

UNITED STATES OF AMERICA  
NATIONAL TRANSPORTATION SAFETY BOARD  
WASHINGTON, D.C.

ISSUED: April 25, 1973

Adopted by the NATIONAL TRANSPORTATION SAFETY BOARD  
at its office in Washington, D. C.  
on the 11th day of April 1973

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FORWARDED TO: )  
Honorable Frank C. Herringer )  
Administrator )  
Urban Mass Transportation )  
Administration )  
Washington, D.C. 20590. )  
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SAFETY RECOMMENDATION R-73-15 thru 18

After the collision of the two Illinois Central Gulf Railroad suburban trains in Chicago, on October 30, 1972, the State of Illinois and the Urban Mass Transportation Administration held up funds for the 15 additional high-liner cars for use on the Illinois Central Gulf Railroad. Secretary Brinegar announced on February 20 a Federal grant of two-thirds funding for the Chicago South Suburban Mass Transit District to buy 15 new double-deck electric commuter cars subject to the following condition:

"Approval of specifications for the 15 new bi-level commuter cars will be held in abeyance by the Urban Mass Transportation Administration pending results of the National Transportation Safety Board investigation of the above mentioned accident and any subsequent safety recommendations which may follow."

The National Transportation Safety Board agrees with UMTA's action. For good reason, the use of cars all of the same type would improve the safety of the commuters on the Illinois Central Gulf Railroad. Testimony at the public hearing and the Board's analysis indicate that the overriding of the frame of the new car and the resultant telescoping which produced most of the fatalities were influenced by the incompatibility of the highliner and the older car. The basic design strength of the older car was inferior to that of the newer car. However, the unsecured trucks of the older car and an incompatible anti-climbing arrangement contributed to the older car's overriding the new highliner.

The result was that the strongest part of the older car, its frame, struck relatively weaker parts of the newer car, above its frame. The Board believes that a collision between two highliner cars in good condition would have resulted in less intrusion into the passenger compartments of the cars. As long as the older cars continue in service, there is a possibility of similar results should a collision occur at the same speeds.

Other safety benefits also may be realized through the replacement of the older cars with new highliner cars. The differences between the braking characteristics of the two types of equipment, described at the public hearing, would be eliminated. In addition, because the new cars would be equipped with two-way radios and speedometers, operating safety would be improved.

The Board has already made interim recommendations to the Illinois Central Gulf Railroad concerning the visibility of the rear ends of trains and marker lights which could, with study by UMTA, be converted into specifications for the 15 additional highliner cars. The Board is also aware of agreements between the Illinois Commerce Commission and the Illinois Central Gulf Railroad to make radio and intercom available to trainmen on the rear ends of trains, to make conductor's brake valve available on rear ends of trains, and to make brake valves accessible to conductors while they are at the control panel in the vestibule. These matters could also be converted into specifications for the 15 additional highliner cars.

The Board has also made recommendations to the Federal Railroad Administration concerning design adequacy of a certain weld used to attach the collision posts to the underframe in highliner cars. It was recommended that FRA determine whether the current design of the attachment of collision posts used on other highliner cars comply with the regulations and that enforcement action be taken to assure that the requirements are met.

In making these recommendations, the Board pointed out that it had not determined whether the current Federal regulations, even if met, would have provided strength sufficient to resist this particular crash. Study of the crash has made it clear that the existing requirements based on the Locomotive Inspection Act do not address many of the factors in crash-resistant design of railroad passenger-carrying equipment. The Board believes that UMTA is capable of improving, through changes to newer cars, some other weaknesses of crash resistance which were not controlled by the existing Federal regulations. The recommended specification areas are meant to provide improvements within the same general design.

The weaknesses which can be improved include:

- 1) The present collision posts, made of channel members, are attached to the underframe, on only one side, in an unbalanced manner so that an impact force along the axis of the car can be converted into a twisting force (torque) at the post attachment point. The attachment point is not optimally designed to resist torque, and is only minimally able to resist lateral bending which is produced by twisting or by any deflection of impact to left or right.
- 2) The underframe design contains a number of single bevel welds which do not develop the full theoretical strength, are unpredictable, and not intended to resist impact optimally. Single bevel welds are warned against in the current edition of the Welding Handbook of the American Welding Society for impact-resisting purposes.
- 3) So-called "skip welds" were used in the attachment of the side sheets of the car to the underframe in the car involved in this accident. The welds developed only about one-third of the strength of a fully welded joint. Full welded joints would not have strengthened the walls sufficiently to prevent the penetration by the opposing car in the crash, but the destruction of full welds would have absorbed more crash energy and probably somewhat reduced the distance of telescoping penetration. The later cars in the previous highliner series included 100 percent welding of the side sheets to underframe, and the full welding is technically feasible.

For these reasons the Safety Board recommends that the following areas be included in specifications for the 15 additional highliner cars to be funded by UMFA:

1. Design specifications to require that all weld designs in the center sill area and in the underframe at ends of cars comply with specified current recommendations of engineering practices, and that single bevel welds not be employed.
2. Design specifications to require that welds, or other fasteners which join side walls to underframe and side walls to roof, develop a high proportion of the strength of the parent metal.

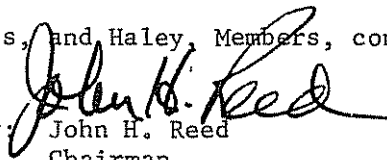
3. Design specifications to insure that the collision posts resist more adequately the impact loads which are likely to be applied by crash forces generally along the axis of the car. The design should not permit such impact loads to produce torque or lateral bending when applied at the logical points by an end to end collision. Collision posts and other structures should be designed to resist torque and bending efficiently.

There is also a lesson to be learned from an earlier collision of two highliner cars at 95th Street during the acceptance testing period, which was described in evidence. In that accident, two cars of current design crashed at speeds of 15 to 18 m.p.h., resulting in costly damage to both cars. There was small-scale, but generalized, permanent distortion of stressed skin caused by wrinkling and buckling of the underframe. The structure served effectively from an injury-prevention point of view, in that no override occurred, and there was no intrusion into the passenger area. However, the implications of the damage, which required complete structural replacement for both cars, are disquieting from the viewpoint of long-term operational costs. The Board believes that it is technically unnecessary to sustain such broad-scale damage in order to protect passengers. The Safety Board therefore recommends:

4. That UMTA require specific statements of intended capability of cars to resist low-speed collision damage in specifications for newly designed cars which are candidates for Federal capital grants. Such specifications should be coordinated with injury resistance specifications which may arise from current funded research.

These recommendations will be released to the public on the issue date shown above. No public dissemination of the contents of this document should be made prior to that date.

Reed Chairman, McAdams, Thayer, Burgess, and Haley, Members, concurred in the above recommendations.

By:   
John H. Reed  
Chairman

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