

2 TRAFFIC AND SAFETY ANALYSIS

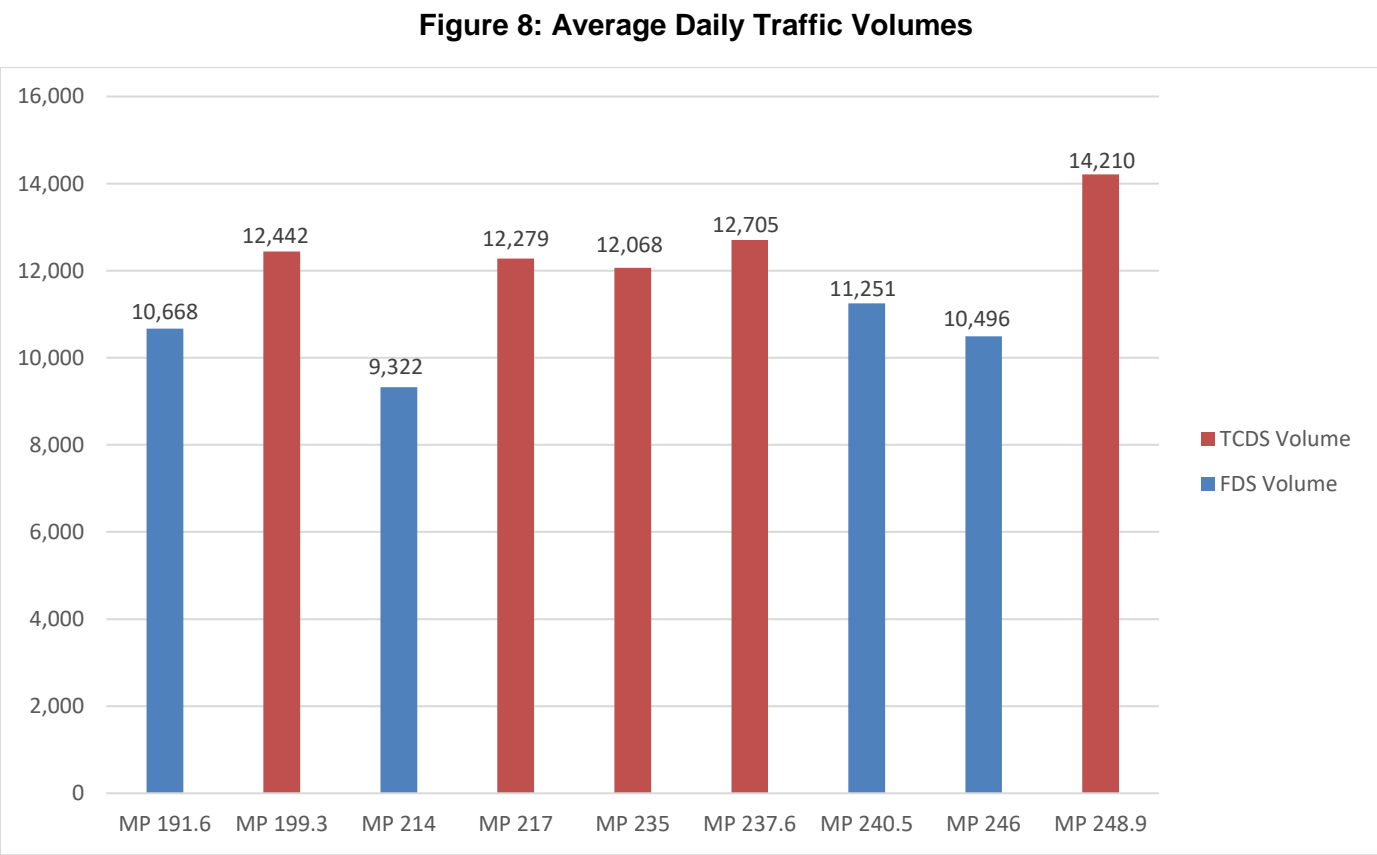
This chapter documents existing and projected traffic volumes, traffic patterns, and operations on SR 87 and intersecting roadways.

2.1 Traffic Data Sources

Traffic data were collected by Field Data Services of Arizona (FDS) on November 29, 2018. Count data collected include 24-hour average daily traffic (ADT) counts at four locations on the mainline of SR 87 as well as on several intersecting streets with SR 87. Data includes vehicle classification counts and speed data at select locations on the mainline SR 87. The collected data was supplemented by ADOT counts as reported to ADOT’s Traffic Count Database System (TCDS). ADT counts were identified at five locations along the analysis corridor using the TCDS.

2.2 SR 87 Daily Traffic Volumes

The bi-directional ADT for each 24-hour count location is provided in **Figure 8**; five of the counts are from the TCDS and four are from FDS. The FDS counts were seasonally-adjusted (increased by 2%) based on data from the continuous count station located at MP 235 (refer to Section 2.3). Daily traffic volumes range from 9,300 to 14,200 vehicles per day throughout the corridor. The highest volumes in the corridor are present on the south side of Payson. The count locations are shown in **Figure 9**.



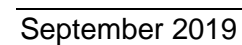
2.3 SR 87 Permanent Counter Station (Seasonal Traffic Fluctuations)

The SR 87 corridor is heavily influenced by seasonal and holiday traffic because it provides a connection between the Phoenix metro area and recreational opportunities in the mountainous northeastern part of the state. To quantify the impacts of summer and holiday travel on the corridor, the continuous count station within the corridor (located at MP 235, south of the intersection with SR 188) was analyzed for holiday and typical summer weekend travel.

Directional traffic volumes were analyzed throughout 2018 for weekdays, Fridays, Saturdays, and Sundays to assess the impact of summer travel on the corridor. Traffic volumes by day and month are provided in **Table 7** along with the total weekend travel volume (sum of Friday, Saturday, and Sunday). A comparison of the monthly average weekday and weekend volumes to the annual average weekday and weekend volumes on the SR 87 corridor at the location of the continuous count station (ID 100983, south of the SR 188 junction) shows that July is the month with the highest seasonal variation in volumes, with the July average weekday volumes being 127% of the annual average weekday volumes and the July average weekend volumes being 131% of the annual average weekend volumes.

Table 7: Traffic Volumes by Month, 2018

Month	Avg. Weekday Volume	% of Annual Avg. Weekday Volume	Avg. Friday Volume	Avg. Saturday Volume	Avg. Sunday Volume	Avg. Weekend Volume	% of Annual Avg. Weekend Volume	% of Annual Avg. Weekly Traffic
January	9,130	80%	11,610	10,608	11,523	11,065	70%	77%
February	9,063	80%	11,716	11,614	12,317	11,965	76%	79%
March	11,412	100%	15,069	14,150	14,333	14,219	90%	96%
April	10,959	96%	15,228	14,632	17,280	15,956	101%	99%
May	11,500	101%	17,329	16,120	17,819	16,970	107%	103%
June	13,134	116%	18,004	15,977	19,359	17,668	112%	114%
July	14,174	125%	20,726	18,447	22,381	20,633	131%	127%
August	11,683	103%	19,155	17,230	21,300	18,587	118%	105%
September	12,199	107%	18,265	16,405	19,582	17,993	114%	112%
October	11,651	103%	17,536	15,103	17,917	16,510	104%	103%
November	11,312	100%	13,902	14,538	15,721	15,129	96%	98%
December	10,099	89%	12,299	12,923	13,118	13,020	82%	88%
Avg. Traffic	11,360	-	15,903	14,812	16,887	15,810	-	-
AADT	12,068 vehicles per day							



Weekend traffic volumes during the summer can be nearly double those observed during the winter months. In addition, holiday weekends experience the highest traffic volumes. On Sunday, July 8, 2018, the permanent count station recorded a daily volume of 22,846 vehicles per day.

The directional distribution is also notable over the different days of the weekend. The predominant flow of traffic is northbound (NB) on Fridays with an average of 57.8% of the traffic traveling NB (minimum of 54.4% NB in February and November and a maximum of 62.7% NB in July). Saturdays have more balanced flow with an average of a 52%/48% directional split NB and southbound (SB), respectively. Sundays are largely the opposite of Fridays, with an average of 59.3% traveling SB (minimum of 56.3% in April and maximum of 64.5% in October). These directional splits further emphasize the impact of recreational travel on the corridor because of the observable imbalance of NB travel on Fridays and SB on Sundays, particularly in the summer months.

Throughout the stakeholder engagement process, the impact of summer weekends on corridor traffic, and holiday weekends in particular, were emphasized by agencies that have jurisdiction in the corridor. The issues are experienced most acutely toward the northern end of the corridor, where NB traffic backs up from the signalized intersections in Payson into the rural portions of the corridor. According to representatives from ADOT, the Town of Payson, and the Department of Public Safety (DPS), typical summer weekend traffic backs up to Gibson Ranch Road or Oxbow Estates (approximately MP 248.5) in the NB direction. Holiday weekends frequently see traffic backing up from Payson through Rye (approximately MP 241) with events such as a crash or a car fire backing traffic up to SR 188 (MP 235.7).

2.4 SR 87 Cross Road Traffic Volumes

Cross road traffic volumes were obtained from both the ADOT TCDS and count data collected by FDS. Cross road traffic volumes are provided in **Table 8** below. The roadways toward the north end of the corridor have higher overall volumes than the roadways in the southern portions of the corridor, though it should be noted that some roadways – Bush Highway in particular – have highly variable volumes due to recreational traffic.

Table 8: Cross Road Traffic Volumes

Roadway	SR 87 Mile Post	ADT	Source
Vista del Oro	195.2	194	FDS
Bush Highway	199.1	2,947	MCDOT ¹
Beeline Highway	218.0	62	FDS
Sunflower Frontage Road	218.0	458	FDS
SR 188	235.7	2,243	FDS
Deer Creek Drive	237.6	1,019	TCDS
Gisela Road (in SR 87 Median)	239.5	213	TCDS
Gisela Road (E of SR 87)	239.5	561	TCDS
Oxbow Trail	248.4	1,362	TCDS
Gibson Ranch Road	249.0	1,102	TCDS

¹<https://www.maricopa.gov/883/B>

2.5 Speed Analysis

Speed data was collected by FDS at several locations along the SR 87 corridor at locations where stakeholders identified speeding as a relevant factor to safety or congestion during the stakeholder engagement process. The locations of the speed studies and collected speed data are provided in **Table 9**.

