

Log H-410

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: July 19, 1984

Forwarded to:

Honorable Elizabeth H. Dole
Secretary
Department of Transportation
Washington, D.C. 20590

SAFETY RECOMMENDATION(S)

H-84-56

At 1:30 a.m., e.d.t., on June 28, 1983, a 100-foot-long suspended span between piers 20 and 21 of the eastbound traffic lanes of the Interstate Route 95 highway bridge over the Mianus River in Greenwich, Connecticut, collapsed and fell 70 feet into the river below. Two tractor-semitrailers and two automobiles plunged into the void in the bridge and were destroyed by impact from the fall. Three vehicle occupants died, and the other three received serious injuries. ^{1/}

The suspended span which collapsed was attached to the bridge structure at each of its four corners. To support the weight of the northeast and southeast corners of the suspended span, each corner was attached to the girders of the cantilever arm of an adjacent anchor span by a pin and hanger assembly. The pin and hanger assembly includes an upper pin attached through the 2 1/2-inch-thick web of the girder of the cantilever arm and a lower pin attached through the 2 1/2-inch-thick web of the girder of the suspended span. One and one half-inch-thick steel hangers connect the upper and lower pins—one on the inner side and one on the outer side of the web.

Sometime before the collapse of the suspended span, the inner hanger in the southeast corner of the span came off of the inner end of the lower pin. This action shifted the entire weight of the southeast corner of the span onto the outer hanger. Over a period of time, the added weight initiated a fatigue crack in the top outer end of the upper pin. The outer hanger gradually worked its way farther outward on the pin, and when it reached the fatigue crack, the shoulder of the pin fractured off and the assembly failed. The span briefly balanced on its connections at the other three corners and then collapsed, southeast corner first, into the river 70 feet below.

The National Transportation Safety Board determined that the probable cause of the collapse of the Mianus River Bridge span was the undetected lateral displacement of the hangers of the pin and hanger suspension assembly in the southeast corner of the span by corrosion-induced forces due to deficiencies in the State of Connecticut's bridge safety inspection and bridge maintenance program.

^{1/} For more detailed information read Highway Accident Report—"Collapse of a Section of Interstate Route 95 Highway Bridge Over the Mianus River, Greenwich, Connecticut, June 28, 1983" (NTSB/HAR-84/03).

The legislative history of the National Bridge Inspection Standards makes it clear that the law intended that inspections be thorough, not cursory. It is clear that, in some respects at least, the inspection of the Mianus River Bridge was cursory and that the mandate of the National Bridge Inspection Standards was not fulfilled in this case. Two persons cannot thoroughly inspect a six-lane, 2,656-foot-long bridge with 24 spans, 60 columns, and 464 bearings in 12 hours, the approximate time the inspectors spent on this interstate bridge every 2 years.

The National Bridge Inspection Standards call for all bridges to be inspected at a minimum of every 2 years. This cycle was followed on the Mianus River Bridge. The Connecticut Department of Transportation (ConnDOT) inspects its "problem" or weight-restricted bridges more frequently. The National Bridge Inspection Standards guidelines suggest the need for more frequent and thorough inspections of certain bridges depending on such factors as age, traffic characteristics, maintenance conditions, and known deficiencies. If ConnDOT had given these factors serious consideration, the Safety Board believes that the Mianus River Bridge would have been inspected more thoroughly. For example, the Mianus River Bridge had had bearing problems for some 20 years. The bridge traffic had increased far beyond expectations, heavy truck traffic was a high percentage of the total traffic, and the quality of State maintenance had decreased. The Safety Board believes that these factors should have alerted ConnDOT to direct more attention to the bridge, its total condition, and the status of its critical elements--the pin and hanger assemblies.

There is nothing inherently wrong with the in-depth bridge inspections being conducted by State inspectors. However, action must be taken to verify that these inspections are adequate to ensure safe bridges. The "paper reviews" of the Federal Highway Administration (FHWA) whether by FHWA divisions, regions, or headquarters, are not sufficient to ensure this. These limited "paper reviews" are not much more than making sure that the State checks off the proper boxes on the structures inventory and appraisal form. The FHWA field reviews are also inadequate--observing a State crew inspect a bridge which is apparently preselected so that the State crew inspectors are aware in advance that they will be observed. Beyond this, a sample of 1 or 2 bridges out of more than 3,000 in the State is far too small to be of much significance.

