TECHNICAL MEMORANDUM

Date: April 11, 2022
To: Salim Clarence, County of Santa Clara
From: Ruta Jariwala, Himangi Mutha, TJKM
Subject: Systemic Safety and Trend Analysis, and Identification of High Injury Network for the County of Santa Clara Local Roadway Safety Plan (LRSP)

This technical memorandum summarizes the results of the collision analysis of collisions that have occurred in the County of Santa Clara between January 1, 2016 and December 31, 2020, as part of the Local Roadway Safety Plan (LRSP). This memorandum includes the following sections:

1. Data Collection
2. Collision Data Analysis
3. Fatal and Severe Injury Collision Analysis
4. Geographic Collision Analysis
5. High Injury Network
6. Summary

The LRSP focuses on systemically identifying and analyzing traffic safety issues and recommends appropriate safety improvements. The memorandum starts with a comprehensive analysis of collisions of all severity types in the County of Santa Clara and compares this with the killed and severe Injury (KSI) collisions. Factors such as collision severity, type of collision, primary collision factor, lighting, weather, and time were analyzed. Following this, a more detailed analysis was conducted for killed and severe injury (KSI) collisions that have occurred on the county's roadways, including analyzing intersection and roadway segment collisions separately. **Figure 1** illustrates all the injury collisions that have occurred in the County of Santa Clara from 1/1/2016 to 12/31/2020.

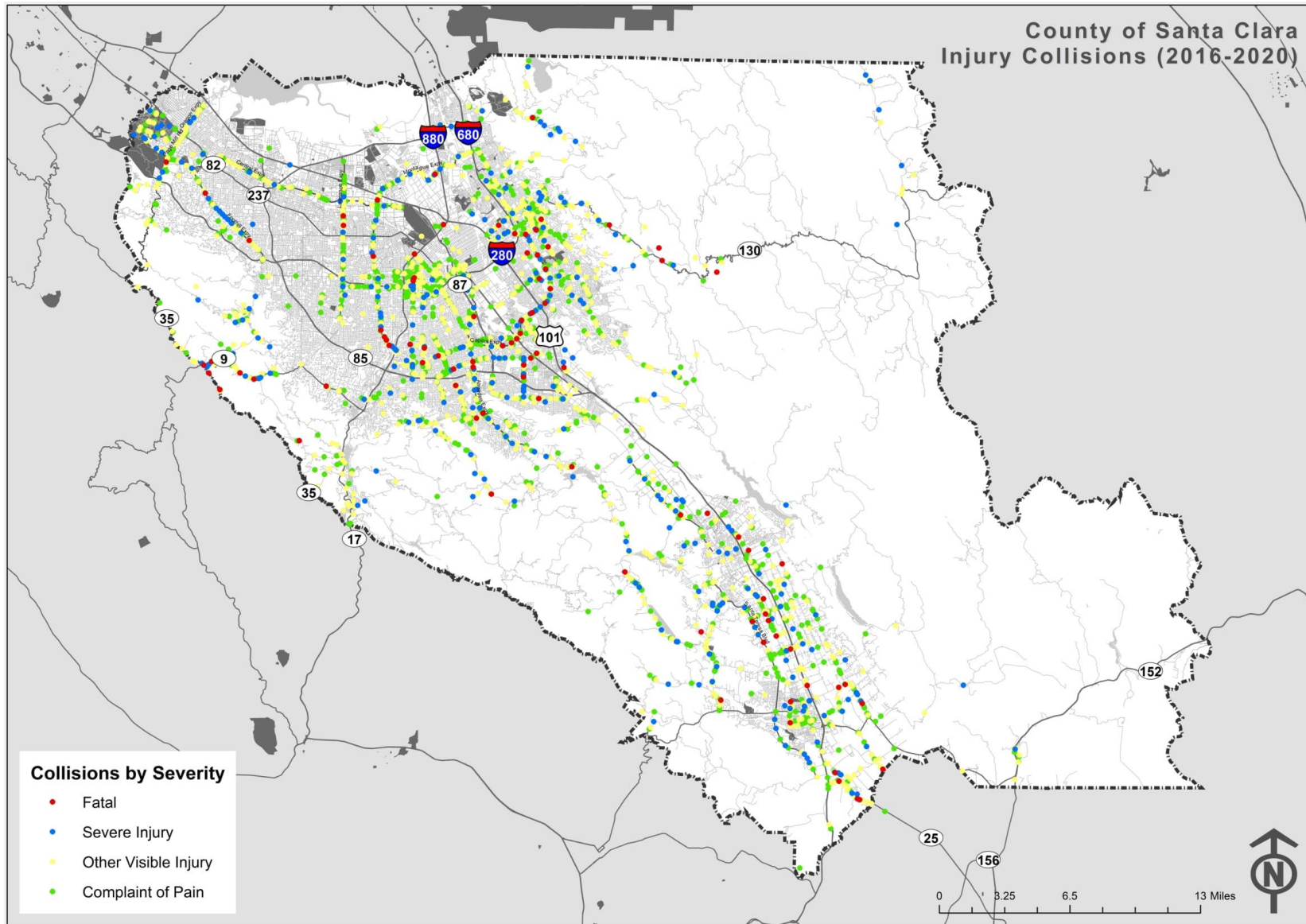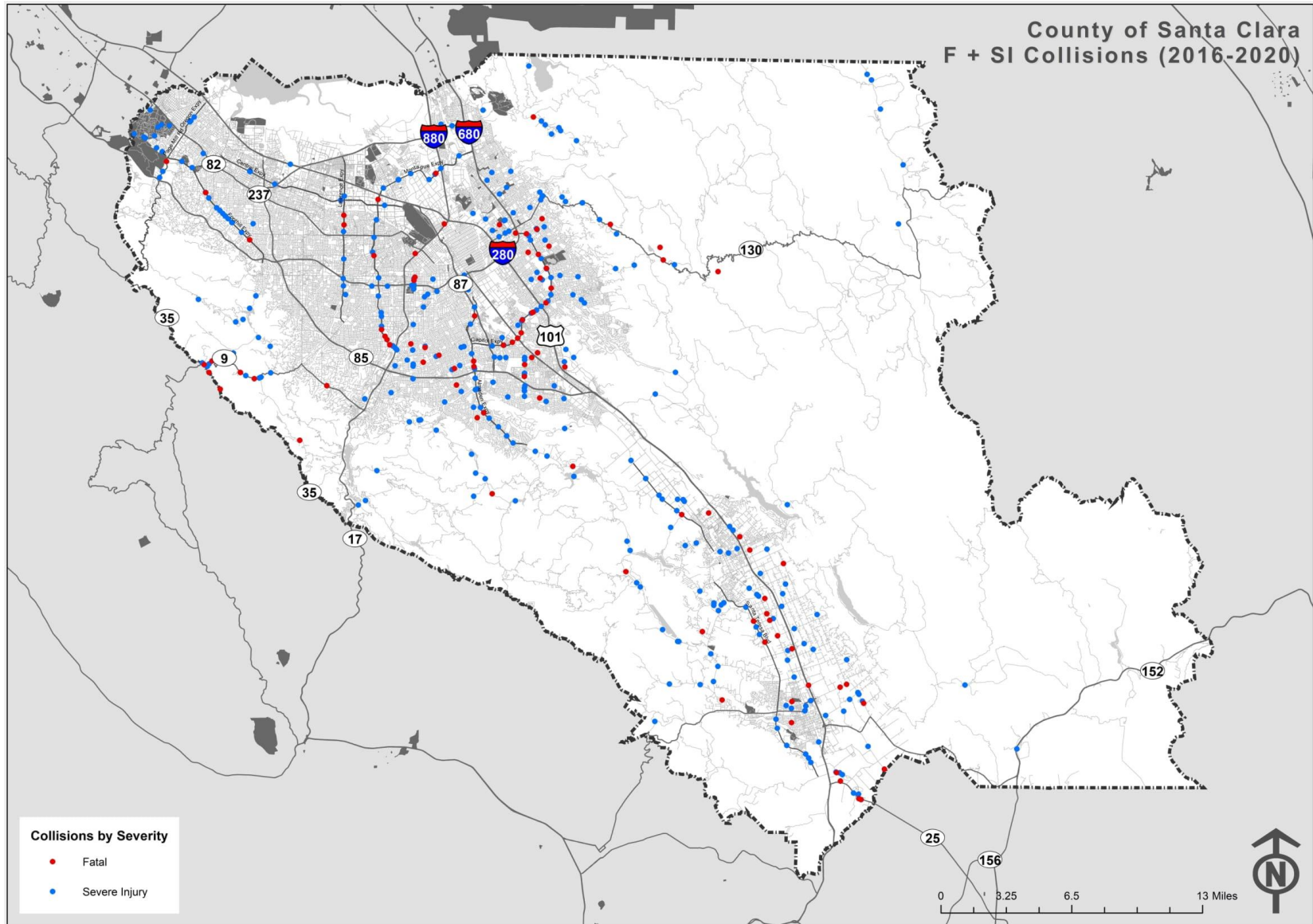# Figure 1. Injury Collisions in the County of Santa Clara (2016-2020)

County of Santa Clara
Injury Collisions (2016-2020)

Collisions by Severity
- Fatal
- Severe Injury
- Other Visible Injury
- Complaint of Pain

Figure 2. Killed and Severe Injury Collisions in the County of Santa Clara (2016-2020)

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DATA COLLECTION

Collision data helps 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 (2016 to 2020) was retrieved from CROSSROADS. This report also has two separate sets of collision data analysis *(for other county roads i.e non-expressways and expressways)* to identify discrete collision trends. The collision data was analyzed and plotted in ArcMap to identify high-risk intersections and roadways segments.

COLLISION DATA ANALYSIS RESULTS

Injury Collision Analysis by Severity

A total number of collisions reported in five years (2016-2020) were 8,652. Amongst all collisions reported on the County of Santa Clara roads, 4,920 were injury collisions and 3,732 collisions were PDO (Property Damaged Only).

Out of a total of 4,920 injury collisions, 2,944 collisions occurred on county roads and 1,976 injury collision occurred on expressways.

Out of 4,920 injury collisions, 2,927 collisions (59%) led to complaint of pain injury and 1,538 collisions (31%) led to a visible injury. There were 455 KSI (killed

Figure 3. Injury Collisions by Severity (2016 -2020)

and severe injury) collisions, of which 355 collisions (7%) led to a severe injury and 100 collisions (2%) led to a fatality. **Figure 3** illustrates the classification of all collisions based on severity.
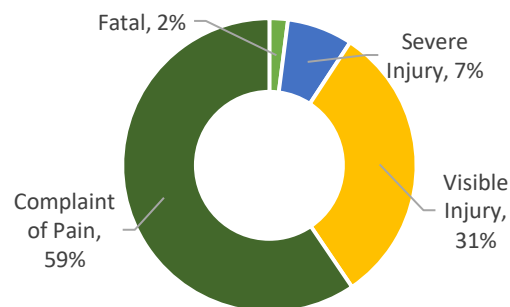
The analysis first includes a comparative evaluation between all collisions and KSI collisions, based on various factors including (but not limited to): collision trend, primary collision factor, collision type, facility type, motor vehicle involved with, weather, lighting, and time of the day. Following this, a comprehensive analysis is conducted for only KSI collisions. KSI collisions cause the most damage to those affected and to infrastructure. The aftermath of these collisions can lead to great expenses for jurisdiction administration. The LRSP process thus focuses on these collision locations to proactively identify and counter safety issues leading to these KSI collisions.

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 1**.

Table 1. Injury Collisions by Severity and Facility Type in County of Santa Clara (2016-2020)

Collision Severity	Roadway Segment	Intersection	Total
Fatal	38	62	100
Severe Injury	131	224	355
Visible Injury	403	1,135	1,538
Complaint of Pain	522	2,405	2,927
Total	**1,094**	**3,826**	**4,920**

Expressways vs. Other County Roads

When evaluating the locations of injury collisions, most collisions occurred on the other county roads i.e on non- expressways. In the County of Santa Clara, 60% of all injury collisions (2,944 collisions) occurred on the other county roads and 40% (1,976 collisions) occurred on expressways. A slightly stronger trend towards collisions occurred on other county roads is seen when looking only at KSI collisions. This classification by facility type can be observed in the analysis below.
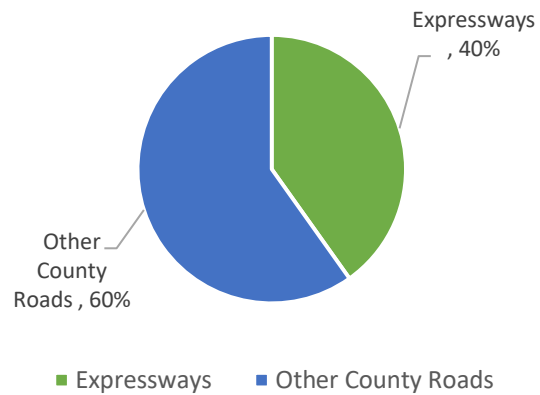

Figure 4.Expressways vs Other County roads Collisions - All Injury Collisions

INJURY COLISION ANALYSIS - OTHER COUNTY ROADS I.E NON-EXPRESSWAYS

A total number of injury collisions reported in five years (2016-2020) were 2,944. Out of 2,944 injury collisions, 1,606 collisions (55%) led to complaint of pain injury and 1,017 collisions (35%) led to a visible injury. There were 319 KSI (killed and severe injury) collisions, of which 255 collisions (9%) led to a severe injury and 64 collisions (2%) led to a fatality. **Figure 5** illustrates the classification of all collisions based on severity.
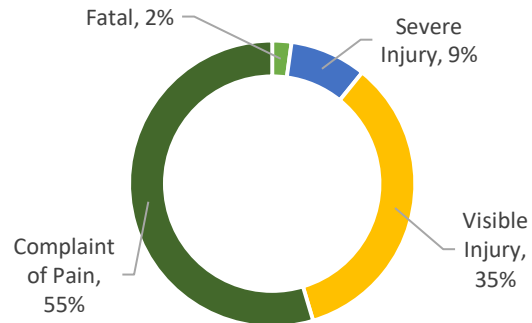

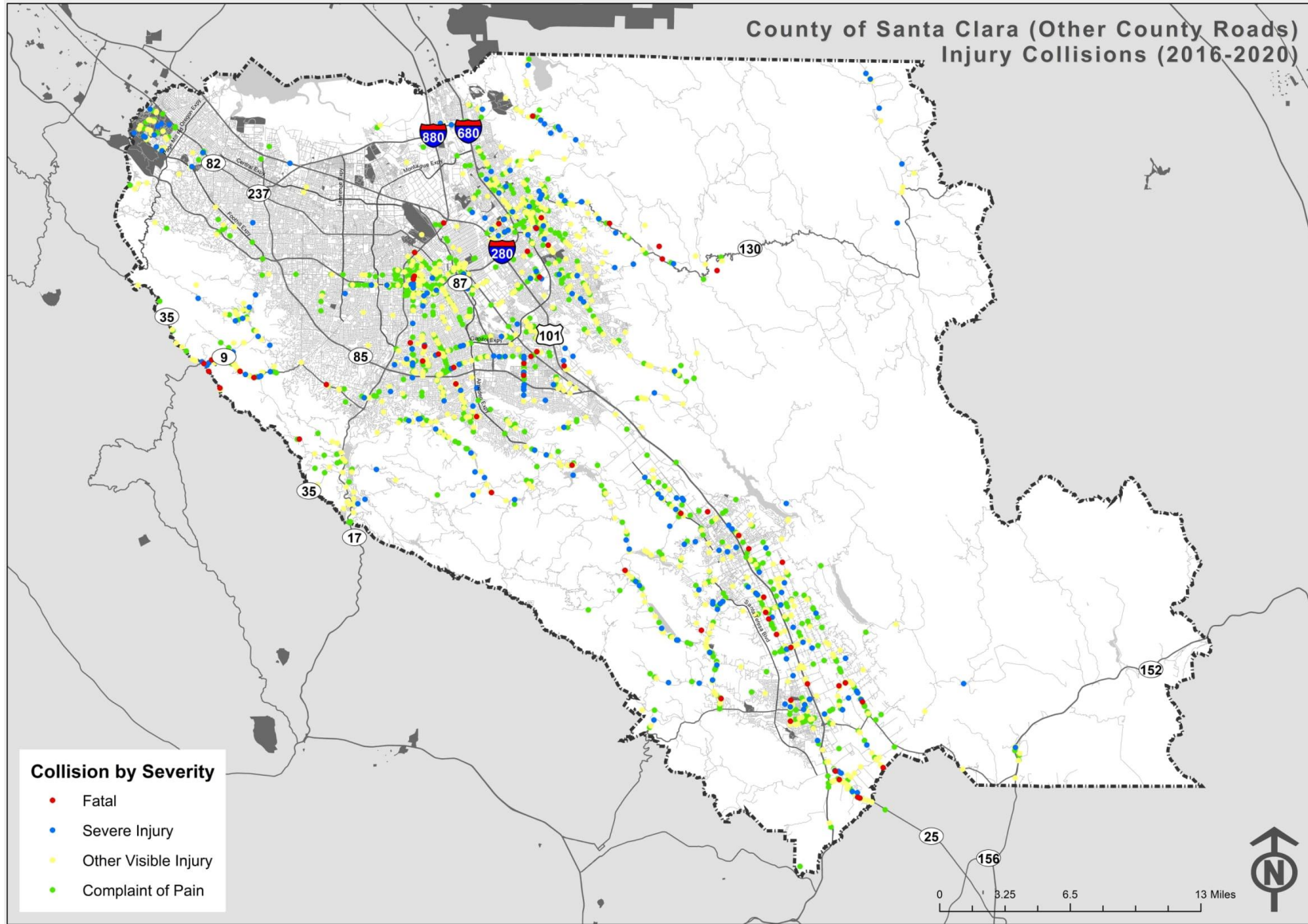**Figure 5. Injury Collisions by Severity (2016 -2020)**

Table 2. Injury Collision by Severity and Facility Type (Other County Roads) (2016-2020)

Collision Severity	Roadway Segment	Intersection	Total
Fatal	32	32	64
Severe Injury	108	147	255
Visible Injury	309	708	1,017
Complaint of Pain	316	1,292	1,608
Total	**765**	**2,179**	**2,944**

Figure 6. Injury Collisions in the County of Santa Clara (Other County Roads) (2016-2020)

County of Santa Clara (Other County Roads)
Injury Collisions (2016-2020)

Collision by Severity
- Fatal
- Severe Injury
- Other Visible Injury
- Complaint of Pain

0   3.25   6.5   13 Miles

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PRELIMINARY ANALYSIS

Yearly Trend

The number of reported collisions of all severity overall increased between 2016 and 2019, whereas the collisions decreased from 2019 to 2020 (the impact of the COVID-19 pandemic on the crash severity has increased from 2018-2020). The year with the highest number of collisions was 2019 (643 collisions), while the year with the lowest number of collisions was 2017 (616 collisions). A total of 319 KSI collisions occurred in the County of Santa Clara during the study period, overall consistent from 2016 to 2020. The least number of KSI collisions occurred in 2016 (52 collisions), while the most occurred in 2019 (80 collisions) and 2020 (71 collisions).
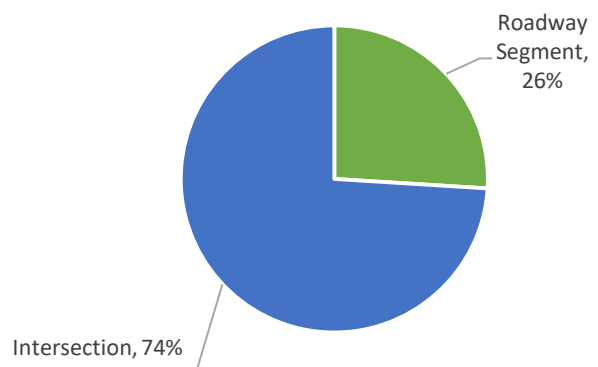
Figure 7 illustrates the five-year collision trend for all collisions, and KSI collisions.
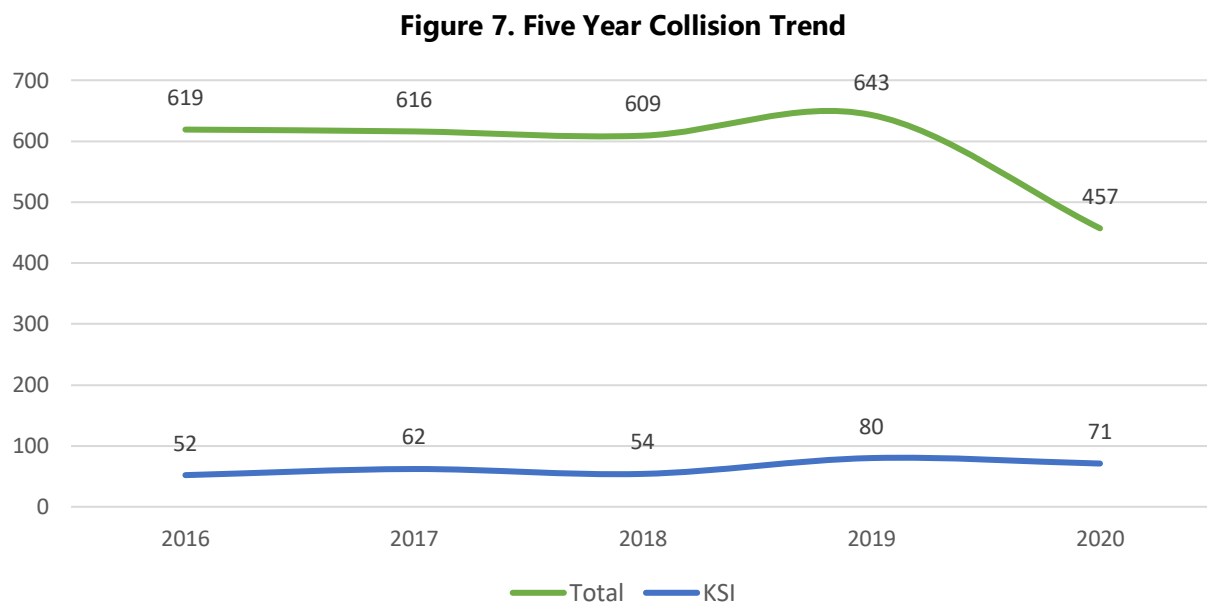
Figure 7. Five Year Collision Trend

Roadway Segment vs. Intersection

When evaluating the locations of injury collisions, most collisions occurred at intersections and not along roadway segments. In the County of Santa Clara, 74% of all collisions (2,179 collisions) occurred at intersections whereas 26% (765 collisions) occurred on roadway segments. A slightly stronger trend towards intersection collisions is seen when looking only at KSI collisions. This classification by facility type can be observed **Figure 8**.


Figure 8. Intersection vs Roadway Collisions – Injury Collisions

Roadway Segment, 26%

Intersection, 74%

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Collision Type

For collisions of all severity, the most commonly occurring collision type was broadside type collisions (26%) and rear end type collisions (17%). The collision types for KSI collisions follow a different pattern, where the most commonly occurring collision type was hit object collisions (28%), vehicle/pedestrian (16%) and broadside (15%). **Figure 9** illustrates the collision type for all injury collisions as well as KSI collisions.

Figure 9. Collision Type: Injury Collisions vs KSI Collision
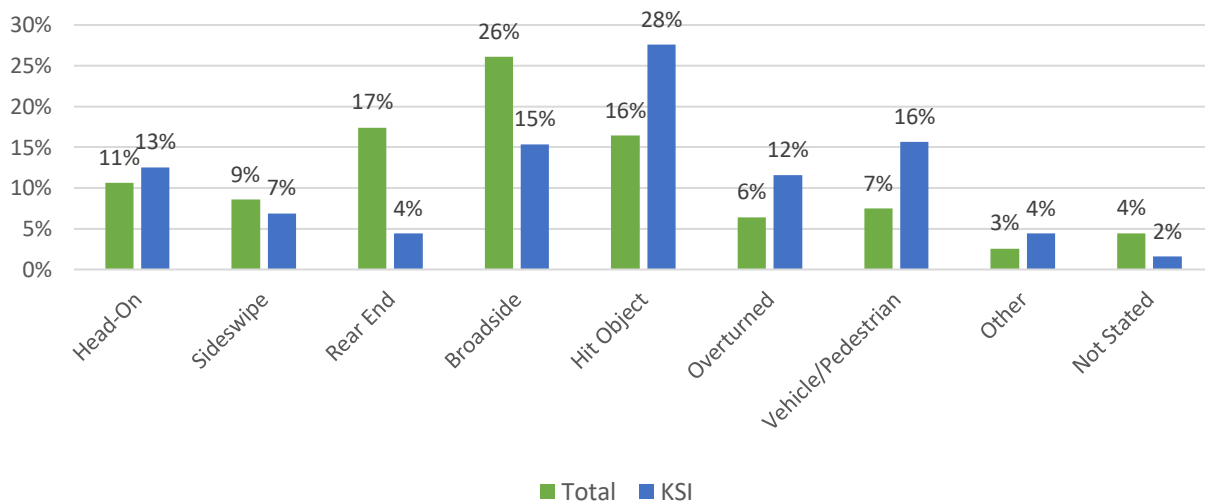
Primary Collision Factor

For collisions of all severity, the most common violation category was observed to be unsafe speed (26%) and automobile right of way (18%) and improper turning (18%). The most common primary violation categories for KSI collisions were improper turning (24%), unsafe speed (18%), pedestrian violation (14%), and automobile right- of way (12%). **Figure 10** illustrates the violation category for collisions of all severity and KSI collisions.

