

SP-20
H-454

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: November 15, 1985

Forwarded to:

Mr. James Golden
Chairman
Colorado State Highway Commission
4201 East Arkansas Avenue
Denver, Colorado 80222

SAFETY RECOMMENDATION(S)

H-85-41 through -43

About 4:48 a.m., m.d.t., on August 1, 1984, a tractor-semitrailer combination operated by Riss International Corporation (Riss) of Kansas City, Missouri, was traveling south on Interstate 25 (I-25) in Denver, Colorado. The flatbed semitrailer was loaded with six torpedoes, Class A explosives, which were being shipped from a U.S. Navy base in Keyport, Washington, to a Navy facility in Groton, Connecticut. The driver intended to turn east onto Interstate 70 (I-70) and was being guided by signs when she steered the vehicle to the right onto the ramp connecting I-25 to I-70. The driver then made a quick turn to the left and the trailer whipped. She applied the footbrake, saw that she had to make a left turn at the bottom of the ramp, and then released the brake and tried to steer through the curve. The tractor-semitrailer overturned onto its right side and into the center lane of I-70, slid 62 feet on its side, struck a 48-inch-high concrete safety-shape barrier, bounced off the barrier, and after sliding another 45 feet came to rest. The driver had not seen a left-turn sign and 25-mph advisory speed plate located on the right side of the exit ramp. It was cracked, glazed, and partially hidden from the approaching driver's view by tree foliage and a lamppost. ^{1/}

Interchanges are probably the most critical parts of a freeway system because of the large amount of information that must be absorbed and acted upon by the driver in a relatively short period of time. The driver's success in the decisionmaking process is highly dependent on the ability to judge what actions must be taken to safely negotiate the interchange. The Riss driver previously had not driven over the interchange ramp from I-25 southbound to I-70 eastbound, and she failed to recognize the characteristics of the ramp early enough to slow the vehicle sufficiently in order to safely negotiate the curve at the end of the ramp.

While the posted (legal) speed limit on I-25 was 55 mph, the beginning of the exit ramp had an advisory (recommended maximum) speed of 45 mph. The advisory speed for the accident ramp was further reduced to 25 mph, and it was posted with a left-turn warning sign on the right side of the ramp 300 feet in advance of the circular curve or

^{1/} For more detailed information read Hazardous Materials Accident Report--"Overturn of a Tractor-Semitrailer Transporting Torpedoes, Denver, Colorado, August 1, 1984" (NTSB/HZM-85/02).

150 feet in advance of the transitional spiral. The 1961, 1971, and 1978 editions of the Manual on Uniform Traffic Control Devices (MUTCD) suggest that a minimum distance for the placement of warning signs be about 250 feet in advance of the hazard or condition. Neither the MUTCD nor the Traffic Control Devices Handbook (TCDH) published by the Federal Highway Administration (FHWA) specifies if the beginning of the spiral or the beginning of the circular curve should be considered the hazard or condition. The 250 feet suggested by the MUTCD is a minimum distance; this becomes important when spirals are used since in some cases, this one for example, the locations of the sign would not be in conformance with MUTCD recommendations if the beginning of the spiral is considered the hazard. The Safety Board believes that the reference for measuring the distance to advance curve warning signs should be clarified; either the MUTCD or the TCDH could serve as the medium for the clarification. Following the accident on August 1, 1984, an additional left-turn warning sign and a 25-mph advisory speed plate were installed on the left side of the ramp about 400 feet in advance of the circular curve.

