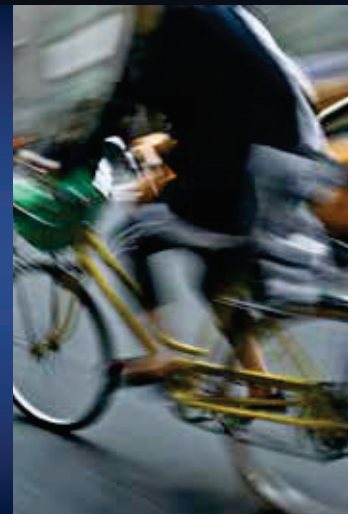


North Carolina Bicycle Crash Facts

2015 - 2019



Prepared for
The North Carolina Department of Transportation
Division of Bicycle and Pedestrian Transportation



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April 2021

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General North Carolina Bicycle Crash Trends

This report provides a summary of crash trends and crash-related factors (where, when, who was involved, and conditions present) for bicycle-motor vehicle crashes across the State. The information should help road safety practitioners, partners, and the public understand prevalent crash and injury-related factors. In turn, this understanding can help suggest a focus for potential treatments. The companion *North Carolina Bicycle Crash Types* summary report provides additional insights and potential treatment targets.

Between 2010 and 2019, 9,478 crashes between bicycles and motor vehicles were reported by North Carolina public safety agencies (Figure 1). The ten-year trend in crashes has been somewhat mixed (up and down). Bicycling tends to be affected by weather patterns, and differences in weather across years and months may affect amounts of bicycling and crashes. Changes in reporting data may also have affected the numbers of crashes reported for different years.¹ From the data available, the highest number of collisions for the entire 10-year period occurred in 2011 with 1,029; 2019 had 907. The five years between 2010 and 2014 averaged 953 reported crashes per year, while the five years between 2015 and 2019 averaged 942 per year. This decrease was due to a 14 percent decline in reported rural bicycle crashes between 2010-2014 and 2015-2019 (Figure 1). Urban areas saw 4 percent more crashes between the five-year periods. Unfortunately, exposure data are lacking that might help explain these trends in reported crashes. Additionally, urban crashes accounted for 73 percent of the total over the 10 years while rural crashes were 27 percent, based on the data reported.

In recent years, there has, however, been an increase in the number of crashes where a bicyclist was killed or suffered a suspected serious injury (Figure 2). This count ranged from a low of 55 bicyclists in 2014 to 90 bicyclists in 2018. It is important to note that in 2016, the NC Department of Transportation revised the definition of A-type injuries from disabling to serious, and B-type injuries from evident to minor. This is a possible contributor to the rise in severe crashes starting in 2016. These revised injury categories were likely phased in at different times across the many reporting jurisdictions in the State. Analyzing the counts of these severe crashes shows a mixed trend before the definition change, in both rural and urban settings. In most years, rural areas had more severe crashes than urban areas due to a prevalence of higher speed two-lane undivided roadways, limited bicycling infrastructure, and less roadway lighting among other possible factors. There has also been an increase in the percent of rural crashes resulting in fatal or serious injury from 12 percent between 2010-2014 to 17 percent between 2015-2019. By comparison, for urban areas this percent increased very slightly, from 4.6 to 4.8 percent.

¹ 2013-2015 data years may have been affected by differences in crash reporting for one or more jurisdictions. In 2016, additional efforts were undertaken to identify all potential bicycle-motor vehicle crashes to help overcome these reporting differences but reported crash data are always subject to accuracy and completeness issues.

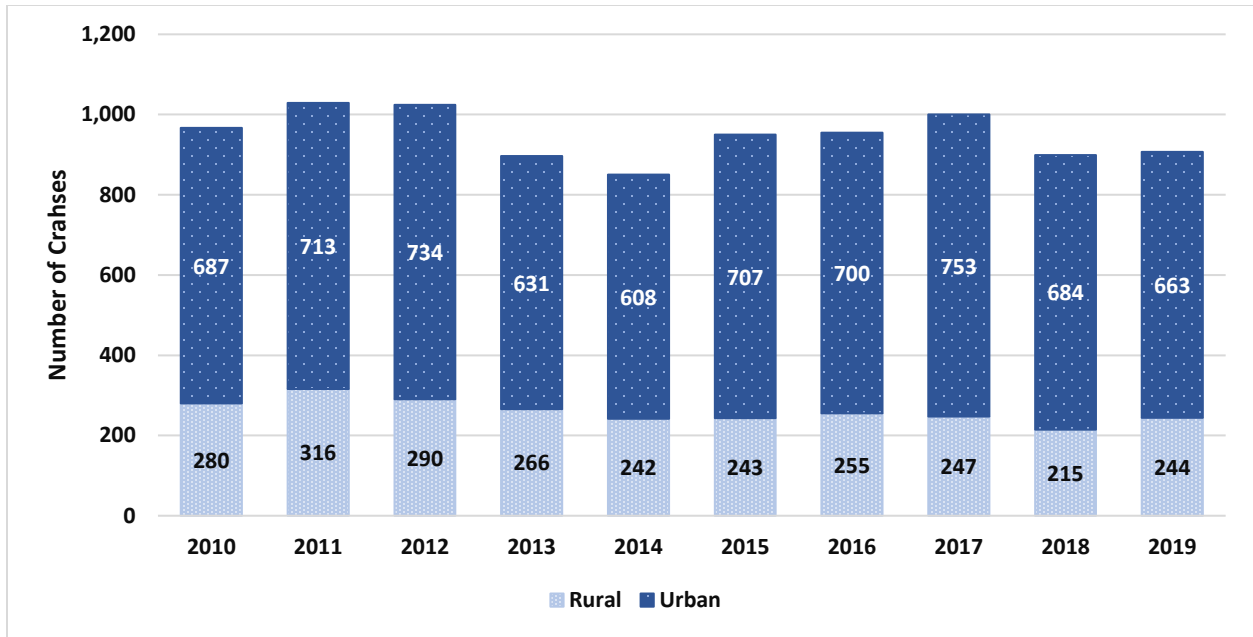


Figure 1 Bicycle-motor vehicle crashes by rural/urban location

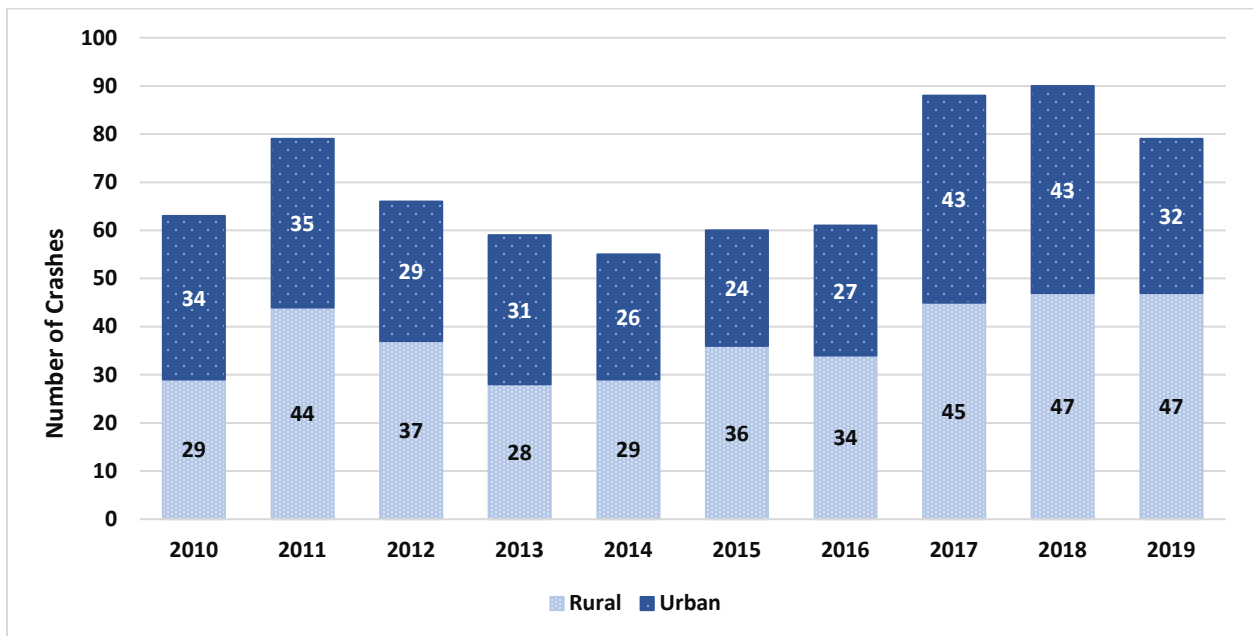


Figure 2 Fatal and suspected serious injury bicycle crashes by rural/urban location

Table 1 presents data for

- the total number of crashes with a fatal injury to any person (bicyclist or vehicle occupant) in the crash
- the total number of crashes with a fatally-injured bicyclist (which excludes a few crashes where a driver or vehicle occupant was fatally injured), and
- the total number of fatally-injured bicyclists.
- the total bicycle-motor vehicle crashes identified for all severities.

