



National Transportation Safety Board

Washington, D. C. 20594

Safety Recommendation

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Date: November 29, 1988

In reply refer to: R-88-78 and -79

Honorable John H. Riley
Administrator
Federal Railroad Administration
Washington, D.C. 20590

On November 12, 1987, National Railroad Passenger Corporation (Amtrak)/Massachusetts Bay Transportation Authority (MBTA) commuter train 8110 was standing partially berthed at the Back Bay station platform in Boston, Massachusetts, when it was struck from the rear by Amtrak/MBTA commuter train 8114.¹

Train 8110 entered the signal block governed by wayside signal 2262-2 behind train 8910 and ahead of train 8114. Wayside signal 2262-2 displayed a false proceed indication (approach aspect) to train 8110 because with train 8910 in the signal block, wayside signal 2262-2 should have displayed a stop and proceed aspect (train 8110's cab signal went to restricting). Further, field tests established that wayside signal 2262-2 displayed false proceed indications with a train in the signal block. The investigation determined that the signal failure resulted from excessive wear on the contacts of the relay because of a unique design feature of the signal systems.

The signal system was designed so that the rear of a train cleared the limits of signal section 2262, and the track circuit in the code repeating section would reset track circuit 2262. Postaccident tests determined that a cycle action was generated in the wayside signal relays when the equipment attempted to reset the track circuit while the signal block was still occupied. The track circuits misinterpreted the cycling reset feature as a code and improperly displayed an approach aspect on the wayside signal when a stop and proceed aspect was required and intended.

¹For more detailed information, read--Railroad Accident Report--Rear-End Collision of Amtrak/Massachusetts Bay Transportation Authority Commuter Trains at Back Bay Station, Boston, Massachusetts, November 12, 1987 (NTSB/RAR-88/05).

This is contrary to the intent of Title 49 Code of Federal Regulations 236.205 which states:

The circuits shall be so installed that each signal governing train movements into a block will display its most restrictive aspect when any of the following conditions obtain within the block:
(a) Occupancy by a train, locomotive, or car

Further, one of the basic tenets of signal design and operation is that in the event either the signal system or a system component does not function as intended, then the system will "fail safe." To this end, signal systems are required to be designed on the closed circuit principle as defined by 49 CFR 236.786:

The principle of circuit design where a normally energized electric circuit which, on being interrupted or deenergized, will cause the controlled function to assume its most restrictive condition.

While the signal system involved in this accident appears to have been designed on the closed circuit principle, the National Transportation Safety Board concludes that this requirement was of itself not sufficient to preclude the signal system from failing in an unsafe manner.

The stated position of train 8114's engineer was that normally he attempted to provide a smooth ride to the passengers aboard his train. Train 8114's speed tape indicated that the engineer employed the same train handling methods when closing on Back Bay station that he had used when preparing to stop at other stations on the morning of the accident. The Safety Board believes that train 8114's engineer may have assumed, based on the false approach aspect displayed by the wayside signal, that the cab signal had degraded to approach (rather than restricting) without visually confirming the aspect, and thus continued to use power while braking. The Safety Board believes that had train 8114's engineer looked at the cab signal when it changed to restricting and initiated the same stopping procedure as the engineer of train 8110, he could have stopped the train short of a collision as there was sufficient distance available to do so. However, the Safety Board believes that the engineer of train 8114 did not look at the cab signal when the train passed wayside signal 2262-2 and thus failed to recognize that it had degraded to restricting. Thus, the Safety Board concludes that the failure of the wayside signal to display the correct aspect and the failure of the engineer of train 8114 to operate his train in compliance with the restricting cab signal were both causal factors in this accident.

The audible alarm produced when the cab signal degrades is identical for all aspects. The Safety Board believes that a different warning sound should be produced by the audible indicator when a cab signal changes to its most restrictive aspect. Perhaps a computer-generated voice announcing the indication the cab signal has changed to may be the most effective way to notify the engineer. This may have alerted the engineer of train 8114 to the imminent danger ahead and caused him to handle his train differently, possibly preventing the accident.

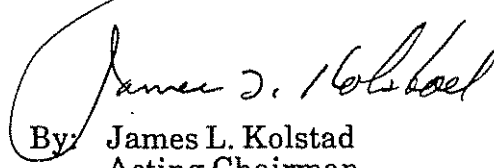
Therefore, as a result of its investigation, the National Transportation Safety Board recommends that the Federal Railroad Administration:

Expand Title 49 Code of Federal Regulations Part 236 to require that signal circuits be designed so that they can not be reset until the entire signal block is unoccupied. (Class II, Priority Action) (R-88-78)

Expand Title 49 Code of Federal Regulations 236.513 to require that when a cab signal changes to display a more restrictive aspect, the audible indicator will produce a different warning sound when the cab signal displays its most restrictive aspect. (Class II, Priority Action) (R-88-79)

Also, the Safety Board issued Safety Recommendations R-88-80 to the city of Boston and R-88-81 and -82 to the National Railroad Passenger Corporation.

KOLSTAD, Acting Chairman, and BURNETT, LAUBER, NALL, and DICKINSON, Members, concurred in these recommendations.


By: James L. Kolstad
Acting Chairman