Bicycle - Motor Vehicle Collisions on Controlled Access Highways in Arizona

Analysis from January 1, 1991 to June 30, 2002

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Introduction

For many locations in Arizona, controlled access highways are the only available routes for travel. Therefore, bicycle travel on these highways is necessary and permitted.

Traffic Engineering Group PGP 1030 establishes a policy for the use of controlled access highways by bicyclists. This policy states that bicycles should not be prohibited from controlled access highways except under those conditions where alternate routes are available and are considered comparable or better in terms of convenience and safety.

Approximately 2000 shoulder-miles of controlled access highway are currently open to bicycle traffic in Arizona. Most of this mileage is on rural Interstate highways.

At the request of the State Traffic Engineer, traffic records were evaluated for all controlled access highways in Arizona to determine the frequency and location of bicycle-motor vehicle collisions on these highways. The study period, January 1, 1991 to June 30, 2002, was chosen in order to receive information from all available records in ADOT's statewide crash records database.

This report also serves to update a previous analysis of bicycle-motor vehicle crashes on controlled-access highways that was performed in October 1998 for the 1993-1998 time period. This report incorporates the crashes analyzed in the previous report, and includes additional reported collisions from before and after the time period studied in the previous report.

Studies of bicycle collisions have shown that bicycle-motor vehicle crashes comprise a relatively small minority (typically less than 20%) of all bicycle crashes, but that such bicycle-motor vehicle crashes tend to have a higher severity than non-motor vehicle related crashes.

Of these bicycle-motor vehicle collisions, studies have shown that approximately 65 to 75% typically occur at intersections and driveways due to turning and crossing traffic. One of the primary safety benefits of controlled access highways is the absence of cross traffic, driveways, and intersections, which benefits both bicyclists and motorists.

Collision Experience

Traffic accident records were reviewed from January 1, 1991 to June 30, 2002.

There were thirteen bicycle-motor vehicle crashes reported as being located on these highways. A detailed analysis of these thirteen crashes showed that four of these crashes actually occurred on frontage roads or cross streets at interchanges, leaving nine crashes that occurred in controlled access locations.

A list of controlled access highways, their status per PGP 1030, and bicycle-motor vehicle collision history:

Interstate 8:
I-8 is open to bicycle travel over its entire length in Arizona (MP 0.0 - 178.33).
Two bicycle-motor vehicle collisions were reported on I-8 during the study period.

The first collision occurred on February 26, 2000, at 1:10 AM, on I-8 at MP 11.5 eastbound. A motor vehicle was attempting to pass another vehicle by entering into the left lane and struck a bicyclist that was already in the left lane. The bicyclist had a prior history of unclear judgement due a medical condition caused by a previous stroke.

The second collision occurred on March 23, 2001, at 10:25 PM, on I-8 at MP 57.2 eastbound. A motor vehicle struck and killed a bicyclist traveling in the eastbound lane, near the lane line separating the two eastbound travel lanes.

Interstate 10:
I-10 is open to bicycle travel from MP 0.0 - 132.66 and from MP 267.11 - 391.23.
Four bicycle-motor vehicle collisions were reported as occurring on I-10 during the study period.

One collision at MP 18.1 was determined to have occurred on the frontage road, which is not part of the controlled access facility.

The second collision occurred on February 1, 1995, at 5:45 PM, on I-10 at MP 183.5 westbound. A driver pulled his motor vehicle onto the shoulder of I-10 where he struck and injured a bicyclist riding on the shoulder.

The third collision occurred on November 10, 2001, at 6:18 PM, on I-10 at MP 264.8 eastbound. A pedestrian was walking a bicycle across the freeway and was struck by a motor vehicle.

The fourth collision occurred on March 12, 2002, at 12:38 PM, on I-10 at MP 262.8 eastbound. An intoxicated pedestrian was walking a bicycle across the freeway and was struck by a motor vehicle.

Interstate 15:
I-15 is open to bicycle travel over its entire length in Arizona (MP 0.0 - 29.40).
One bicycle-motor vehicle collision was reported on I-15 during the study period.

The collision occurred on September 24, 2000, at 8:15 PM, on I-15 at MP 11.7 southbound. A motor vehicle traveling in the right lane struck a bicyclist riding near the edge line between the shoulder and right lane. The driver of the motor vehicle was driving under the influence of alcohol.