The numbers of crashes involving multiple bicyclists is small, but identifying the precise numbers killed and injured is not always straight-forward. In some cases, a bicyclist may die within the one-year period following a crash in which a fatality is assumed to be crash-related, but all the data may not be updated in time for inclusion in these records. In other cases, there are errors or inconsistencies in the data that require further inspection to resolve. Despite these issues, the data suggest that for the 2015-2019 period, a total of 107 bicyclists were killed in North Carolina in the 4,711 total crashes over these five years (Table 1). No crashes were indicated to involve multiple bicyclist fatalities in this period.

Table 1 Bicycle crashes resulting in fatal injuries, 2015-2019

| Definitions | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|------|------|-------|------|------|-------|
| Total number of crashes with any fatal Injury (may include motor vehicle occupants) | 24 | 18 | 30 | 18 | 19 | 109 |
| Total number of crashes with a fatally injured bicyclist | 23 | 17 | 30 | 18 | 19 | 107 |
| Total number of fatally injured bicyclists | 23 | 17 | 30 | 18 | 19 | 107 |
| Total crashes - all severity included in these analyses | 950 | 955 | 1,000 | 899 | 907 | 4,711 |

In addition to the 107 bicyclist fatalities, another 272 bicyclists received suspected serious injuries per the reporting officers. As mentioned above, the increase in suspected serious injury crashes beginning in 2017 likely reflects, in part, the changed crash severity definitions.

Exposure Notes

Apart from fluctuations in the number of crashes that is due to chance and changes in reporting, the amount and numbers of people riding, volumes of traffic, locations of riding, and characteristics of those locations tend to affect bicycle-motor vehicle crash frequencies. Behaviors of bicyclists and motorists also affect crash risk. We currently lack estimates on the amounts of riding by bicyclists in NC in different location types. Variation in year-to-year crashes may also be subject to such influences as weather trends and other factors that may affect the amount of riding. Another primary risk factor is motor vehicle traffic volumes, although the risk does not generally increase in a linear proportion to traffic volume. Traffic volumes have generally been increasing throughout the study period, so other factors may be helping to counter that trend in crash risk exposure. In addition, as mentioned above and in footnote 1, changes in reporting practices can sometimes contribute to variations in reported bicycle crashes, potentially leading to incorrect inferences about trends.

Data Notes

Crashes are officially reportable to the NC Division of Motor Vehicles (source of these data) if a fatality, injury, or at least \$1,000 property damage occurred. Note that the data in these reports, and behind the query tool on the [North Carolina Pedestrian and Bicycle Crash Data Tool](#) website may include a small number of non-injury (or non-observed injury) crashes with low property damage that were not officially “reportable”, but which had nevertheless been reported to the State Division of Motor Vehicles

by local agencies. Non-reportable crashes may not be included in other State crash statistics. Because under-reporting of bicycle crashes is common,² any crashes in the database that involved bicyclists were retained in these data. In addition, injuries, even serious injuries that led to visits to emergency departments or other medical facilities, are sometimes noted after the crash report is filed, but crash reports may not be updated with such information.

As with all crash data, the reported numbers in the crash characteristics that follow undoubtedly reflect some error, including errors or gaps in reporting, as well as errors made during data entry and coding, but every effort has been made to ensure the highest quality and accuracy possible.³ It is also possible that reports for some bicycle crashes that occurred were not received by DMV in time to include in these data. The data used in these analyses are a snapshot received after reporting for each year is thought to be complete, but there are inevitably more crashes reported.

The remainder of this report summarizes the person, location types, time, environmental and roadway characteristics for the 4,711 bicycle-motor vehicle crashes reported statewide. This information, and similar information developed for local communities, can aid in the targeting of resources and countermeasures to address bicycle safety problems. See the companion *North Carolina Bicycle Crash Types* summary report for descriptions of crash groups along with an analysis of the most common and injurious bicycle crash group in North Carolina. This specific crash information can also aid in identifying and developing appropriate treatments.

Bicyclist Characteristics

In crashes involving more than one bicyclist, the following characteristics are associated with the most severely injured bicyclist reported on in the crash, or in cases where the injury is the same, the youngest child involved. The numbers and percentages in the tables below therefore reflect the most severely injured cyclist only and exclude cases with missing data for the bicyclist.

Bicyclist Age

Table 2 shows bicyclist crashes by age group for each year of the study period. Teenagers and young adults between 16 and 34 had the highest proportion of crashes with just under 40 percent, followed closely by the 35 to 64 year-old group. Similar to pedestrian crashes, the percentage of crashes involving seniors has generally increased through the study period.

² Stutts et al., 1999. Injury to Pedestrians and Bicyclists: An analysis based on hospital emergency department data. Report No. FHWA-RD-99-078. US Department of Transportation, Federal Highway Administration.

³ Note that each crash report was reviewed for the data described in these reports and available on the NCDOT-DBPT website for query. This review offered the opportunity to correct some coding errors.

Table 2 Age group of bicyclists involved in crashes⁴

| Bicyclist Age | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---------------|--------------------|-------|-------|-------|-------|--------------------|
| <16 | 171 | 149 | 159 | 131 | 136 | 746 |
| | 18.2% ¹ | 16.3% | 16.2% | 14.9% | 15.5% | 16.2% ² |
| 16-34 | 369 | 368 | 383 | 354 | 338 | 1,812 |
| | 39.3% | 40.3% | 39.0% | 40.2% | 38.5% | 39.5% |
| 35-64 | 356 | 353 | 371 | 342 | 331 | 1,753 |
| | 37.9% | 38.7% | 37.8% | 38.9% | 37.7% | 38.2% |
| 65+ | 44 | 43 | 68 | 53 | 73 | 281 |
| | 4.7% | 4.7% | 6.9% | 6.0% | 8.3% | 6.1% |
| Total | 940 | 913 | 981 | 880 | 878 | 4,592 ⁴ |
| | 20.5% ³ | 19.9% | 21.4% | 19.2% | 19.1% | |

Over the 5-year study period, young adults age 16 to 34 also had the highest crash rate per 10,000 residents in the State, while seniors over 65 had the lowest (Table 3). The rate for children under 16 (0.7) fell compared with the previous 5-year period (2010-2014; 0.9) while the rates for the other groups remained nearly the same (Table 3 and Table 4). Analysis by population helps to normalize trends according to population changes over time among the different age groups, but do not provide information about the amounts of riding among the different ages.

