North Carolina
Bicycle Crash Facts
2006 - 2010

Prepared for

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

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General NC Bicycle Crash Trends

Nearly 9500 bicycle-motor vehicle crashes were reported to the DMV from 2001 to 2010. From 2001 to 2003, the total number of crashes fluctuated around 900 each year, but trended upward from 2003 to a peak of 1042 in 2008 (Figure 1). The number reported in 2009, a somewhat anomalous data year,[1] was significantly lower than other years. Apart from an unusual drop in 2009, the ten year trend has seen a gradually upward trajectory, with the number of crashes reported in 2010 again close to 1000 at 968. The rise is reflected by an increase in urban area crashes which accounted for about 70% of the collisions over the most recent five years compared to about 67% for the first five years.

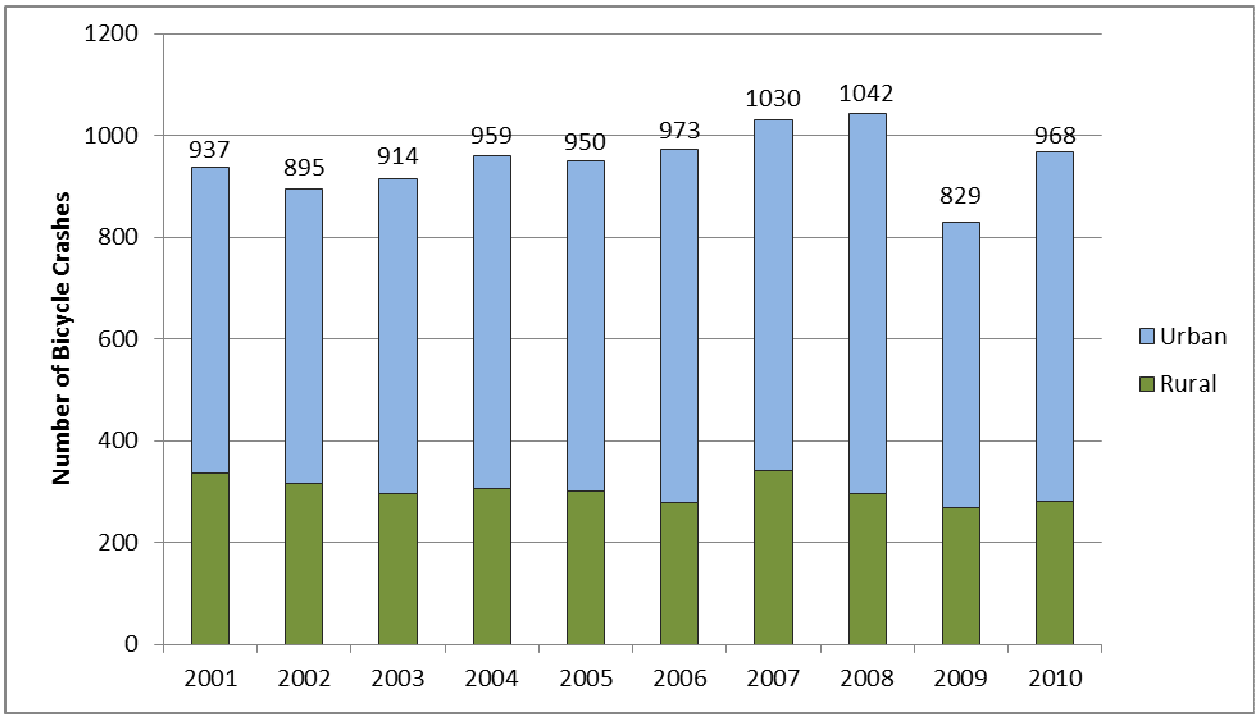

Figure 1. NC bicycle crash trends, 2001 – 2010 (counts of crashes).

Apart from natural fluctuations in the number of crashes that is due to chance, the amount and locations of riding by bicyclists would have the greatest impacts on bicycle collision frequencies. Unfortunately, data are unavailable on the amounts of riding by cyclists in NC to compare between years. Variation in year-to-year collisions may be subject to influences

[1] Statewide, annual Vehicle Miles Traveled increased by 1.1% from 101.5 billion, to 102.6 billion from 2008 to 2009, so a reduction in driving would not seem to explain the drop in bicycle crashes. There is no information on the amount of bicycling but little reason to think that there was a significant decrease from 2007 to 2008. Weather trends could have affected bicycling amounts. There were some concerns by State officials that the reporting of crashes for 2009 was not as complete compared to prior years.

such as weather trends and other factors that may affect the amount of riding. Another primary risk factor would be motor vehicle traffic volumes, so a combination of amounts of riding, motorized travel, reporting changes, and other factors including safety improvements, but also including chance – could explain the variations in reported bicycle collisions. For example, motorized vehicle miles traveled declined on average across the State in 2008; there may have been an associated increase in bicycling, but caution is advised in interpreting one year decreases or increases in bicycle crashes.

For the most recent five-year period (2006-2010), a total of 4843 bicycle-motor vehicle crashes, or an average of 969 per year have been reported. More than half of these crashes, approximately 56%, occurred within the counties in the Piedmont region with numbers trending upwards through 2008. About 37% occurred in the Coastal Plain counties, with the remaining 8% in the Mountain region of the State (Figure 2.)

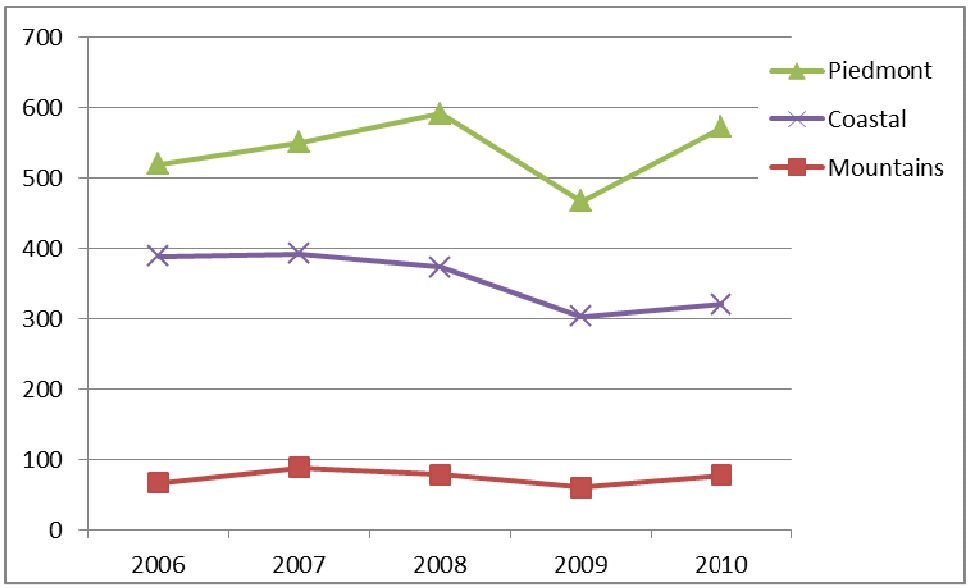

Figure 2. Five-year bicycle crash trends by region of NC.

There were a total of 100 fatal bicyclist crashes from 2006-2010. On average, 23 bicyclists were killed with another 836 being injured or possibly injured each year (injury types A – C; Table 1). An ambulance was requested for two-thirds of the collisions (data not shown).

Table 1. Five-year bicycle crash injury levels. (Counts are of crashes, with injury level of the first bicyclist in each crash.)

