North Carolina
Bicycle Crash Facts
2012 - 2016

Prepared for

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

THE UNIVERSITY OF NORTH CAROLINA
HIGHWAY SAFETY RESEARCH CENTER

Mike Vann
Libby Thomas
Daniel Levitt

December 2018

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Division of Bicycle and Pedestrian Transportation,
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General NC 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 treatment targets and road designs.

Between 2007 and 2016, 9,377 collisions 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). Besides changes in exposure (less driving in 2009), changes in reporting data may have affected these numbers for 2009, 2013, 2014, and 2015, particularly from urban areas.[1] From the data available, the highest number of collisions for the entire 10-year period occurred in 2012 with 1,024; 2016 had 955. The five years between 2007 and 2011 averaged 940 reported crashes per year, while the five years between 2012 and 2016 averaged a similar 935 per year. Urban crashes accounted for 71 percent of the total over the 10 years while rural crashes were 29 percent, but these percentages are subject to change when more complete data are available.

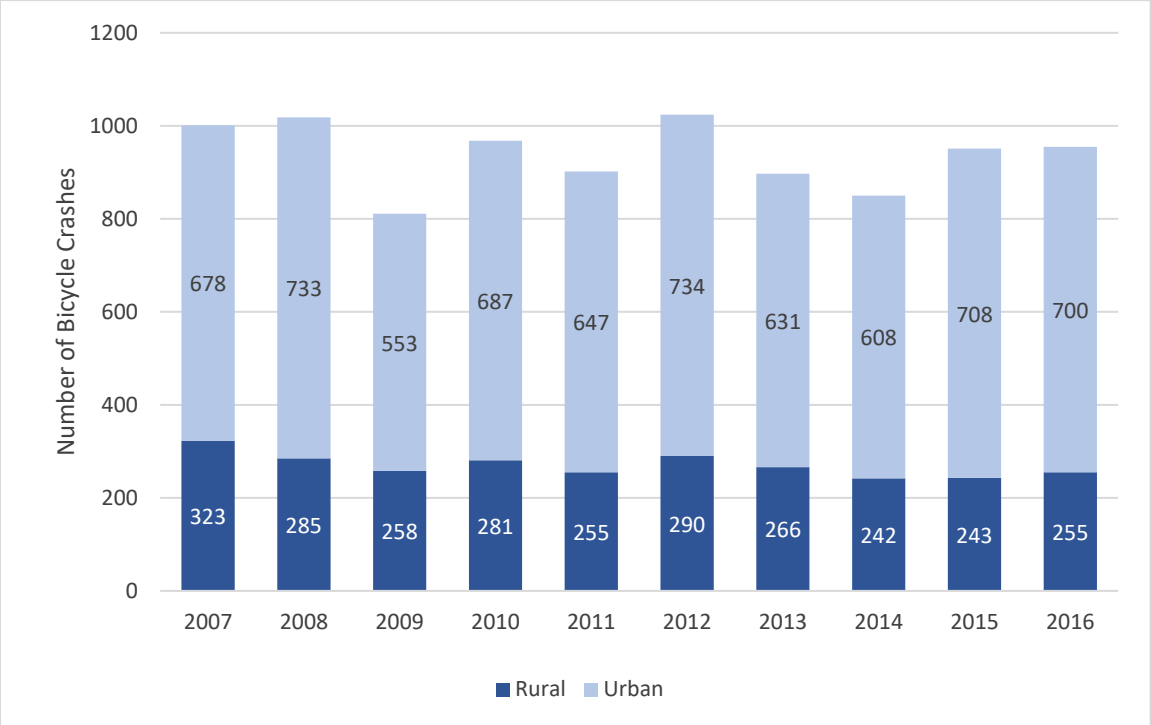

Figure 1 NC bicycle crashes, 2007 - 2016

[1] There may have been some anomalies in reporting of 2009 data for at least one urban jurisdiction, while 2013-2015 data years may also 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.

Beginning in 2014, the research team began an effort to compile the total number of bicyclists killed and injured in crashes. The numbers of collisions 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 30-day 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. This threshold on reporting may exclude if a person in a crash dies of injures received after 30 days. In other cases, there are errors or inconsistencies in the data that require further inspection to resolve. Despite these issues, our best efforts suggest that for the 2014-16 period, a total of 59 bicyclists were killed in the 2,756 total crashes over these years and included in the analyses below (Table 1). No crashes were indicated to involve multiple bicyclist fatalities in this period.

Table 1 Bicycle crashes resulting in fatal injuries, 2014-2016

Definitions	2014	2015	2016	3-yrs Total
Crash Severity = Fatal (highest severity = one or more persons in the crash were killed)	17	24	17	59
Total Number of Bicyclists Killed	17	24	17	59
Bicyclist Injury Severity = Killed (first bicyclist in the crash used in analyses, may not be fatally injured)	17	23	17	58
Total Crashes - all severity included in these analyses	850	951	955	2,756

The remainder of this report focuses on crashes for the most recent five-year period. A total of 4,677 collisions were reported and identified from 2012 to 2016. Of these, 108 crashes involved bicyclist fatalities with another 194 crashes resulting in bicyclists receiving disabling type injuries per the reporting officers (Figure 2). The lowest percentage of fatal crashes over the study period was observed in 2016. No crashes over the five years involved motorist fatalities, however five crashes caused disabling injuries for a motorist.