Table 3 Bicyclist age group crash rate by population, 2015-2019

| Bicyclist age group | Total crashes, 2015-2019 | Avg. 1-year Count | July 2017 population estimate ⁵ | Avg. yearly crash rate / 10,000 |
|---------------------|--------------------------|-------------------|--|---------------------------------|
| < 16 | 746 | 149.2 | 2,037,904 | 0.7 |
| 16-34 | 1,812 | 362.4 | 2,614,202 | 1.4 |
| 35-64 | 1,753 | 350.6 | 4,002,400 | 0.9 |
| 65+ | 281 | 56.2 | 1,616,294 | 0.3 |
| Total | 4,592 | 918.4 | 10,270,800 | 0.9 |

⁴ In this and each subsequent table, the formatting is as follows:

The top row for each variable level is the count of crashes with that characteristic. The numbers in the bottom rows for each category are percentages of the yearly total.

¹ = Row percent of column total

² = Row total percent of total

³ = Column total percent of total

⁴ = Total includes total minus any cases with missing or unknown data

⁵ Mid-period year population estimates were obtained for Tables 3 and 4 from North Carolina Office of State Budget and Management website: https://files.nc.gov/ncosbm/demog/statesingleage_2010_2019.html

Table 4 Bicyclist age group crash rate by population, 2010-2014

| Bicyclist age group | Total crashes, 2010-2014 | Avg. 1-year Count | July 2012 population estimate | Avg. yearly crash rate / 10,000 |
|---------------------|--------------------------|-------------------|-------------------------------|---------------------------------|
| < 16 | 894 | 178.8 | 2,034,045 | 0.9 |
| 16-34 | 1,804 | 360.8 | 2,497,319 | 1.4 |
| 35-64 | 1,847 | 369.4 | 3,875,939 | 1.0 |
| 65+ | 153 | 30.6 | 1,341,820 | 0.2 |
| Total | 4,698 | 939.6 | 9,749,123 | 1.0 |

Bicyclist Injury

Table 5 shows the data for 2015-2019 bicycle crashes.⁶ Bicycle crashes tend to be serious, with over 2 percent resulting in fatal injury over the study period. By comparison, around 0.5 percent of all motor vehicle crashes in NC resulted in fatal injuries.⁷ Additionally, close to 6 percent of all bicycle crashes resulted in suspected serious injuries over the five-year period. The high number of unknown injury crashes in 2016 was the result of missing injury data from some municipalities.

Table 5 Five-year bicycle crash injury levels

| Bicyclist injury | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|-----------------------------|-------|-------|-------|-------|-------|-------|
| K: Killed | 23 | 17 | 30 | 18 | 19 | 107 |
| | 2.4% | 1.8% | 3.0% | 2.0% | 2.1% | 2.3% |
| A: Suspected Serious Injury | 37 | 45 | 58 | 72 | 60 | 272 |
| | 3.9% | 4.7% | 5.8% | 8.0% | 6.6% | 5.8% |
| B: Suspected Minor Injury | 406 | 366 | 421 | 363 | 361 | 1,917 |
| | 42.7% | 38.3% | 42.1% | 40.2% | 39.8% | 40.7% |
| C: Possible Injury | 365 | 372 | 362 | 315 | 347 | 1,761 |
| | 38.4% | 39.0% | 36.2% | 35.0% | 38.3% | 37.4% |
| O: No Injury | 100 | 93 | 97 | 105 | 85 | 480 |
| | 10.5% | 9.7% | 9.7% | 11.7% | 9.4% | 10.2% |
| Unknown Injury | 19 | 62 | 32 | 26 | 35 | 174 |
| | 2.0% | 6.5% | 3.2% | 2.9% | 3.9% | 3.7% |
| Total | 950 | 955 | 1,000 | 899 | 907 | 4,711 |
| | 20.2% | 20.3% | 21.2% | 19.1% | 19.3% | |

Table 6 shows the number and percent of bicyclists by age group who received fatal/suspected serious or suspected serious/possible/no/unknown injuries. While adults age 35 to 64 accounted for around 38 percent of all crashes over the five-year period, they represented 48 percent of the most severe crashes.

⁶ Counts are of crashes with the severity of bicyclist injury reported for the most seriously-injured bicyclist in the crash (if > 1). As shown previously, for this period, the numbers of fatally-injured bicyclists and numbers of fatal crashes were the same.

⁷ North Carolina 2019 Traffic Crash Facts:

<https://connect.ncdot.gov/business/DMV/CrashFactsDocuments/2019%20Crash%20Facts.pdf>

Bicyclists 65 and older also made up a higher percentage of fatal and serious injury crashes compared to more minor crashes.

Table 6 Bicyclist injury severity by age group

| Bicyclist age group | Fatal or Suspected Serious Injury | Suspected Minor, Possible, No or Unknown Injury | Total |
|---------------------|-----------------------------------|---|-------|
| < 16 | 52 | 694 | 746 |
| | 13.8% | 16.5% | 16.2% |
| 16-34 | 105 | 1,707 | 1,812 |
| | 27.9% | 40.5% | 39.5% |
| 35-64 | 181 | 1,572 | 1,753 |
| | 48.1% | 37.3% | 38.2% |
| 65+ | 38 | 243 | 281 |
| | 10.1% | 5.8% | 6.1% |
| Total | 376 | 4,216 | 4,592 |
| | 8.2% | 91.8% | |

Bicyclist Gender

There was relatively little change year-to-year, with male bicyclists accounting for an average of 84 percent of crashes in which gender was indicated. However, female bicyclists suffered a higher percentage of the fatal or serious injury crashes (18 percent) compared to their total crashes (16 percent) (Table 7).

Table 7 Gender by injury level

| Bicyclist gender | Fatal or Suspected Serious Injury | Suspected Minor, Possible, No, or Unknown Injury | Total |
|------------------|-----------------------------------|--|-------|
| Female | 68 | 662 | 730 |
| | 17.9% | 15.8% | 16.0% |
| Male | 311 | 3,534 | 3,845 |
| | 82.1% | 84.2% | 84.0% |
| Total | 379 | 4,196 | 4,575 |
| | 8.3% | 91.7% | |

Bicyclist Race/Ethnicity

White bicyclists were involved in more crashes in the State than any other race or ethnic group (Table 8). The increase or decrease in crash frequencies between 2010-2014 and 2015-2019 time periods varies across racial or ethnic groups. Among known categories, Other race/ethnicity had the highest increase of crash numbers (46 percent) between 2010-2014 and 2015-2019. The percentage increase among Unknown/Missing (meaning race/ethnicity was not reported) also increased by 67 percent. Due to the relative infrequency of fatal and serious injury bicyclist crashes, these trends by racial and ethnic groups are not reported for bicyclists.

Table 8 All crashes by race of bicyclist, 2010-2014 and 2015-2019

| Bicyclist Race/Ethnicity | 2010-2014 | 2015-2019 | Percent Change |
|---------------------------------|------------------|------------------|-----------------------|
| Asian American | 48 | 52 | 8.3% |
| Black | 1,612 | 1,542 | -4.3% |
| Hispanic (of any race) | 249 | 251 | 0.8% |
| Native American | 54 | 46 | -17.4% |
| Other | 52 | 76 | 46.2% |
| Unknown/Missing | 95 | 158 | 66.3% |
| White | 2,657 | 2,586 | -2.7% |
| Total | 4,767 | 4,711 | -1.2% |

When considering the rate per population, however, Black bicyclists were disproportionately involved in crashes with motor vehicles over both five-year periods compared to other groups (Appendix - Figure 10). Details of crash counts per race or ethnicity can also be found in the Appendix. The reasons for variations in rates of crash involvement per population likely relate most to amounts of bicycling by different groups, as well as differences in risk of locations and times of riding, and other factors that are not well-understood.

Bicyclist Alcohol or Drug Use

According to the information available on police crash reports, alcohol and/or drug use was detected or suspected for over 5 percent of all bicyclists involved in crashes where these data were available (Table 9). Suspected alcohol or drug use does not confirm that alcohol or drugs were factors in the crash. Additionally, there are difficulties in detecting drug use and tests may not be available to measure all potentially impairing drugs or assess their possible influence on crashes.