Figure 10. Violation Categories: Injury Collisions vs KSI
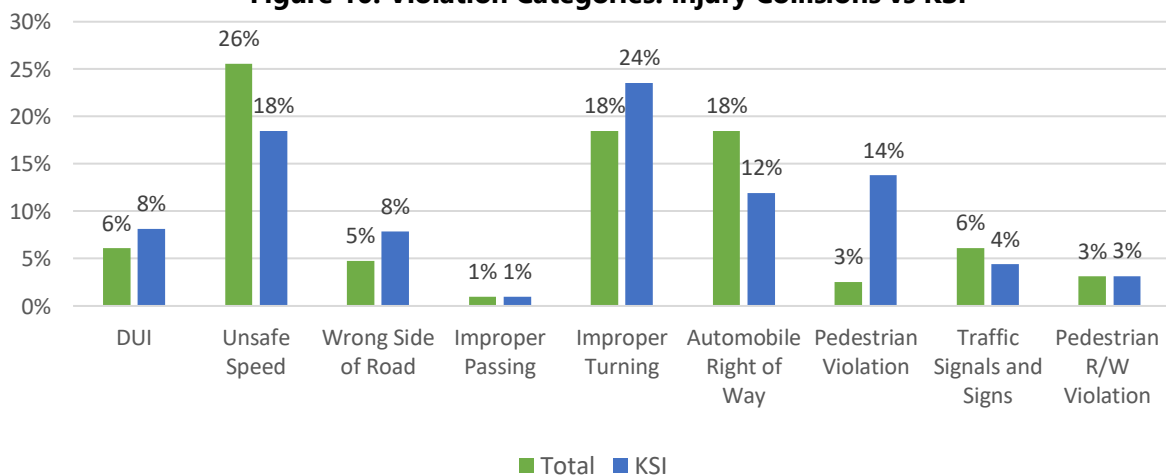
Motor Vehicle Involved With

For collisions of all severity, 50% of the collisions occurred due to motor vehicle colliding with other vehicles. This was followed by fixed object collisions (18%), and pedestrian collisions (9%). For KSI collisions, 28% involved other motor vehicle, 26% of the collisions involved fixed object, and 17% involved pedestrian. **Figure 11** illustrates the motor vehicle involved with category for collisions all severity and KSI collisions.

Figure 11. Motor Vehicle Involved With: Injury Collisions vs KSI Collisions
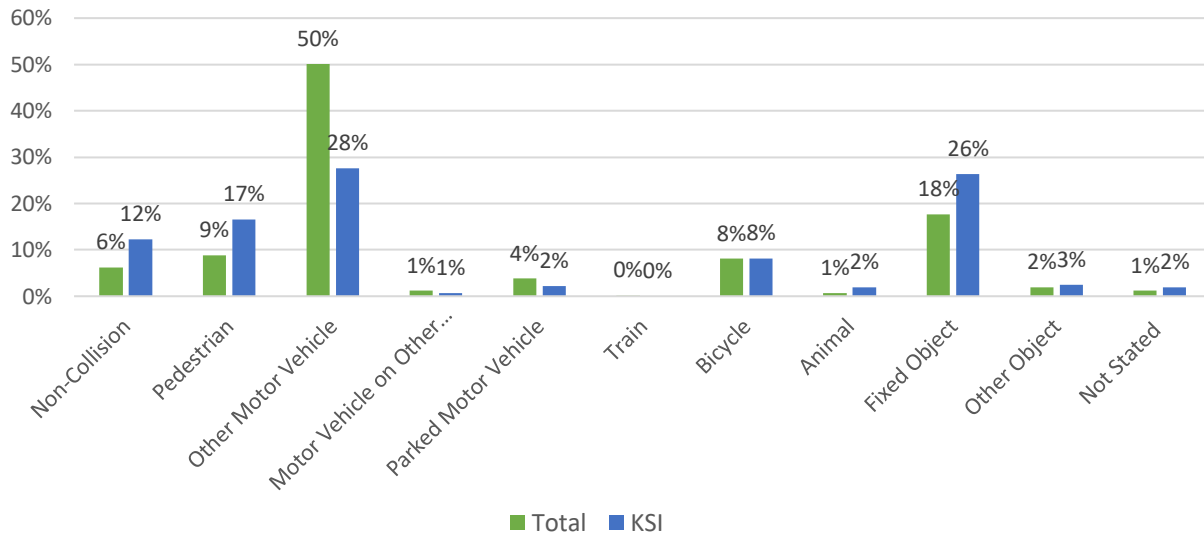
Modes

In addition to motor vehicle involved with, modes include a more detailed breakdown of the vehicle type at fault in the collisions, including motorcycles and trucks. For collisions of all severity, the majority were caused by a passenger car (39%), followed by truck or bus (7%). Crashes with pedestrian and bicycle were 8%. Passenger car (34%) makes up the majority of KSI collisions and pedestrian/bicycle caused collisions (21%) rose in percentage. **Figure 12** illustrates the percentage for collisions of all severity as well as KSI collisions by mode.

Figure 12. Modes: Injury Collisions vs KSI Collisions
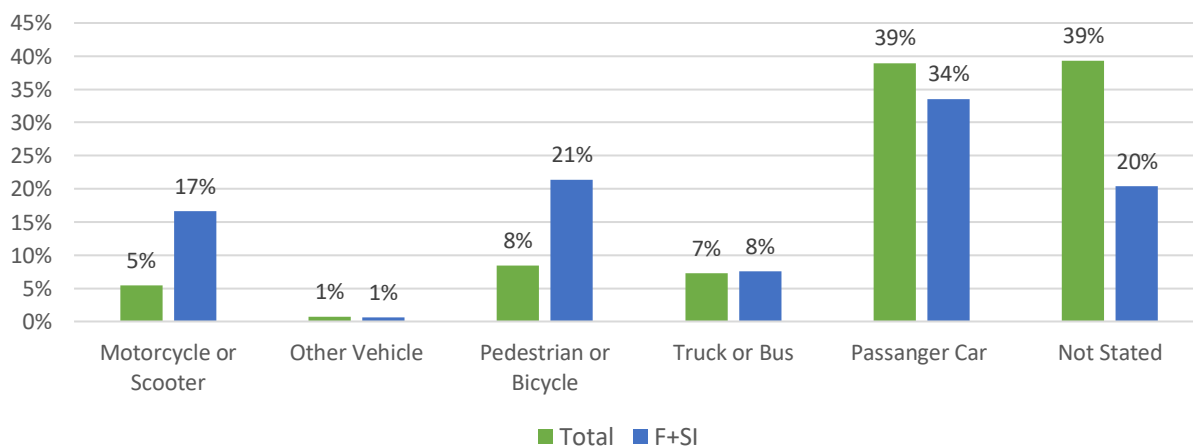
Lighting

For collisions of all severity, 68% of collisions occurred in daylight, while 17% of collisions occurred in the dark on streets with streetlights. For KSI collisions, a higher percentage of crashes occurred in daytime conditions, with 55% of collisions having occurred in daylight and 23% of collisions occurred in the dark on streets with street lights. **Figure 13** illustrates the lighting condition for collisions of all severity and KSI collisions.
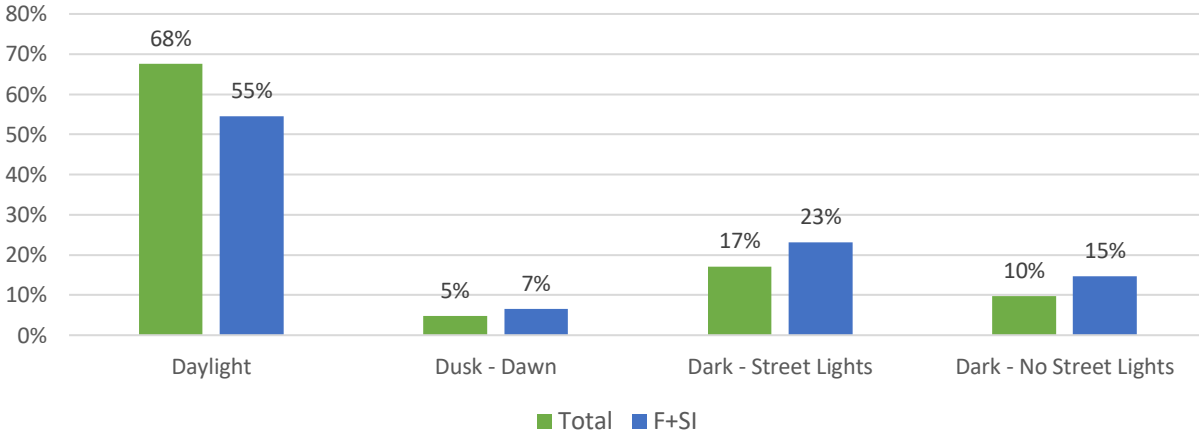
Figure 13. Lighting Conditions: Injury Collisions vs KSI Collisions

Time of the Day

For collisions of all severity, the hour with the most number of collisions was between 4:30 p.m. to 5:30 p.m. (8.5%), while the hour with the fewest number of collisions was between 3:00 a.m. to 4:00 a.m. (1.2%). For all KSI collisions, maximum number of collisions occurred between 3:00 p.m. to 4:00 p.m. (7.5%). **Figure 14** illustrates the percentage of collisions occurring during each hour of the day for all collisions as well as KSI collisions.

Figure 14. Time of the Day: Injury Collisions vs KSI
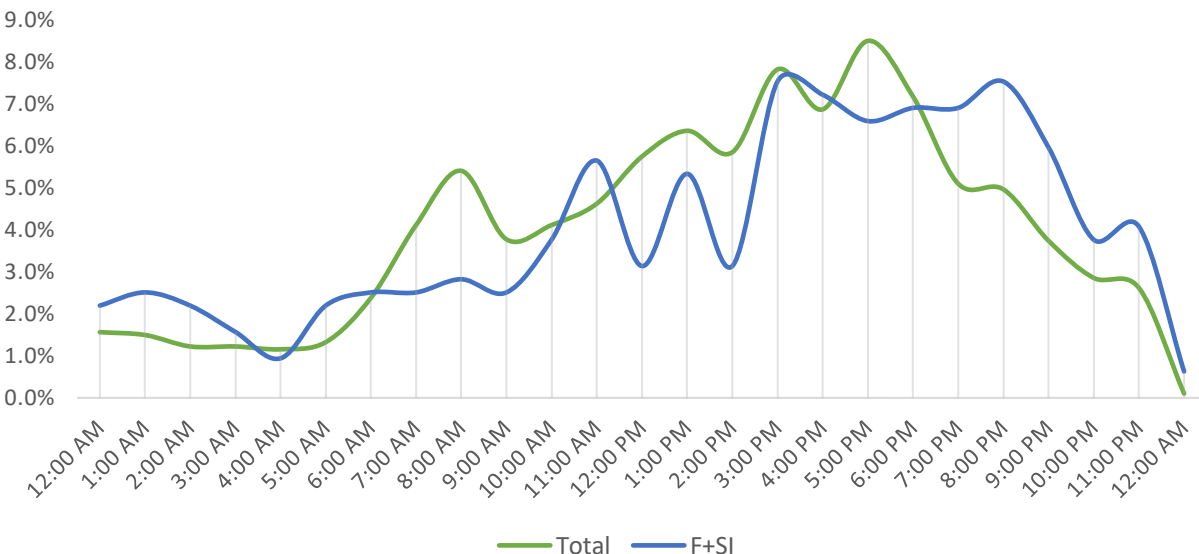
Killed and Severe Injury Collisions of Other County Roads

This section describes a detailed collision analysis performed for KSI collisions occurring at roadway segments and intersections in the County of Santa Clara. Of the total 319 KSI collisions that occurred during the study period, 140 collisions (44%) occurred on roadway segments and 179 collisions (56%) occurred at intersections. This distribution is illustrated in **Figure 15** below.

Figure 15. Intersection vs. Roadway Segment Collisions: KSI Collisions

Injury Collisions (Other County Roads)

- Roadway Segment, 26%
- Intersection, 74%

KSI Collisions

- Roadway Segment, 44%
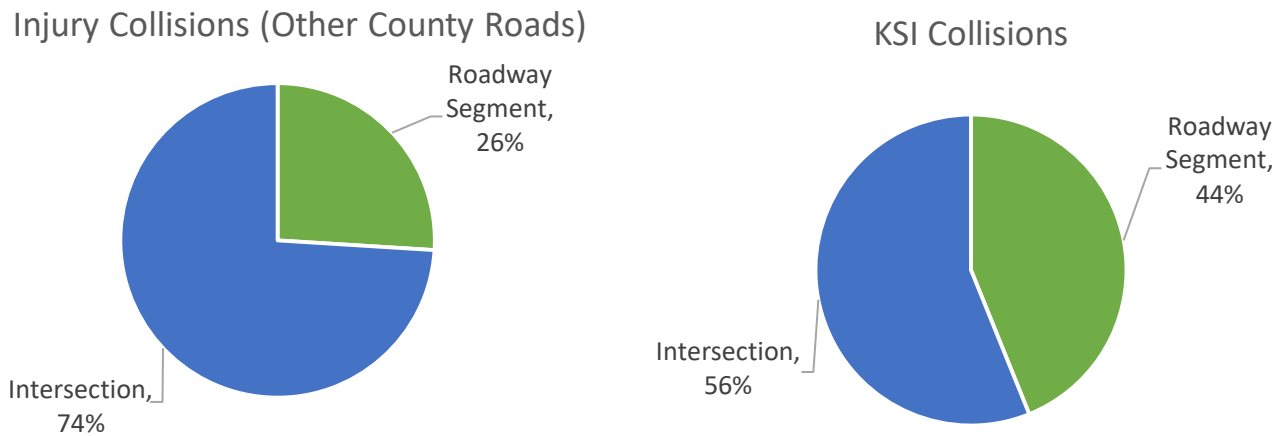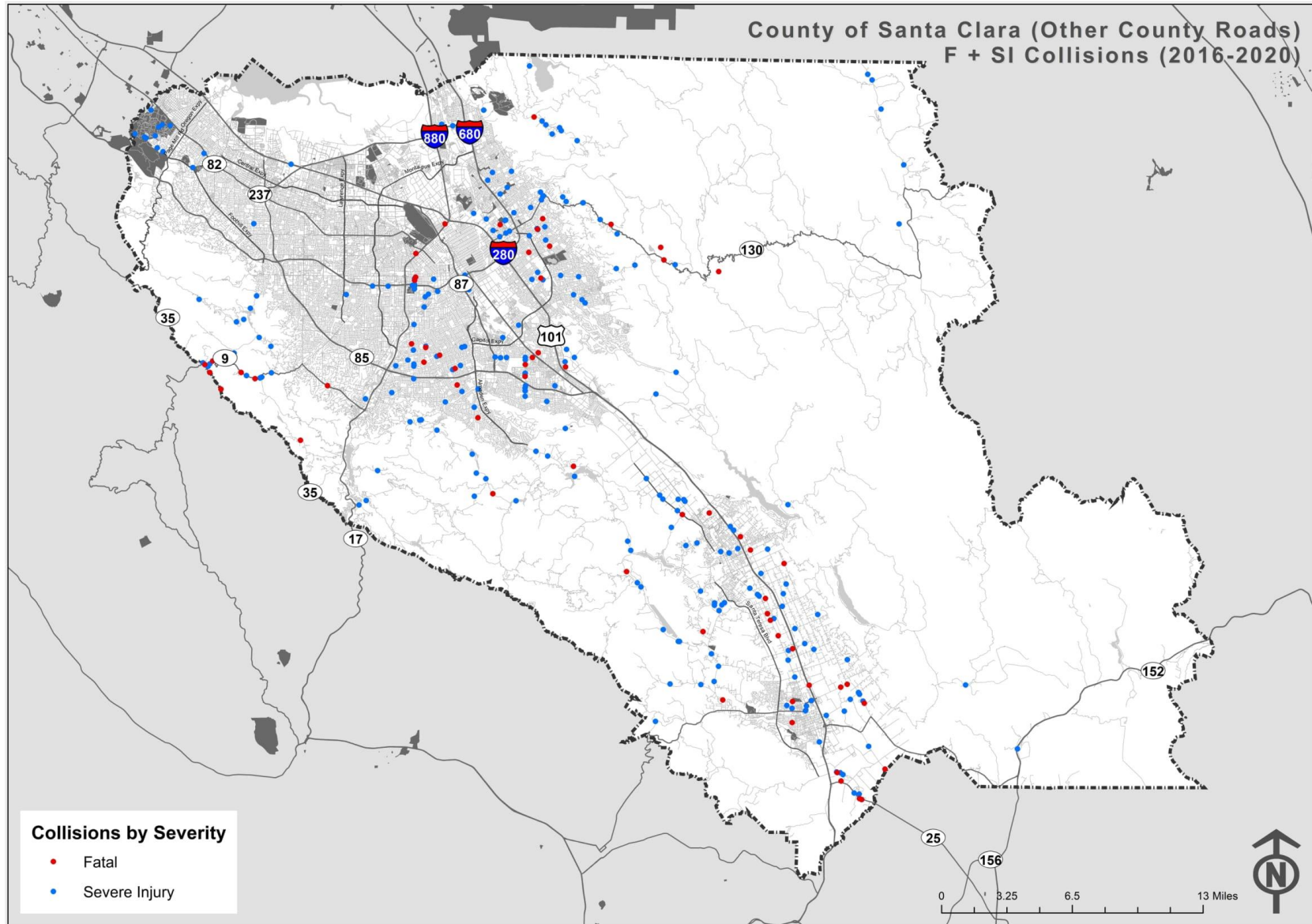- Intersection, 56%

Figure 16 maps the KSI collisions that occurred the County of Santa Clara during the study period.

Figure 16. Killed and Severe Injury Collisions for Other County Roads (2016-2020)

County of Santa Clara (Other County Roads)
F + SI Collisions (2016-2020)

Collisions by Severity
- Fatal
- Severe Injury

0   3.25   6.5   13 Miles

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Collision Type and Location Type

Higher frequency of KSI collision type were hit object involved collisions (18%) on the roadway segments and overturned collisions (8%) at the intersection, along with broadside (13%) and vehicle/pedestrian (13%) type collisions. Of all KSI collisions 7% were head on type and overturned collisions (8%) that occurred at intersection. **Figure 17** shows killed and severe injury collisions by location type and collision type.

Figure 17. KSI Collision Type vs Location Type
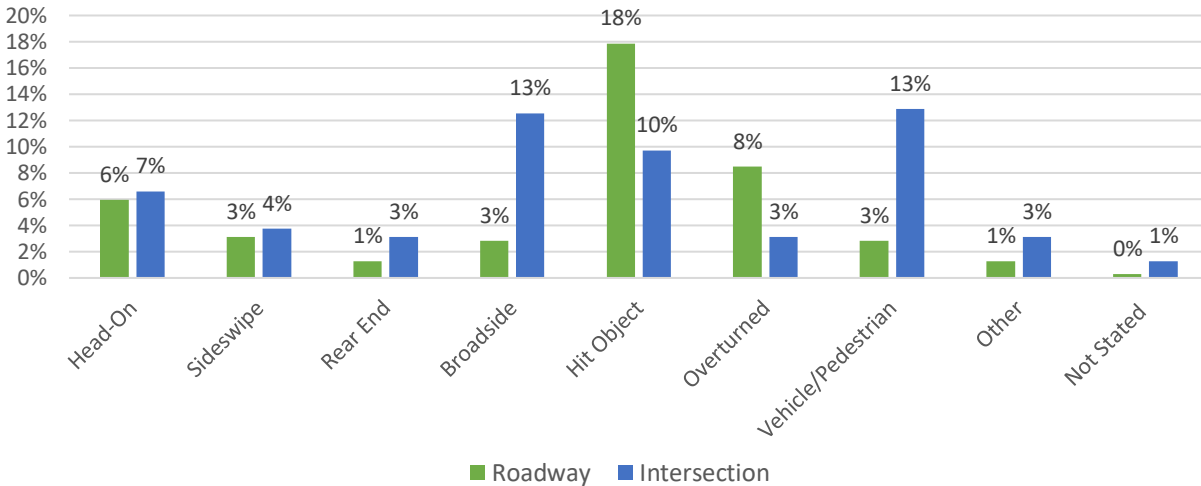
Violation Category and Location Type

The most common violation types among KSI collisions were improper turning (35%), unsafe speed (23%), DUI (12%) and automobile right of way (16%). These KSI collisions primarily occurred at roadway segments. Improper turning was the most common violation category along roadway segments, and unsafe speed at intersections. **Figure 18** shows killed and severe injury collisions by location type and violation category.

Figure 18. KSI Collisions: Violation Category vs Location Type
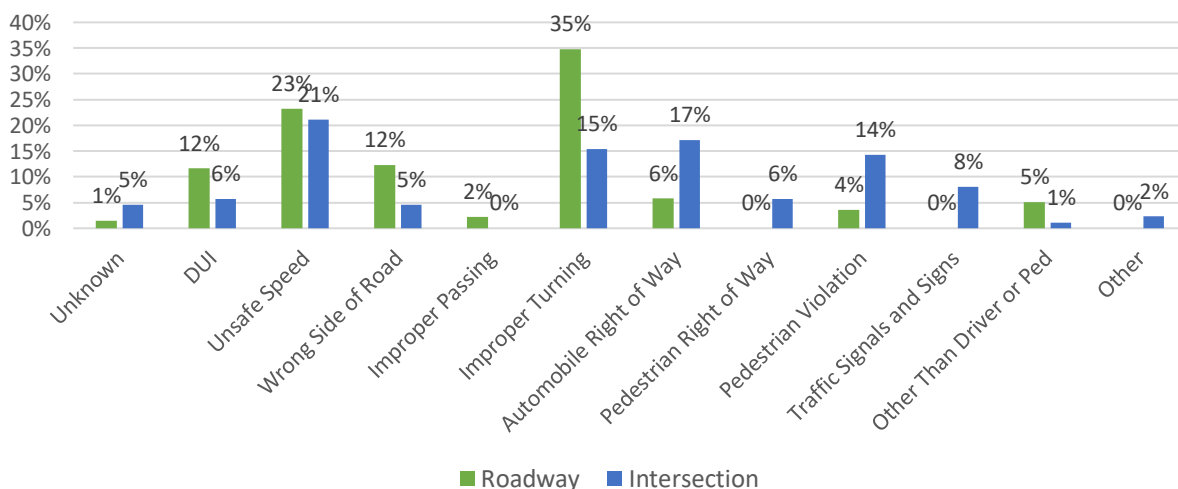
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Motor Vehicle Involved With and Location Type

KSI collisions involving motor vehicle was the most common type of collision occurring at intersections (56% of all KSI collisions). On roadway segments, the most common collision was with fixed objects (36% of all KSI collisions). **Figure 19** shows killed and severe injury collisions by location type and collision type.

Figure 19. KSI Collisions: Motor Vehicle Involved With vs Location Type
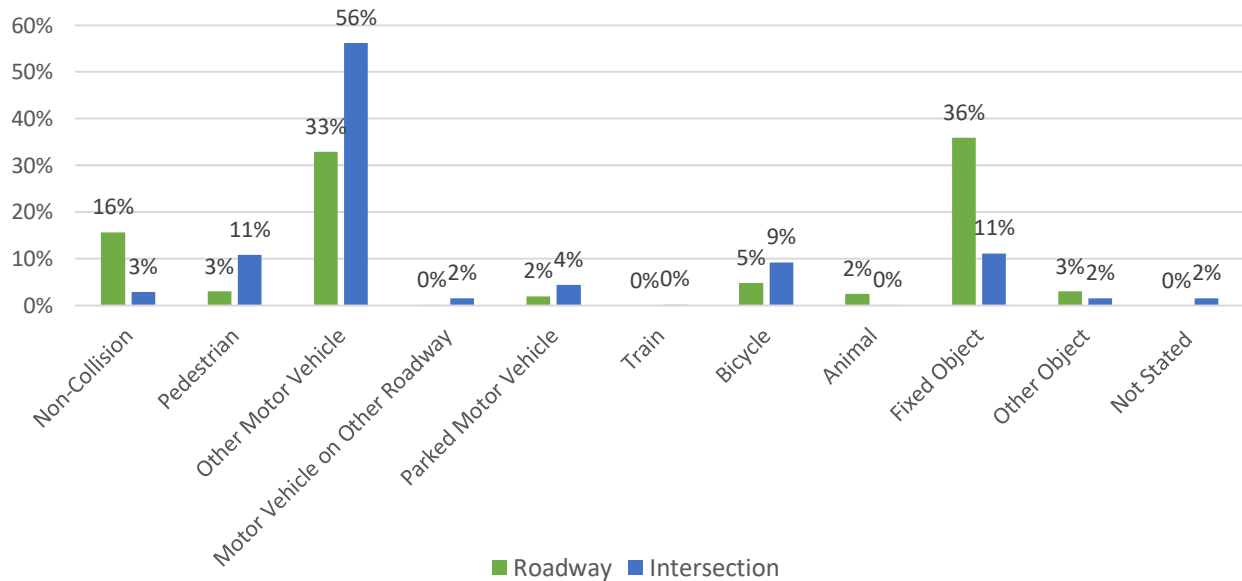
Lighting vs and Location Type

Most KSI collisions occurred during the daylight on roadways (28%). The second was daylight conditions (27%) occurring at intersections. 21% of the collision occurred in the dark with street lights at the intersection and 11% of collision occurred in dark with no street lights. **Figure 20** shows killed and severe injury collisions by location type and lighting conditions.

