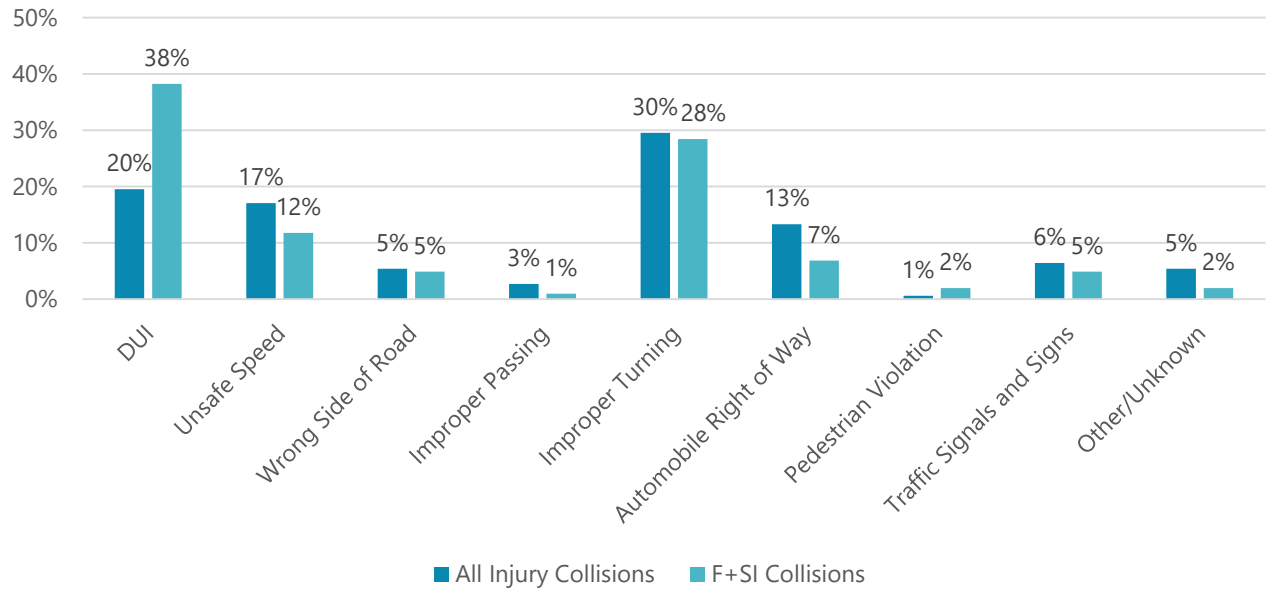
FIGURE 10: COLLISION TYPE – ALL INJURY COLLISIONS AND F+SI COLLISIONS



PRIMARY COLLISION FACTOR

The primary collision factor is determined from the type of violation noted by law enforcement officials at the site. For all injury collisions, the most common violation category was observed to be improper turning (30%) and driving under the influence (DUI) (20%). The most common primary violation categories for F+SI collisions were DUI (38%), improper turning (28%) and unsafe speed (12%). **Figure 11** illustrates the violation category for all injury collisions and F+SI collisions.

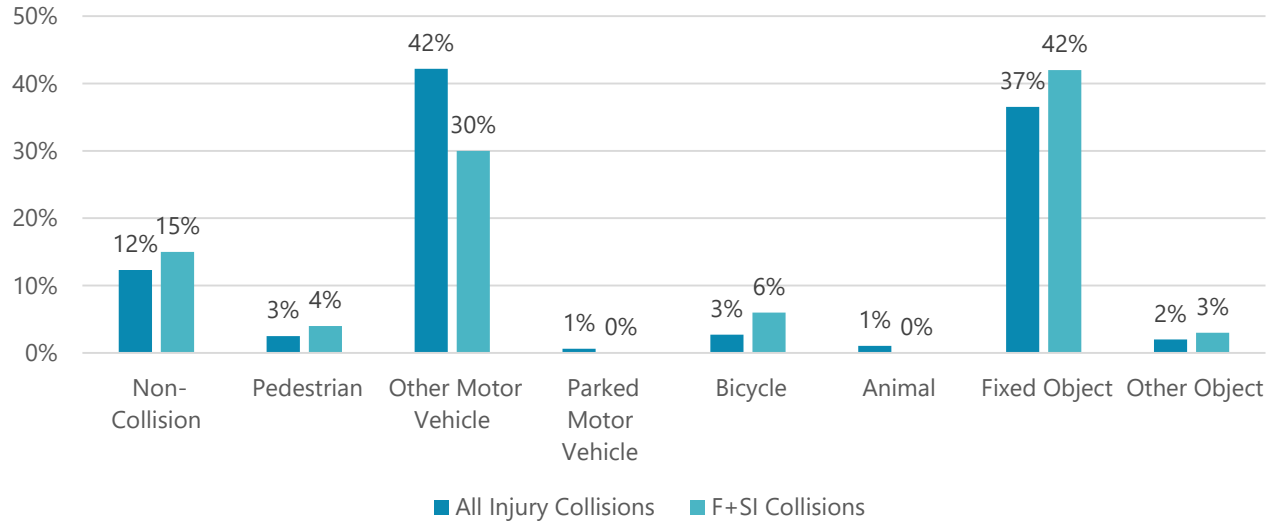
FIGURE 11: VIOLATION CATEGORIES: ALL INJURY COLLISIONS AND F+SI COLLISIONS



MOTOR VEHICLE INVOLVED WITH

Motor vehicles involved in a collision with an object, a person, an animal, and another vehicle is noted by law enforcement. For all injury collisions, 42% occurred when motor vehicles collided with other vehicles. This was followed by motor vehicles colliding with fixed objects (37%) and non-collisions (e.g., overturned) (12%). For F+SI collisions, 42% involved a fixed object, 30% of the collisions involved another motor vehicle, and 15% were classified as a non-collision. **Figure 12** illustrates the motor vehicle involved with category for all injury collisions as well as F+SI collisions.

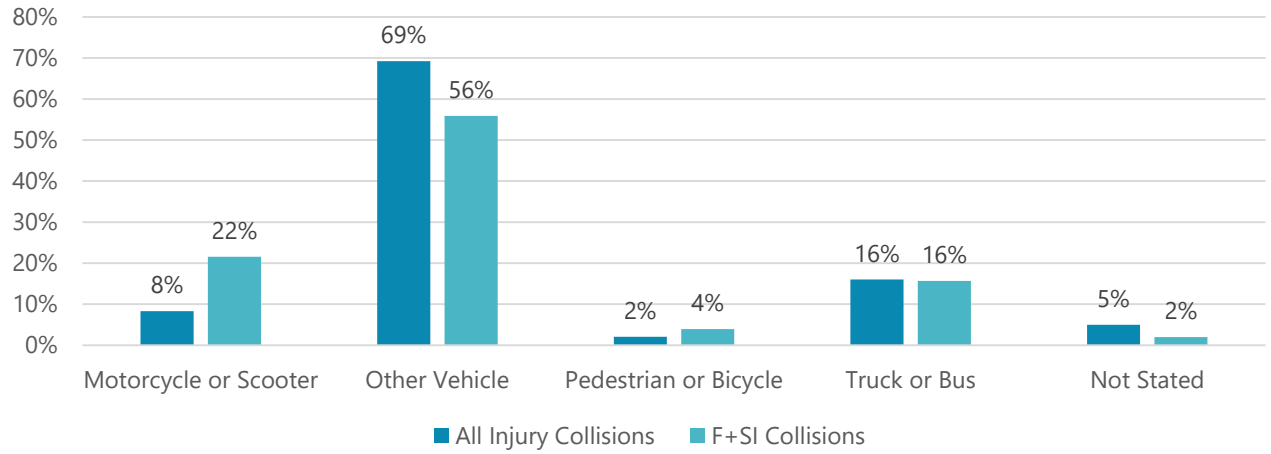
FIGURE 12: MOTOR VEHICLE INVOLVED WITH: ALL INJURY COLLISIONS AND F+SI COLLISIONS



MODES

In addition to motor vehicle involved with, modes include a more detailed breakdown of the vehicle type at fault in the accident, including motorcycles and trucks. For all injury collisions, the majority occurred with another vehicle (69%), followed by truck or bus (16%). Collisions with other vehicles also makes up the majority of F+SI collisions, but motorcycle/scooter collisions comprise a significant percentage, underscoring the fact that riding scooters and motorcycles is more vulnerable to a fatality or severe injury. **Figure 13** illustrates the percentage for all injury collisions as well as F+SI collisions by mode.

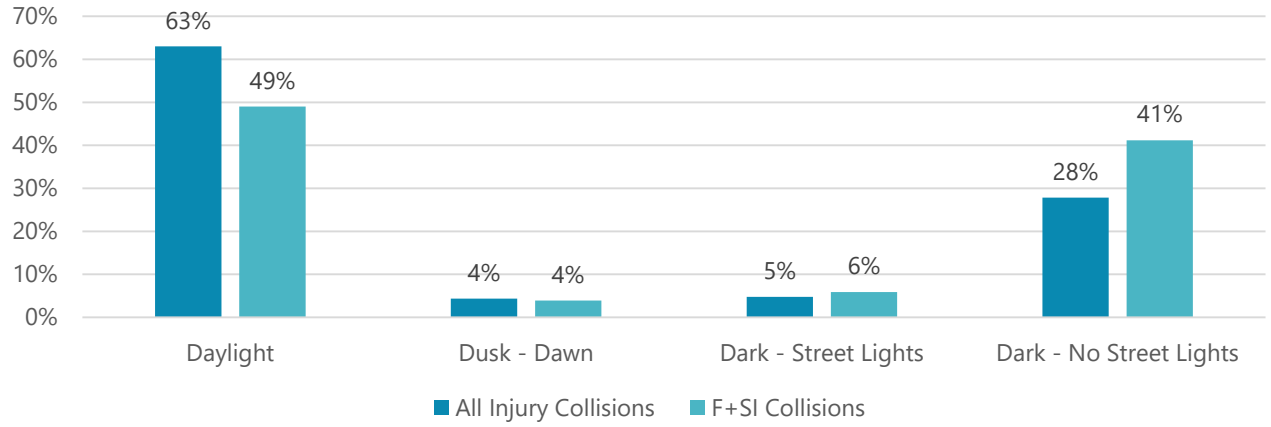
FIGURE 13: MODES: ALL INJURY COLLISIONS AND F+SI COLLISIONS



LIGHTING

For all injury collisions, 63% of collisions occurred in daylight, while 28% of collisions occurred in the dark on streets with no street lights. For F+SI collisions, 49% of collisions occurred in daylight and 41% of collisions occurred in the dark on streets with no street lights. **Figure 14** illustrates the lighting condition for all injury collisions and F+SI collisions.

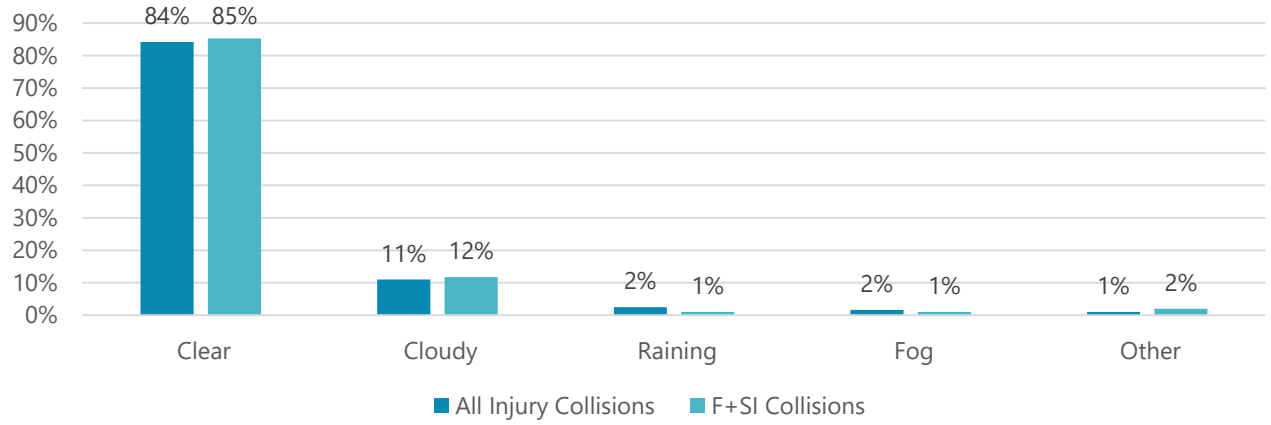
FIGURE 14: LIGHTING CONDITIONS: ALL INJURY COLLISIONS VS. F+SI COLLISIONS



WEATHER

For all injury collisions, the vast majority occurred during clear weather conditions (84%). For F+SI collisions similar trends have been observed, with 85% of the collisions having occurred during clear weather conditions. **Figure 15** illustrates the percent distribution of weather conditions during an occurrence of all injury collisions as well as F+SI collisions.

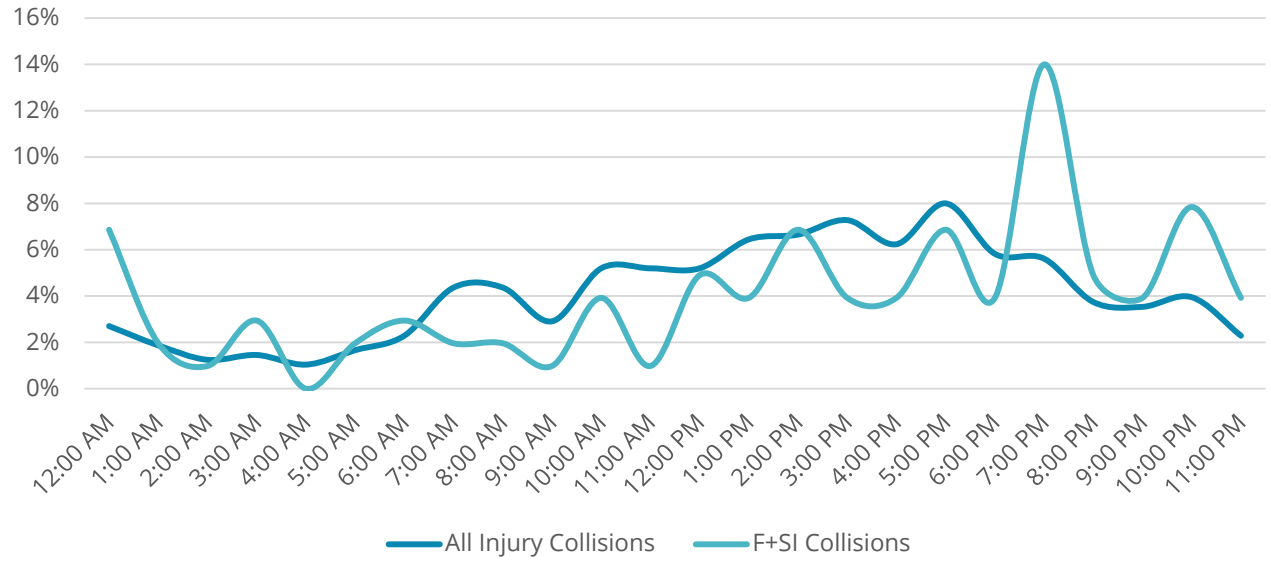
FIGURE 15: WEATHER CONDITIONS: ALL INJURY COLLISIONS AND F+SI COLLISIONS



TIME OF DAY

For all injury collisions, the hour with the most number of collisions was between 5:00 p.m. to 6:00 p.m. (8%), while the hours with the fewest number of collisions was between 2:00 a.m. to 5:00 a.m. (1% each). For all F+SI collisions, the maximum number of collisions occurred between 7:00 p.m. to 8:00 p.m. (14%). Other notable hours that had high F+SI collisions were 10:00 p.m. to 11:00 p.m. (8%), 2:00 p.m. to 3:00 p.m. (7%), and 5:00 p.m. to 6:00 p.m. (7%). The six-hour period beginning at 2:00 pm. and ending at 8:00 p.m. had 39% of F+SI collisions. **Figure 16** illustrates the percentage of collisions occurring during each hour of the day for all injury collisions as well as F+SI collisions.