Table 9 Bicyclist use of alcohol or drugs

| Bicyclist alcohol / drug use suspected or detected | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|-------------|-------------|-------------|-------------|-------------|--------------|
| No | 872 | 855 | 904 | 691 | 711 | 4,033 |
| | 92.5% | 93.1% | 92.0% | 90.7% | 90.1% | 91.8% |
| Alcohol and Drugs Impairment Suspected or Detected | 0 | 1 | 2 | 2 | 2 | 7 |
| | 0.0% | 0.1% | 0.2% | 0.3% | 0.3% | 0.2% |
| Alcohol Impairment Suspected or Detected | 47 | 38 | 47 | 34 | 42 | 208 |
| | 5.0% | 4.1% | 4.8% | 4.5% | 5.3% | 4.7% |
| Drug Impairment Suspected or Detected | 1 | 2 | 1 | 5 | 1 | 10 |
| | 0.1% | 0.2% | 0.1% | 0.7% | 0.1% | 0.2% |
| Unknown | 23 | 22 | 29 | 30 | 33 | 137 |
| | 2.4% | 2.4% | 3.0% | 3.9% | 4.2% | 3.1% |
| Total | 943 | 918 | 983 | 762 | 789 | 4,395 |
| | 21.5% | 20.9% | 22.4% | 17.3% | 18.0% | |

Bicyclist alcohol/drug use was more common among crashes resulting in fatal or serious injury (Figure 3). While alcohol or drug use was indicated in 4 percent of minor, possible, no, or unknown injury crashes (when use was suspected or known), alcohol and/or drug use was indicated in over 14 percent of fatal and suspected serious injury crashes.

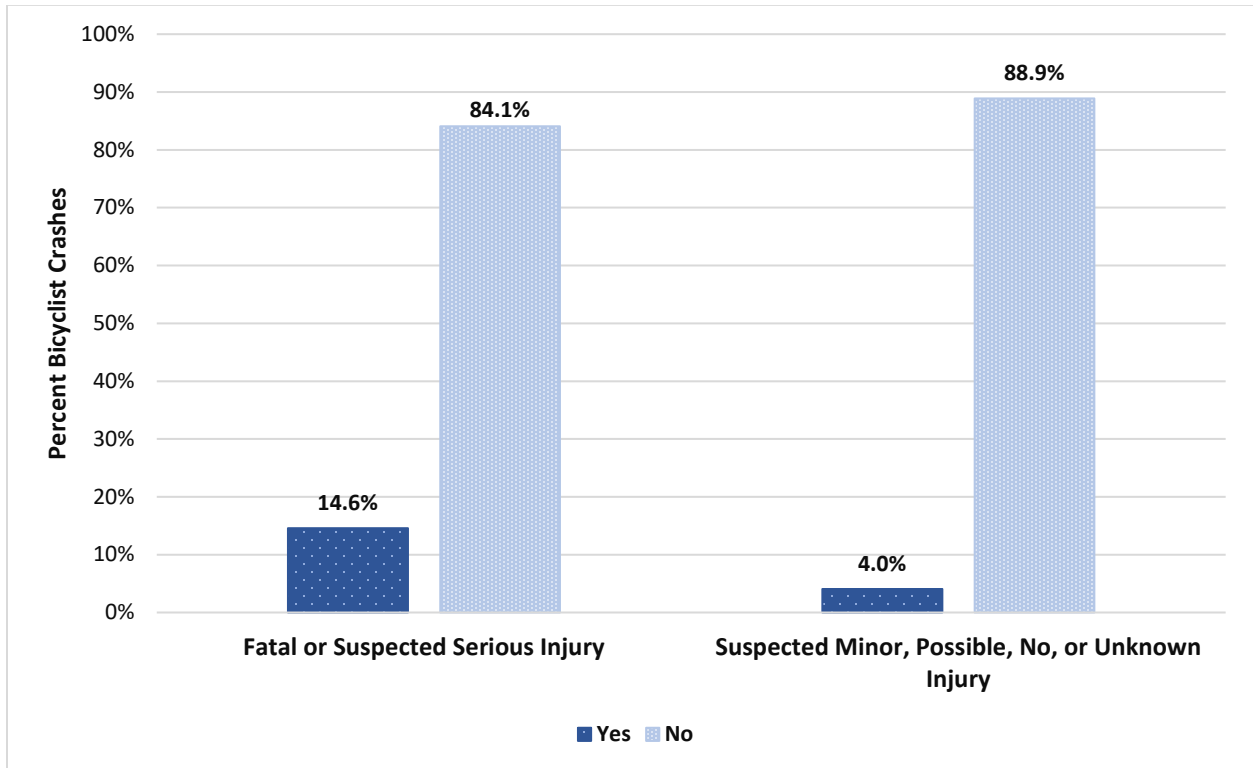


Figure 3 Alcohol or drug use by bicyclist injury level

Driver Characteristics

On average, over 16 percent of the crashes were reported to involve hit and run drivers (data not shown), in itself of interest to enforcement and safety officials. Driver characteristics data are usually lacking for hit and run drivers unless they were subsequently identified; occasionally data are missing for other drivers as well. The numbers and percentages in the driver tables below reflect the first driver involved in the crash and exclude cases with missing data for the drivers.

Driver Age

Drivers between 35 and 64 accounted for around 47 percent of all crashes with bicyclists where the driver’s age is known (Table 10). However, drivers younger than 35 had the highest rate of crashes relative to their proportion of the population with close to 6 per 10,000 people (data not shown).

Table 10 Age of drivers involved in crashes with bicyclists

| Driver Age Group | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|------------------|-------|-------|-------|-------|-------|-------|
| <35 | 319 | 332 | 337 | 264 | 276 | 1,528 |
| | 38.6% | 40.8% | 39.1% | 35.0% | 35.8% | 37.9% |
| 35 - 64 | 381 | 372 | 396 | 346 | 382 | 1,877 |
| | 46.1% | 45.7% | 45.9% | 45.9% | 49.5% | 46.6% |
| 65+ | 126 | 110 | 129 | 144 | 114 | 623 |
| | 15.3% | 13.5% | 15.0% | 19.1% | 14.8% | 15.5% |
| Total | 826 | 814 | 862 | 754 | 772 | 4,028 |
| | 20.5% | 20.2% | 21.4% | 18.7% | 19.2% | |

Driver Race/Ethnicity

White drivers were most involved in crashes with bicyclists in the State (Table 11). The rate of increase or decrease among driver racial or ethnic group also varied between 2010-2014 and 2015-2019 with Native Americans seeing the largest decrease and Other race/ethnicity again having the highest percentage increase.

Table 11 All crashes by race of driver, 2010-2014 and 2015-2019

| Driver Race/Ethnicity | 2010-2014 | 2015-2019 | Percent Change |
|------------------------|-----------|-----------|----------------|
| Asian American | 43 | 58 | 34.9% |
| Black | 1,177 | 1,277 | 8.5% |
| Hispanic (of any race) | 158 | 190 | 20.3% |
| Native American | 56 | 43 | -23.2% |
| Other | 54 | 86 | 59.3% |
| Unknown/Missing | 648 | 691 | 6.6% |
| White | 2,631 | 2,366 | -10.1% |
| Total | 4,767 | 4,711 | -1.2% |

Similar to the bicyclist rate data, Black drivers had a higher rate of being involved in bicycle crashes Statewide (Appendix A - Figure 11). Other racial/ethnic groups had lower driver crash rates with the increase or decrease varying between 2010-2014 and 2015-2019. Other race/ethnicity had the highest crash rate increase between 2010-2014 and 2015-2019. As for bicyclists and pedestrians, interpretation of these differences by different demographic groups is complicated by a lack of data on amounts, locations, and times of driving by different groups, and numbers of bicyclists cycling in the same areas, trends in reporting by race/ethnicity, and others. For example, some populations may have more nighttime work shifts and therefore be more exposed to driving and bicycling under nighttime conditions. Self-identification by race/ethnicity could also change over time.

