Log H-325A

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: May 17, 1983

Forwarded to:

Honorable Ray A. Barnhart
Administrator
Federal Highway Administration
400 Seventh Street, S.W.
Washington, D.C. 20590

SAFETY RECOMMENDATION(S)

H-83-23 and -24

About 6:50 a.m., on September 21, 1981, a Gulf Oil Company tractor-cargo tank semitrailer, transporting 8,300 gallons of gasoline, slid and tipped over on dry pavement as the truckdriver attempted to negotiate a 220-foot-radius right curve on the southbound approach to the Fleming Park Bridge in Allegheny County, Pennsylvania, at an estimated speed of about 45 mph. The truck started to tip over in the right lane of the two-lane approach. It then slid across the left lane, onto and over a 7-inch-high curb, and then over a 13-inch-high concrete divider into the path of an oncoming bus. Upon impact, the gasoline cargo ignited, and flames engulfed the truck, the bus, and part of the bridge. Although the truckdriver, busdriver, and all nine bus passengers escaped from the burning wreckage, three persons were injured seriously. Both the bus and tractor-cargo tank semitrailer were destroyed, and the main supporting members, endposts, and other critical bridge elements were damaged severely. After the accident, the bridge was closed to all traffic; currently, only two lanes of traffic are allowed on the bridge.

Before the accident, about 13,700 vehicles used the bridge daily. Trucks constituted about 20 to 30 percent of the traffic count, many of which were tank trucks carrying hazardous materials. The speed limit on the curve was 55 mph, a speed which exceeded the critical speed of the curve and the tipover speed for the accident vehicle. The Safety Board calculated the safe speed for the right curve to be 27 mph. The Safety Board has recommended that Allegheny County conduct a study to define a safe speed and to post signing consistent with the guidelines promulgated in the Manual on Uniform Traffic Control Devices before the bridge is reopened to four-lane traffic.

The 13-inch-high concrete divider between opposing traffic was installed as part of the original 1952 bridge design and does not meet current guidelines of the American Association of State Highway and Transportation Officials (AASHTO). The 13-inch-high divider is in addition to and set back from a 7-inch-high curb. The divider cannot adequately redirect vehicles, especially heavy vehicles. Likewise, the approach and transition guardrail leading to the bridge endposts does not protect adequately either the motorist or the truss span of the bridge. As part of a major bridge reconstruction project beginning this year, both the median and roadside barriers are to be replaced with 32-inch-high "New Jersey" barriers in conformance with AASHTO guidelines. However, such a barrier, while far superior to the existing divider, probably would not have prevented the vehicle involved in the subject accident from crossing into the opposite lanes.

In 1980, the Safety Board investigated an accident involving a gasoline tank truck pulling a gasoline tank trailer on a heavily traveled California freeway. 1/ In the accident sequence, a pickup truck was squeezed between the tank truck and a 32-inch-high New Jersey barrier which separated opposing lanes of traffic on the eight-lane section of highway. The tank trailer swung into and rolled over the median barrier. In the pickup truck, five persons died of thermal injuries and two were burned severely. The number of deaths easily could have been greater had the tank trailer separated from the tank truck or had the entire vehicle rolled over the divider.

The dynamics involved in the California and Fleming Park Bridge accidents are quite different, and neither simulates the conditions in classic barrier testing where the front of the vehicle strikes the barrier at an angle. However, they illustrate that accidents involving barriers and heavy, high-center-of-gravity vehicles do occur and can be catastrophic. Therefore, these vehicles should be included in any research and development of high-performance barrier systems. The passage of the Surface Transportation Assistance Act of 1982, which allows longer, wider, and heavier combination vehicles, further emphasizes this need.

The Safety Board is aware that the Federal Highway Administration (FHWA) has been crash testing heavier vehicles into barriers, but the Board believes that more tests and development are needed. For example, FHWA-sponsored crash testing and evaluation of a tangent section of a heavily reinforced 32-inch-high New Jersey barrier have shown that the barrier satisfactorily redirected a 40,000-pound intercity bus at 54 mph and a 15° impact angle. 2/ However, in a test with a 40,000-pound tractor-semitrailer at 53 mph and a 15° impact angle, the truck climbed and straddled the barrier, indicating that these impact conditions probably impose an upper performance limit on the 32-inch-high New Jersey barrier. On July 15, 1982, the FHWA sponsored a test involving an 80,000-pound tractor-semitrailer and a 42-inch-high New Jersey barrier. The tractor was redirected from its 16° impact angle while the trailer overrode the barrier without breaking away. Additional FHWA-sponsored research has indicated that bridge railing 54 inches high can redirect an 80,000-pound tractor-semitrailer on a tangent section of roadway.

The heaviest vehicle tested on curved sections of the New Jersey barrier has been a 20,000-pound schoolbus. The bus was successfully redirected at 40 mph from a 15° impact angle. 3/ No tests were performed with heavier and/or higher center of gravity vehicles.

Newer "high performance" traffic barriers, such as the selfrestoring barrier (SERB), appear to have the potential to contain and redirect subcompact passenger vehicles and heavier vehicles with higher centers of gravity. Barrier effectiveness must relate to the safe containment and redirection of vehicles at both ends of the size and weight spectrums. Evaluation of such designs through additional crash tests of heavier vehicles with higher centers of gravity, such as 80,000-pound tractor-semitrailers and gasoline tank trucks, would allow highway designers to select the safest system for a particular situation and improve overall highway safety.

1/ Highway Accident Report--"Multiple-Vehicle Collision and Fire, U.S. Route 101, Los Angeles, California, March 3, 1980" (NTSB-HAR-80-5).
2/ "Concrete Median Barrier Research," Report No. FHWA/RD-77-4, Volume 2, Research Report, March 1976.
3/ "Bridge Rail Retrofit for Curved Structures," Report No. FHWA/RD (not assigned), Volume 2, Technical Report, December 1981.

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

> Expand the performance testing of the New Jersey barrier on curved roadway sections to include crash testing of heavier vehicles with higher centers of gravity such as 80,000-pound tractor-semitrailers and gasoline tank trucks. (Class II, Priority Action) (H-83-23)
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> Include the testing of heavier vehicles with higher centers of gravity in current high-performance barrier research and development. In particular, encourage the design and development of barriers that can safely contain or redirect small passenger vehicles and heavier vehicles with higher centers of gravity, such as 80,000-pound tractor-semitrailers and gasoline tank trucks. (Class II, Priority Action) (H-83-24)

BURNETT, Chairman, GOLDMAN, Vice Chairman, and McADAMS and ENGEN, Members, concurred in these recommendations. BURSLEY, Member, did not participate.

By: Jim Burnett
Chairman