Figure 20. KSI Collisions: Lighting vs and Location Type
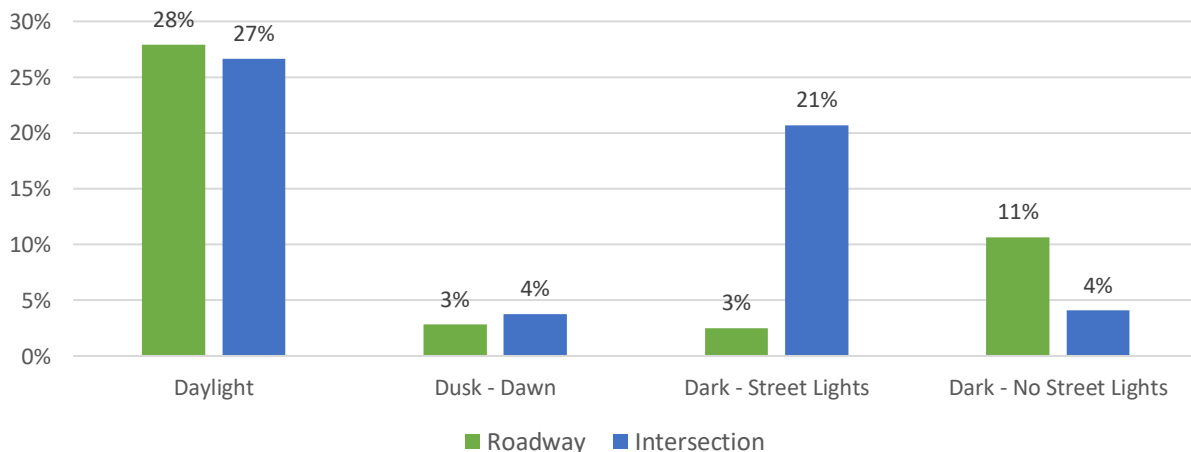
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Time of the Day vs and Location Type

The time duration with the most KSI collisions was during 6:00 p.m. to 9:00 p.m. These primarily occurred at intersections, though the most number of roadway segment KSI collisions occurred between 3:00 p.m. and 6:00 p.m. **Figure 21** shows killed and severe injury collisions by location type and time of day.

Figure 21. KSI Collisions: Time of Day vs Location Type
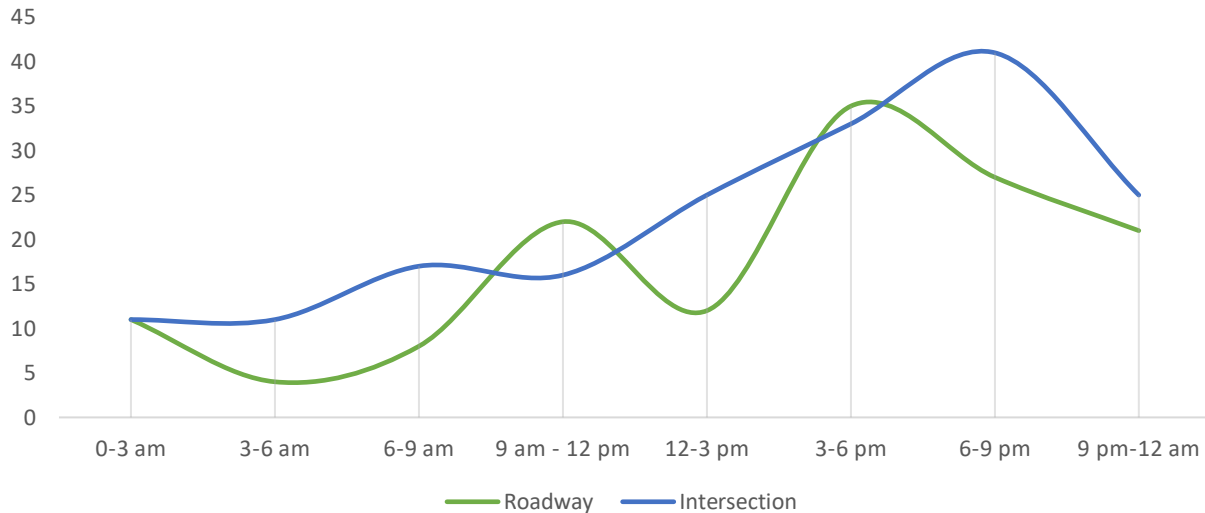
Gender vs Age

For KSI collisions, the gender of the party at fault was much more likely to be male than female (25% of KSI collisions were caused by a male). The largest age group was 20-29 years (46%). Parties at fault under 40 years of age accounts for just under half (49%) of all KSI collisions. **Figure 22** illustrates the gender and age of the party at fault for KSI collisions.

Figure 22. KSI Collisions: Gender and Age
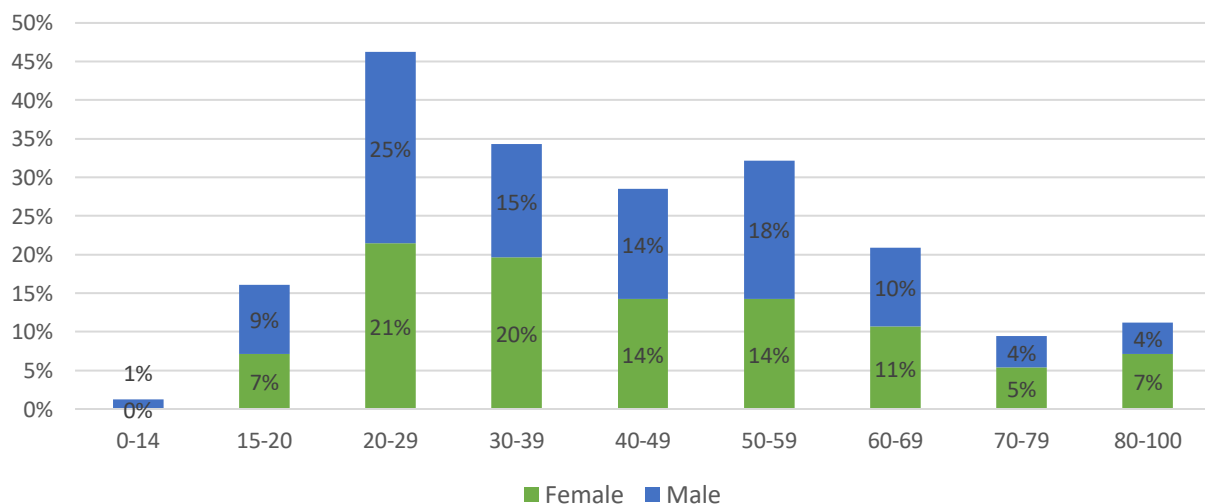
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Collision Type vs. Movement Preceding Collision of Party at Fault

The most common type of collision for KSI collisions was hit object collisions. Of these collisions, Proceeding Straight was the most common movement preceding the collision of the party at fault (38% of all KSI collisions), followed by ran off road (14%). **Figure 23** shows distribution of collision type and the movement by the party at fault preceding the collision.

Figure 23. KSI Collisions by Collision Type and Movement Preceding Collisions of Party at Fault
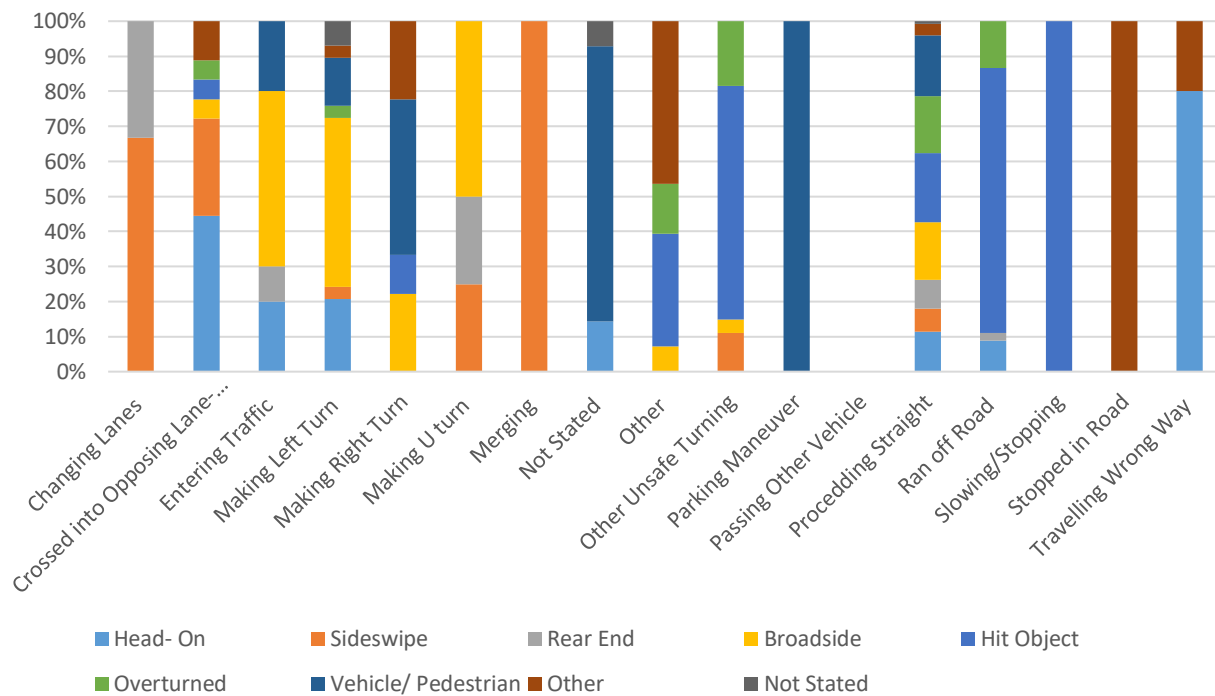
GEOGRAPHIC COLLISION ANALYSIS

This section describes a detailed geographic collision analysis performed for injury collisions occurring on roadway segments and at intersections in the County of Santa Clara. The above collision analysis was used to identify five main collision factors that highlight the top trends among collisions on other county roads. These five collision factors were identified to be, broadside collisions, rear end collisions, nighttime collisions, unsafe speed violation, and improper turning violation.

Broadside Type Collisions

Broadside collisions represented the highest proportion of collisions of all severity (26%), when 15% considering only KSI collisions. It was the most common collision type among KSI collisions. **Figure 24** shows the distribution of broadside collisions throughout the County of Santa Clara between 2016 and 2020. N White Rd, Moorpark Ave Leigh Ave and Foxworthy Ave have a higher concentration of broadside collisions, compared to other County roads.

Rear End Type Collisions

Rear End collisions caused 17% of all injury collisions, 4% a significant percentage of KSI collisions. **Figure 25** shows the distribution of rear end collisions throughout the County of Santa Clara during 2016 to 2020. N White Rd, Moorpark Ave and S Bascom Ave have a higher concentration of rear end collisions, compared to other County roads.

Nighttime Type Collisions

Collisions occurring at night represented only 17% of all injury collisions, but rose significantly to 23% of KSI collisions, indicating that lighting may be a factor in those collisions. **Figure 26** shows the distribution of nighttime collisions throughout the County of Santa Clara between 2016 and 2020. N White Rd, Snell Ave and Moorpark Ave have a higher concentration of nighttime collisions, compared to other roads in the County of Santa Clara.

Unsafe Speed Violations

26% of all injury collisions, a significant percentage of KSI collisions (18%) in County were caused by unsafe speed, the highest of any violation type among all injury collisions. **Figure 27** shows the distribution of unsafe speed collisions throughout the County of Santa Clara between 2016 and 2020. Moor Park Ave and N White Rd have a higher concentration of unsafe speed collisions, compared to other County roads.

Improper Turning Type Collisions

Improper turning collisions accounted for 18% of all KSI collisions (the most of any category), compared to 24% of all injury collisions. **Figure 28** shows the distribution of improper turning violation collisions throughout the County of Santa Clara between 2016 and 2020. Bolsa Rd, Watsonville Rd and Heather Heights Rd have a higher concentration of improper turning violation collisions, compared to other County roads.

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Figure 24. County of Santa Clara Broadside Type Collisions (2016 - 2020)

County of Santa Clara (Other County Roads)
Broadside Type Collisions
(2016-2020)

Broadside Collisions

Low — High

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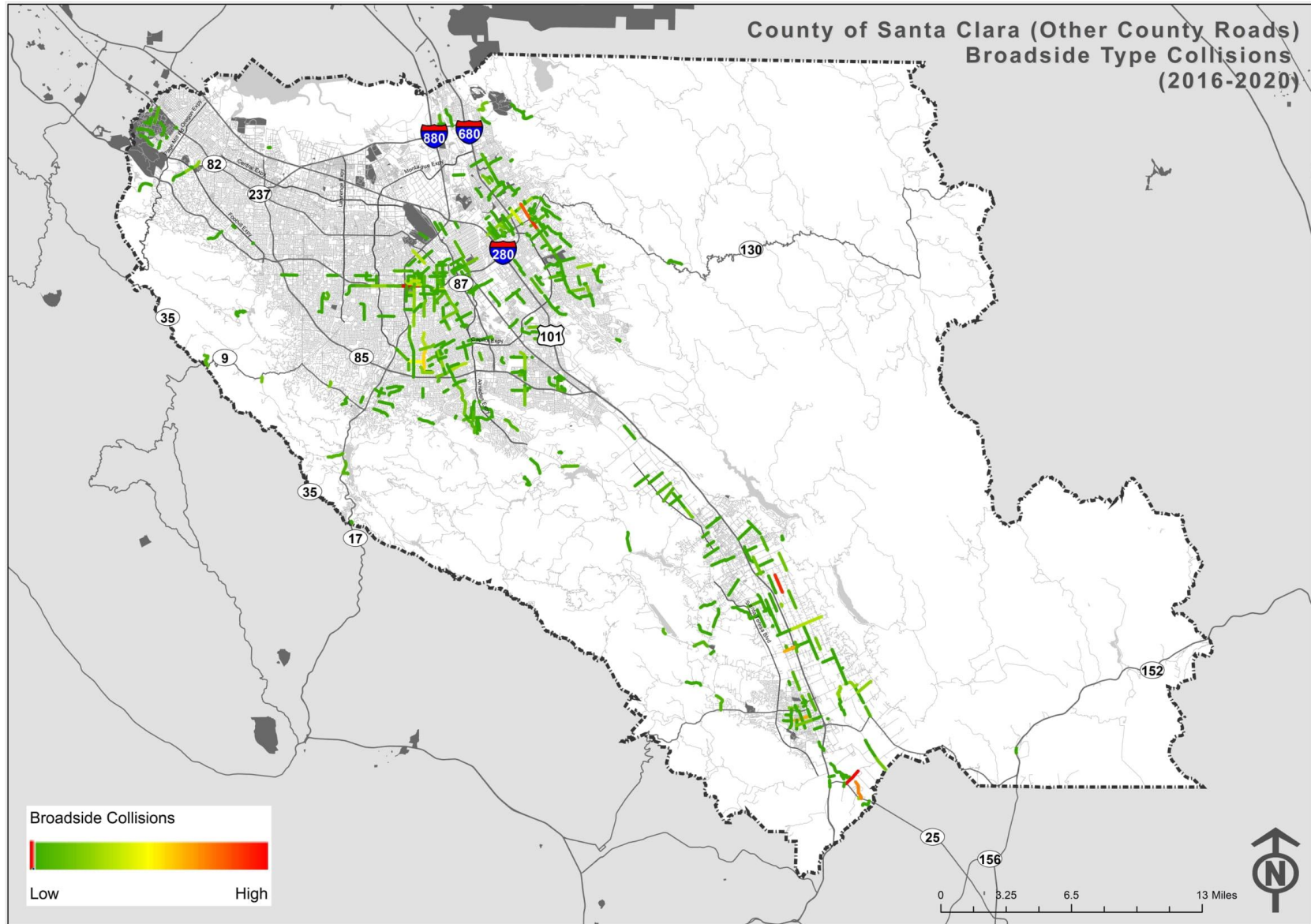
Figure 25. County of Santa Clara Rear End Type Collisions (2016 - 2020)

County of Santa Clara (Other County Roads)
Rear End Type Collisions
(2016-2020)

Rear End Collisions

Low   High

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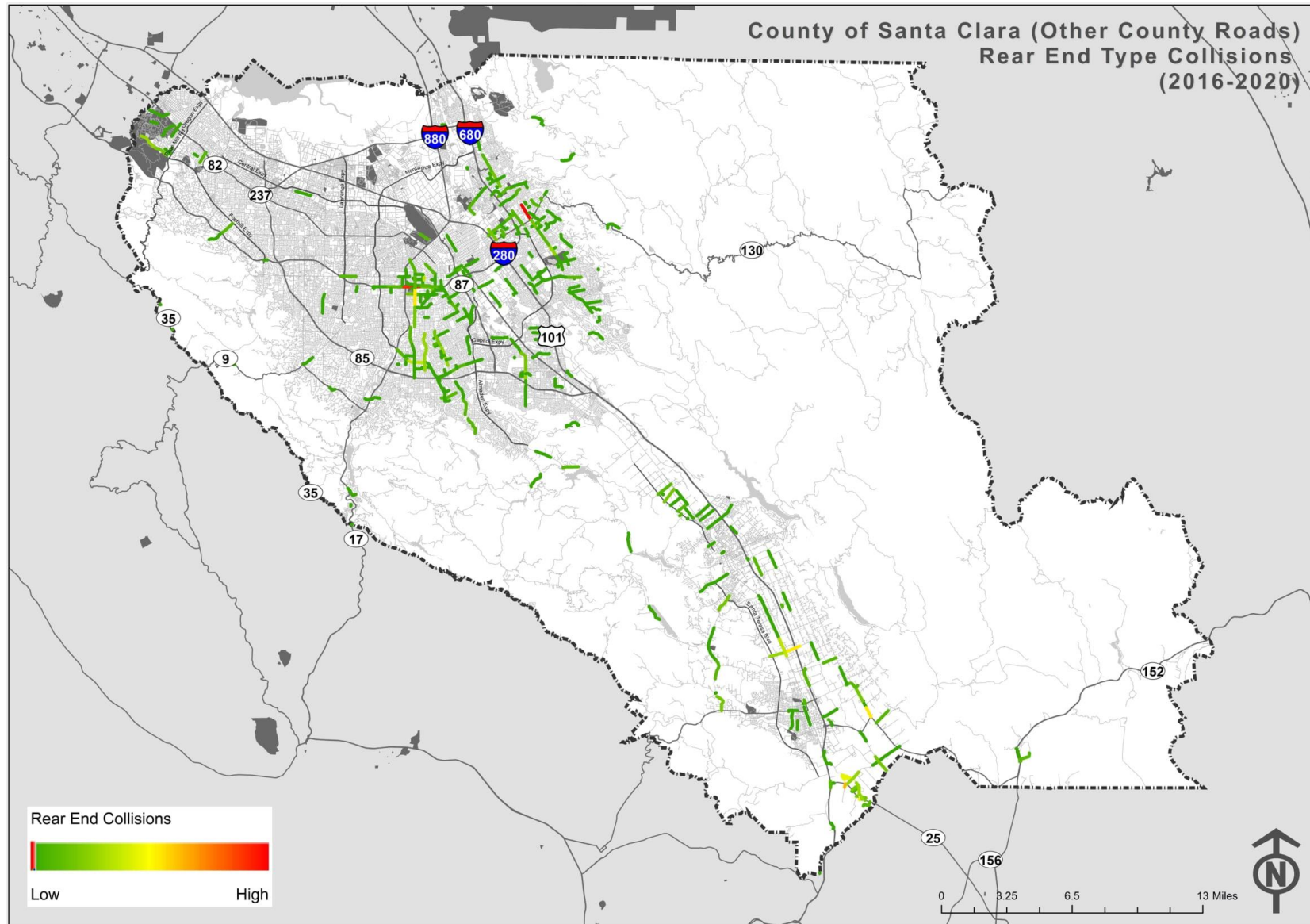
Figure 26. County of Santa Clara Nighttime Type Collisions (2016 - 2020)

County of Santa Clara (Other County Roads)
Night Time Collisions
(2016-2020)

Night Time Collisions

Low   High

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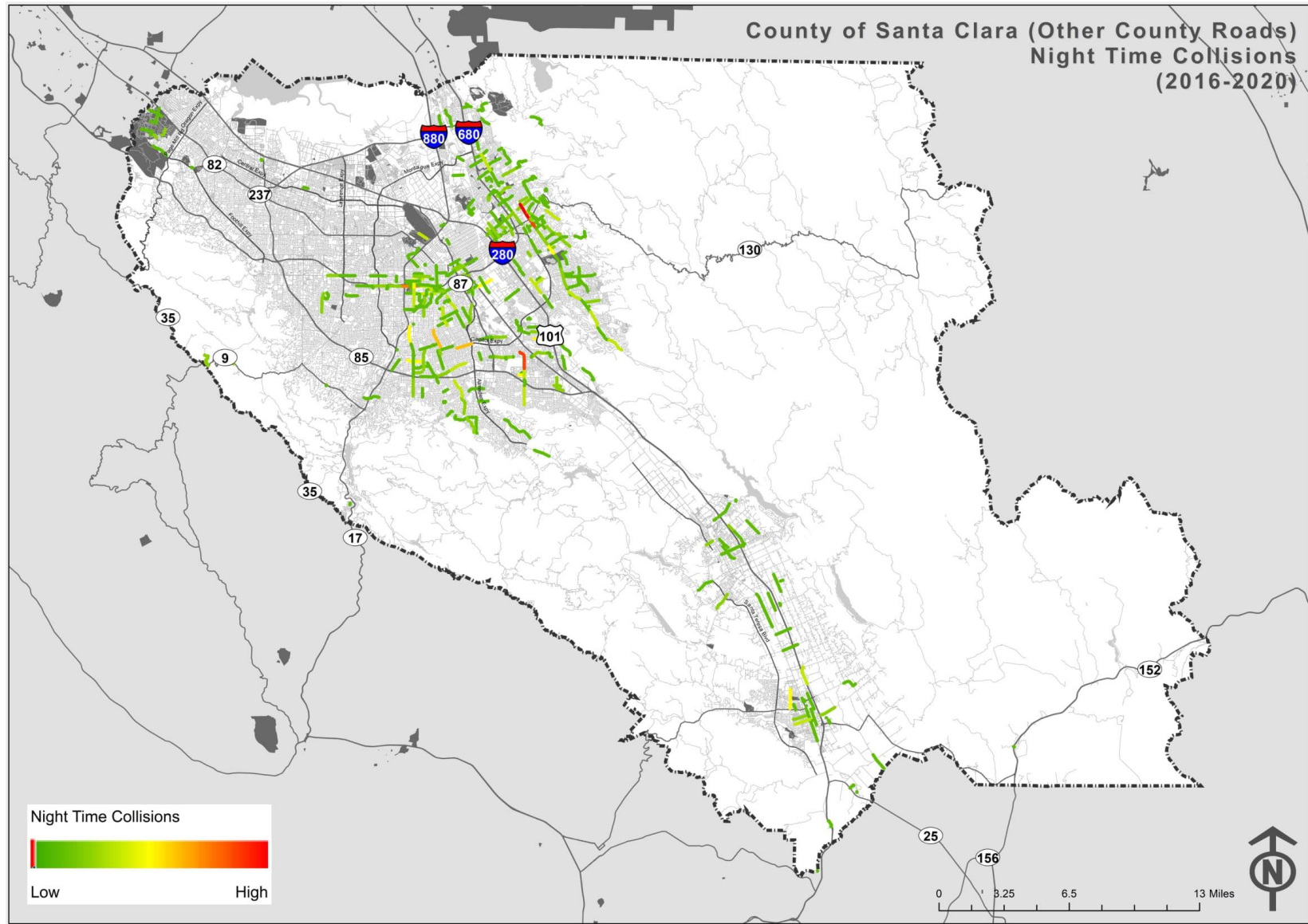
Figure 27. County of Santa Clara Unsafe Speed Violation Collisions (2016 - 2020)

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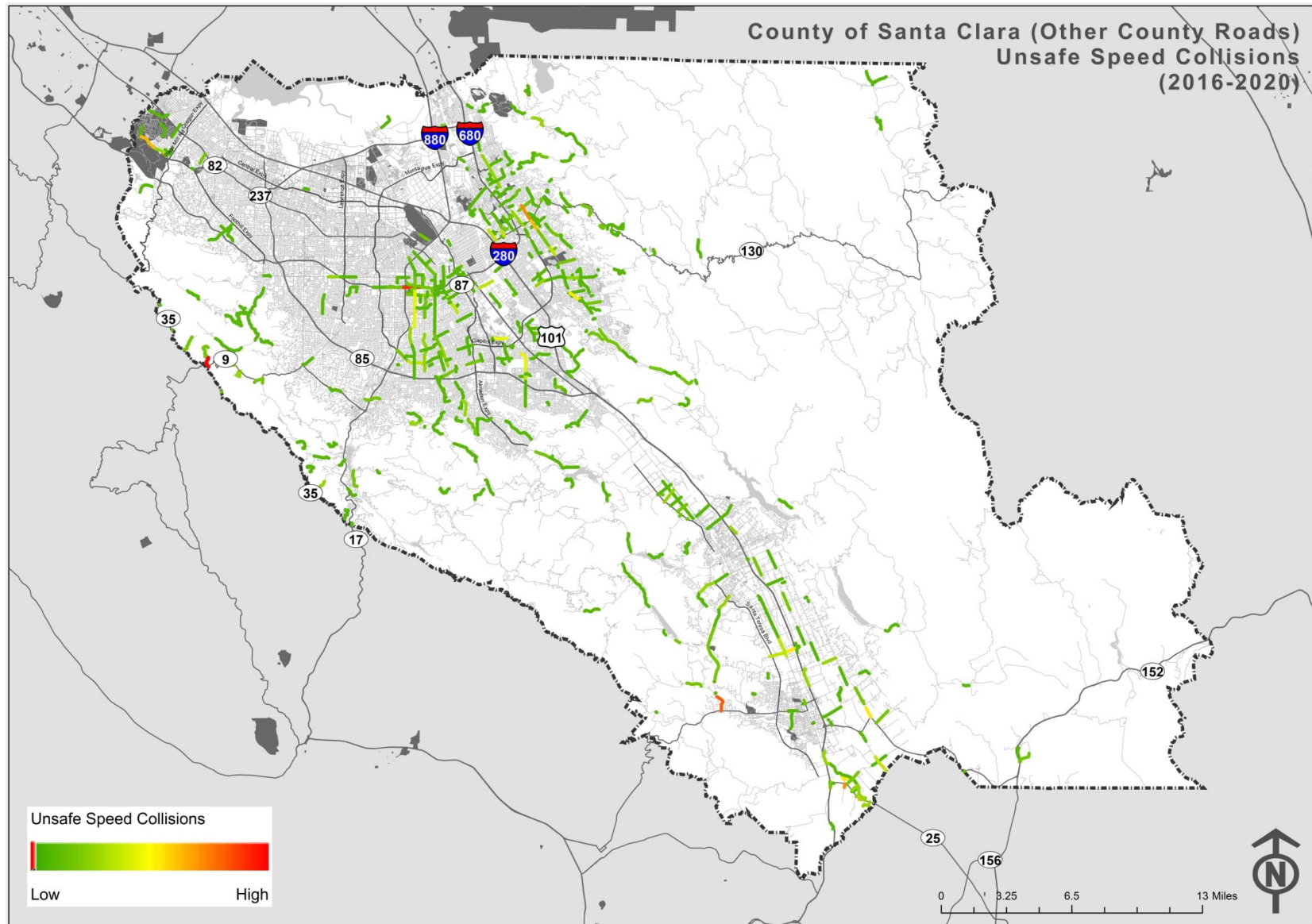
Figure 28. County of Santa Clara Improper Turning Violation Collisions (2016 - 2020)