During 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 A-type injuries in 2016. These revised injury categories were likely phased in at different times across the many reporting jurisdictions in the state and were not in effect for the full year. Therefore, in the tables below, the labels of ‘disabling injury’ and ‘evident injury’ were applied to all 2016 A-type and B-type severity indications, respectively, as it cannot be determined which may have been reported under the updated severity definitions.

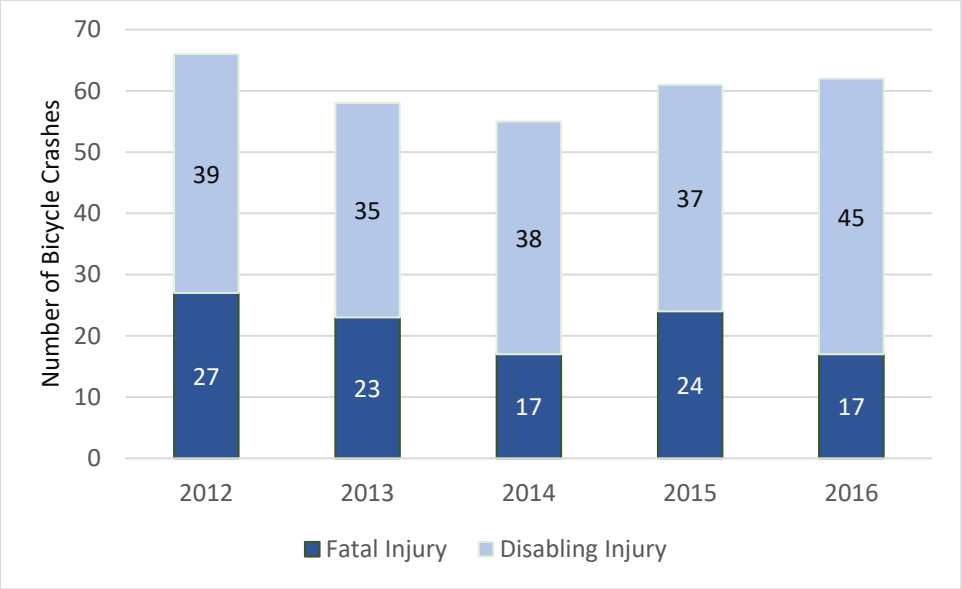

Figure 2 NC fatal and disabling injury bicycle crashes

Apart from fluctuations in the number of crashes that is due to chance and reporting differences and changes, the amount and numbers of people riding, volumes of traffic, locations of riding, and characteristics of those locations tend to affect bicycle-motor vehicle collision frequencies. Behaviors of bicyclists and motorists also affect collision risk. We currently lack estimates on the amounts of riding by bicyclists in NC in different location types. Variation in year-to-year collisions 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 since 2008, 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 crash reporting practices can sometimes contribute to variations in reported bicycle collisions, potentially leading to incorrect inferences about trends.

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) collisions 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 collisions may not be included in other State crash statistics. Because under-reporting of bicycle crashes is common,[2] any collisions 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. Law enforcement officers make their best determinations of injury status using the KABCO scale (K, Killed; A-type, disabling/serious; B-type, evident/minor; C-type, possible; and O = no observable injury), but are typically not trained medically, and lack the diagnostic tools to make precise injury determinations.

[2] 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.

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]

The remainder of this report summarizes the person, location types, time, environmental and roadway characteristics for the 4,673 bicycle-motor vehicle crashes reported statewide for 2012-2016. 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

Although, as noted, there are a few crashes involving more than one bicyclist, the following characteristics are associated with the 'first' bicyclist reported on in the crash. The numbers and percentages in the tables below reflect the first bicyclist involved in the crash and exclude cases with missing data for the bicyclist.

Bicyclist Age

With year-to-year variability in the number and proportions of crashes by different ages, clear trends are difficult to decipher (Table 2). (Age group intervals vary to show more detail for the younger age groups.) Over the entire five-year time period, the largest proportion of crashes involved the 50 to 59-year group (16%), followed by the 20 to 24-year group (14%), and the 40 to 49-year age group (13%). Crashes among children have fluctuated.

[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 crashes[4]

Bicyclist age	2012	2013	2014	2015	2016	Total
0-5	8	13	13	7	5	46
	0.8% [1]	1.5%	1.5%	0.8%	0.5%	1.0% [2]
6-10	63	57	52	59	55	286
	6.3%	6.4%	6.2%	6.4%	6.0%	6.2%
11-15	114	93	86	105	86	484
	11.3%	10.5%	10.2%	11.3%	9.3%	10.6%
16-19	95	97	92	100	90	474
	9.5%	10.9%	10.9%	10.8%	9.8%	10.3%
20-24	157	121	109	109	132	628
	15.6%	13.6%	12.9%	11.7%	14.3%	13.7%
25-29	87	70	78	105	92	432
	8.7%	7.9%	9.2%	11.3%	10.0%	9.4%
30-39	106	106	117	100	100	529
	10.5%	12.0%	13.8%	10.8%	10.9%	11.5%
40-49	147	121	100	108	126	602
	14.6%	13.6%	11.8%	11.6%	13.7%	13.1%
50-59	144	144	129	159	141	717
	14.3%	16.2%	15.3%	17.1%	15.3%	15.6%
60-69	61	53	55	63	68	300
	6.1%	6.0%	6.5%	6.8%	7.4%	6.5%
70+	23	12	13	13	25	86
	2.3%	1.4%	1.5%	1.4%	2.7%	1.9%
Total	1,005	887	845	928	920	4,585 [4]
	21.9% [3]	19.3%	18.4%	20.2%	20.1%	

Combining age categories into larger ranges gives a more in-depth picture of crash involvement by population. Over the 5-year study period, young adults age 16 to 34 have the highest crash rate per 10,000 residents in the state, while seniors over 65 have the lowest. The rate for children under 16 fell compared with the previous 5-year period (2007-2011) while the rates for the other groups remained nearly the same (Table 3 and Table 4). Analyses by population help 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.)

