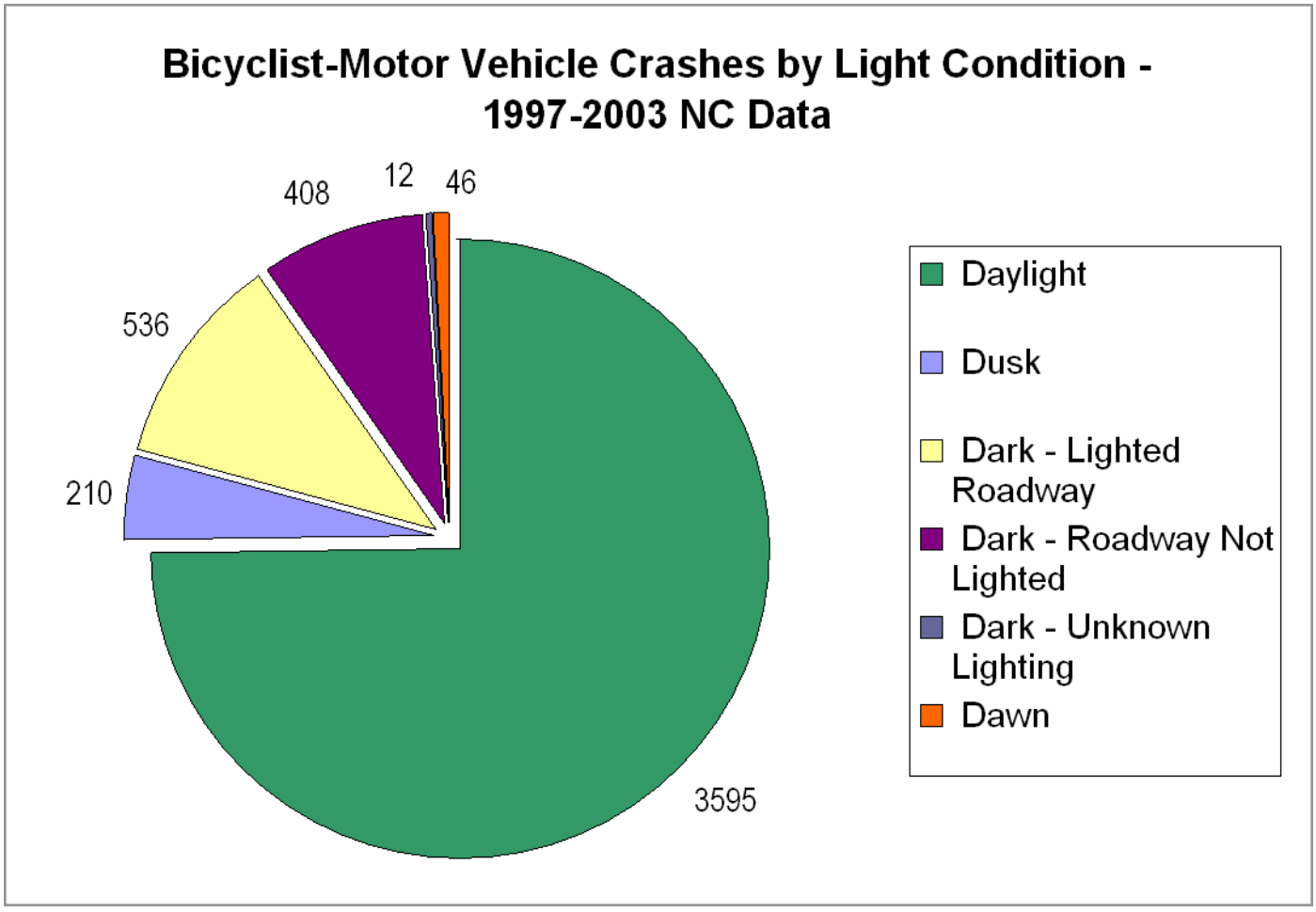
Chapter 2 – Bicyclist Crash Factors



Chapter 1 provided an overview of the need to provide a more bicycle-friendly environment on streets and highways. This chapter provides an overview of the bicycle safety problem and related factors that must be understood to select appropriate facilities and programs to improve bicycle safety and mobility. A brief description of the bicycle crash problem in the United States is discussed in the following sections and is also reported by Hunter, et al. in a related publication.[1] Similar statistics should be produced for States and municipalities to better understand the specific problems at the community level and thus select appropriate countermeasures.

