Project Background

The Enhanced Rear Signaling (ERS) for Heavy Trucks project investigated methods to reduce or mitigate crashes where a heavy truck has been struck from behind by another vehicle. In 2006 there were approximately 23,500 rear-end crashes involving heavy trucks, which resulted in 135 fatalities and 1,603 incapacitating injuries. This particular collision type results in higher-than-usual rates of fatalities and injuries compared to types of rear-end crashes in which the lead vehicle is a light vehicle. These crashes occur with such sufficient frequency that they are a cause of concern within regulatory agencies. As part of the Federal Motor Carrier Safety Administration’s (FMCSA) goal of reducing the overall number of truck crashes, this crash configuration is one that is important to the agency.

Prior to the current effort, two phases of work had been completed on this project by General Dynamics and Freese Enterprises. Phase I entailed a crash data analysis to determine causal factors of these crashes and the development or identification of countermeasures to aid in reducing them. Phase II entailed the development of a prototype system that incorporated the countermeasures from Phase I.

Project Objective

The purpose of the Phase III effort, conducted by the Virginia Tech Transportation Institute (VTTI), was threefold: (1) conduct a General Estimates System (GES) database analysis using the most recent data available to report various break-outs/characterizations of rear-end truck crashes, (2) explore the benefits of the countermeasures developed in Phases I and II, and (3) design a plan for a large-scale Field Operational Test (FOT) to assess countermeasures for rear-end truck crashes.

GES Database Analysis

Using the most recent data available (2006), VTTI conducted a GES database analysis following a similar strategy employed by General Dynamics in Phase I that used GES data from 2001 to report various break-outs/characterizations of rear-end truck crashes. The three most common rear-end crash configurations were Lead Vehicle Stopped (11,249 rear-end crashes), Lead Vehicle Traveling Slower (6,978 rear-end crashes), and Lead Vehicle Decelerating (5,282 rear-end crashes). In each of these configurations the lead vehicle (i.e., the vehicle being struck) was the heavy truck.

Static and Dynamic Testing of Countermeasures

A series of static and dynamic empirical data collection efforts were performed to test and evaluate potential countermeasures (which included testing on the Virginia Smart Road). Countermeasures tested included external auditory signals, rear warning-light signals, and passive conspicuity octagonal...
markings. In addition to the dynamic Smart Road testing, VTTI conducted another dynamic evaluation of the final ERS candidate and the associated activation algorithms. This dynamic evaluation was conducted on public roadways in order to observe and measure the reaction of the driving public.

Design a Large-scale FOT Plan

A requirement prior to regulation is the conduct of a large-scale data collection effort in a real-world, naturalistic environment. Based on the results of Phase III, a final ERS system was recommended for testing in an FOT. The ERS system included a rear warning-light signal positioned on the rear bumper of the heavy truck trailer combined with a radar-based activation system. Phase III involved the development of a detailed FOT plan to test this ERS system in a fleet environment. Phase III was a two-year project and was completed on September 17, 2010.

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