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NATIONAL TRANSPORTATION SAFETY BOARD

Washington, D.C. 20594

Safety Recommendation

Date: September 30, 1994

In Reply Refer To: I-94-7 and M-94-30

LTG Arthur E. Williams
U.S. Army Corps of Engineers
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Washington, D.C. 20314

On September 22, 1993, about 2:45 a.m., barges that were being pushed by the towboat MAUVILLA in dense fog struck and displaced the Big Bayou Canot railroad bridge near Mobile, Alabama.[1] About 2:53 a.m., National Railroad Passenger Corporation (Amtrak) train 2, the Sunset Limited, en route from Los Angeles, California, to Miami, Florida, with 220 persons on board, struck the displaced bridge and derailed. The three locomotive units, the baggage and dormitory cars, and two of the six passenger cars fell into the water. The fuel tanks on the locomotive units ruptured, and the locomotive units and the baggage and dormitory cars caught fire. Forty-two passengers and 5 crewmembers were killed; 103 passengers were injured. The towboat's four crewmembers were not injured.

While bridge strikes are fairly common, comprehensive tracking of their occurrence and systematic evaluation of bridge vulnerability to vessel collision are lacking. Ensuring that appropriate protective measures are provided for bridges such as the one over the Big Bayou Canot is an issue that requires a coordinated national effort. This accident emphasizes the need for such an undertaking to avoid similar mishaps. Subsequent actions taken to protect the Big Bayou Canot railroad bridge, however laudable, may not be sufficient to prevent a similar incident, and the degree to which thousands of other bridges are at risk is unknown.

Determining which protective method or combination of methods is appropriate depends on the vulnerability of each structure and thus should be preceded by a comprehensive risk analysis, which will make possible a rank ordering of bridges in need of protection. The

[1]For more information, read Railroad-Marine Accident Report–*Derailment of Amtrak Train No. 2 on the CSXT Big Bayou Canot Bridge Near Mobile, Alabama, September 22, 1993* (NTSB/RAR-94/01).

accident in Mobile occurred only a few months after another serious vessel collision and bridge collapse that the Safety Board investigated.[2] These incidents underscore the urgent need to develop a comprehensive risk assessment methodology for bridges and to ensure that it is uniformly applied to all bridges in the United States.

The term "risk," according to a previous Safety Board study, refers to the probability of an event occurring and the consequences of the occurrence.[3] Risk assessment is the process by which risks are identified, quantified, qualified, analyzed, and presented; it combines these variables into a single measure of risk, thereby allowing a comparison and ranking of the factors being analyzed. Risk management uses the results of this analysis to reduce risk to an "acceptable level" and can be applied to any bridge in the Nation, including the one that spans the Big Bayou Canot. The operational factors for each bridge in the United States are unique and should determine the type of protection provided for each structure.

Protection from vessel collision can be provided in several ways. New bridges can be built with large vertical and horizontal clearances. In the case of existing bridges that cannot be moved or replaced, other measures are available to minimize risk. They include changes to the channel or aids to navigation such as signs, buoys, retroreflective material on the structure, bridge lighting, radar reflectors, radar beacons (RACONS),[4] and fog signals.[5] Islands, caissons, dolphins, and fenders are also means of affording protection. Manually activated traffic control devices, alignment or movement detection systems, and clear bridge identification to facilitate the notification process are all measures that can reduce loss of life or property in the event of an accident.

Bridges for which the chance of a catastrophic accident is highest should receive the greatest protection. A railroad bridge that carries numerous passenger trains, hazardous material loads, or both across a waterway merits more attention than a bridge over the same waterway that does not. Similarly, a bridge that spans a waterway with traffic of 200 barges a day is at greater risk than one that spans a waterway carrying 5 barges a day. The location of a bridge is another consideration.

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[2]Highway-Marine Accident Report--*Collision of the U.S. Towboat CHRIS and Tow with the Judge William Seeber Bridge, New Orleans, Louisiana, May 28, 1993* (NTSB/HAR-94/03).

[3]Special Study--*Protection of Transportation Facilities Against Earthquakes* (NTSB/STS-72/01).

[4]When triggered by a vessel's radar signal, RACONS transmit a coded reply display on the vessel's radarscope and provide the approximate range and bearing to the beacon.

[5]As provided at 33 CFR 118, Coast Guard District Commanders can require such items for bridges. Often they are not required, especially on bridges in the advance approval category, until the maritime industry, having experienced problems with a structure, requests a change in existing protective measures from the Coast Guard. Until an accident occurs, whatever protective measures are in place are considered adequate.

Several factors, including the volume of railroad traffic, numbers of passenger and hazardous material trains, proximity to commercial navigation channels, and volume of marine traffic, should be considered when assessing the vulnerability of railroad bridges to collisions from marine vessels. Only when the vulnerability of a bridge has been adequately assessed can an informed decision be made on the appropriate type of protection. The assessment method should allow vulnerability to vessel collision among bridges to be compared so that priorities for protective measures can be assigned.

Highway bridges are also at risk from vessel collisions, as the collapse of the Judge William Seeber Bridge in New Orleans, Louisiana, on May 28, 1993, demonstrated (see footnote 2). The Safety Board discussed the factors that must be considered in conducting a risk assessment of highway bridges in its report on that accident. Among those factors are daily vehicle traffic over the bridge and the structure's importance to the local economy.