Driver Alcohol or Drug Use

Alcohol and/or drug use by drivers in crashes with bicyclists was detected or suspected in less than 2 percent of crashes (Table 12). This indication does not confirm impairment, or that alcohol or drugs were factors in the crash. Additionally, due to the many types of drugs and potential interactions along

with difficulty in detecting diverse types of drugs and/or their effects, the relationship of these data to crash risk is uncertain. However, with increasing concerns about opioids and other classes of drugs, there may be interest in tracking and better-understanding these data.

Table 12 Driver use of alcohol or drugs

| Driver alcohol / drug use suspected or detected | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|--|-------|-------|-------|-------|-------|-------|
| No | 795 | 789 | 833 | 732 | 748 | 3,897 |
| | 94.0% | 94.0% | 94.1% | 91.4% | 90.8% | 92.9% |
| Alcohol and Drugs Impairment Suspected or Detected | 1 | 1 | 2 | 1 | 0 | 5 |
| | 0.1% | 0.1% | 0.2% | 0.1% | 0.0% | 0.1% |
| Alcohol Impairment Suspected or Detected | 11 | 10 | 10 | 9 | 6 | 46 |
| | 1.3% | 1.2% | 1.1% | 1.1% | 0.7% | 1.1% |
| Drug Impairment Suspected or Detected | 2 | 2 | 2 | 3 | 1 | 10 |
| | 0.2% | 0.2% | 0.2% | 0.4% | 0.1% | 0.2% |
| Unknown | 37 | 37 | 38 | 56 | 69 | 237 |
| | 4.4% | 4.4% | 4.3% | 7.0% | 8.4% | 5.6% |
| Total | 846 | 839 | 885 | 801 | 824 | 4,195 |
| | 20.2% | 20.0% | 21.1% | 19.1% | 19.6% | |

Alcohol and/or drug use was detected or suspected of a driver in over 6 percent of bicycle crashes involving a fatal or serious injury (Table 13). This rate is significantly higher than for all crashes where this variable is known.

Table 13 Driver use of alcohol or drugs by bicyclist injury level

| Driver alcohol/drug use suspected or detected | Fatal or Suspected Serious Injury | Suspected Minor, Possible, No, or Unknown Injury | Total |
|---|-----------------------------------|--|-------|
| Yes | 20 | 41 | 61 |
| | 6.1% | 1.1% | 1.5% |
| No | 308 | 3,589 | 3,897 |
| | 93.9% | 98.9% | 98.5% |
| Total | 328 | 3,630 | 3,958 |
| | 8.3% | 91.7% | |

Where Bicycle Crashes Occur

Development Extent

This section and chart, and the next section on development type, again present data for a 10-year interval. As previously mentioned, around 73 percent of NC bicycle crashes between 2010 and 2019 occurred in urban settings, with around 27 percent in rural areas of the State, although, as noted above, data for urban and some rural jurisdictions may not be equally complete for all years (Figure 1).

Although designated as rural, some of these locations could also be built up or partly developed. In fact, when looking at development density, as coded by the reporting enforcement agencies, the trend is more heavily weighted toward bicycle crashes occurring in at least somewhat developed areas: around 86 percent of all crashes occurred in areas that are at least 30 percent developed, while 14 percent occurred in areas that are less than 30 percent developed, on average (Figure 4).

Areas that are between 30 percent and 70 percent developed may represent areas in transition, as well as areas near urban areas that are accessible by bicycling. In these areas, infrastructure may remain suburban to more rural in nature and traffic speeds may remain relatively high, while demand for cycling, traffic volumes, and roadway complexity may be increasing, but again, there is a lack of data on amounts of cycling by location to better understand these issues.

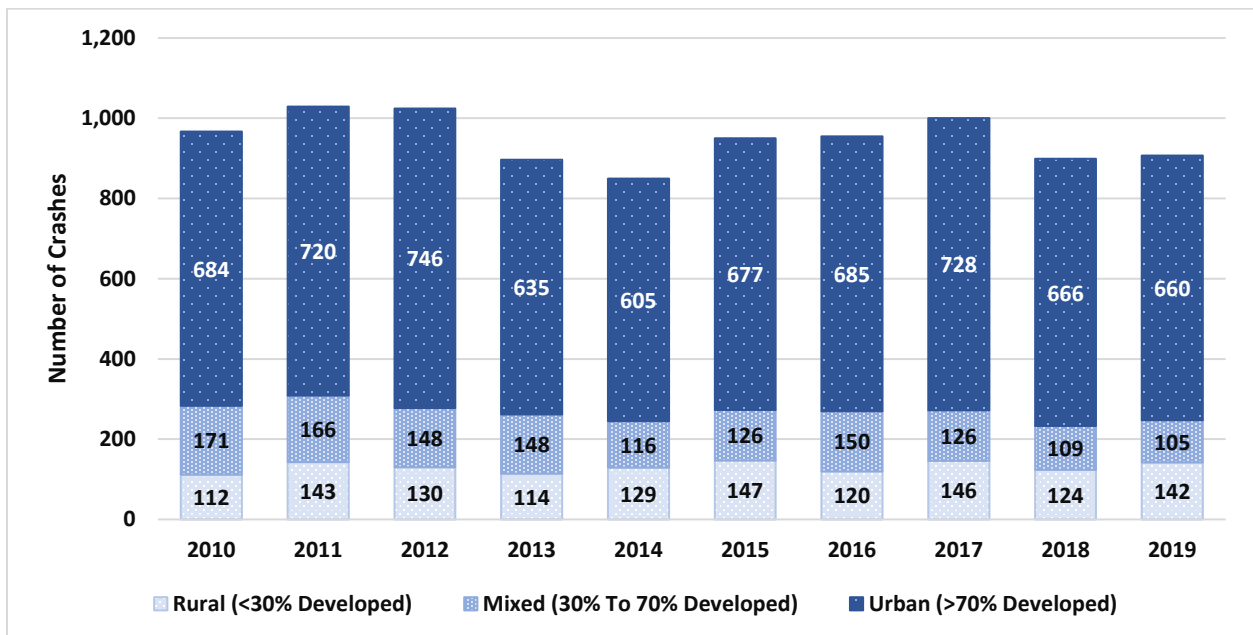


Figure 4 Bicycle crashes by development extent

Development Type

Somewhat reflecting the information on development extent, 44 percent of crashes occurred in areas indicated as commercial districts, 41 percent occurred in areas that were residential in character, over 12 percent in areas designated as farms, woods, or pasture, and less than 4 percent occurred in institutional or industrial areas (Figure 5). It is notable the number of crashes occurring in commercial areas increased between 2010 and 2019 while the number occurring in residential areas declined in general.