FIGURE 16: TIME OF DAY: ALL INJURY COLLISIONS AND F+SI COLLISIONS



F+SI Collisions

This section describes a detailed cross-tabulation collision analysis performed for F+SI collisions occurring at roadway segments and intersections in unincorporated Solano County. Of the total 102 F+SI collisions that occurred during the study period (2018-2022), 64 collisions (63%) occurred on roadway segments and 38 collisions (37%) occurred at intersections. This distribution is illustrated in **Figure 17**.

FIGURE 17: INTERSECTION AND ROADWAY SEGMENT COLLISIONS – F+SI COLLISIONS

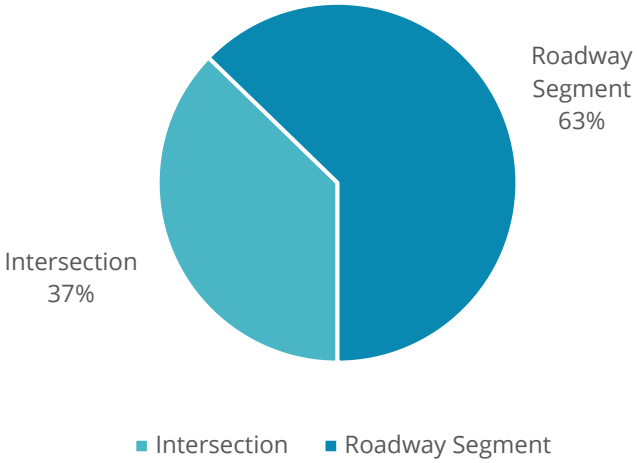
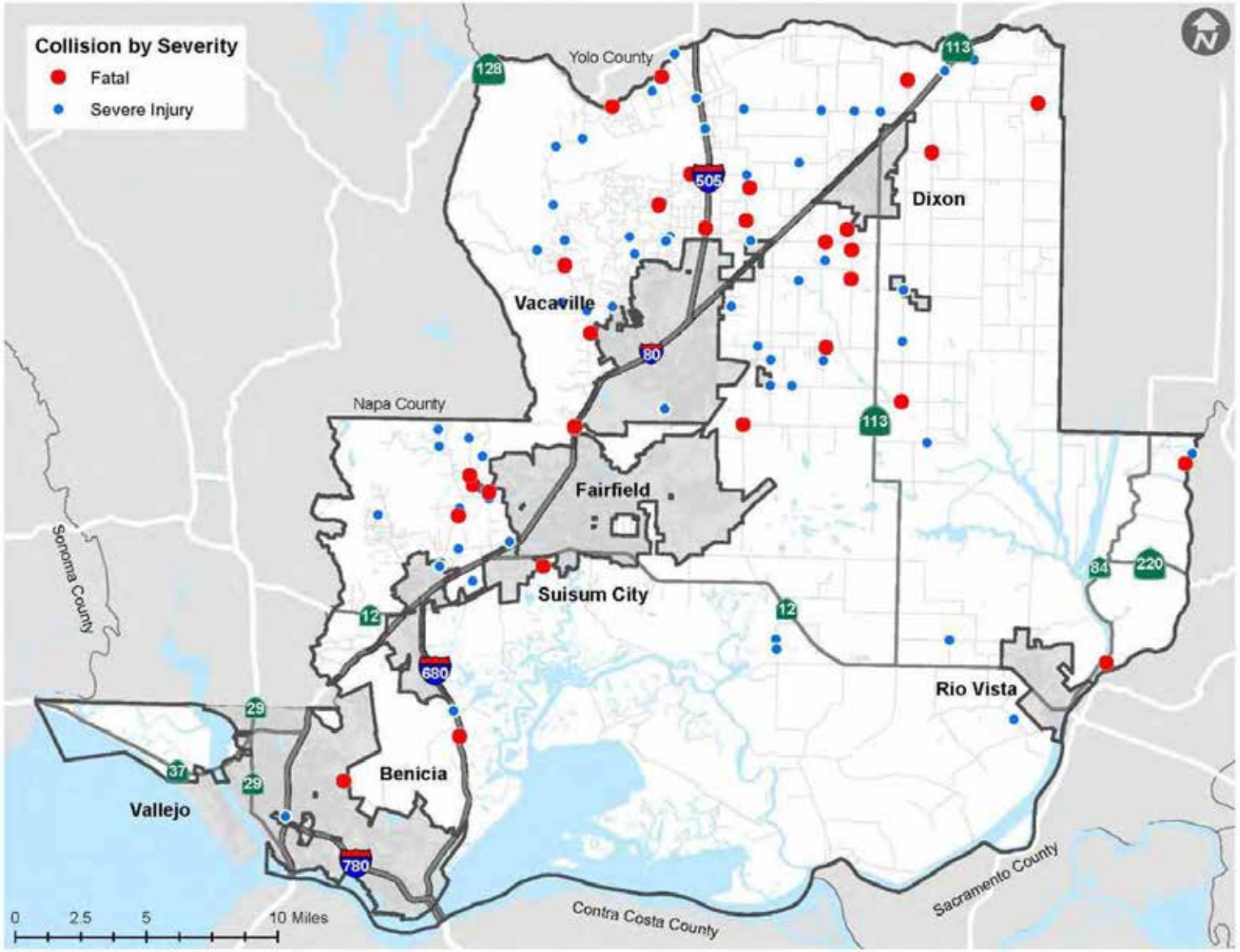


Figure 18 maps the F+SI collisions that occurred in unincorporated Solano County during the study period.

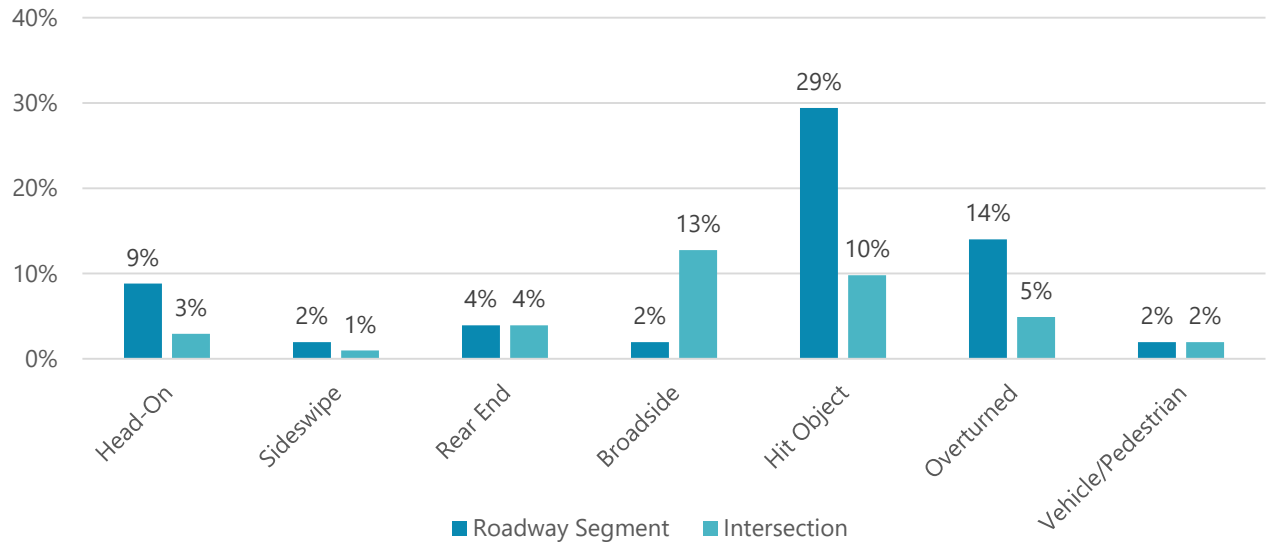
FIGURE 18: F+SI (2018-2022)



COLLISION TYPE AND LOCATION TYPE

The most common F+SI collision type was hit objects. These collisions were most likely to occur on roadway segments, along with overturned and broadside collisions. Broadside collisions that led to an F+SI more commonly occurred at intersections. **Figure 19** shows F+SI collisions locations as well as the collision type.

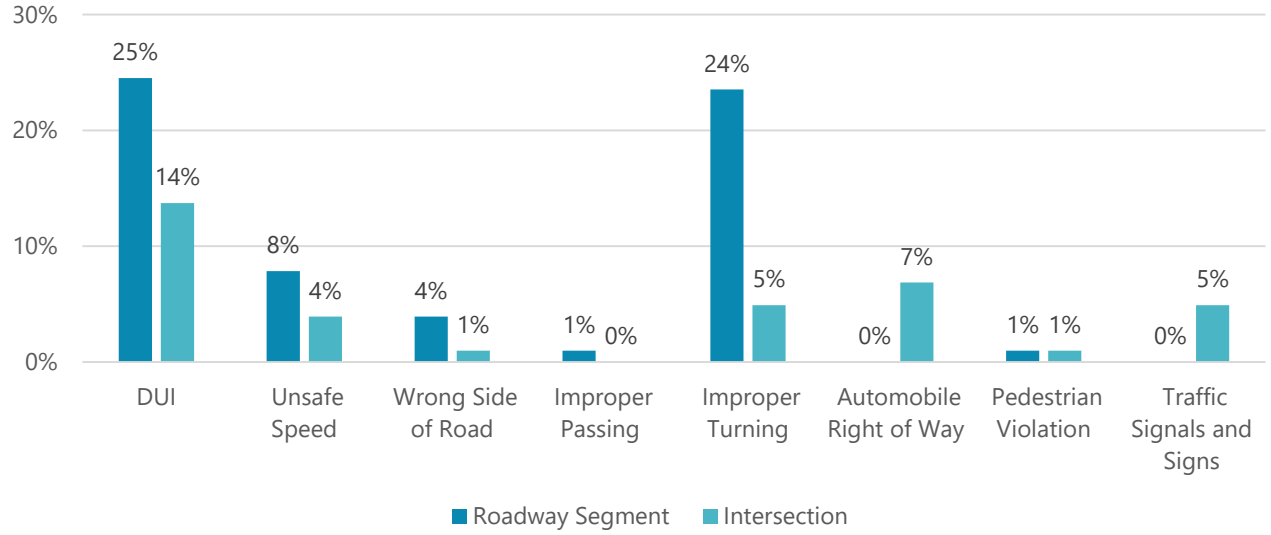
FIGURE 19: F+SI COLLISIONS: COLLISION TYPE AND LOCATION TYPE (2018-2022)



VIOLATION CATEGORY AND LOCATION TYPE

The most common F+SI collision type were DUI, improper turning, and unsafe speed collisions. These F+SI collisions primarily occurred on roadway segments. DUI was also the most common violation category at intersections, followed by automobile right of way and traffic signals and signs. **Figure 20** shows F+SI collisions as well as the location type and violation category.

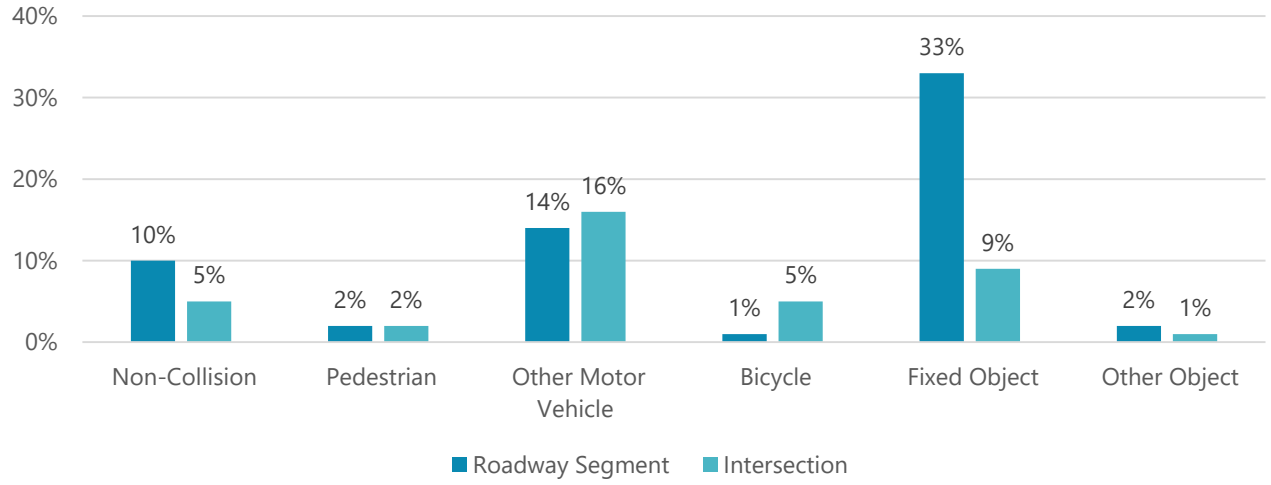
FIGURE 20: F+SI COLLISIONS: VIOLATION CATEGORY AND LOCATION TYPE (2018-2022)



MOTOR VEHICLE INVOLVED WITH AND LOCATION TYPE

Collisions involving a fixed object were the most common types of F+SI type collisions occurring on roadway segments. The same types of collisions occurred at intersections, however, more occurred with other motor vehicles than with fixed objects. **Figure 21** shows F+SI collision locations as well as the motor vehicle involved with category.

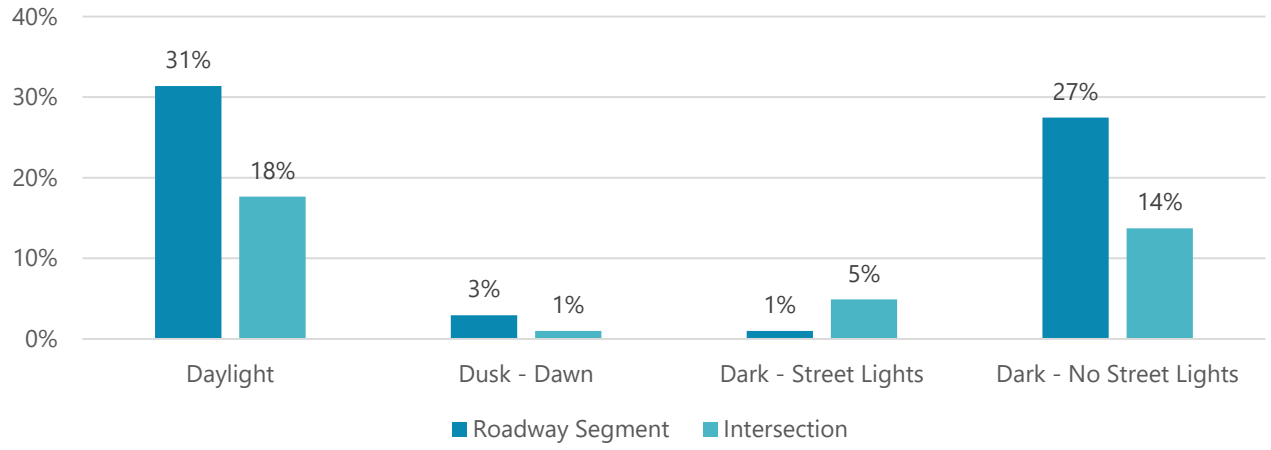
FIGURE 21: F+SI COLLISIONS: MOTOR VEHICLE INVOLVED WITH AND LOCATION TYPE (2018-2022)



LIGHTING AND LOCATION TYPE

Most F+SI collisions occurred in daylight on roadway segments. The second most common lighting condition for F+SI collisions was collisions that occurred in the dark with no street lights. **Figure 22** shows F+SI collision locations as well as lighting conditions.