No single entity is responsible for the safety of the Nation's bridges. Federal, State, and local governments, as well as private industry, share that responsibility, and such fragmentation of authority often leads to a piecemeal, uneven approach to bridge safety. What's more, bridge safety involves several transportation modes, including marine, railroad, and highway; and several Federal agencies, including the Coast Guard, the Federal Railroad Administration, the Federal Highway Administration, and the U.S. Army Corps of Engineers (USACE), have a role in oversight of these modes. The Safety Board concludes that development of a national risk assessment program for determining bridge vulnerability to vessel collision is needed and believes that the Department of Transportation (DOT) modal agencies should develop one. The Safety Board further concludes that the transportation regulatory agencies need a standard methodology for determining the vulnerability of the Nation's highway and railroad bridges to collisions from marine vessels, for formulating a ranking system to identify those bridges at greatest risk, and for providing guidance on the effectiveness and appropriateness of protective measures.

The Safety Board believes that the DOT should convene an intermodal task force for this purpose. At a minimum, the methodology should address the highway bridge factors discussed in the Safety Board's report on the collapse of the Judge Seeber Bridge and the railroad bridge factors discussed in this report (see footnotes 1 and 2). It should include a ranking system that will identify bridges at greatest risk so that protective measures can be prioritized. In addition, it should provide guidance on the effectiveness and appropriateness of protective measures such as warning signs, lighting, navigation markers, alignment detectors, pier protection, dolphins, caissons, and radar beacons.

Recent advances in computer technology have made possible the development of digitized electronic charts that can be presented on a video screen. The National Oceanic and Atmospheric Administration (NOAA) is digitally scanning all of its charts, which number about 1,000, and expects to complete the project by the end of 1995. Beginning in fall 1994, NOAA, in cooperation with a commercial enterprise, will issue about 400 charts on floppy disks, which are expected to cost about the same as the paper charts. The USACE does not plan to digitize

its river charts for distribution to users, but it has digitally scanned its St. Louis-to-New Orleans charts for internal use in survey and river maintenance operations. USACE charts for the Tombigbee River from Demopolis, Alabama, to the Tennessee River are also being digitized for internal use and should be completed next year.

The NAVSTAR Global Positioning System (GPS) provides a highly accurate[6] navigational aid that is available worldwide, and international organizations are cooperating to develop standards for GPS equipment and electronic charts. Navigating in rivers and restricted waters requires a more accurate system, and the differential GPS (DGPS) is being developed to meet this need.[7] DGPS land stations, which have broadcast ranges of up to 240 miles, broadcast corrections for use by GPS receivers. The station network for the U.S. east and south coasts is being tested and evaluated, and the entire network is scheduled to be operational by January 1996. The USACE, in cooperation with the Coast Guard, has built DGPS stations in St. Louis, Missouri; Memphis, Tennessee; and Vicksburg, Mississippi. The DGPS station network for the Mississippi River, which is also being tested and evaluated, is expected to be operational by June 1997. The Coast Guard plans to build 11 more DGPS stations in the Western Rivers area.

Digital chart technology, coupled with GPS navigation technology, has made possible continuous electronic representation of navigational positions on computer. Mariners have long plotted their positions based on where they were rather than where they are. Electronic charting will give them continuous, real-time data, allowing them to monitor their positions by looking at the screen. The Safety Board welcomes these advances in technology, which should significantly improve navigation safety. If an electronic charting system and the DGPS had been available and installed on inland towing vessels such as the MAUVILLA, the accident at the Big Bayou Canot railroad bridge could have been avoided. The Safety Board believes that the Coast Guard and the USACE should promote the development and application of low-cost electronic charting navigation devices for inland rivers.

Therefore, the National Transportation Safety Board recommends that the U. S. Army Corps of Engineers:

> Cooperate with the U.S. Department of Transportation in developing a standard methodology for determining the vulnerability of the Nation's highway and railroad bridges to collisions from marine vessels, formulating a ranking system to identify bridges at greatest risk, and providing guidance on the effectiveness and appropriateness of protective measures. (Class II, Priority Action) (I-94-7))

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[6]It can give positions accurate to 100 meters.

[7]Accuracy is in the 8- to 10-meter range, and greater accuracies are possible. Newer GPS receivers are of higher quality and yield greater accuracy, which is also a function of the vessel's closeness to the DGPS station.

Promote, in cooperation with the U.S. Coast Guard, the development and application of low-cost electronic charting navigation devices for inland rivers. (Class II, Priority Action) (M-94-30))

Also, the Safety Board issued Safety Recommendations I-94-3 through -6 to the U.S. Department of Transportation; M-94-31 through -38 to the U.S. Coast Guard; R-94-6 through -8 to the National Railroad Passenger Corporation (Amtrak); I-94-8 to the Federal Emergency Management Agency; M-94-39 through -41 to The American Waterways Operators, Inc.; M-94-42 through -45 to the Warrior & Gulf Navigation Company; R-94-9 and -10 to the Association of American Railroads; and R-94-11 and -12 to the American Short Line Railroad Association.

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 I-94-7 and M-94-30 in your reply. If you need additional information, you may call (202) 382-6860.

Acting Chairman Hall and Members LAUBER, HAMMERSCHMIDT, and VOGT concurred in these recommendations.

By: Jim Hall
Acting Chairman