Table 9: Speed Analysis Statistics

Mile Post	Dir.	Speed Limit	% of Traffic > 10mph under Speed Limit	50 th Percentile Speed	85 th Percentile Speed
191.6	NB	65	2.7%	72 mph	74 mph
191.6	SB	65	37.2%	56 mph	61 mph
205.0	NB	65	8.4%	70 mph	74 mph
214.0	NB	65	33.0%	57 mph	61 mph
214.0	SB	65	16.3%	65 mph	72 mph
221.0	SB	65	13.5%	69 mph	73 mph
227.0	NB	65	16.9%	63 mph	69 mph
240.5	NB	65	3.6%	69 mph	73 mph
240.5	SB	65	1.5%	72 mph	74 mph
243.5	NB	65	91.7%	51 mph	54 mph
246.0	NB	65	44.4%	56 mph	63 mph
246.5	SB	55	6.1%	72 mph	74 mph

The speed data shows that speeding is an issue at several locations with horizontal curves, including SB MP 246.5 (Corvair Curve), where the 85th percentile speed is almost 20 mph over the speed limit; SB MP 214, which is an identified crash hot spot, and NB MP 205, which is also an identified crash hot spot.

The speed data showing percentage of traffic traveling greater than 10 mph under the speed limit supports a need for climbing lanes, including at NB MP 214 (33% greater than 10 mph under the speed limit); NB MP 227 (17% greater than 10 mph under the speed limit); and NB MP 243.5 (92% greater than 10 mph under the speed limit).

2.6 Future Traffic Volumes

Historical traffic volumes from the ADOT TCDS were used to develop future traffic forecasts for the 2030 and 2040 planning horizon years. There are five count locations along the corridor with historical average annual daily traffic (AADT) volumes from which historical trendlines could be developed. These count stations are located at MP 199.3, 217.0, 235.0, 237.6, and 248.9. Historical AADT volumes at each count station and their associated growth trendlines are shown in **Figure 10**.

Growth trendlines based on annual count data for every year between 1990 and 2018 were used to forecast future traffic volumes. The resulting 2030 and 2040 traffic forecasts are provided in

Table 10. A factor was applied to AADTs to estimate weekend volumes. Based on data from the continuous count station, weekend volumes are 39% higher than weekday volumes. This factor was used to convert forecasted AADT volumes to forecasted weekend volumes as weekend volumes are considered the “design” volumes due to how frequently volumes reach that level.

Figure 10: Historic AADT Volumes and Growth Trendlines

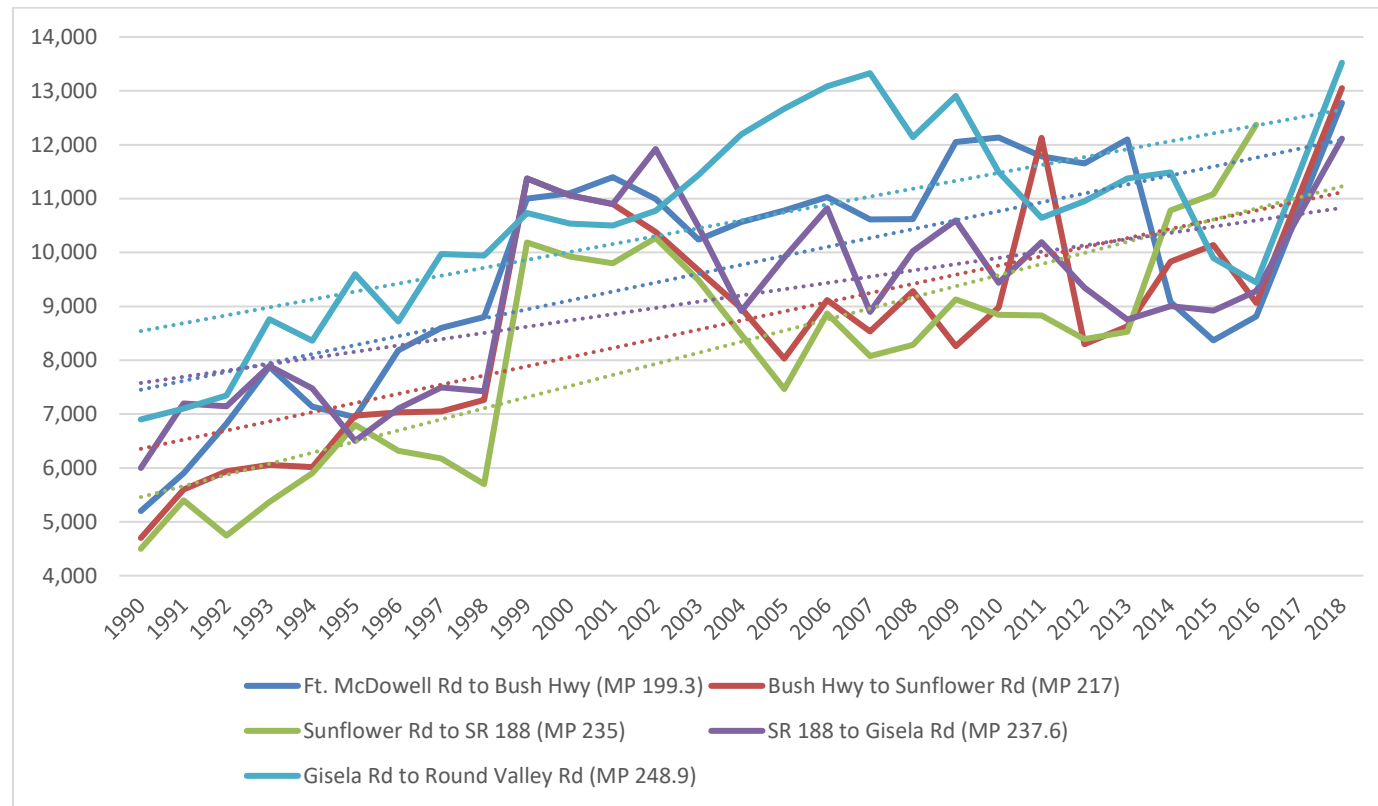


Table 10: Forecasted AADT and Weekend Traffic Volumes

Segment	Annual Growth Rate*	Forecasted 2030 AADT	Forecasted 2030 Average Weekend Volumes	Forecasted 2040 AADT	Forecasted 2040 Average Weekend Volumes
Ft. McDowell Rd to Bush Hwy (MP 199.3)	1.55%	14,089	19,584	15,746	21,887
Bush Hwy to Sunflower Rd (MP 217)	1.75%	12,990	18,056	14,691	20,420
Sunflower Rd to SR 188 (MP 235)	2.19%	13,494	18,756	15,554	21,620
SR 188 to Gisela Rd (MP 237.6)	1.16%	12,105	16,826	13,266	18,439
Gisela Rd to Round Valley Rd (MP 248.9)	1.26%	14,267	19,831	15,735	21,871

*Growth rates calculated from a trendline based on annual count volumes from 1990-2018

2.7 Future Traffic Operations

Roadway segment levels of service (LOS) for existing travel volumes and forecasted travel volumes were developed using the Highway Capacity Software, which uses methodologies from the Highway Capacity Manual (HCM) 2010 developed by the Transportation Research Board (TRB). The criteria for roadway segment LOS are provided in **Table 11**. These LOS within the corridor is provided in **Table 12**.

Table 11: Level of Service Criteria for Roadway Segments

Level of Service	Density (pc/mi/ln) ¹
A	≤11
B	>11-18
C	>18-26
D	>26-35
E	>35-45
F	Demand exceeds capacity OR density >45

Table 12: Existing and Forecasted Segment Levels of Service

Segment	Existing AADT	Existing Weekend	2030 AADT	2030 Average Weekend	2040 AADT	2040 Average Weekend
Ft. McDowell Rd to Bush Hwy (MP 199.3)	A	B	A	B	B	B
Bush Hwy to Sunflower Rd (MP 217)	A	B	A	B	A	B
Sunflower Rd to SR 188 (MP 235)	A	B	B	B	B	C
SR 188 to Gisela Rd (MP 237.6)	B	B	B	B	B	B
Gisela Rd to Round Valley Rd (MP 248.9)	B	C	B	C	B	C

Levels of service are anticipated to remain at acceptable levels (LOS C or better) for the entire corridor through the planning horizon year of 2040.

2.8 Traffic Analysis Findings Summary

- LOS (volume/capacity) is expected to remain at acceptable levels (LOS B or better) through 2040 from an AADT perspective for all evaluated segments; however, average (and peak) weekends already experience LOS C or worse, and this condition is anticipated to further degrade over time as volumes continue to grow through 2040.
- Speed data shows high speed variability on both uphill and downhill sections, including at the following sections with historically high numbers of crashes:
 - MP 191.6 SB (5 mph difference between 50th and 85th percentile speed)
 - MP 214.0 SB (7 mph difference between 50th and 85th percentile speed)
 - MP 227.0 NB (6 mph difference between 50th and 85th percentile speed)

- MP 246.0 NB (7 mph difference between 50th and 85th percentile speed)
- Downhill sections, including Corvair curve (SB MP 245), are candidates for speed-reducing improvements to reduce the number of vehicles traveling greater than 10 mph over the speed limit.
- Uphill sections, including NB MP 213-216.5, NB MP 219-223, and NB MP 243-246.5, are candidates for capacity-enhancing improvements like climbing lanes.

2.9 Safety Analysis

2.9.1 2017 SR 87/SR 360/SR 377 Corridor Profile Study

SR 87 between MP 191 and MP 250 was evaluated as part of the SR 87/SR 260/SR 377 Corridor Profile Study (CPS) completed in 2017. The safety performance analysis for the CPS reviewed historical crash data from 2010 to 2014 which revealed the overall corridor safety performance was “below average” compared to the performance of similar roadways on the State Highway System. Areas of concern identified in the 2017 CPS include:

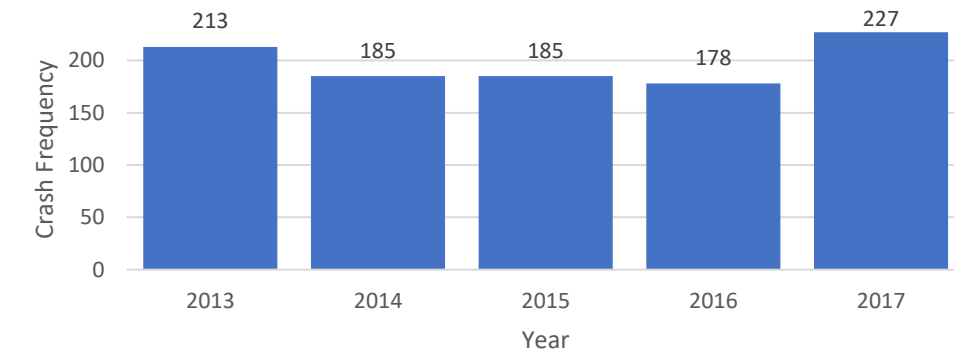
- The segment of SR 87 from Rye (MP 241) to Green Valley Pkwy/BIA 101 (MP 250) performed “below average” in the top five Arizona Strategic Highway Safety Plan (SHSP) emphasis areas. The segment of SR 87 from Fort McDowell Rd (MP 191) to SR 188 (MP 235) performed “below average” in motorcycle-involved crashes. The safety performance area became an emphasis area for the corridor in the CPS.
- SR 87 southbound at MP 246, known as Corvair Curve, has historically had many crashes. Temporary jersey barriers were placed in the past, but they have since been removed.
- The SR 188/SR 87 intersection experienced the greatest frequency of intersection related crashes. A Road Safety Assessment (RSA) was completed prior to 2016. The RSA observations identified that many vehicles ran the stop sign on SR 188. The area experiences heavy recreational use (trucks with trailers or boats). During outreach efforts for the CPS, a grade-separated interchange at SR 188/SR 87 was suggested by the District.

