log#R6461B

# NATIONAL TRANSPORTATION SAFETY BOARD

*Washington, D.C. 20594*

## Safety Recommendation

**Date:** JAN 7 1994

**In Reply Refer To:** R-93-26 and -27

Mr. Jack R. Gilstrap
Executive Vice President
American Public Transit Association
1201 New York Avenue, NW
Washington, DC 20005

At 9:34 a.m on January 18, 1993, Northern Indiana Commuter Transportation District (NICTD) eastbound commuter train 7, traveling from Chicago, Illinois, to South Bend, Indiana, and NICTD westbound commuter train 12, traveling from South Bend to Chicago, collided at mile post (MP) 61.1 in Gary, Indiana. Train 7 and train 12 consisted of two and of three passenger cars, respectively. Train 7 passed a stop signal at MP 61.2, and its lead car 27 blocked westbound traffic where the tracks intersect. After train 12 crossed the Gary Gauntlet Bridge, the left front corner of its lead car 36 struck the left front corner of the train 7 lead car 27. As a result of the collision, 7 passengers died and 95 people sustained injuries. The estimated damage for both trains was $854,000.[1]

The National Transportation Safety Board is concerned about the adequacy of the corner post structure in self-propelled passenger cars that allows significant inward car body intrusion and the subsequent serious injuries and fatalities in a corner-to-corner collision. This accident is the second collision investigated by the Safety Board within a 2-year period involving corner-to-corner impact of self-propelled, multiple-unit (MU) locomotive, electric-powered passenger

[1]For more detailed information, read Railroad Accident Report--*Collision between Northern Indiana Commuter Transportation District Eastbound Train 7 and Westbound Train 12 near Gary, Indiana, on January 18, 1993* (NTSB/RAR-93/03).

rail cars. The first collision on May 10, 1991, involved two unoccupied passenger trains, occurred during a switching maneuver at a very low speed, and resulted in two minor injuries to railroad employees.[2] Because of the low impact speed, passenger compartment intrusion was minimal and no serious injuries occurred.

The self-propelled, MU, electric-powered, light-weight stainless steel construction, passenger rail cars[3] that the NICTD operates in revenue service are typical of the self-propelled electric cars used in suburban commuter rail service. Each 85-foot-long, 118,000-pound car operates on 1,500 volts, direct current, supplied by overhead catenary wire. The operator controls are in a control compartment at both ends of each car.

A reconstruction of the events suggests that the two car bodies overlapped about a foot and collided longitudinally left corner to left corner. The corner post structure yielded upon impact and folded inward, exposing the thin-skinned sidewall to the collision forces. As relative forward movement continued, the pressure of the opposing car body forces separated the sidewall panels at the corner posts, which experienced complete structural failure. The sidewall panels then continued to separate along their roofline and floorline in a peeling action and folded inward into the passenger compartment. The intrusion continued as the movement continued until the car bodies had sufficiently separated.

Cars 27 and 36 had the sidewall and related collision debris displace the survival space of the occupants. This displaced area is called an intrusion zone. Occupants in both cars who experienced the fatal or serious injuries were situated either within intrusion zones or adjacent to them. The fatalities resulted from blunt impact trauma to the head, upper torso, and extremities; the serious injuries were fractures, internal trauma, and lacerations. However, several occupants in both cars who were also within intrusion zones received relatively minor injuries. Occupants situated outside the intrusion zones and in other than the lead cars reported minor or no injuries.

The passenger rail cars (MU locomotives) operated by the NICTD, as described, must comply with the car body design requirements for MU locomotives in 49 Code of Federal Regulations (CFR) 229.141. Several design features, such as collision posts, provide for the protection of vulnerable areas of the car body in a head-on collision. By deforming on impact, collision posts absorb substantial kinetic energy (crash forces) in a coupler-to-coupler collision and prevent, or at least reduce, the tendency for car body telescoping, in which one car body intrudes longitudinally into another. However, collision posts do not afford protection to corner areas in a corner-to-corner collision because the posts are generally adjacent to the control

---

[2]Field Accident Brief--*Collision between Two SEPTA (Southeastern Pennsylvania Transportation Authority) Commuter Trains near Paoli, Pennsylvania, on May 10, 1991* (NTSB/NYC91FRO11A).

[3]Manufactured by Nippon Sharyo Seizo Kaisha, Ltd., of Toyokawa, Japan, under a subcontract from Sumitomo Corporation of America.

compartment door. Moreover, the design requirements in 49 CFR 229.141 do not address car body corner post structural requirements. How much car body intrusion protection that the corner post structure will provide without such requirements before it yields and experiences complete structural failure is relative to how much kinetic energy it can absorb in a collision.

