

H-496B



# National Transportation Safety Board

Washington, D.C. 20594

## Safety Recommendation

Date: June 9, 1987

In reply refer to: H-87-18

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

About 2:43 p.m. central standard time on November 11, 1985, a schoolbus owned by R. W. Harmon and Sons, Inc. was eastbound on I-70 transporting 13 high school students to their homes in St. Louis, Missouri, from the Parkway North Senior High School. As the schoolbus was approaching the Lucas and Hunt Road exit, it went out of control, swerved to the right, and the right front of the schoolbus struck a guard rail, a concrete pedestal, and a sign support pillar located adjacent to the right eastbound roadway. The schoolbus body and the steering axle separated from the chassis during the collision. The weather was cloudy and the pavement was dry. The schoolbus did not catch fire. Two students were killed; the schoolbus driver and one student sustained serious injuries, and the remaining 10 students sustained minor to moderate injuries. <sup>1/</sup>

When the sign support pillar and its concrete pedestal were installed, there were no Missouri or Federal highway design standards in effect to provide for a "clear zone" adjacent to the highway which was free of obstacles and which provided space for the safe recovery of an errant vehicle, and Missouri standards in effect at the time required a 2-foot distance from the guard rail to the object it protected.

According to tests of the type of W-beam guard rail installed at the accident site, the guard rail deflected between about 2 to 4 feet when struck by passenger autos approaching the guard rail at speeds over 55 mph and angles of 25° or more. The collision of the schoolbus with the guard rail at a 12°-approach angle deflected the guard rail outboard at a maximum of about 4 feet, about 2 feet past the preaccident distance of the inboard face of the concrete pedestal from the guard rail. Further outboard deflection of the guard rail was prevented when the outboard face of the guard rail was deflected flush against the concrete pedestal.

Although new highway design standards in Missouri provide for a 4-foot deflection distance from a guard rail to a fixed object, the Safety Board believes that, even if the distance from the guard rail to the pedestal was 4 feet instead of 2 feet, the upper portion of the schoolbus body would probably still have struck the sign pillar due to the amount the guard rail actually deflected and the height of the schoolbus body over the top of the guard rail.

<sup>1/</sup> For more detailed information, read -- Highway Accident Report -- "Schoolbus Loss of Control and Collision with Guard Rail and Sign Pillar, U.S. Highway 70 Near Lucas and Hunt Road, St. Louis County, Missouri, November 11, 1985" (NTSB/HAR-87/2).

The Safety Board believes that although the highway design had no role in contributing to the cause of the accident, the location of the concrete pedestal and the sign support pillar in combination with the type and location of the guard rail installed to protect the pedestal and the pillar contributed to the severity of the accident.

Full-scale crash testing of barrier systems, including guard rails, using large vehicles has been limited. A test of a W-section guard rail similar to that installed at the accident site, as specified in the 1977 American Association of State Highway and Transportation Officials (AASHTO) Guide 2/ was conducted in June 1980 by the Texas Transportation Institute. The vehicle used was a ballasted schoolbus weighing 20,050 pounds. The W-section guard rail failed to contain the schoolbus satisfactorily. 3/

Additional tests with schoolbuses were performed in June 1980 using a Thrie-Beam guard rail and in January 1981 using a modified Thrie-Beam guard rail. In addition to redirecting the schoolbuses successfully, the modified Thrie-Beam guard rail successfully redirected a 32,000-pound intercity bus at an impact speed of 60 mph and an impact angle of 15°. According to a 1982 cost analysis, the Thrie-Beam guard rail costs about 25 percent more than the conventional guard rail. 4/

There are also other high-performance barriers available, such as the New Jersey-shaped concrete barrier and the Self-Restoring Traffic Barrier (SERB). Tests on the SERB by Southwest Research have found it to smoothly redirect small autos, schoolbuses, and intercity buses. 5/

The in-place guard rail at the accident site failed to prevent the schoolbus body from overriding the guard rail and colliding with the concrete pedestal and the sign pillar. The collision with the sign pillar caused the greatest amount of damage and deformation of the schoolbus body and subjected the schoolbus occupants to the most severe crash forces experienced during the collision sequence.

Assuming that any in-place barrier system had successfully redirected the schoolbus away from the pedestal and sign pillar, and that this redirection would not have resulted in an equally severe secondary collision with another vehicle and/or a fixed object, the Safety Board concludes that the results of the collision would have been considerably less severe.

Even though the minimum standard for guard rail distance to protected objects had changed from 2 feet to 4 feet, after the accident the guard rail was replaced in its preaccident configuration with no apparent evaluation of its performance or consideration given to upgrading the guard rail. The Safety Board has a long-standing concern about this issue, which resulted in a safety improvement recommendation involving the repair of crash-damaged highway fixtures.

2/ For more detailed information, read -- "Guide for Selecting, Locating, and Designing Traffic Barriers," The American Association of State Highway and Transportation Officials (AASHTO), 444 North Capitol Street N.W., Washington, D.C. 20001, 1977.

3/ Texas Transportation Institute, "Test and Evaluation of W-Beam and Thrie-Beam Guardrails," draft final report, March 1981.

4/ Ivery, Donald L., and McDevitt, Charles F., "Thrie-Beam Guardrails for School and Intercity Buses," Transportation Research Board Paper, January 1982.

5/ Southwest Research Institute, "SERB - A New High-Performance Self-Restoring Traffic Barrier," January 1981.