2.9.2 2013 – 2017 Corridor-Level Safety Analysis

To gain insight into crash occurrence for the SR 87 corridor so that effective countermeasures can be identified, an updated analysis of crash data was performed for the most recent five years (2013-2017). The results of this analysis provide an overview of crash trends and patterns, and those resulting in fatalities (K) and serious injuries (A). Corridor-wide crash statistics are provided in **Figure 12**.

During the 2010 to 2014 evaluation period for the 2017 SR 87/SR 360/ SR 377 CPS, 971 crashes occurred between MP 191 and MP 250. During the 2013 to 2017 evaluation period for the 2019 SR 87 MP 191 to MP 250 CDS, 988 crashes occurred between MP 191 and MP 250, as shown in **Figure 11**. The overall trend of crash frequencies over both evaluation periods is about the same with an average of 196 crashes occurring annually. Preliminary 2018 crash statistics indicate a 6% increase in crashes along the corridor from 2017.

Figure 11: Total Crash Frequencies (2013-2017)



Each year, there have been between two and twelve crashes resulting in serious injury and between two and nine crashes resulting in death. **Figure 13** shows the number of crashes by injury severity. The following definitions and attributes of Injury Severity (Status) are extracted from the Model Minimum Uniform Crash Criteria (MMUCC) Guidelines, Fourth Edition (2012), as required by FHWA for MAP-21 compliance and to conform to KABCO framework. KABCO is used by law enforcement to code crashes by the severity of injury that occurs as follows:

1. No Injury (O) - No apparent injury is a situation where there is no reason to believe that the person received any bodily harm from the motor vehicle crash. There is no physical evidence of injury and the person does not report any change in normal function.
2. Possible Injury (C) - An injury reported or claimed which is not a fatal, suspected serious or suspected minor injury. Examples include momentary loss of consciousness, claim of injury, limping, or complaint of pain or nausea. Possible injuries are those which are reported by the person or are indicated by his/her behavior, but no wounds or injuries are readily evident.
3. Suspected Minor Injury (B) - A minor injury is any injury that is evident at the scene of the crash, other than fatal or serious injuries. Examples include lump on the head, abrasions, bruises, minor lacerations (cuts on the skin surface with minimal bleeding and no exposure of deeper tissue/muscle).
4. Suspected Serious Injury (A) - Any injury other than a fatal injury which results in one or more of the following:
 - a. Severe laceration resulting in exposure of underlying tissues/muscle/organs or resulting in significant loss of blood
 - b. Broken or distorted extremity (arm or leg)
 - c. Crush injuries
 - d. Suspected skull, chest, or abdominal injury other than bruises or minor lacerations
 - e. Significant burns (second and third-degree burns covering 10% or more of the body)
 - f. Unconsciousness when taken from the crash scene
 - g. Paralysis
5. Fatal Injury (K) - Any injury that results in death within 30 days after the motor vehicle crash occurred. If the person did not die at the scene but died within 30 days of the motor vehicle crash in which the injury occurred, the injury classification should be changed from the attribute previously assigned to the attribute “Fatal Injury”.

Figure 12: SR 87 Corridor-Wide Crash Statistics (2013-2017)

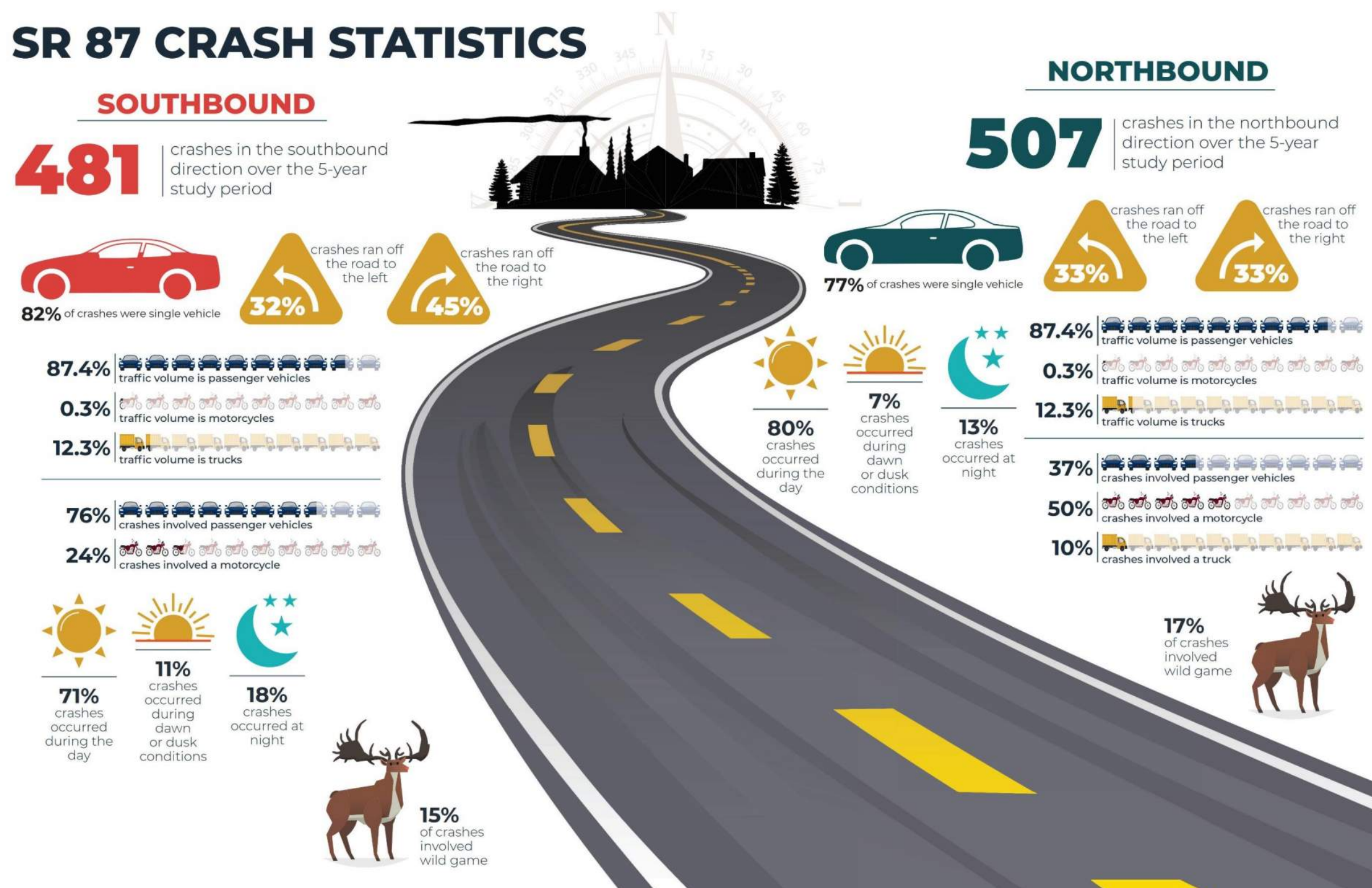
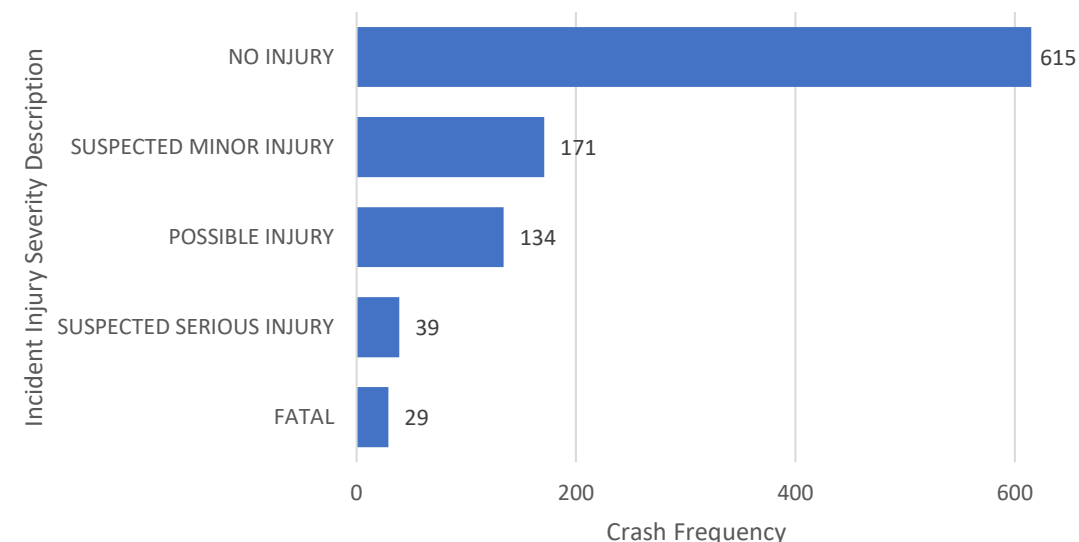
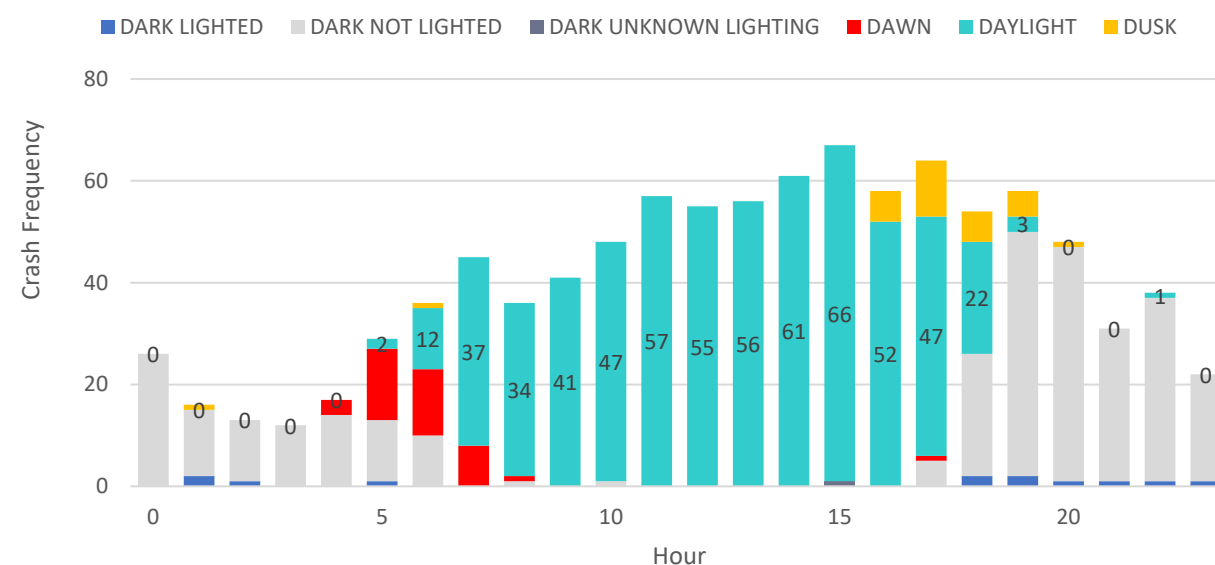


