



Log H-560D

National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: June 20, 1991

In reply refer to: H-91-27 through -31

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Administrator
Federal Highway Administration
400 Seventh Street, N.W.
Washington, D.C. 20590

About 5:40 p.m. on July 26, 1990, a truck operated by Double B Sales, Inc., transporting eight automobiles entered a highway work zone near Sutton, West Virginia, on northbound Interstate Highway 79 and struck the rear of a utility trailer being towed by a Dodge Aspen. The Aspen then struck the rear of a Plymouth Colt, and the Double B truck and the two automobiles traveled into the closed right lane and collided with three West Virginia Department of Transportation (WVDOT) maintenance vehicles.

Fire ensued, and the eight occupants in the Aspen and the Colt died. The Aspen, Colt, Double B truck, and two of the three WVDOT vehicles were either destroyed or severely damaged. The Double B truckdriver and one firefighter sustained minor injuries.¹

Lapses in attention while driving are a phenomenon that most drivers experience. These lapses in attention have occurred, for example, when one cannot remember certain landmarks that were just seen along the route. Little is known either about the cognitive processes that occur during long duration tasks, such as driving, or about the decisionmaking requirements that are needed to make a response.

A number of theories on vigilance performance, including expectancy, signal detection, and arousal, have been proposed in research literature. All have limitations in explaining performance in tasks requiring sustained attention. While no single theory can comprehensively account for vigilance performance, research has shown that vigilance decrements are associated with losses in sensory/perceptual sensitivity, with failure to direct and maintain

¹For more detailed information, read Highway Accident Report--"Multiple Vehicle Collision and Fire in a Work Zone on Interstate Highway 79 near Sutton, West Virginia, July 26, 1990" (NTSB/HAR-91/01).

attention, and with shifts in the decisionmaking criteria that govern actions taken (or not taken) in response to this sensory information.²

Clear failures of an apparently unimpaired observer to detect, or at least to respond to, signals like those associated with work zone traffic advisories suggest a breakdown in one or more of the above-mentioned processes, but it is very difficult to determine the characteristics of work zone traffic advisories that will attract and hold attention, provide more readily understandable displays of critical information, and counteract predictable decrements in drivers' vigilance performance. Furthermore, such research should include a wider range of driver sensory and perceptual abilities, such as the fatigued and the elderly driver. The Safety Board believes that the Federal Highway Administration (FHWA) should conduct or sponsor such research.

Also, the Safety Board believes that the FHWA and the States should develop additional devices and procedures that appeal to the various senses in order to alert an approaching driver to the presence of a work zone. Installation of "rumble strips" at decreasing intervals may cause an otherwise inattentive driver to perceive that his speed approaching a work zone is too high. Progressively decreasing the spacing of barrels, drums, or barricades may also produce an awareness of excess speed.

The traffic control devices in the work zone at the accident site were in substantial compliance with the Manual on Uniform Traffic Control Devices (MUTCD) and West Virginia guidelines. The Safety Board believes that these guidelines, concerning signing and other work zone safety features, provide more than adequate advance warning for a vigilant driver, but may be inadequate for an inattentive or otherwise impaired driver. To address this problem, using the concept of the "design driver" in the establishment of work zone safety features has recently been advocated.³ This concept assumes that some drivers traveling through the work zone may be impaired due to a medical condition or the use of alcohol or other drugs; therefore, in targeting these drivers, the use of more aggressive signing and other devices is warranted. Based on its review of accidents involving heavy trucks that found inattention due to fatigue a significant causal factor, the Safety Board believes that the "design driver" concept should be expanded and that work zone project managers should target inattentive/fatigued drivers, as well as impaired drivers, when designing work zone safety features.

The flagger at the accident site was positioned 200 to 210 feet before the bump. The MUTCD states, "Flagger stations shall be located far enough in

²Dember, W.N., and Warn, J.S., Psychology of Perception, 2nd edition, Holt, Rinehart and Winston, 1979; and Wickens, C.D., Engineering Psychology and Human Performance, Charles E. Merrill Publishing Company, Columbus, Ohio, 1984.

³Lewis, Russell M., "Work Zone Safety; Using What We Know; Road User Characteristics in Highway Work Zones," Handout at the Transportation Research Board's Workshop on Human Factors in Transportation, January 1991.

advance of the work site, so that approaching traffic will have sufficient distance to reduce speed before entering the project. This distance is related to approach speed and physical conditions at the site; however, 200 to 300 feet is desirable." In addition, the WVDOT manual recommends that the flagger station should be in advance of the work site so that the "approaching traffic will have sufficient distance to reduce speed before entering the project . . . 500 feet is desirable." The placement of the flagger complied with MUTCD guidelines, but not with the WVDOT manual. The FHWA is currently revising the MUTCD pertaining to work zone flagger placement. The Safety Board believes that the MUTCD should provide for flagger placement based on actual vehicle approach speed, pavement conditions, commercial vehicle deceleration rates, and the "design driver" concept.

Both the MUTCD and WVDOT manuals also state that the flagger should be in a position to warn workers of approaching danger, such as out-of-control vehicles. However, the greater the distance of flagger placement ahead of the actual work area, the more difficult it becomes to warn workers in the zone of an erratic vehicle's approach. The Safety Board concludes that the MUTCD and WVDOT manuals should also be revised to encourage the use of audible devices, such as warning horns, by flaggers to warn highway workers of the approach of erratic vehicles. The sounding of such a device may also serve to alert an inattentive driver.

Therefore, the National Transportation Safety Board recommends that the Federal Highway Administration:

Conduct research to determine: a) what characteristics of work zone traffic advisories work best to counter driver inattention, and b) how to provide more readily understandable displays of critical information. Use the results of this research to design better and more meaningful work zone traffic advisories. (Class III, Longer-Term Action) (H-91-27)

Encourage the use of work zone safety devices and procedures, such as "rumble strips," that alert the various senses. (Class II, Priority Action) (H-91-28)

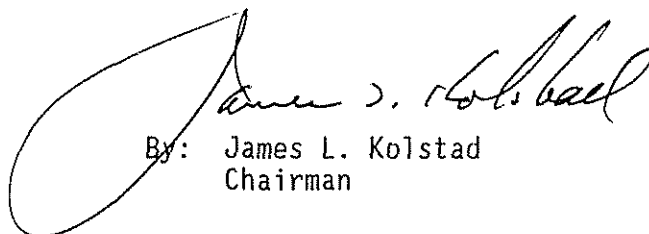
Encourage the use of the "design driver" concept, which assumes that some drivers are impaired or inattentive, in designing work zone safety features and signing. (Class II, Priority Action) (H-91-29)

Revise Section 6F-5 of the Manual on Uniform Traffic Control Devices to establish recommended distances for posting flaggers at work zones based on the legal speed limit approaching the zone. (Class II, Priority Action) (H-91-30)

Add a section to the Manual on Uniform Traffic Control Devices encouraging or requiring the use of audible warning devices, such as horns, by work zone flaggers to alert highway workers of the approach of an erratic vehicle. (Class II, Priority Action) (H-91-31)

Also, the Safety Board issued Safety Recommendations H-91-14 to the Double B Auto Sales, Inc.; H-91-15 through -21 to the West Virginia Department of Transportation; H-91-22 through -25 to the State of New York; and H-91-26 to the National Automobile Transporter's Association.

KOLSTAD, Chairman, COUGHLIN, Vice Chairman, LAUBER, BURNETT, and HART, Members, concurred in these recommendations.



By: James L. Kolstad
Chairman