Statewide Heavy-Truck Crash Assessment

tech transfer summary

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> The objective of this study was to investigate and identify the causes, locations, and other factors related to heavy-truck crashes in Iowa with the goal of reducing crashes and promoting safety.

Background

In 2010, 16.5 percent of all fatal vehicle crashes in Iowa involved large trucks compared to the national average of 7.8 percent. Only about 16 percent of these fatalities involved the occupants of the heavy vehicles, meaning that a majority of the fatalities in fatal crashes involve non-heavy-truck occupants.

These statistics demonstrate the severe nature of heavy-truck crashes and underscore the serious impact that these crashes can have on the traveling public. These statistics also indicate Iowa may have a disproportionately higher safety risk compared to the nation with respect to heavy-truck safety.

Problem Statement

Several national studies, and a few statewide studies, have investigated large-truck crashes. However, no rigorous analysis of heavy-truck crashes has been conducted for Iowa.

Research Description

This study used the most current statewide crash data to perform an in-depth analysis of heavy-truck crashes in Iowa. This study also attempted to assess crash experience with respect to commercial driver's license (CDL) licensure. In addition, this study used citation data from the Iowa Department of Transportation (DOT) Motor Vehicle Division and Iowa State Patrol to investigate the possible relationship between past enforcement efforts and crash experience.

Research Methodology

To conduct the crash analysis, Iowa crash data for 2007 through 2012 were used to prepare descriptive statistics and to develop statistical models for single- and multiple-vehicle heavy-truck crash severity. Single-vehicle crashes were modeled using a binary probit model with outcomes of injury (fatal, major, minor, or possible injury) or no injury (property damage only). Multiple-vehicle crashes were modeled using a nested logit model with severity outcomes of severe injury (fatal or major injury), minor injury (minor or possible injury), and no injury (property damage only), with the two injury outcomes placed in a nest.

The analysis of CDL licensure data used 2008 through 2012 CDL new licensure and licensure renewal information linked to the crash data. Both descriptive statistics and negative binomial model estimates were utilized to investigate license characteristics, driver experience, and crash frequency.

In an effort to investigate the relationship between enforcement activities and crashes, the most recent four years of commercial motor vehicle-related public enforcement data (2009 through 2012) were used to conduct a statewide analysis, which included descriptive statistics and a test of proportions for time of day, day of week, month, road system, and county. Selected descriptive results are also presented geographically in the final report at the county and primary-road segment levels.

Key Findings

Findings from the two statistical crash severity models were both complimentary and contradictory. Both models found older drivers to be associated with more severe injuries. Both models also indicated crashes that have an impact on and damage the front of both heavy trucks and non-heavy trucks play a significant role in the severity outcome of the crash.

The findings were consistent with previous research identifying the importance of the heavy-truck frontal structure as well as other safety features, such as stability control, air bags, collision and lane departure warning systems, and improved braking systems.

The main disparity of the two statistical crash models relates to the effect that single-unit and combination trucks have on crash severity, with combination trucks being associated with a higher probability of a severe injury in multiple-vehicle collisions and single-unit trucks being associated with a higher probability of an injury in single-vehicle crashes.

Other factors found to be significant in either of the two models relate to the manner of the collision, temporal factors (season, day of week, time of day), vehicle characteristics, roadway characteristics, and environmental factors. Here are a few highlights of these results:

- Posted speed limits were found to have potentially great influence on heavy-truck crash-severity outcomes, with higher speeds being associated with more severe crash outcomes

- Severe crashes were more likely during morning (5 a.m. to 8 a.m.) and midday (11 a.m. to 2 p.m.)

- Severe crashes were more likely toward the beginning of the week (Monday or Tuesday) and over the weekend (Saturday or Sunday)

Other findings based on model results, descriptive statistics, and a test of proportions included the following:

- While the majority of crashes occurred with dry surface conditions, a higher proportion of multiple-vehicle crashes occurred with snow and slush surface conditions

- The majority of multiple-vehicle and single-vehicle crashes occurred in daylight conditions, but a statistically significant greater proportion occurred with dark, unlighted road conditions

- Younger heavy-truck drivers (ages 20 to 34) had proportionally higher involvement in single-vehicle crashes than in multiple-vehicle crashes

- The proportion of heavy-truck drivers under the age of 30 involved in a crash was higher than the proportion of Iowa CDL license holders under the age of 30, not considering vehicle miles of travel of these drivers

- Heavy-truck driver age distribution is far more concentrated than non-heavy-truck driver age distribution, with a greater percentage of heavy-truck drivers who are 30 to 64 and with percentage differences between heavy-truck drivers and non-heavy-truck drivers most pronounced between the ages of 40 and 59, and particularly between the ages of 45 and 54

Descriptive statistics and the results from test proportions indicated differences in proportions between law enforcement contacts and crashes both temporally and spatially for time of day, day of week, month, road classifications, and individual counties.

Temporally, contact proportions were much less during the early morning hours from 2:00 a.m. to 8:00 a.m. and mid- to late-afternoon hours from 2:00 p.m. to 6:00 p.m. along with Saturdays and Sundays.

Enforcement contact proportions were generally lower for non-primary (state) roadways. Lower proportions of crashes were consistently observed with higher proportions of enforcement contacts.

No significant differences were found between the electronic citation component (ECCO) and commercial motor vehicle inspections (VSIS) contacts, and their statewide proportions were generally consistent, possibly suggesting that either ECCO or VSIS contacts may be used as a proxy for law enforcement activity.

Implementation Readiness and Benefits

The findings of this research may benefit the areas of heavy-truck design, driver education and licensing, and law enforcement resource allocation. In addition, the findings support education of heavy-truck drivers about the importance of being alert after extended off-duty periods and also susceptibility to fatigue in the morning. Finally, the findings may be used, in part, by law enforcement agencies in developing schedules, establishing enforcement priorities, and monitoring enforcement impacts.