Figure 13: Crashes by Injury Severity (2013-2017)



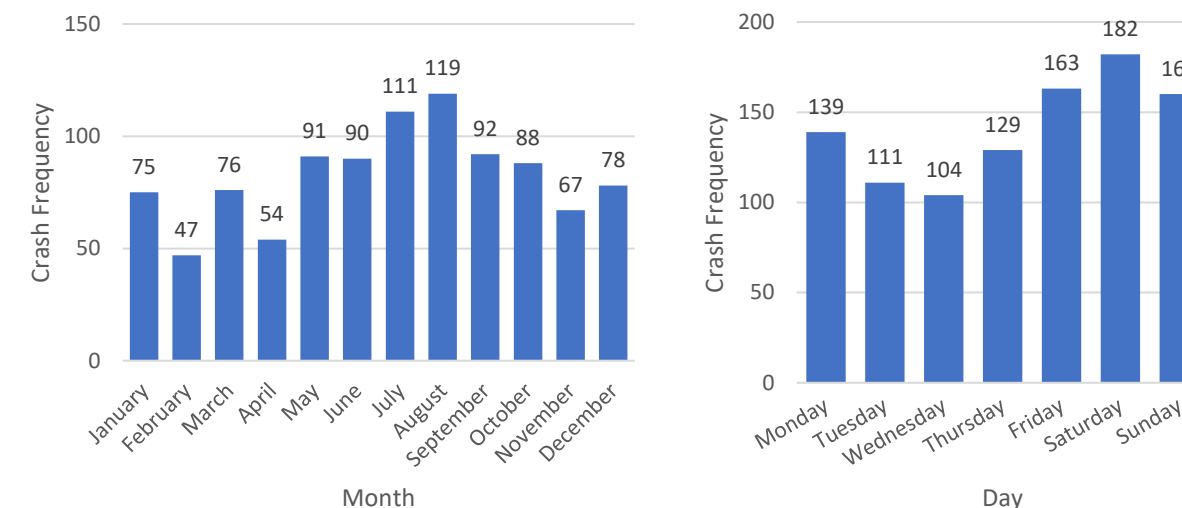
Crashes have occurred most frequently in afternoon and evening hours of the day as depicted by light condition in **Figure 14** below.

Figure 14: Crashes by Hour of Day and Lighting Condition (2013-2017)



The most crashes have occurred during the months of July and August and on weekends, as illustrated in **Figure 15**. This correlates with the greatest amounts of traffic on the corridor for recreation and tourism.

Figure 15: Crashes by Month and Day (2013-2017)



The most severe injury (A) and fatal crashes (K) have occurred during the months of March and May and on Saturdays and Sundays, as illustrated in **Figure 16**. Motorcyclists on the corridor are involved in 35% of acute injury and fatal crashes as shown in **Figure 17**; however, represent less than 1% of total traffic. The lack of a protected vehicle compartment means that motorcycle riders and passengers are much more vulnerable to injury crashes. The task of operating a motorcycle is much more demanding than operating a passenger vehicle. Riders must focus on coordinating speed and body lean, and managing traction and control, while navigating various surfaces, curves, and conditions.

Figure 16: Severe Injury Crashes by Month and Day (2013-2017)

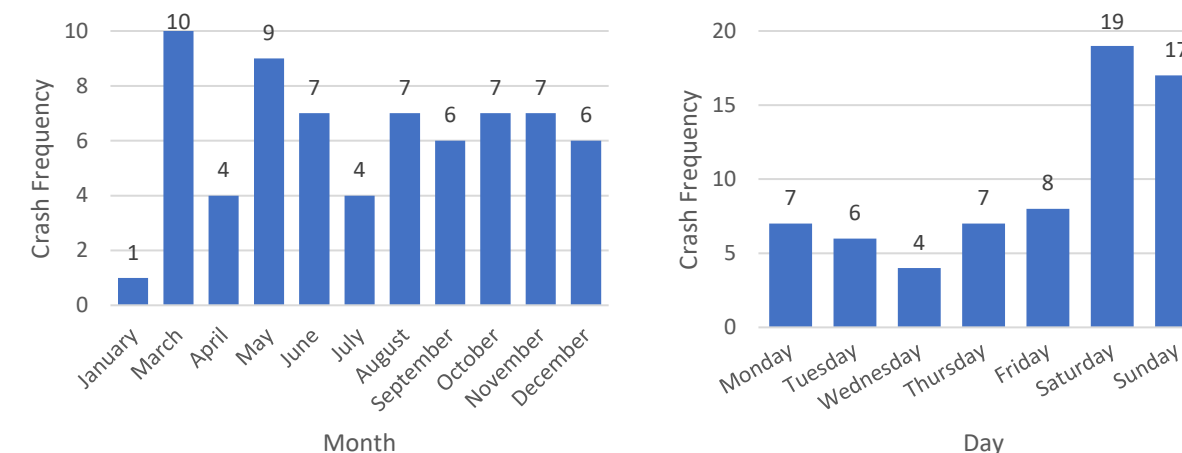
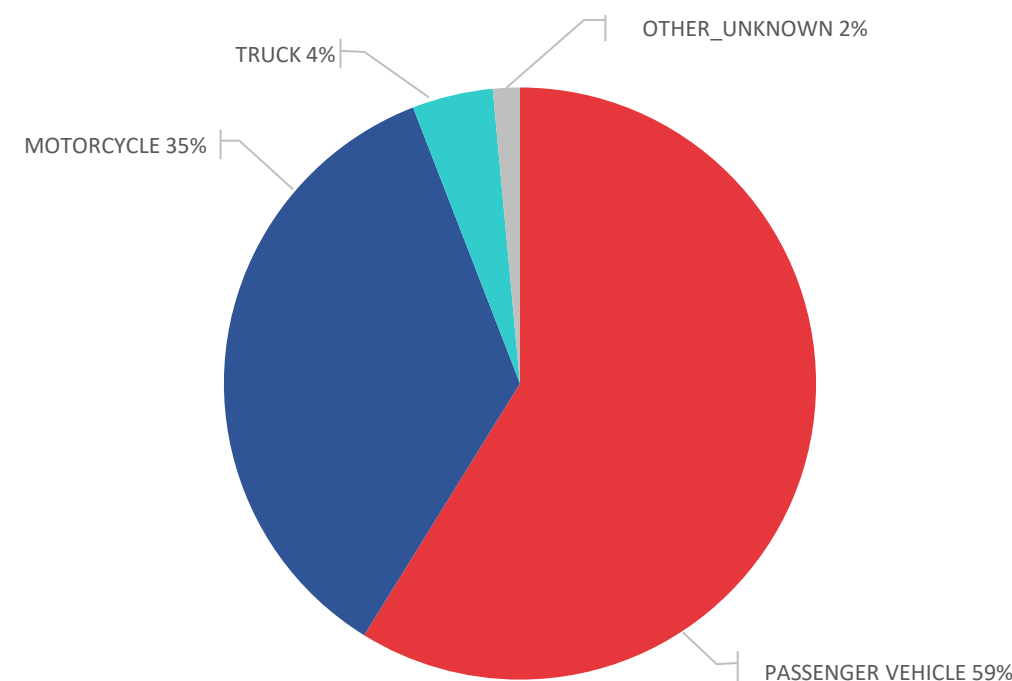


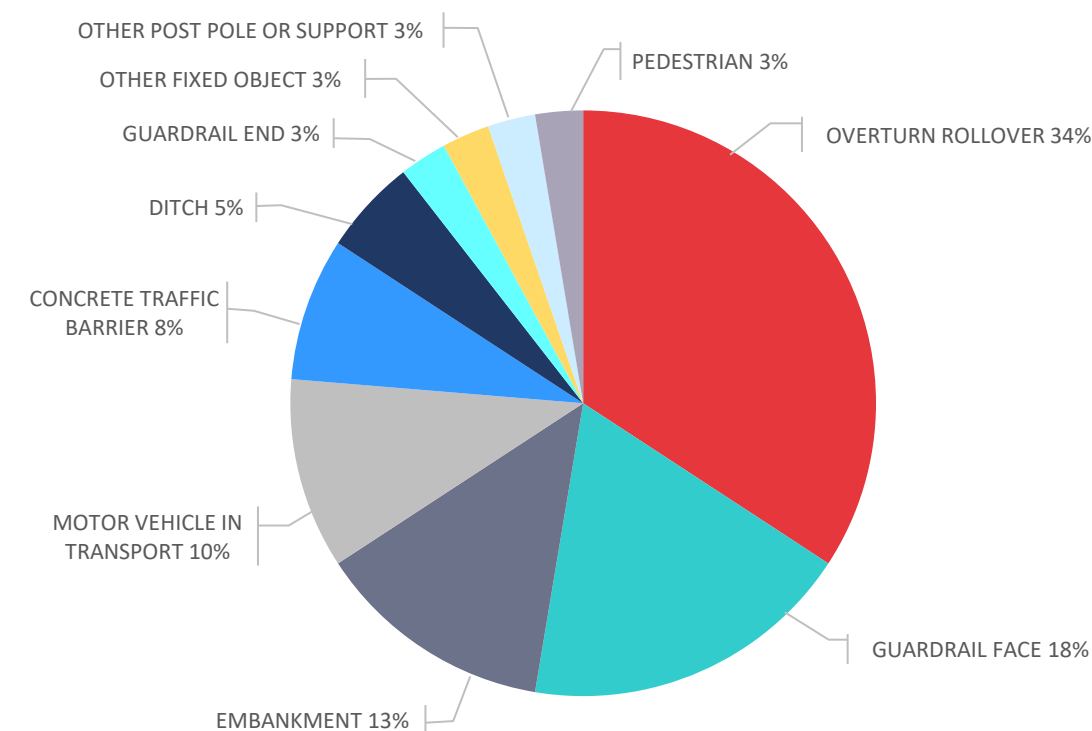
Figure 17: Suspected Serious Injury (A) and Fatal Crashes (K) by Vehicle Type (2013-2017)



- 82% were single vehicle crashes.
- 90% of crashes occurred with dry surface conditions.
- 18% of crashes occurred at night, 71% occurred during the day, and 11% of crashes occurred during dawn or dusk conditions.
- 76% of crashes involved passenger vehicles. 24% crashes involved a motorcycle.
- Drivers were traveling too fast for conditions in 40% of the crashes.
- Alcohol, drugs, medication, or fatigue were influential in 37% of the crashes.
- 63% of drivers used a safety device (seat belt or helmet).
- 45% of crashes ran off the road to the right; 32% of crashes ran off the road to the left.