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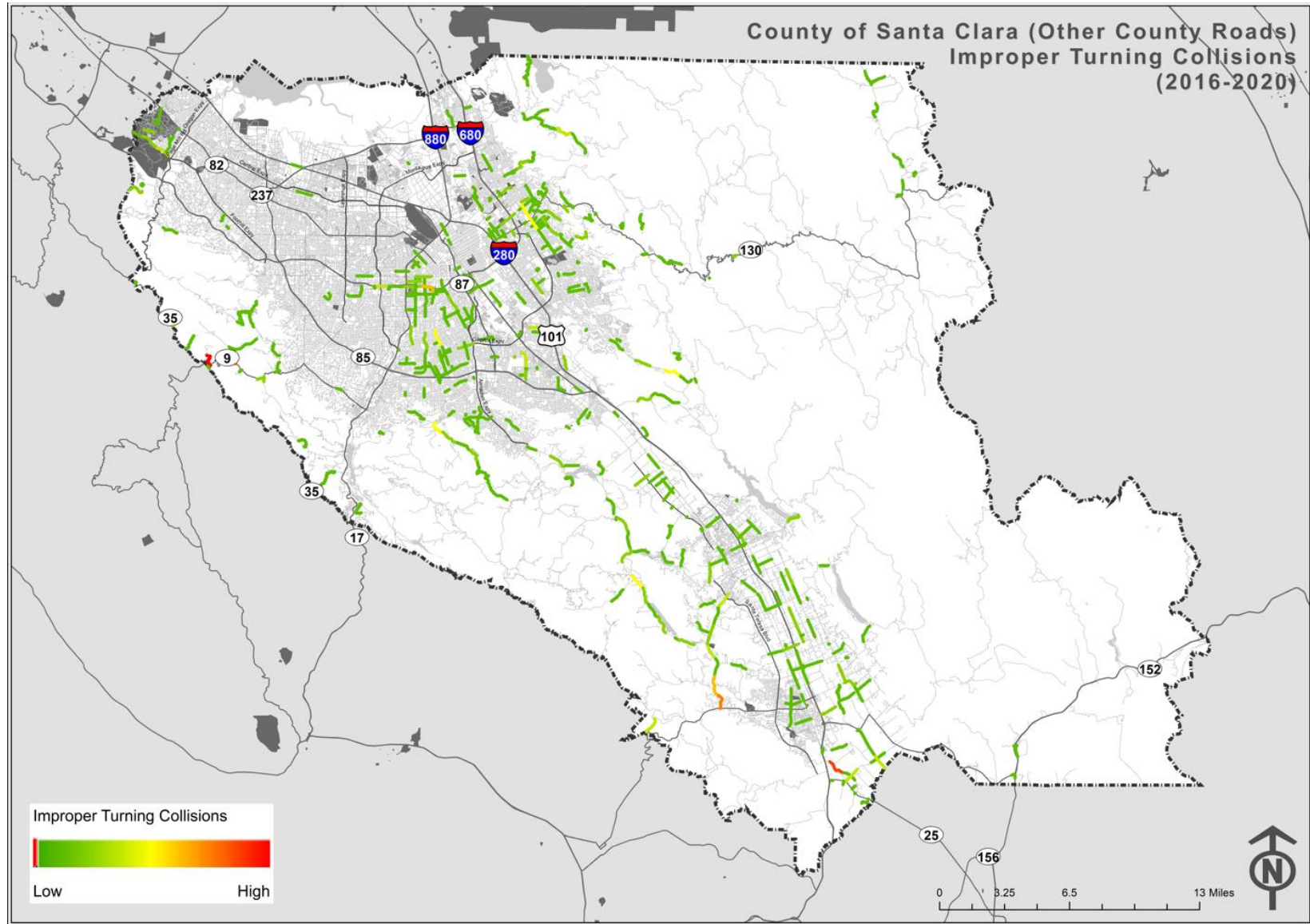
Figure 29. Injury Collisions in the County of Santa Clara (Expressways) (2016-2020)

County of Santa Clara (Expressways)
Injury Collisions
(2016-2020)

Collisions by Severity
- Fatal
- Severe Injury
- Other Visible Injury
- Complaint of Pain

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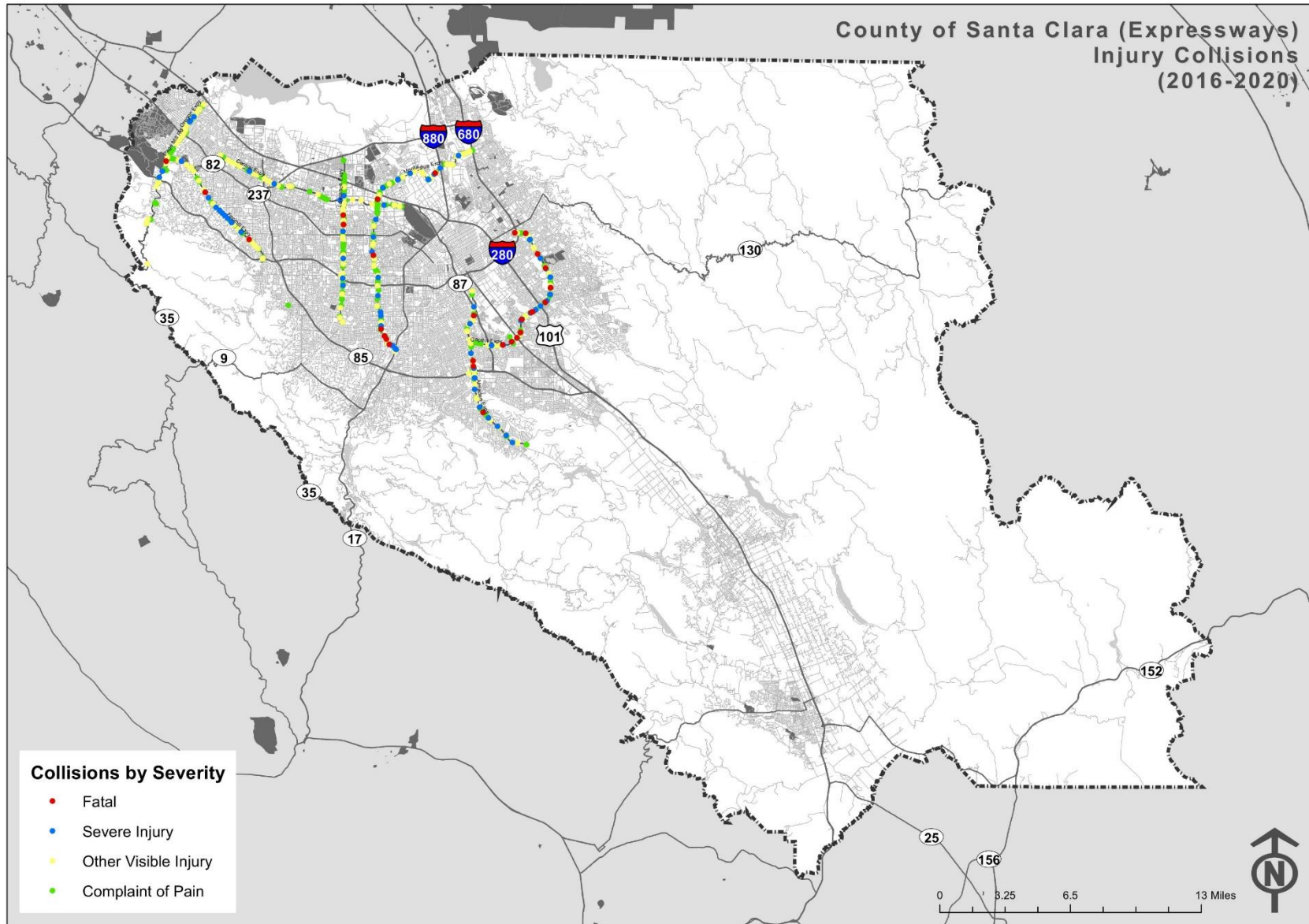
INJURY COLLISION ANALYSIS BY SEVERITY -EXPRESSWAYS

A total 1,976 injury collisions reported in five years (2016-2020) were on Expressways within the County of Santa Clara. **Figure 29** illustrates all injury collisions on Expressway in the County reported in five years.

Out of 1,976 injury collisions, 1,319 collisions (67%) led to complaint of pain injury and 521 collisions (26%) led to a visible injury. There were 136 KSI (killed and severe injury) collisions, of which 100 collisions (5%) led to a severe injury and 36 collisions (2%) led to a fatality. **Figure 30** illustrates the classification of all collisions based on severity.
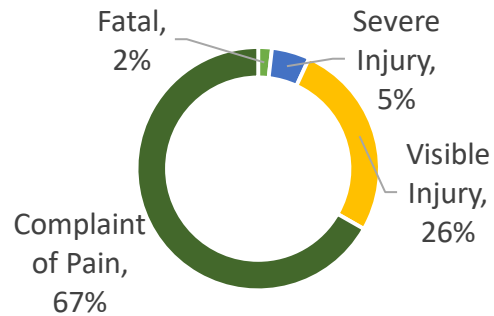
Figure 30. Injury Collisions by Severity (2016 -2020)

Table 3. Injury Collision by Severity and Facility Type (Expressways) (2016-2020)

Collision Severity	Roadway Segment	Intersection	Total
Fatal	6	30	36
Severe Injury	23	77	100
Visible Injury	94	427	521
Complaint of Pain	206	1,113	1,319
Total	**329**	**1,647**	**1,976**

PRELIMINARY ANALYSIS

Yearly Trend

The trend in the collisions has been seen to reduce every year on expressways. The number of reported collisions of all severity were higher in number between 2016 and 2017, whereas the collisions decreased from 2019 to 2020. The year with the highest number of collisions was 2016 (525 collisions), while the year with the lowest number of collisions was 2020 (187 collisions). A total of 136 KSI collisions occurred in the County of Santa Clara during the study period, overall consistent from 2016 to 2020. The least number of KSI collisions occurred in 2020 (13 collisions), while the most occurred in 2016 (33 collisions). **Figure 31** illustrates the five-year collision trend for all injury collisions and KSI collisions.

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Figure 31. Five Year Collision Trend (2016-2020)
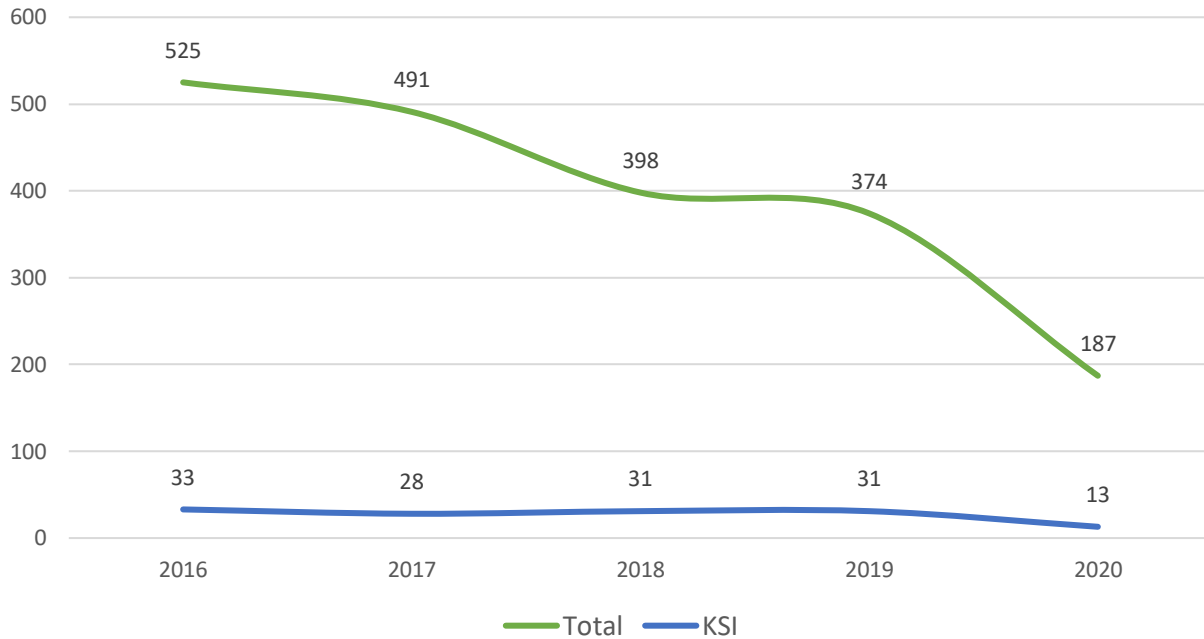
Legend: —— Total —— KSI

Data points (Total): 2016: 525, 2017: 491, 2018: 398, 2019: 374, 2020: 187

Data points (KSI): 2016: 33, 2017: 28, 2018: 31, 2019: 31, 2020: 13

Roadway Segment vs. Intersection

When evaluating the locations of injury collisions, most collisions occurred at intersections and not along the expressways. In the County of Santa Clara, 83% of all collisions (1,647 collisions) occurred at intersections whereas 17% (329 collisions) occurred on roadway segments. A slightly stronger trend towards intersection collisions is seen when looking only at KSI collisions. This classification by facility type can be observed **Figure 32**.

Figure 32. Intersection vs Roadway Collisions – Injury Collisions
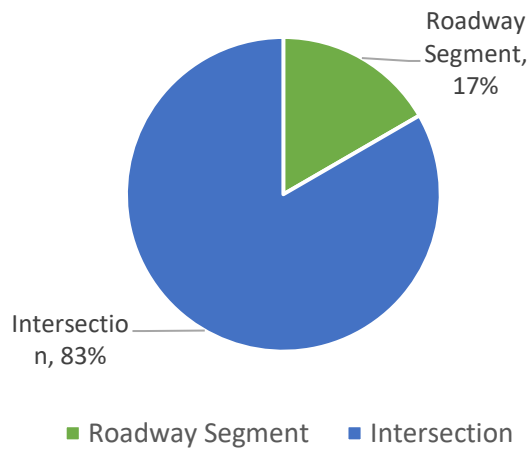
Roadway Segment, 17%
Intersection, 83%

Legend: ■ Roadway Segment ■ Intersection

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Collision Type

For collisions of all severity, the most commonly occurring collision type was rear end type collisions (42%) and broadside type collisions (22%). The collision types for KSI collisions follow a different pattern, where the most commonly occurring collision type was broadside type collisions (21%), and vehicle/pedestrian (15%) and hit object (15%).

Figure 33 illustrates the collision type for all injury collisions as well as KSI collisions.

Figure 33. Collision Type: Injury Collisions vs KSI Collisions
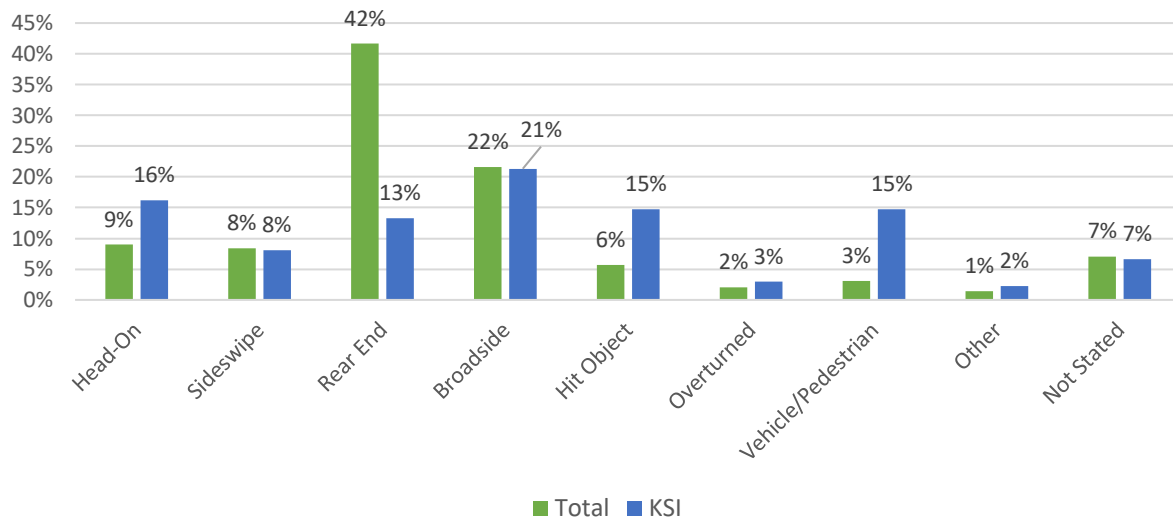
Primary Collision Factor

For collisions of all severity, the most common violation category was observed to be unsafe speed (41%) and traffic signal and signs (15%) and improper turning (10%). The most common primary violation categories for KSI collisions were unsafe speed (17%), DUI (15%), traffic signals and signs (12%), and improper turning (11%). **Figure 34** illustrates the violation category for collisions of all severity and KSI collisions.

Figure 34. Violation Categories: Injury Collisions vs KSI

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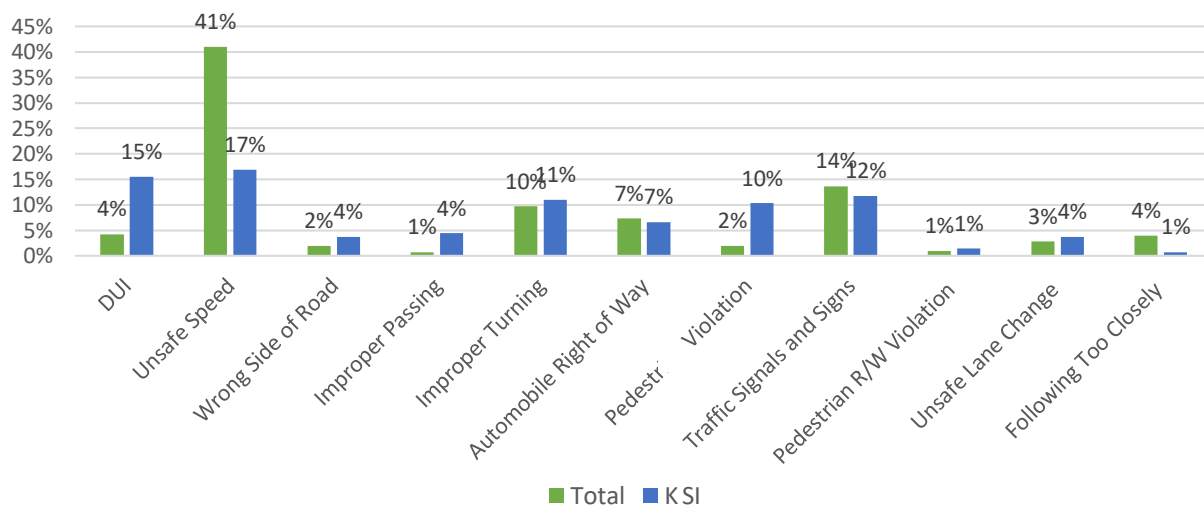
Motor Vehicle Involved With

For collisions of all severity, 75% of the collisions occurred due to motor vehicle colliding with other vehicles. This was followed by fixed object collisions (9%), and bicycle collisions (6%). For KSI collisions, 38% involved other motor vehicle, 21% of the collisions involved fixed object, and 19% involved pedestrian. **Figure 35** illustrates the motor vehicle involved with category for collisions all severity and KSI collisions.

Figure 35. Motor Vehicle Involved With: Injury Collisions vs KSI Collisions
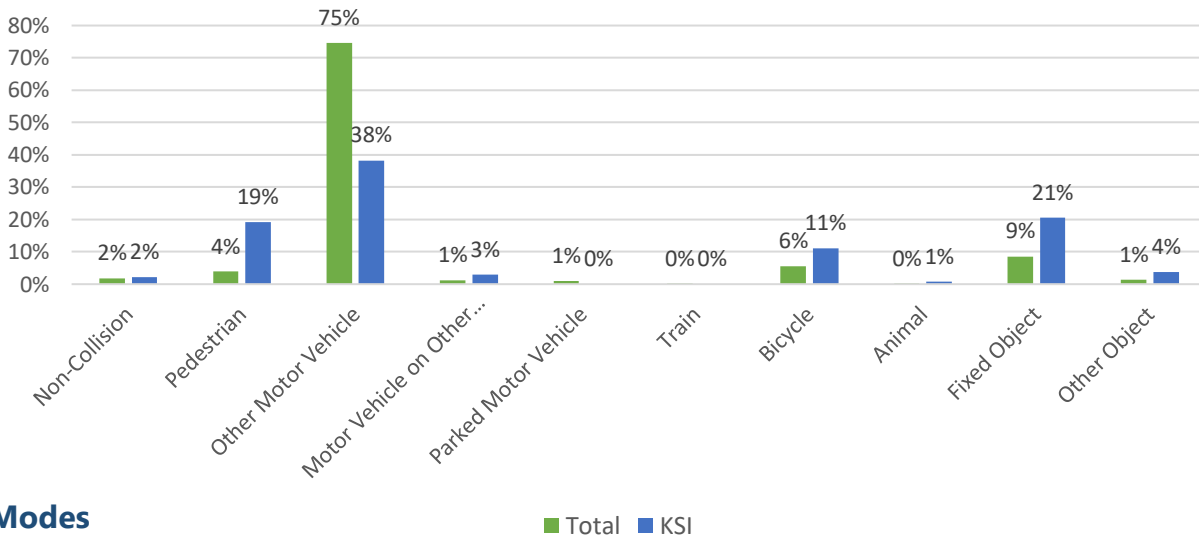
Modes

In addition to motor vehicle involved with, modes include a more detailed breakdown of the vehicle type at fault in the collisions, including motorcycles and trucks. For collisions of all severity, the majority were caused by a passenger car (42%), followed by pedestrian or bicycle (5%). Passenger car (27%) makes up the majority of KSI collisions and pedestrian/bicycle caused collisions (20%) rose in percentage. **Figure 36** illustrates the percentage for collisions of all severity as well as KSI collisions by mode.

Figure 36. Modes: Injury Collisions vs KSI Collisions
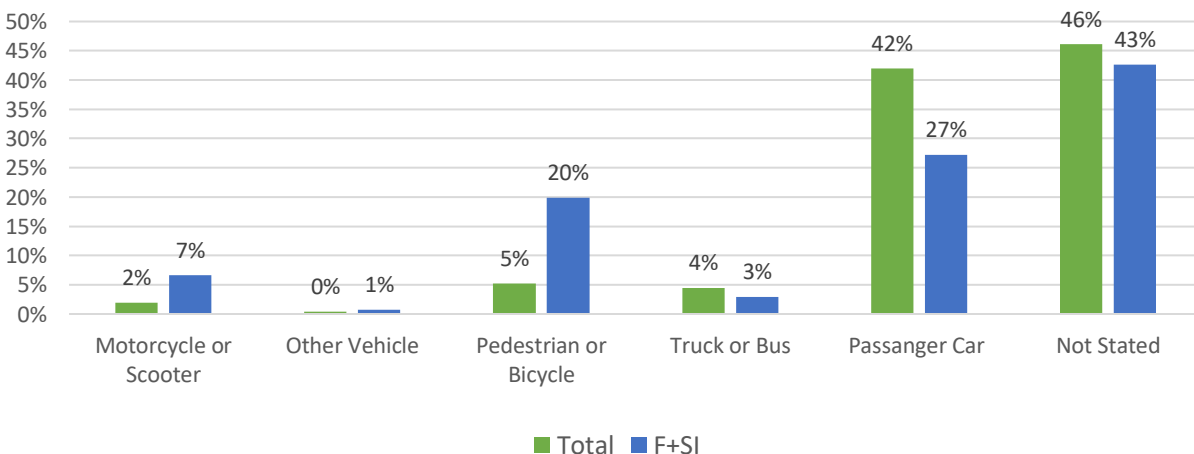
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Time of the Day

For collisions of all severity, the hour with the most number of collisions was between 4:00 p.m. to 5:00 p.m. (8%), while the hour with the fewest number of collisions was between 3:00 a.m. to 5:00 a.m. (1%). For all KSI collisions, maximum number of collisions occurred between 9:00 a.m. to 10:00 p.m. (10%) and between 8:00 p.m. to 9:00 p.m. **Figure 37** illustrates the percentage of collisions occurring during each hour of the day for injury collisions as well as KSI collisions.