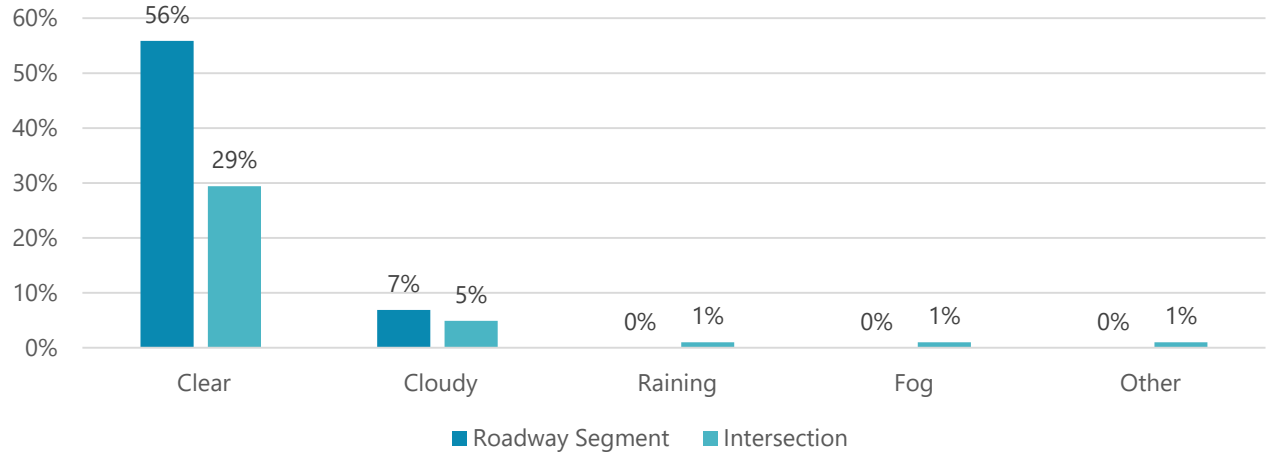
FIGURE 22: F+SI COLLISIONS: LIGHTING AND LOCATION TYPE (2018-2022)



WEATHER AND LOCATION TYPE

The majority of F+SI collisions occurred during clear weather on roadway segments and at intersections. **Figure 23** shows F+SI collision locations as well as weather conditions.

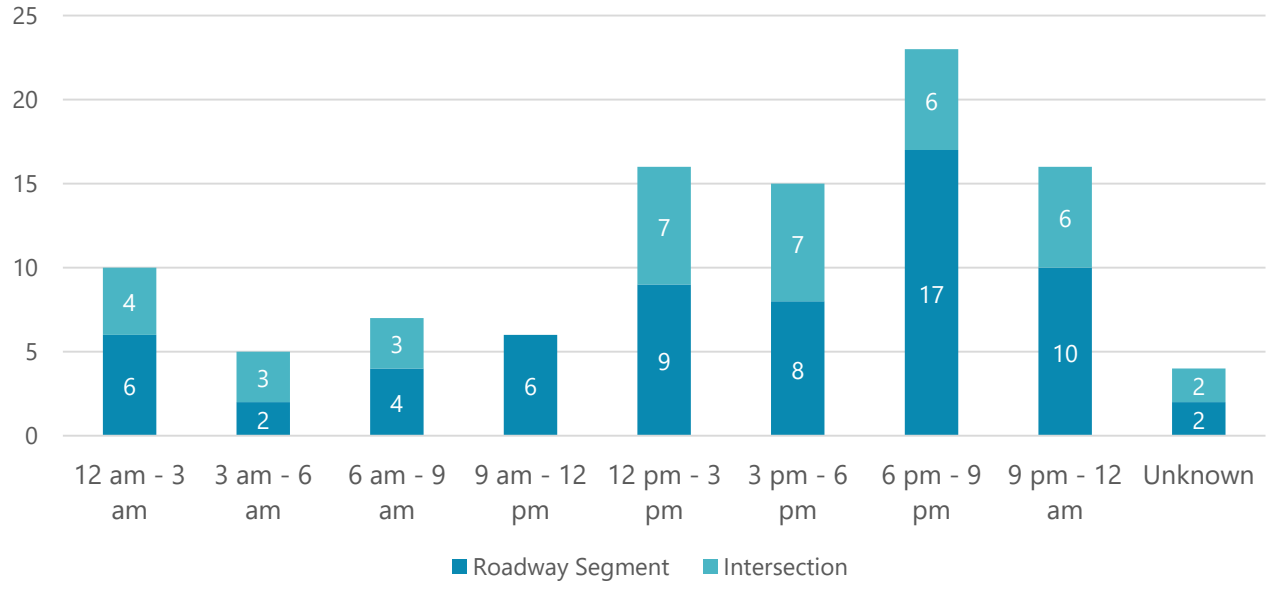
FIGURE 23: F+SI COLLISIONS: WEATHER VS LOCATION TYPE (2018-2022)



TIME OF DAY AND LOCATION TYPE

The time period with the most F+SI collisions was during 6:00 p.m. to 9:00 p.m. For roadway segments, the time period between 6:00 p.m. to 9:00 p.m. had highest collisions. **Figure 24** shows F+SI collisions by location type and time of day.

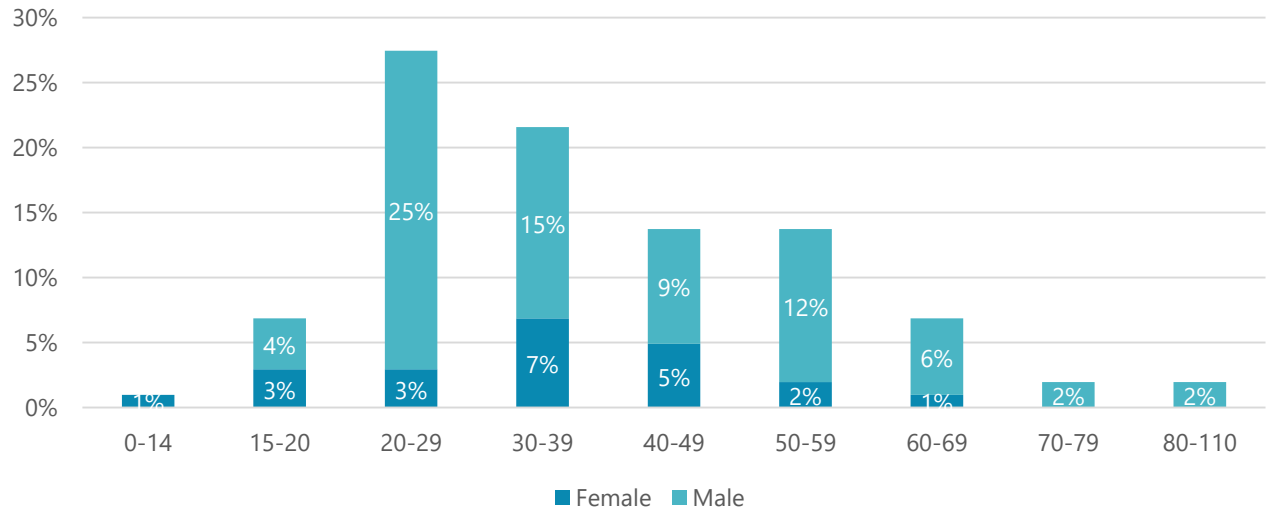
FIGURE 24: F+SI COLLISIONS: TIME OF DAY AND LOCATION TYPE (2018-2022)



GENDER AND AGE

For F+SI collisions, the gender of the party at fault was much more likely to be male than female (75% of F+SI collisions were caused by a male). The party at fault was also more likely to be younger, with the largest age group being 20-29 years (28%). Parties at fault under 40 years of age accounts for just over half (57%) of all F+SI collisions. **Figure 25** illustrates the gender and age of the party at fault for F+SI collisions.

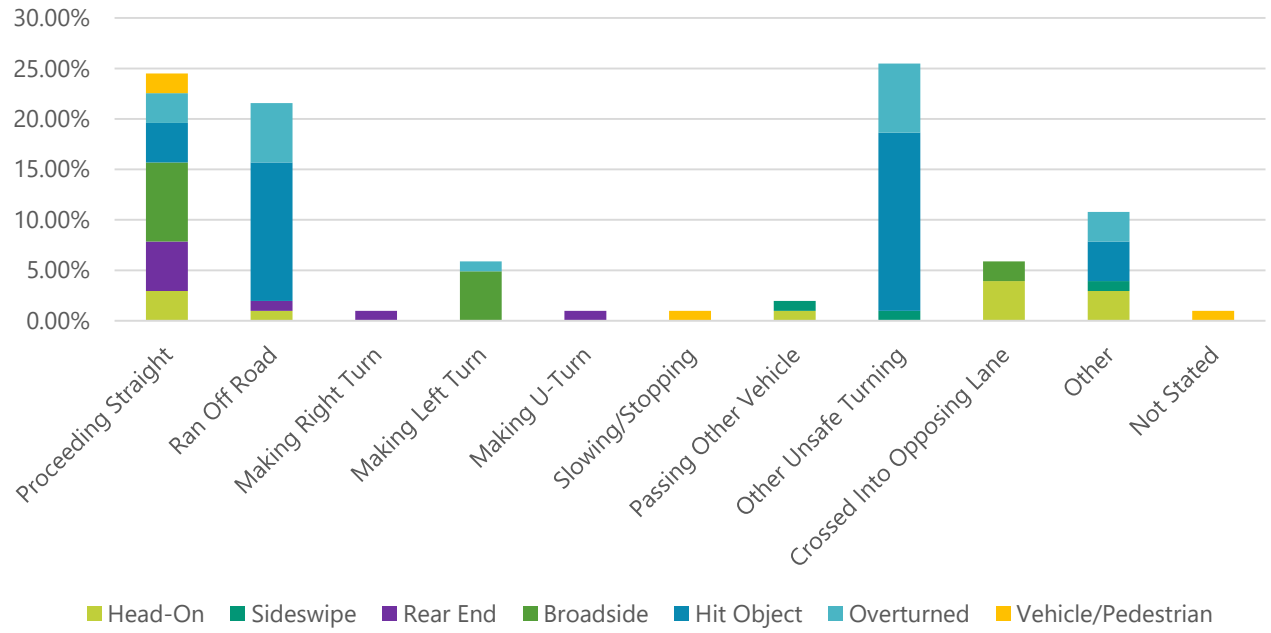
FIGURE 25: F+SI COLLISIONS BY GENDER AND AGE



COLLISION TYPE AND MOVEMENT PRECEDING COLLISION OF PARTY AT FAULT

The most common type of collision for F+SI collisions was hit objects. Of these collisions, other unsafe turning was the most common movement preceding the collision of the party at fault (18%), followed by ran off road (14%). **Figure 26** shows this distribution.

FIGURE 26: F+SI COLLISIONS BY COLLISION TYPE AND MOVEMENT PRECEDING COLLISIONS OF PARTY AT FAULT



GEOGRAPHIC COLLISION ANALYSIS

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

HIT OBJECT COLLISIONS

Hit object collisions represented the highest proportion of both collisions of all injury (36%), and F+SI collisions (39%). **Figure 27** shows the distribution of hit object injury collisions throughout unincorporated Solano County between 2018 and 2022. Pleasants Valley Road, Suisun Valley Road, Gibson Canyon Road, and Mankas Corner Road, Lopes Road have a higher frequency of hit object collisions, compared to other unincorporated Solano County roads.

IMPROPER TURNING COLLISIONS

For F+SI collisions in unincorporated Solano County, 28% of collisions were improper turning collisions. It was the most common violation type among all injury collisions (30%). **Figure 28** shows the distribution of improper turning collisions throughout unincorporated Solano County between 2018 and 2022. Pleasants Valley Road, Suisun Valley Road, Lopes Road and Gibson Canyon Road have a higher concentration of improper turning collisions, compared to other unincorporated Solano County roads.

BROADSIDE COLLISIONS

For all injury collisions in unincorporated Solano County, 24% were broadside collisions. The share of F+SI broadside collisions is 14%. A majority (83%) of broadside collisions occurred at intersection. **Figure 29** shows the distribution of broadside collisions throughout unincorporated Solano County between 2018 and 2022. Midway Road, Lewis Road, S A St, and Hawkins Road have a higher concentration of broadside collisions, compared to other unincorporated Solano County roads.

NIGHTTIME COLLISIONS

Nighttime collisions accounted for 37% of all injury collisions and 51% of F+SI collisions. The majority of these nighttime collisions occurred in areas without street lights, given the unincorporated county's rural nature. **Figure 30** shows the distribution of nighttime collisions throughout unincorporated Solano County between 2018 and 2022. Midway Road, Putah Creek Road, Suisun Valley Road, and Gibson Canyon Road have a higher frequency of nighttime collisions, compared to other unincorporated Solano County roads.

DUI COLLISIONS

For F+SI collisions in unincorporated Solano County, 38% of collisions were reported as DUI collisions (compared to only 20% of all injury collisions). **Figure 31** shows the distribution of DUI collisions throughout the Unincorporated Solano County between 2018 and 2022. Putah Creek Road, Mankas Corner Road, Meridian Road, and Green Valley Road have a higher frequency of DUI collisions, compared to other unincorporated Solano County roads.

