California Motorcycle Crashes: 
Roadway and Rider Contributing Factors

Introduction

The number of motorcycle fatalities in the United States (US) has followed a consistently increasing trend from 1997 to 2007. The state of California has been the largest single contributor to the US fatalities total over that period. This paper provides an overview of the crash conditions and injury severity in both single motorcycle crashes and two-vehicle crashes involving motorcycles with a focus on roadway and rider factors.

Methodology

The Highway Safety Information System (HSIS) is a census of police-reported crashes occurring on US highways and contains details on the accident, vehicles, and occupants involved in a crash. The HSIS data from the state of California for the years 1998-2007 was merged with roadway profile information to provide insights about the influence of roadway profile on both crash occurrence and injury outcome. The following selection criteria were applied: crashes involving at least one motorcycle and a maximum of two vehicles; the first and most harmful events are known for both the crash and motorcycle respectively; and the crash can be matched to a specific section of roadway. As the HSIS data is derived from Police Accident Reports for crashes occurring on state highways, the database does not capture all of the injuries and fatalities occurring on all roadways within the state. For example, in 2007 the HSIS database included 210 of the 518 motorcycle fatalities that were recorded in FARS for the state of California.

Findings

Motorcycle fatalities on California state highways have consistently followed the US national trend and have increased by almost 250% between the years 1998 and 2007. The graph in Figure 1 shows the distribution of both single- and multiple-vehicle police-reported motorcycle crashes occurring on California state highways between 1998 and 2007. Annually, there was a higher incidence of two-vehicle motorcycle crashes when compared with single vehicle crashes. There may be a potential underreporting of the single vehicle motorcycle crashes that do not result in severe injury or substantial property damage as the result of collision. Alcohol involvement for the motorcycle rider was reported for over 10% of single-vehicle motorcycle crashes and approximately 5% of two-vehicle motorcycle crashes. There was a higher percentage of severe/fatal injuries associated with single vehicle motorcycle crashes (Figure 2).

![Figure 1: CA HSIS 1998-2007 – Annual number of single- and two-vehicle crashes occurring on California state highways](image-url)
The graph in Figure 3 shows the first object contacted in single vehicle motorcycle crashes. It was identified that in 55% of crashes, the motorcycle was coded as having overturned “without contacting any further objects throughout the sequence of crash events.” These impacts accounted for less than 44% of severe/fatal injuries. There was a higher risk of severe/fatal injury relative to crash involvement in impacts to a longitudinal barrier, the roadside profile, and overturning with further contact to other objects. Further examination of the location of the first object contacted, Figure 4, shows that approximately 45% of impacts occurred on the roadway, however, when comparing the incidence of severe/fatal injury with the number of involved motorcyclists, there was a higher risk of severe/fatal injury when the motorcycle impact occurred beyond the shoulder (roadside and off-roadway). Approximately half of motorcyclists were involved in collisions occurring in urban environments, sustaining 40% of serious/fatal injuries.

Figure 5 shows the distribution of motorcyclist age in both single- and multiple-vehicle motorcycle crashes. One-fifth of motorcyclists were aged 50 years old or greater, and accounted for almost one-quarter of those seriously or fatally injured. Similar injury trends were observed when the data was disaggregated by single- and multiple-vehicle crashes.
Almost three-quarters of two-vehicle crashes involving motorcyclists were crashes in which both vehicles were traveling in the same direction. Motorcyclists that encountered circumstances where both vehicles were traveling in opposite directions (14%) sustained 27% of serious/fatal injuries. The largest distribution of two-vehicle motorcycle crashes occurred away from highway intersections, with more than 60% of motorcyclists involved in a crash that occurred more than 1 mile from a highway intersection, as shown in Figure 6. Almost thirty-percent of motorcyclists were involved in a crash occurring within ¼ mile of an intersection, accounting for 35% of those seriously/fatally injured.

Conclusions
The risk of serious and fatal injury in single vehicle motorcycle crashes increases as the motorcycle moves away from the roadway and interacts with both the roadside hardware and roadside profile. There was also a higher risk of serious and fatal injury associated with older motorcyclists involved in both single- and two-vehicle motorcycle collisions. Further study is required to further understand the crash sequence associated with multi-event crash scenarios where the crash was not coded as Overturned (No Further Contacts). Since over 60% of severe and fatal injuries occur beyond the road shoulder, preventing roadside departure while minimizing the risk associated with contacting the roadside hardware would likely improve the overall safety of motorcyclists involved in single vehicle crashes.

Reference

For More Information
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