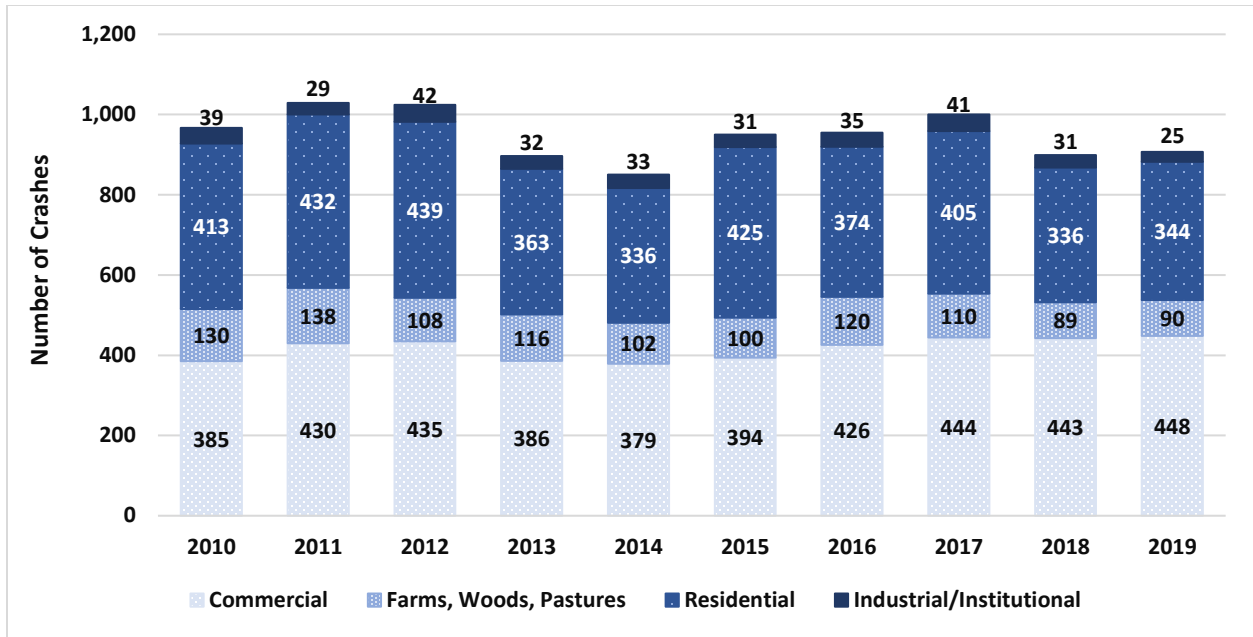


Figure 5 Bicycle crashes by development type

Environment and Time Factors

Day of Week and Time of Day

Friday afternoon between 3 and 6 pm was the day and time with the highest number of bicycle crashes during the study period, with the daily peak on all weekdays also occurring between 6 and 9 pm (Table 14). These hours also traditionally have a high amount of motor vehicle traffic and during the winter months, the sun sets by this time period. The number of overnight (12 am to 6 am) crashes was, however, low. Weekdays each had more crashes than either weekend day (Saturday or Sunday).

Table 14 Bicycle crashes by time of day and day of week, 2015-2019

| | Sun | Mon | Tues | Weds | Thurs | Fri | Sat | Total |
|-------------------|-----|-----|------|------|-------|-----|-----|-------|
| 12 am to 6 am | 31 | 21 | 18 | 18 | 15 | 25 | 35 | 163 |
| 6 am to 9 am | 32 | 80 | 73 | 83 | 72 | 77 | 37 | 454 |
| 9 am to 12pm | 84 | 86 | 77 | 107 | 92 | 78 | 123 | 647 |
| 12 pm to 3 pm | 119 | 132 | 112 | 109 | 114 | 148 | 103 | 837 |
| 3 pm to 6 pm | 122 | 205 | 202 | 185 | 210 | 214 | 136 | 1,274 |
| 6 pm to 9 pm | 109 | 135 | 166 | 147 | 151 | 125 | 136 | 969 |
| 9 pm to 12 am | 52 | 38 | 52 | 57 | 40 | 65 | 63 | 367 |
| Day of Week Total | 538 | 697 | 700 | 706 | 694 | 732 | 633 | 4,711 |

Light Conditions

During the study period, 74 percent of crashes happened during daylight hours when most bicycle riding takes place. Around 75 percent of daylight crashes occurred in urban areas (Figure 6). However, there were differences between urban and rural areas for crashes occurring in dark conditions. Over 60 percent of crashes along dark, unlighted roadways were in rural areas; by comparison only 5 percent of dark, lighted roadway crashes were rural.

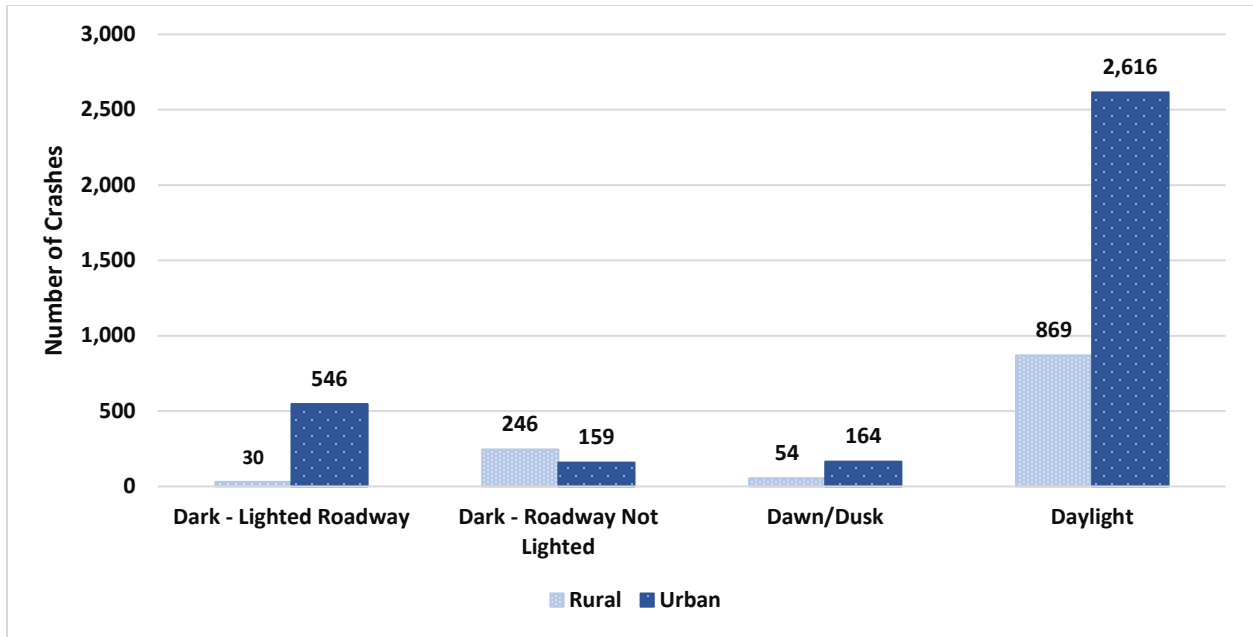


Figure 6 Rural/Urban crashes by light conditions, 2015-2019

According to NHTSA’s Traffic Safety Facts report, 50 percent of all bicyclists killed nationwide were involved in dark roadway crashes in 2018 (National Center for Statistics and Analysis, 2020) – this figure includes both unlighted as well as lighted roads. North Carolina State law requires bicyclists operating at night to have an active front light visible from at least 300 feet, and a red rear light visible from at least 300 feet or bright clothing that is visible for at least 300 feet.⁸ In addition, active rear lights are also available to supplement passive reflectors. Active lighting, reflective clothing, bicycle treatments, leg and arm bands, helmets or other reflective gear may help to increase the conspicuity of cyclists riding at night, but these measures may be insufficient and not widely available to all cyclists.

Locations where bicyclists frequently ride at night, such as trail crossings or commuting routes, may be considered for enhanced street lighting at crossings, and other measures such as speed control and controlled crossing points. (See Gibbons et al. 2008 FHWA report on lighting design for midblock crossings <https://www.fhwa.dot.gov/publications/research/safety/08053/> for more information.)

Month of Year and Light Conditions

There was substantial difference in the proportions of bicycle-motor vehicle crashes related to month of year. In contrast to pedestrian crashes, more bicycle crashes occurred during the warmer months (Figure 7), especially April through October (around 70% of all crashes) with September (11%) being the most prevalent month during the study period. Winter months typically observe the fewest bicycle-motor vehicle crashes.

Crashes occurring in dark conditions were more prevalent in the fall and early winter. September through December accounted for 42 percent of all dark condition crashes during the five year period, with November having more of these crashes than any other month.