FIGURE 27: SOLANO COUNTY HIT OBJECT COLLISIONS (2018-2022)

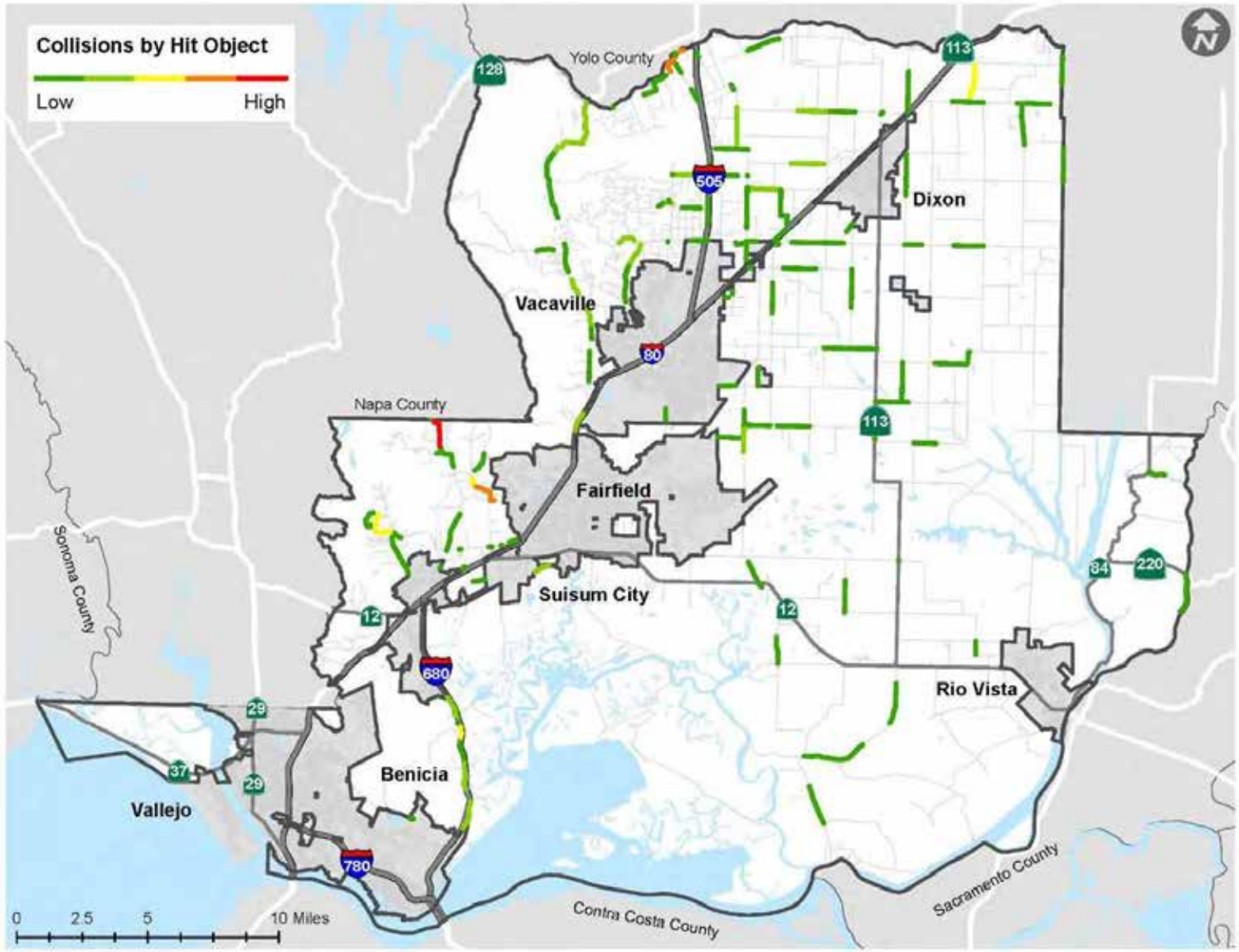


FIGURE 28: SOLANO COUNTY IMPROPER TURNING COLLISIONS (2018-2022)

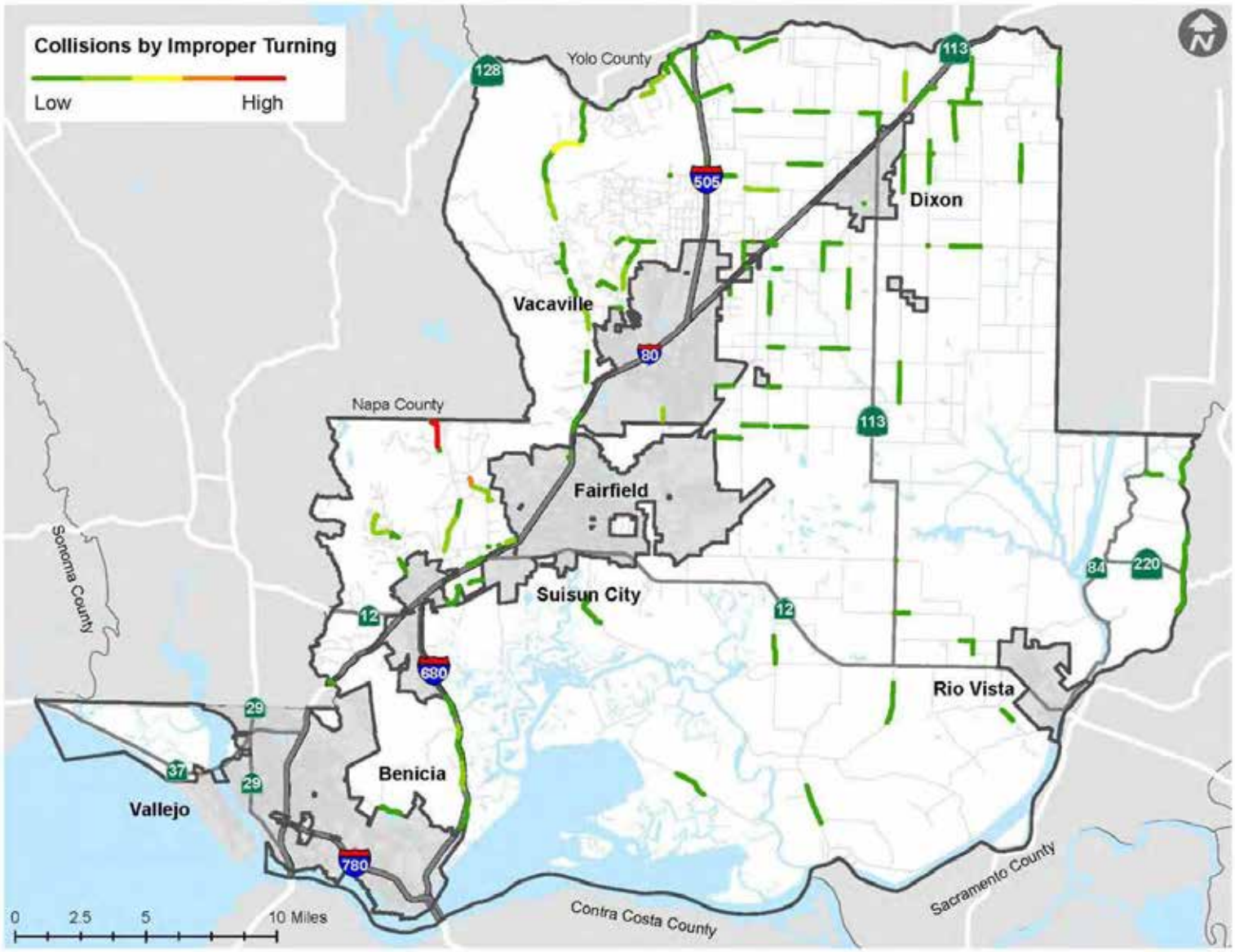


FIGURE 29: SOLANO COUNTY BROADSIDE COLLISIONS (2018-2022)

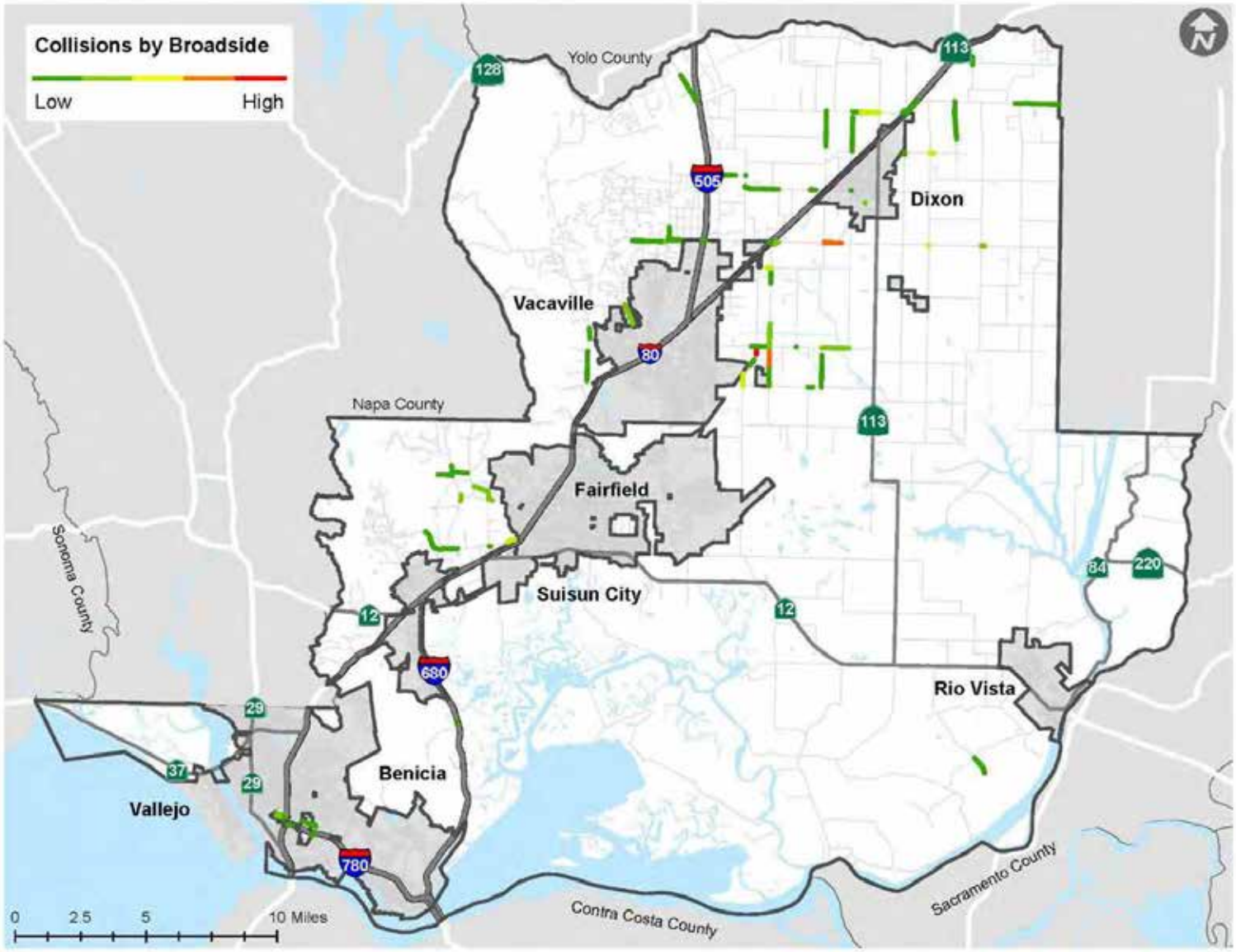


FIGURE 30: SOLANO COUNTY NIGHTTIME COLLISIONS (2018-2022)

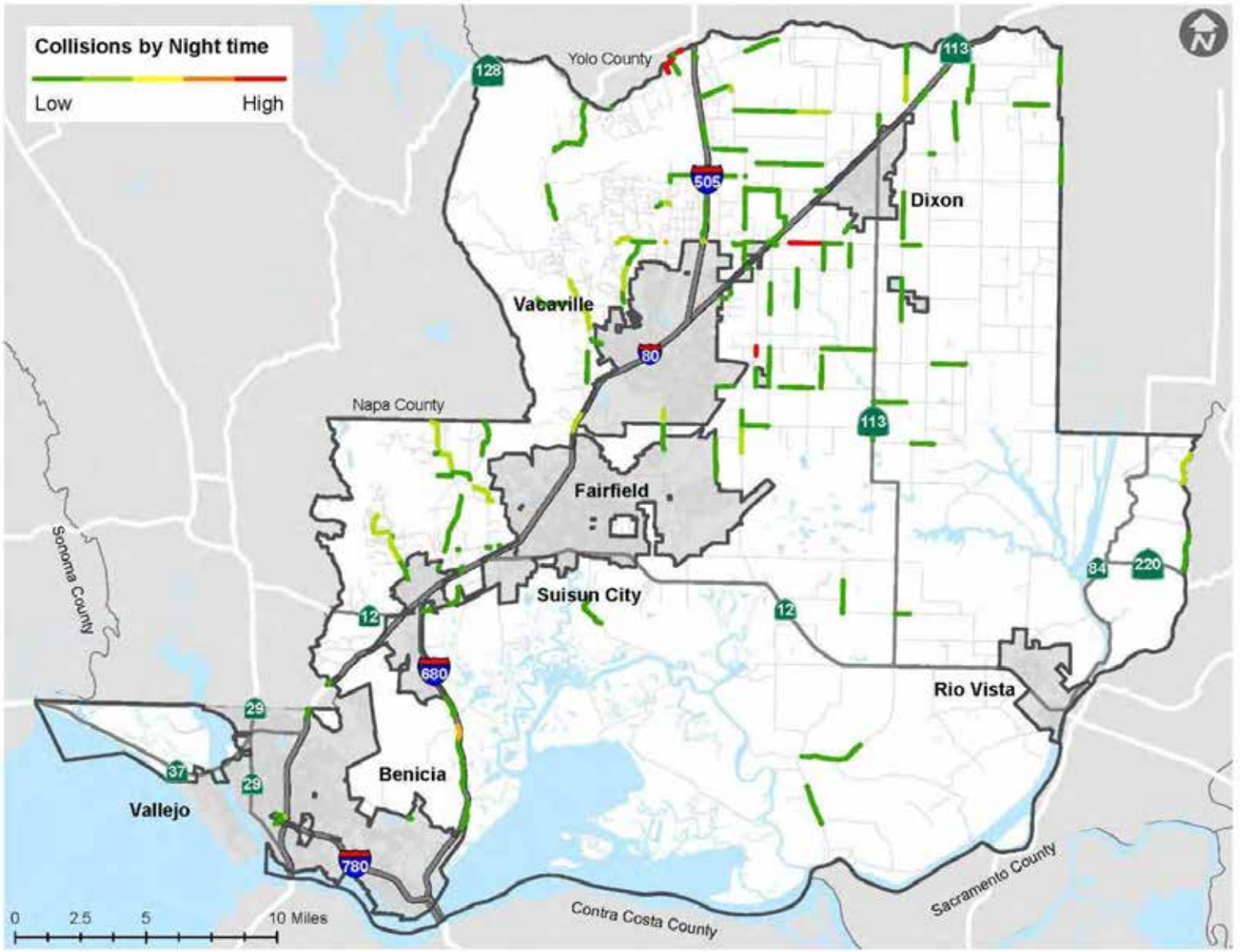
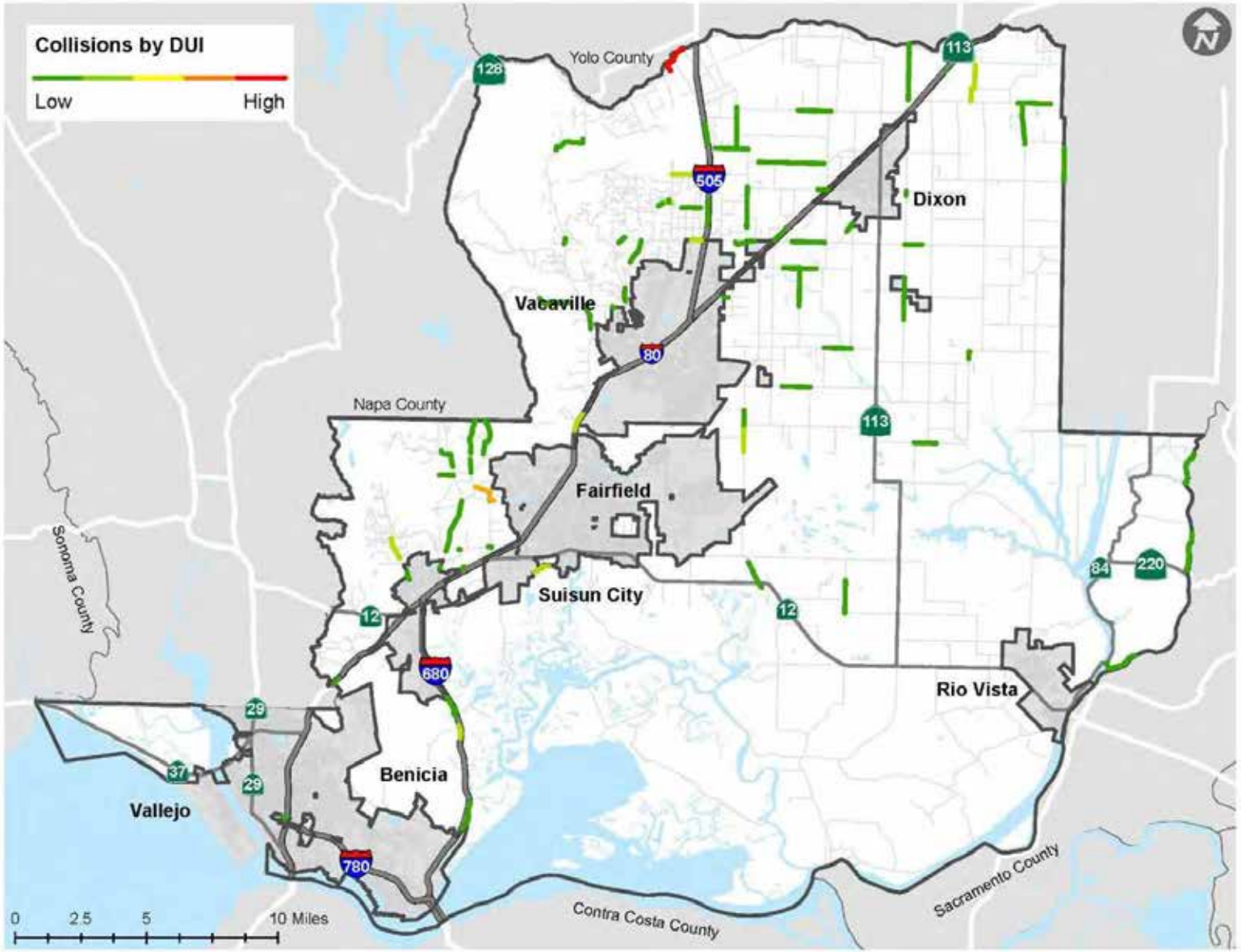


FIGURE 31: SOLANO COUNTY DUI COLLISIONS (2018-2022)



Collision Severity Weight

The California Department of Transportation (Caltrans) uses the cost of a collision as the unit of measurement to compare locations where collisions have occurred. The comparison leads to a prioritized list of roadways and intersections to receive funds for safety improvements. The cost factor is comprehensive in that F+SI collision is weighed with a much higher cost than property damage only collision. A collision severity weight was used to identify the high severity collision network, using the EPDO method. The EPDO method accounts for both the severity and frequency of collisions by converting each collision to an equivalent number of PDO collisions. The EPDO method assigns a crash cost and score to each collision according to the severity of the crash weighted by the comprehensive crash cost. These EPDO scores are calculated using a simplified version of the comprehensive crash costs per HSIP Cycle 12 application. The weights used in the analysis are shown below in **Table 3**.