[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

Table 3 Bicyclist age group crash rate by population, 2012-2016

Bicyclist age group	Total crashes, 2012-2016	Avg. 1-year Count	July 2014 population estimate [5]	Avg. yearly crash rate / 10,000
< 16	816	163.2	2,038,703	0.8
16-34	1,829	365.8	2,538,336	1.4
35-64	1,749	349.8	3,914,087	0.9
65+	184	36.8	1,454,516	0.3
Total all ages	4,578	915.6	9,945,642	0.9

Table 4 Bicyclist age group crash rate by population, 2007-2011

Bicyclist age group	Total crashes, 2007-2011	Avg. 1-year Count	July 2009 population estimate	Avg. yearly crash rate / 10,000
< 16	1,057	211.4	2,009,421	1.1
16-34	1,640	328.0	2,428,848	1.4
35-64	1,803	360.6	3,792,541	1.0
65+	128	25.6	1,204,586	0.2
Total all ages	4,628	925.6	9,435,396	1.0

Bicyclist Injury

Table 5 shows the data for all five years of 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 result in fatal injuries.[7] Additionally, over 4 percent of all bicycle crashes resulted in disabling (A-type) injuries over the five-year period. The sharp increase in unknown injury crashes in 2016 was the result of missing injury data from some municipalities.

[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. M

[6] Counts are of crashes with the severity of bicyclist injury reported for the 'first bicyclist'.

[7] North Carolina 2016 Traffic Crash Facts: https://connect.ncdot.gov/business/DMV/DMV%20Documents/2016%20Crash%20Facts.pdf

Table 5 Five-year bicycle crash injury levels

Bicyclist injury	2012	2013	2014	2015	2016	Total
K: Killed	27	23	16	23	17	106
	2.6%	2.6%	1.9%	2.4%	1.8%	2.3%
A: Disabling Injury	39	35	38	37	45	194
	3.8%	3.9%	4.5%	3.9%	4.7%	4.1%
B: Evident Injury	414	343	356	406	366	1,885
	40.4%	38.2%	41.9%	42.7%	38.3%	40.3%
C: Possible Injury	424	372	343	365	372	1,876
	41.4%	41.5%	40.4%	38.4%	39.0%	40.1%
O: No Injury	84	104	79	100	93	460
	8.2%	11.6%	9.3%	10.5%	9.7%	9.8%
Unknown Injury	36	20	18	20	62	156
	3.5%	2.2%	2.1%	2.1%	6.5%	3.3%
Total	1,024	897	850	951	955	4,677
	21.9%	19.2%	18.2%	20.3%	20.4%	

Table 6 shows the number and percent of bicyclists by age group who received fatal/disabling or evident/possible/no/unknown injuries. While adults age 35 to 64 account for around 38 percent of all crashes over the five-year period, they represent 51 percent of the most severe crashes. Bicyclists 65 and older also made up a higher percentage of fatal and disabling injury crashes compared to more minor crashes.

Table 6 Bicyclist injury severity by age group

Bicyclist age group	Fatal or Disabling Injury	Evident, Possible, No or Unknown Injury	Total
< 16 years	43	773	816
	14.4%	18.1%	17.8%
16-34	81	1,748	1,829
	27.2%	40.8%	40.0%
35-64	152	1,597	1,749
	51.0%	37.3%	38.2%
65+	22	162	184
	7.4%	3.8%	4.0%
Total	298	4,280	4,578
	6.5%	93.5%	

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 five percent of all bicyclists involved in crashes where this data was available (Table 7). 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 7 Bicyclist use of alcohol or drugs

Bicyclist alcohol / drug use suspected or detected	2012	2013	2014	2015	2016	Total
No	904	812	779	872	854	4,221
	90.5%	91.6%	91.9%	92.5%	93.1%	91.9%
Alcohol and Drugs Impairment Suspected or Detected	9	3	5	0	1	18
	0.9%	0.3%	0.6%	0.0%	0.1%	0.4%
Alcohol Impairment Suspected or Detected	52	45	40	47	38	222
	5.2%	5.1%	4.7%	5.0%	4.1%	4.8%
Drug Impairment Suspected or Detected	3	2	1	1	2	9
	0.3%	0.2%	0.1%	0.1%	0.2%	0.2%
Unknown	31	24	23	23	22	123
	3.1%	2.7%	2.7%	2.4%	2.4%	2.7%
Total	999	886	848	943	917	4,593
	21.8%	19.3%	18.5%	20.5%	20.0%	

Examining crashes where alcohol/drug use was reported by injury level shows that alcohol/drug-indicated crashes are over-represented among those resulting in fatal or disabling injury (Figure 3). While drug use was indicated in about 5 percent of evident or minor injury crashes (when use was suspected or known), alcohol and/or drug use was indicated in over 14 percent of fatal and disabling injury crashes.