Bicyclist Injury	2006	2007	2008	2009	2010	Total
K: Killed	20	17	29	14	20	100
	2.1 [1]	1.7	2.8	1.7	2.1	2.1 [2]
A: Disabling Injury	56	70	48	44	43	261
	6	7.1	4.7	5.4	4.6	5.6
B: Evident Injury	399	442	433	355	445	2074
	42.9	44.6	42.5	43.6	47.3	44.2
C: Possible Injury	371	374	407	330	337	1819
	39.8	37.7	40	40.5	35.8	38.7
O: No Injury	85	89	101	72	96	443
	9.1	9	9.9	8.8	10.2	9.4
Total	931	992	1018	815	941	4697 [4]
	19.8 [3]	21.1	21.7	17.4	20	

[1] Row percent of column total
[2] Row total percent of total
[3] Column total percent of total
[4] Total includes the first bicyclist in crash less any cases with missing or unknown injury data

The remainder of this report summarizes the location types, person, time, environmental and roadway characteristics for the 4,843 bicycle-motor vehicle crashes that were reported statewide for2006 – 2010. This information, and similar information developed for local communities, can aid in the targeting of resources and countermeasures to address bicycle safety problems. Descriptions of the types of crashes, or events leading up to the crash, are provided in the companion Bicycle Crash Types Summary report. Crash type information can also aid in identifying and developing appropriate treatments.

These data may include non-injury collisions with less than $1000 property damage which were not officially “reportable” but had been reported to the State Division of Motor Vehicles. Non-reportable collisions would usually not be included in other State crash statistics. However, many bicycle crashes go unreported each year, including bike-only crashes on roadways, numerous off-roadway crashes, as well as bicycle-pedestrian and some bicycle-motor vehicle crashes that occur on public roads. These unreported crashes can also result in serious injury, requiring treatment at a hospital or doctor’s office.

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.[2]

[2] However, 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 such as mis-identification of bicyclists as pedestrians or vice versa, or assignment of the motorist characteristics to the bicyclist.

Where NC Bicycle Crashes Occur

As shown in figure 1, more than two-thirds (70%) of NC bicycle collisions over the past five years occurred within municipal (urban) limits, with about 31% in rural (unincorporated) areas of the State. However, 57% of the fatalities occurred in rural areas. Although designated as rural (outside of municipal limits), some designated rural areas could be built up.

When looking at development density, as coded by the reporting enforcement agencies, the picture becomes even more weighted toward bicycle crashes occurring in at least somewhat developed areas, with 84% occurring in areas that are at least 30 percent developed, and only 16% indicated to occur in areas that are less than 30% developed (Table 2).

The areas that are between 30 and 70% developed may represent areas in transition and challenging areas to ride, where infrastructure is often still more rural in nature and traffic speeds remain high, while traffic volumes and roadway complexity are increasing. From 2006 to 2009 there was an increasing trend in the proportion of crashes occurring in partially developed areas, although the proportion and number dropped off in 2010.

Table 2. NC bicycle-motor vehicle crashes by area development extent.

Development extent	2006	2007	2008	2009	2010	Total
Rural (<30% Developed)	158	157	158	144	172	789
	16.2[1]	15.2	15.2	17.4	17.8	16.3[2]
Mixed (30% To 70% Developed)	127	152	161	131	112	683
	13.1	14.8	15.5	15.8	11.6	14.1
Urban (>70% Developed)	688	721	723	554	684	3370
	70.7	70	69.4	66.8	70.7	69.6
Total	973	1,030	1,s042	829	967	4,842
	20.1[3]	21.3	21.5	17.1	20	100

[1] Row percent of column total
[2] Row total percent of total
[3] Column total percent of total

Reflecting the information on development extent, 43% of crashes occurred in areas indicated as residential in nature, 41% in commercial districts, 13% in areas designated as farms, woods, or pasture, and very small percentages occurred in institutional (2.5%) and industrial areas (0.2%) (Table 3)

Table 3. NC bicycle-motor vehicle crashes by crash area by development type.

Development type	2006	2007	2008	2009	2010	Total
Farms, Woods, Pastures	124	130	120	126	131	631
	12.7[1]	12.6	11.5	15.2	13.5	13[2]
Residential	428	467	426	363	413	2,097
	44	45.3	40.9	43.8	42.7	43.3
Commercial	398	414	465	317	385	1,979
	40.9	40.2	44.6	38.2	39.7	40.9
Institutional	21	16	30	21	35	123
	2.2	1.6	2.9	2.5	3.6	2.5
Industrial	2	3	1	2	4	12
	0.2	0.3	0.1	0.2	0.4	0.2
Total	973	1,030	1,042	829	969	4,843
	20.1[3]	21.3	21.5	17.1	20	100

[1] Row percent of column total
[2] Row total percent of total
[3] Column total percent of total

Using 2008 (middle year) population estimates as a rate denominator, the yearly bicycle crash rate averages about 1 per 10,000 residents for the State as a whole; 1.4 per 10,000 across all urban areas, and 0.6 per 10,000 residents in unincorporated (more rural) areas of the State for the most recent five-year time period.[3] The difference between rural and urban crash rates likely reflects greater concentration of destinations in urban areas providing greater opportunities for bicycling, such as commuting and utilitarian trips, than in rural areas of the state.

The ten counties with the highest numbers of bicycle-motor vehicle crashes are shown in Table 4. The ten highest crash counties accounted for nearly 55% of NC's reported bicycle-motor vehicle crashes. Most of the counties are highly urbanized. Thus, the high crash counties are, to a large extent, reflections of where people live in the State. However, the crash rates based on population do vary among the high crash frequency counties. For example, Forsyth County, fourth in population with 343,704 is 11th on the list (not shown here) in terms of crash count; the rate is 0.6 per 10,000 residents. The county-level rates

[3] 2008 statewide population was estimated (September 17, 2009 update) at 5,099,708 municipal and 4,127,938 for unincorporated areas. Population estimates are from the Office of State Budget and Management, Municipal and Non-Municipal Population by County, retrieved from http://www.osbm.state.nc.us/ncosbm/facts_and_figures/socioeconomic_data/population_estimates/demog/ctotm08.htm

may reflect differences in amounts of cycling in the counties in addition to other exposure and risk factors.

Table 4. The ten NC counties with the highest numbers of bicycle crashes from 2006-2010. (Crashes for all counties may be obtained through the crash data query tool.)

County	Five-year crash count	Percent of NC total (4843)	Average 1-year count	July 2008 population estimate	Avg. yearly crash rate / 10,000 residents
Mecklenburg	605	12.5	121	877,007	1.38
Wake	603	12.5	120.6	864,429	1.40
Guilford	302	6.2	60.4	468,344	1.29
New Hanover	265	5.5	53	192,235	2.76
Cumberland	206	4.3	41.2	316,914	1.30
Durham	201	4.2	40.2	260,420	1.54
Buncombe	129	2.7	25.8	227,875	1.13
Orange	113	2.3	22.6	129,296	1.75
Robeson	112	2.3	22.4	130,316	1.72
Gaston	104	2.1	20.8	204,971	1.01
Total 10 counties	2640	54.6	528	3,671,807	1.44

Reflecting the high crash counties, a majority of the cities with the highest crash frequencies are the most populous cities in those counties (Table 5). These 11 cities accounted for about 44% of the State's reported bicycle crashes. The crash rates based on population averaged 1.9 per 10,000 residents, which is somewhat higher than the average of 1.4 per 10,000 for municipalities across the entire State. The numbers may reflect differences in amounts of bicycling as well as other risk factors. Lower rates of auto ownership, factors such as presence of colleges and universities, or a strong cycling culture, may foster more widespread use of bicycles in some communities than others. However, there are no data to directly compare crash rates based on miles of bicycling, numbers of cycling trips, or other better measures of exposure.

Table 5. The ten NC cities with the highest numbers of bicycle collisions, 2006-2010. (Previous numerical ranking in parentheses following municipal name.)