TABLE 3: EPDO SCORE USED IN HIGHWAY SAFETY IMPROVEMENT PROGRAM

COLLISION SEVERITY	EPDO SCORE*
Fatal	165
Severe	165
Visible Injury	11
Possible Injury	6
PDO	1

**This is the score used in HSIP Cycle 12 for collisions on roadway segments, to simplify the analysis this study uses the same score for all F+SI collisions, including those at intersections.*

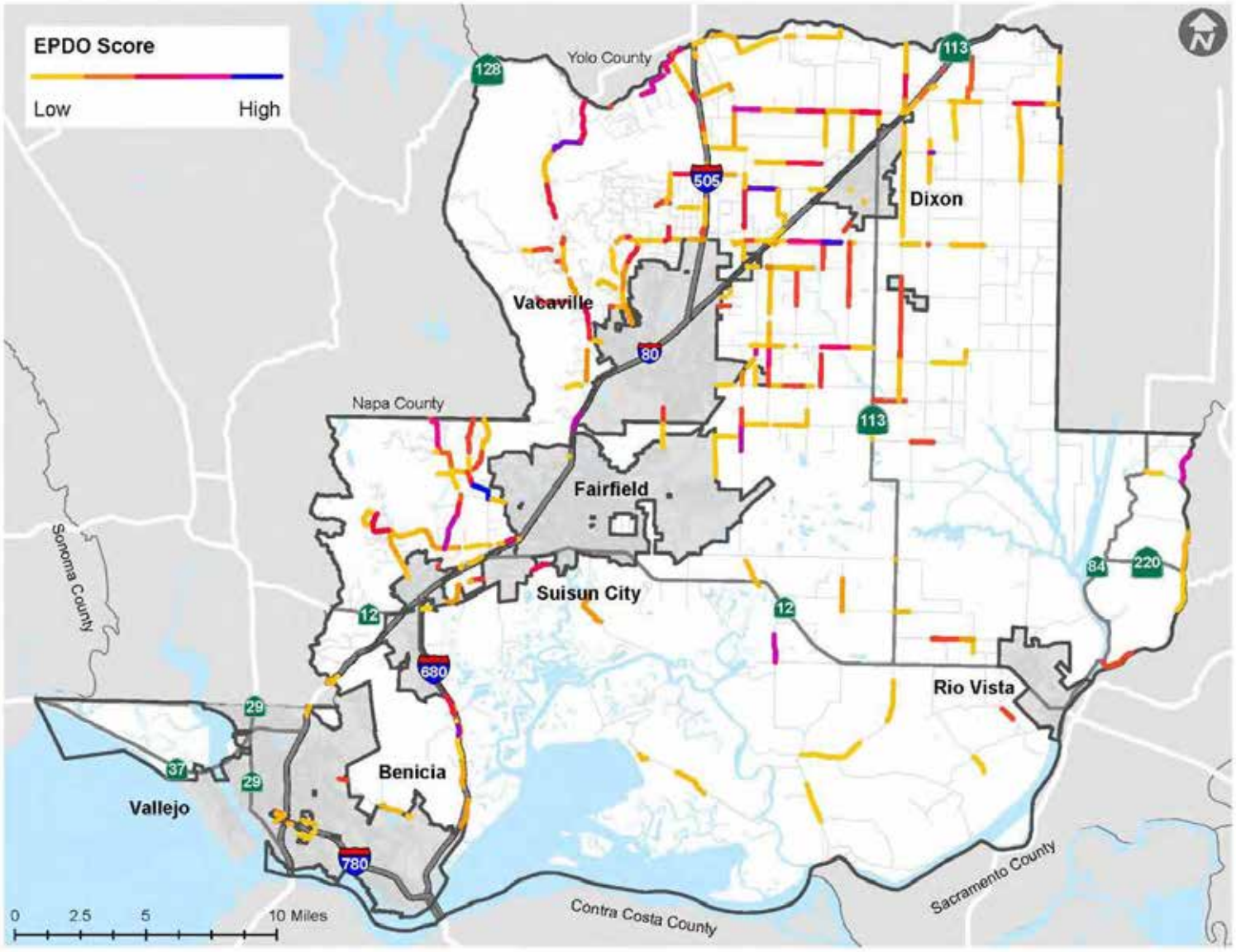
EPDO is used because it provides a methodology for the project team to understand the locations in Solano County that are experiencing the most severe crashes. Because of the high score given to F+SI crashes, locations that have these types of crashes are more likely to receive a higher EPDO score than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

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 Solano County were geolocated onto county's road network. For the purposes of this analysis, PDO collisions were excluded. GIS is then used to calculate the EPDO score for each roadway segment and intersection countywide, which is then ranked according to its score.

The EPDO scores for all collisions are aggregated in a variety of ways to identify collision patterns, such as location hot-spots. The weighted collisions were geo-located on to unincorporated Solano County's road network.

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

FIGURE 32: SOLANO COUNTY SEVERITY INDEX



High Injury Network

The next step in the process was to identify high-risk roadway segments and intersections in unincorporated Solano County. The methodology for scoring the high injury locations is the EPDO method; that is, the same method used in the severity weight section.

Figures 33 and **34** show the top 14 high-collision intersections and top 15 high-collision roadway segments.

For the purposes of the high collision network analysis, intersections include collisions that occurred within 250 feet of it and roadways include all collisions that occurred along the roadway except for collisions that occurred directly at an intersection. Such collisions are assigned a zero value in intersection distance column in the SWITRS dataset.

FIGURE 33: SOLANO COUNTY HIGH INJURY INTERSECTIONS

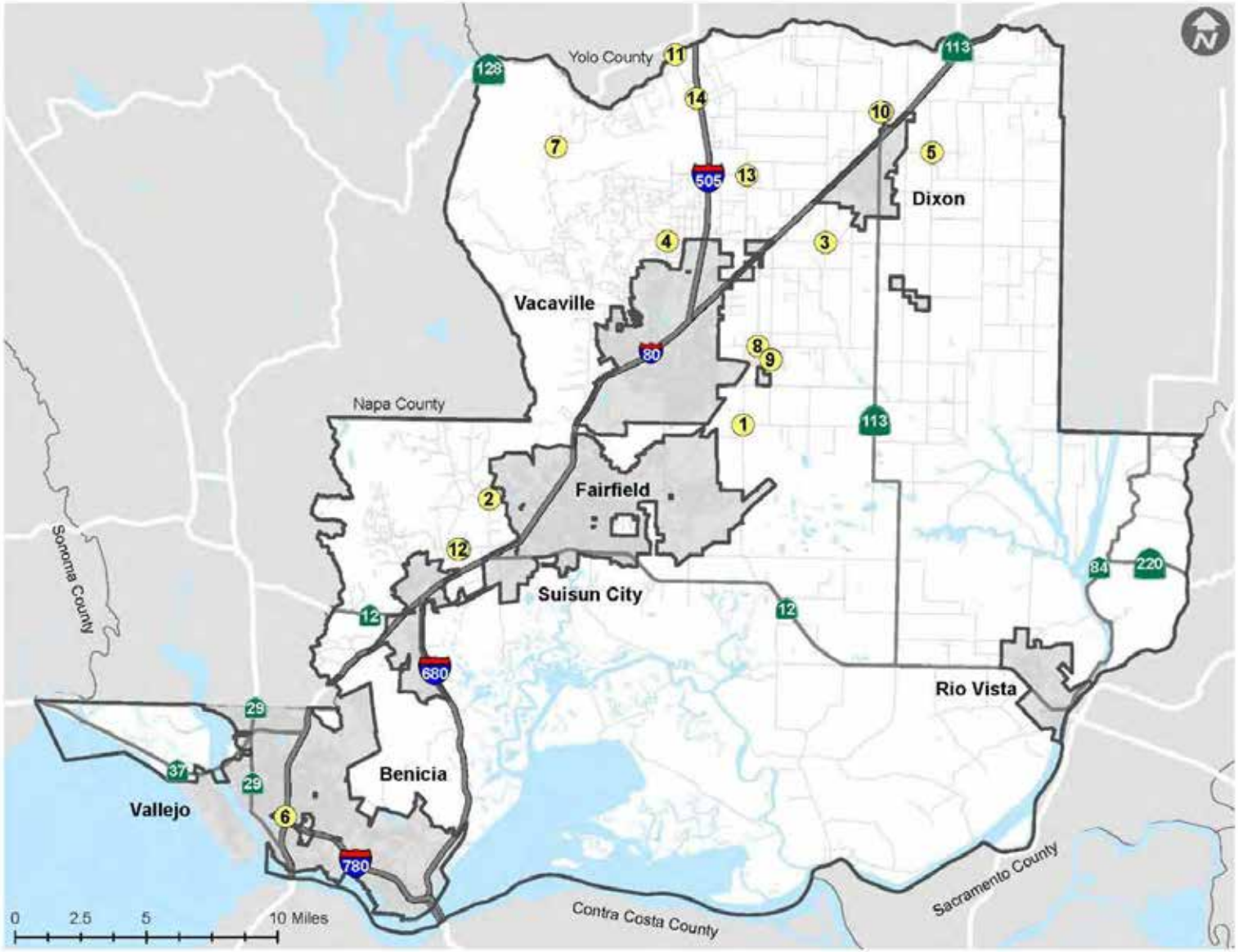
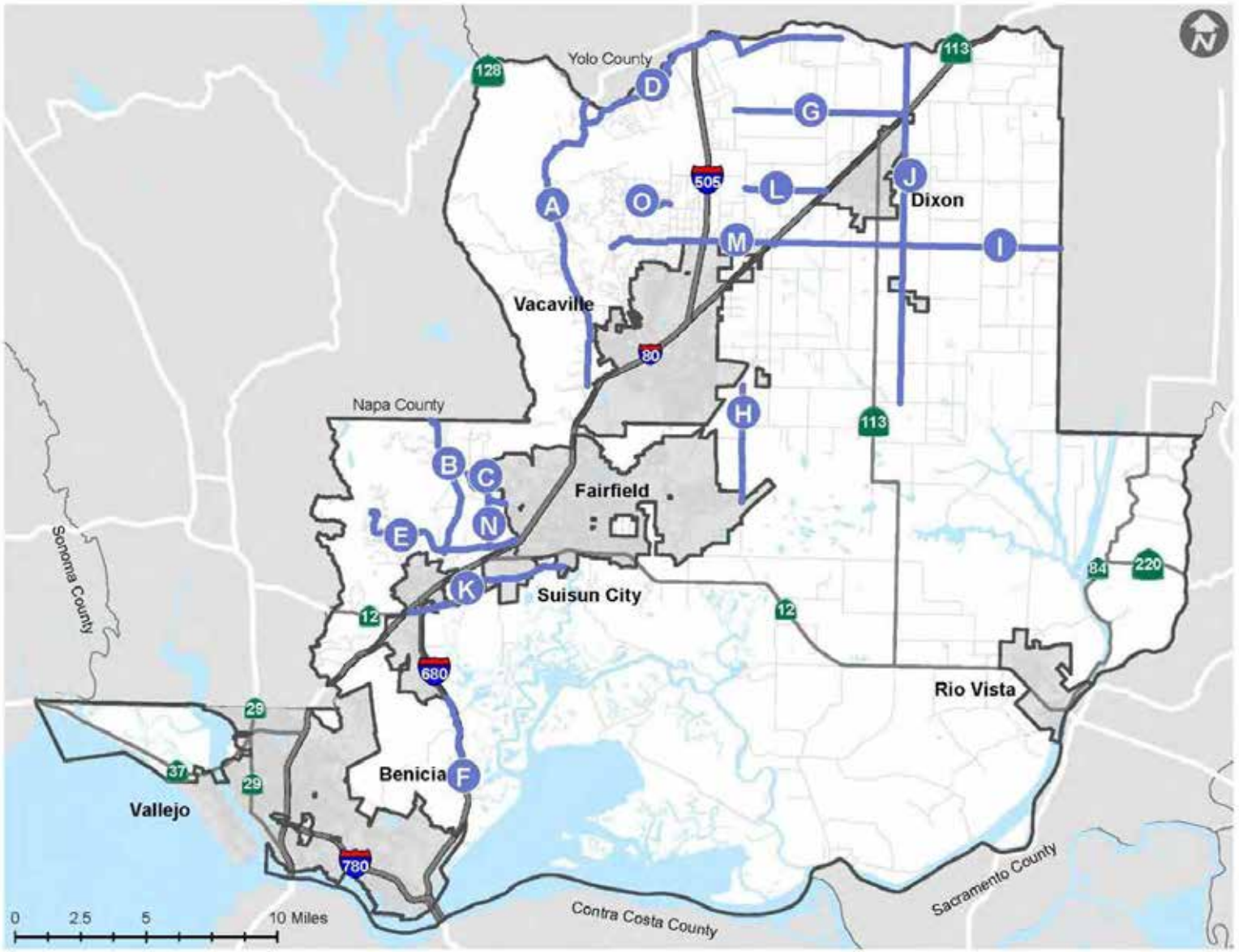


FIGURE 34: SOLANO COUNTY HIGH INJURY ROADWAY SEGMENTS



INTERSECTION RANKING

A total of 14 intersections were identified as high injury intersections. There were a total of 22 F+SI collisions that occurred at these intersections. The intersection of Hay Road and Meridian Road has the highest EPDO score, indicating the suggested highest priority location for improvement.

Table 4 lists the EPDO score of the top 14 identified high-collision intersections along with the types of collisions that were occurred at these locations.