MAGNITUDE OF THE PROBLEM

Bicycle/motor vehicle crashes are a serious problem throughout the world. The United States has a particular problem with bicyclist deaths and injuries.

Specifically, 622 bicyclists were reported to have been killed in motor vehicle crashes in the United States in 2003.[2] These deaths accounted for 1.5 percent of the 42,643 motor vehicle deaths nationwide that year. An estimated 46,000 bicyclists were injured in motor vehicle collisions, which represent 1.6 percent of the 2.9 million total persons injured in traffic crashes.[2]

These bicycle crashes with motor vehicles are a primary source of information on events causing injury to bicyclists. However, these data are frequently referred to as the "tip of the iceberg," in that these crashes are limited almost entirely to events that occur on public roadways. Thus, possible exclusions include bicycle-motor vehicle crashes that occur in non-roadway locations such as shared-use paths, parking lots, driveways, and sidewalks, as well as falls or other non-collision events that do not involve a motor vehicle, regardless of whether they occur on a roadway or in a non-roadway location. In a study using data collected at eight hospital emergency departments from three states, Stutts and Hunter found that 70 percent of the reported bicycle injury events did not involve a motor vehicle. In addition, 31 percent of the bicyclists were injured in non-roadway locations such as sidewalks, parking lots, or off-road trails.[3]

PHOTO BY DAN BURDEN

Fatality and injury crash rates are lower for bicyclists age 65 and older compared with other age groups.

PHOTO BY DAN BURDEN

Some crashes occur when motorists turn right soon after overtaking bicyclists.

Bicyclist fatalities in collisions with motor vehicles decreased 23.3 percent between 1993 and 2003, and bicyclist injuries in collisions with motor vehicles decreased 35.3 percent during the same period. It does not appear that these declines are due to less bicycling. Based on the *National Personal Transportation Survey* data, the reported number of bicycling trips increased from 1.7 to 3.3 billion between 1990 and 1995. The *2001 National Household Travel Survey 10 Year Status Report* also indicated 3.3 billion reported bicycling trips.[4,5] The *National Bicycling and Walking Study*[5], published in 1994, had major goals of doubling the percentage of total trips made by bicycling and walking and simultaneously reducing by 10 percent the number of bicyclists killed or injured in traffic crashes. Progress is being made, and these continue to be important goals for all professions dealing with these non-motorized modes.

BICYCLISTS MOST AT RISK

Bicycle crashes affect all age groups, but the highest injury and fatality rates (per population) are associated with younger riders. The 10 to 15 age group has both the highest fatality rate and the highest injury rate.[2] This age group is more associated with ride-outs from driveways and intersections, swerving left and right, riding in the wrong direction and crossing midblock.[1] Bicyclists under age 16 accounted for 23 percent of all bicyclists killed and 37 percent of bicyclists injured in crashes with motor vehicles in 2003. There is a trend of bicyclists age 25 and older accounting for an increasing proportion of bicyclist deaths since 1993, which likely reflects more riding (exposure) by this group. The fatality and injury crash rates for bicyclists age 65 and older are generally lower than for other age groups, and this likely reflects where and when they ride—generally in safer locations and at safer times of day—and most likely that they ride less.[1,2]

Male bicyclists are more likely to be involved in crashes than females. In 2003, 88 percent of bicyclists killed and 78 percent of bicyclists injured were males. Similarly, the fatality and injury rates per capita were higher for males.[2]

PLACE AND TIME OF OCCURRENCE

Once again, crash information tends to reflect exposure. Almost 70 percent of bicyclist fatalities occur in urban areas, and 71 percent occur at non-intersection locations. The hours of 5 p.m. to 9 p.m. account for 31 percent of fatalities, and the months of June, July, and August for 35 percent.[2]

Other locational information indicates that, for all bicycle-motor vehicle crashes[1]:

- About one-third occur on local streets.
- About half are associated with intersections.
- About three-fourths occur on roads with speed limits of 35 mph or less.