Municipality (previous rank)	2006-2010 Count	Percent of NC total (4843)	Average 1-year count	July 2008 population estimate	Avg. yearly crash rate / 10,000 residents
Charlotte (1)	549	11.3	109.8	683,541	1.61
Raleigh (2)	410	8.5	82	377,353	2.17
Wilmington (4)	185	3.8	37	101,526	3.64
Greensboro (5)	183	3.8	36.6	263,268	1.39
Durham (3)	183	3.8	36.6	228,480	1.60
Fayetteville (6)	158	3.3	31.6	181,481	1.74
Rocky Mount (7)	110	2.3	22	59,228	3.71
Asheville (8)	93	1.9	18.6	78,313	2.38
Cary (10)	86	1.8	17.2	141,167	1.22
High Point	76	1.6	15.2	100,645	1.51
Chapel Hill (9)	73	1.5	14.6	55,616	2.63
Total 11 cities	2106	43.6	421.2	2,270,618	1.86

The crash fact descriptions that follow are also undoubtedly related to exposure, or when and where people ride, who is riding (age, attitudes, skill and physical condition) as well as numbers and distance or time length of trips and the numbers of motorists on the roadways. And, as already mentioned, crash numbers can also change over time simply due to chance, to changes in crash reporting procedures, weather, or other factors such as economics that affect the amounts of cycling and driving, and also as a result of safety-related factors including engineering, educational, and enforcement initiatives to create a safer cycling environment.

Bicyclist Characteristics

Bicyclist Age

There is year-to-year variability in the crash involvement by age groups of bicyclists across the five years of data but also seem to be clear trends (Table 6. Note that age group intervals vary to show more detail for the younger age groups.) Overall, the largest proportion of crashes involved ages 11-15 years (nearly 16%), although the involvement of this group continues to decline, from 18% in 2005 to 13% in 2009. Children less than 16 years old on average accounted for 26% of all the crashes, but again, crash involvement by children continues a general downward trend. Teens and young adults of college age (16 to 20 and 21 to 25-year groups), were also highly represented, together accounting for another 23%, with the 21 to 25 year group showing increasing crash trends. Those aged 41 – 50 and 51 to 60 have also shown increases in crash involvement over this period. Among adults, only the 31 to 40 year, and 71 and over age groups saw numerical and proportional decreases in their crash involvement over this time period. NC seems to be following national trends, with middle to older adult ages showing higher crash involvement over recent years, perhaps reflecting increasing age of the population as well as more riding by these age groups.

Table 6. Age group of bicyclists involved in crashes.

Bicyclist age	2006	2007	2008	2009	2010	Total
0-5	12	15	13	5	6	51
	1.3 [1]	1.5	1.3	0.6	0.6	1.1 [2]
6-10	88	109	71	64	73	405
	9.2	10.9	6.9	7.7	7.6	8.5
11-15	158	167	154	108	112	699
	16.5	16.7	15	13.1	11.7	14.7
16-20	135	150	143	115	120	663
	14.1	15	13.9	13.9	12.6	13.9
21-25	91	74	92	104	116	477
	9.5	7.4	8.9	12.6	12.1	10
26-30	64	52	81	67	68	332
	6.7	5.2	7.9	8.1	7.1	7
31-40	118	136	120	77	127	578
	12.3	13.6	11.7	9.3	13.3	12.1
41-50	165	158	179	157	160	819
	17.2	15.8	17.4	19	16.7	17.2
51-60	85	106	117	95	123	526
	8.9	10.6	11.4	11.5	12.9	11
61-70	20	23	50	26	42	161
	2.1	2.3	4.9	3.1	4.4	3.4
71+	22	11	10	8	9	60
	2.3	1.1	1	1	0.9	1.3
Total	958	1,001	1,030	826	956	4,771 [4]
	20.1 [3]	21	21.6	17.3	20	

[1] Row percent of column total
[2] Row total percent of total
[3] Column total percent of total
[4] Total includes the first bicyclist in crash less any cases with missing or unknown data

From 2006 to 2010, of the 100 bicyclists killed whose ages were known,

- 2 were children from 6 to 10 years old,
- 4 were children from 11 to 15 years,
- 13 were youth from 16 to 19,
- 5 were 20 to 24 years,
- 6 were 25 to 29 years,
- 14 were 30 to 39,
- 26 were 40 to 49,
- 17 were 50 to 59,
- 8 were 60 to 69, and
- 5 were aged 70 and older.

Figure 3 shows the number of crashes by age group killed, injured and reported to receive no injuries for 2006-2010.

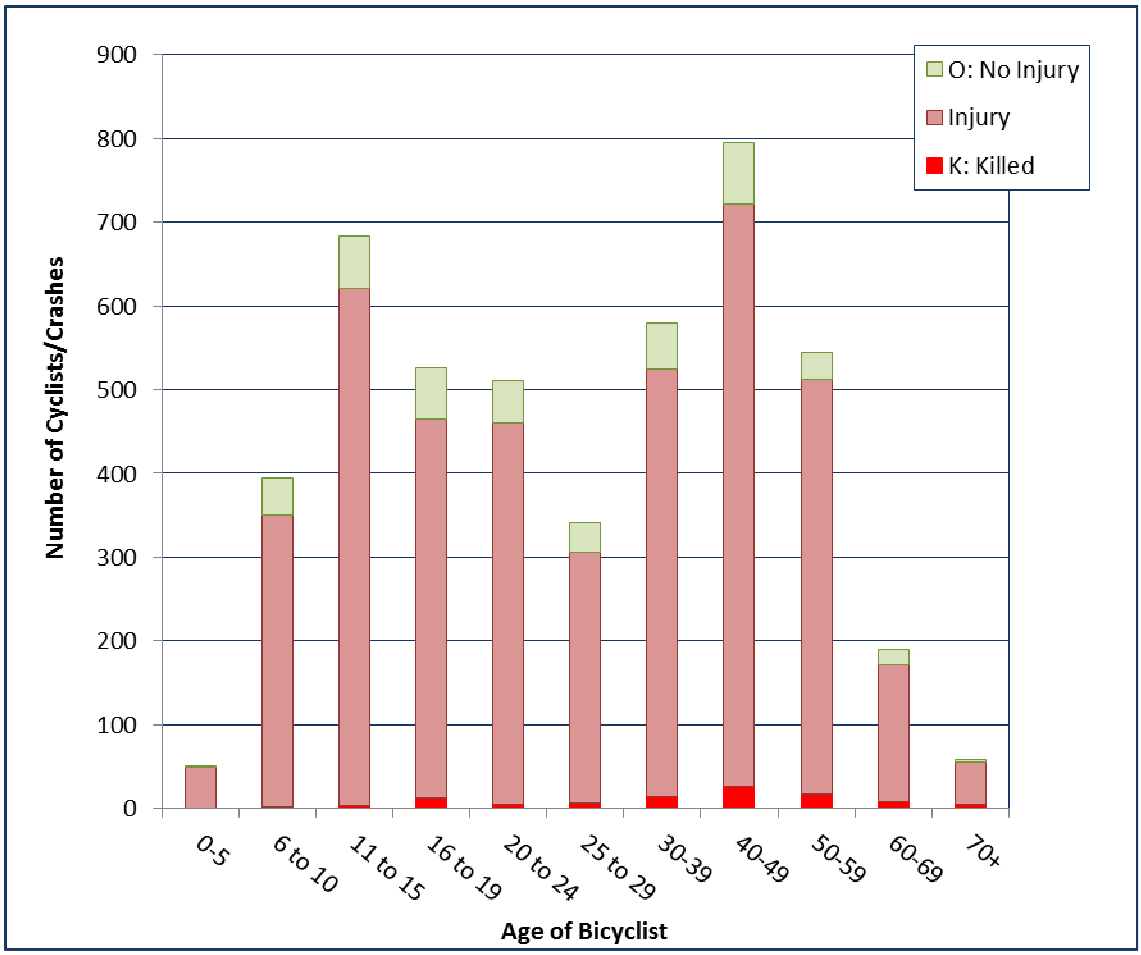

Figure 3. Injury by Age group of Bicyclist, 2006-2010.