TABLE 4: HIGH INJURY INTERSECTIONS

ID	Intersection	Total	F+ SI	HIT OBJECT	IMPROPER TURNING	BROAD -SIDE	NIGHT-TIME	DUI	EPDO Score
		Collisions							
1	Hay Road and Meridian Road	3	3	2	0	0	3	3	495
2	Abernathy Road and Mankas Corner Road	5	2	1	1	1	2	1	353
3	Batavia Road and Midway Road	4	2	1	1	3	0	0	342
4	Browns Valley Road and Cantelow Road/ Timm Road	4	2	1	0	2	3	0	342
5	Robben Road and Vaughn Road	3	2	0	1	3	1	0	341
6	Benicia Road and Lemon Street/ Lincoln Road	3	2	0	0	2	2	1	336
7	Quail Canyon Road and Pleasants Valley Road	2	2	0	1	0	0	0	330
8	Byrnes Road and Hawkins Road	11	1	0	0	10	4	0	240
9	Holdener Road and Lewis Road	6	1	0	0	6	1	0	210
10	Sievers Road and Currey Road	3	1	0	1	3	0	0	182
11	Railroad Avenue and Putah Creek Road	2	1	2	0	0	2	2	176
12	Rockville Road and Willotta Drive	2	1	1	0	1	1	1	176
13	Meridian Road and Allendale Road	2	1	1	0	1	1	0	171
14	Winters Road and Wolfskill Road	2	1	1	1	1	0	0	171

ROADWAY SEGMENT RANKING

A total of 15 corridors were identified as high injury corridors. There were 49 F+SI collisions on these corridors. The corridor with the highest number of F+SI collisions is Pleasants Valley Road with seven F+SI collisions.

Table 5 lists the EPDO score of the top 15 identified high-collision corridors along with the number of F+SI collisions, total collisions, and length of corridor.

TABLE 5: HIGH INJURY CORRIDORS

ID	Corridors	Total	F + SI	HIT OBJECT	IMPROPER TURNING	BROAD -SIDE	NIGHT-TIME	DUI	Length (miles)	EPDO Score
		Collisions								
A	Pleasants Valley Road: Yolo County Line to Cherry Glen Road	24	7	14	13	1	8	3	12.5	1302
B	Suisun Valley Road: 650 ft. south of Rockville Road to Napa County Line	23	5	10	11	2	6	3	5.7	963
C	Mankas Corner Road: Fairfield City Limit to Clayton Road	14	3	7	6	2	3	3	2.1	921
D	Putah Creek Road: Pleasants Valley Road to Stevenson Bridge Road	13	3	6	6	0	5	3	12.0	745
E	Rockville Road: Fairfield City Limit to Tartan way	21	4	8	7	5	5	2	7.1	637
F	Lopes Road: 5600 ft. north of Marshview Road to 1500 ft. south of Parish Road	9	3	8	6	0	6	3	3.5	546
G	Sievers Road: Halley Road to Pedrick Road	9	4	2	3	2	4	1	6.5	535
H	Meridian Road: Fry Road to Fairfield City Limit	4	3	3	0	0	3	3	4.4	501
I	Midway Road: Leeve Road to Timm Road	20	3	6	4	3	8	5	14.9	477
J	Pedrick Road: Yolo County Line to Maine Prairie Road	13	2	5	4	0	5	3	13.6	441
K	Cordelia Road: I-80 to Park Lane	9	2	3	3	0	1	2	7.0	387
L	Dixon Avenue: I-80 to Meridian Road	7	2	2	2	2	2	1	3.0	375
M	Cantelow Road: Browns Valley Road to Steiger Hill Road	7	3	4	3	1	4	1	2.2	364
N	Abernathy Road: Mankas Corner Road to Rockville Road	4	3	1	1	0	2	1	1.8	341
O	Peaceful Glen Road: Timm Road to Acacia Lane	3	2	3	0	0	3	3	0.9	336

Cut-Through Traffic

Solano County experiences a high volume of inter-regional traffic between the Bay Area, Sacramento, and other regions due to its location on I-80 between regions. During peak periods and on peak weekend times, motorists on I-80 can experience heavy congestion at locations in Fairfield, Vacaville, and Dixon. As a result, many drivers exit the freeway and travel on unincorporated County roads to avoid the I-80 congestion, which can in turn cause congestion and safety issues on rural roads that, in many cases, were not designed to handle inter-regional traffic. As part of the LRSP process, County staff included seven additional corridors where large amounts of cut through traffic diverted from I-80 is experienced to receive countermeasures that could help address safety concerns. The corridors are as follows:

- Suisun Valley Road (traffic to and from Napa)
- Tremont Road between Dixon and Davis
- Midway Road between Vacaville and Dixon
- Lyon Road between Vacaville and Fairfield
- Sievers Road between Dixon and Davis
- Cherry Glen Road/Pleasants Valley Road
- Weber Road between Vacaville and Dixon

Chapter 3 Summary

During the study period of 2018-2022, a total of 481 injury collisions occurred on unincorporated Solano County roads, of which 102 resulted in either a fatality or severe injury. The number of collisions occurring each year has been slightly increasing except for a dip in 2019 and 2020. Based on the collision data, five prominent trends emerged: hit object collisions, improper turning collisions, broadside collisions, nighttime collisions, and DUI collisions. Each of these became the focus of analysis because they were prominent factors in causing F+SI collisions on Solano County roadways. A more detailed geographic analysis was conducted for each of the five identified trends.

Hit Object Collisions: This type of collision represented the highest proportion of F+SI collisions (39%), and all injury collisions (36%). They are most concentrated on Pleasants Valley Road, Suisun Valley Road, Gibson Canyon Road, and Mankas Corner Road, Lopes Road.

Improper Turning Collisions: This type of violation caused 28% of all F+SI collisions and was the most common violation type among all injury collisions (30%). They were observed to be more concentrated along Pleasants Valley Road, Suisun Valley Road, Lopes Road and Gibson Canyon Road.

Broadside Collisions: 24% of all injury collisions were broadside collisions, higher than its share of F+SI collisions (14%). They were more concentrated on Midway Road, Lewis Road, S A St, and Hawkins Road.

Nighttime Collisions: 37% of all injury collisions and 51% of all F+SI collisions occurred during low light conditions. The majority of these nighttime collisions occurred in areas without street lights, given the rural nature of unincorporated Solano County. Higher concentrations of nighttime collisions were observed on Midway Road, Putah Creek Road, Suisun Valley Road, and Gibson Canyon Road.

DUI Collisions: 38% of F+SI collisions occurred as a result of motorists driving under the influence (compared to only 20% of all injury collisions). They were observed to be more concentrated along Putah Creek Road, Mankas Corner Road, Meridian Road, and Green Valley Road.

Once a geographic analysis was conducted of prominent collision trends, a collision severity weight was used to identify the high-risk network. 14 intersections and 15 roadway segments across the unincorporated County were identified as high-risk based on their EPDO score, which takes into account the severity of collisions occurring at a particular intersection or on a roadway segment. Pleasants Valley Road from Yolo County Line to Cherry Glen Road was identified as the highest ranking roadway segment, while Hay Road and Meridian Road was the highest ranking intersection and the only intersection with three F+SI collisions.

COMPARISON OF COLLISION TRENDS: 2016-2020 VS. 2018-2022

The 2023 Local Roadway Safety Plan (LRSP) analyzed collision data for the period of January 1, 2016, to December 31, 2020, in unincorporated Solano County. While there is an overlap of three years (2018, 2019, and 2020) with the current LRSP update covering the period from 2018 to 2022, it is essential to compare the notable collision trends observed in both study periods. This comparison can provide insights into the evolving traffic safety landscape and inform strategies for targeted interventions.

- A 33% increase in the number of F+SI collisions was observed during 2018-2022 period comparing to 2016-2020.
- While the overall trend of type of collisions remained similar comparing with previous LRSP trends, hit object injury collisions decreased by 11%, and the share of broadside injury collisions increased by 8%.
- DUI violations increased by 5% during 2018-2022.

- Motor vehicle collisions with fixed objects decreased by 12% during 2018-2022.
- Motorcycle or scooter collisions increased from 3% to 8%, representing a 5% increase.
- F+SI collisions occurring in dark lighting conditions with no street lights increased from 29% to 41%, a difference of 12%.
- The peak time for F+SI collisions shifted from 12 pm to 3 pm (in the previous LRSP) to 6 pm to 9 pm.

NEXT STEPS

The next steps include identifying strategies corresponding to the 5 E's of safety (Engineering, Enforcement, Education, Equity and EMS) to comprehensively make the roadways of unincorporated Solano County safer for all modes of transportation.

CHAPTER 4 EMPHASIS AREAS

Emphasis areas are focus areas for the LRSP that are identified through the comprehensive collision analysis of the identified High Injury Network in Solano County. Emphasis areas help in identifying appropriate safety strategies and countermeasures with the greatest potential to reduce collisions occurring at high injury locations. They can include (but not be limited to): specific collision types, human behaviors, facility types, and specific intersections or corridors.

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

The 5 E's of Traffic Safety

The LRSP utilizes a comprehensive approach to safety incorporating the "5 E's of traffic safety": **E**ngineering, **E**nforcement, **E**ducation, **E**quity and **E**MS. This approach recognizes that not all locations can be addressed solely by engineering infrastructure improvements. Incorporating the 5 E's of traffic safety is often required to ensure successful implementation of significant safety improvements and reduce the severity and frequency of collisions throughout a jurisdiction.

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

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

Existing Traffic Safety Efforts in Solano County

The County of Solano and partner agencies have implemented safety strategies corresponding to the 5 E's of traffic safety. The strategies detailed in this section can supplement these existing programs and concentrate ongoing effort on the High Injury Network and crash types. These initiatives are summarized in the following table:

TABLE 6: EXISTING TRAFFIC SAFETY EFFORTS IN SOLANO COUNTY

DOCUMENT/PROGRAM	DESCRIPTION	E'S ADDRESSED
2018 Solano Travel Safety Plan (2018)	This plan identifies the collision trends, such as crash types or violation types which were used to identify specific countermeasures and project lists for each jurisdiction in Solano County, including the unincorporated areas.	Engineering
Regional Traffic Impact Fee (RTIF)	Solano County assesses a Public Facility Fee that is utilized towards roadway and transit improvements throughout the county. 5% of the revenue is utilized for unincorporated County roads, with additional revenue coming from the revenue divided amongst the five RTIF districts. The fee averages $1.4 million in revenue per year countywide (as of FY 2019-20).	Engineering
Highway Safety Improvement Program (HSIP) Projects	The County has been highly successful in obtaining HSIP funding for safety projects on unincorporated County roads. These include guard rail upgrades, shoulder widening, striping, and pedestrian upgrades. The County has been awarded funding most recently in Cycles 5, 6, 8, and 10.	Engineering
California Highway Patrol (CHP)	CHP Solano provides traffic enforcement on all unincorporated Solano County roads, in addition to state highways throughout the county.	Enforcement, EMS
CHP Start Smart Driver Safety Education	CHP Solano offers driver safety education classes, particularly for teens and their parents to teach safe driving habits and the rules of the road.	Education
Solano Active Transportation Plan – Unincorporated County Chapter (2020)	The chapter of Solano ATP includes a summary of the existing pedestrian and bicycle networks and recommends new engineering projects. The collision analysis section of this chapter summarizes the pedestrian and bicycle-involved collision trends and high-risk locations in Unincorporated Solano County.	Engineering
Solano Safe Routes to School Program	This program is established with the goal of increase the number of children walking and biking to school safely, reduce traffic congestion, and improve air quality around schools, increase daily physical activity levels and reduce obesity and other health risks, and improve academic performance among children.	Engineering Education
Safe Routes for Seniors	STA, utilizing a grant from the California Office of Traffic Safety, is implementing a program to promote pedestrian safety among older adults in Solano County. The goal is to engage the community, share information, and collaborate with city and county stakeholders to make local roadways safer.	Education, Engineering
Solano Mobility Program	The Solano Mobility Program provides mobility services and programs for commuters, employers, seniors, youth, and people with disabilities in Solano County. The variety of services and programs offer ways to get around the local community and beyond without driving.	Education
Mature Driver Improvement Courses	Solano Mobility offers DMV approved, mature driver courses designed for persons 55 years of age or older. The course focuses on an overview of current traffic laws, defensive driving techniques, and safe vehicle operations.	Education

Factors Considered in the Determination of Emphasis Areas

This section presents additional collision data analysis of collision type, collision factors, facility type, roadway geometries, and party level data, analyzed for the various emphasized areas. Emphasis areas were determined by factors that led to the highest amount of injury collisions, with a specific emphasis on F+SI collisions. For the purposes of determining the emphasis areas, only injury collisions on the High Injury Network are presented below. There were a total of 216 collisions occurred on high injury corridors and intersections. Doing so allows the project team to drill further down into the most predominant collision trends and specifically identify their causes at the high-risk locations. Three of the emphasis areas selected were also predominant collision trends in the unincorporated County from the 2018 Solano Travel Safety Plan: roadway departure collisions, DUI collisions, and improper turning collisions.

Each emphasis area is accompanied by comprehensive programs, policies and countermeasures to reduce collisions on County roads in that specific emphasis area. It will provide the basis by which the countermeasure toolbox is developed for each identified high-risk location. Additionally, the emphasis areas will be further refined from stakeholder and public input in subsequent stages of the study.

Solano County experienced 216 collisions on its High Injury Network, which consists of all identified high-risk intersections and roadway segments. All statistics presented below are based on these High Injury Network collisions. The identified emphasis areas are as follows:

- Emphasis Area 1 – Address Roadway Segment Collisions
- Emphasis Area 2 – Reduce Hit Object and Roadway Departure Collisions
- Emphasis Area 3 – Reduce Improper Turning Collisions
- Emphasis Area 4 – Address Driving Under the Influence Collisions
- Emphasis Area 5 – Reduce Broadside Collisions
- Emphasis Area 6 – Reduce Nighttime Collisions
- Emphasis Area 7 - Reduce Motorcycle Collisions
- Emphasis Area 8 - Address Younger Adult Party at Fault Collision

EMPHASIS AREA 1 – ADDRESS ROADWAY SEGMENT COLLISIONS

Of the 216 collisions that occurred on the High Injury Network, 125 (58%) of these collisions occurred on a roadway segment, including 36 F+SI collisions. The following collision data is based on only roadway segment injury collisions in the High Injury Network of the unincorporated Solano County, followed by E's strategies selected to address roadway segment collisions.

50% Hit Object	37% Nighttime	42% Improper Turning

TABLE 7: EMPHASIS AREA 1 STRATEGIES

OBJECTIVE: REDUCE THE NUMBER OF F+SI VERE INJURY COLLISIONS ON ROADWAY SEGMENTS			
	STRATEGY	**PERFORMANCE MEASURE**	**AGENCIES/ ORGANIZATIONS**
Education	Conduct public information and education campaign for roadway safety laws regarding speeding, stop signs, and turning left or right.	Number of education campaigns and/or surveys	County/CHP
Enforcement	Targeted enforcement along high-risk roadway segments to monitor traffic law violations right-of-way violations, speed limit laws and other violations that occur along roadway segments.	Number of tickets issued	CHP
Engineering	• R01NT, Add Segment Lighting • R02, Remove or relocate fixed objects outside of Clear Recovery Zone • R04, Install Guardrail • R15, Widen shoulder • R21, Improve pavement friction (High Friction Surface Treatments) • R22, Install/Upgrade signs with new fluorescent sheeting (regulatory or warning) • R23, Install chevron signs on horizontal curves • R24 or R25, Install curve advance warning signs • R27, Install delineators, reflectors and/or object markers • R28, Install edge-lines and centerlines • R31, Install edge-line rumble strips/stripes	Number of roadways improved	County
EMS	SI04EV, Install emergency vehicle pre-emption systems. Improve resource deployment and clear routes for emergency responses to collision sites.	EMS vehicle response time	Fire districts and EMS response teams

EMPHASIS AREA 2 – REDUCE HIT OBJECT AND ROADWAY DEPARTURE COLLISIONS

Thirty Nine (39%) of the High Injury Network collisions were hit object collisions, including 25 F+SI collisions. Roadway departure collisions are combined due to the strong correlation between roadway departures and hit object collisions. Roadway departure collisions were also identified as a prominent collision trend in the 2018 Solano Travel Safety Plan. The following collision data is based on only hit object injury collisions on the High Injury Network of unincorporated Solano County, followed by E's strategies.

