

Log H-409

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: July 19 1984

Forwarded to:
Mr. Francis B. Francois
Executive Director
American Association of State
Highway and Transportation Officials
444 North Capitol Street, N.W.
Washington, D.C. 00000

SAFETY RECOMMENDATION(S)
H-84-55

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 bridge was designed in 1955 according to the "Standard Specifications for Highway Bridges (1953)" of the American Association of State Highway Officials (AASHO), the "Standard Specifications for Welded Highways and Railroad Bridges--Design, Construction, and Repair (1947)" of the American Welding Society, the "Specifications for Highway and Bridge Design by Contracting Engineers (May 1954)" of the Connecticut State Highway Department, and the "Standard Specifications for Roads, Bridges and Incidental Construction Form No. 808 (January 1955)" of the Connecticut State Highway Department. Construction of the bridge began on February 6, 1956, and was completed on December 27, 1958.

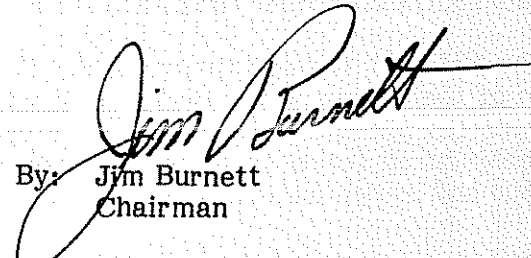
Article 3.6.42.-Pins and Pin Nuts of the 1953 AASHO specifications states that members joined by pins ". . . shall be held against lateral movement on the pins." The article does not define the movements or the forces which might cause movement. The designer did not consider any lateral force or movement in the design of the pin and hanger assembly. The bridge designer's chief engineer testified that ". . . the retainer plate [pin cap] is to act as a guide, like a washer--all it is is an oversized washer. In this case it was not designed to take any lateral load, because there are no design forces that the code specifies concerning it, nor would you expect it to." The detail was adapted from a standard type in common use at the time. The engineer said that the washer was added to provide an additional plane for rotation should one side of the hanger freeze up.

The AASHO specifications used in the design of this bridge required that members joined by pins be held against lateral movement. However, there were no design provisions made to "hold" the hangers against lateral movement on the pins of the suspended spans. The only element that resembled a retainer was the pin cap, but it was not designed to take any lateral load. Obviously, there were lateral forces and movement of the hanger on the pin leading to pressure on the pin cap, but these forces were primarily due to corrosion which the designer did not consider. Neither did the designer consider torsional forces which might cause out-of-plane movement. Testimony at the Safety Board's public hearing indicated that the foregoing corrosion and torsional forces and resulting movements normally would not have been considered in 1955 in designing a pin and hanger suspension, nor would they normally be considered today.

Therefore, the National Transportation Safety Board recommends that the American Association of State Highway and Transportation Officials:

Modify Article 1.7.27 of the "Standard Specifications for Highway Bridges" (1977) and succeeding "Interim Specifications" to describe forces which might result in lateral movements of members on pins to be considered in designing pinned assemblies. (Class II, Priority Action) (H-84-55)

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

By: 
Jim Burnett
Chairman