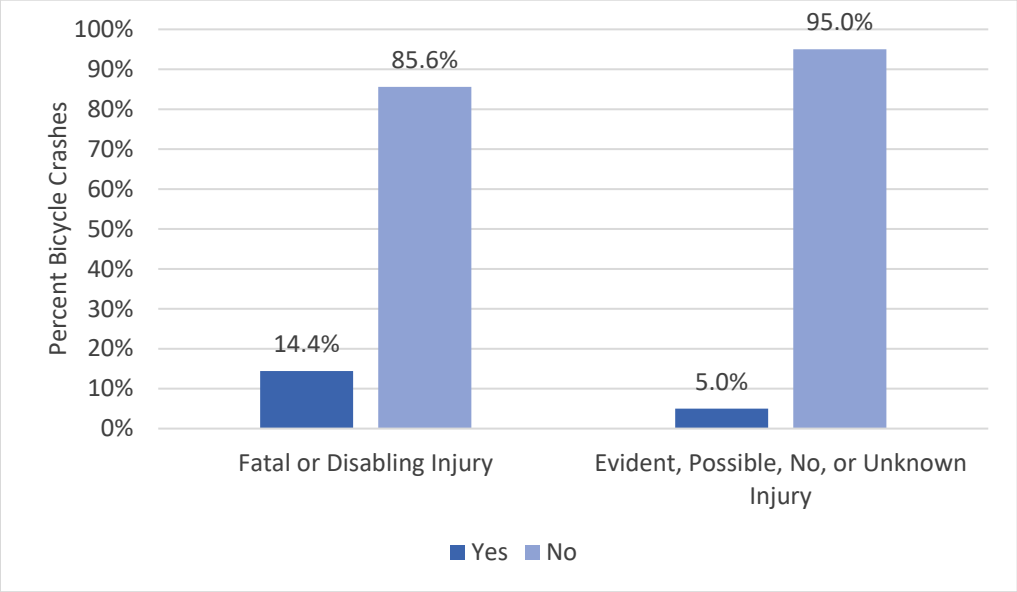

Figure 3 Alcohol or drug use by bicyclist injury level

Bicyclist Gender

There was relatively little change year-to-year, with male bicyclists accounting for an average of around 85 percent of crashes in where gender was indicated. Males are also strongly over-represented in the most serious crashes with 86 percent of fatal or disabling injury crashes having a male victim (Table 8).

Table 8 Gender by injury level

Bicyclist gender	Fatal or Disabling Injury	Evident, Possible, No, or Unknown Injury	Total
Female	42	654	696
	14.0%	15.3%	15.2%
Male	259	3,623	3,882
	86.0%	84.7%	84.8%
Total	301	4,277	4,578
	6.6%	93.4%	

Driver Characteristics

On average, over 14 percent of the collisions 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 younger than age 25 accounted for around 18 percent of all collisions with bicyclists (Table 9). Additionally, drivers ages 25 to 29 accounted for over 11 percent (age intervals are shorter for younger age groups to show more detail). Among 10-year+ age groups, the largest proportion of crashes involved the 30 to 39-year group of drivers (over 18%), followed by the 40 to 49-year old group (over 17%). The proportions decrease by age for groups aged 50 and older. Again, these percentages reflect population numbers by age group as well as other types of exposure (amounts and times of driving and other risk factors).

Table 9 Age of drivers involved in crashes with bicyclists

Driver age	2012	2013	2014	2015	2016	Total
< 20	77	39	45	47	52	260
	8.7%	5.0%	6.2%	5.7%	6.4%	6.4%
20-24	122	103	77	95	76	473
	13.8%	13.2%	10.5%	11.5%	9.3%	11.7%
25-29	97	82	80	93	117	469
	11.0%	10.5%	10.9%	11.3%	14.4%	11.6%
30-39	152	138	133	155	160	738
	17.2%	17.6%	18.2%	18.8%	19.6%	18.3%
40-49	148	155	132	128	128	691
	16.8%	19.8%	18.1%	15.5%	15.7%	17.1%
50-59	113	104	108	118	120	563
	12.8%	13.3%	14.8%	14.3%	14.7%	13.9%
60-69	96	104	79	112	93	484
	10.9%	13.3%	10.8%	13.6%	11.4%	12.0%
70+	78	57	77	78	69	359
	8.8%	7.3%	10.5%	9.4%	8.5%	8.9%
Total	883	782	731	826	815	4,037
	21.9%	19.4%	18.1%	20.5%	20.2%	

Driver Alcohol or Drug Use

Alcohol and/or drug use by drivers in crashes with bicyclists was detected or suspected in 2 percent of crashes (Table 10). 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 accuracy of these data 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 10 Driver use of alcohol or drugs

Driver alcohol / drug use suspected or detected	2012	2013	2014	2015	2016	Total
No	857	747	695	796	789	3,884
	94.0%	92.9%	92.5%	94.0%	94.05	93.5%
Alcohol and Drugs Impairment Suspected or Detected	0	3	0	1	1	5
	0.0%	0.4%	0.0%	0.1%	0.1%	0.1%
Alcohol Impairment Suspected or Detected	13	17	15	11	10	66
	1.4%	2.1%	2.0%	1.3%	1.2%	1.6%
Drug Impairment Suspected or Detected	3	2	4	2	2	13
	0.3%	0.2%	0.5%	0.2%	0.2%	0.3%
Unknown	39	35	37	37	37	185
	4.3%	4.4%	4.9%	4.4%	4.4%	4.5%
Total	912	804	751	847	839	4,153
	22.0%	19.4%	18.1%	20.4%	20.2%	

Where Bicycle Crashes Occur

Development Extent

As previously mentioned, around 71 percent of NC bicycle collisions between 2012 and 2016 occurred in urban settings, with around 29 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: over 85 percent of all crashes occurred in areas that are at least 30 percent developed, while fewer than 15 percent occurred in areas that are less than 30 percent developed, on average (Table 11).

