Bicycle-Involved Crashes in Michigan: 2016-2020

Jason Parks, Patrick Bowman, Carol Flannagan, Colleen Peterson

University of Michigan Transportation Research Institute

Contents

Special Note

The Michigan Office of Highway Safety Planning and the University of Michigan Transportation Research Institute acknowledge the differences in traffic and commuting patterns in 2020 due to the COVID-19 pandemic. Travel restrictions from the "Stay Home, Stay Safe" Executive Order (EO 2020-21) were initially in place starting on March 24, 2020. That order was then extended through additional executive orders. The stay-at-home order was officially lifted June 1, 2020.

Overall, the total number of police-reported crashes on Michigan roadways decreased by 21.93 percent, declining from 314,376 in 2019 to 245,432 in 2020. The 2020 fatality count was 1,083, up 9.95 percent from the 2019 figure of 985. Compared with 2019, people sustaining injuries were down 18.65 percent. Vehicle miles traveled, licensed drivers, and vehicle registrations decreased in 2020: vehicle miles traveled decreased 15.53 percent to 86.31 billion, motor vehicle registrations were down 0.49 percent to 9.04 million, and the number of licensed drivers was down 1.86 percent to 7.12 million. The increased fatality count in combination with the reduction of the exposure factors contributed to the fatality rate of 1.25 per 100 million miles of travel, a 30.16 percent increase from 2019 (0.96 per 100 million miles). The 2020 fatality rate is also above the 10-year (2011-2020) average of 1.01 fatalities per 100 million miles.

1.0 Executive Summary

This report provides an analysis of police-reported motor vehicle crashes involving bicyclists on public roadways in Michigan from 2016 through 2020. Key findings include:

- From 2016-2020, the peak number of bicycle-involved crashes occurred in 2016 with 1,959, and the low occurred in 2020 with 1,224, a decrease of 37.5% from 2016 to 2020.
- The lowest number of fatal bicycle-involved crashes took place in 2017 and 2019 with 21 each; the highest number occurred in 2020 with 37.
- A total of 78.8% of bicycle-involved crashes involved injury or fatality, compared to 17.5% for motor-vehicle-only crashes.
- In 2016 and 2020, there were 38 bicyclist fatalities, while in 2017, 2018, and 2019, 21 bicyclist fatalities occurred on Michigan roadways each year.
- Bicycle-involved crashes have strong seasonality with much higher numbers in the warmer months.
- Saturday and Sunday are the days of the week with the lowest counts of bicycle-involved crashes.
- Bicycle-involved crashes occur most often on clear days, during daylight, and generally in the afternoon/early evening.
- About 66% of bicycle-involved crashes but only 45% of fatal bicycle-involved crashes took place at intersections.
- In bicycle-involved crashes involving alcohol, 75.4% of the bicyclists and 26.3% of the motor-vehicle drivers were reported to have been drinking.
- Among the 60.0% of bicyclists of known age one and older whose helmet status was recorded, 23.3% were wearing a helmet. Bicyclists age 15 to 20 had the lowest helmet use rates.

2.0 Introduction

This report analyzes police-reported motor vehicle crashes involving bicyclists on public roadways in Michigan from 2016 through 2020. Michigan traffic crashes are defined as taking place on public roadways in Michigan, involving at least one motor vehicle in transport, and resulting in death, injury, or property damage of $1,000 or more. Bicycle-involved crashes are characterized in terms of severity, temporal patterns, and roadway and environmental variables. Impairment is examined at the crash level as well as according to whether alcohol was used by bicyclists or motor vehicle drivers in these crashes.

In this report, injury severity of people involved in crashes is frequently categorized according to the KABCO scale:

- K - Fatal Injury
- A - Suspected Serious Injury
- B - Suspected Minor Injury
- C - Possible Injury
- O - No Apparent Injury

Similarly, crashes are sometimes classified according to the most severe injury suffered by anyone involved in the crash. Again, the KABCO scale is used, but for O-level severity this refers to crashes with property damage only (PDO) instead of no injury or fatality.

3.0 Crash Trends and Injury Severity

3.1 Crash Count Trends

Table 1 shows the counts of motor vehicle crashes involving bicyclists in Michigan over the past five years, both for all police-reported crashes and for those involving a fatality. The table also indicates the number of fatalities among bicyclists each year. This number had held steady from 2017-2019 at 21 fatalities but increased to 38 in 2020, the same count as in 2016.

Table 1. Bicycle-Involved Crashes

Year	Bicycle-Involved Crashes	Bicycle-Involved Fatal Crashes	Bicycle Fatalities
2016	1,959	33	38
2017	1,712	21	21
2018	1,546	23	21
2019	1,492	21	21
2020	1,224	37	38
Total	**7,933**	**135**	**139**

Figure 1 shows the five-year trend for bicycle-involved crashes. With a high in 2016 of 1,959 crashes, the number of bicycle-involved crashes decreased in each of the four subsequent years down to 1,224 crashes in 2020, a net drop of 37.5% from 2016. Despite the decreasing trend for bicycle-involved crashes, bicycle-involved fatal crashes varied between 21 and 37.