During the five-year study period, 17 crashes resulted in suspected serious injury (A) and 21 crashes resulted in death (K). A summary of first harmful event for the serious injury and fatal crashes in the southbound direction is provided in **Figure 19**.

Figure 19: Southbound Serious Injury and Fatal Crashes by First Harmful Event (2013-2017)



Crashes of all severities were reviewed by frequency, location, types, and trends. In the southbound direction, there is one hot spot that has a propensity for crashes as illustrated in **Figure 20** at MP 246, also known as Corvair Curve. Two additional locations were identified as hot spots for severe crashes, as illustrated in **Figure 21**. These locations have been further analyzed.

2.9.3 2013 – 2017 Crash Trends and Hot Spots in the Southbound Direction

There have been 481 crashes on SR 87 in the southbound direction between MP 191 and MP 250 over the past five years. The overall trend of crash frequencies over the five-year analysis period is increasing as shown in **Figure 18** despite the total annual crashes on the corridor maintaining a steady frequency.

Figure 18: Southbound Crash Frequencies (2013-2017)

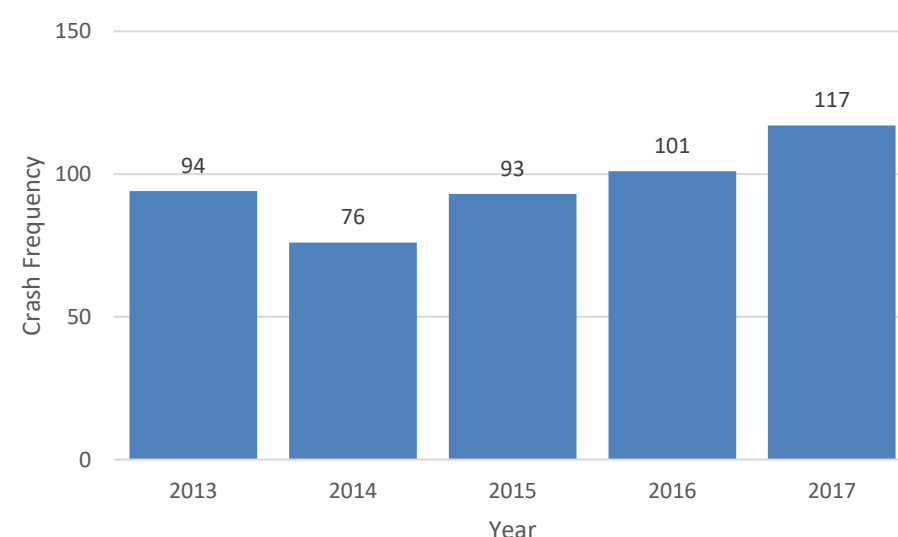


Figure 20: Hot Spot Analysis of All Crashes (2013-2017)

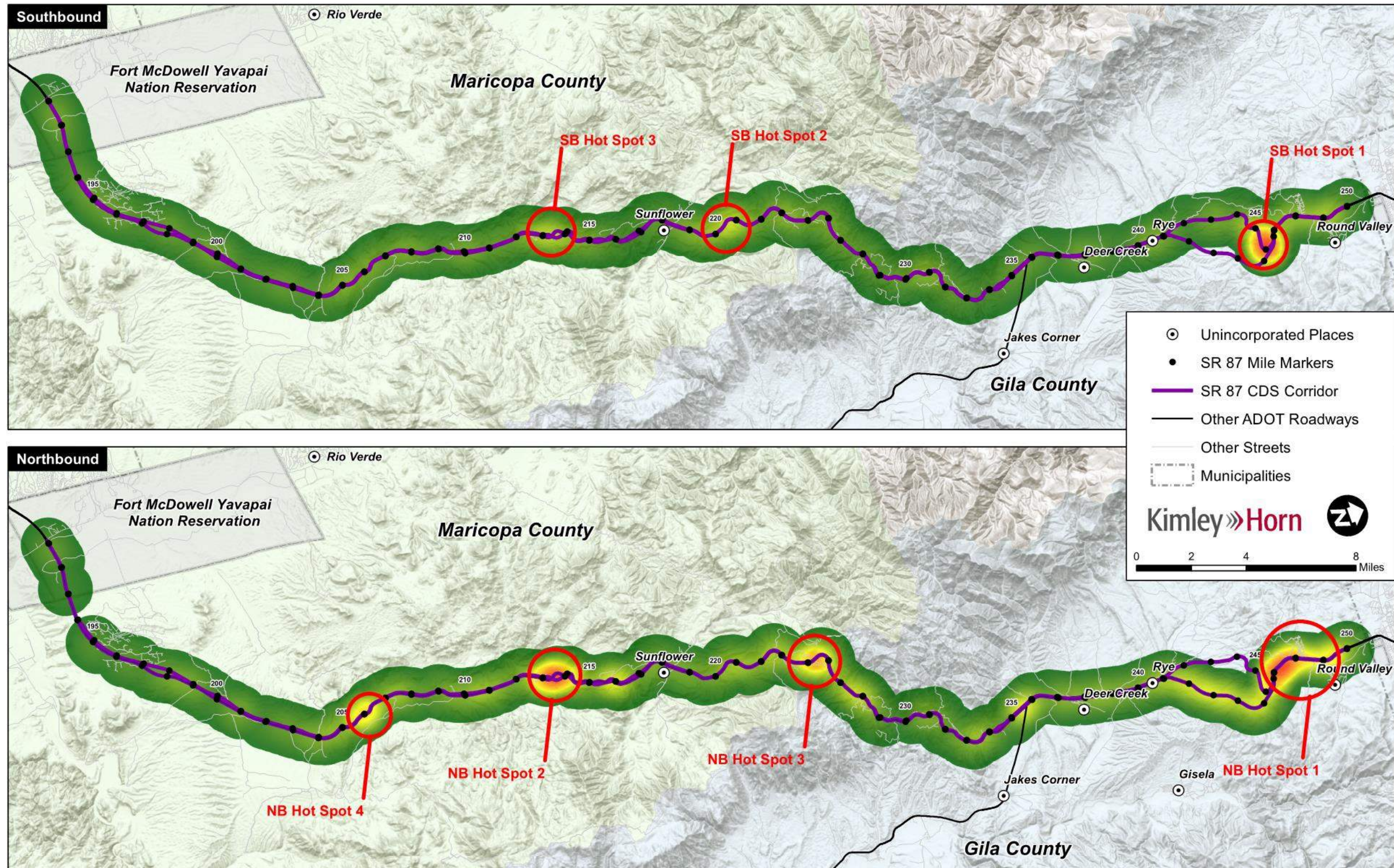
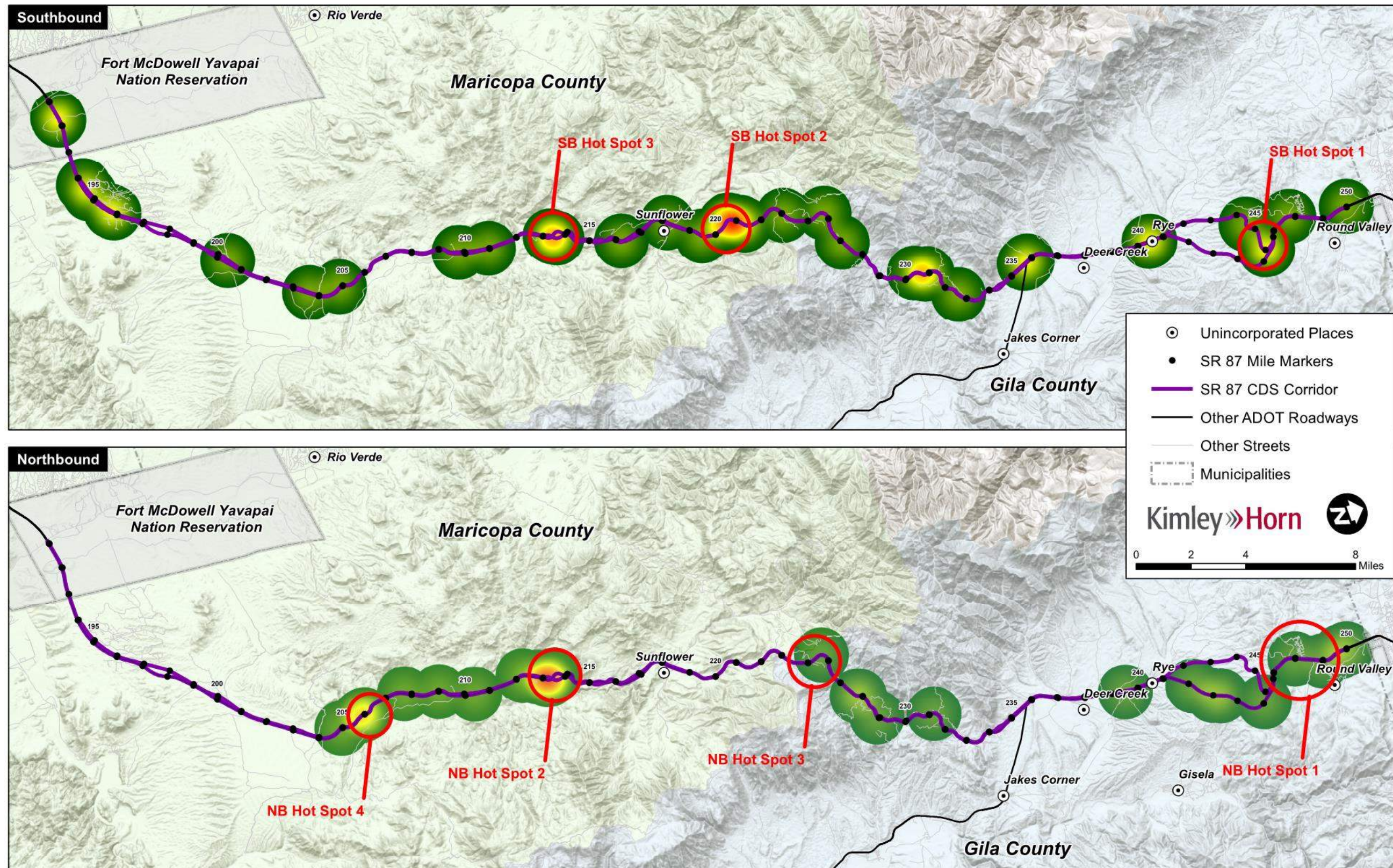