Bicyclist Gender

There is relatively little change year-to-year, with male bicyclists accounting for about 85% of the crash-involved bicyclists in NC (Table 7).

Table 7. Gender of bicyclists involved in crashes.

Gender	2006	2007	2008	2009	2010	Total
Female	811	857	878	708	823	4077
	84.9 [1]	85.3	84.8	85.9	86.4	85.4 [2]
Male	144	148	157	116	130	695
	15.1	14.7	15.2	14.1	13.6	14.6
Total	955	1005	1035	824	953	4,772 [4]
	20 [3]	21.1	21.7	17.3	20	

[1] Row percent of column total
[2] Row total percent of total
[3] Column total percent of total
[4] Total includes the first bicyclist in crash less any cases with missing data.

Bicyclist Race

Black bicyclists accounted for 38% on average over this time period, with a marked decrease in crash involvement in 2008, 2009, and 2010 compared to earlier years. This trend suggests a possible decrease in riding by black bicyclists, but data to support this conjecture are lacking. White bicyclists comprised about 54% over the time period, with the proportion increasing over the five years (Table 8). Bicyclists identified as Hispanic account for about 5%, Native American for about 1.5%, and Asians for 1% or less on average.

Table 8. Bicyclist race/ethnicity.

Race / ethnicity	2006	2007	2008	2009	2010	Total
Asian	9	9	10	6	10	44
	1 [1]	0.9	1	0.7	1.1	0.9 [2]
Black	404	402	373	277	326	1780
	42.4	40.2	36.2	33.9	34.5	37.6
Hispanic	49	55	57	34	51	246
	5.2	5.5	5.5	4.2	5.4	5.2
Native American	16	14	17	9	12	68
	1.7	1.4	1.6	1.1	1.3	1.4
White	468	513	565	482	538	2566
	49.4	51.3	54.8	58.9	57	54.1
Other	3	7	9	10	7	36
	0.3	0.7	0.9	1.2	0.7	0.8
Total	947	1000	1031	818	944	4740 [4]
	20 [3]	21.1	21.8	17.2	19.9	

[1] Row percent of column total
[2] Row total percent of totals
[3] Column total percent of total
[4] Total includes the first bicyclist in crash less any cases with missing data.

Bicyclist Alcohol Use

According to the information available on police crash reports, alcohol use by bicyclists was detected or suspected in about 8% of all bicyclists involved in crashes from 2006-2010 and the number and proportion using alcohol both appear to be declining (Table 9). Suspected alcohol use does not confirm that alcohol was a factor in the crash.

Table 9. Bicyclist use of alcohol.

Bicyclist Alcohol Use suspected/detected	2006	2007	2008	2009	2010	Total
No	883	944	950	773	901	4451
	91.6 [1]	93.1	91.4	93.2	93.9	92.6 [2]
Yes	81	70	89	56	59	355
	8.4	6.9	8.6	6.8	6.1	7.4
Total	964	1,014	1,039	829	960	4,806 [4]
	20.1 [3]	21.1	21.6	17.2	20	

[1] Row percent of column total
[2] Row total percent of totals
[3] Column total percent of total
[4] Total includes the first bicyclist in crash less any cases with missing data.

Driver and Vehicle Characteristics

Fourteen percent of the collisions were reported to involve hit and run drivers over this time period, 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.

Driver Age

On average, drivers age 25 and younger accounted for more than 23% of all collisions with bicyclists (Table 10. Note that again age intervals vary). Drivers ages 26 to 30 accounted for another 10%. Among 10-year+ age groups, the largest proportion of crashes involved the 31 to 40 year old group of drivers (19%), closely followed by the 41 to 50 year old group (18%) with proportions decreasing with increasing age of groups 51 and older.

Table 10. Ages of drivers involved in crashes with bicyclists.

Driver Age	2006	2007	2008	2009	2010	Total
15 or younger	8	1	2	2	1	13
	0.9 [1]	0.1	0.2	0.3	0.1	0.3 [2]
16-20	88	90	89	66	74	407
	10.2	10.1	9.7	9.3	8.9	9.7
21-25	120	111	135	103	106	575
	14	12.5	14.8	14.5	12.7	13.7
26-30	81	87	91	76	74	409
	9.4	9.8	10	10.7	8.9	9.7
31-40	151	161	174	133	166	785
	17.6	18.1	19.1	18.7	19.9	18.6
41-50	166	149	173	107	141	736
	19.3	16.7	18.9	15	16.9	17.5
51-60	114	139	120	94	130	597
	13.3	15.6	13.1	13.2	15.6	14.2
61-70	80	87	70	66	75	378
	9.3	9.8	7.7	9.3	9	9
71+	52	66	59	65	69	311
	6	7.4	6.5	9.1	8.3	7.4
Total	860	891	913	712	836	4,212[4]
	20.4 [3]	21.2	21.7	16.9	19.8	

[1] Row percent of column total
[2] Row total percent of totals
[3] Column total percent of total
[4] Total includes the first motorist in crash less any cases with missing data, including hit and run drivers.

Driver Gender

Male drivers accounted for 55% of the bicycle-motor vehicle crashes and female drivers 45% over this period (Table 11). Although there are year-to-year fluctuations, no obvious trend is apparent.

Table 11. Gender of drivers involved in collisions with bicyclists.

Driver Gender	2006	2007	2008	2009	2010	Total
Female	398	401	422	311	369	1901
	46.4 [1]	45	46.3	43.7	44	45.2 [2]
Male	460	490	489	401	469	2309
	53.6	55	53.7	56.3	56	54.8
Total	858	891	911	712	838	4,210 [4]
	20.4 [3]	21.2	21.6	16.9	19.9	

[1] Row percent of column total
[2] Row total percent of totals
[3] Column total percent of total
[4] Total includes the first motorist in crash less any cases with missing data, including hit and run drivers.

Driver Race

White drivers were involved in 63% and Black drivers 31% of the crashes with bicyclists on average (Table 12). Drivers identifying as Hispanic accounted for about 3% of the 2006-2010 crash-involved drivers, and all other groups combined for less than 4%.

Table 12. Race/ethnicity of drivers involved in collisions with bicyclists.

Driver Race	2006	2007	2008	2009	2010	Total
Asian	5	14	7	8	13	47
	0.6 [1]	1.6	0.8	1.1	1.6	1.1 [2]
Black	272	273	279	221	241	1286
	31.9	30.9	30.7	31.2	28.9	30.7
Hispanic	37	28	33	16	29	143
	4.3	3.2	3.6	2.3	3.5	3.4
Native American	15	14	9	8	13	59
	1.8	1.6	1	1.1	1.6	1.4
White	517	549	569	451	531	2617
	60.5	62.1	62.7	63.6	63.7	62.5
Other	8	6	11	5	7	37
	0.9	0.7	1.2	0.7	0.8	0.9
Total	854	884	908	709	834	4,189 [4]
	20.4 [3]	21.1	21.7	16.9	19.9	

[1] Row percent of column total
[2] Row total percent of totals
[3] Column total percent of total
[4] Total includes the first motorist in crash less any cases with missing data, including hit and run drivers.

Driver Injury Severity

As would be expected, drivers are rarely seriously injured in crashes with bicyclists. Approximately 97% received no injuries from 2006-2010, with about 3% reported to receive possible or evident injuries (data not shown). There were apparently two driver-related fatalities over the five-year time period.

Driver Alcohol Use

Alcohol use by drivers in crashes with bicyclists was detected or suspected in about 2% of crashes (Table 13). This indication does not confirm impairment or that alcohol was a factor in the crash.

Table 13. Suspected alcohol use among drivers involved in collisions with bicyclists.