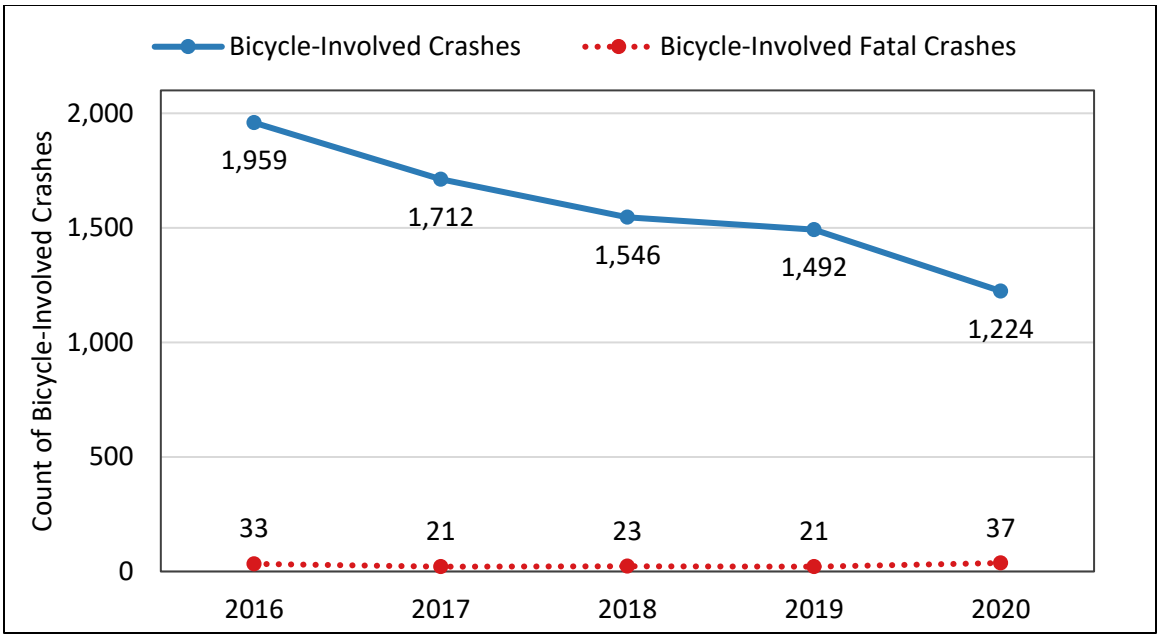

Figure 1 – Bicycle-Involved Crashes by Year

3.2 Crash Severity

Table 2 compares crash severities for crashes involving bicyclists and crashes involving only motor vehicles. About 1.7% of bicycle-involved crashes were fatal and 9.3% involved suspected serious injuries. Only 21.2% of bicycle-involved crashes were without injury, compared with 82.5% of crashes involving only motor vehicles. These differences in police-reported crashes highlight the vulnerability of bicyclists compared with motor vehicle occupants.

Table 2. Crash Severity Distributions for Bicycle-Involved and Motor-Vehicle-Only Crashes, 2016-2020

Crash Severity – Worst Injury in Crash	Bicycle-Involved Crashes	Motor Vehicle Only Crashes
Fatal Injury (K)	1.7%	0.3%
Suspected Serious Injury (A)	9.3%	1.4%
Suspected Minor Injury (B)	35.4%	4.8%
Possible Injury (C)	32.5%	11.0%
No Injury (O) - Property Damage Only (PDO)	21.2%	82.5%
Total	**100%**	**100%**

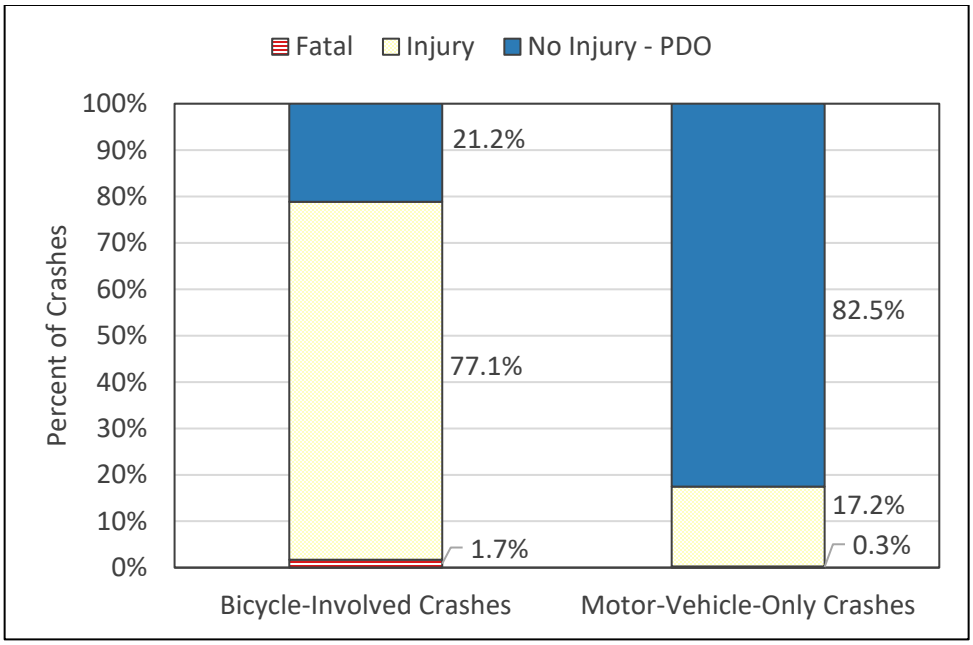

Figure 2 – Crash Severity of Bicycle-Involved and Motor-Vehicle-Only Crashes, 2016-2020

Figure 2 provides a striking visual comparison of the crash severity distributions between bicycle-involved crashes and motor-vehicle-only crashes. Both crash types are categorized according to the worst injury in the crash—fatal, injury (injuries ranging from suspected serious to possible injury), or PDO (property damage only). The figure illustrates the much greater likelihood of death or injury in bicycle-involved crashes compared with crashes involving only motor vehicles.