Areas that are between 30 percent and 70 percent developed may represent areas in transition, where infrastructure is often still more rural in nature and traffic speeds remain high, while demand for cycling, traffic volumes and roadway complexity may be increasing.

Table 11 Bicycle crashes by area of development extent

Development extent	2012	2013	2014	2015	2016	Total
Rural (<30% Developed)	146	148	116	126	150	686
	14.3%	16.5%	13.6%	13.2%	15.7%	14.7%
Mixed (30% To 70% Developed)	128	114	129	148	120	639
	12.5%	12.7%	15.2%	15.6%	12.6%	13.7%
Urban (>70% Developed)	746	635	605	677	685	3,348
	73.1%	70.8%	71.2%	71.2%	71.7%	71.6%
Total	1,020	897	850	951	955	4,673
	21.8%	19.2%	18.2%	20.4%	20.4%	

Development Type

Somewhat reflecting the information on development extent, 43 percent of crashes occurred in areas indicated as commercial districts, 41 percent occurred in areas that were residential in character, over 11 percent in areas designated as farms, woods, or pasture, and small percentages occurred in institutional (over 3%) and industrial areas (< 0.5%) (Table 12).

Table 12 Bicycle crashes by development type

Development type	2012	2013	2014	2015	2016	Total
Commercial	435	386	379	395	426	2,021
	42.6%	43.0%	44.6%	41.5%	44.6%	43.2%
Farms, Woods, Pastures	106	116	102	100	120	544
	10.4%	12.9%	12.0%	10.5%	12.6%	11.6%
Industrial	3	6	3	5	1	18
	0.3%	0.7%	0.4%	0.5%	0.1%	0.4%
Institutional	39	26	30	26	34	155
	3.8%	2.9%	3.5%	2.7%	3.6%	3.3%
Residential	437	363	336	425	374	1,935
	42.8%	40.4%	39.5%	44.7%	39.2%	41.4%
Total	1,020	897	850	951	955	4,673
	21.8%	19.2%	18.2%	20.4%	20.4%	

Temporal and Environmental Factors

Month of Year

There is substantial difference in the proportions of bicycle-motor vehicle crashes related to month of year. In contrast to pedestrian collisions, more bicycle collisions occur during the warmer months (Figure 4), especially April through October (over 70% of all crashes) with September (over 11%) being the most prevalent month during the study period. January and February typically observe the fewest bicycle-motor vehicle collisions.

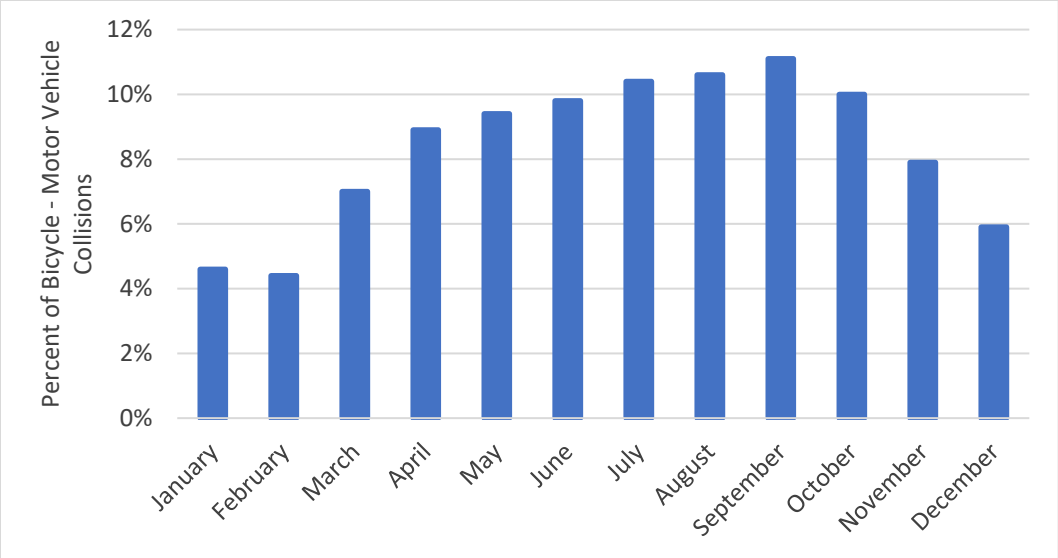

Figure 4 Bicycle crashes by month

Day of Week and Time of Day

Weekdays have a higher crash rate compared with weekends (Figure 5). Specifically, Friday was the highest crash day for the study period with Sundays having the fewest number.

