National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

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In reply refer to: H-01-10 and -11

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In the past 2 years, the National Transportation Safety Board investigated nine rear-end collisions in which 20 people died and 181 were injured (three accidents involved buses and one accident involved 24 vehicles).[1] Common to all nine accidents was the rear following vehicle driver's degraded perception of traffic conditions ahead.[2] During its investigation of the rear-end collisions, the Safety Board examined the striking vehicles and did not find mechanical defects that would have contributed to the accidents. In each collision, the driver of the striking vehicle tested negative for alcohol or drugs. Some of these collisions occurred because atmospheric conditions, such as sun glare or fog and smoke, interfered with the driver's ability to detect slower moving or stopped traffic ahead. In other accidents, the driver did not notice that traffic had come to a halt due to congestion at work zones or to other accidents. Still others involved drivers who were distracted or fatigued. Regardless of the individual circumstances, the drivers in these accidents were unable to detect slowed or stopped traffic and to stop their vehicles in time to prevent a rear-end collision.

As the Safety Board reported in 1995[3] and further discussed at its public hearing, Advanced Safety Technologies for Commercial Vehicle Applications, held August 31 through September 2, 1999, existing technology in the form of Intelligent Transportation Systems (ITS) can prevent rear-end collisions. Such systems, capable of alerting drivers to slowed or stopped traffic ahead, have been available for several years but are not in widespread use. The technology to alert drivers to traffic ahead includes adaptive cruise control (ACC), collision warning system (CWS), and infrastructure-based congestion warning systems. In the nine accidents investigated

[1] The accidents occurred in Moriarty, New Mexico; Sweetwater, Tennessee; Trenton, Georgia; Sullivan, Indiana; Tinnie, New Mexico; Wellborn, Florida; West Haven, Connecticut; Elk Creek, Nebraska; and Eureka, Missouri.

[2] Driver inattention is a major causal factor in about 91 percent of rear-end crashes, as reported in: U.S. Department of Transportation, ITS Joint Program Office, *Program Area Descriptions: Motor Vehicle Crashes—Data Analysis and IVI Program Emphasis* (November 1999).

[3] National Transportation Safety Board, *Multiple Vehicle Collision With Fire During Fog Near Milepost 118 on Interstate 40, Menifee, Arkansas, January 9, 1995, and Special Investigation of Collision Warning Technology*, Highway Accident Report NTSB/HAR-95/03 (Washington, DC: NTSB, 1995).

by the Safety Board, one (and sometimes more) of these technologies would have helped alert the drivers to the vehicles ahead, so that they could slow their vehicles, and would have prevented or mitigated the circumstances of the collisions.

The work being done by private industry and the Government on vehicle- and infrastructure-based technology is encouraging, but the pace of testing and of standards development for all vehicles and of deployment for commercial vehicles is cause for concern, given the increasing number of rear-end collisions and the number of fatalities when commercial vehicles are involved. Therefore, the Safety Board has explored the issues involved in deploying technological solutions in its special investigation report *Vehicle- and Infrastructure-Based Technology for the Prevention of Rear-End Collisions*,[4] which focused on some of the challenges, including implementation, consumer acceptance, public perception, and training associated with the deployment of such systems.

Although requiring the use of the CWS is critical, consumer acceptance of the technology is equally critical. For example, educating the public of the benefits of seat belts has been as important as equipping the vehicles with or requiring the use of seat belts. The U.S. Department of Transportation (DOT) study on consumer acceptance of various automotive technologies reported that drivers, particularly older drivers, were enthusiastic about the ACC and the CWS, but were wary of how they operated and their reliability. While only 43 percent of the drivers surveyed would purchase an ACC system, 98 percent of drivers who actually drove with an ACC in the field operational test said they would purchase the system. Some drivers may be wary of new technology before using it; when air bags were first employed, people were initially apprehensive. To educate the public, the DOT and Allstate Insurance Company sponsored a demonstration of air bags using crash dummies.[5] The exhibit traveled to 100 cities over a 3-year period beginning in 1990. The purpose of the exhibit, according to Allstate's chairman and chief executive officer, was to "encourage consumers to purchase cars with air bags because we know they save lives and reduce injuries." A similar program could be developed to inform the public on the safety benefits of the CWS. The average driver, whether a passenger car or commercial vehicle driver, does not know what actually exists in the way of ITS and has never experienced what it is like to drive with some of these technologies.[6]

From August 31 through September 2, 1999, the Safety Board held the public hearing Advanced Safety Technologies for Commercial Vehicle Applications.[7] In discussing what the Government can do to promote the implementation of technology at the public hearing, a trucking company representative said that the Government could provide more information on the technologies, so that the data presented by the manufacturers is not suspect (consumers may think the manufacturer is just trying to sell something). He added that electronics in trucks is still

[4] For more information, read: National Transportation Safety Board, *Vehicle- and Infrastructure-Based Technology for the Prevention of Rear-End Collisions*, Special Investigation Report NTSB/SIR-01/01 (Washington, DC: NTSB, 2001).