4.0 Temporal Variables

4.1 Month of Year

Figure 3 shows the number of bicycle-involved crashes across different months of the year. About 78% of bicycle-involved crashes occurred from May through October, with the top months being July, August, and September. The fewest bicycle-involved crashes occurred in January and February, with a combined 4.4% of the total. The bicycle-involved crash pattern aligns with the cycling season in Michigan, which generally spans from April through October.

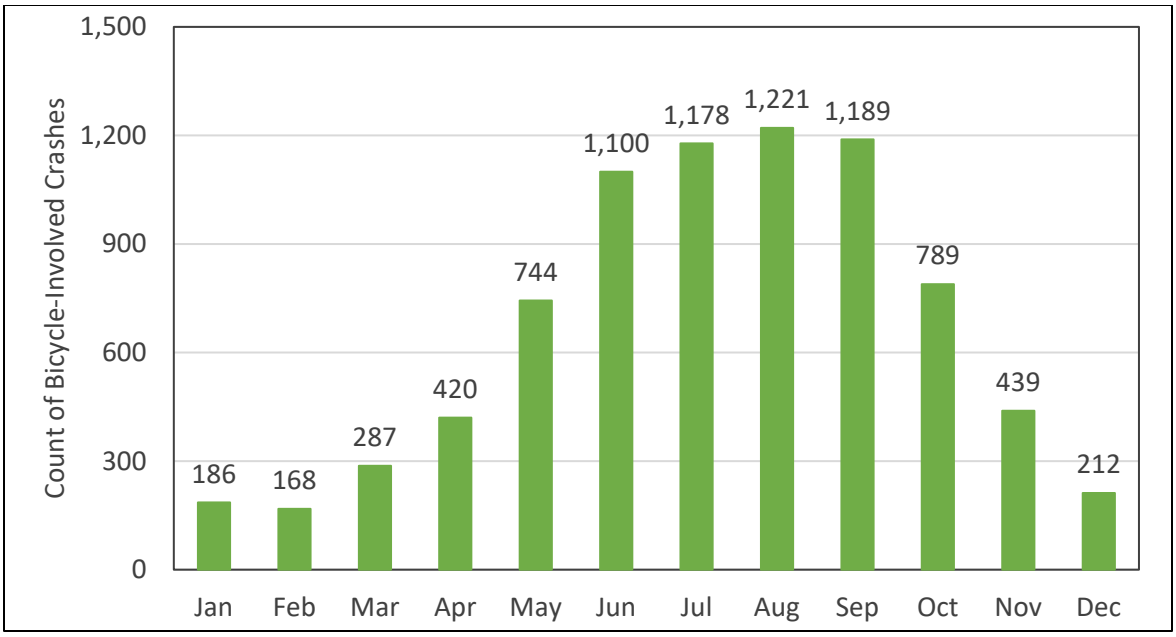

Figure 3 – Bicycle-Involved Crashes by Month, 2016-2020

4.2 Day of Week

Figure 4 shows the number of bicycle-involved crashes on each day of the week. Counts were higher on the weekdays compared to weekends, which may reflect travel by bicycle to work and school. The percent of bicycle-involved crashes on each weekday ranged from 15.0% to 16.6%, compared with 9.5% on Sunday and 11.1% on Saturday.