Driver Alcohol Use Suspected/Detected	2006	2007	2008	2009	2010	Total
No	855	888	911	719	849	4,222
	98.4 [1]	97.9	97.6	98.1	98.6	98.1 [1]
Yes	14	19	22	14	12	81
	1.6	2.1	2.4	1.9	1.4	1.9
Total	869	907	933	733	861	4,303 [4]
	20.2 [3]	21.1	21.7	17	20	

[1] Row percent of column total
[2] Row total percent of totals
[3] Column total percent of total
[4] Total includes the first motorist in crash less any cases with missing data, including hit and run drivers.

Vehicle Type

Most vehicles involved in crashes with bicyclists were passenger vehicles, including cars, pickups, light trucks and mini vans, sport utility vehicles (SUVs), and vans, which together accounted for about 95% of collisions with bicyclists (data not shown). While passenger cars accounted for the majority (58%), SUVs and pickups accounted for about 15% each, and vans and mini-vans and other light trucks for about 8% combined.

School and activity buses were involved in 14 collisions with bicyclists over this time period and commercial buses in 8. Other heavy vehicles, including all types of large trucks, other buses, and motor homes accounted for 74 collisions, or less than 2% of the total, but heavy vehicles, including buses tend to contribute to severe injuries and thus are a concern. Motorcycles were involved in 29 collisions with bicycles; taxicabs with 6. Twenty-seven police vehicles were involved in collisions with bicyclists over this time period. No other emergency vehicles were represented.

Temporal and Environmental Factors

Month of Year

There is substantial difference in the proportions of bicycle-motor vehicle crashes as related to month of year. In contrast to pedestrian collisions, more bicycle collisions occur during the summer months with about 55 percent of collisions occurring from May to September in North Carolina. The numbers of crashes reported decline through the fall and winter, and climb again in spring months (Figure 4). There was also year-to-year variability in the number of crashes by season as illustrated in Figure 5. This variation could relate in part to the varying periods of warm and cold weather or rainy and clear/cloudy conditions and amounts of riding in any given year, and in part to chance.

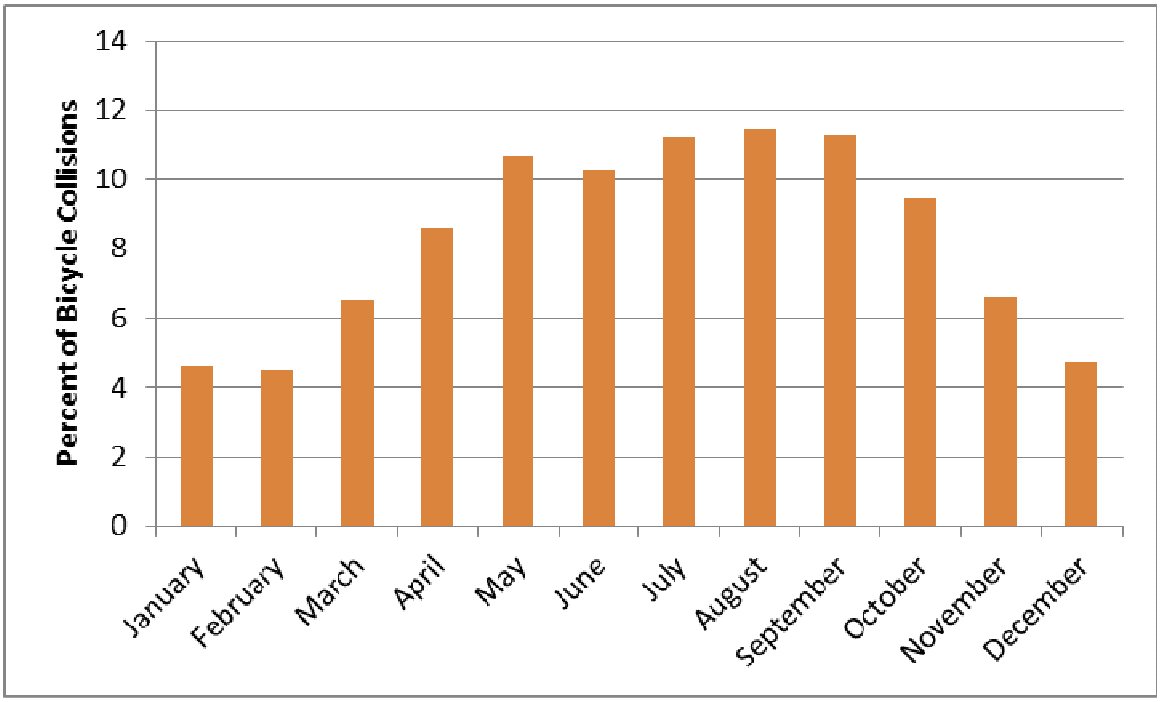

Figure 4. NC bicycle collisions by crash month, 2006-2010.

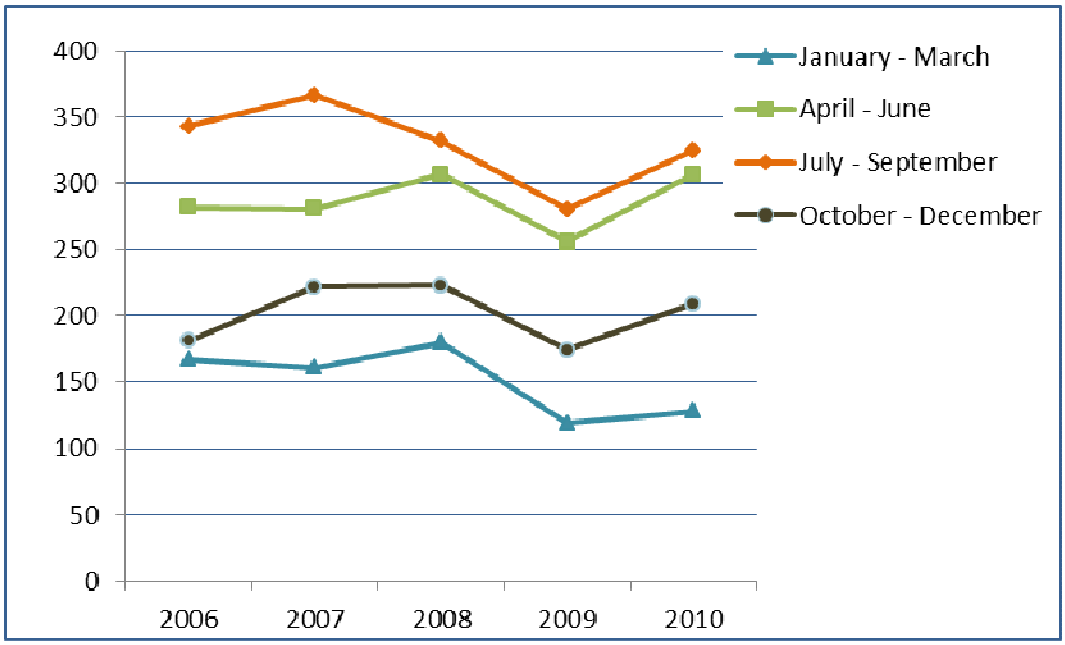

Figure 5. Seasonal trend in NC bicycle collisions, 2006-2010.

Day of Week

On average, bicycle-motor vehicle crashes were fairly equally spread across weekdays with weekend days of Saturday and, particularly, Sunday having fewer crashes than weekdays (Figure 6). Commuting trips would likely be lower on weekend days while recreational trips may be higher, but we have no data to verify the volume and types of trips by day, nor how risk factors might differ for different types of trips. One-fourth (25) of all the bicyclist fatalities over the five year period occurred, however, on Saturdays with another 9% on Sundays (data not shown). The remaining 66 fatalities were fairly evenly spread across weekdays.

