

LANE CHANGE AND MERGING RELATED CRASHES HAVE DIVERSE OUTCOMES: A CIREN CASE REVIEW

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ABSTRACT

Objective

Lane change-related crashes involving two cars have been described to result in loss of property and not injury. However, when they take place at high speeds, these scenarios have the potential to turn into multi-vehicle crashes. Multi-vehicle crashes that occur on the highway may start out as lane-change or merging crashes and evolve into near side impacts, frontal impacts, and rollover crashes. This analysis was conducted to describe the diversity of injuries and outcomes related to lane-change impacts.

Methods

First, the National Automotive Sampling System (NASS) was screened for lane-change or merging related crashes (Crash Type = 46 or 47). The database was analyzed using SAS 9.3 PROC SURVEYLOGISTIC which accounts for the sample weights for NASS CDS using ratio inflation factor. Second, a manual review of Crash Injury Research and Engineering Network (CIREN) was conducted. Crash scenarios that began as lane change impacts between two cars were included.

Results

The NASS data predicted a risk of injury to all body regions, but the error bars for the AIS 3+ injuries overlap zero. The 19 CIREN cases described 148 documented injuries; 122 of the injuries were categorized as not severe (AIS 1-2) and 26 were categorized as severe (AIS 3-6). Of the severe injuries, 7 were to the thorax and 12 were to the lower extremity.

Discussion

Driver over reaction, or lack of reaction played a part in the outcome of these cases. Although many of the severe injuries were found to be contact related, bending motions caused by erratic vehicle motions also resulted in injuries. Automated vehicles may be able to perceive and process their environment faster than their human driver. They could also potentially mitigate driver over corrections and/or reduce secondary impacts, such as those that occur in lane-change or merging related outcomes.

Keywords: lane-change, merging, injury biomechanics, injury epidemiology, CIREN, NASS-CDS, automated vehicle, crash imminent safety, automated vehicle behaviors, intelligent vehicles

INTRODUCTION

“Vehicle(s) changing lanes-same direction” is sixth in terms of frequency (for light-vehicle crashes) out of 37 pre-crash scenarios described in the Department of Transportation 810 767 report [1]. Ideal lane change-related crashes, involving two cars, usually result in loss of property and not injury, however when they take place at high speeds these scenarios have the potential to turn into multi-vehicle crashes (Fig. 1) [1-3]. The National Highway Traffic Safety Administration (NHTSA) reported that highway lane change crashes represent \$4 billion in economic cost and 3% of functional years lost based on a review of the 2004 General Estimates System [1]. Multi-vehicle crashes that occur on the highway may start out as lane-

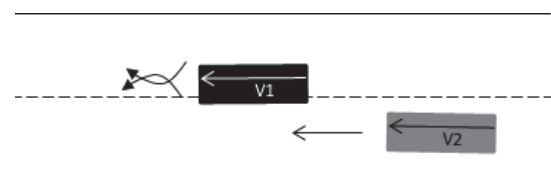


Figure 1. Lane change crashes often begin as minor impacts, but can escalate.