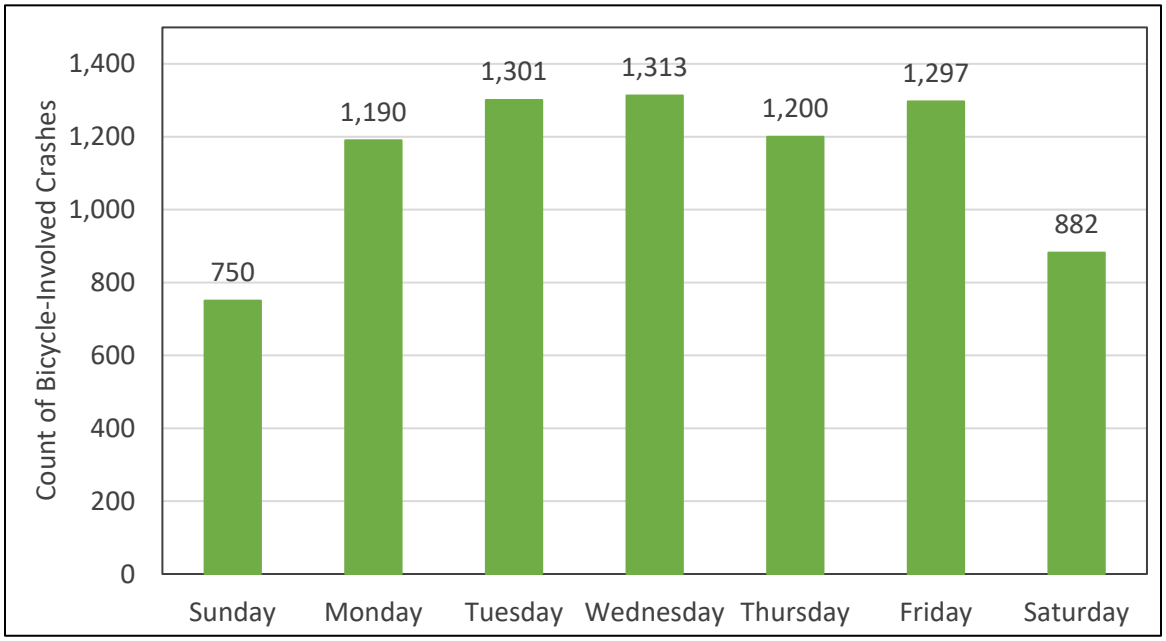

Figure 4 – Bicycle-Involved Crashes by Day of Week, 2016-2020

4.3 Time of Day

Figure 5 shows the number of bicycle-involved crashes across the hours of the day. We see that the number of bicycle-involved crashes generally rose from the 9:00 a.m. hour through the 4:00 p.m. hour, when 9.9% of bicycle-involved crashes occurred. The number then declined each hour, reaching the low point during the 3:00 a.m. hour, when just 16 bicycle-involved crashes (0.2%) occurred over the five-year period.

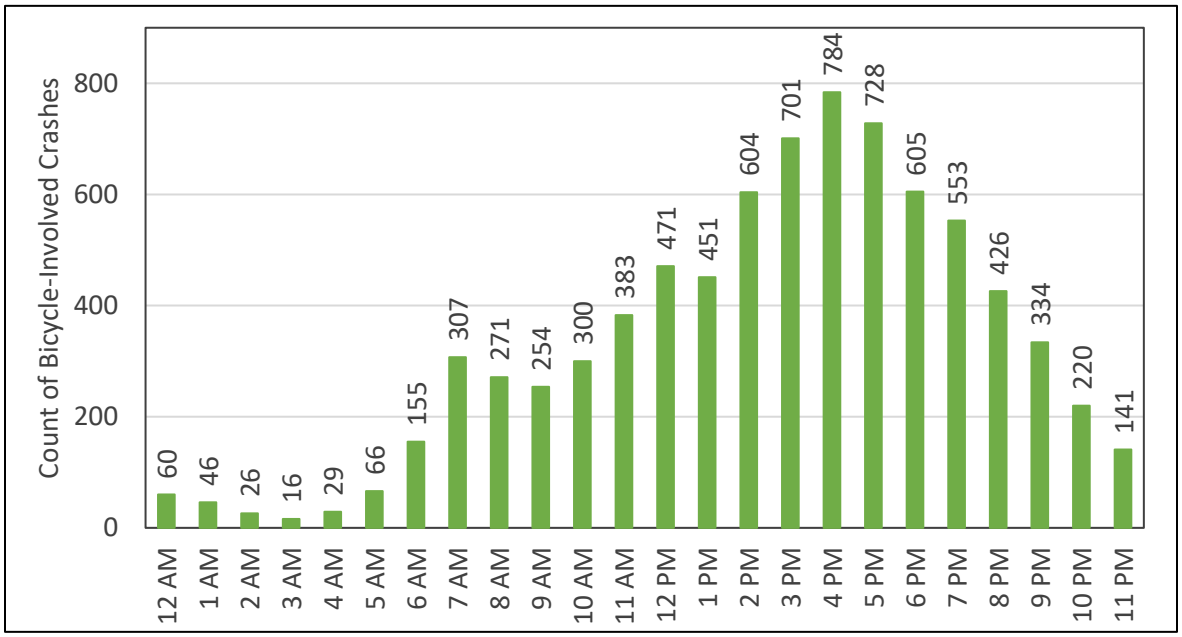

Figure 5 – Bicycle-Involved Crashes by Time of Day, 2016-2020

5.0 External/Environmental Conditions

5.1 Light Conditions

Figure 6 shows crash counts by light condition for bicycle-involved crashes. About 76.0% of bicycle-involved crashes occurred in daylight conditions, 13.1% in dark-lighted conditions, and 5.2% in dark-unlighted conditions. This distribution is likely related to exposure since bicyclists are more likely to be out during the daytime than at night.