Interstate 17:
I-17 is open to bicycle travel from MP 217.10 - 340.05.
Three bicycle-motor vehicle collisions were reported as occurring on I-17 during the study period.

One collision at MP 204 was determined to have occurred on the frontage road, which is not part of the controlled access facility.

The second collision occurred on January 25, 1996, at 4:45 PM, on I-17 at MP 222.5 southbound. A motor vehicle traveling near the right edge of the right lane struck and injured a bicyclist riding at or near the edge line between the shoulder and right lane.

The third collision occurred on February 12, 1994, at 8:30 PM, on I-17 at MP 291.4 southbound. A motor vehicle traveling in the right lane struck and killed a bicyclist riding near the edge line between the shoulder and right lane.

Interstate 19:
I-19 is open to bicycle travel from km 0.0 - 69.59.
No bicycle-motor vehicle collisions were reported on I-19 during the study period.

Interstate 40:
I-40 is open to bicycle travel over its entire length in Arizona (MP 0.0 - 359.63).
No bicycle-motor vehicle collisions were reported on I-40 during the study period.

State Route 51:
SR 51 is prohibited to bicycle travel over its entire length in Arizona.
One bicycle-motor vehicle collision was reported on SR 51 during the study period.

One collision near McDowell Road was determined to have occurred on the frontage road, which is not part of the controlled access facility.

US Highway 60:
US 60 is prohibited to bicycle travel over its length as a controlled access highway in Arizona, from MP 164.23 - 198.41. Bicycle travel is unrestricted on all other segments of US 60 in Arizona, since these are not controlled access highways.

One bicycle-motor vehicle collision was reported as occurring on US 60 within this segment during the study period, but was determined to have occurred on the crossroad at a traffic interchange, which is not part of the controlled access facility.

State Loop 101:
Loop 101 is prohibited to bicycle travel over its length as a controlled access highway in Arizona.
No bicycle-motor vehicle collisions were reported on Loop 101 during the study period.

State Route 143:
SR 143 is prohibited to bicycle travel over its entire length in Arizona.
No bicycle-motor vehicle collisions were reported on SR 143 during the study period.

State Route 153:
SR 153 is prohibited to bicycle travel over its length as a controlled access highway in Arizona.
No bicycle-motor vehicle collisions were reported on SR 153 during the study period.

State Loop 202/Spur 202:
Loop 202 and Spur 202 are prohibited to bicycle travel over their length as controlled access highways in Arizona.
One bicycle-motor vehicle collision was reported on Loop 202/Spur 202 during the study period.

The collision occurred on November 26, 1997, at 6:54 PM, on Loop 202 at MP 0.7 eastbound. A vehicle operated by a person apparently under the influence of alcohol or drugs was driving partially in the right travel lane and partially on the shoulder of Loop 202, and struck and killed a bicyclist riding on the shoulder.

State Route 210:
SR 210 is prohibited to bicycle travel over its length as a controlled access highway in Arizona. No bicycle-motor vehicle collisions were reported on the controlled-access segment of State Route 210 during the study period.

Collision Factors and Statistics

Of the nine total motor vehicle-bicycle collisions on controlled access highways in the study period:

Collision Type:

Rear End:	4	(45%)
Sideswipe, Same Direction:	3	(33%)
Angle:	2	(22%)

Collision Severity:

Fatal:	3	(33%)
Injury:	6	(67%)
Property Damage Only:	0	(0%)

Light Condition:

Daylight:	3	(33%)
Darkness	6	(67%)

Roadway Junction:

Non-Merge Area:	9	(100%)
Merge Area (onramp/offramp):	0	(0%)

Rural / Urban Area:

Urban:	4	(44%)
Rural:	5	(56%)

Location Regulated and Signed as Permitted / Prohibited to Bicycling:

Permitted:	5	(56%)
Prohibited:	4	(44%)

DUI / Impaired Motor Vehicle Driver Involvement:

Yes:	2	(22%)
No:	7	(78%)

DUI / Impaired Bicyclist Involvement:

Yes:	2	(11%)
No:	7	(89%)

Bicyclist Age:

Adult (Over 18):	9	(100%)
Child (Under 18):	0	(0%)

Motor Vehicle Operator Error:

Yes:	4	(45%)
No:	3	(33%)
Indeterminate/Unknown:	2	(22%)

Bicyclist Error:

Yes:	4	(45%)
No:	2	(22%)
Indeterminate/Unknown:	3	(33%)

Analysis

Traffic crash rates are typically analyzed by determining the number of collisions or the severity of collisions divided by vehicle-miles of travel for that roadway segment. However, there exists no reliable method for determining bicycle-miles of travel on highways, so this method of comparison cannot be used for this analysis.

