



Predicting Truck Crash Involvement: Developing a Commercial Driver Behavior-Based Model and Recommended Countermeasures

The Problem

Efforts by government and industry over the years to reduce large truck crashes have led to a number of significant positive trends. The U.S. Department of Transportation (USDOT) recently reported a decrease in the fatal crash rate for large trucks from 2.2 fatalities per 100M vehicle miles traveled (VMT) in 2000 to 1.9 fatal crashes per 100M VMT in 2003¹. In spite of increasing VMT and increased congestion over the years, the trucking industry has seen a general downward trend in fatal, injury and property damage crash rates over the last 20 years.

However, both industry and government recognize that more must be done to reduce the overall number of large truck crashes. Prior research studies, including the Federal Motor Carrier Safety Administration (FMCSA) Large Truck Crash Causation Study, point to driver-related factors as a critical reason for the majority of crashes involving large trucks. Therefore, focusing on driver behaviors will have the most profound impact on crash reduction.

Research Goal

The objective of this research was to design and test an analytical model for predicting future crash involvement based on prior driver history information. A second objective of the research, conducted in conjunction with the Commercial Vehicle Safety Alliance (CVSA), was to identify effective enforcement actions to counteract the driving behaviors and events that are predictive of future crash involvement.

Methodology

This research is one of the first studies of its kind to analyze several available subsets of driver-specific data and statistically relate the data to future crashes. Data sources included the Motor Carrier Management Information System (MCMIS) and the Commercial Drivers License Information System (CDLIS).



The main dependent variable is crash involvement. For purposes of this research, crash involvement is the objective measure of driver "safety." The independent variables are driver-specific performance indicators mined from the data including: specific violations; driver traffic conviction information; as well as past accident involvement information.

¹Large Truck Crash Facts 2003, Analysis Division, Federal Motor Carrier Safety Administration, FMCSA-RI-04-033, February 2005.

Driver data was gathered across a three-year time frame, and was analyzed to determine future crash predictability. For each of the drivers in the selected samples, driver history regarding past inspections and crashes were derived from MCMIS, and past conviction data was derived from CDLIS. Descriptive statistics were run on this entire dataset to develop the targeted samples.

Appropriate statistical tests, including chi-square analyses, were used to identify statistically significant predictions for future crash involvement based on past inspection, conviction, and/or crash information.

In order to associate the negative behaviors and events with enforcement strategies on a state-by-state basis, an objective measure was created that developed a statistical relationship between CMV traffic enforcement and a weighted crash metric. All 51 enforcement jurisdictions were surveyed to identify current enforcement activities addressing CMV driver behavior. Additional research was conducted on those states identified as "top tier" to identify targeted enforcement strategies and best practices.



Findings

The predictive model included data on 540,750 drivers. The analysis shows reckless driving and improper turn violations as the two violations associated with the highest increase in likelihood of a future crash. The four convictions with the highest likelihood of a future crash are: improper or erratic lane change; failure to yield right of way; improper turn; and failure to maintain proper lane. When a driver receives a conviction for one of these behaviors, the likelihood of a future crash increases between 91 and 100 percent. Table 1 ranks the top 10 driver events by the percentage increase in the likelihood of a future crash.

Table 1

Summary of Crash Likelihood for all Data Analyzed	
If a driver had:	The crash likelihood increases:
A Reckless Driving violation	325%
An Improper Turn violation	105%
An Improper or Erratic Lane Change conviction	100%
A Failure to Yield Right of Way conviction	97%
An Improper Turn conviction	94%
A Failure to Maintain Proper Lane conviction	91%
A Past Crash	87%
An Improper Lane Change violation	78%
A Failure to Yield Right of Way violation	70%
A Driving Too Fast for Conditions conviction	62%

The targeted surveys and interviews indicated that successful enforcement programs and strategies for addressing problem driver behaviors are those that exhibit one or more of the following components:

- ❑ Center on aggressive driving apprehension programs/initiatives;
- ❑ Target both commercial motor vehicle (CMV) and non-CMV behavior patterns;
- ❑ Utilize both highly visible and covert enforcement activities; and
- ❑ Incorporate an internal performance-based system for managing enforcement by specific crash types, driver behaviors, and locations.

The research also surveyed carriers to identify those hiring, training, and remediation practices most likely to mitigate the impacts of the problem behaviors identified.

A complete listing of findings and recommendations can be found in the full report, *Predicting Truck Crash Involvement: Developing a Commercial Driver Behavior-Based Model and Recommended Countermeasures*.

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