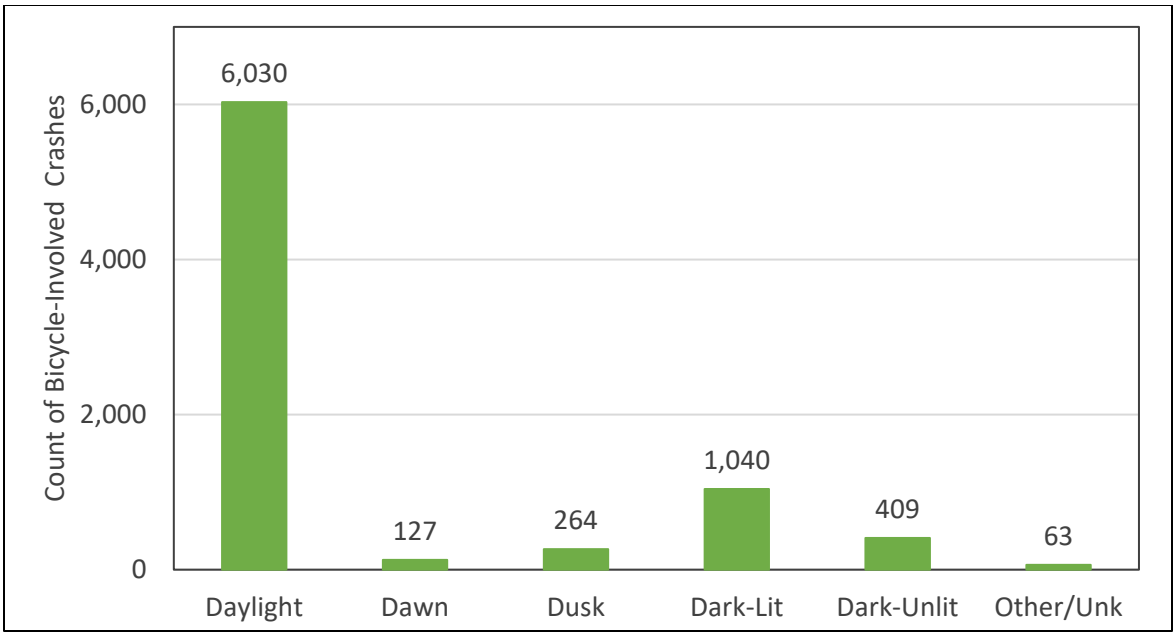

Figure 6 – Bicycle-Involved Crashes by Light Condition, 2016-2020

5.2 Weather Conditions

Figure 7 depicts weather conditions at the time of bicycle-involved crashes. Favorable weather was the norm, with 92.6% of the crashes occurring during clear or cloudy conditions and just 5.2% of the bicycle-involved crashes taking place when it was raining. Again, these weather-related crash patterns are likely related to exposure, with bicyclists less likely to be riding during bad weather.

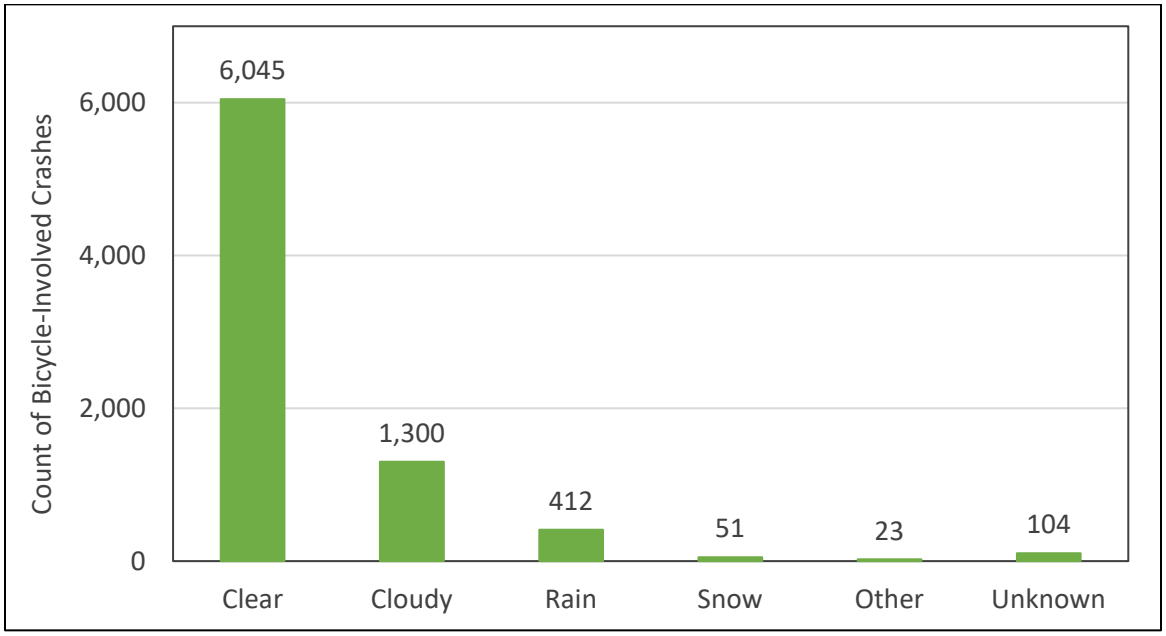

Figure 7 – Bicycle-Involved Crashes by Weather Condition, 2016-2020

6.0 Road Factors

6.1 Relation to Intersection

Table 3 indicates whether or not bicycle-involved crashes occurred at intersections. Most bicycle-involved crashes took place at intersections, but most fatal bicycle-involved crashes took place at non-intersections. About 66.1% of all bicycle-involved crashes and 45.2% of fatal bicycle-involved crashes occurred at intersections.