ALCOHOL INVOLVEMENT

Driving under the influence of alcohol is a well-publicized issue as related to motorists in this country. It is also an issue for bicyclists. Alcohol involvement for either the bicyclist or motor vehicle driver was reported in more than one-third of the crashes that resulted in a bicyclist fatality in 2003. Some 28 percent of fatally injured bicyclists were reported to have a blood alcohol concentration (BAC) of 0.01 grams per deciliter (g/dl), and 24 percent, a subset of the above group, had a BAC of 0.08 g/dl or higher.[2] Alcohol crashes tend to involve older bicyclists and are more frequent on weekends and during hours of darkness.[1]

PHOTO BY DAN BURDEN

Many bicycle crashes occur at intersections; a frequent factor involves the bicyclist not obeying traffic signals or stop signs.

PHOTO BY DAN BURDEN

The hours of 5 p.m to 9 p.m. account for 31 percent of bicycle crash fatalities. Alcohol-related crashes are also more likely to occur during hours of darkness.

SPECIAL SITUATIONS INVOLVING BICYCLISTS

Within any community where bicycling occurs with any frequency, there are a number of situations that lead to problems. Efforts to improve these situations will lead to improved bicycle safety.

WRONG-WAY RIDING

Wrong-way riding, or riding facing traffic, remains a prevalent problem. This behavior puts bicyclists in a position where motorists are not expecting them to be, whether the bicyclist is in the street or on the sidewalk. An exam-

PHOTO BY DAN BURDEN

Sidewalk riding can be treacherous.

ple is a motorist making a right turn on red. The motorist is looking primarily to the left for a gap in traffic and may not recognize a bicyclist riding against traffic, either in the street or on the sidewalk.

SIDEWALK RIDING

Sidewalk riding is permitted in many, but not all, communities. Indeed, separated sidewalk bike paths, routinely used by both bicyclists and pedestrians, are sometimes used next to busy streets. If allowed on sidewalks, bicyclists need to basically travel at the speed that pedestrians walk, or about 5 to 8 km/h (3 to 5 mi/h). An inherent danger in sidewalk riding comes from the presence of driveways that cross the sidewalk. Motorists tend to drive across the sidewalk to get a better view of traffic, and this can lead to crashes with bicyclists riding on the sidewalk, especially those riding against the normal flow of traffic. The problem is similar to what is described above, where a motorist turning right from a driveway is looking primarily to the left for a gap in traffic. This same pattern is present at intersections, where bicyclists riding on the sidewalk may ride through the crosswalk, or bicyclists riding on a shared-use path or trail adjacent to the roadway may ride into the path of motor vehicles Motorists tend to expect pedestrians to emerge from sidewalks. When bicyclists make this maneuver and travel considerably faster than pedestrians, the potential for crashes is increased.

PRESENCE OF DRIVEWAYS

Besides the potential crashes involving motorists in driveways and bicyclists on sidewalks mentioned above, considerable crashes also occur when motor vehicles pull into the street from a driveway and strike a bicyclist riding in the street. A variety of factors can be present in these crashes, including the size of the bicycle making it difficult to be seen, a bicyclist riding at night without proper lights, and poor sight distance at the driveway. Access control to limit the number of driveways on bicycling corridors can help. In addition, special signing and/or pavement marking at the point the driveway crosses the sidewalk and enters the street can be useful remedies.

PHOTO BY DAN BURDEN

Many crashes occur when motor vehicles pull into the street from a driveway and strike a bicyclist riding in the street.

NIGHT BICYCLE RIDING

Data from the National Center for Statistics and Analysis indicate that 31 percent of bicyclist crashes occur between the hours of 5 p.m. and 9 p.m.[2] Not all of these crashes would result from lack of lighting associated

PHOTO BY DAN BURDEN

Lights and reflectors can make bicycling safer at night.

with the bicycle, but the problem is considerable. Analysis of recent data from North Carolina shows that almost 20 percent of bicycle-motor vehicle crashes occur under conditions of darkness (http://www.pedbikeinfo.org/pbcat/pdf/summary_bike_facts5yrs.pdf).[6] An additional 5 percent of crashes occur at dusk. This is an educational issue for bicyclists, and local police need to be more willing to let bicyclists know if they are riding with improper equipment, whether through a warning or a citation. Besides headlights and rear reflectors, a variety of pulsing lights for the bicycle or the bicyclist now exist.