⁸ BikeWalk NC (n.d.) website: <https://www.bikewalknc.org/important-nc-traffic-laws-applicable-to-bicyclists/>

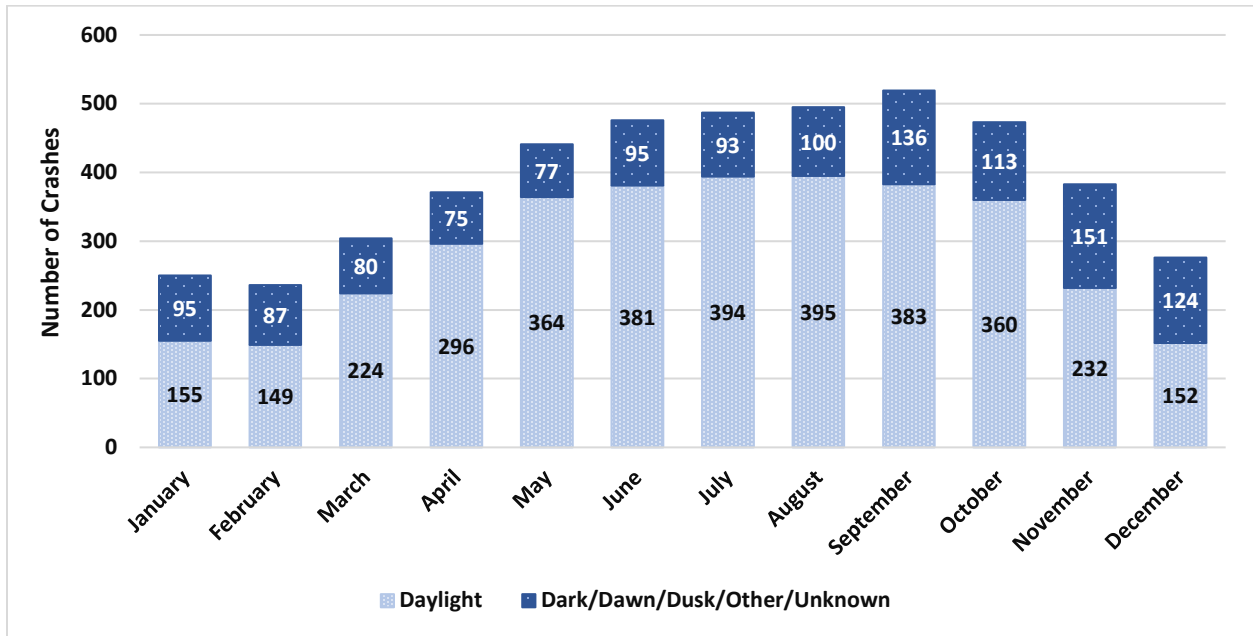


Figure 7 Bicycle crashes by month and light conditions, 2015-2019

Weather

Most – 95 percent over the five years – of bicycle-motor vehicle crashes occurred under clear or cloudy weather conditions (Figure 8). Close to 5 percent of crashes took place under rainy conditions, with all other (icy, snowy, foggy, and other) conditions accounted for the remainder. Nevertheless, wet or slippery conditions affect bicyclists’ stability and efforts should be made to provide surfaces (which include pavement markings, utility covers, etc.) suitable for riding in wet weather. Over 8 percent of crashes occurred when surfaces were wet or had standing water, which includes after a rainfall (surface conditions data not shown).

Any year-to-year variations in the number of crashes that occurred during poor weather is partially related to exposure (e.g., more rainy weather crashes occurring during wetter years).

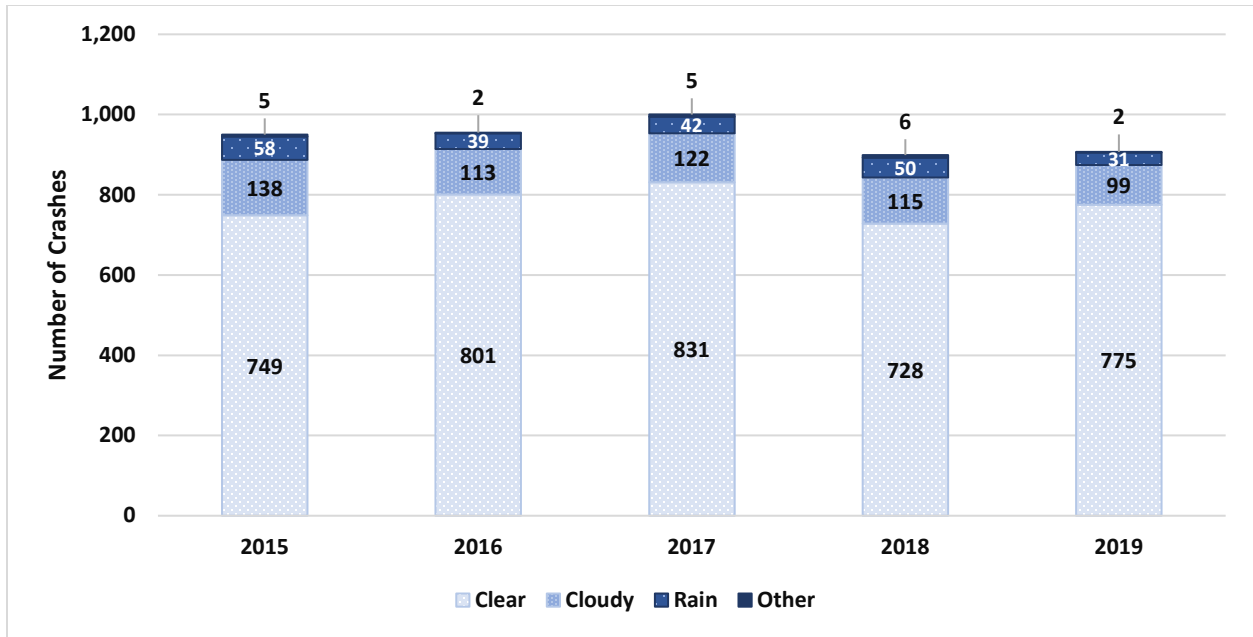


Figure 8 Bicycle crashes by weather conditions

Roadway Characteristics

Speed Limit

A majority, around 67 percent, of NC’s bicycle-motor vehicle crashes that occurred on roadways with speed limit indications, occurred on roads with speed limits of 35 mph or less. However, crashes on higher speed roads were, on average, more severe. Less than 5 percent of bicyclists struck on NC roads with speed limits of 35 mph and lower received fatal or suspected serious injuries, but the proportions rose to around 25 percent of those struck on 50 - 75 mph roads (Figure 9).

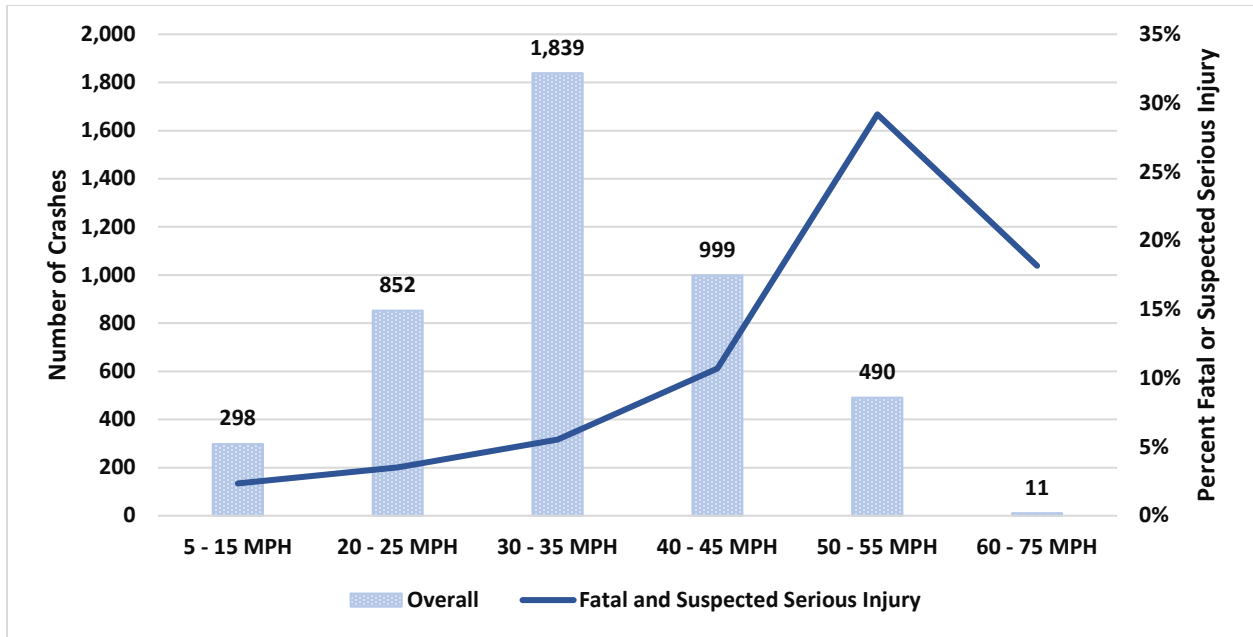


Figure 9 Bicycle crashes and fatal/suspected serious injury by posted speed limit of roadway, 2015-2019

The crash factors discussed in this summary provide information useful for assessing problems and providing safe and accessible bicycle facilities for local and State roads. Resources such as the *North Carolina Pedestrian and Bicycle Road Safety Assessment Guide* (Thomas et al., 2018), *Guidance to Improve Pedestrian and Bicyclist Safety at Intersections* (Sanders et al., 2020), BIKESAFE (2014), and others described in the *North Carolina Bicycle Crash Types* report, can provide additional assistance with diagnosing and identifying appropriate treatments for bicycle safety issues.