Table 3. Bicycle-Involved Crashes by Relation to Intersection, 2016-2020

Relation to Intersection	Fatal Crash (may also be injuries)	All Bicycle-Involved Crashes
Non-Intersection Crash	74	2,686
Intersection Crash	61	5,247
Total	**135**	**7,933**

6.2 Speed Limit

To examine speed limit at the crash site, bicycle-involved crashes were split into three groups according to levels of the KABCO scale of crash severity: fatal injury (K), all injuries (serious - A, minor - B, possible - C), and no injury with property damage only (O). Figure 8 shows the percentage of these three groups of crashes according to posted speed limit ranges at the crash site. Crashes with an unknown speed limit, about 2.6% of the total, were excluded.

There are relatively few crashes at posted speed limits of 15 mph or less (1.4%) and 60+ mph (0.5%). A majority of crashes occur within 20-35 mph (66.4%) and 40-55 mph (31.7%) posted speed limits. For the O-level crashes, 76.3% occurred at posted speeds of 35 mph or less. In contrast, 66.4% of A/B/C-level crashes and just 31.1% of crashes involving a fatality took place at posted speeds of 35 mph or less. In general, the percentage of fatalities increased with increases in posted speed limits except for in the very few cases of crashes at 60+ mph: 0.5% of crashes at posted speeds of 25 mph or less involved a fatal injury, 2.6% of crashes at posted speeds of 30 mph or higher involved a fatality, and 7.9% of crashes involved a fatality at speeds of 50 mph or higher. In general, bicyclists are more likely to use roadways in the lower speed limit ranges, but, unsurprisingly, when bicycle-involved crashes occur in higher speed limit zones they are much more likely to be severe.

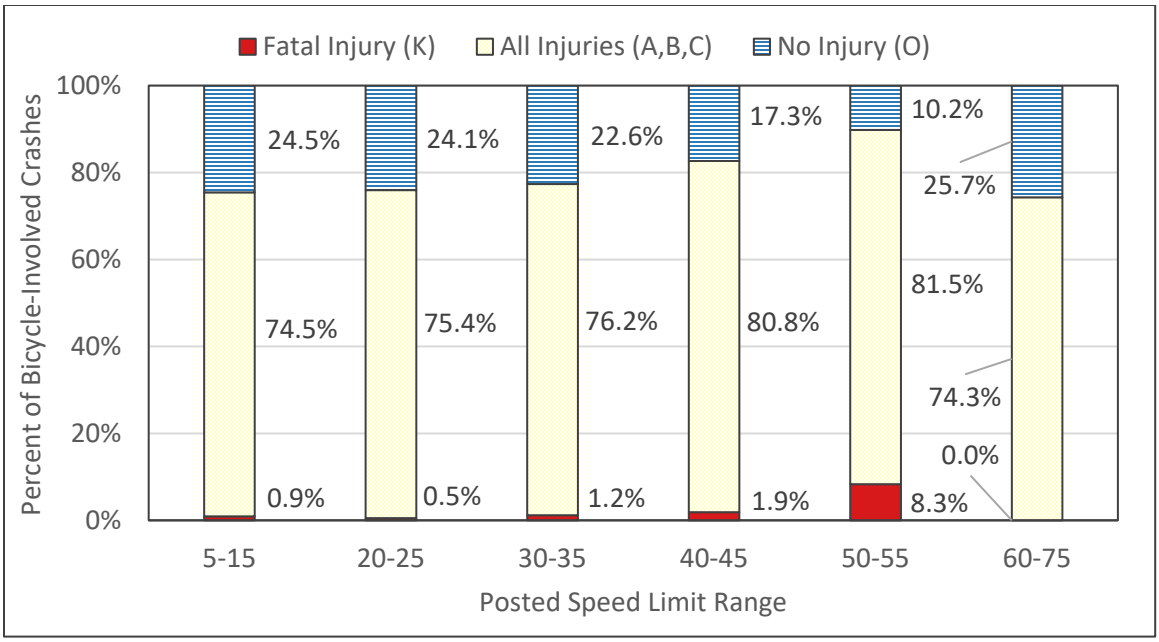

Figure 8 – Bicycle-Involved Crashes by Speed Limit at Crash Site and Severity, 2016-2020

7.0 Impairment-Related Crashes

Table 4 compares impairment distributions for bicycle-involved crashes and crashes involving only motor vehicles. Impairment status is based on what is reported by the police officer at the time of the crash for both bicyclists and drivers. The crashes are split into those not involving alcohol or drugs, those involving alcohol only, those involving drugs only, and crashes involving both alcohol and drugs. The impairment distributions for bicycle-involved crashes and motor-vehicle-only crashes are similar, although a slightly larger share of bicycle-involved crashes (3.4%) involved alcohol only compared with motor vehicle crashes (2.8%).

Table 4. Impairment Distributions for Bicycle-Involved and Motor Vehicle Crashes, 2016-2020

Impairment	Bicycle-Involved Crashes	Motor-Vehicle-Only Crashes
Alcohol Only	3.4%	2.8%
Drugs Only	0.5%	0.5%
Alcohol & Drugs	0.4%	0.4%
None	95.7%	96.3%
Total	**100%**	**100%**

In the five years of data, there were 299 bicycle-involved crashes involving alcohol. Figure 9 shows the drinking status for the bicyclists and motor vehicle drivers in those crashes (two drivers with unknown alcohol use were excluded). Of the 301 bicyclists in these crashes, 227 (75.4%) were drinking. In contrast, of the 304 drivers in these crashes, only 80 (26.3%) were drinking.