Figure 21: Hot Spot Analysis of Serious Injury and Fatal Crashes (2013-2017)



SB Hot Spot Location 1 - SR 87 southbound at MP 246, known as Corvair Curve, has historically had many crashes and continues to be identified as the most significant crash hot spot with 63 crashes on the curve (which is approximately 1.8 miles in length) for the five-year analysis period, and 41 of those crashes occurred within a 1,000-foot roadway segment within the curve. Below are statistics specifically for crashes at Corvair Curve:

- 87% were single vehicle crashes.
- 46% of crashes occurred with wet surface conditions; 11% occurred with ice, frost, or snow surface conditions.
- 46% of crashes occurred at night (there is no roadway lighting in this area).
- 94% of crashes involved passenger vehicles. One crash involved a motorcycle and two crashes involved trucks.
- Drivers were traveling too fast for conditions in 57% of the crashes.
- Alcohol, drugs, or fatigue were influential in six of the crashes.
- Four of the crashes involved wild game.
- 92% of drivers used a safety device (seat belt or helmet).
- One crash resulted in serious injury and one crash resulted in a fatality.

SB Hot Spot Location 2 - SR 87 southbound for the mile and a half between MP 220.0 to MP 221.5 is also identified as a hot spot for both the frequency and severity of crashes in the southbound direction, with 27 total crashes.

- 81% were single vehicle crashes.
- 15% of crashes occurred with wet surface conditions, 11% occurred with ice or frost conditions.
- 26% of crashes occurred at night (there is no roadway lighting in this area).
- 81% of crashes involved passenger vehicles, four crashes involved a motorcycle, and one involved a truck.
- Drivers were traveling too fast for conditions in 56% of the crashes.
- Alcohol was influential in two of the crashes.
- One of the crashes involved wild game, seven (26%) involved overturning, and eight (30%) struck the concrete barrier or guardrail.
- 78% of drivers used a safety device (seat belt or helmet).
- Three crashes resulted in serious injuries and two motorcycle crashes resulted in a fatality.
- 33% ran off the road to the right; 4% ran off the road to the left; 33% hit the concrete traffic barrier; four crashes involved equipment failure.

SB Hot Spot Location 3 - SR 87 southbound for the mile between MP 214.0 to MP 213.0 is also identified as a hot spot for both the frequency and severity of crashes in the southbound direction, with 20 total crashes.

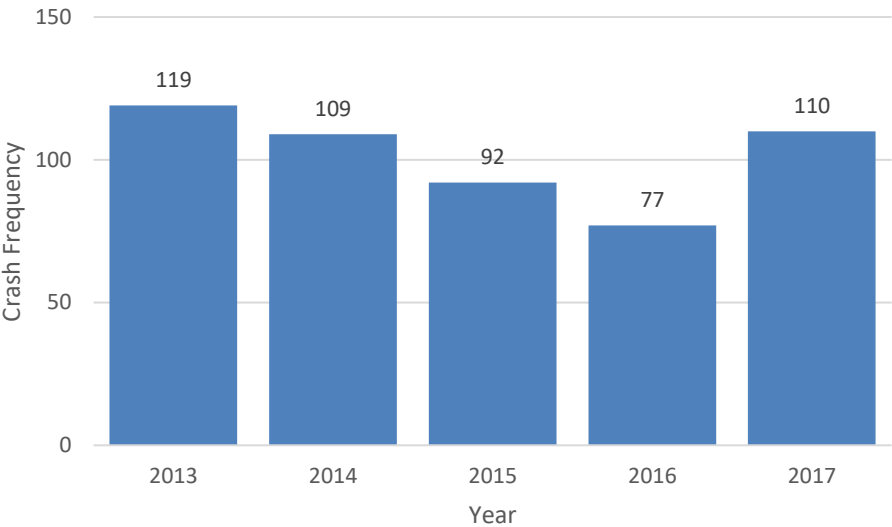
- 48% were single vehicle crashes.
- 11% of crashes occurred with wet surface conditions.
- 19% of crashes occurred at night (there is no roadway lighting in this area).
- 75% of crashes involved passenger vehicles, two crashes involved a motorcycle, and two involved a truck.
- Drivers were traveling too fast for conditions in 33% of the crashes.

- Fatigue was influential in three of the crashes.
- Two of the crashes involved wild game, five (19%) involved overturning, and two (7%) struck the concrete barrier or guardrail.
- 63% of drivers used a safety device (seat belt or helmet).
- Two crashes resulted in serious injuries, of which, one was a motorcycle, and one crash resulted in a fatality.
- 11% ran off the road to the right; 19% ran off the road to the left; 19% hit another motor vehicle in transport; one crash involved equipment failure; one crash involved fire/explosion.

2.9.4 2013 – 2017 Crash Trends and Hot Spots in the Northbound Direction

There have been 507 crashes on SR 87 in the northbound direction between MP 191 and MP 250 over the past five years. Twenty-two resulted in serious injury and eight resulted in death. The overall trend of crash frequencies has been slightly decreasing over the past five years of data as shown in **Figure 22**.

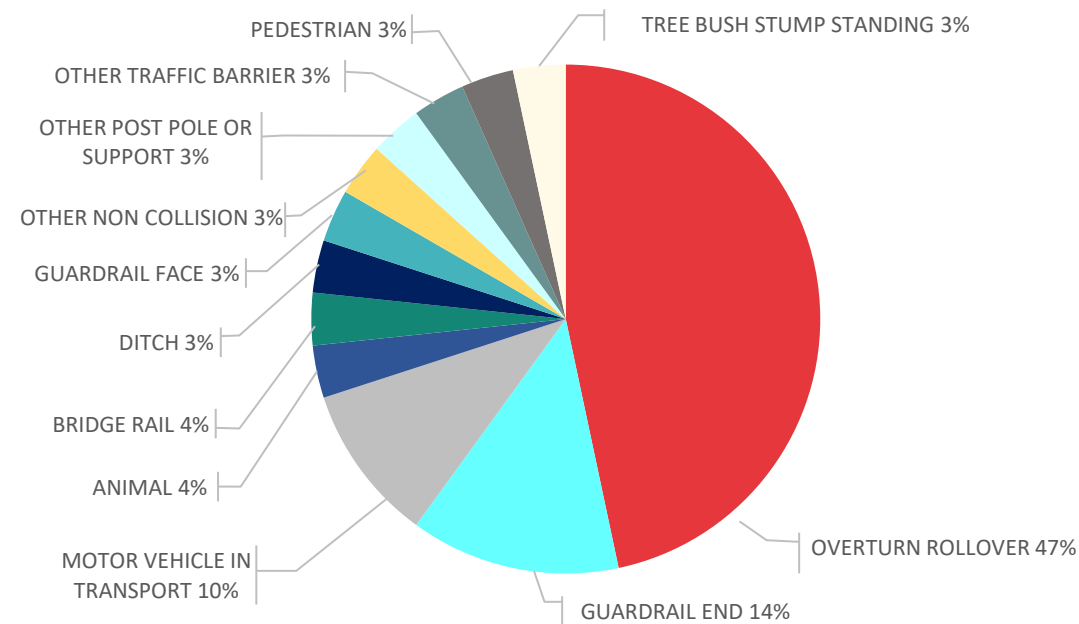
Figure 22: Northbound Crash Frequencies (2013-2017)



- 77% were single vehicle crashes.
- 90% of crashes occurred with dry surface conditions.
- 13% of crashes occurred at night. 80% occurred during the day.
- 37% of crashes involved passenger vehicles. 15 crashes (50%) involved a motorcycle and three crashes (10%) involved a truck.
- Drivers were traveling too fast for conditions in 43% of the crashes.
- Alcohol, drugs, or medication were influential in three (10%) of the crashes.
- One of the crashes involved wild game.
- 63% of drivers used a safety device (seat belt or helmet.)
- One of the crashes was crossover related and one was intersection related.
- 33% ran off the road to the right, 33% ran off the road to the left, two overturned, two crossed the centerline.

A summary of first harmful event for the serious injury and fatal crashes in the northbound direction is provided below in **Figure 23**.

Figure 23: Northbound Serious Injury and Fatal Crashes by First Harmful Event (2013-2017)



In the northbound direction, there are four notable hot spots that have a propensity for crashes as illustrated in **Figure 20**. Two of these have also been identified as hot spots for severity, as illustrated in **Figure 21**.

NB Hot Spot Location 1 - SR 87 northbound between MP 247.0 to MP 249.9 is the hot spot with the greatest frequency of crashes in the northbound direction, with 62 crashes.

- 81% were single vehicle crashes.
- 95% of crashes occurred with dry surface conditions and one crash occurred with snowy surface conditions.
- 48% of crashes occurred at night (there is limited roadway lighting in this area).
- 79% of crashes involved passenger vehicles. More than half of these were “pickup trucks less than one ton”. Two crashes involved a motorcycle and eight crashes involved trucks.
- Drivers were traveling too fast for conditions in 19% of the crashes.
- Alcohol or fatigue were influential in six (10%) of the crashes.
- 45% of crashes involved wild game.
- 90% of drivers used a safety device (seat belt or helmet).
- One crash resulted in serious injury and two crashes resulted in fatalities.
- 24% of crashes ran off the road to the right; 13% ran off the road to the left; one overturned; two crossed the centerline and three involved a fire or explosion.
- Four crashes were intersection or crossover related.

NB Hot Spot Location 2 - SR 87 northbound between MP 213.0 to MP 214.9 is an identified hot spot for both the frequency and severity of crashes, with 48 crashes.