Figure 37. Time of the Day: Injury Collisions vs KSI
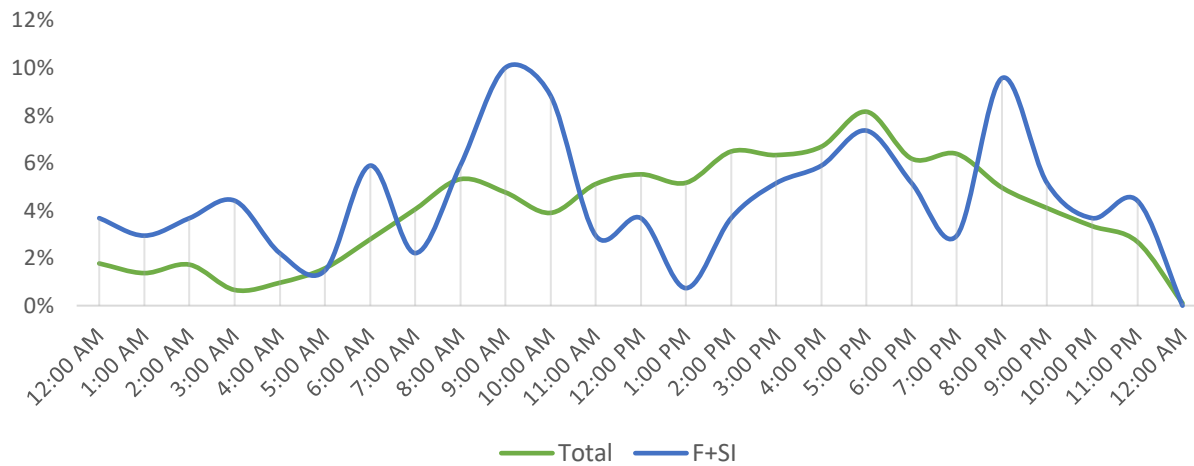
Lighting

For collisions of all severity, 64% of collisions occurred in daylight, while 27% of collisions occurred in the dark on streets with streetlights. For KSI collisions, a higher percentage of crashes occurred in daytime conditions, with 45% of collisions having occurred in daylight and 40% of collisions occurred in the dark on streets with street lights. **Figure 38** illustrates the lighting condition for collisions of all severity and KSI collisions.

Figure 38. Lighting Conditions: Injury Collisions vs KSI Collisions

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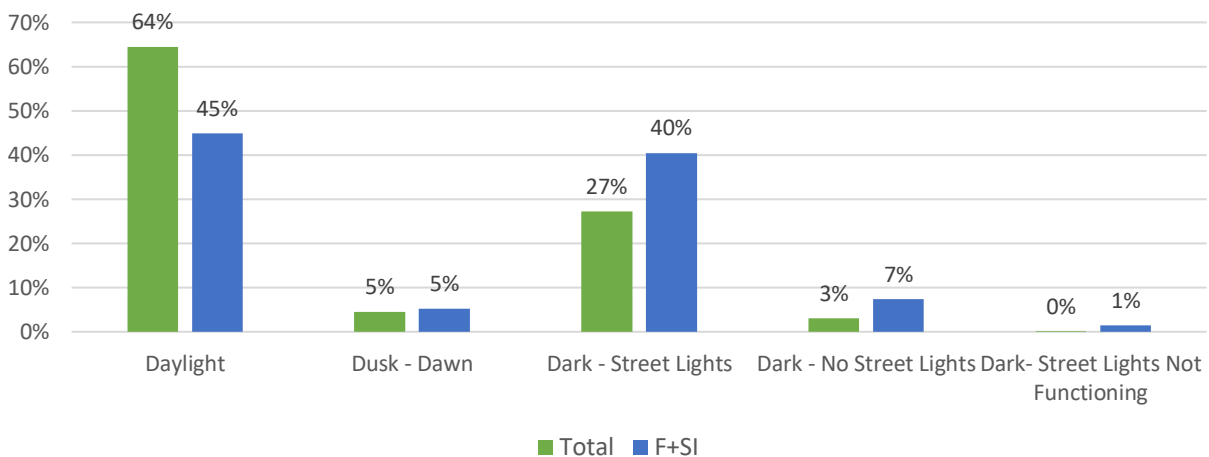
Fatal and Severe Injury Collisions for Expressways

This section describes a detailed collision analysis performed for KSI collisions occurring at roadway segments and intersections in the County of Santa Clara. Of the total 136 KSI collisions that occurred during the study period, 29 collisions (21%) occurred on roadway segments and 107 collisions (79%) occurred at intersections. This distribution is illustrated in **Figure 39** below. **Figure 40** maps the KSI collisions that occurred the County of Santa Clara during the study period.

Figure 39. Intersection vs. Roadway Segment Injury Collisions: KSI Collisions

Collisions on Expressways

Roadway Segment, 26%

Intersection, 74%

KSI Collisions

Roadway Segment, 44%

Intersection, 56%
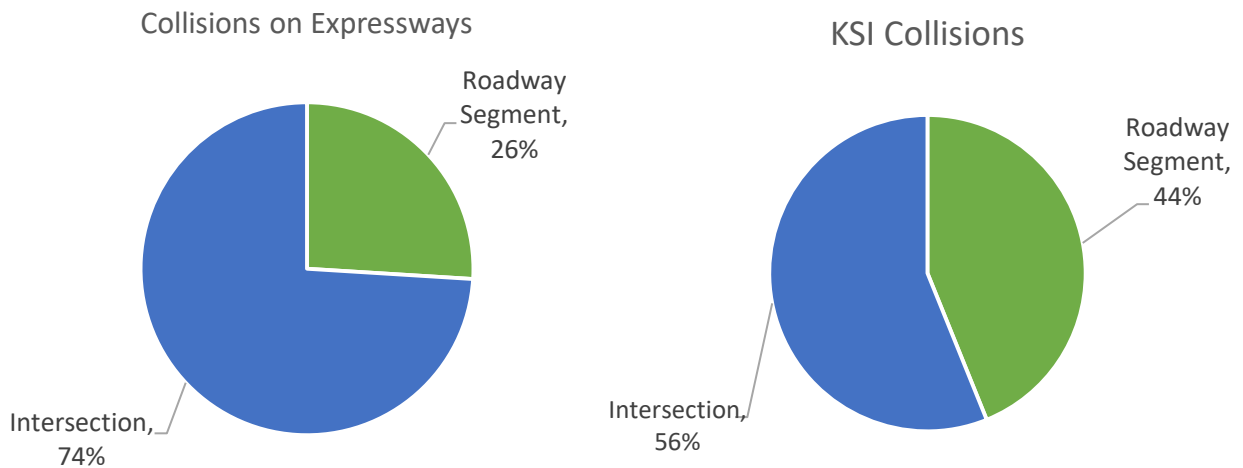
Figure 40. Killed and Severe Injury Collisions for Expressways (2016-2020)

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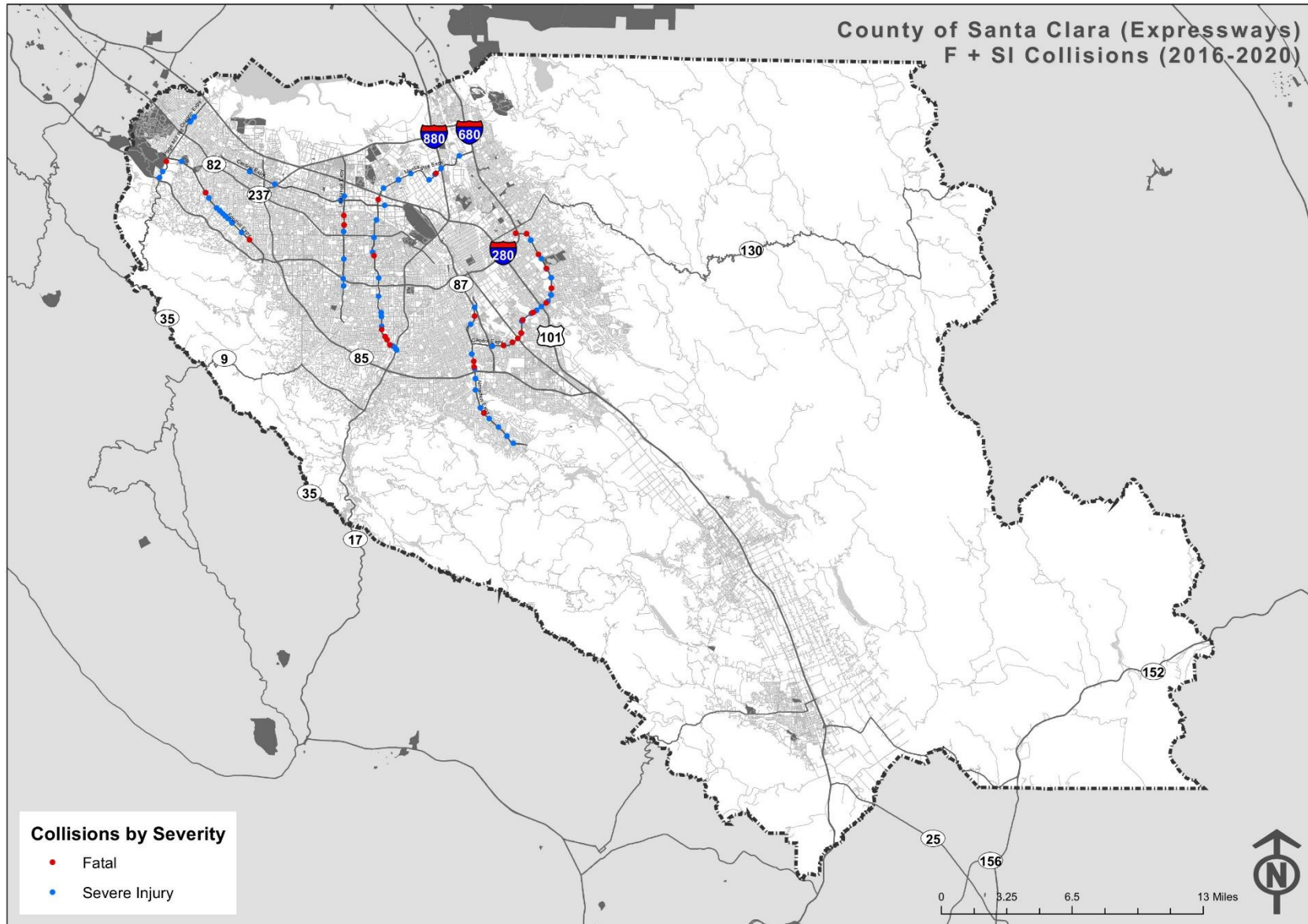
Collision Type and Location Type

Higher frequency of KSI collision type were hit object collisions (34%) on the roadway segments and broadside type collisions (24%) at the intersection, along with hit object (21%) and vehicle/pedestrian (17%) type collisions. Of all KSI collisions 14% were rear end type and sideswipe collisions (10%) that occurred at intersection.

Figure 41 shows killed and severe injury collisions by location type and collision type.

Figure 41. KSI Collision Type vs Location Type
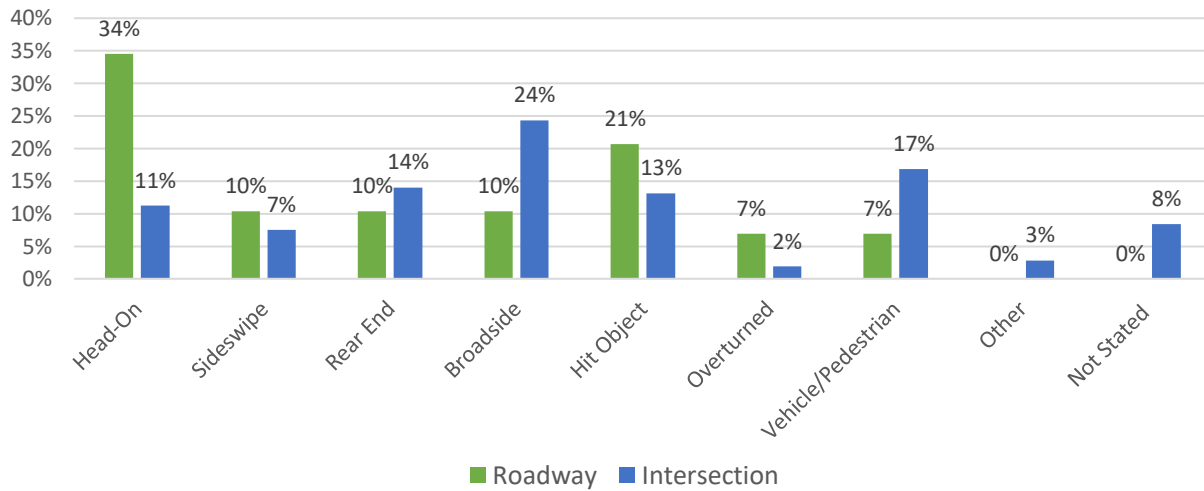
Violation Category and Location Type

The most common violation types among KSI collisions were unsafe speed (21%), traffic signals and signs violation (18%), DUI (19%) and improper turning (15%). These KSI collisions occurred on roadway segment and at the intersection. DUI was the most common violation category along roadway segments, and unsafe speed at intersections. **Figure 42** shows killed and severe injury collisions by location type and violation category.

Figure 42. KSI Collisions: Violation Category vs Location Type
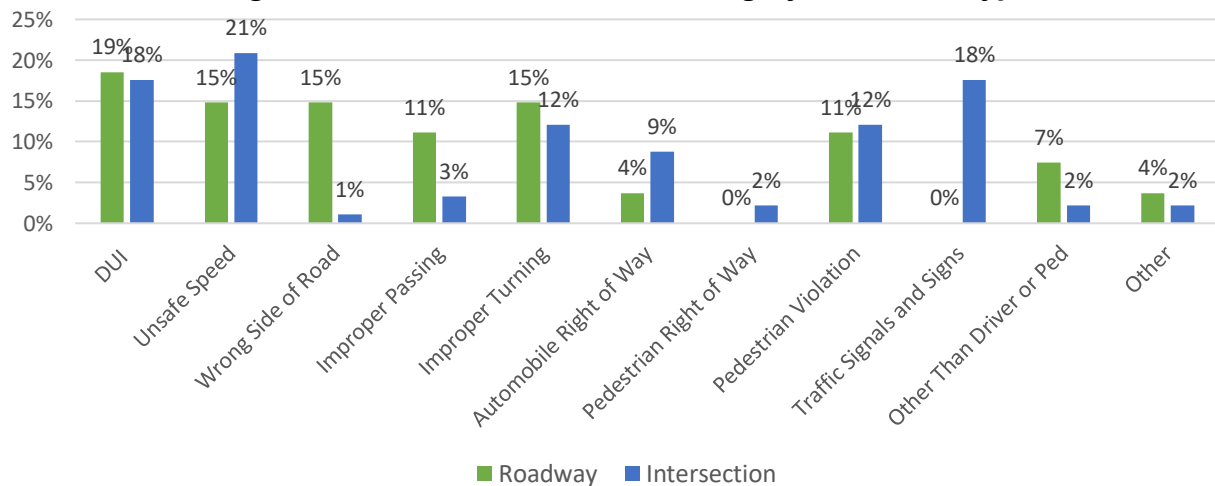
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Motor Vehicle Involved With and Location Type

KSI collisions involving motor vehicle was the most common type of collision occurring at intersections (41% of all KSI collisions). On roadway segments, the most common collision involving motor vehicle (31% of all KSI collisions).

Figure 1 **43** shows killed and severe injury collisions by location type and motor vehicle involved with.

Figure 43. KSI Collisions: Motor Vehicle Involved With vs Location Type
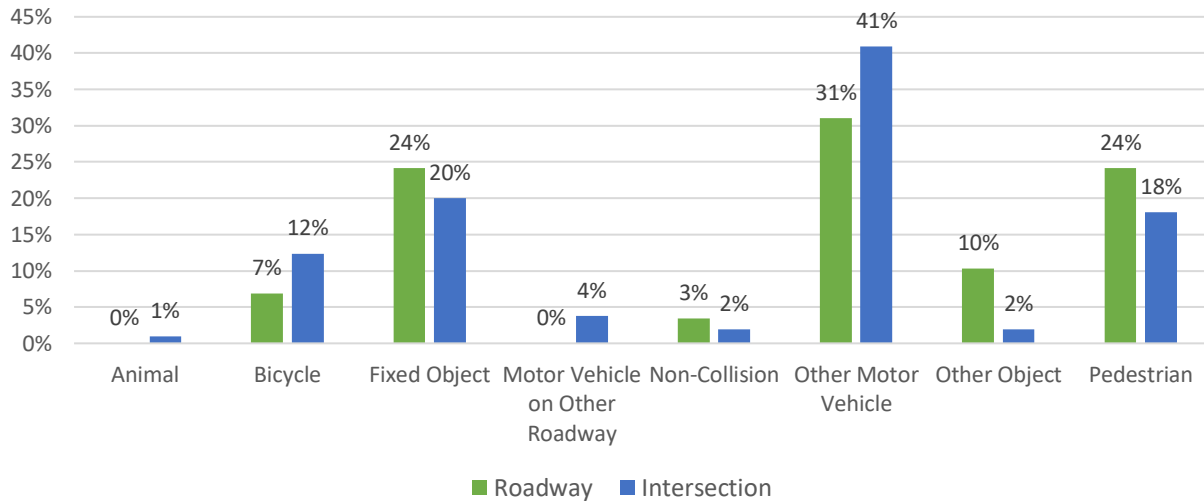
Lighting vs and Location Type

Most KSI collisions occurred during the daylight at the intersection (54%). The second was daylight conditions (11%) occurring on roadway segments. 24% of the collision occurred in the dark with street lights at the intersection and 2% of collision occurred in dark with no street lights.

Figure 44 shows killed and severe injury collisions by location type and lighting conditions.

Figure 44. KSI Collisions: Lighting vs and Location Type
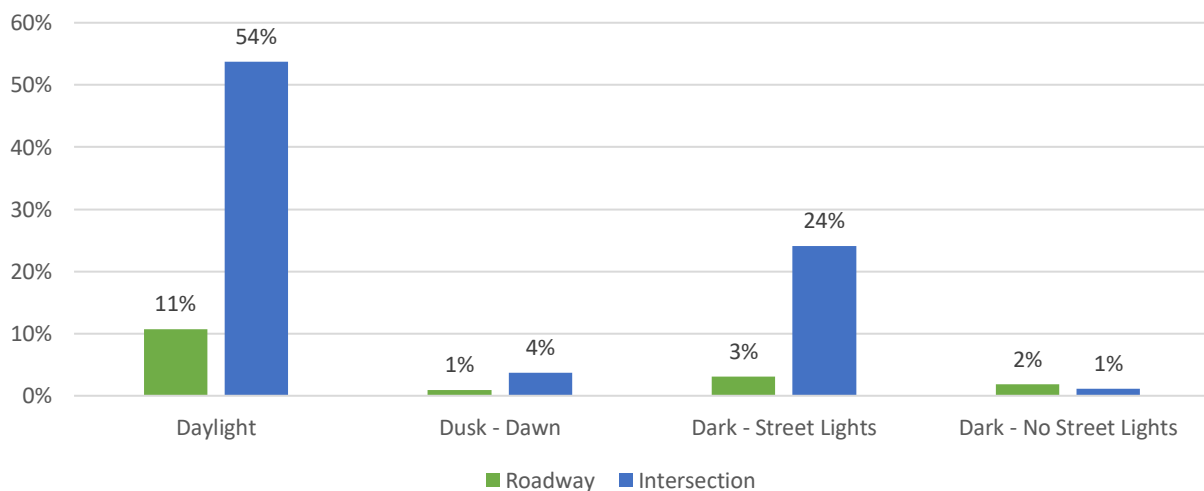
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Time of the Day vs and Location Type

The time duration with the most KSI collisions was during 3:00 p.m. to 6:00 p.m. These primarily occurred at intersections, though the most number of roadway segment KSI collisions occurred between 6:00 p.m. and 9:00 p.m.

Figure 45 shows killed and severe injury collisions by location type and time of day.

Figure 45. KSI Collisions: Time of Day vs Location Type
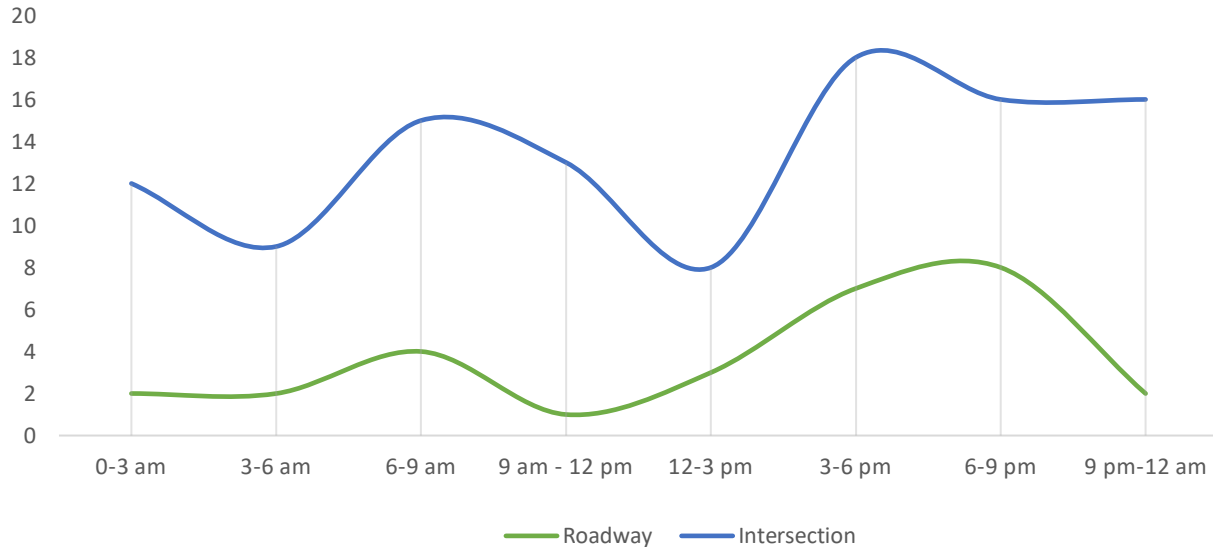
Gender vs Age

For KSI collisions, the gender of the party at fault was much more likely to be male than female (34% of KSI collisions were caused by a male). 0% of the females between 0-14 contribute to KSI Collisions. The largest age group was 20-29 years (55%). Parties at fault under 40 years of age accounts for just under half (52%) of all KSI collisions. **Figure 46** illustrates the gender and age of the party at fault for KSI collisions.

Figure 46. KSI Collisions: Gender and Age
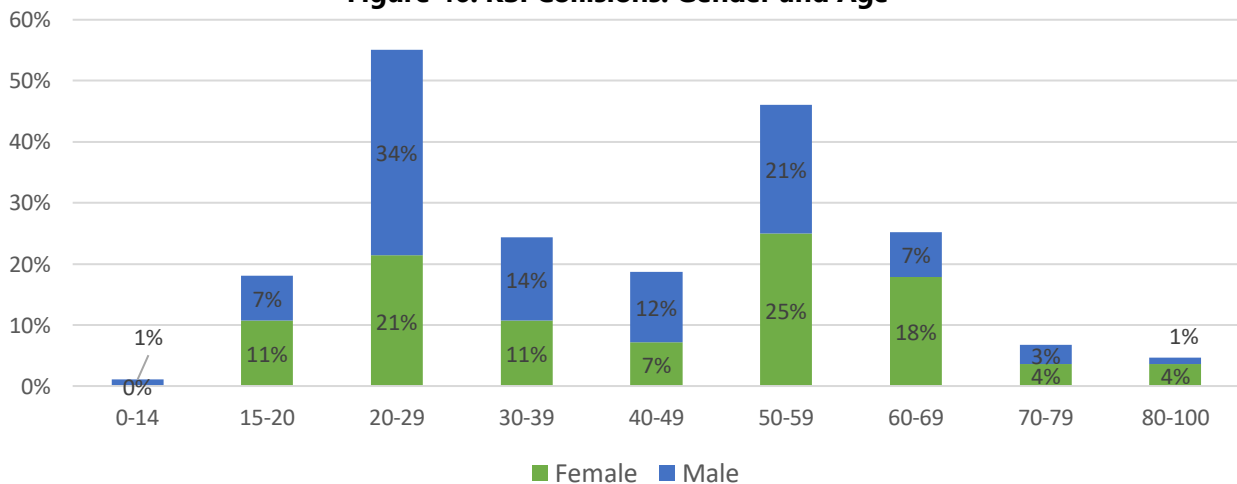
Collision Type vs. Movement Preceding Collision of Party at Fault

The most common type of collision for KSI collisions was broadside collisions. Of these collisions, Proceeding Straight was the most common movement preceding the collision of the party at fault (51% of all KSI collisions), followed by making U-turn (8%). **Figure 47** shows distribution of collision type and the movement by the party at fault preceding the collision.