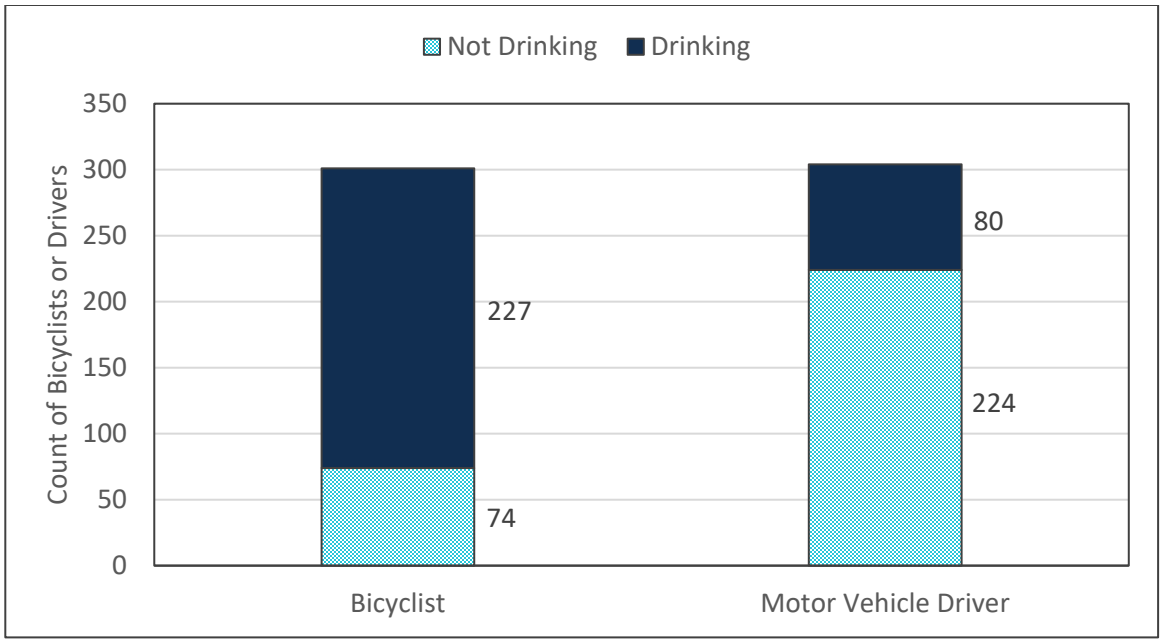

Figure 9 – Bicyclists and Drivers in Alcohol-Involved Bicycle-Involved Crashes, 2016-2020

8.0 Bicyclist Age and Helmet Use

Of the 8,005 bicyclists involved in crashes over the five-year period, age was unknown for 324 and coded as "0" for 170. In theory, zero values should mean less than one year old, but in reality, most of these were likely also unknown age. Excluding both of those categories leaves us with 7,511 bicyclists and their age groups are charted in Figure 10. For these bicyclists of known age one and older, 25.5% were under age 18 and 64.6% were under age 40.