Proper audit of the State's procedures should include, among other things, a careful review and evaluation of a substantial number of bridge inspection reports, especially those concerning the more complex bridges, and covering each inspection team; a review of hours spent on inspection at specific bridges; surprise visits to bridges during regular inspections; review of the use of equipment employed in inspection (such as a snooper, scaffolding, ultrasonic, radiographic, etc.); and a review of management policies and procedures and of the inspectors' training programs.

Although Federal requirements call for bridge inspections at a minimum of every 2 years, they do not specify the depth of the inspections. Periodic in-depth inspections, probably at least every 10 years, should be required both to extend the useful life of the bridge and to ensure the safety of bridge users. Such inspections were in fact recommended by the FHWA in a memorandum to the States in 1968. ^{2/} Inspections also should be more frequent or in greater depth when the bridge is subject to such adverse conditions as heavy truck traffic and use of deicing salts.

^{2/} U.S. Department of Transportation, Federal Highway Administration, Bureau of Public Roads, Instructional Memorandum 40-1-68, 32-40, Subject: Bridge Safety Inspections, March 12, 1968.

Periodic in-depth inspections are made of other structures. For example, aircraft major overhauls are done periodically (in addition to routine maintenance), depending on such variables as numbers of landings and takeoffs. Ships are inspected annually while afloat, and in more depth while on drydock about every 2 years, depending on the time the ship spends in salt water.

The General Accounting Office (GAO) issued a report in 1975 concerning the FHWA's program for identifying, improving, and replacing unsafe bridges on the Federal-aid highway system. ^{3/} The report emphasized the need for more attention at both the Federal and State levels. It concluded that the FHWA did not actually require the 3-week inspection training course based on its "Bridge Inspector's Training Manual," and that relatively little use had been made of the course. In Connecticut, for example, the course has been condensed to a 4- or 5-day session and is given on a 3-year cycle. FHWA's review of ConnDOT's compliance with the National Bridge Inspection Standards did not review the adequacy of their training course--in fact, it did not even mention that one existed.

The GAO report recognized that identification of structural defects, corrosion, and fatigue was becoming more important because many bridges were old and the heavy truck traffic was increasing. It identified a need to develop inspection equipment for use by bridge inspectors to detect structural defects not visible to the eye so as to protect the public against bridge failures. Research has been done in this area, but the resulting technology has not yet filtered down to the inspection level. The inspectors of the Mianus River Bridge, for example, did not have and never used equipment to perform nondestructive tests. The FHWA's review of ConnDOT's compliance with the National Bridge Inspection Standards did not address the need for such equipment by the inspection teams.

In August 1981, the GAO issued another report on bridges, which said there was a need for better compliance by the States with the National Bridge Inspection Standards. ^{4/} The report indicated that some States have fallen short of the intent of the standards and expressed the view that it is not enough for the States to meet the minimum requirements of the standards. Furthermore, it contended that the annual review by the FHWA does little to determine that State compliance with the standards produces the ultimate goal of ensuring against the collapse of bridges. Connecticut technically followed the standards, but its bridge inspection program was still inadequate to prevent the collapse of the Mianus River Bridge span.

The DOT's Inspector General should review the FHWA's audit program to identify and correct shortcomings and to strengthen the program's evaluations of State compliance with the National Bridge Inspection Standards to meet the intent of the Congress of promoting the safety of the American public driving and riding across the Nation's bridges.

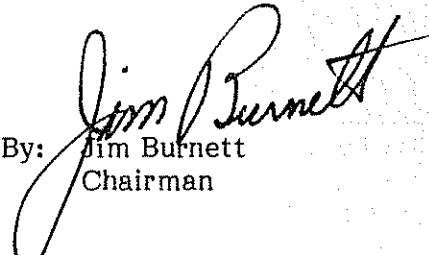
Therefore, the National Transportation Safety Board recommends that the U.S. Department of Transportation:

^{3/} "Unsafe Bridges on Federal-Aid Highways Need More Attention," Comptroller General of the United States, General Accounting Office, Report to Congress, July 2, 1975 (RED-75-385).

^{4/} "Better Targeting of Federal Funds Needed to Eliminate Unsafe Bridges," Comptroller General of the United States, General Accounting Office, Report to the Honorable James R. Sasser, United States Senate, August 11, 1981.

Direct the DOT Inspector General to review the Federal Highway Administration's bridge inspection audit program for its sufficiency in establishing State compliance with the National Bridge Inspection Standards. (Class II, Priority Action) (H-84-56)

BURNETT, Chairman, GOLDMAN, Vice Chairman, and BURSLEY and GROSE, Members, concurred in this recommendation.

By: 
Jim Burnett
Chairman