Helping Drivers Avoid Rear-End Crashes

Forward Collision Warning (FCW) systems are designed to notify drivers of a rear-end crash before it occurs, which will allow the driver time to either avoid the crash altogether or reduce its severity with a faster reaction time. This is accomplished by tracking the position of lead vehicles, typically using a vehicle onboard radar (VORAD©) system, and alerting drivers when the dynamics become indicative of a crash (e.g., approaching the lead vehicle too quickly).

Drivers of commercial motor vehicles, in particular, stand to benefit from such feedback given the lengthy stopping distances that arise as a consequence of the mass of their vehicles.

FCW Safety Benefit Evaluation

The National Highway Traffic Safety Administration (NHTSA) assigned the Virginia Tech Transportation Institute (VTTI) Contract DTNH22-05-D-01019, Task Order # 13, Safety Benefit Evaluation of a Forward Collision Warning System. The purpose of this task order was to use the rear-end (RE) conflicts observed in a previously collected commercial motor vehicle vehicle naturalistic driving database (assembled by VTTI) to evaluate the number of RE conflicts that would have been avoided had drivers received FCW feedback. This was accomplished by overlaying the FCW algorithms on the recorded RE conflict driving data.

Human Performance Modeling

The driver response behavior to the FCW alarms was then simulated using a Monte Carlo approach. Since various grades of FCW alarms are generated for a given conflict, an assumption was made that drivers braked to the FCW alarm that yielded the best conflict avoidance performance.

Estimating Safety Benefits

The number of conflicts avoided and the additional response time available prior to encountering a crash were both determined from the results of the Monte Carlo simulation. These results were then used to compute a prevention ratio (PR) and an exposure ratio (ER). The PR is a measure of drivers’ ability to avoid a crash once they have encountered an RE conflict, while the ER is a measure of drivers’ ability to avoid a conflict scenario altogether. The PR and ER were then combined to compute an overall crash reduction estimate. This simulation determined that a nationwide deployment of FCW systems in commercial motor vehicles could reduce the number of RE crashes by 21 percent.

Commercial motor vehicle with an onboard radar system detecting a lead vehicle.