BICYCLISTS RIDING NEXT TO PARKED VEHICLES—THE "DOORING" PROBLEM

Serious injury can occur when a bicyclist strikes a door when a motorist exits a parked vehicle. In communities with bicycling corridors on streets with parked vehicles, this crash type can occur with reasonable frequency. Several on-street treatments are available. If there is a bike lane next to the parked vehicle, use of a double-striped bike lane is preferable, in that bicyclists tend to center in the middle of the bike lane, thus placing themselves further away from a door opening. Some communities are also experimenting with symbols, such as the typical bike lane logo inside a directional arrow, to see if bicyclists will track over the symbol and away from door openings. Bicyclist education emphasizing the danger of riding too close to parked vehicles would also be helpful.

PHOTO MICHAEL KING

A bicyclist passing parked vehicles can be injured if a motorist opens his or her door and strikes the bicyclist.

PHOTO BY DAN BURDEN

Bicycle-motor vehicle crashes at intersections often occur due to the bicyclist ignoring traffic signals or signs.

BICYCLISTS NOT OBEYING TRAFFIC CONTROL AT INTERSECTIONS

About half of the bicycle-motor vehicle crashes occur at or near intersections.[1] While many of these crashes are not the fault of bicyclists, a frequent factor in these crashes is the bicyclist who ignores either traffic signals or stop signs at intersections. Bicyclist education is one remedy, but perhaps more important is law enforcement. Police often fail to respond to inappropriate maneuvers by bicyclists, and while it may be unrealistic to expect large increases in citations to bicyclists, wholesale increases in warnings could be effective.

BICYCLE CRASHES INVOLVING CHILDREN

Although bicyclists 25 years of age and older are increasingly involved in injury and fatality crashes, the number of crashes involving children under age 16 remains large. In 2003, the group under age 16 accounted for 23 percent of bicyclist fatalities and 37 percent of bicyclist injuries.[2] Based on North Carolina data, the under 16 group also tends to be overrepresented in crashes where the bicyclist was at fault. (http://www.pedbikeinfo.org/pbcat/pdf/summary_bike_types5yrs.pdf).[7] Crash types where this group is overrepresented include riding out or through intersections with stop signs, riding out at non-intersection locations such as driveways, turning or merging in front of traffic, and non-roadway crashes, including those in parking lots and driveways. In essence, there are behavioral issues present that are related to lack of experience. As noted above, bicyclist education and police enforcement or warnings could help with this problem.

USE OF BICYCLE HELMETS

At present there are 21 states (counting the District of Columbia as a "state") and at least 148 localities with some form of a mandatory bicycle helmet laws. Thirteen states have no state or local helmet laws of any kind (Bicycle Helmet Safety Institute Web site, 2006). Many serious head injuries occur at low speeds and are preventable if helmets are worn properly.

While helmets may not have an impact on the frequency of crashes, numerous studies have found that use of ap-

PHOTO MICHAEL KING

Younger bicyclists have the highest injury and fatality rates associated with bicycle crashes.

proved bicycle helmets significantly reduces the risk of fatal injury, serious head and brain injury, head injury, and middle and upper face injury among bicyclists of all ages involved in all types of crashes and crash severities. Relative risk reductions estimated in a meta-analysis of 16 peer-reviewed studies were 60 percent for head injury (OR=0.40; CI 0.29, 0.55), 58 percent for brain injury (OR=0.42; CI 0.26, 0.67), 47 percent for facial injury (OR=0.53; CI 0.39, 0.73), and 73 percent for fatal injury (OR=0.27; CI 0.10, 0.71).[8]

Rivara et al. (1999) report that helmets that do not fit properly or are misused also increase the risk of head injury. Helmets tipped backward exposing the forehead were associated with a 50 percent increase in risk of head injury when compared with helmets properly centered. Using another measure of poor helmet fit, it was also found that half of children wearing helmets 2 cm or more wider than their heads had experienced a head injury.[9]