Because this accident was the second collision within a 2-year period to involve corner-to-corner impact and it resulted in numerous fatalities and serious injuries that may have been prevented, the corner post design requirements of MU locomotives have become a significant crashworthiness issue of particular interest to the Safety Board. MU locomotive passenger cars that are built without adequate collision energy absorption structures in the corner post assemblies are vulnerable to car body intrusion in noncoupler-to-coupler collisions. The use of an energy absorption structure in the corner post assembly, similar to the collision post that is required on each side of the control compartment door, would have provided significant additional resistance to impact intrusion.

The damage that both trains sustained after the initial impact resulted from the action of dynamic forces that caused the left front corner and sidewall of the passenger compartment of each car to experience a complete structural failure and intrude inward. Because no structure was available in the corner post areas to successfully absorb the crash forces of the collision, the substantial car body intrusion into each car left no survival space in the left front areas of either car. Consequently, the collision produced numerous fatalities and serious injuries. The Safety Board concludes that the use of collision energy absorption structures in the corner post assemblies of these rail cars would have decreased the impact intrusion in this collision and may have prevented or substantially reduced the number of fatalities and serious injuries.

During the investigation of this accident, the Safety Board reviewed the Federal Railroad Administration (FRA) accident report database to detect a possible correlation between car body crashworthiness and structural design deficiencies in passenger rail cars. The Safety Board also reviewed data from its *Railroad Accident Reports--Brief Format of 1988-91 Accidents*. A comprehensive analysis could not be performed because the database of detailed passenger rail car accident damage information was inadequate. Nevertheless, the review indicated that nonpowered light-rail and subway passenger cars are also vulnerable to car body intrusion because they are often constructed to the same design specifications and exposed to the same collision energy forces as the MU locomotive passenger cars. The April 1993 issue of *Railway Age* reported that about 1,300 passenger rail cars are scheduled for delivery this year and that about 2,300 cars (all types) are anticipated to be ordered in 1994-98. A crash energy performance standard should be extended to all passenger rail cars for which a need is demonstrated, especially lead cars.

The FRA has major responsibility for developing and enforcing safety standards; however, other organizations, government and private, share in this responsibility. As a Federal financial assistance agency, the Federal Transit Administration (FTA) provides grants to urban mass transit projects. Because these FTA grants fund the costs of transit acquisition, construction, and operations as well as improvement to existing facilities and equipment, the

FTA has a responsibility to ensure the equipment purchased through FTA funding meets the highest safety standards. Additionally, the American Public Transit Association (APTA), as a nonprofit international organization representing the transit industry in the private sector, should also have an interest in promoting action that would enhance the safety of passengers that use public transit.

The Safety Board realizes that the FTA does not regulate the rapid transit industry and that most APTA members do not fall under FRA regulations. However, because both the FTA and the APTA have an influential leadership role in the transit industry, they are in a position to encourage the transit industry to voluntarily adopt the FRA safety standards as guidelines for purchasing new cars. Therefore, the Safety Board believes that the APTA, in cooperation with the FRA, should study the feasibility of providing car body corner post structures on all self-propelled passenger cars and control cab locomotives to afford occupant protection during corner collisions. If feasible, the FRA should amend the locomotive safety standards accordingly.

During its investigation, the Safety Board examined the possibility that on the day of the accident, the engineer of train 7 was inattentive to his duties. He said that train 7 was traveling at a speed of 40 mph from the Clark crossover to signal 601. That distance of 1,746 feet can be traveled in about 30 seconds at that speed. Because signal 601 is visible in advance of the Clark crossover, the engineer should have had sufficient time to determine the status of the signal.

The engineer said that he continued to proceed toward the bridge even after he viewed a "dark" signal. Because the signal system was working properly, the engineer could not have received a "dark" signal. In addition, the NICTD rules state that a signal imperfectly displayed, or the absence of a signal at a place where a signal is usually displayed, should be regarded as the most restrictive indication afforded by that signal. Under these circumstances, he should have taken immediate action to stop his train.

The investigation disclosed that after the engineer applied the emergency brakes, train 7 fouled the westbound track about a foot. The Safety Board concludes that the engineer of train 7 was inattentive to his duties when he passed the approach indication displayed at signal 621 and the stop indication displayed at signal 601. Because of his inattentiveness, he failed to stop at signal 601, which caused his train to foul the westbound track. The Safety Board also concludes that had the engineer acted immediately when he perceived a dark signal and applied the emergency brakes, as he should have, train 7 would have proceeded past signal 601 but would have stopped short of where it fouled the westbound track.

The engineer of train 12 stated that he received a proceed indication at both signals 592 and 602. The deadheading collector/brakeman, who rode with him in the control compartment, verified this statement. The engineer recalled that he and the deadheading collector/brakeman had discussed the location of train 7; the engineer did not expect the two trains to meet at the Gary Gauntlet Bridge but to pass each other either before or after train 12 had crossed the bridge.