Figure 47. KSI Collisions by Collision Type and Movement Preceding Collisions of Party at Fault
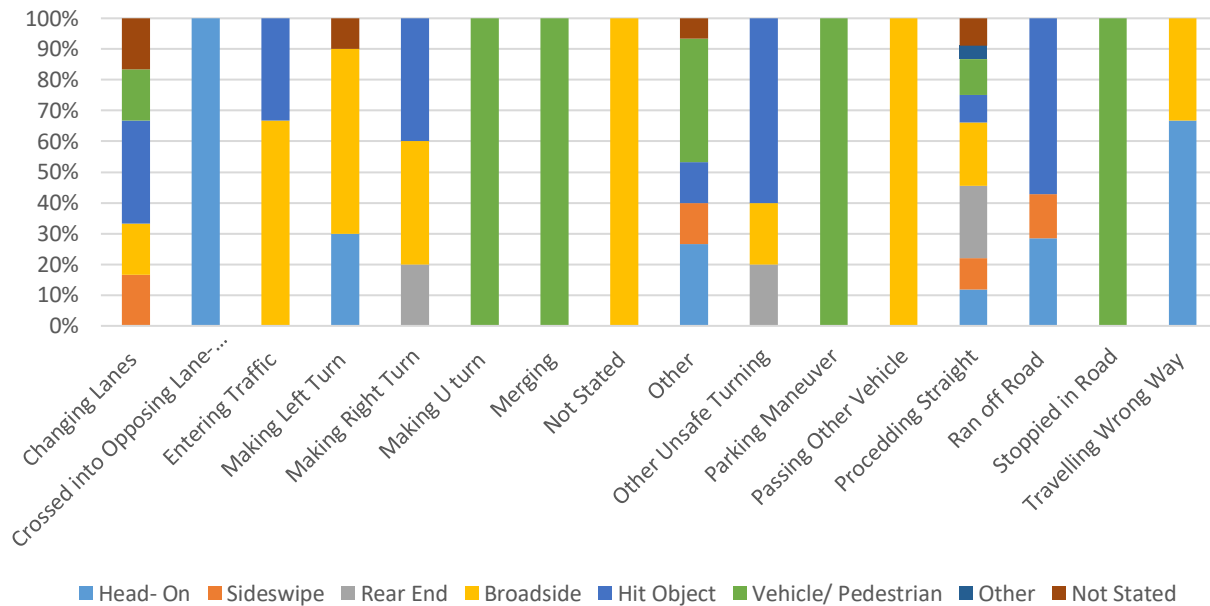
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GEOGRAPHIC COLLISION ANALYSIS

This section describes a detailed geographic collision analysis performed for injury collisions occurring on expressways and at their intersections in the County of Santa Clara. The above collision analysis was used to identify five main collision factors that highlight the top trends among collision on expressways in the County of Santa Clara. These five collision factors were identified to be rear end collisions, broadside collisions, nighttime collisions, unsafe speed violation, and improper turning violation.

Rear End Type Collisions

Rear End collisions caused 42% of all injury collisions, 13% a significant percentage of KSI collisions. It was the most common collision type among KSI collisions. **Figure 48** shows the distribution of rear end collisions on expressways throughout the County of Santa Clara, during 2016 to 2020. Capitol, Almaden and Page Mill-Oregon Expressway have a higher concentration of rear end collisions, compared to other County roads.

Broadside Type Collisions

Broadside collisions represented the highest proportion of collisions of all severity (22%), when 21% collisions considering only KSI collisions. **Figure 49** shows the distribution of broadside collisions on expressways throughout the County of Santa Clara between 2016 and 2020. Capitol, Almaden and Montague Expressway have a higher concentration of broadside collisions, compared to other County roads.

Nighttime Type Collisions

Collisions occurring at night represented only 40% of all injury collisions, 27% of KSI collisions, indicating that lighting may be a factor in those collisions. **Figure 50** shows the distribution of nighttime collisions on expressways throughout the County of Santa Clara between 2016 and 2020. Capitol, Almaden and Montague Expressway have a higher concentration of nighttime collisions, compared to other roads in the County of Santa Clara.

Unsafe Speed Violations

41% of all injury collisions, a significant percentage of KSI collisions (17%) in County were caused by unsafe speed, the highest of any violation type among all injury collisions. **Figure 51** shows the distribution of unsafe speed violation on expressways throughout the County of Santa Clara between 2016 and 2020. Capitol, Almaden and Page Mill-Oregon Expressway have a higher concentration of unsafe speed collisions, compared to other County roads.

Improper Turning Type Collisions

Improper turning collisions accounted for 10% of all KSI collisions (the most of any category), compared to 11% of all injury collisions. **Figure 52** shows the distribution of improper turning violation on expressways throughout the County of Santa Clara between 2016 and 2020. Capitol, Almaden and Page Mill-Oregon Expressway have a higher concentration of improper turning violation collisions, compared to other County roads.

Figure 48. County of Santa Clara Rear End Type Collisions (2016 - 2020)

County of Santa Clara (Expressways)
Rearend Type Collisions
(2016-2020)

Rearend Collisions

Low   High

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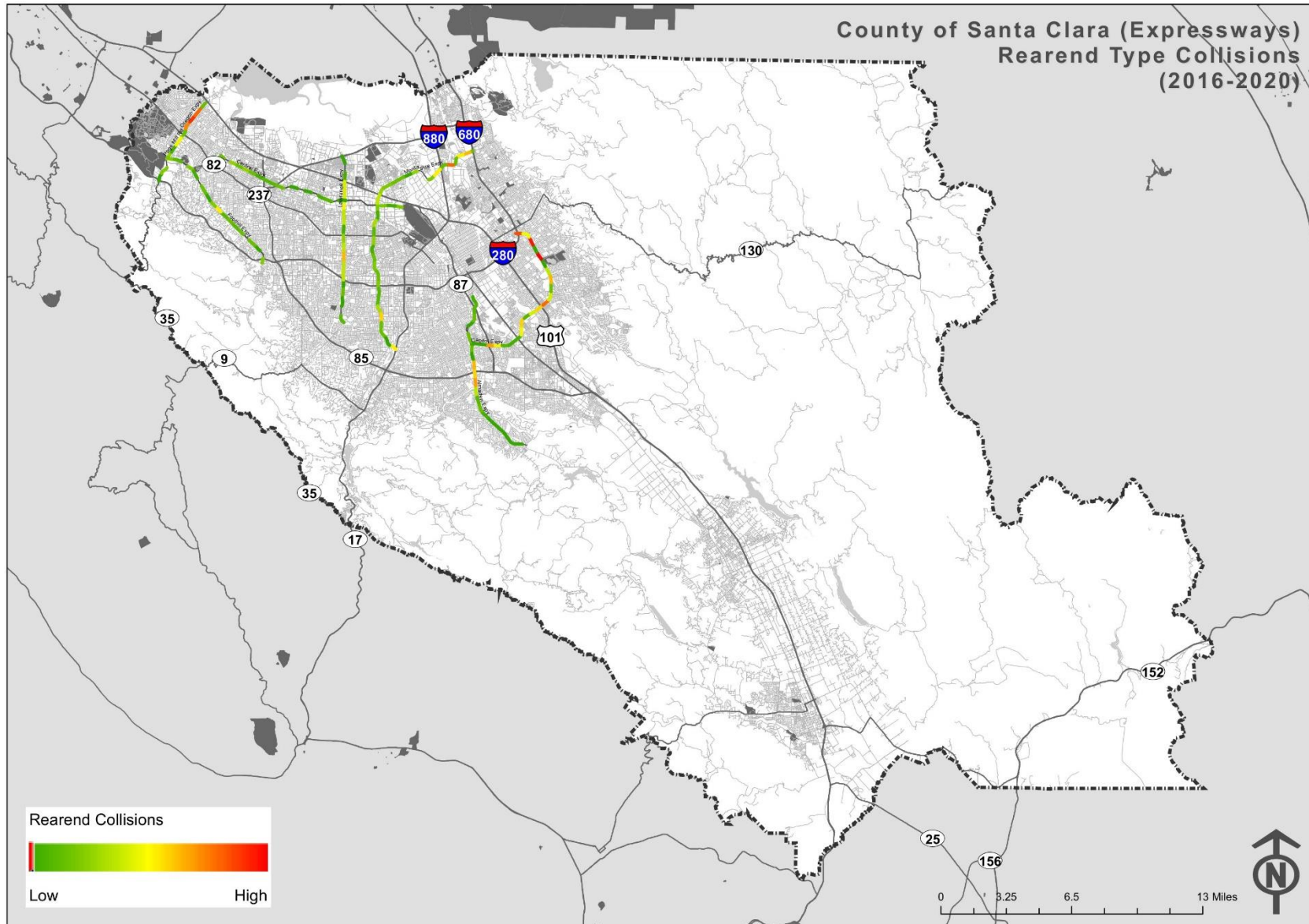
Figure 49. County of Santa Clara Broadside Type Collisions (2016 - 2020)

CALIFORNIA I FLORIDA I TEXAS
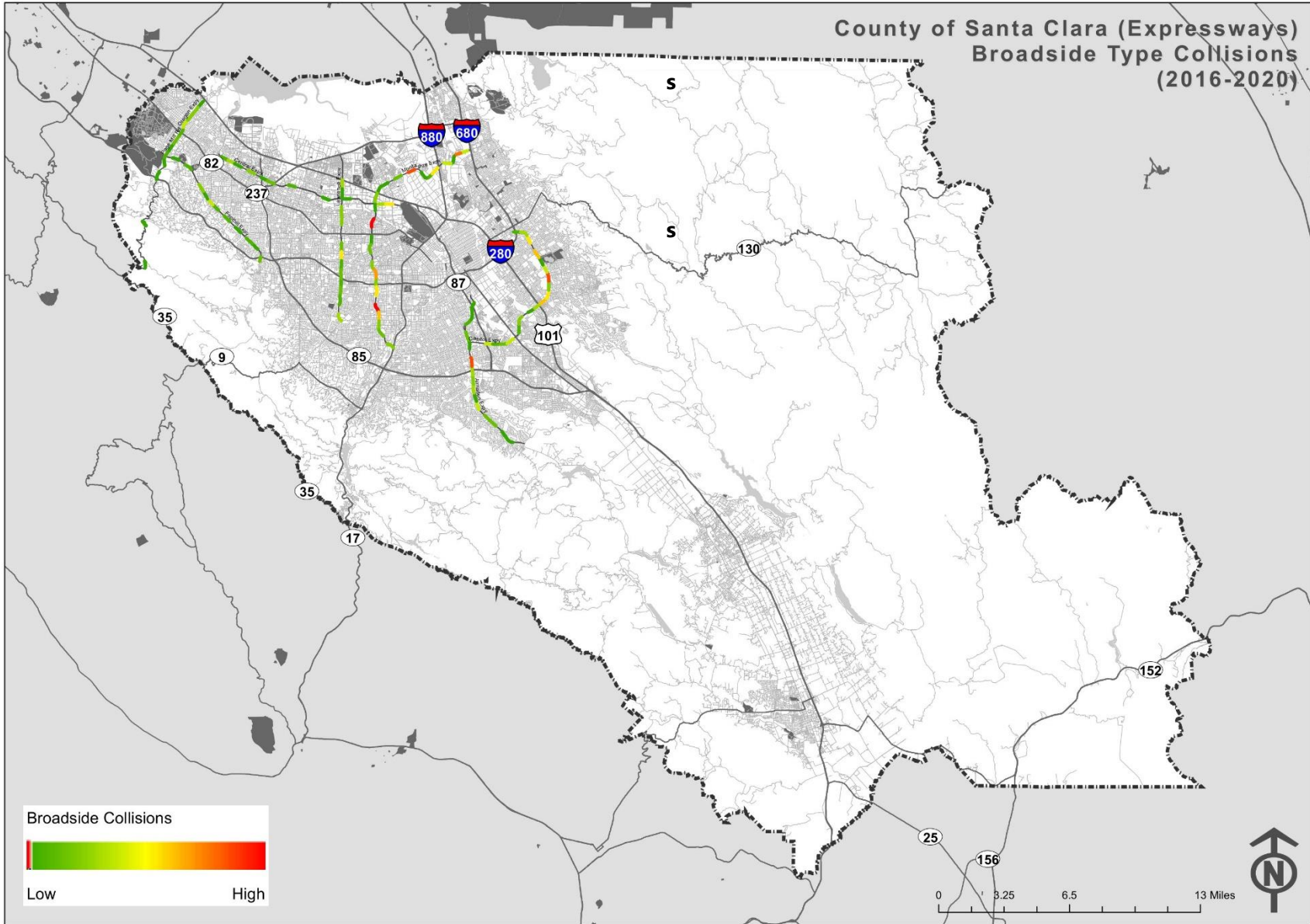
Figure 50. County of Santa Clara Nighttime Type Collisions (2016 - 2020)

County of Santa Clara (Expressways)
Night Time Collisions
(2016-2020)

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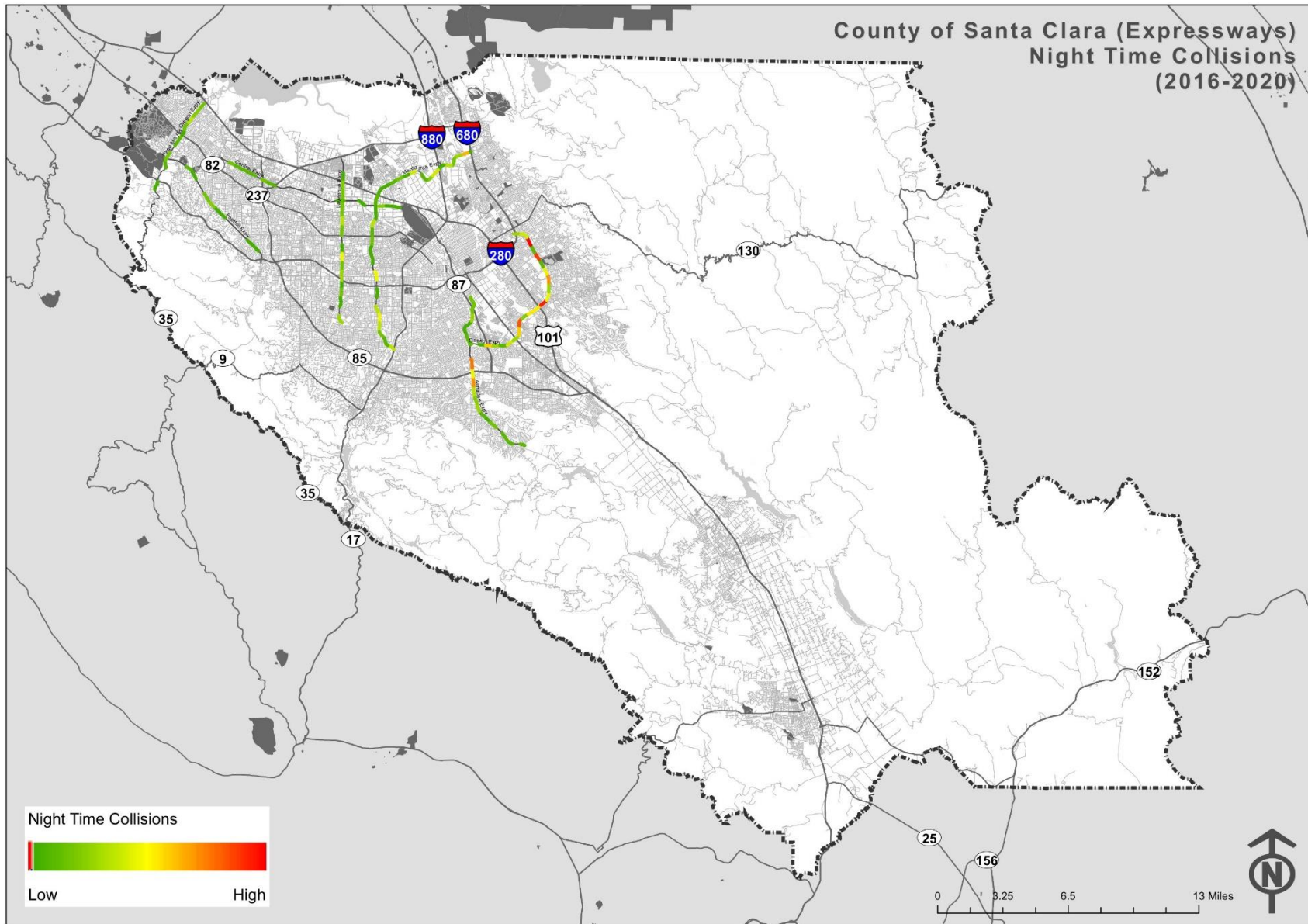
Figure 51. County of Santa Clara Unsafe Speed Violation Collisions (2016 - 2020)

County of Santa Clara (Expressways)
Unsafe Speed Collisions
(2016-2020)

Unsafe Speed Collisions

Low   High

0   3.25   6.5   13 Miles

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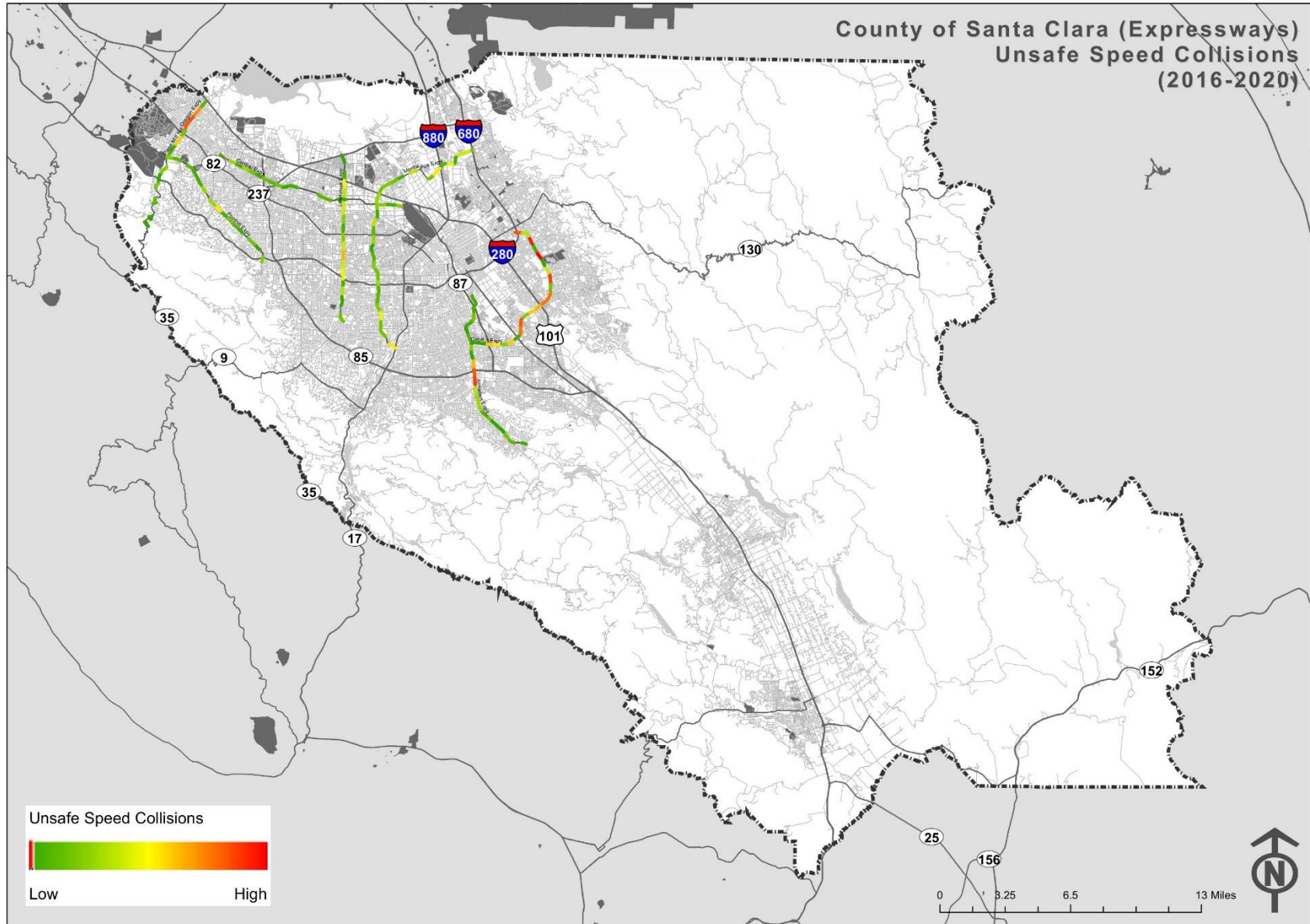
Figure 52. County of Santa Clara Improper Turning Violation Collisions (2016 - 2020)

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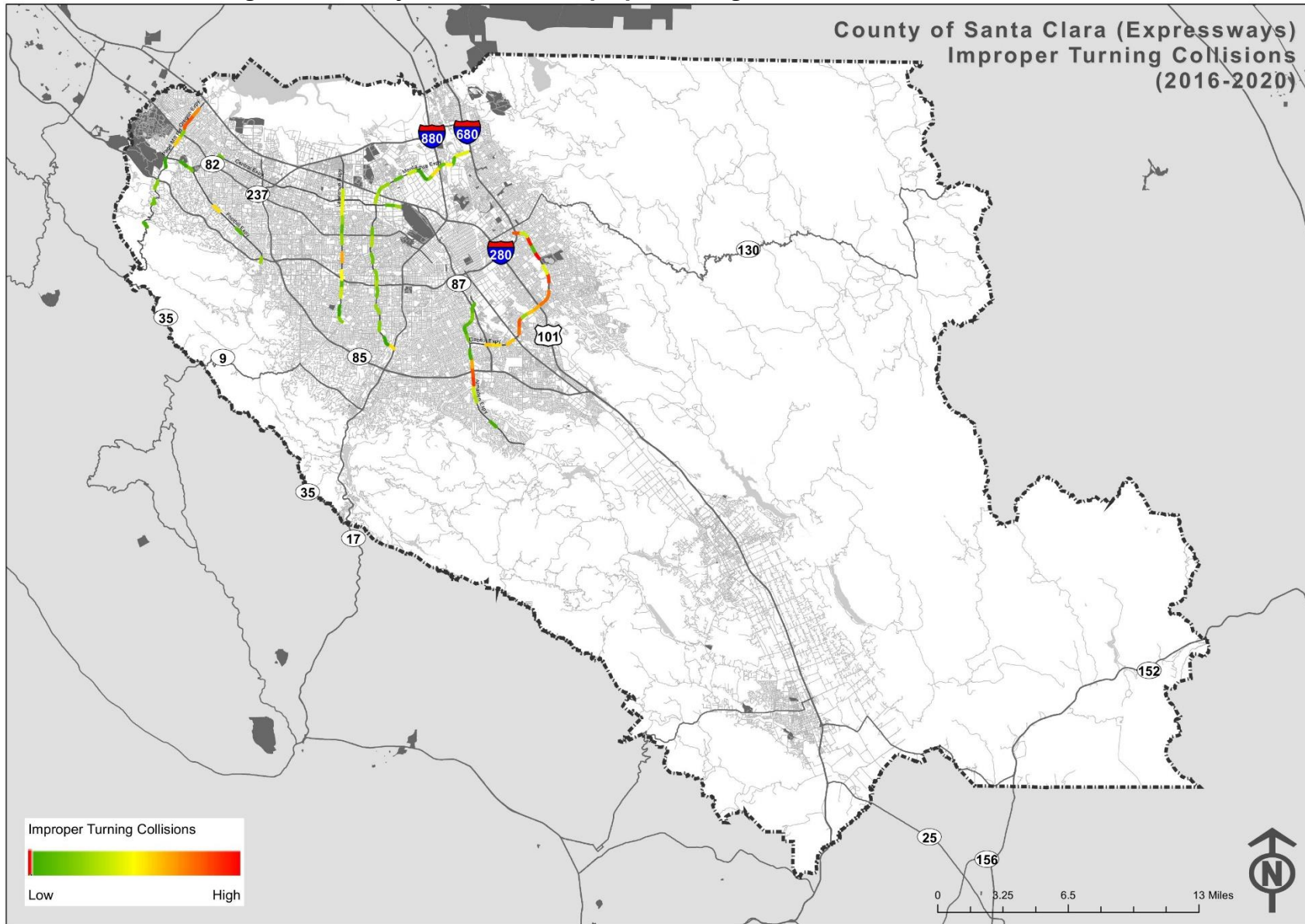
COLLISION TREND ANALYSIS- PEDESTRIAN AND BICYCLE COLLISIONS

Other County Roads

Out of 2,944 injury collisions, 499 collisions (**17**%) involved pedestrian and bicycle collisions. There were 79 KSI (killed and severe injury) collisions, of which 63 collisions (13%) led to a severe injury and 16 collisions (3%) led to a fatality. **Figure 53** illustrates the classification of pedestrian and bicycle collisions based on severity on other county roads.
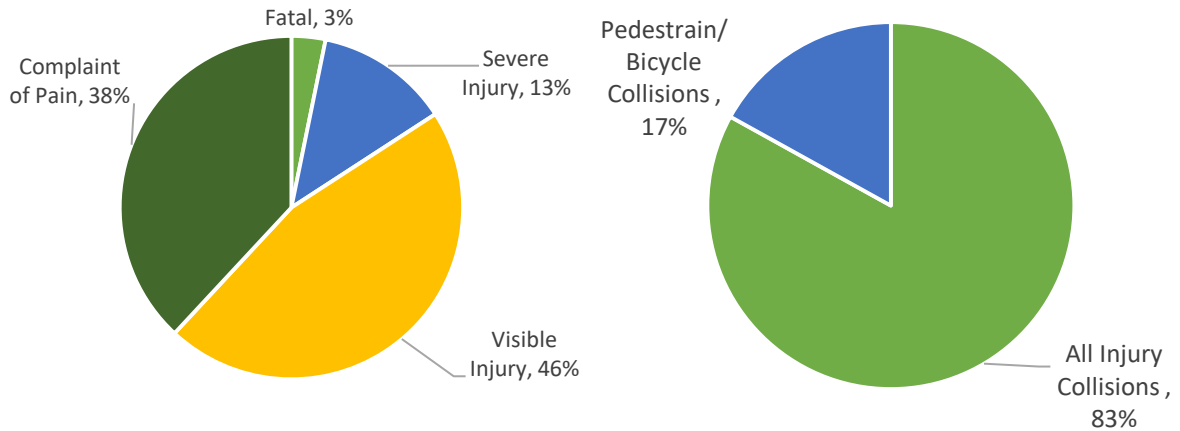
Figure 53: Pedestrian and Bicycle Collisions based on severity (2016-2020)