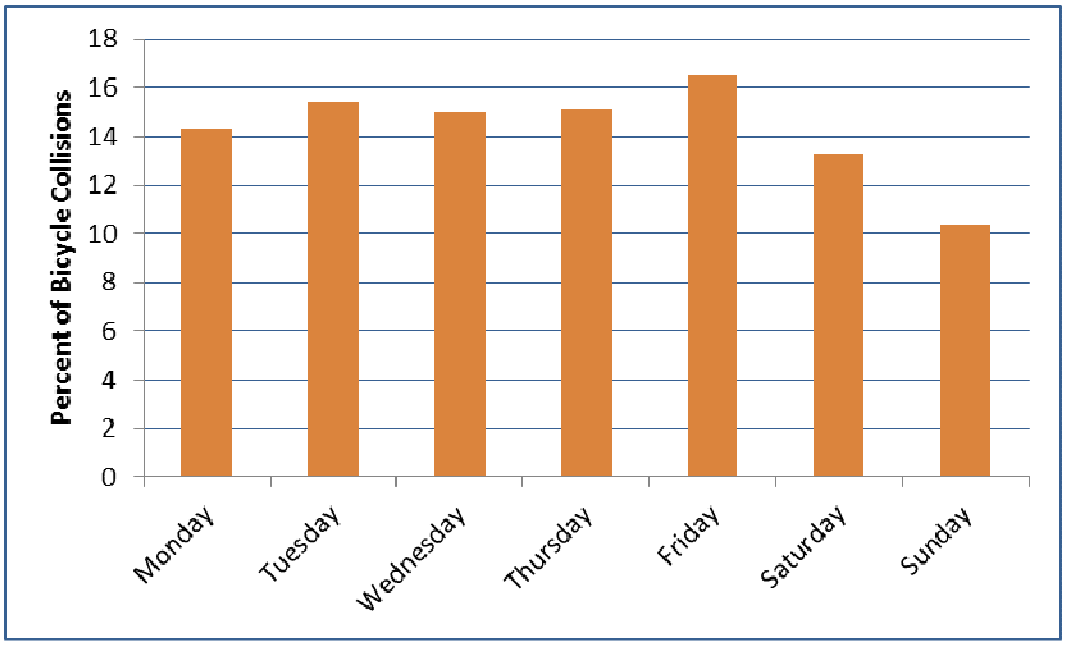

Figure 6. NC bicycle crashes by day of week, 2006-2010.

Time of Day

More than half of all bicycle collisions (51%) occurred between the mid-afternoon to evening hours of 3 and 9 pm (Table 14). On average, 29% occurred between 3 and 6 pm, peak travel times for school and work commuters and after-school riding for children. During some months, darkness is also falling during these hours. There does seem to be a slight declining trend in the number and proportion occurring between 3 and 6 pm since 2006, but it is unknown whether this trend will continue or may reflect differences in who is riding and when (such as fewer children riding after school).

Exposure data are lacking to know whether nighttime hours are over-represented for crashes, but compared to morning commute hours (6 to 9 am), the evening hours of 6 to 9 pm seem to be clearly over-represented with 22% while the morning period accounts for only 8%.

Table 14. Time of Day of NC Bicycle Collisions.

Time of Day	2006	2007	2008	2009	2010	Total
midnight to 3 am	15	32	20	18	18	103
	1.5 [1]	3.1	1.9	2.2	1.9	2.1 [2]
3 am to 6 am	9	15	13	17	19	73
	0.9	1.5	1.2	2.1	2	1.5
6 am to 9 am	69	74	100	65	93	401
	7.1	7.2	9.6	7.8	9.6	8.3
9 am to noon	99	107	111	89	108	514
	10.2	10.4	10.7	10.7	11.1	10.6
noon to 3 pm	196	182	177	141	161	857
	20.1	17.7	17	17	16.6	17.7
3 pm to 6 pm	294	307	294	234	265	1394
	30.2	29.8	28.2	28.2	27.3	28.8
6 pm to 9 pm	207	224	236	189	227	1083
	21.3	21.7	22.6	22.8	23.4	22.4
9 pm to midnight	84	89	91	76	78	418
	8.6	8.6	8.7	9.2	8	8.6
Total	973	1030	1042	829	969	4843 [4]
	20.1 [3]	21.3	21.5	17.1	20	

[1] Row percent of column total
[2] Row total percent of totals
[3] Column total percent of total
[4] Total includes the first motorist in crash less any cases with missing data, including hit and run drivers.

Light Conditions

About three-fourths (73%) of crashes happen in conditions of daylight during the five years (Figure 7). Another 22% occur during conditions of darkness, and in about half of these the roadway was lighted and half, unlighted. Dawn and dusk conditions combined account for about 5% of crashes with all other or unknown lighting conditions accounting for about ½ of 1%. There is some variability across years in these percentages, but no distinct trends.

NC State law requires bicyclists operating at night to have an active, white front light visible from at least 300 feet, and a rear, red reflector that is visible from a distance of 200 feet. In addition, active rear, red lights are also available to supplement passive reflectors. Reflective clothing, leg and arm bands, helmets or other reflective gear may further help increase the conspicuity of cyclists riding at night.

Additional roadway lighting could also be considered in unlighted areas where bicyclists frequently ride at night, and at shared use path and roadway intersections.

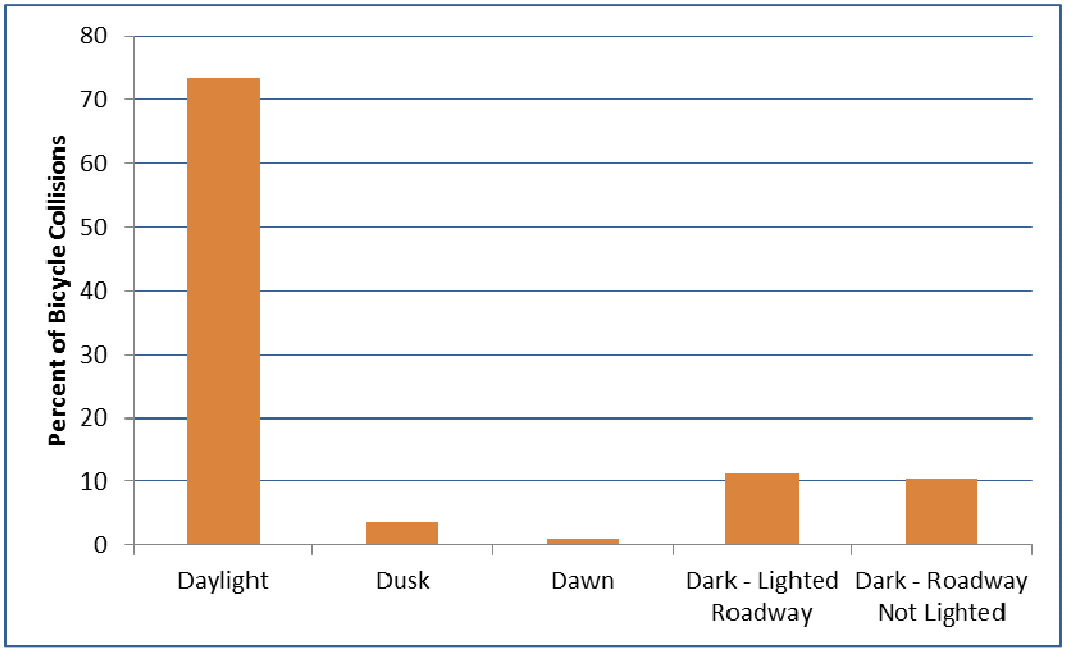

Figure 7. NC Bicycle collisions by light condition, 2006 - 2010.