- 88% were single vehicle crashes.
- 77% of crashes occurred with dry surface conditions. 17% of crashes occurred with wet surface conditions, three crashes occurred with ice or frost surface conditions, and debris contributed to four crashes (three involving motorcycles).
- 19% of crashes occurred at night (there is no roadway lighting in this area).
- 60% of crashes involved passenger vehicles, 16 crashes (33%) involved a motorcycle, and two crashes involved trucks.
- Drivers were traveling too fast for conditions in 50% of the crashes.
- Fatigue was influential in two of the crashes.
- 13% of crashes involved wild game.
- 85% of drivers used a safety device (seat belt or helmet.)
- Six crashes resulted in serious injuries (all were motorcyclists), but there were no fatalities.
- 31% ran off the road to the right; 17% ran off the road to the left; 15% ran off the road into an embankment, guardrail, or other non-fixed object; one crossed the centerline, two involved a fire or explosion; and four involved equipment failures.
- Six occurred from MP 213.2 to MP 213.5 where the driver was negotiating a curve, ran off the road to the right, and the vehicle overturned. There is no guardrail or barrier on the right side of the roadway between MP 213 and MP 213.41.

NB Hot Spot Location 3 - SR 87 northbound between MP 223.8 to MP 224.8 is a hot spot for crash frequencies, with 30 crashes.

- 77% were single vehicle crashes.
- 65% of crashes occurred with dry surface conditions, 19% of crashes occurred with wet surface conditions, and 15% of crashes occurred with snow surface conditions.
- 38% of crashes occurred at night (there is no roadway lighting in this area).
- 92% of crashes involved passenger vehicles and one crash involved a truck.
- Drivers were traveling too fast for conditions in 50% of the crashes.
- Alcohol, illness, or fatigue was influential in four of the crashes.
- No crashes involved wild game.
- 88% of drivers used a safety device (seat belt or helmet).
- One crash resulted in a serious injury; there were no fatalities.
- 23% ran off the road to the right; 12% ran off the road to the left; 27% ran off the road into guardrail or concrete traffic barrier; two involved a fire or explosion; and three involved equipment failures.

NB Hot Spot Location 4 - SR 87 northbound between MP 205.0 and MP 206.5 is an identified hot spot for both the frequency and severity of crashes with 27 total crashes.

- 85% were single vehicle crashes.
- 85% of crashes occurred with dry surface conditions and 15% of crashes occurred with wet surface conditions.
- 11% of crashes occurred at night (there is no roadway lighting in this area).
- 56% of crashes involved passenger vehicles and 44% of crashes involved a motorcycle.
- Drivers were traveling too fast for conditions in 26% of the crashes.

- Alcohol was influential in one of the crashes.
- 37% of crashes involved a vehicle overturning.
- 78% of drivers used a safety device (seat belt or helmet.)
- Three crashes involving motorcyclists resulted in serious injuries, two crashes involving motorcyclists striking a guardrail end or face resulted in fatalities.
- 56% ran off the road to the left; 11% ran off the road into guardrail; one involved a fire or explosion; one involved equipment failure; one crossed the centerline; and four overturned or jackknifed.

2.9.5 2013 – 2017 Intersection and Intersection-Related Crash Trends and Hot Spots

There are 33 intersections on SR 87 from MP 191 to MP 250. There are relatively few intersection-related crashes, with 18 occurring within the five-year analysis period as summarized below in Table 13.

Table 13: Intersection Crash History

MP	Intersection	Grade Separated	Access	Crashes
191.8	Hiawatha Hood Road	No	4-way	1
192.1	Rodeo Drive	No	4-way	0
194.5	Burnt Water Tail	No	3-way	0
195.2	Vista del Oro	No	3-way	0
196.0	Goldfield Road	No	3-way	0
196.3	Pleasant View Road	No	Right-in-right-out	1
196.6	Median Crossover	No	3-way	0
197.3	Meridian Road	No	Right-in-right-out	0
199.1	Bush Highway	Yes	Diamond Interchange	0
203.9	Cline Cabin Road	No	4-way	1
207.8	FR 68 Access Road	No	4-way	1
209.5	FR 68	No	4-way	0
210.5	Ballantine Trailhead	No	4-way	1
212.7	Sycamore Creek	No	4-way	1
217.4	FR 1704	No	3-way	0
218.0	Sunflower	No	4-way	0
218.5	FR 22	No	3-way	0
220.0	Unnamed Road	No	Right-in-right-out	0
222.7	FR 626	No	4-way	0
229.6	FR 26	Yes	Right-in-right-out	1
235.7	SR 188	No	4-way	4
236.7	Unnamed Road	No	3-way	0
237.6	Deer Creek Drive	No	4-way	0
238.5	FR 1438	No	3-way	0
239.2	Barnhardt Road	No	4-way	0
239.5	Gisela Road	No	3-way	1
240.0	Matlock Gas	No	3-way	1
240.5	South Rye Crossover	No	4-way	2
240.8	North Rye Crossover	No	4-way	0
247.8	FR 535	No	3-way	1
248.4	Ox Bow Estates	No	3-way	0
248.7	FR 375B	No	3-way	0
249.0	Gibson Ranch Road	No	3-way	2

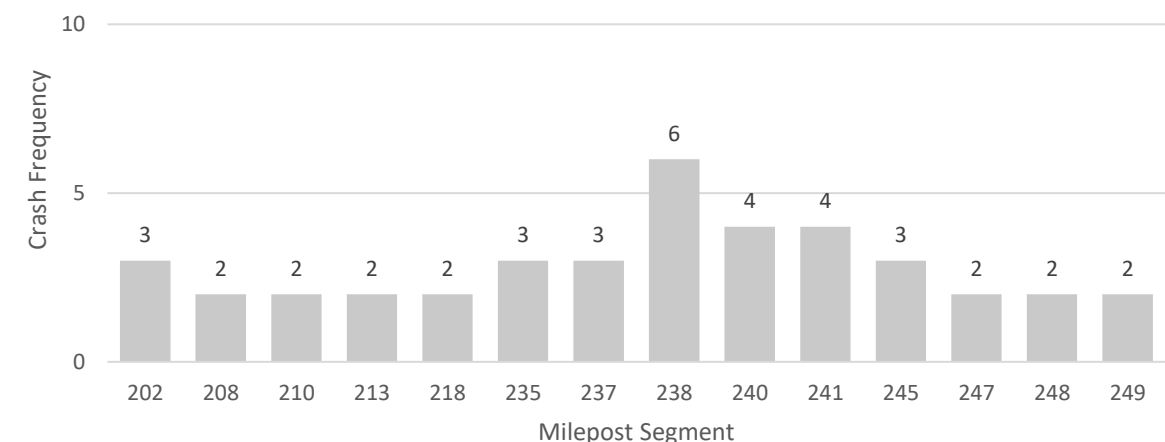
The SR 188/SR 87 intersection experienced the most intersection-related crashes. In 2016, signage, rumble strips, and turn lanes were added at the SR 188/SR 87 intersection upon recommendation of a Road Safety Assessment (RSA). There were no recorded crashes at this intersection in 2017. There is insufficient crash data available for a period after the improvements were made to draw conclusions from the improvements.

2.9.6 2013 – 2017 Other Crash Trends and Hot Spots

2.9.6.1 Animal – Related Crashes

The most crashes involving animals have occurred on SR 87 SB between MP 238.0 and MP 238.9, as illustrated below in **Figure 24**, where SR 87 transverses Clover Wash and roadside vegetation is denser. Rye Creek to the north and Deer Creek to the south form part of the Tonto Creek Basin where wild game is prevalent.

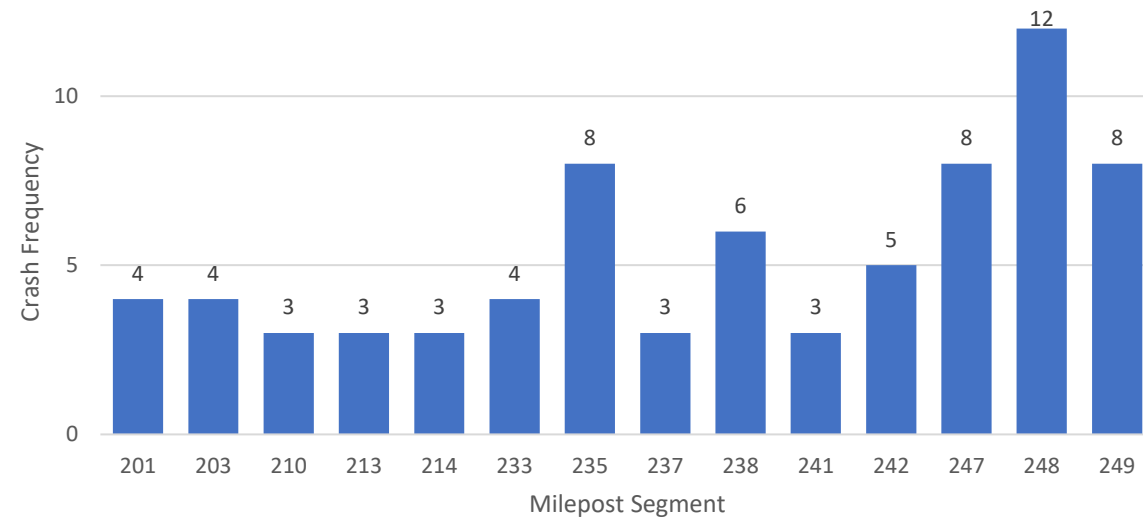
Figure 24: Top 10 Southbound Segments for Animal-related Incidents



The most crashes involving animals have occurred on SR 87 NB between MP 235.0 and MP 235.9, MP 238.0 and MP 238.9, MP 247.0 and MP 249.9 as illustrated below in **Figure 25**, where wild game is prevalent and roadside vegetation is denser. Between MP 235.0 and MP 235.9, there appears to be a water source to the east of SR 87 which may be attracting wild game.

Arizona is home to approximately 35,000 elk. The preferred and most effective wildlife mitigation on State highways are underpasses and overpasses in combination with wildlife fencing in between to direct the animals to these crossings. An at-grade elk detection and warning system currently exists on SR 260 (two lanes), ten miles east of Payson. Installed in 2007, at a cost of \$700,000 for the three-mile project area, the system has reduced elk-vehicle crashes by 98%; from an average of 11 elk-vehicle collision per year to three over 10 years. Due to the volumes and speed of motor vehicle traffic on SR 87, an at-grade elk crossing is not recommended. Dynamic elk warning systems should be explored at hot spots for animal-related incidents as a near-term safety countermeasure. ADOT should coordinate with AGFD to locate and design grade separated crossings as the ultimate countermeasure.

Figure 25: Top 10 Northbound Segments for Animal-related Incidents



2.9.6.2 Rollover Crashes

Rollover incidents are more likely to result in serious injury or death. Drivers travelling too fast for conditions navigating curves, swerving to avoid an object in the road, or who are impaired are more likely to lose control of their vehicle and run off the road. Depending on their vehicle type and presence of physical barriers, the vehicle may overturn. As depicted in **Figure 26** and **Figure 27**, the most rollover incidents occurred in the segment of SR 87 SB mileposts 194, 220, and 249 and in the segment of SR 87 NB mileposts 205, 207, and 213.