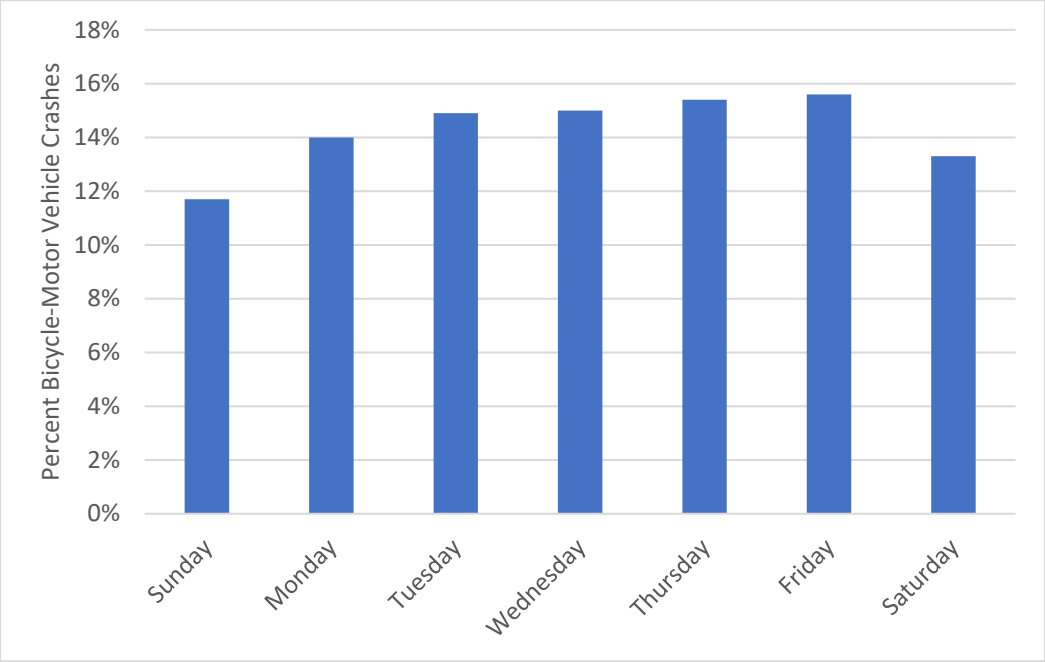

Figure 5 Bicycle crashes by day of the week

3 pm to 6 pm is the most prevalent time for bicycle-motor vehicle collisions during the study period with over 27 percent of all reported crashes occurring during these hours (Figure 6). By contrast, less than 4 percent occurred in the overnight hours between 12 and 6 am.

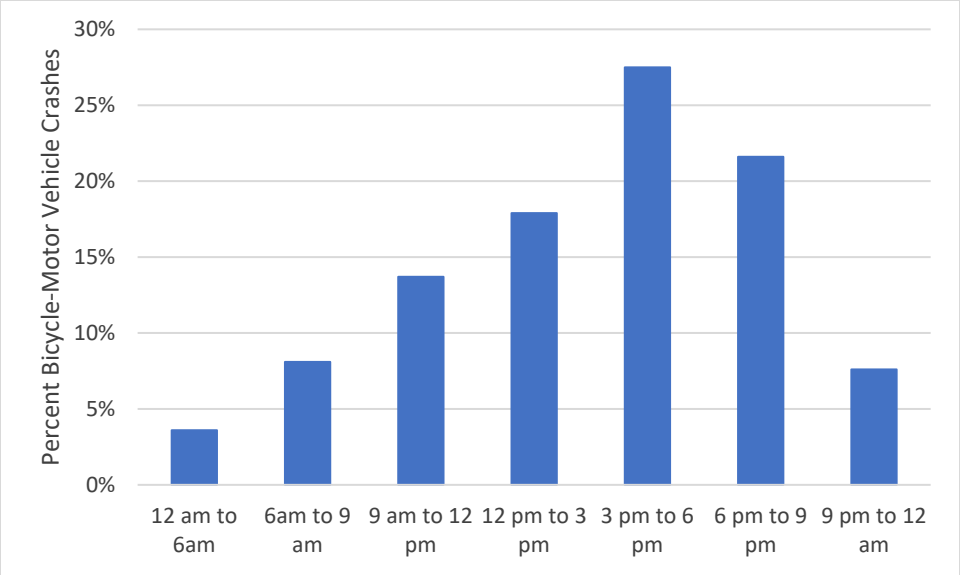

Figure 6 Bicycle Crashes by Time of Day

Light Conditions

Just under 74 percent of crashes happened during daylight hours when most bicycle riding takes place (Figure 7). Twelve percent occurred in darkness on lighted roadways, with around 9 percent at night on unlighted road sections. Dawn and dusk conditions combined account for around 5 percent of crashes, with all other or unknown lighting conditions accounting for less than 1 percent. There is some variability across years in these percentages, but no distinct trends. The proportions of crashes occurring under lower light conditions may be over-represented based on the amount of riding that occurs under such conditions, but we lack data to support this conjecture.