Weather

The vast majority – 96% over this time period – of crashes occurred under clear (83%) and cloudy (13%) weather conditions (Figure 8). About 3% of bicycle-motor vehicle crashes took place under rainy conditions with all other icy, snowy, foggy, and other conditions accounting for less than 1% of the total. Nevertheless, wet or slippery conditions affect bicyclists' ability to ride safely and efforts should be made to provide surfaces suitable for riding in wet weather. About 8% or twice as many bicycle collisions occurred when surfaces were wet or had standing water as occurred while it was actually raining (surfaces data not shown).

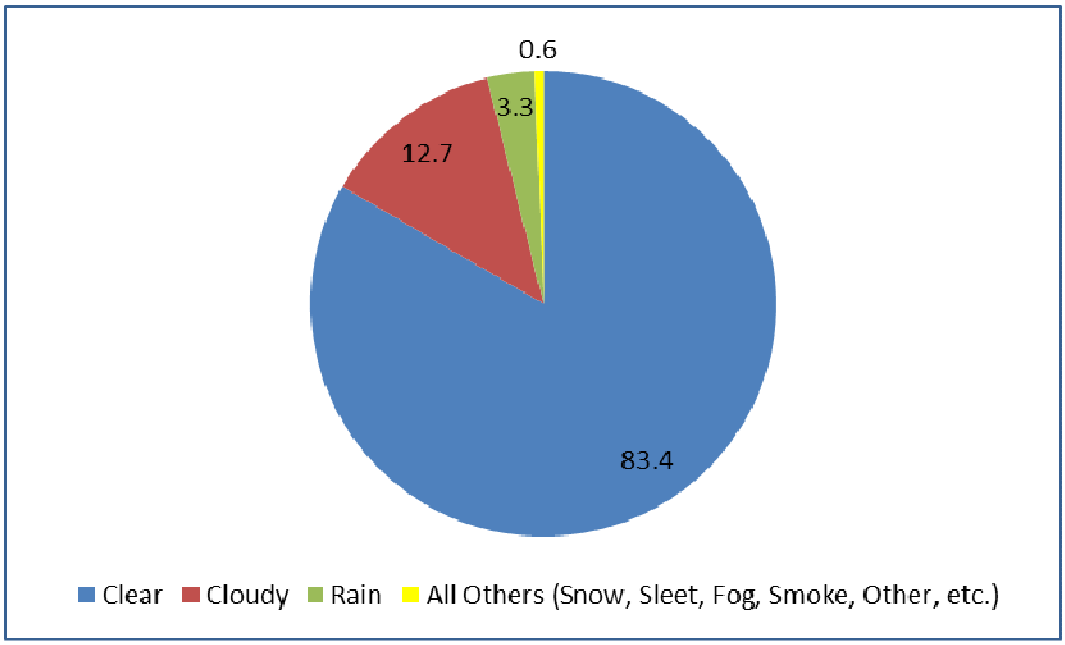

Figure 8. Weather conditions and NC bicycle collisions, 2006-2010.

Roadway Characteristics

Roadway Type

On average, more than three-fourths of bicycle collisions occurred on two-way, undivided roadways and about 16% on two-way roads divided by a median, with much smaller percentages on two-way roads divided with a positive median barrier (often freeways), or on one-way roads (Figure 9).

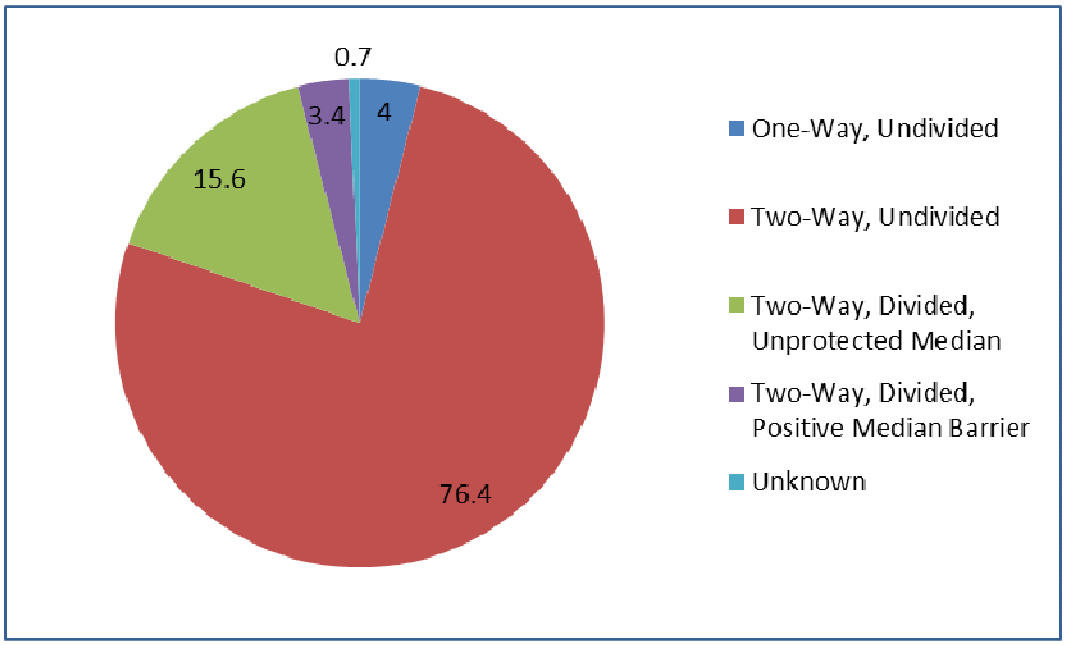

Figure 9. Road configuration and bicycle crashes, 2006-2010.

Number of Through Lanes

A majority, 60%, of bicycle-motor vehicle crashes also occurred on roads with two through lanes of traffic (Figure 10). Sixteen percent were on roads of four lanes, 10% on roads of 5 lanes, and 8% on roads of 3 lanes, with on 2% on one-lane roads. Another 4-5% were on roads of more than 5 through travel lanes.

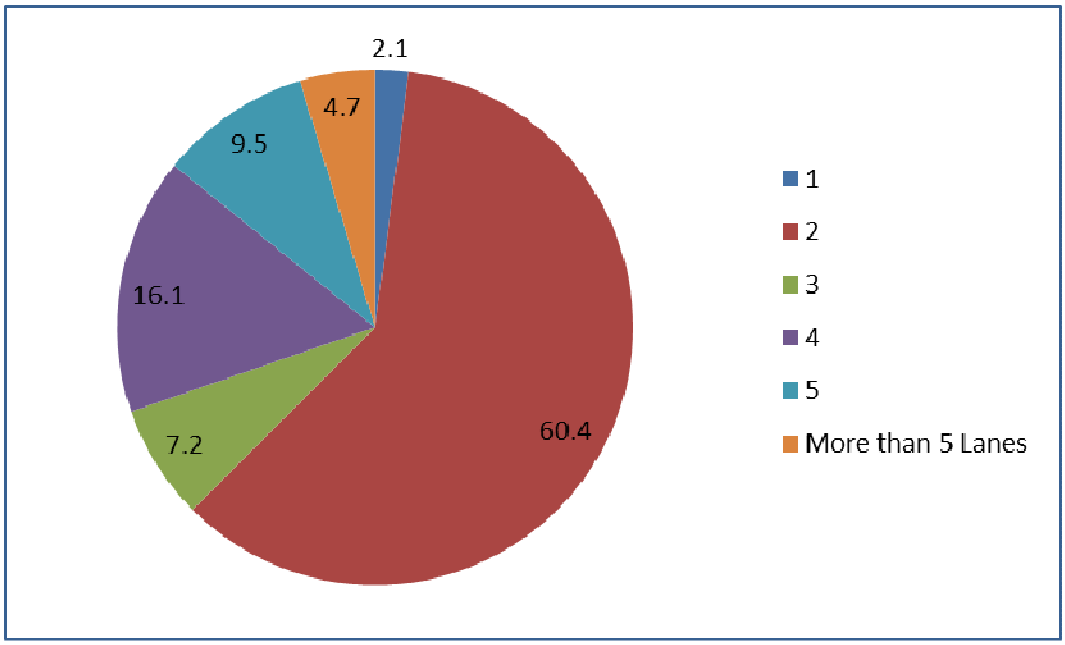

Figure 10. Bicyclist crash percentages by number of through travel lanes, 2006-2010.