58% Improper Turning	32% DUI Collisions	52% Nighttime Collisions

TABLE 8: EMPHASIS AREA 2 STRATEGIES

OBJECTIVE: REDUCE THE NUMBER OF F+SI HIT OBJECT AND ROADWAY DEPARTURE COLLISIONS			
	STRATEGY	**PERFORMANCE MEASURE**	**AGENCIES/ ORGANIZATIONS**
Education	Conduct safety campaigns and outreach to raise awareness of safety needs against roadway departure crashes, such as unsafe speeds, distracted driving, improper turning, and driving under the influence. Continue to utilize existing CHP education campaigns/classes, such as Start Smart.	Number of education campaigns	County/CHP
Enforcement	Targeted enforcement at high-risk rural roadways where hit object/roadway departure collisions are more common.	Number of tickets issued	CHP
Engineering	• NS08, Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs • R01NT, Add Segment Lighting • R02, Remove or relocate fixed objects outside of Clear Recovery Zone • R04, Install Guardrail • R06 or R07, Flatten side slopes • R22, Install/Upgrade signs with new fluorescent sheeting (regulatory or warning) • R23, Install chevron signs on horizontal curves • R24 or R25, Install curve advance warning signs • R26, Install dynamic/variable speed warning signs • R27, Install delineators, reflectors and/or object markers • R28, Install edge-lines and centerlines • R31, Install edge-line rumble strips/stripes	Number of locations improved	County
EMS	SI04EV, Install emergency vehicle pre-emption systems. Improve resource deployment and clear routes for emergency responses to collision sites.	EMS vehicle response time	Fire districts and EMS response teams

EMPHASIS AREA 3 – REDUCE IMPROPER TURNING COLLISIONS

Thirty four (34%) of the collisions on the High Injury Network were improper turning collisions, including 20 F+SI collision. Improper turning collisions accounted for 25% of the total EPDO score in unincorporated Solano County from the 2018 Solano Travel Safety Plan. The following collision data is based on only improper turning caused injury collisions on the High Injury Network of unincorporated Solano County, followed by E's strategies selected to address improper turning collisions.

67% Hit Object Collisions	33% Nighttime	18% Overturned Collisions

TABLE 9: EMPHASIS AREA 3 STRATEGIES

OBJECTIVE: REDUCE THE NUMBER OF F+SI COLLISIONS ON ROADWAY SEGMENTS AND INTERSECTIONS THAT ARE A RESULT OF IMPROPER TURNING			
	STRATEGY	**PERFORMANCE MEASURE**	**AGENCIES/ ORGANIZATIONS**
Education	Conduct safety campaigns and outreach to raise their awareness of safety needs against improper turning crashes, such as safe driving habits classes offered by CHP or Solano Mobility (a program of the STA).	Number of education campaigns	County/CHP
Enforcement	Targeted enforcement at high-risk intersections and roadway segments to monitor improper turning violations.	Number of tickets issued	CHP
Engineering	• SI08, Install raised pavement markers and striping (Through Intersection) • SI16RA/NS04RA/NS05RA, Convert intersection to roundabout • NS08, Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs • NS09, Upgrade intersection pavement markings (NS.I.) • NS13, Improve sight distance to intersection (Clear Sight Triangles) • NS16, Install raised median on approaches (NS.I.) • R02, Remove or relocate fixed objects outside of Clear Recovery Zone • R22, Install/Upgrade signs with new fluorescent sheeting (regulatory or warning) • R23, Install chevron signs on horizontal curves • R24 or R25, Install curve advance warning signs • R27, Install delineators, reflectors and/or object markers • R28, Install edge-lines and centerlines • R31, Install edge-line rumble strips/stripes	Number of intersections and roadway segments improved	County
EMS	SI04EV, Install emergency vehicle pre-emption systems. Improve resource deployment and clear routes for emergency responses to collision sites.	EMS vehicle response time	Fire districts and EMS response teams

EMPHASIS AREA 4 – ADDRESS DUI COLLISIONS

Eighteen (18%) collisions on the High Injury Network were due to driving under the influence of alcohol or drugs, including 19 F+SI collision. DUI collisions accounted for 25% of the unincorporated County's EPDO score in the 2018 Solano Travel Safety Plan. The following collision data is based on only DUI injury collisions on the High Injury Network of unincorporated Solano County, followed by E's strategies selected to address DUI collisions.

71% Hit Object Collisions	71% collision victims has age range 20-39	71% Nighttime Collisions

TABLE 10: EMPHASIS AREA 4 STRATEGIES

OBJECTIVE: REDUCE THE NUMBER OF F+SI COLLISIONS THAT OCCUR DUE TO DRIVING UNDER THE INFLUENCE			
	STRATEGY	**PERFORMANCE MEASURE**	**AGENCIES/ ORGANIZATIONS**
Education	Conduct safety campaigns and outreach for safety laws regarding driving under the influence, such as existing CHP campaigns to address drunk driving.	Number of education campaigns	County/CHP
Enforcement	Targeted enforcement at high-risk intersections and roadway locations to monitor violations of driving under influence. Establish DUI check points near high-risk locations as appropriate.	Number of tickets issued	CHP
Engineering	• SI02, Improve signal hardware: lenses, back-plates with retroreflective borders, mounting, size, and number • SI08, Install raised pavement markers and striping (Through Intersection) • NS08, Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs • NS09, Upgrade intersection pavement markings (NS.I.) • NS11, Install flashing beacons as advance warning (NS.I.) • R01NT, Add Segment Lighting • R02, Remove or relocate fixed objects outside of Clear Recovery Zone • R04, Install Guardrail • R15, Widen shoulder • R22, Install/Upgrade signs with new fluorescent sheeting (regulatory or warning) • R27, Install delineators, reflectors and/or object markers	Number of locations improved	County
EMS	SI04EV, Install emergency vehicle pre-emption systems. Improve resource deployment and clear routes for emergency responses to collision sites.	EMS vehicle response time	Fire districts and EMS response teams

EMPHASIS AREA 5 – REDUCE BROADSIDE COLLISIONS

Twenty three (23%) of the collisions on the High Injury Network resulted in broadside collision, including 12 F+SI collisions. The following collision data is based on only broadside injury collisions on the High Injury Network of unincorporated Solano County, followed by E's strategies selected to address overturned collisions.

76% At intersection	49% Auto ROW Violations	24% F+SI Collisions

TABLE 11: EMPHASIS AREA 5 STRATEGIES

OBJECTIVE: REDUCE THE NUMBER OF F+SI COLLISIONS THAT OCCUR DUE TO BROADSIDE COLLISIONS			
	STRATEGY	**PERFORMANCE MEASURE**	**AGENCIES/ ORGANIZATIONS**
Educatio	Conduct public information and education campaigns for intersection safety laws regarding traffic lights, stop signs and turning left or right.	Number of education campaigns	County/CHP
Enforcement	Targeted enforcement at high-injury locations where violations that lead to broadside collisions are more common, such as automobile right of way and traffic signal/stop sign violations.	Number of tickets issued	CHP
Engineering	• SI02, Improve signal hardware: lenses, back-plates with retroreflective borders, mounting, size, and number • SI03, Improve signal timing (coordination, phases, red, yellow, or operation) • SI05, Install left-turn lane and add turn phase (signal has no left-turn lane or phase before) • SI06, Provide protected left turn phase (left turn lane already exists) • SI07, Convert signal to mast arm (from pedestal-mounted) • SI08, Install raised pavement markers and striping (Through Intersection) • SI15RA/NS04RA/NS05RA, Convert intersection to roundabout • NS02, Convert to all-way STOP control (from 2-way or Yield control) • NS03, Install signals • NS08, Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs • NS09, Upgrade intersection pavement markings (NS.I.) • NS10, Install flashing beacons at stop controlled intersections • NS11, Install flashing beacons as advance warning (NS.I.) • NS13, Improve sight distance to intersection (Clear Sight Triangles) • NS15, add splitter-islands on the minor road approaches • SI11/NS16, install raised median on approaches	Number of locations improved	County
EMS	SI04EV, Install emergency vehicle pre-emption systems. Improve resource deployment and clear routes for emergency responses to collision sites.	EMS vehicle response time	Fire districts and EMS response teams

EMPHASIS AREA 6 – REDUCE NIGHTTIME COLLISIONS

Thirty Five (35%) of the collisions on the High Injury Network occurred at night, including 27 F+SI collision. The following collision data is based on only nighttime injury collisions on the High Injury Network of unincorporated Solano County, followed by E's strategies selected to address nighttime collisions.

36% Collisions due to DUI	32% Improper Turning	58% Hit Object Collisions

TABLE 12: EMPHASIS AREA 6 STRATEGIES

OBJECTIVE: REDUCE THE NUMBER OF F+SI COLLISIONS THAT OCCUR DURING NIGHTTIME			
	STRATEGY	**PERFORMANCE MEASURE**	**AGENCIES/ ORGANIZATIONS**
Education	Develop awareness program to inform motorists of safe nighttime driving habits, as well as high-risk collision locations and the most common violations/collision types occurring at night. Utilize existing CHP campaigns warning of the dangers of drunk driving.	Number of education campaigns	County/CHP
Enforcement	Targeted enforcement at high-risk intersections and roadway locations where nighttime collisions are more common. Establish DUI check points at night where appropriate.	Number of tickets issued	CHP
Engineering	• SI01NT or NS01NT, Install intersection lighting • SI02, Improve signal hardware • NS08, Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs • NS09, Upgrade intersection pavement markings (NS.I.) • NS10, Install Flashing Beacons at Stop-Controlled Intersections • NS11, Install flashing beacons as advance warning (NS.I.) • R01NT, Add Segment Lighting • R02, Remove or relocate fixed objects outside of Clear Recovery Zone • R22, Install/Upgrade signs with new fluorescent sheeting (regulatory or warning) • R27, Install delineators, reflectors and/or object markers • R28, Install edge-lines and centerlines • R31, Install edge-line rumble strips/stripes	Number of locations improved	County
EMS	SI04EV, Install emergency vehicle pre-emption systems. Improve resource deployment and clear routes for emergency responses to collision sites.	EMS vehicle response time	Fire districts and EMS response teams

EMPHASIS AREA 7 – REDUCE MOTORCYCLE COLLISIONS

Twelve (12%) of the collisions on the High Injury Network were motorcycle collisions, including 15 F+SI collisions. Of these motorcycle collisions, six were collisions due to improper passing, seven were overturned, and six factored into non-collision. The following collision data is based on only motorcycle injury collisions on the High Injury Network of unincorporated Solano County, followed by 5 E's strategies selected to address motorcycle collisions.

42% Improper Turning **50% Overturned** **58% F+SI Collisions**

TABLE 13: EMPHASIS AREA 7 STRATEGIES

OBJECTIVE: REDUCE THE NUMBER OF F+SI MOTORCYCLE COLLISIONS			
	STRATEGY	**PERFORMANCE MEASURE**	**AGENCIES/ ORGANIZATIONS**
Education	Conduct public information and education campaign for safety laws regarding motorcycle collisions and motorcyclists' higher risk of F+SI collisions. Utilize existing CHP programs, such as the Motorcycle Safety Program, to encourage safe motorcycle riding habits.	Number of education campaigns	County/CHP
Enforcement	Targeted enforcement at high-risk locations to monitor motorcycle collisions.	Number of tickets issued	CHP
Engineering	• SI16RA/NS04RA/NS05RA, Convert intersection to roundabout • NS08, Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs • NS09, Upgrade intersection pavement markings (NS.I.) • R04, Install Guardrail • R15, Widen shoulder • R22, Install/Upgrade signs with new fluorescent sheeting (regulatory or warning) • R26, Install dynamic/variable speed warning signs • R27, Install delineators, reflectors and/or object markers • R28, Install edge-lines and centerlines • R29, Install no-passing line • R31, Install edge-line rumble strips/stripes	Number of locations improved	County
EMS	SI04EV, Install emergency vehicle pre-emption systems. Improve resource deployment and clear routes for emergency responses to collision sites.	EMS vehicle response time	Fire districts and EMS response teams

EMPHASIS AREA 8 – ADDRESS YOUNGER ADULT PARTY AT FAULT COLLISIONS

Of the 216 reported collisions on the High Injury Network of unincorporated Solano County, 37% were caused by a party at fault under the age of 30. The following is a review of the demographic data provided in the party at fault data of the collisions occurring on the High Injury Network, along with educational strategies to address younger adult party at fault collisions.

24% F+SI Collisions Party at Fault was Between the Ages of 18-30	79% F+SI Collisions Party at Fault was a Male

TABLE 14: EMPHASIS AREA 8 STRATEGIES

OBJECTIVE: REDUCE THE NUMBER OF F+SI COLLISIONS CAUSED BY YOUNG ADULTS			
	STRATEGY	**PERFORMANCE MEASURE**	**AGENCIES/ORGANIZATIONS**
Education	Target educational programs for young adults. Distribute brochures/fliers with basic red light running, speeding, distracted driving, improper turning, aggressive driving and stop sign violations information at driver training programs. Include statistics of young adult larger risks of fatalities. Involve school districts in such campaigns. Utilize existing CHP programs and classes, such as Start Smart.	Number of education campaigns	County/School Districts/CHP

Table 3. Countermeasures for Intersections

ID	Intersection	Control	Consolidated CMs (HSIP-Eligible - Refer to LRSM* 2024)						Notes/Additional CM (HSIP and non-HSIP)
			CM1	CM2	CM3	CM4	CM5	CM6	
I-1	Hay Road and Meridian Road	One way Stop controlled	NS10	NS14	NS01NT	NS09	NS12	NS08	Guard rail near canal ditches; channelizers if truck turning radius allows; widen shoulder
I-2	Abernathy Road and Mankas Corner Road	All way Stop controlled	NS10	NS12	NS11	NS14	NS13		Remove objects within clear zone; lighted STOP signs; channelizers; widen shoulders
I-3	Batavia Road and Midway Road	Two-way Stop controlled	NS01NT	NS14	NS13	NS05RA	NS15	NS09	Speed feedback signs; consider roundabout if existing CMs do not yield crash reductions
I-4	Browns Valley Road and Cantelow Road/ Tim	One way Stop controlled	NS08	NS13	NS11				
I-5	Robben Road and Vaughn Road	Two-way Stop controlled	NS08	NS11	NS16				Add new barriers to stop drivers from doing donuts at intersection
I-6	Benicia Road and Lemon Street/ Lincoln Road	Signal	SI08	SI10	SI03	SI02	SI09		Adjust west leg ped indication; Apply safe offset to driveway access; improve visibility; high-visibility crosswalks
I-7	Quail Canyon Road and Pleasants Valley Roa	One way Stop controlled	NS13	NS14	NS11	NS08	NS09	NS01NT	Flatten horizontal curve on Pleasants Valley; advance warning signs; widen inside shoulder on curve; object markers; STOP sign on Quail Canyon
I-8	Byrnes Road and Hawkins Road	Two-way Stop controlled	NS01NT	NS10*	NS11*	NS02**	NS15	NS08	Channelizers on CL; lighted STOP signs at Byrnes to supplement lighted warning from RTIF 2021; lighted warning signs on Hawkins; add'l lighting
I-9	Holdener Road and Lewis Road	Two-way Stop controlled	NS08	NS10	NS02**	NS12	NS11		Fix offset on Holdener; guard rail around canal; large object markers
I-10	Sievers Road and Currey Road	Two-way Stop controlled	NS08	NS11					
I-11	Railroad Avenue and Putah Creek Road	One way Stop controlled	NS08	NS11	NS13	NS15			
I-12	Rockville Road and Willotta Drive	One way Stop controlled	NS08	NS11	NS13				
I-13	Meridian Road and Allendale Road	One way Stop controlled	NS08	NS11	NS14	NS09			
I-14	Winters Road and Wolfskill Road	One way Stop controlled	NS10	NS09	NS12	NS15	NS01NT		Object markers; channelizers on centerline; widen shoulders at intersection; install bicycle facility; Share the Road sign

