

M-148

NATIONAL TRANSPORTATION SAFETY BOARD  
WASHINGTON, D.C.

ISSUED: April 22, 1981

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Forwarded to:  
  
Honorable D. Robert Graham  
Governor of Florida  
Tallahassee, Florida 32301  
  
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SAFETY RECOMMENDATION(S)  
  
M-81-23

About 0734 e.d.t. on May 9, 1980, the Liberian bulk carrier M/V SUMMIT VENTURE rammed a support pier of the western span of the Sunshine Skyway Bridge in Tampa Bay, Florida. As a result of the ramming, anchor pier 2S was destroyed and about 1,297 feet of bridge deck and superstructure fell about 150 feet into the bay. A Greyhound bus, a small pickup truck, and six automobiles fell into the bay and 35 persons died. Repair costs were estimated at about \$30 million for the bridge and about \$1 million for the SUMMIT VENTURE. 1/

Theoretically, a cantilever bridge structure remains stable by a system of balanced weights. The weight of the anchor arm spans balances the weight of the cantilever arm spans and the suspended span, with the main channel piers acting as fulcrums and main supports. The anchor piers perform the dual functions of providing support for the anchor arm span and the steel deck truss span and of maintaining the stability of the structure's balance. Because of these major functions of support and balance, the anchor piers are critical elements of the structure.

Pier 2S was designed as a support for the steel deck truss span between piers 2S and 3S and for the south anchor arm span between piers 1S and 2S. Under normal conditions, the columns of pier 2S would be subjected to large vertical support loads and only minimal horizontal wind loads. The horizontal load exerted on the west column of pier 2S by the impact of the SUMMIT VENTURE far exceeded the maximum horizontal design load, and the column failed. Once the west column had failed, the south anchor arm span and the steel deck truss span began to twist to the west and an overstress condition was induced in the east column, and both columns and the pier cap collapsed into the bay.

After pier 2S had failed, the unsupported weight of the steel deck truss span and the south anchor arm span caused the steel deck truss span to pull away from its connection at pier 3S. The separation of those two spans caused a chain reaction of

1/ For more detailed information, read "Marine Accident Report--Ramming of the Sunshine Skyway Bridge by the Liberian Bulk Carrier SUMMIT VENTURE, Tampa Bay, Florida, May 9, 1980" (NTSB-MAR-81-3).

instability and twisting to the east in the south cantilever arm span, the south anchor arm span, and the suspended span. The steel deck truss span fell into the bay with the roadway facing west. The south cantilever arm span and the south anchor arm span lifted off the west bearing assembly and slid off the east bearing assembly at pier 1S, and, along with the suspended span, fell into the bay with the roadway and superstructure facing east. The weight of the north anchor arm span and the north cantilever arm span, and the support provided by pier 1N, helped to arrest the chain reaction of instability and twisting at the pin connection between the suspended span and the north cantilever arm span. That span remained stable and upright, but a 36-foot section of the span was pulled downward as the suspended span fell into the bay. Therefore, the Safety Board concludes that the collapse of the steel deck truss span, the south anchor arm span, the south cantilever arm span, and the suspended span resulted directly from the loss of support at pier 2S and the chain reaction which followed.

Pier 1S did not play an active part in the collapse, nor did any of the concrete piles. The replacement of some missing rivets and bolts and the repair of some structural steel members had been deferred, but the minor reduction of local strength attributable to those items is insignificant when compared to the extreme forces which acted on large parts of the bridge during the collapse. Therefore, the Safety Board concludes that the condition of the Sunshine Skyway Bridge with respect to maintenance and repair did not contribute to the collapse of about 1,297 feet of the bridge span.

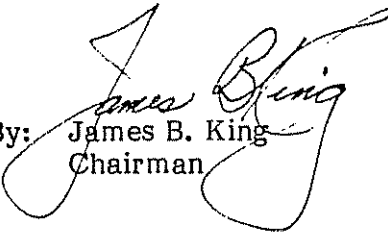
The mass and design of bridge piers and pier protection systems and the configuration, weight, and speed of vessels have a direct effect on the damage which may result from a collision. The bulwark and the forecastle of the SUMMIT VENTURE struck the pier column before the lower bow struck the pier crashwall. If the pier crashwall had been larger, or if a pier protection system had been installed at that location, the initial impact would have occurred near the waterline. Because the pier crashwall is anchored through the pier footer directly into the bay bottom and is larger and stronger than the columns, it is possible that sufficient energy might have been absorbed to reduce the vessel's forward motion and perhaps to redirect the vessel before the bulwark and forecastle struck the column. While the pier still could have been damaged, only the vessel's mast would have struck the bridge span if the vessel had been redirected to starboard. The vessel could have passed under the bridge span if it had been redirected to port, and the damage to the bridge span might have been minimized.

Because the Coast Guard and the Federal Highway Administration (FHWA) have no requirements or standards for structural pier protection, the bridge owner must determine what, if any, protection will be provided. However, the Government of France requires that all bridges over navigable waterways be protected against vessel impact. For small vessels, this is done by reinforcing the piers, while in the case of large vessels steps are taken to ensure that vessels go aground on artificial islands and do not strike the piers. The official French view is that vessel collision is so frequent an occurrence that it is absolutely essential to safeguard against it. Bridge owners should consider protecting existing vulnerable bridges and take particular care in pier placement in future bridge construction. The FHWA should examine this issue carefully in its review process for bridges built with Federal aid funds.

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

Provide structural pier protection for the cantilever arm piers and the anchor arm piers of the Sunshine Skyway Bridge. (Class II, Priority Action) (M-81-23)

KING, Chairman, and McADAMS and GOLDMAN, Members, concurred in this recommendation. DRIVER, Vice Chairman, and BURSLEY, Member, did not participate.

By:   
James B. King  
Chairman