An alternative would be to compare the number of bicycle-motor vehicle crashes on controlled access highways versus the total number of crashes on all roadways statewide. This method is limited in that is does not take into account the significant variance in bicycle traffic volumes on roadways statewide. The total number of reported bicycle-motor vehicle crashes in the state of Arizona for the study period was 25,563. Therefore, these incidents comprised only 0.035% of the total reported bicycle-motor vehicle crashes in Arizona during the evaluation period – a very small number, given the size of the controlled access highway system.

Two collisions, or 22% of the total, were angle collisions involving bicyclists crossing the highway. These collisions occurred on I-10 in an urban area southeast of downtown Tucson within a two-mile segment. These bicyclists were not traveling along the highway in accordance with PGP 1030, but were attempting to cross the freeway right of way to reach destinations on the other side of the highway. The frequency and grouping of these collisions suggests that it may be advisable to improve opportunities for bicyclists to cross the I-10 corridor in future construction.

Overtaking and sideswipe collisions comprised the remaining 78% of the collisions studied. This could be interpreted as showing that high-speed overtaking of cyclists by motorists is inherently unsafe, but this conclusion is not supported by other more comprehensive collision studies across the US. Further, if such overtaking maneuvers were inherently dangerous, then the number of collisions would probably be much higher, given the exposure of cyclists using these roadways. It seems that the design of the controlled access facility minimizes the risk of other crash types for cyclists, leaving only the relatively small risk from overtaking traffic.

From an analysis of traffic flow patterns, it would appear the primary point of conflict between bicycles and other traffic on controlled access highways would be at ramp locations, where the paths of the through bicyclist and the entering or exiting motorist cross. It is notable, however, that none of the reported crashes occurred at these locations. This may be due to greater care being exhibited by cyclists and motorists at these locations.

Two of the overtaking crashes involved bicyclists traveling along roadway segments prohibited to cycling. This implies that bicyclists may be using prohibited roadways on a continuing or systematic basis, but this is unverified. The reason these cyclists may be choosing to use the controlled access highway instead of parallel streets despite the prohibition may be directly related to the perceived risk from turning and crossing traffic on the other streets. In addition, the controlled access facility may be considered more convenient in terms of travel time, distance, and accessibility.

Visibility of the bicyclist seems to have been a factor in four of the collisions, although two of these crashes involved bicyclists crossing controlled access highways, not traveling along these highways.

It is notable that 100% of the crashes involved bicyclists above the age of 18. This seems to imply that the typical bicyclist using a controlled-access highway is an adult. This could imply that children under the age of 18 are operating in locations and in ways that minimize their crash exposure, but more likely implies that children are simply not bicycling on controlled access highways.

Conclusions

The rate of bicycle-motor vehicle crashes on controlled access highways is less than one per year across the entire state of Arizona for over a decade, clearly implying that there is not a large-scale safety problem associated with the use of these highways by bicyclists.

Further changes on the use of controlled access highways by bicyclists must be evaluated in light of the very small percentage of motor vehicle-bicycle crashes occurring on these roadways.

Recommendations

When requested, adjustments should be made to bicycle access on controlled access highways in accordance with PGP 1030 based on sound engineering judgment that recognizes bicyclists as legitimate users of our roadway system.

When such changes are planned, an objective safety evaluation should be made not only of the controlled access route, but of alternate routes as well, focusing on the crash risk to the bicyclist from all sources. Such case-by-case evaluations should take into account the following items on both the controlled access and alternate routes:

- Existing conditions
- Crash history of both routes
- Location and accessibility of destinations
- Cross traffic at intersections and driveways
- Lane and shoulder widths
- Traffic volumes and speeds
- Special hazards such as unretrofitted drain grates, rough pavement, railroad tracks, and rumble strips
- Other specific concerns

Attention to these important issues should result in improved travel for bicyclists, motorists, and other roadway users.