*Supplement existing CMs (eg. install on remaining approaches to intersection)
**All-Way stop warrant should be conducted

Recommended HSIP Countermeasures (Refer to LRSM for more details about each countermeasure)

NS01NT = Add intersection lighting
NS02 = Convert to all-way STOP control (from 2-way or Yield control)
NS05RA = Convert intersection to roundabout (from 2-way stop or Yield control)
NS08 = Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs
NS09 = Upgrade intersection pavement markings
NS10 = Install Flashing Beacons at Stop-Controlled Intersections
NS11 = Install flashing beacons as advance warning (NS.I.)
NS12 = Install transverse rumble strips on approaches
NS13 = Improve sight distance to intersection (Clear Sight Triangles)
NS14 = Improve pavement friction (High Friction Surface Treatments)
NS15 = Install splitter-islands on the minor road approaches
NS16 = Install raised median on approaches
NS19 = Install right-turn lane (NS.I.)
SI02 = Improve signal hardware: lenses, back-plates with retroreflective borders, mounting, size, and number
SI03 = Improve signal timing (coordination, phases, red, yellow, or operation)
SI08 = Install raised pavement markers and striping (through intersection)
SI09 =Install flashing beacons as advance warning (S.I.)
SI10 = Improve pavement friction (High Friction Surface Treatments)

Table 4. Countermeasures for Roadway Segments

ID	Roadway Segment	Consolidated CMs (HSIP-Eligible - Refer to LRSM* 2024)						Notes/Additional CM (HSIP and non-HSIP)
		CM1	CM2	CM3	CM4	CM5	CM6	
A	Pleasants Valley Road: Yolo County Line to Cherry Glen Road	R23	R26	R31	R15	R04	R30	Flatten horizontal curves; widen shoulder for clear recovery and bikes; curve advance warning; widen lanes to 12'
B	Suisun Valley Road: 650 ft. south of Rockville Road to Napa Cou	R30	R26	R23	R24	R15	R17	Flatten horizontal curves; widen shoulder for clear recovery and bikes; widen lanes to 12'
C	Mankas Corner Road: Fairfield City Limit to Clayton Road	R23	R26	R31	R04	R30		
D	Putah Creek Road: Pleasants Valley Road to Stevenson Bridge R	R21	R25	R26	R31	R27	R15	NH1 Speed Feedback Sign; Flashing curve warning and/or flashing chevrons at 90 degree curves (to supplement existing signs)
E	Rockville Road: Fairfield City Limit to Tartan way	R22	R26	R31	R30	R21	R27	NH1
F	Lopes Road: 5600 ft. north of Marshview Road to 1500 ft. south of Parish Road	R23	R26	R31	R15	R04	R30	
G	Sievers Road: Halley Road to Pedrick Road	R30	R31	R22	R27	R32		NH2
H	Meridian Road: Fry Road to Fairfield City Limit	R30	R31	R23	R23	R27	R01NT	Curve warning sign at McCrory Rd
I	Midway Road: Leeve Road to Timm Road	R30	R31	R22	R27	R32		
J	Pedrick Road: Yolo County Line to Maine Prairie Road	R31	R26	R27	R22	R02	R15	NH1 Speed Feedback Sign
K	Cordelia Road: I-80 to Park Lane	R04	R23	R26	R27	R30	R31	NH1 Speed Feedback Sign; Guard rail and chevrons at S-curve
L	Dixon Avenue: I-80 to Meridian Road	R25	R26	R30	R06	R27	R15	NH1; Chevrons and advance curve warning on S curve; speed feedback signs; shoulder widening applies to area W of Jahn Rd
M	Cantelow Road: Browns Valley Road to Steiger Hill Road	R01NT	R28	R23	R22	R27		R28: English Hill to Steiger Hill
N	Abernathy Road: Mankas Corner Road to Rockville Road	R01NT	R22	R27				
O	Peaceful Glen Road: Timm Road to Acacia Lane	R01NT	R22	R23	R25	R26		DUI enforcement

**Non-HSIP Eligible CMs	Code
Speed Feedback Signs	NH1
Pave Road	NH2

Recommended HSIP Countermeasures (Refer to LRSM for more details about each countermeasure)

R01NT = Add Segment Lighting
R02 = Remove or relocate fixed objects outside of Clear Recovery Zone
R04 = Install guardrail
R06 = Flatten side slopes
R15 = Widen shoulder
R16 = Curve shoulder widening (Outside Only)
R17 = Improve horizontal alignment (flatten curves)
R21 = Improve pavement friction (High Friction Surface Treatments)
R22 = Install/Upgrade signs with new fluorescent sheeting (regulatory or warning)
R23 = Install chevron signs on horizontal curves
R24 = Install curve advance warning signs
R25 = Install curve advance warning signs (flashing beacon)
R26 = Install dynamic/variable speed warning signs
R27 = Install delineators, reflectors and/or object markers
R28 = Install edge-lines and centerlines
R29 = Install no-passing line
R30 = Install centerline rumble strips/stripes
R31 = Install edgeline rumble strips/stripes
R32 = Speed Safety Cameras

Table 5. Non-Engineering Countermeasures

	Strategy	Performance Measure	Organizations to be involved
Education	Conduct public information and education campaign for intersection safety laws, unsafe speeds, distracted driving, improper turning and driving under the influence.	Number of education campaigns	County/ School District/CHP
	Conduct bicycle safety campaigns and outreach to raise their awareness of bicycle safety needs through media outlets, social media and Bike and Walk Mendocino. Create a pamphlet for bicycle safety	Number of education campaigns	County/ School District/CHP
Enforcement	Targeted enforcement at high-risk locations.	Number of tickets issued.	CHP
	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	CHP
Emergency Medical Services (EMS)	SI05, Install emergency vehicle pre-emption systems	EMS vehicle response time.	Fire Districts and EMS Response Teams
	Increase the number of EMS/fire control personnel taking Traffic Incident Management Training	number of EMS/fire control personnel taking Traffic Incident Management Training	Fire Districts and EMS Response Teams

SAFETY PROJECTS

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

Specific countermeasures and improvements were selected from the 2024 Caltrans LRSM, where:

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

The corresponding number refers to the countermeasure number in the LRSM (2024). The countermeasures were grouped into safety projects for high-risk intersections and roadway segments. A total of five safety projects were developed. All countermeasures were identified based on the technical teams' assessment of viability that consisted of extensive analysis, observations, County staff input, and stakeholder/community input. The most applicable and appropriate countermeasures are grouped together to form projects that can help make high-risk locations safer.

Table 1 lists the safety projects for high-risk intersections and roadway segments, along with up to three HSIP approved countermeasures per location. The safety projects were developed based on the previously completed collision analysis, which was used to identify main collision attributes that were found to be leading factors of fatal and severe collisions in unincorporated Solano County. These collision factors are shown below, as well as viable safety projects that can help address these factors.

Hit Object Collisions: This type of collision represented the highest proportion of F+SI collisions (39%), and collisions of all severity (36%). To address these collisions, viable safety projects include edge line rumble strips/stripes, widen shoulders, installing delineators, reflectors, and object markers, installing curve warning signs, installing chevron signs at horizontal curves, and installing/upgrading signs with new fluorescent sheeting.

Improper Turning Collisions: This violation category caused 28% of all F+SI collisions and was the most common violation type among collisions of all severity (30%). Viable safety projects to help address these include installing edge line rumble strips/stripes, widening shoulders, installing guard rail, improving pavement friction, improving sight distance, installing/upgrading signs with new fluorescent sheeting, installing flashing curve warning signs, and installing chevrons at horizontal curves.

Broadside Collisions: 14% of all F+SI collisions were broadside collisions, compare to its share of collisions of all severity (24%). Viable safety projects to help address these collisions include adding turn lanes, improving sight distances, installing/upgrading signs with new fluorescent sheeting, adding reflective pavement markers, improve signal timing, install raised median on approaches.

Nighttime Collisions: 37% of all severity collisions and 51% of all F+SI collisions occurred at night or during dusk or dawn. The majority of these nighttime collisions occurred in areas without street lights, given the rural nature of unincorporated Solano County. Viable safety projects to help address these collisions include transverse rumble strips, upgrading intersection pavement markings, installing flashing beacons at stop controlled intersections, installing/upgrading larger or additional stop signs or other intersection regulatory/warning signs, installing flashing beacons as advance warning, installing intersection lighting or upgrade lighting with higher lumens, installing edge line and centerline rumble strips/stripes, installing flashing curve advance warning signs, installing chevron signs on horizontal curves, installing/upgrading signs with new fluorescent sheeting, and installing delineators, reflectors, and object markers.

DUI Collisions: 38% of F+SI collisions occurred as a result of DUI compared to only 20% of collisions of all severity. In addition to educational measures recommended in the emphasis areas section, viable safety projects have been recommended to increase visibility and alert drivers of upcoming intersections or hazards. These are the same as what is listed for nighttime collision recommendations above.

Table 1 lists identified projects for the unincorporated areas of Solano County and the title of each countermeasure is located in **Table 2**.

TABLE 1: LIST OF VIABLE SAFETY PROJECTS

Sr. No	Locations	CM1	CM2	CM3
Project 1 Unsignalized Intersection Safety				
I-2	Abernathy Road and Mankas Corner Road		NS10	NS11
I-4	Browns Valley Road and Cantelow Road/ Timm Road	NS08		NS11
I-9	Holdener Road and Lewis Road	NS08	NS10	NS11
I-10	Sievers Road and Currey Road	NS08		NS11
I-11	Railroad Avenue and Putah Creek Road	NS08		NS11
I-12	Rockville Road and Willotta Drive	NS08		NS11
I-13	Meridian Road and Allendale Road	NS08		NS11
I-14	Winters Road and Wolfskill Road		NS10	
I-15	Hartley Road and Robinson Road	NS08	NS10	
Project 2 Unsignalized Intersection Safety				
I-2	Abernathy Road and Mankas Corner Road		NS12	NS13
I-4	Browns Valley Road and Cantelow Road/ Timm Road			NS13
I-9	Holdener Road and Lewis Road		NS12	
I-11	Railroad Avenue and Putah Creek Road			NS13
I-12	Rockville Road and Willotta Drive			NS13
I-13	Meridian Road and Allendale Road	NS09		
I-14	Winters Road and Wolfskill Road	NS09	NS12	
I-15	Hartley Road and Robinson Road	NS09	NS12	
Project 3 Safety on Roadway Segments				
D1	Putah Creek Road: Stevenson Bridge Road to Race Course Ln			R27
D2	Putah Creek Road: Holmes Rd to Pleasants Valley Road			R27
E	Rockville Road: Chadbourne Rd to Tarton Way		R22	R27
G	Sievers Road: Halley Road to Pedrick Road		R22	R27
H	Meridian Road: Fry Road to Fairfield City Limit			R27
I	Midway Road: Leeve Road to Timm Road		R22	R27
J1	Pedrick Road: Yolo County Line to Sievers Rd	R02	R22	R27
J2	Pedrick Road: Dixon Ave to Maine Prairie Road	R02	R22	R27
M	Cantelow Road: Browns Valley Road to Steiger Hill Road		R22	R27
N	Abernathy Road: Mankas Corner Road to Rockville Road		R22	R27
O	Peaceful Glen Road: Timm Road to Acacia Lane		R22	
Q	Tremont Road: Sparling Lane to Yolo County Line	R02	R22	
S	Pitt School Road: Hawkins Road to Midway Road	R02	R22	
Project 4 Safety on Roadway Segments				

Sr. No	Locations	CM1	CM2	CM3
A	Pleasants Valley Road: Cantelow Rd to Cherry Glen Rd	R04	R23	R26
B	Suisun Valley Road: Twin Sisters Rd to Rockville Rd		R23	R26
C	Mankas Corner Road: Fairfield City Limit to Clayton Road	R04	R23	R26
D1	Putah Creek Road: Stevenson Bridge Road to Race Course Ln			R26
D2	Putah Creek Road: Holmes Rd to Pleasants Valley Road			R26
E	Rockville Road: Chadbourne Rd to Tarton Way			R26
F	Lopes Road: 5600 ft. north of Marshview Road to 1500 ft. south of Parish Road	R04	R23	R26
H	Meridian Road: Fry Road to Fairfield City Limit		R23	R26
J1	Pedrick Road: Yolo County Line to Sievers Rd			R26
J2	Pedrick Road: Dixon Ave to Maine Prairie Road			R26
M	Cantelow Road: Browns Valley Road to Steiger Hill Road		R23	
O	Peaceful Glen Road: Timm Road to Acacia Lane		R23	R26
Project 5 Safety on Roadway Segments				
A	Pleasants Valley Road: Cantelow Rd to Cherry Glen Rd	R30	R31	
B	Suisun Valley Road: Twin Sisters Rd to Rockville Rd	R30		
C	Mankas Corner Road: Fairfield City Limit to Clayton Road	R30	R31	
D1	Putah Creek Road: Stevenson Bridge Road to Race Course Ln		R31	
D2	Putah Creek Road: Holmes Rd to Pleasants Valley Road		R31	
E	Rockville Road: Chadbourne Rd to Tarton Way	R30	R31	
F	Lopes Road: 5600 ft. north of Marshview Road to 1500 ft. south of Parish Road	R30	R31	
G	Sievers Road: Halley Road to Pedrick Road	R30	R31	
H	Meridian Road: Fry Road to Fairfield City Limit	R30	R31	R01NT
I	Midway Road: Leeve Road to Timm Road	R30	R31	
J1	Pedrick Road: Yolo County Line to Sievers Rd		R31	
J2	Pedrick Road: Dixon Ave to Maine Prairie Road		R31	
M	Cantelow Road: Browns Valley Road to Steiger Hill Road			R01NT
N	Abernathy Road: Mankas Corner Road to Rockville Road			R01NT
O	Peaceful Glen Road: Timm Road to Acacia Lane			R01NT
Q	Tremont Road: Sparling Lane to Yolo County Line		R31	R01NT
S	Pitt School Road: Hawkins Road to Midway Road		R31	R01NT

Notes: CM – countermeasure.

TABLE 2: LIST OF COUNTERMEASURES

COUNTERMEASURE NAME
NS08 = Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs
NS09 = Upgrade intersection pavement markings
NS10 = Install Flashing Beacons at Stop-Controlled Intersections
NS11 = Install flashing beacons as advance warning (NS.I.)
NS12 = Install transverse rumble strips on approaches
NS13 = Improve sight distance to intersection (Clear Sight Triangles)
R01NT = Add Segment Lighting
R02 = Remove or relocate fixed objects outside of Clear Recovery Zone
R04 = Install guardrail
R22 = Install/Upgrade signs with new fluorescent sheeting (regulatory or warning)
R23 = Install chevron signs on horizontal curves
R26 = Install dynamic/variable speed warning signs
R27 = Install delineators, reflectors and/or object markers
R30 = Install centerline rumble strips/stripes
R31 = Install edgeline rumble strips/stripes