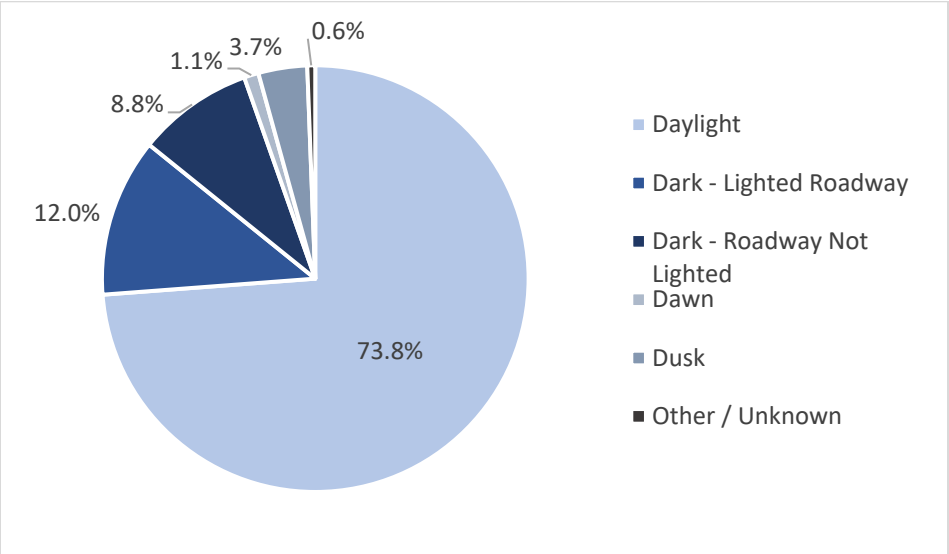

Figure 7 Bicycle crashes by light conditions

There are significant differences between rural and urban locations for dark roadway crashes. Close to 21 percent of all rural crashes occurred in darkness along unlighted roads compared with around 4

percent in urban areas. Only around 3 percent of rural dark crashes involved a lighted roadway compared with over 15 percent in urban areas (Table 13).

Table 13 Rural/urban crashes by light conditions

Light conditions	Rural	Urban	Total
Daylight	920	2,528	3,448
	71.2%	74.8%	73.8%
Dusk	47	126	173
	3.6%	3.7%	3.7%
Dawn	16	34	50
	1.2%	1.0%	1.1%
Dark-lighted roadway	37	524	561
	2.9%	15.5%	12.0%
Dark-roadway not lighted	268	145	413
	20.7%	4.3%	8.8%
Other / unknown	4	24	28
	0.3%	0.7%	0.6%
Total	1,292	3,381	4,673
	27.6%	72.4%	

North Carolina State law requires bicyclists operating at night to have an active, white front light visible from at least 300 feet, and a red rear light visible from at least 300 feet or wearing bright clothing that is visible for at least 300 feet.[8] In addition, active rear, red lights are also available to supplement passive reflectors. Reflective clothing, bicycle treatments, leg and arm bands, helmets or other reflective gear may further help to increase the conspicuity of cyclists riding at night.

Locations where bicyclists frequently ride at night, such as trail crossings or commuting routes, may also be considered for enhanced street lighting at crossings, and better separated facilities such as signals for crossings and separated bike lanes or paths. (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.)

Weather

Most – nearly 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 accounting for less than 1 percent of the total. Nevertheless, wet or slippery conditions affect bicyclists' ability to ride safely and efforts should be made to provide surfaces (which include pavement markings, utility covers, etc.) suitable for riding in wet weather. Close to 9 percent of crashes occurred when surfaces were wet or had standing water, which includes after a rainfall (surface conditions data not shown).

[8] From BikeWalkNC website: https://www.bikewalknc.org/important-nc-traffic-laws-applicable-to-bicyclists/

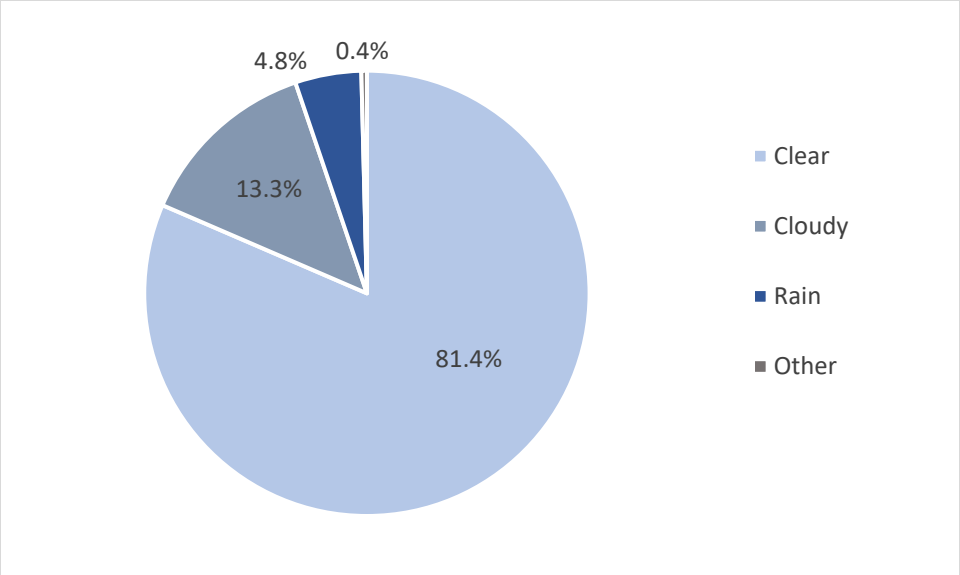

Figure 8 Bicycle crashes by weather conditions

Roadway Characteristics

Roadway Type

On average, more than three-fourths of bicycle collisions that occurred on a roadway or road right-of-way occurred on two-way, undivided roads. Close to 16 percent occurred on two-way roads divided by an unprotected median, with much smaller percentages on two-way roads divided with a positive median barrier (often limited access roads), or on one-way roads (Figure 9). Note that these designations are based on crash reporting; more accurate estimations of roadway characteristics may be obtained by joining the crash data with accurate roadway inventory data.