Figure 26: Top 10 Southbound Segments for Rollover Incidents

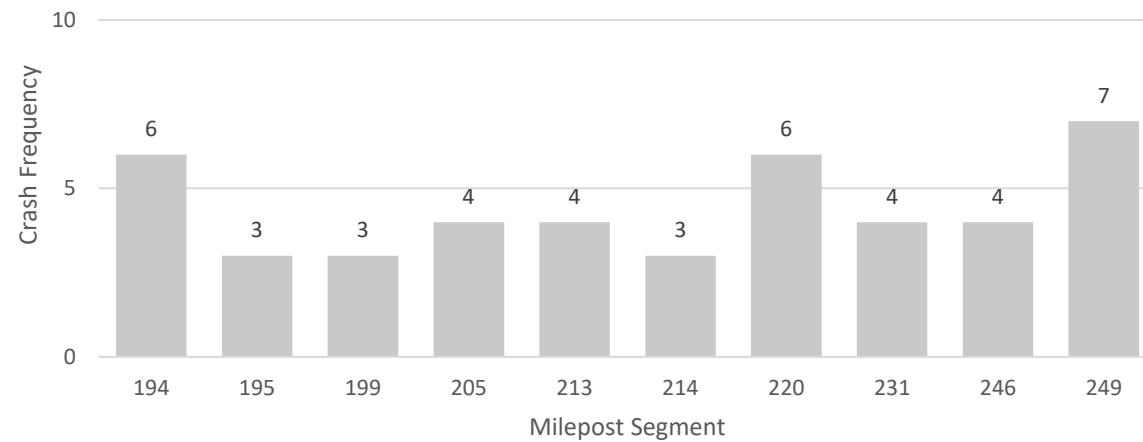
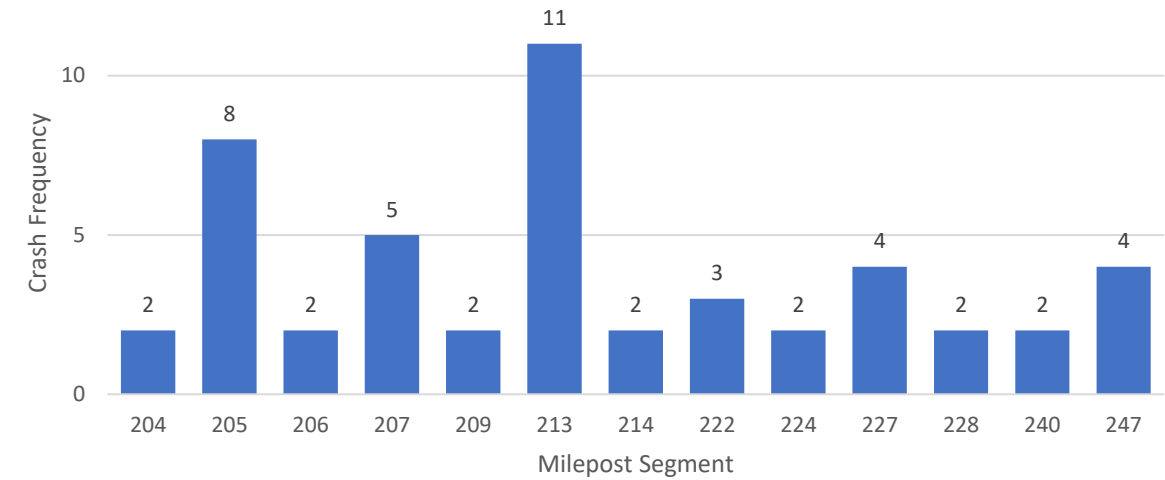


Figure 27: Top 10 Northbound Segments for Rollover Incidents



2.9.6.3 Debris-related Crashes

There is a history of rockfall from embankments along the corridor. **Figure 28** and **Figure 29** indicate the segments along the corridor with the highest crash experience related to debris in the roadway.

Figure 28: Top Southbound Segments for Incidents with Debris in the Roadway

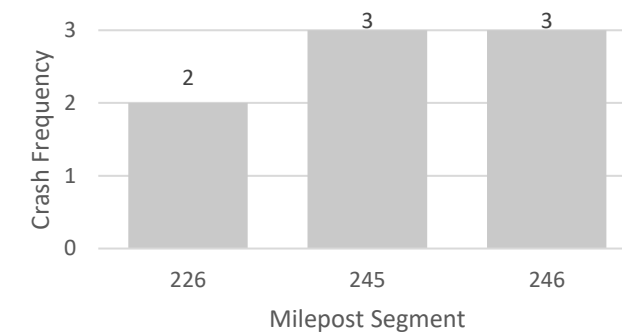
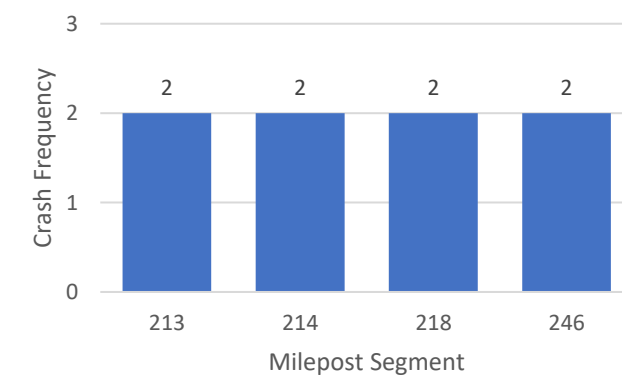


Figure 29: Top Northbound Segments for Incidents with Debris in the Roadway



2.9.7 Corridor Safety Analysis Summary

The corridor safety analysis reveals the need to address crashes on horizontal curves, speeding-related crashes, crashes involving motorcycles, and run-off-road crashes. Likely contributing factors were developed based on the information obtained through the overall crash analysis, hot spot crash summaries, and previously completed safety-related projects. The following are primary contributing factors of crashes on SR 87 between MP 191 and MP 250:

- Speed too fast for conditions
- Roadway departure
- Pavement surface condition
- Improper lane changes
- Shoulder/rumble strip condition
- Roadway geometry
- Clear zone slopes and obstructions
- Slippery/wet pavement surface
- Animals on roadway
- Inadequate lighting
- Driving under the influence

The locations where solutions will be investigated in more depth are summarized below in **Table 14**.

2.9.8 Crash Variability and Regression to the Mean

Crashes are random events that naturally fluctuate over time at any given site. Over a span of several years, crash data fluctuates between several high and low points around an expected average crash frequency. A short-term average crash frequency may be significantly higher or lower than the long-term average crash frequency. Typically, a minimum of three years of crash data is used for analysis. Five years of data was used in the analysis for the 2017 CPS and this study to avoid the regression to the mean phenomenon; however, shifts in the locations of crash hot spots along the corridor were observed between the two analysis periods. Safety countermeasures proposed in this study include both spot improvements and systemic improvements, which identify sites based on roadway characteristics.

Table 14: Safety Summary on the SR 87 Corridor

Direction	Approx. Begin	Approx. End	Crash Frequency (per mile)	Description
Northbound Corridor	191.0	250.0	507 (8.6)	<ul style="list-style-type: none"> • 77% were single vehicle crashes • 50% involved a motorcycle • 10% involved a truck • 66% of vehicles ran off road • Vehicles overturning, hitting guardrail end, and hitting other vehicles resulted in 70% of serious injury and fatal crashes
Northbound Hotspot	205.0	206.5	27 (16.9)	<ul style="list-style-type: none"> • 15% occurred with wet surface conditions • 44% involved a motorcycle • 37% involved overturning • 56% of vehicles ran off the road to the left • 15% involved overturning or jackknifing

Direction	Approx. Begin	Approx. End	Crash Frequency (per mile)	Description
Northbound Hotspot	205.0	205.9	8 (8.0)	<ul style="list-style-type: none"> • Crashes in the hot spot involved overturning
Northbound Hotspot	213.0	214.0	48 (43.6)	<ul style="list-style-type: none"> • 23% occurred with wet, ice, or frost surface conditions • 8% involved debris in the roadway • 13% involved wild game • 33% involved a motorcycle • 48% of vehicles ran off the road
Northbound Hotspot	213.0	213.9	11 (11.0)	<ul style="list-style-type: none"> • Crashes in the hot spot involved overturning
Northbound Hotspot	223.8	224.8	30 (27.3)	<ul style="list-style-type: none"> • 34% occurred with wet or snow surface conditions • 38% occurred at night • 50% of drivers were traveling too fast for conditions • 13% involved impairment • 35% of vehicles ran off the road • 27% of vehicles struck guardrail or concrete traffic barrier
Northbound Hotspot	235.0	235.9	8 (8.0)	<ul style="list-style-type: none"> • Crashes involved wild game
Northbound Hotspot	247.0	249.9	62 (21.4)	<ul style="list-style-type: none"> • 48% occurred at night • 13% involved a truck • 45% of crashes involved wild game • 10% involved impairment • 37% of vehicles ran off the road
Northbound Hotspot	247.0	249.9	28 (9.7)	<ul style="list-style-type: none"> • Crashes in the hot spot involved wild game
Southbound Corridor	250.0	191.0	481 (8.1)	<ul style="list-style-type: none"> • 82% were single vehicle crashes • 24% involved a motorcycle • 37% involved impairment • 77% of vehicles ran off the road • Vehicles overturning, hitting guardrail face, and hitting embankments resulted in 66% of serious injury and fatal crashes
Southbound Hotspot	246.0	246.9	63 (63.0)	<ul style="list-style-type: none"> • 57% occurred with wet, ice, frost, or snow surface conditions • 46% occurred at night • 57% of drivers were traveling too fast for conditions • 10% involved impairment
Southbound Hotspot	194.9	194.0	6 (6.0)	<ul style="list-style-type: none"> • Crashes involved overturning
Southbound Hotspot	220.0	221.5	27 (16.9)	<ul style="list-style-type: none"> • 26% occurred with wet, ice, frost, or snow surface conditions • 56% of drivers were traveling too fast for conditions • 26% involved overturning • 33% ran off the road to the right
Southbound Hotspot	220.9	220.0	6 (6.0)	<ul style="list-style-type: none"> • Crashes in the hot spot involved overturning
Southbound Hotspot	238.9	238.0	6 (6.0)	<ul style="list-style-type: none"> • Crashes involved wild game
Southbound Hotspot	249.9	249.0	7 (7.0)	<ul style="list-style-type: none"> • Crashes involved overturning