Reflecting the lane number trends, the vast majority of bicycle-motor vehicle crashes occur on two-way, undivided roadways (77%) with about 4% on one-way roads (data not shown). About 18% occur on two-way roads divided by a median.

Speed Limit

A majority (64%) of NC's bicycle-motor vehicle crashes (that occurred on roadways with posted limits) occurred on roads with speed limits of 35 mph or less, similar to the 69% of crashes that occurred inside city limits (of crashes that occurred on streets with a posted limit). The group of 40–45 mph roadways accounted for 22% of crashes, more than the 20-25 mph roadways, and 50 mph and above posted roadways accounted for 14% (Figure 11). While there is some variability in the crash percentages by year, no obvious trends are evident.

Crashes on higher speed roads may be especially severe. Less than 1% of bicyclists struck on NC roads with speed limits of 35 mph and lower were killed, but the proportions killed rose to 3%, 8%, and 38% of those struck on 40 – 45 mph, 50 – 55 mph, and 60 – 75 mph roadways, respectively. In all, 79% of bicyclists killed were struck on roadways of 40 mph limits and higher, the majority on 50 – 55 mph roadways. (Note that there is a lack of reliable information on actual travel speeds of the striking vehicles, but the speed limit of the roadway provides some information about the general travel speed.)

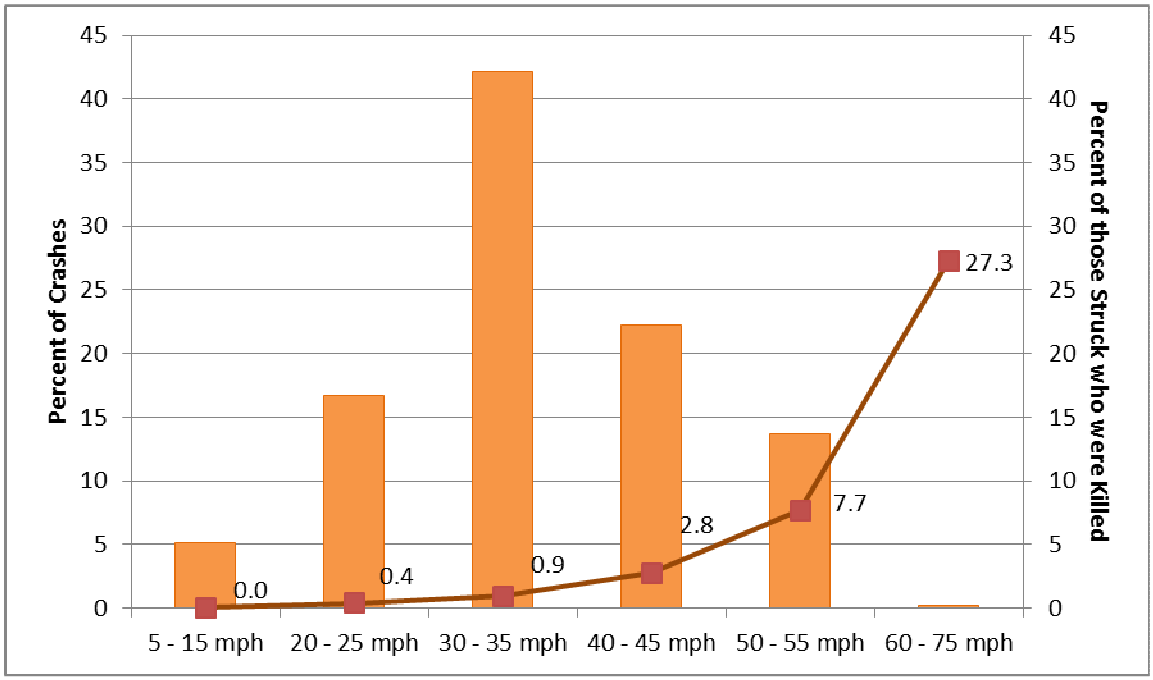

Figure 11. Percentage of NC bicycle crashes by different roadway speed limits, 2006-2010. The red line and markers indicate the percentage of those struck who were killed for the different speed limits.

More than half of North Carolina's bicycle collisions occurred at non-junction locations with no apparent special features (bridges, tunnels, driveways, etc.). The next largest numbers

occurred at various types of intersections with most occurring at four-way (18%) and T-intersections (15%) and other types of junctions including public/commercial driveways (7%) and private driveways (3%). All types of other features such as tunnels, bridges and overpasses accounted for 3%.

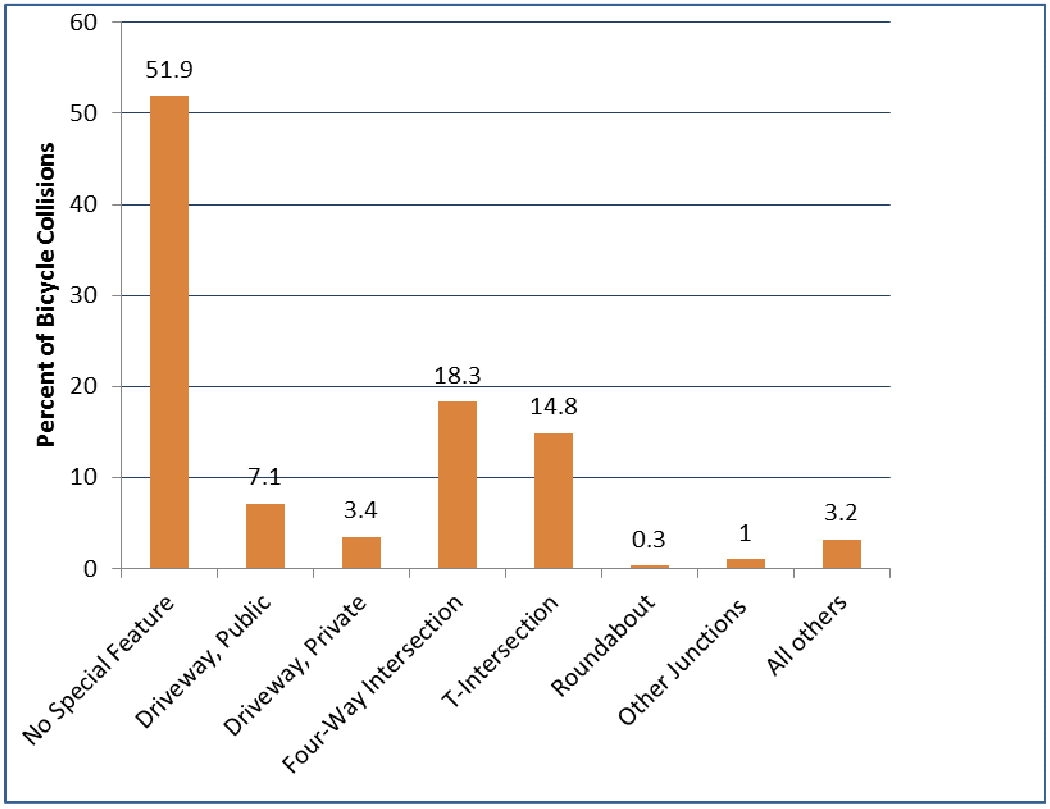

Figure 12. Road feature at collision location, 2006-2010.

For additional information on the types and other characteristics of bicycle-motor vehicle crashes occurring in the State over the same time period, see the **North Carolina Bicycle Crash Types** summary report.