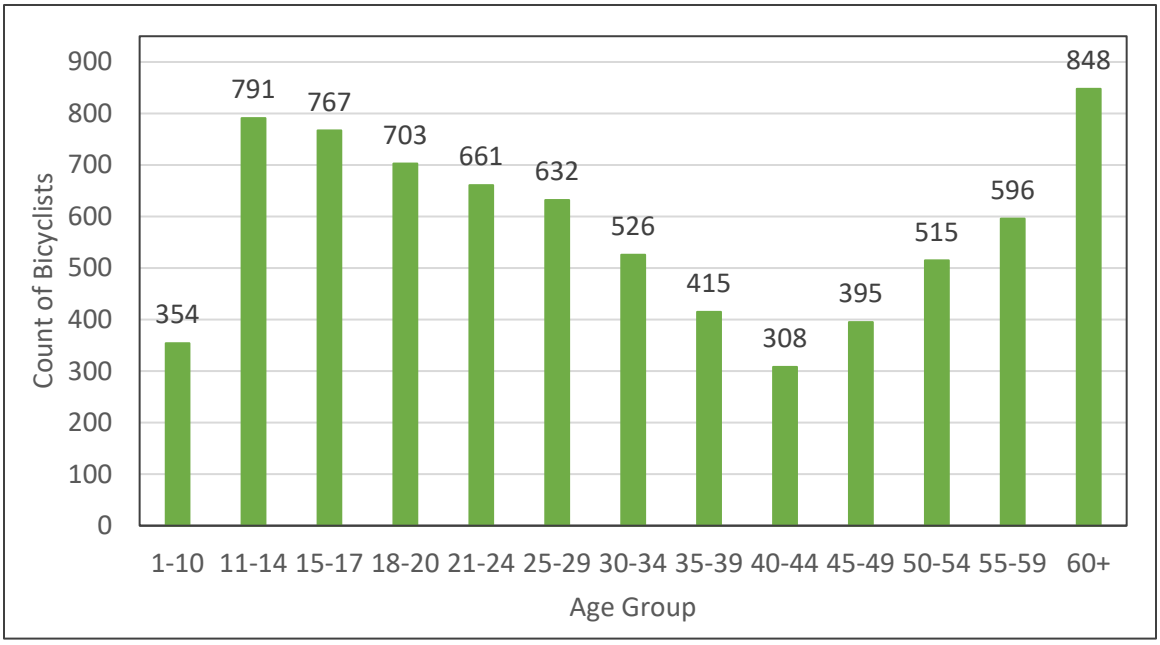

Figure 10 – Bicyclists in Crashes by Age Group, 2016-2020

Of the 7,511 bicyclists of known age one and older, helmet use was not reported for 3,006 (40.0%) bicyclists. These cases were coded as helmet use unknown, no belts available, or some other level of the Person Restraint variable. When helmet use was reported, 1,048 (23.3%) bicyclists were reported as having worn a helmet at the time of the crash and 3,457 (76.7%) were unhelmeted. Since helmet use was not recorded in a large share of cases, it is unknown how well the known helmet use distribution represents the entire population of crash-involved bicyclists.

That said, it is still interesting to compare helmet use rates among age groups where helmet use was known. Figure 11 shows the percentage of crash-involved bicyclists in each age group who were helmeted at the time of the crash, again restricting to bicyclists with known helmet use. In general, the percentage helmeted was higher for older riders than younger riders. The 15-17 (9.3%) and 18-20 (9.0%) year-old riders had the lowest percentages of helmet use. Conversely, the age groups with the highest percentages of helmet use were the two oldest. Of the 366 bicyclists age 55-59, 114 (31.1%) were helmeted. Among bicyclists 60 and older, 217 (40.6%) of 535 were helmeted.

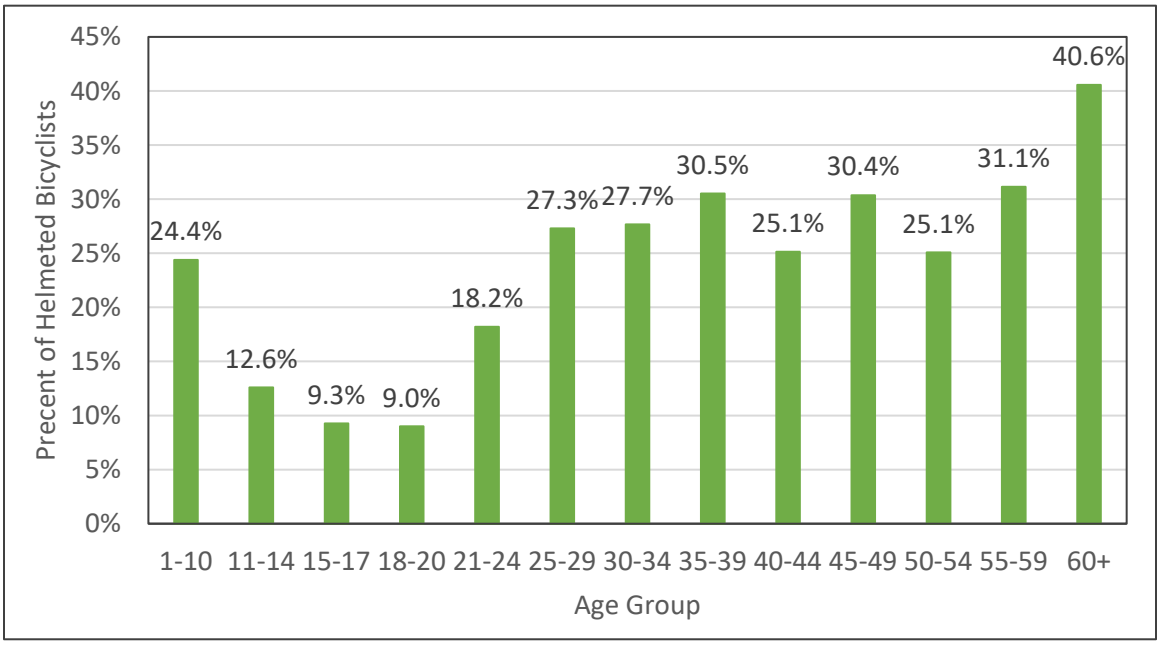

Figure 11 – Percent of Helmeted Bicyclists in Crashes by Age Group, 2016-2020

9.0 Summary

From 2016 through 2020 in Michigan, an average of 1,587 motor vehicle crashes involving a bicyclist took place each year. In a typical year, 27 bicycle-involved crashes involved at least one fatality. Bicyclists are vulnerable roadway users compared with motor vehicle occupants, as they lack the protection a vehicle's frame, airbags, and seat belts provide. While only 17.5% of crashes involving only motor vehicles resulted in death or injury, 78.8% of bicycle-involved crashes resulted in death or injury to at least one person.

Bicycle-involved crashes were concentrated during the warmer months, in clear weather, on the weekdays, and during daytime hours. The majority of bicycle-involved crashes took place at intersections, but the majority of fatal bicycle-involved crashes occurred at non-intersections. For

bicycle-involved crashes that involved alcohol, alcohol use was reported for the bicyclists about three times as often as for the motor vehicle drivers.