Research Results

ATRI American Transportation Research Institute

Safety by Design: Optimizing Highway Safety in Work Zones

The Problem

As the U.S. population and economy continue to grow, more pressure is being placed on the nation's road and bridge infrastructure today than at any point in history. This growth has left the nation's system of roads and bridges in a perpetual state of repair. As all motorists are aware, road maintenance and construction projects often cause significant traffic congestion, as well as contribute to an increasing number of accidents and fatalities.

Work zone-related crashes that involve large trucks are often more serious and more likely to result in fatalities. In order to mitigate the consequences of large truck crashes in work zones, research is needed to understand the underlying causes of truck-involved work zone crashes and from those findings develop appropriate countermeasures to reduce their frequency and severity. The American Transportation Research Institute (ATRI) initiated this research to investigate the factors that contribute to truck-involved work zone accidents.

Research Goal

The objective of the research is to identify and analyze critical information on the extent of truck-involved work zone crashes, both nationally and in those states where such data exists. Based on that data, ATRI analyzed work zone designs and other issues that may increase work zone safety.

ATRI convened top work zone experts from around the country for participation on the Project Advisory Committee. The Advisory Committee – comprised of representatives from state DOTs, Federal Highway Administration (FHWA), Federal Motor Carrier Safety Administration (FMCSA), American Association of State Highway and Transportation Officials (AAHSTO), Texas Transportation Institute, and the Commercial Safety Vehicle Alliance (CVSA) – examined research data and findings and made recommendations for improving work zone safety.

Data Findings

After collecting and examining available national and state datasets, several trends have emerged. The most significant of these is the now well-acknowledged realization that large trucks may be somewhat over-represented in work zone crashes. Overall, national estimates indicate that commercial trucks represent 10.3 percent of all motor vehicles registered nationwide and account for 16.1 percent of total motor vehicle miles traveled. However, the FMCSA estimates that nearly one-fourth of all fatal work zone crashes involve a large truck.

Other findings include:

- The time of day and days of the week at which truck-involved fatal work zone crashes occur are considerably different than for the entire vehicle population as a whole. Specifically, more truck-involved fatal work zone crashes occur during weekdays than for the entire vehicle population as a whole. It is not clear to what extent this difference is due to work zone and/or traffic characteristics, work zone exposure differences, or differences in the mix of large trucks and automobiles.
- The number of vehicles that are typically involved in fatal crashes increases when the crash occurs in a work zone. This trend is evident for all vehicle types,

but especially so when large trucks are involved. Large trucks are involved in 17 percent of 2+ vehicle fatal crashes outside of work zones, but 31 percent of the 2+ fatal crashes that occur within work zones.

- Rear-end fatal crashes tend to increase in work zones for both the entire vehicle population and for truck-involved fatal crashes only; however, it is not always clear from the data who is rear-ending whom. It is clear that most of the fatal work zone crashes are angle and head-on events. Rear-end crashes also make up a significant proportion of total work zone crashes, although sideswipe crashes are the most common type of work zone crashes in total. Together, these data indicate that head-on crashes are fairly infrequent in work zones, regardless of whether or not a truck is involved, but are very severe when they do occur. In contrast, sideswipe crashes are very frequent in work zones but do not typically result in fatalities.
- Data collection protocols and tools for crashes, citations and events lack uniformity and standardization, making it challenging for researchers to analyze the little data that is available on work zone safety.

The research identified several work zone geometric and traffic control device considerations which may improve large truck safety in work zones, including discussions on lane and shoulder widths, and signage. In addition, it is readily apparent that many design configurations were derived from automobile geometrics and specifications.

The research also determined that a number of knowledge gaps still exist relating to the underlying causes or contributory factors associated with large truck crashes in work zones, such as exposure, driver behavior and work zone design.

Identifying Solutions

At this time, the ability of researchers to positively identify appropriate crash countermeasures is limited due to a lack of full understanding of: the extent of large truck overrepresentation in work zone crashes; a driver's underlying physiological and behavioral contributors to work zone crashes; and the extent to which work zone design features further influence crash likelihood and outcomes. Certainly, there are a number of work zone traffic management practices and technologies that are presently being used with the intent of reducing the frequency and severity of all types of crashes in work zones (including those involving large trucks), which are detailed in the full report.

However, it is clear that additional data and analyses are needed to better understand the extent and nature of large truck crashes in work zones as well as what can be done to reduce or eliminate such crashes. Additional research is needed to better quantify and characterize large truck exposure in work zones so as to better assess the extent and type of crash overrepresentation that may be occurring. In addition to improving data on large truck exposure, improvements are needed in identifying the characteristics of the crashes themselves. A number of geometric criteria that are used in work zone designs should be investigated for their appropriateness in accommodating large trucks. The influence of lane and pavement width should be evaluated, as should the design characteristics of median crossovers.

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