Table 4. Pedestrian and Bicycle Injury Collision by Severity and Facility Type (Other County Roads) (2016-2020)

Collision Severity	Roadway Segment	Intersection	Total	Percentage
Fatal	6	10	16	3%
Severe Injury	15	48	63	13%
Visible Injury	20	210	230	46%
Complaint of Pain	19	171	190	38%
Total	**60**	**439**	**499**	**100%**

Expressways

Out of 1,976 injury collisions, 187 collisions (**9**%) involved pedestrian and bicycle collisions. There were 41 KSI (killed and severe injury) collisions, of which 24 collisions (13%) led to a severe injury and 17 collisions (9%) led to a fatality. **Figure 54** illustrates the classification of pedestrian and bicycle collisions based on severity on expressways.
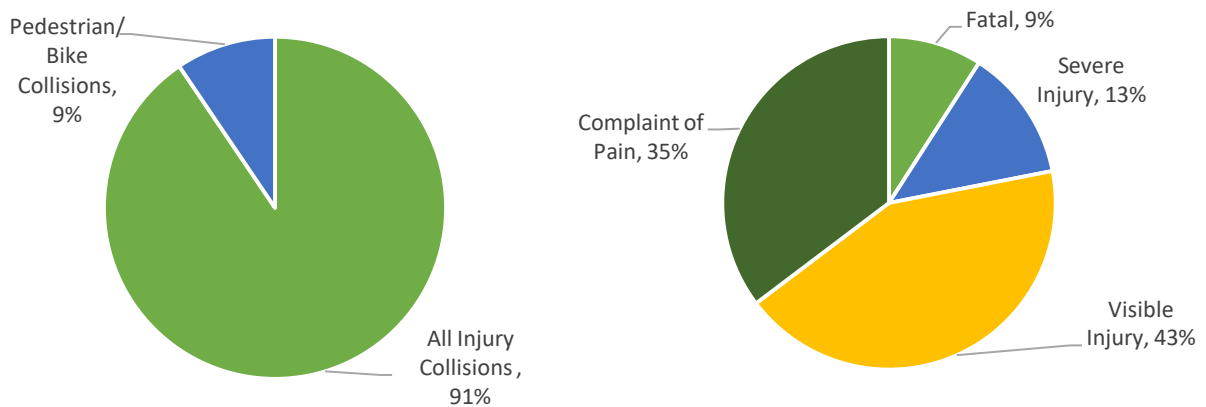
Figure 54: Pedestrian and Bicycle Collisions based on severity (2016-2020)

Table 5. Pedestrian and Bicycle Injury Collision by Severity and Facility Type (Expressways) (2016-2020)

Collision Severity	Roadway Segment	Intersection	Total	Percentage
Fatal	2	15	17	9%
Severe Injury	7	17	24	13%
Visible Injury	10	70	80	43%
Complaint of Pain	13	53	66	35%
Total	**32**	**155**	**187**	**100%**

Figure 55. Pedestrian and Bicycle Injury Collisions for Other County Roads (2016-2020)

Santa Clara County Bike & Pedestrain
Injury Collisions (2016-2020)

Collisions by Severity
- Fatal
- Severe Injury
- Other Visible Injury
- Complaint of Pain

0   3.25   6.5   13 Miles

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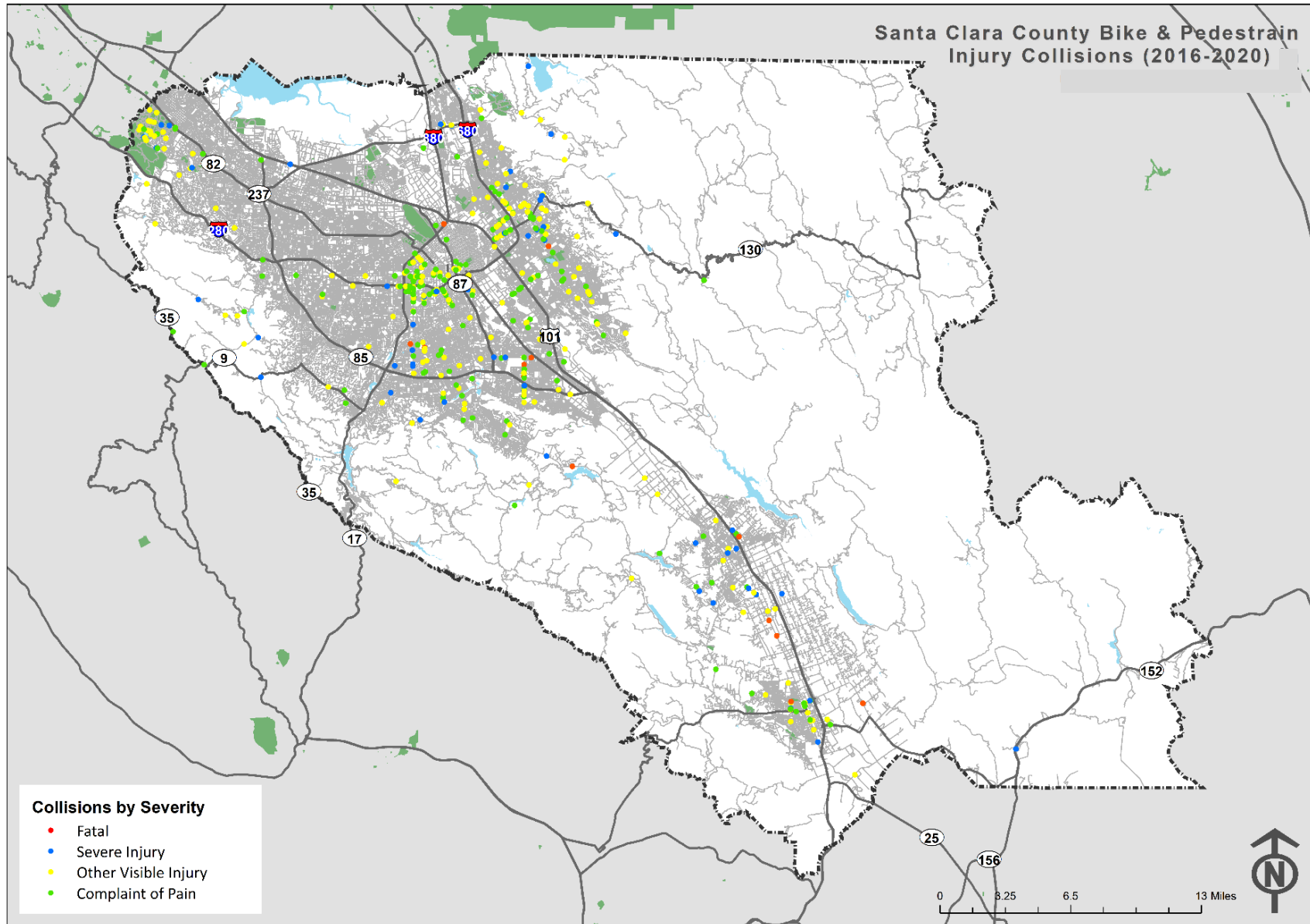
Figure 56. Killed and Severe Injury Collisions for Other County Roads (2016-2020)

Santa Clara County Bike & Pedestrian
Injury Collisions (2016-2020)

Collisions by Severity
- Fatal
- Severe Injury

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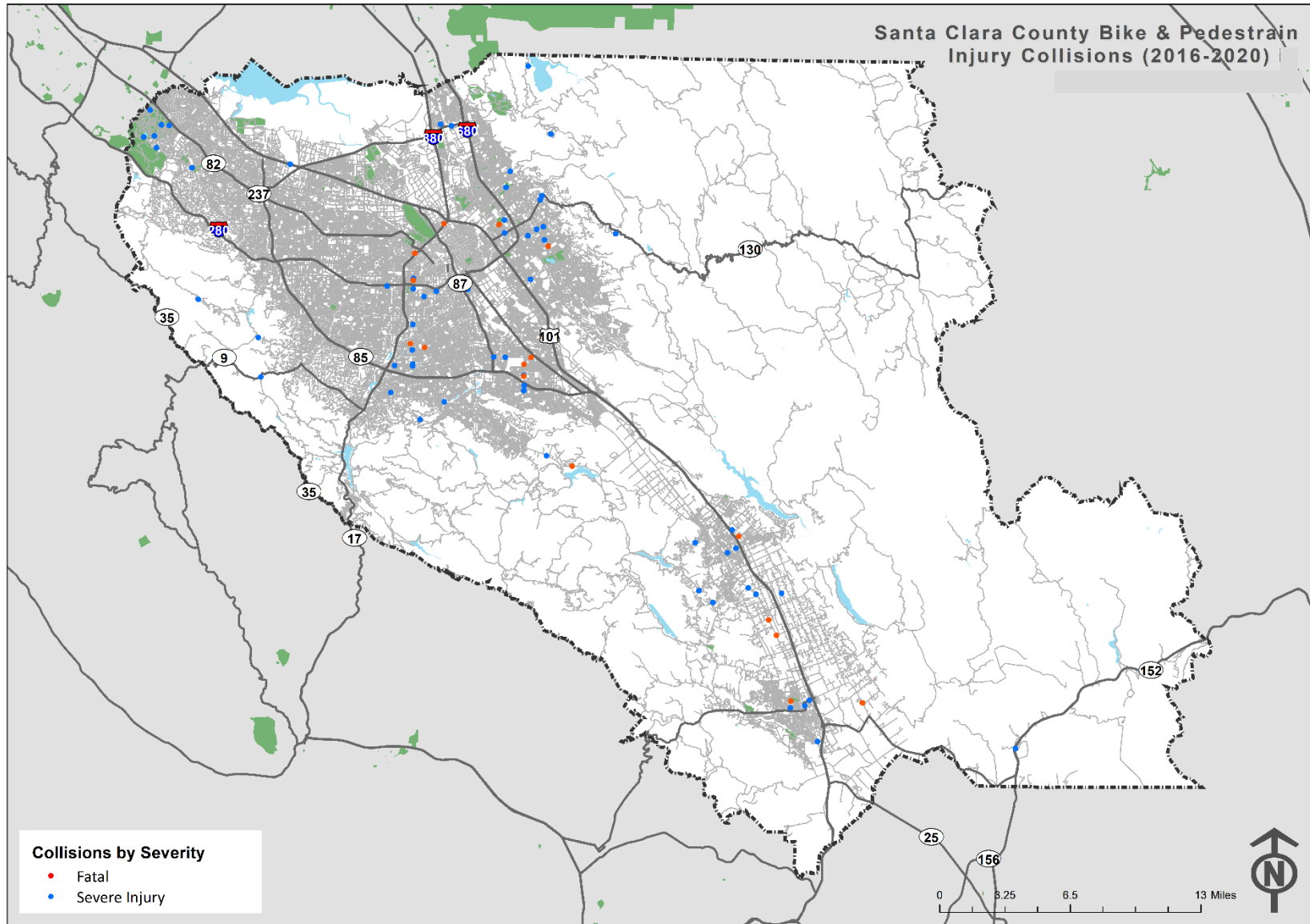
Figure 57. Pedestrian and Bicycle Injury Collisions for Expressways (2016-2020)

Santa Clara County
Bike & Pedestrain
Injury Collisions (2016-2020)

Collisions by Severity
- Fatal
- Severe Injury
- Other Visible Injury
- Complaint of Pain

CALIFORNIA I FLORIDA I TEXAS
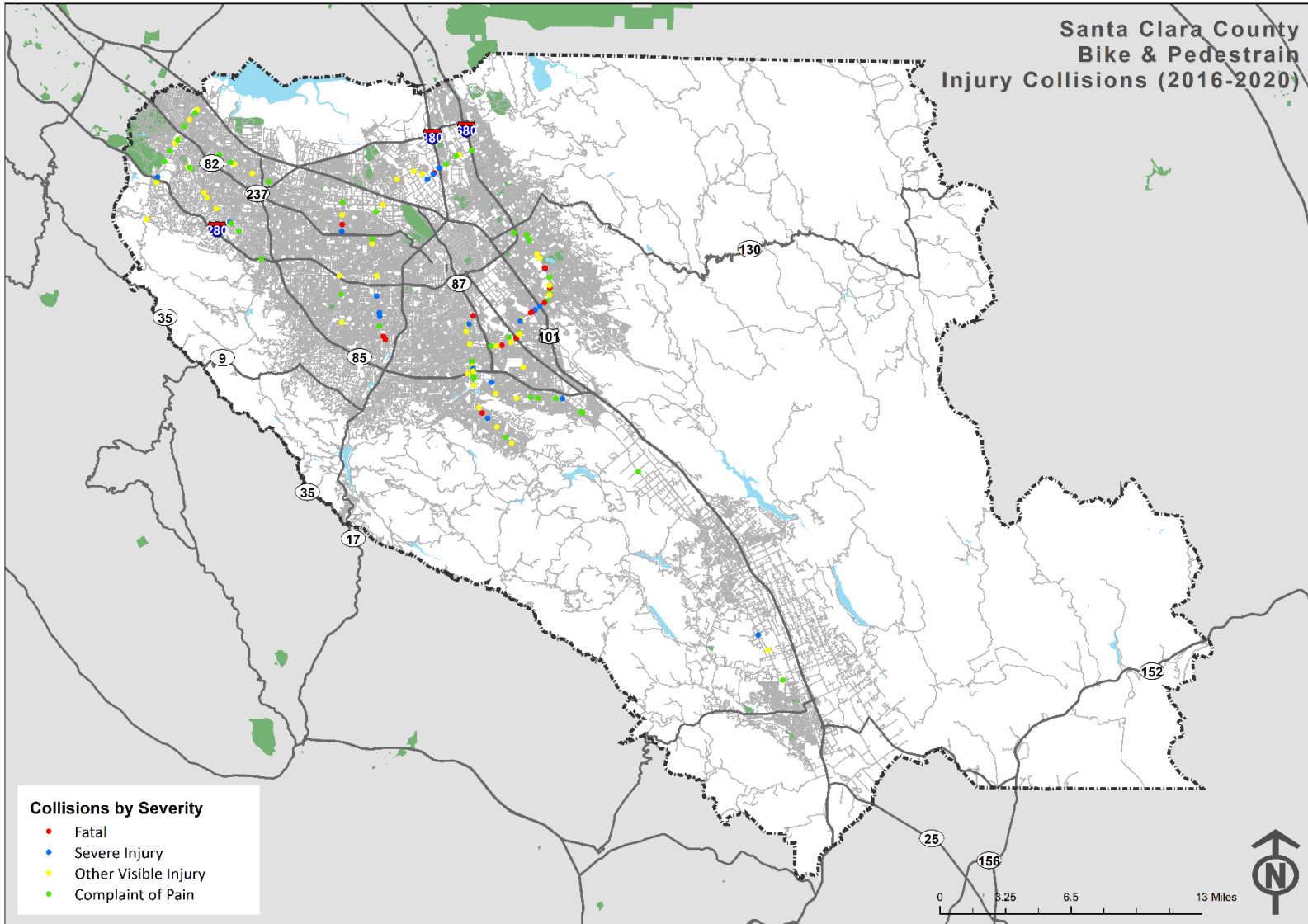
Figure 58. Killed and Severe Injury Collisions for Expressways (2016-2020)

Santa Clara County
Bike & Pedestrain
KSI Collisions (2016-2020)

Collisions by Severity
- Fatal
- Severe Injury

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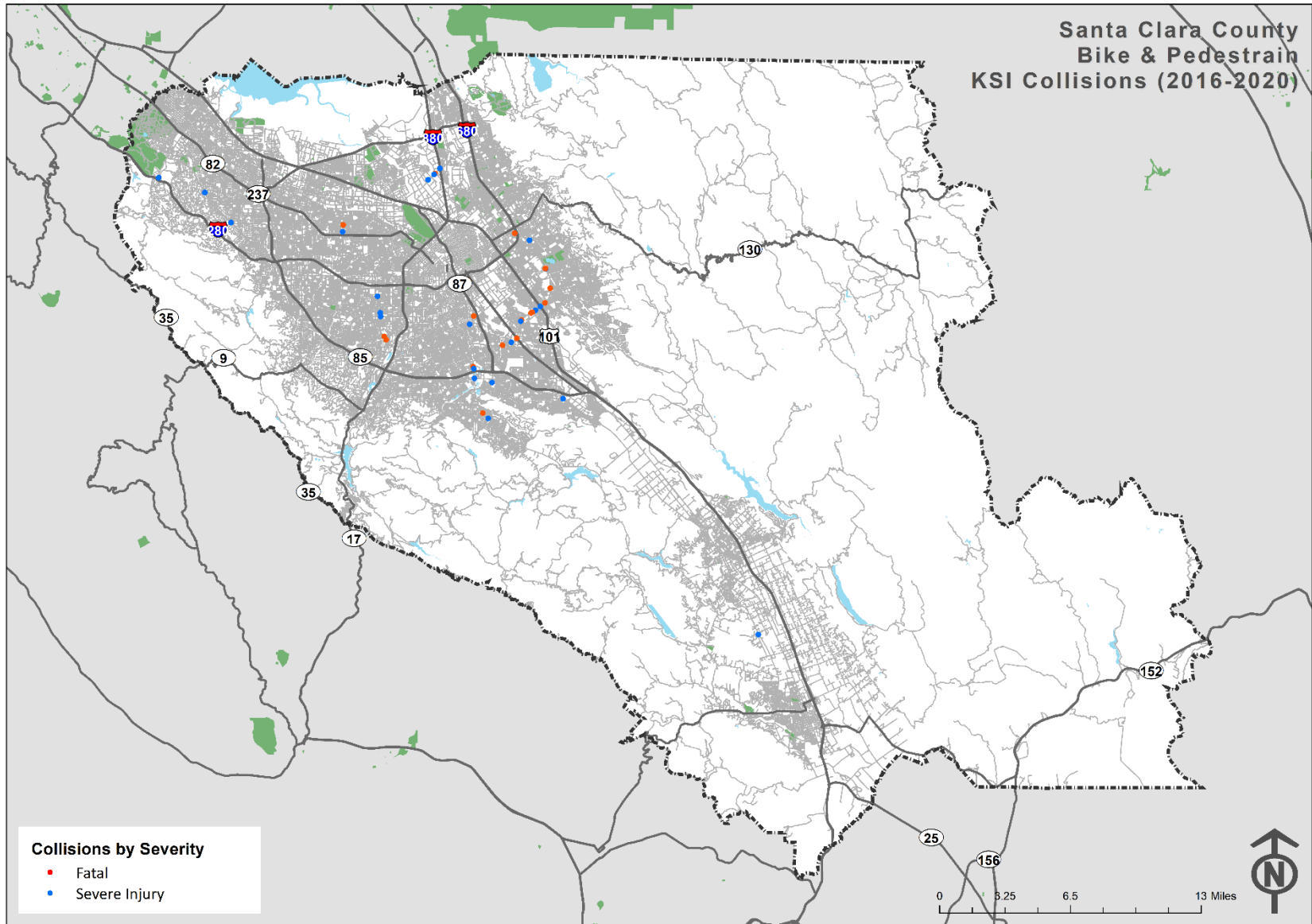
COLLISION TREND ANALYSIS

This section describes collation of geographic collision analysis performed for injury collisions occurring on expressways and other county roads within the County. Below listed are five main collision factors that highlight the top trends among collisions in the County of Santa Clara. These five collision factors are rear end collisions, broadside collisions, nighttime collisions, unsafe speed violation, and improper turning violation. Collation of collision trends between other county roads and expressways is given in **Table 6 and 7**.

Table 6. Injury Collision Trend Analysis (Other County Roads and Expressways)

Collision Trends	Other County Roads (Injury Collisions)	Expressways (Injury Collisions)
Read End Type Collisions	17%	42%
Broadside Type Collisions	**26%**	22%
Nighttime Collisions	17%	**40%**
Unsafe Speed	26%	**41%**
Improper Turning Collisions	18%	10%

Table 7. Killed and Severe Injury Collision Trend Analysis (Other County Roads and Expressways)

Collision Trends	Other County Roads (Injury Collisions)	Expressways (Injury Collisions)
Read End Type Collisions	4%	13%
Broadside Type Collisions	15%	**21%**
Nighttime Collisions	23%	**27%**
Unsafe Speed	18%	17%
Improper Turning Collisions	**24%**	11%

Table 8. Pedestrian and Bike Injury Collision Trend Analysis (Other County Roads and Expressways)

Collision Trends	Other County Roads (Injury Collisions)	Expressways (Injury Collisions)
Pedestrian and Bicycle Collisions	**17%**	**9%**

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COLLISION SEVERITY WEIGHT

Equivalent Property Damage Only (EPDO) method was used to identify the high severity collision network. The EPDO method accounts for both the severity and frequency of collisions by converting each collision to an equivalent number of property damage only (PDO) collisions. The EPDO method assigns a crash cost and score to each collision according to the severity of the crash weighted by the comprehensive crash cost. These EPDO scores are calculated using a simplified version of the comprehensive crash costs per HSIP Cycle 10 application. The weights used in the analysis are shown below in **Table 9**.

Table 9. 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 KSI collisions regardless of location.

EPDO is used because it provides a methodology for the project team to understand the locations in County of Santa Clara that are experiencing the most severe crashes. Because of the high score given to fatal and severe injury crashes, locations that have these types of crashes are more likely to receive a higher EPDO score than other locations that may have more collisions, but fewer fatal or severe injury collisions. Locations that have the highest EPDO scores are selected for inclusion in the High Collision Network, shown in the next section. 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 CROSSROADS 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 injury collisions can then be aggregated in a variety of ways to identify collision patterns, such as location hot-spots. The weighted collisions for the County of Santa Clara were geolocated onto County's road network. GIS is then used to calculate the EPDO score for each roadway segment and intersection citywide, which is then ranked according to its score. **Figure 59 and Figure 60** shows the location and geographic concentration of collisions by their EPDO score.