At 1:35 p.m. on August 6, 1976, near Neola, Iowa, a Tri-Center Community Schools schoolbus left the roadway, struck and overrode a guard rail and concrete bridge parapet, fell about 15 feet onto a sloped embankment below the bridge, and landed on its roof. Three children were killed, and the driver and 29 children were injured. 6/ On the day after the accident, the State of Iowa replaced the damaged guard rail with one that had the same design deficiencies as the old one.

Highway Safety Program Standard (HSPS) Number 12, administered by the Federal Highway Administration of the U.S. Department of Transportation, requires that ". . . State and local jurisdictions establish programs to correct safety deficiencies on all urban and rural roads with new construction, reconstruction, and improved maintenance" and that "Procedures should be established, if they are not presently used, for a plan of operation to repair and correct crash-damaged highway features that may create a hazard to the traveling public."

As a result of its investigation of the Neola, Iowa, accident, the Safety Board was concerned that the maintenance procedures that the Iowa Department of Transportation used at this accident location may reflect some ineffectiveness in the national effort to establish roadway maintenance programs that are in compliance with HSPS 12. The Safety Board issued Safety Recommendation H-77-1 to the Federal Highway Administration:

Examine and report to the Board on the effectiveness of Federal Highway Administration efforts to establish roadway maintenance programs that comply with Highway Safety Program Standard Number 12. This report should, as a minimum, review: (1) the adequacy of information about postcrash corrective maintenance procedures and devices in the FHWA maintenance policy; (2) the availability and implementation of training programs in, and up-to-date standards for, post crash corrective maintenance; and (3) a sample of accidents to assess post-crash maintenance practices within each FHWA region.

In response to this recommendation the FHWA: (1) issued FHWA Notice N 7560.4, Federal-Aid Participation in Highway Appurtenances (crash-damaged), which was superseded by FHWA Notice N 7560.6 in 1979; (2) submitted a summary report to the Safety Board on State Maintenance Practices in Replacement of Damaged Highway Hardware; and (3) distributed the 1977 edition of the FHWA Maintenance and Highway Safety Handbook to FHWA Regional and Division (State Headquarters) offices.

FHWA Notice N 7560.6 provides information on the use of Federal aid funds for safety projects to upgrade highway appurtenances that must be replaced due to vehicle accidents, and advised the FHWA Regional and Division offices to encourage the States to adopt a policy of upgrading accident-damaged appurtenances. The Notice did not provide for redistribution of the notice to the appropriate State highway offices.

The summary report furnished to the Safety Board by the FHWA in response to Safety Recommendation H-77-1 stated that the major reasons States generally replace crash-damaged highway appurtenances in kind are: (1) the cost of materials which meet present rather than previously-existing design standards is usually higher; (2) existing inventories of materials meeting previously-existing standards cannot be used; (3) some State liability laws may hold various highway departments accountable for damage as a result of subsequent accidents if an appurtenance is not replaced to the standard existing

6/ NTSB Docket No. HY-56-76.

at the time of the original construction; and (4) maintenance personnel are not always aware of the latest standards and installation methods. The summary report concluded, "Hopefully, continued emphasis by FHWA will result in more statewide upgrading projects and changes in some State policies." Based upon these actions by the FHWA, Safety Recommendation H-77-1 was classified as "Closed—Acceptable Action" on October 29, 1979.

As a result of its investigation of the St. Louis accident, the Safety Board believes that there is more to be done to meet the intent of HSPS 12. The FHWA should reissue FHWA Notice N 7560.6, "Federal Aid Participation in Highway Appurtenances," and instruct FHWA Regional and Division offices to: (1) provide copies of the Notice to the States; (2) actively encourage the States to develop procedures to systematically evaluate the performance of crash-damaged highway safety appurtenances; and (3) encourage the States to upgrade crash-damaged appurtenances if necessary to meet current design standards.

Therefore, as a result of its investigation, the National Transportation Safety Board recommends that the Federal Highway Administration:

Reissue Federal Highway Administration Notice N 7560.6, "Federal Aid Participation in Highway Appurtenances," and instruct Federal Highway Administration Division Offices to provide copies of the notice to the States. Actively encourage the States to systematically evaluate the performance of crash-damaged highway safety appurtenances and upgrade crash-damaged appurtenances if necessary to meet current design standards. (Class II, Priority Action) (H-87-18)

Also as a result of its investigation, the Safety Board issued Safety Recommendations H-87-19 to the Governor of the State of Missouri, and H-87-20 to the Governors of Alabama, Arizona, Connecticut, Georgia, Idaho, Indiana, Iowa, Kentucky, Louisiana, Maine, Massachusetts, Michigan, Mississippi, Missouri, Montana, Nebraska, Nevada, North Dakota, South Carolina, Vermont, Wyoming, and the Mayor of the District of Columbia. In addition, the Safety Board issued Safety Recommendation H-87-21 to the Governors of Alabama, Arizona, Arkansas, Colorado, Connecticut, Delaware, Florida, Georgia, Idaho, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Massachusetts, Michigan, Mississippi, Missouri, Montana, Nebraska, Nevada, North Dakota, Ohio, South Carolina, South Dakota, Texas, Vermont, Virginia, Washington, Wyoming, and the Mayor of the District of Columbia.

BURNETT, Chairman, GOLDMAN, Vice Chairman, and LAUBER and NALL, Members, concurred in this recommendation.

By:   
Chairman