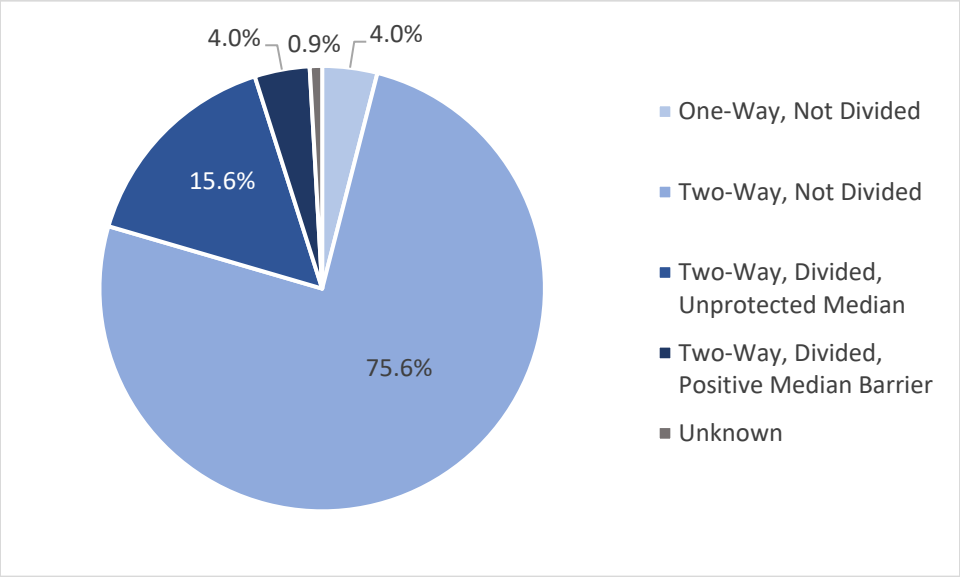

Figure 9 Bicycle crashes by roadway configuration

Speed Limit

A majority (over 62%) 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 may be especially severe. Over 8 percent of bicyclists struck on NC roads with speed limits of 35 mph and lower received fatal or disabling type injuries, but the proportions rose to 21 percent of those struck on 50 - 55 mph roads (Figure 10).

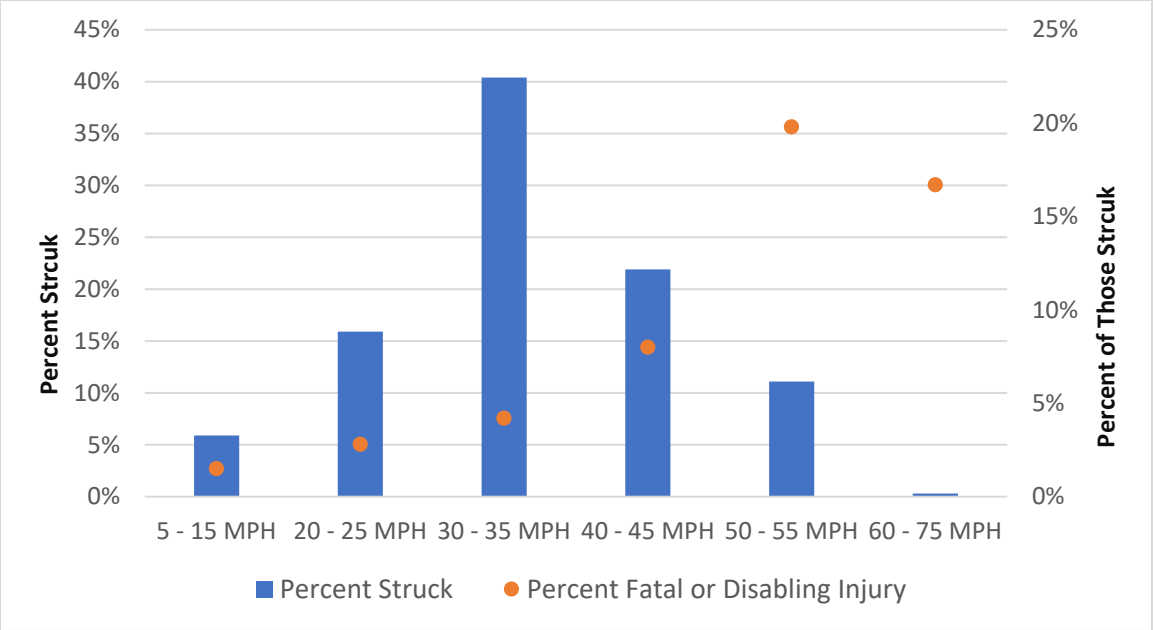

Figure 10 Speed limits and severity of bicycle crashes (red markers indicate the percentage of crashes on different speed limit roads with fatal or disabling injury)

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, BIKESAFE: Bicycle Safety Guide and Countermeasure Selection System, and others 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, please see the companion *North Carolina Bicycle Crash Types, 2012-2016* summary report.

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