Figure 59. County of Santa Clara EPDO Score: Other County Roads

County of Santa Clara (Other County Roads)
EPDO Score
(2016-2020)

EPDO Score

Low   High

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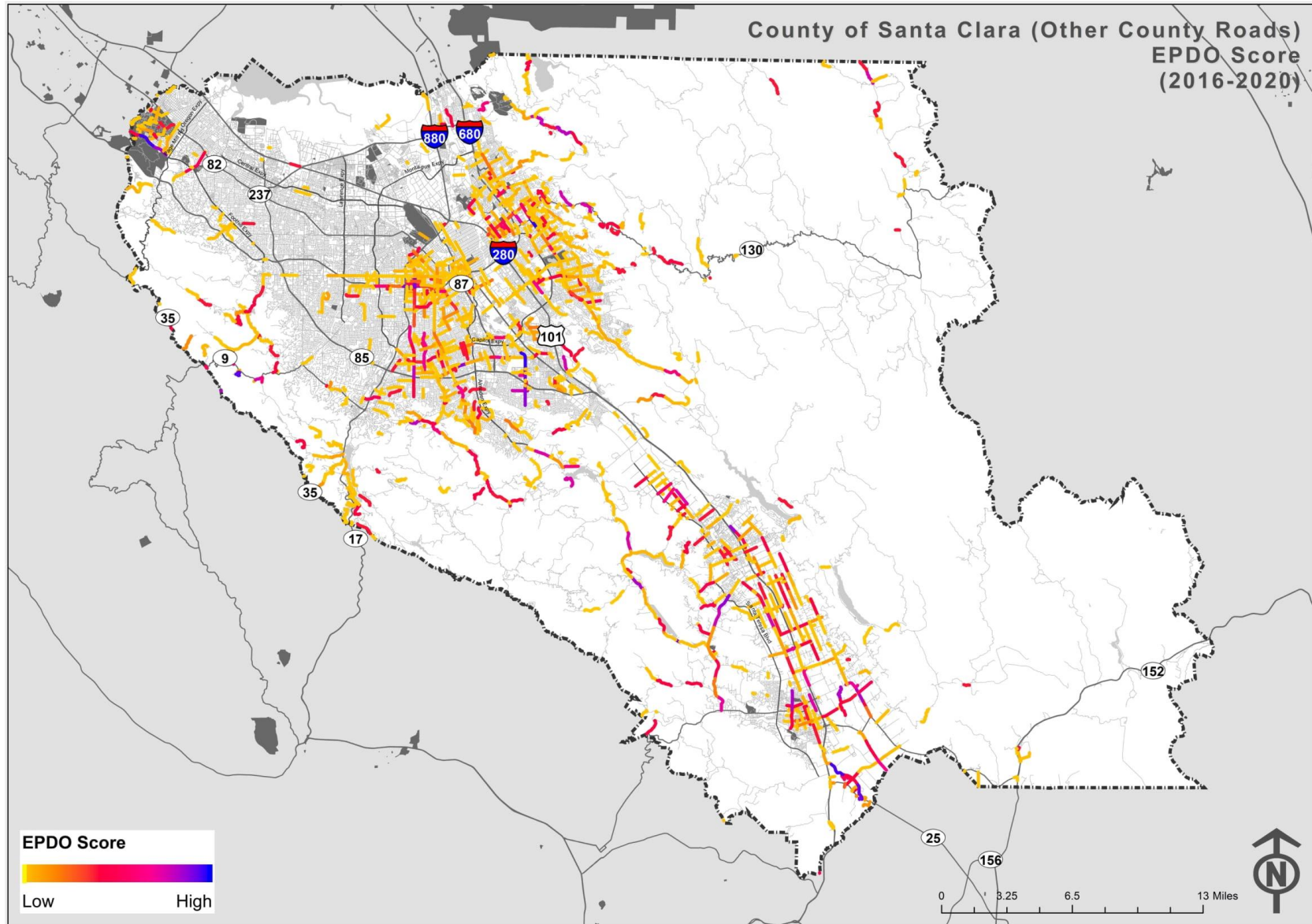
Figure 60. County of Santa Clara EPDO Score: Expressways

County of Santa Clara (Expressways)
EPDO Score
(2016-2020)

EPDO Score
Low — High

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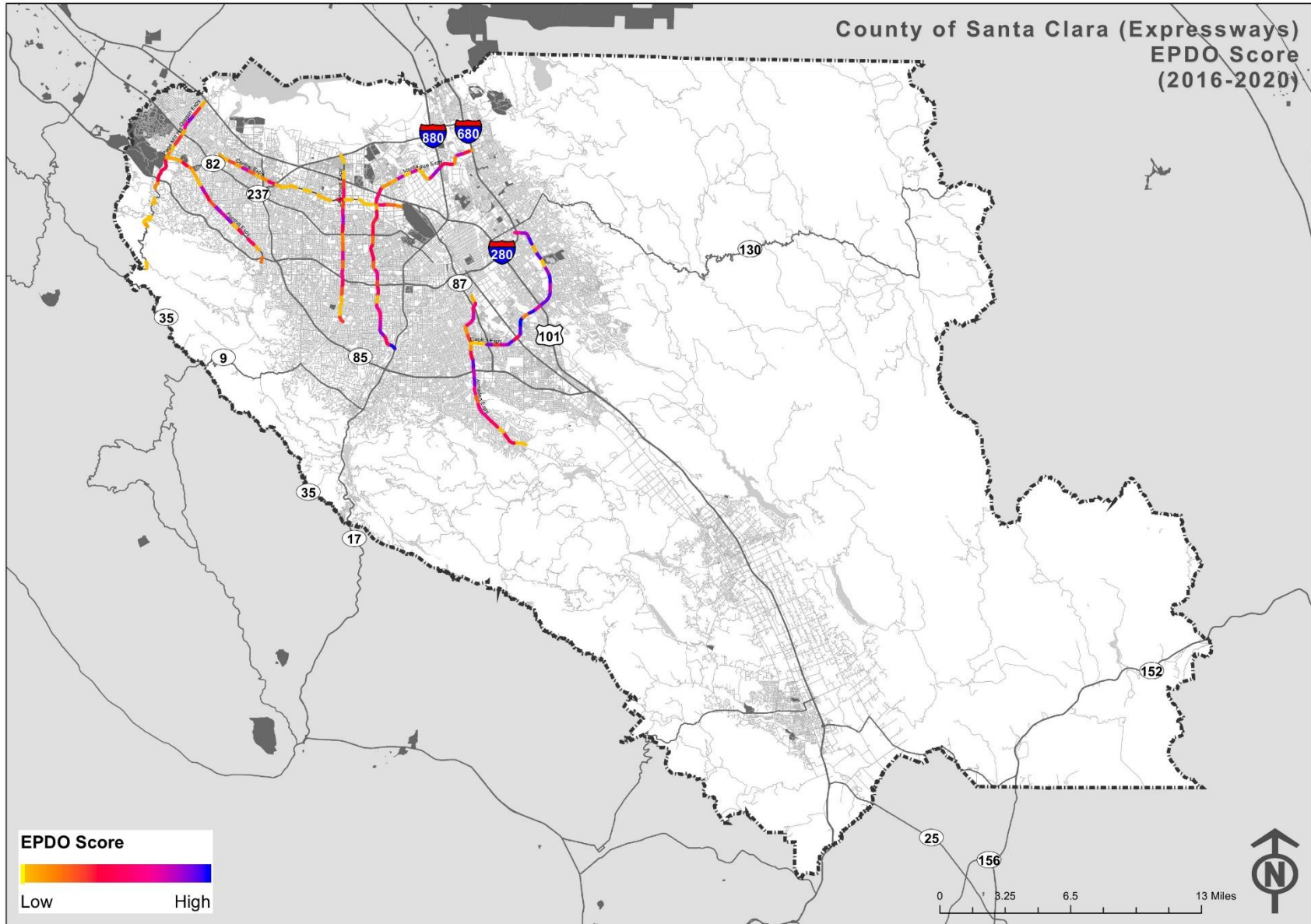
HIGH INJURY NETWORK

Following the detailed collision analysis, the next step was to identify the high-injury roadway segments and intersections in the County of Santa Clara. The methodology for scoring the high injury locations is the same method as used in the severity weight section. **Figure 61** and **Figure 62** shows the top 10 high-collision roadway segments, and top 10 high-collision intersections for other county roads and expressways. **Figure 63** and **Figure 65** identifies top intersections and corridors for pedestrian and bicycle collisions.

For the purposes of the high collision network analysis, intersections include injury collisions that occurred within 250 feet of it and roadways include all collisions that occurred along the roadway except for collisions that occurred directly at an intersection. Such collisions are assigned a 0 value in distance from intersection value column in the CROSSROADS.

Figure 61. County of Santa Clara High Injury Network (Other County Roads)

Couty of Santa Clara (Other County Roads)
High Injury Network
(2016-2020)

ID	Intersection	Total Injury Collisions	KSI Collisions	Severity Weight
1	Uvas Rd (County Rd G8) & Wallace Pl (Non-signalized)	4	3	506
2	Junipero Serra Blvd & Campus Drive (Signalized)	7	2	375
3	Leavesley Rd (County Hwy G9) & Holsclaw Rd (Non-signalized)	4	2	347
4	Moorpark Ave & South Bascom Avenue (signalized)	19	1	283
5	Leavesley Rd (G9) & New Ave (Non-Signalized)	10	1	234
6	Renova Dr & S Bascom Ave (Signalized)	8	1	212
7	Sycamore Avenue & East San Martin Avenue (Non-Signalized)	8	1	207

ID	Corridors	Total	KSI	Length (miles)	Severity Weight
A	Junipero Serra Blvd: Alpine Rd (Northwest County Limit) to Page Mill Road	13	3	2.5	585
B	Uvas Rd (County Rd G8): Casa Loma Rd to Watsonville Rd	8	3	9.7	540
C	Masten Ave: S Valley Frwy to Center Ave	17	2	0.8	435
D	Church Ave: S Valley Freeway (US-101) to De Paul Cir	14	1	2.0	412
E	Holsclaw Rd: Leavesley Rd to Pacheco Pass Hwy (SR 152)	5	0	2.6	353

Legend

⬤ Intersection

— Corridor

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OTHER COUNTY ROADS

Intersection Rankings

7 intersections were identified as high collision intersections. There were a total of 60 collisions and 11 KSI collisions that occurred at these intersections. The intersection of Uvas Rd (County Rd G8) & Wallace Pl and Junipero Serra Blvd & Campus Drive had the highest number of KSI collisions with three.

Table 10 lists the collision rate of the top 7 identified high-risk intersections along with their severity weight and the number of KSI collisions.

Table 10. High Collision Intersections (Other County Roads/Non-Expressways)

ID	Intersection	Total Injury Collisions	KSI Collisions	Severity Weight
1	Uvas Rd (County Rd G8) & Wallace Pl (Non-signalized)	4	3	506
2	Junipero Serra Blvd & Campus Drive (Signalized)	7	2	375
3	Leavesley Rd (County Hwy G9) & Holsclaw Rd (Non-signalized)	4	2	347
4	Moorpark Ave & South Bascom Avenue (signalized)	19	1	283
5	Leavesley Rd (G9) & New Ave (Non-Signalized)	10	1	234
6	Renova Dr & S Bascom Ave (Signalized)	8	1	212
7	Sycamore Avenue & East San Martin Avenue (Non- Signalized)	8	1	207

Corridor Rankings

5 corridors were identified as high collision corridors. There was a total 57 injury collisions and 9 KSI collisions on these corridors. Junipero Serra Blvd and Uvas Rd corridors had the highest number of KSI collisions with 3.

Table 11 lists the collision rate of the top 5 identified high-collision corridors along with the number of KSI collisions, total collisions, corridor length, and severity weight.

Table 11. High Collision Corridors (Other County Roads)

ID	Corridors	Total	KSI	Length (miles)	Severity Weight
A	Junipero Serra Blvd: Alpine Rd (Northwest County Limit) to Page Mill Road	13	3	2.5	585
B	Uvas Rd (County Rd G8): Casa Loma Rd to Watsonville Rd	8	3	9.7	540
C	Masten Ave: S Valley Frwy to Center Ave	17	2	0.8	435
D	Church Ave: S Valley Freeway (US-101) to De Paul Cir	14	1	2.0	412
E	Holsclaw Rd: Leavesley Rd to Pacheco Pass Hwy (SR 152)	5	0	2.6	353

Figure 62. County of Santa Clara High Injury Network (Expressways)

ID	Intersection
1	E Capitol Expressway & Senter Rd (Signalized)
2	E Capitol Expressway & Quimby Rd (Signalized)
3	E Capitol Expressway & Story Rd (Signalized)
4	Almaden Expressway & O' Grady Dr (Signalized)
5	E Capitol Expressway & Seven Trees Blvd (Signalized)
6	E Capitol Expressway & Snell Avenue (Signalized)
7	E Capitol Expressway & Aborn Rd (Signalized)
8	Almaden Expressway & Blossom Hill Rd (County Rd G10) Signalized)
9	E Capitol Expressway & Ocala Avenue (Signalized)
10	E Capitol Expressway & Narvaez Avenue (Signalized)

ID	Corridors
A	Capitol Expressway: S Jackson Avenue to Almaden Expressway (County Road G8)
B	San Thomas Expressway: Bayshore Freeway (Interstate 101) to Camden Ave (SR 17)
C	Foothill Expressway: Page Mill Rd to Junipero Serra Freeway (Interstate 280)
D	Almaden Expressway: Almaden Rd to Harry Rd (County Rd G8)
E	Central Expressway (County Road G6): San Antonio Rd to De La Cruz Blvd
F	Montague Expressway: Bayshore Freeway (Interchange 101) to Landess Ave (Interstate 680)
G	Lawrence Expressway: Southbay Freeway (SR 237-County Highway GZ) to Saratoga Ave
H	Page Mill Rd: El Camino Real (SR 82) to County Limit (South)
I	Oregon Expressway: Interchange 101 to El Camino Real (SR 82)

Legend

⬤ Intersection

━━ Corridor

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EXPRESSWAYS

Intersection Rankings

10 intersections were identified as high collision intersections. There were a total of 311 collisions and 27 KSI collisions that occurred at these intersections. The intersection of E Capitol Expressway & Senter Rd and E Capitol Expressway & Quimby Rd had the highest number of KSI collisions with three and four.

Table 12 lists the collision rate of the top 10 identified high-risk intersections along with their severity weight and the number of KSI collisions.

Table 12. High Collision Intersections (Expressways)

ID	Intersection	Total Injury Collisions	KSI Collisions	Severity Weight
1	E Capitol Expressway & Senter Rd (Signalized)	34	4	900
2	E Capitol Expressway & Quimby Rd (Signalized)	39	3	786
3	E Capitol Expressway & Story Rd (Signalized)	45	3	772
4	Almaden Expressway & O' Grady Dr (Signalized)	29	3	701
5	E Capitol Expressway & Seven Trees Blvd (Signalized)	28	3	700
6	E Capitol Expressway & Snell Avenue (Signalized)	27	3	684
7	E Capitol Expressway & Aborn Rd (Signalized)	23	3	645
8	Almaden Expressway & Blossom Hill Rd (County Rd G10) (Signalized)	33	2	546
9	E Capitol Expressway & Ocala Avenue (Signalized)	38	1	442
10	E Capitol Expressway & Narvaez Avenue (Signalized)	15	2	438

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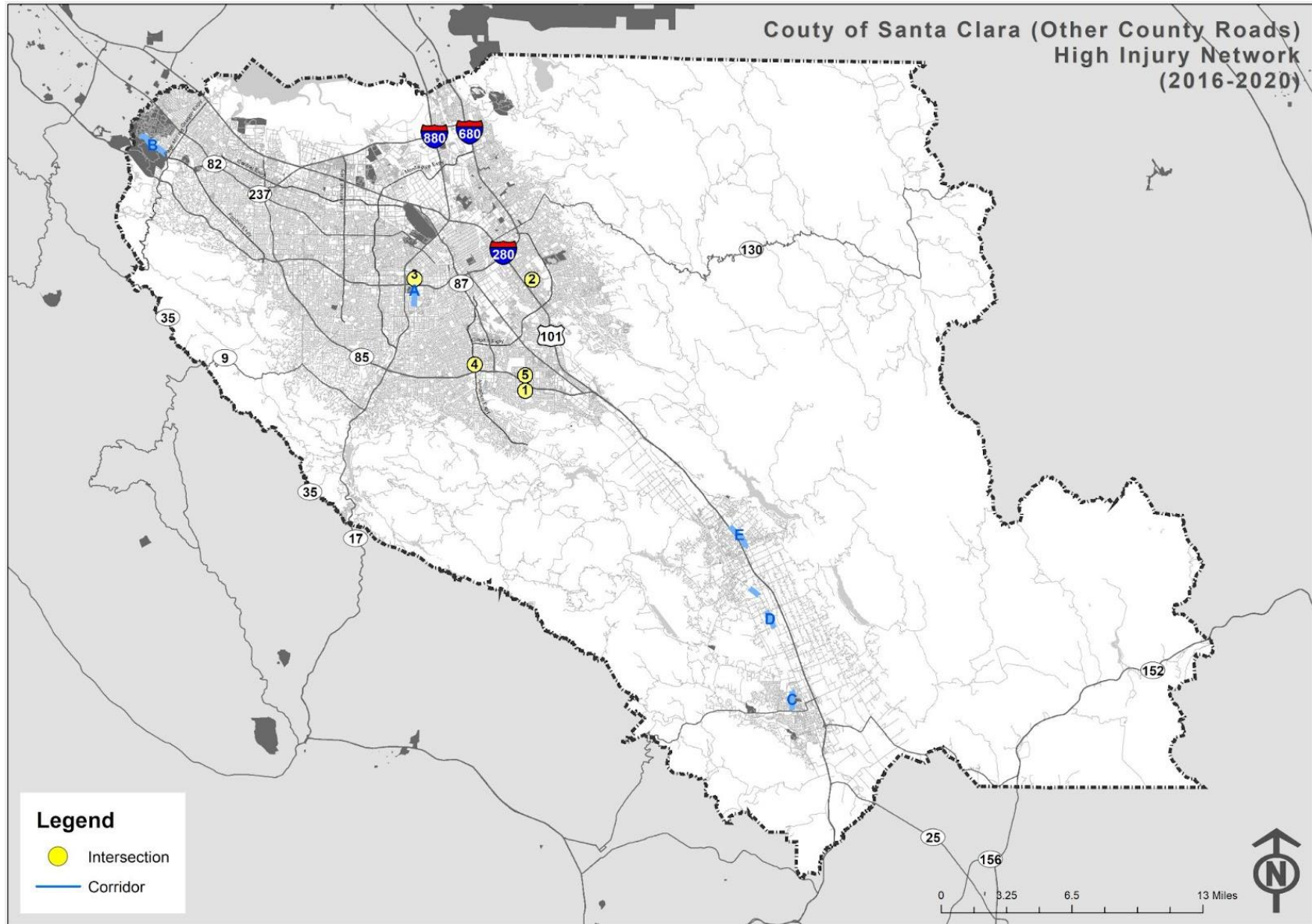
Corridor Rankings

9 corridors were identified as high collision corridors. There was a total 817 injury collisions and 51 KSI collisions on these corridors. Capitol Expressway and San Thomas Expressway had the highest number of KSI collisions with twelve.

Table 13 lists the collision rate of the top 9 identified high-collision corridors along with the number of KSI collisions, total collisions, corridor length, and severity weight.

Table 13. High Collision Corridors (Expressways)

ID	Corridors	Total	KSI	Length (miles)	Severity Weight
A	Capitol Expressway: S Jackson Avenue to Almaden Expressway (County Road G8)	136	12	10.0	2884
B	San Thomas Expressway: Bayshore Freeway (Interstate 101) to Camden Ave (SR 17)	120	12	9.1	2723
C	Foothill Expressway: Page Mill Rd to Junipero Serra Freeway (Interstate 280)	84	10	8.0	2209
D	Almaden Expressway: Almaden Rd to Harry Rd (County Rd G8)	75	5	9.0	1390
E	Central Expressway (County Road G6): San Antonio Rd to De La Cruz Blvd	76	4	11.0	1232
F	Montague Expressway: Bayshore Freeway (Interchange 101) to Landess Ave (Interstate 680)	88	3	6.0	1105
G	Lawrence Expressway: Southbay Freeway (SR 237-County Highway G2) to Saratoga Ave	112	1	8.4	941
H	Page Mill Rd: El Camino Real (SR 82) to County Limit (South)	61	3	11.8	933
I	Oregon Expressway: Interchange 101 to El Camino Real (SR 82)	65	1	2.0	619

Figure 63. County of Santa Clara High Injury Network (Pedestrian and Bicycle-Other County Roads)

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PEDESTRIAN AND BICYCLE

Intersection Rankings (Other County Roads)

3 intersections were identified as high collision intersections. There were a total of 17 collisions and 12 KSI collisions that occurred at these intersections. The intersection of Elliot St and Vaughn Ave had the highest number of KSI collisions with five.

Table 14 lists the collision rate of the top 3 identified high-risk intersections along with their severity weight and the number of KSI collisions.

Table 14. High Collision Intersections (Other County Roads)

| ID	Intersection	Total Injury Collisions	KSI Collisions	Severity Weight
1	Calero Ave & Snell Ave (Signalized)	3	3	341
2	S King Rd & Tully Rd (Signalized)	8	4	222
3	Elliott St and Vaughn Ave (Stop Control)	6	5	215

Corridor Rankings (Other County Roads)

5 corridors were identified as high collision corridors. There was a total 29 injury collisions and 10 KSI collisions on these corridors. S Bascom Ave and Junipero Serra Blvd had the highest number of KSI collisions with two.

Table 15 lists the collision rate of the top 5 identified high-collision corridors along with the number of KSI collisions, total collisions, corridor length, and severity weight.

Table 15. High Collision Corridors (Other County Roads)

ID	Corridors	Total	KSI	Length (miles)	Severity Weight
A	S Bascom Ave: Moorpark Ave to Hamilton Ave	13	2	2.0	416
B	Junipero Serra Blvd: Alpine Rd (Northwest County Limit) to Page Mill Road	6	2	2.5	369
C	Wren Ave: Martelli Dr to First St	4	2	0.7	347
D	Monterey Hwy: Fritzgerald Ave to Watsonville Rd	3	2	4.0	341
E	Condit Rd: E Dunne Ave to Tennant Ave	3	2	1.0	336

Figure 64. County of Santa Clara High Injury Network (Pedestrian and Bicycle-Expressways)

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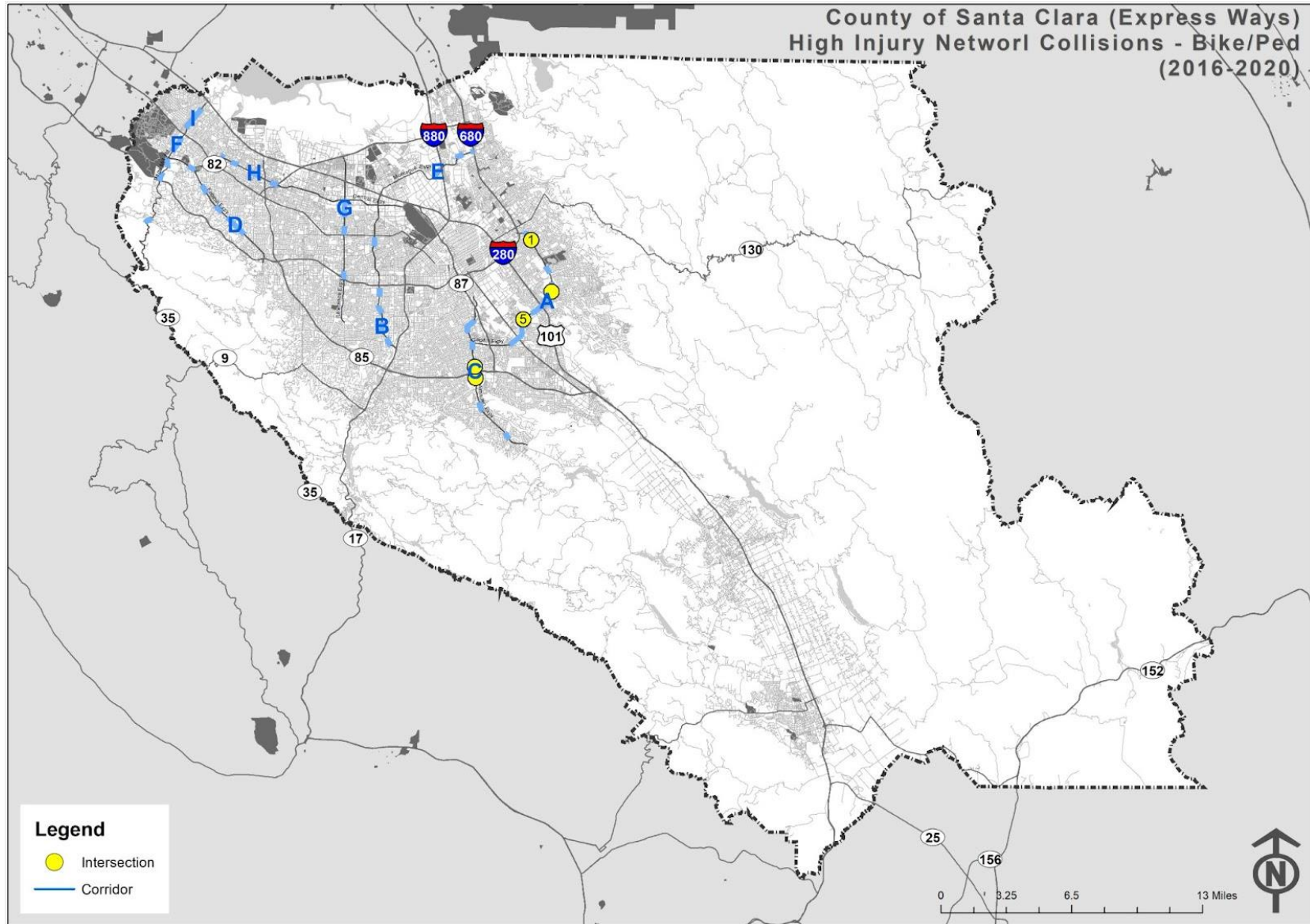
Intersection Rankings (Expressways)

5 intersections were identified as high collision intersections. There were a total of 32 collisions and 7 KSI collisions that occurred at these intersections. The intersection of Capital Expressway & Story Rd and Capitol Expressway & Aborn Square had the highest number of KSI collisions with two.

Table 16 lists the collision rate of the top 5 identified high-risk intersections along with their severity weight and the number of KSI collisions.

Table 16. High Collision Intersections (Expressways)

ID	Intersection	Total Injury Collisions	KSI Collisions	Severity Weight
1	Capitol Expressway & Story Rd (Signalized)	7	2	370
2	Capitol Expressway & Aborn Square Rd (No Control)	3	2	341
3	Almaden Expressway & Cherry Ave (Signalized)	11	1	260
4	Almaden Expressway & Blossom Hill Rd/Co Hwy G8 (Signalized)	6	1	210
5	Capitol Expressway & Senter Rd (Signalized)	5	1	199

Corridor Rankings (Expressways)

9 corridors were identified as high collision corridors. There was a total 75 injury collisions and 17 KSI collisions on these corridors. Capitol Expressway and San Thomas Expressway had the highest number of KSI collisions with six and three.

Table 17 lists the collision rate of the top 9 identified high-collision corridors along with the number of KSI collisions, total collisions, corridor length, and severity weight.

Table 17. High Collision Corridors (Expressways)

ID	Corridors	Total	KSI	Length (miles)	Severity Weight
A	Capitol Expressway: Quimby Rd to Snell Ave	18	6	4.6	1092
B	San Thomas Expressway: Bayshore Freeway (Interstate 101) to Camden Ave (SR 17)	5	3	6.2	507
C	Almaden Expressway: Almaden Rd to Harry Rd (County Rd G8)	14	2	8.0	437
D	Foothill Expressway: Page Mill Rd to Junipero Serra Freeway (Interstate 280)	9	2	9.9	392
E	Montague Expressway: Bayshore Freeway (Interchange 101) to Landess Ave (Interstate 680)	5	2	4.0	353
F	Page Mill Rd: El Camino Real (SR 82) to County Limit (South)	8	1	11.0	227
G	Lawrence Expressway: Buckley St to Stevens Creek Blvd	5	1	2.6	199
H	Central Expressway (County Road G6): San Antonio Rd to Ferguson Drive	7	0	3.1	67
I	Oregon Expressway: Interchange 101 to El Camino Real (SR 82)	4	0	2.0	39

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