



# National Transportation Safety Board

Washington, D.C. 20594

## Safety Recommendation

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Date: July 24, 1990

In reply refer to: H-90-73

Honorable Ned McWherter  
Governor of Tennessee  
Nashville, Tennessee 37219

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About 8:15 p.m. central standard time, April 1, 1989, an 85.5-foot section of the 4,201-foot-long northbound U.S. Route 51 bridge over the Hatchie River fell about 20 feet into the 24-foot-deep rain-swollen river after two pile-supported column bents supporting three bridge spans collapsed. Witness reports and physical evidence indicate that the southern column bent (70) and the two spans that it supported fell quickly, causing four passenger cars and one tractor-semitrailer to plunge into the river. The adjacent column bent (71) and the span that it was supporting then collapsed on top of the vehicles. The river had apparently been at flood stage since November 1988. All eight vehicle occupants died as a result of the collapse.<sup>1</sup>

Based on the physical evidence, witness statements, bridge inspection reports, and research data, the Safety Board found that the following sequence of events occurred, resulting in the collapse of the northbound U.S. 51 Bridge spans. Following the construction of the northbound bridge, the Hatchie River conformed to a pattern of natural channel migration, moving northward at a average rate of 0.8 feet per year until 1974. In 1974, the Tennessee Department of Transportation (TDOT) constructed a 999-foot-long southbound bridge 58 feet west of and parallel to the northbound bridge. The constriction of the Hatchie River flood plain caused by the construction of the southbound bridge embankments reduced the available area (4,201 feet to 1,000 feet) through which flood waters passed downstream at the bridge site. In response to this flood plain constriction, the Hatchie River underwent a series of changes in an attempt to reach a hydrologic balance with the reduced flood plain opening. One of those changes was an increase in the northward migration of the main channel. By 1979, the north bank of the main channel was about 20 feet north of pier 7 (when the bridge was constructed, the north bank was south of pier 7). The main channel continued to move northward at an accelerated rate until 1981. At that time, the channel began

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<sup>1</sup>For more detailed information, read Highway Accident Report--"Collapse of Hatchie River Bridge, Covington, Tennessee on April 1, 1990." (NTSB/HAR-90/01).

to reach a balance with the flood plain constriction; and between 1981 and 1989, the rate of channel migration slowed. By 1985, the north bank of the main channel had moved north of column bent 70, and the streambed at the column bent was about 4 feet beneath the bottom of the footing. By 1989, the streambed was 5.9 feet or more below the bottom of the footing. Additionally, the duration and severity of the 1988/89 flood season probably caused from 3 to 4 feet of local scour at column bent 70.

As a result of the combined effects of channel migration and local scour, the friction piles supporting column bent 70 became exposed to water as much as 10 feet deep, and these piles were no longer capable of supporting the bridge loads. Therefore, about 7:15 p.m. on April 1, 1989, as vehicles passed over spans 77 and 78, the piles supporting column bent 70 began to embed, and the column bent began to lean northward. As a result, the 78-ton spans began to shift, placing additional vertical and lateral forces on column bent 70 as they slid away from pier 7 and column bent 71. About 8:00 p.m., as additional vehicles passed over the spans, the piles continued to embed or buckle, creating the 2- to 3-foot depression in the bridge deck described by witnesses. Shortly afterward, the column bent fell northward, and spans 77 and 78 fell into the river.

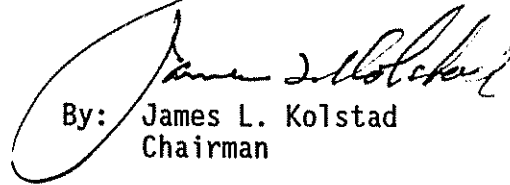
As a result of a 1985 TDOT inspection of the northbound U.S. 51 Bridge, maintenance recommendations to protect column bent 70 from scour were issued by the TDOT regional inspection office to the region 4 Engineering Director. During the Safety Board's public hearing, the region 4 Director testified that because of budget and manpower constraints, less than 50 percent of the annual computer-transmitted maintenance recommendations were accomplished. Therefore, the Safety Board concludes that because TDOT did not have sufficient resources to accomplish the majority of the maintenance recommendations, it missed the opportunity to correct the channel migration beneath column bent 70, or protect column bent 70 from scour, through routine preventive maintenance. Accordingly, the Safety Board believes that the State of Tennessee should provide TDOT with maintenance resources necessary to accomplish maintenance recommendations developed as a result of bridge inspections.

Therefore, the National Transportation Safety Board recommends that the State of Tennessee:

Provide maintenance resources necessary to complete recommended repairs developed as a result of bridge inspections. (Class II, Priority Action) (H-90-73)

Also, as a result of its investigation, the Safety Board issued Safety Recommendations H-90-50 through -06 to the Federal Highway Administration, H-90-61 through -63 to the American Association of State Highway and Transportation Officials, and H-90-64 through -72 to the Tennessee Department of Transportation. The Safety Board also reiterated Safety Recommendation H-89-72 to the American Association of State Highway and Transportation Officials.

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

  
By: James L. Kolstad  
Chairman