The Colorado Department of Highways (CDOH) failed to notice the poor condition of the turn sign and 25-mph advisory speed plate--they probably were more than 20 years old--and the obstructions blocking the motorist's view of the signs. The TCDH states that Type II (engineering grade) reflective sheeting "... can be expected to provide satisfactory performance under normal use for a period of 5 to 7 years." It was quite obvious that the signs had outlived their useful life and that their reflectivity had severely deteriorated. (Both the left-turn warning sign and the 25-mph advisory speed plate were replaced with new signs following the accident.) Various methods employed by other States to check reflectivity include the use of a reflectivity meter or the use of samples of reflective materials for comparison judgments. The CDOH should adopt a more systematic approach to the inspection and inventory of signs, especially those signs that are critical in warning motorists of hazards. The inventory should include the dates that signs were installed. In October 1984, the Center for Auto Safety petitioned the FHWA to consider formally, through the rulemaking process, the need for standards of retroreflective illumination and performance criteria for various traffic control devices, and the FHWA has issued a Notice of Proposed Rulemaking in the Federal Register (50 FR 16515, April 26, 1985) and requested that comments be submitted by February 15, 1986.

Reflective sheeting must meet minimum levels of performance on Federal highway projects that are under the direct administration of the FHWA, but after a project is accepted there is no Federal requirement that a specific level of retroreflectivity be maintained. There are no specific performance criteria established for State-administered Federal-aid projects. The interstate maintenance guidelines (23 U.S.C. 635.501 to 635.509) require that the interstate routes be "maintained at the level required by the purposes for which they were designed" and that "signs be legible and visible." The turn sign did not meet these requirements. Although one sign in poor condition does not mean that all of the State's signing is deficient or unsatisfactory, it appeared to Safety Board investigators that several other warning signs in the interchange area also were in poor condition and probably about 20 years old. Since this is about triple the 7-year life expectancy of a road sign, it is very likely that these signs do not function as designed.

The motorist traveling from I-25 southbound to I-70 eastbound who is not familiar with this interchange depends heavily upon signing for guidance. The guidance task is not simple because of the numerous decision points in a short distance. Every effort should be made to simplify and remove unnecessary signing because of the need to focus the driver's attention on the safe speeds and conditions ahead. The substitution of symbols for words

should be considered to simplify the communication of information to the motorist, i.e., the use of airport symbol signs which are used in many urban areas where there is only one major public airport.

The CDOH's Highway Safety Improvement Program which directs itself primarily toward the reduction or elimination of roadway design and operational deficiencies that actually cause or may in the future cause highway accidents, has achieved high benefit-cost ratios in many low-cost projects. The highest benefit-cost ratio achieved for signing improvements was with a 9.7 : 1 ratio, while guardrail and markings/delineation improvements achieved lower ratios, 8.1 : 1 and 3.9 : 1 respectively. This strategy led to improvements on the I-70 eastbound approach to the interchange where advisory speed plates and flashing beacons were installed overhead to warn motorists of the 25-mph curve from I-70 eastbound to I-25 northbound. Because of the preeminent role of the interstate system in transportation, there is a need for superior signing on the interstate system, and the FHWA should encourage Colorado and other States to place greater emphasis on maintaining traffic signs at the level required by the purpose for which the highways were designed.

Therefore, the National Transportation Safety Board recommends that the Colorado Department of Highways:

Institute a more effective program of inspection of traffic control signs in which the visibility and reflectorization of signs will be formally and systematically addressed and priority will be given to locations where there are known hazardous conditions. (Class II, Priority Action) (H-85-41)

Provide more effective signing in advance of and throughout the ramp from Interstate 25 southbound to Interstate 70 eastbound to alert the motorist to the route options, safe speeds, and conditions ahead giving consideration to elimination of unnecessary signs and installation of diagrammetric guide signing. (Class II, Priority Action) (H-85-42)

Evaluate the adequacy of existing hazard warning signs on interstate highway ramps using accepted traffic engineering methods. (Class II, Priority Action) (H-85-43)

The National Transportation Safety Board is an independent Federal agency with the statutory responsibility "... to promote transportation safety by conducting independent accident investigations and by formulating safety improvement recommendations" (Public Law 93-633). The Safety Board is vitally interested in any action taken as a result of its safety recommendations. Therefore, it would appreciate a response from you regarding action taken or contemplated with respect to the recommendations in this letter. Please refer to Safety Recommendations H-85-41 through -43 in your reply.

BURNETT, Chairman, GOLDMAN, Vice Chairman, and BURSLEY, Member, concurred in these recommendations.

By: 
Jim Burnett
Chairman