For additional information on the crash groups and other characteristics of bicycle-motor vehicle crashes occurring in the State over the same time period, and additional information on potential treatments, the companion *North Carolina Bicycle Crash Types, 2015-2019* summary report also provides more information.

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Appendix: Crash Involvement and Population-based Rates by Race/Ethnicity

Table 15 presents State-wide population estimates for the mid-point years (2012 and 2017) and crash involvement for bicyclists and drivers for the period 2010-2019.

Table 15 Racial/Ethnic group population and crash counts Statewide

| | 2010-2014 | | | 2015-2019 | | |
|------------------------|-------------------|------------|---------|-------------------|------------|---------|
| | Population (2012) | Bicyclists | Drivers | Population (2017) | Bicyclists | Drivers |
| Black | 2,145,146 | 1,612 | 1,177 | 2,267,685 | 1,542 | 1,277 |
| Asian American | 249,988 | 48 | 43 | 297,444 | 52 | 58 |
| Native American | 156,848 | 54 | 56 | 175,239 | 46 | 43 |
| Hispanic (of any race) | 895,784 | 249 | 158 | 1,069,941 | 251 | 190 |
| White | 6,996,991 | 2,657 | 2,631 | 7,280,260 | 2,586 | 2,366 |

The rates are illustrated by bicyclist race/ethnicity per 10,000 population statewide (Figure 10) and by race/ethnicity of drivers (Figure 11). (Note that bicyclist crashes were too scarce to present these data by region of the State as shown in the pedestrian report.)

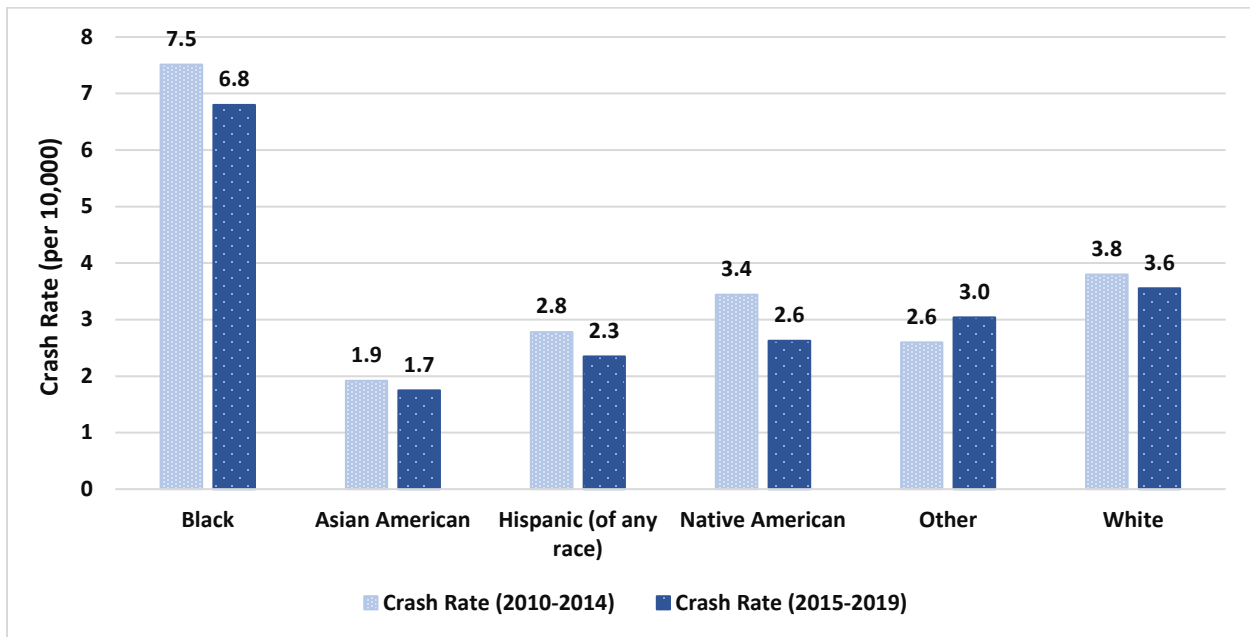


Figure 10 Crash rate by race of bicyclist for 2010-2014 and 2015-2019, Statewide

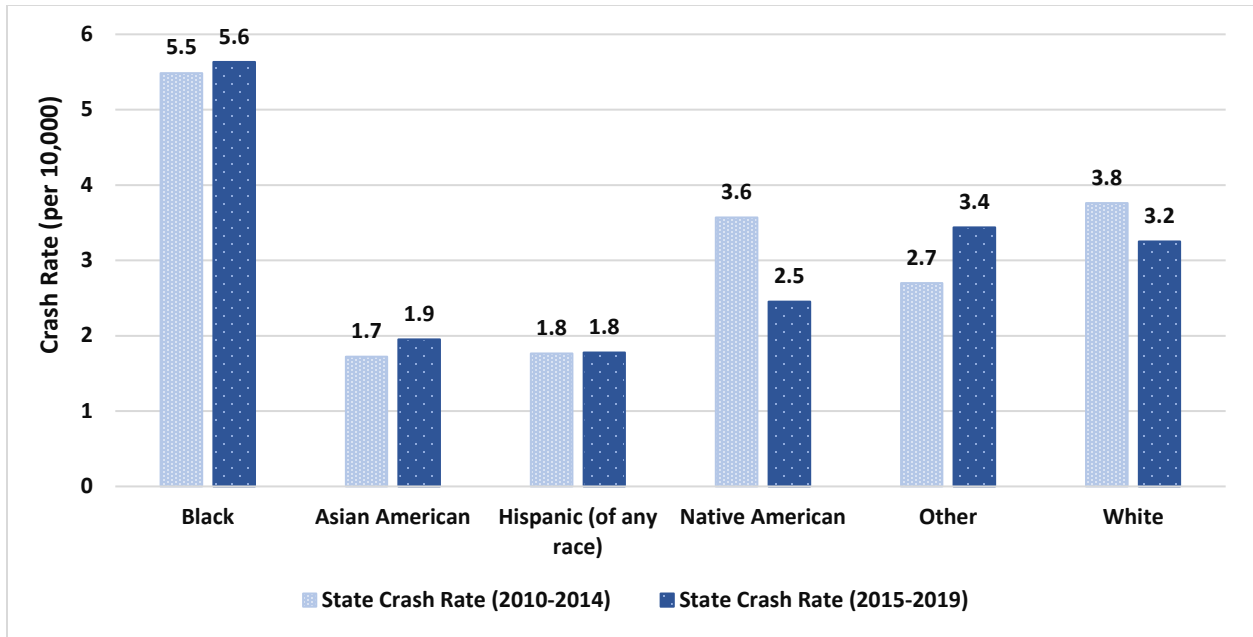


Figure 11 Crash rate by race of driver for 2010-2014 and 2015-2019, Statewide