[5] Insurance Institute of Highway Safety, *IIHS Status Report*, Volume 25, Number 10 (Arlington, VA: November 17, 1990).

[6] Michael A. Regan, Claes Tingvall, David Healy, and Laurie Williams, "Trial and Evaluation of Integrated In-Car ITS Technologies: Report on an Australian Research Program," *Seventh World Congress on Intelligent Transport Systems, November 5-9, 2000, Turin, Italy*.

[7] National Transportation Safety Board, Docket No. DCA-99-FH-002.

relatively new and that consumers are not yet completely comfortable with it. If the Government would publish solid data on the benefit of a certain technology, and the benefits of multiple technologies, the trucking industry may be more apt to adopt the electronics. Transmitting this information to the public is crucial to the acceptance of the ACC and the CWS technologies. The Safety Board has concluded that information concerning the use and benefits of effective CWSs and ACCs is critical to their acceptance by the driving public.

Infrastructure-based systems detect stopped or slowed traffic and relay relevant traffic information, such as the location or the speed of a traffic queue, to drivers upstream of the end of the queue. The systems can be stationary, for instance in locations that experience frequent traffic congestion, or portable, as in work zones.

An efficient means of alleviating the accident risk due to backups while expeditiously accomplishing the work may be to use ITS to detect the queue ends and to warn traffic of backups. The location at which an operating sign is activated changes as the queue grows. As part of a queue length detection system, active signs providing information on speeds and queue length upstream of the end of the queue may help alert drivers to congestion ahead, resulting in fewer or less severe accidents. The Safety Board has concluded that the number of accidents that continue to occur at construction work zones suggests that efforts to inform drivers of congestion at these work zone sites have not been adequate.

One of the difficulties with queue length detectors is that the end of the queue can vary by location or by time of day. Where to place the sensors so that upstream queues do not exceed the detection range but the message warning is not so far back that it loses relevance is difficult to determine. Many agencies rely on the expertise and experience of field personnel who know how far back traffic typically queues along a given section of roadway. Tools do exist to predict queue length. However, according to information provided by the Work Zone Safety Information Clearinghouse, because driver behavior can change dramatically in response to congestion (traffic diverting to other routes), to accurately predict queue lengths with any degree of certainty is difficult, prior to the formation of congestion. Therefore, multiple variable message signs can be spaced upstream of the traffic and activated when the queue approaches that location.

The Federal Highway Administration, in cooperation with the American Association of State Highway Transportation Officials, updates the *Manual on Uniform Traffic Control Devices* every 5 years. The most recent update, the Millennium Edition, was released January 17, 2001. This manual contains recommended practices for all roadway traffic control devices (in particular, signage and signals). Although not required to, many States adopt the *Manual on Uniform Traffic Control Devices* guidelines.

The National Transportation Safety Board recommends that the Federal Highway Administration:

> Develop and implement, in cooperation with the National Highway Traffic Safety Administration; the Intelligent Transportation Society of America; and the truck, motorcoach, and automobile manufacturers, a program to inform the public and commercial drivers on the benefits, use, and effectiveness of collision warning systems and adaptive cruise controls. (H-01-10)

Develop a procedure that States can use to conduct a risk analysis for work zone backups; require, where appropriate, the use of a queue length detection and warning system; and incorporate that procedure for a queue length detection and warning system for work zones in the *Manual on Uniform Traffic Control Devices* work zone guidelines. (H-01-11)

The Safety Board also issued safety recommendations to the U.S. Department of Transportation; the National Highway Traffic Safety Administration; automobile, motorcoach, and truck manufacturers; the Intelligent Transportation Society of America; the American Trucking Associations, Inc.; the Owner-Operator Independent Driver Association; and the National Private Truck Council.

Please refer to Safety Recommendations H-01-10 and -11 in your reply. If you need additional information, you may call (202) 314-6440.

Acting Chairman CARMODY and Members HAMMERSCHMIDT, GOGLIA, and BLACK concurred in these recommendations.

Original Signed

By: Carol J. Carmody
Acting Chairman