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National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: August 28, 1997

In Reply Refer To: R-97-26 through -31

Mr. A. R. Carpenter
President and Chief Executive Officer
CSX Transportation Inc.
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About 5:39 p.m. on February 16, 1996, Maryland Rail Commuter (MARC) train 286 collided with National Railroad Passenger Corporation (Amtrak) passenger train 29 near Silver Spring, Maryland. En route from Brunswick, Maryland, to Union Station in Washington, DC, MARC train 286 was traveling under CSX Transportation Inc. (CSXT) operation and control on CSXT tracks. MARC train 286 passed an APPROACH signal before making a station stop at Kensington, Maryland; proceeded as if the signal had been CLEAR; and, then, could not stop for the STOP signal at Georgetown Junction, where it collided with Amtrak train 29. All 3 CSXT operating crewmembers and 8 of the 20 passengers on MARC train 286 were killed in the derailment and subsequent fire. Eleven passengers on MARC train 286 and 15 of the 182 crewmembers and passengers on Amtrak train 29 were injured.¹

The National Transportation Safety Board determined that the probable cause of this accident was the apparent failure of the engineer and the traincrew because of multiple distractions to operate MARC train 286 according to signal indications and the failure of the Federal Railroad Administration (FRA), the Federal Transit Administration (FTA), the Maryland Mass Transit Administration (MTA), and the CSXT to ensure that a comprehensive human factors analysis for the Brunswick Line signal modifications was conducted to identify potential sources of human error and to provide a redundant safety system that could compensate for human error.

Contributing to the accident was the lack of comprehensive safety oversight on the CSXT/MARC system to ensure the safety of the commuting public. Contributing to the severity of the accident and the loss of life was the lack of appropriate regulations to ensure adequate emergency egress features on the railroad passenger cars.

¹For more detailed information, read Railroad Accident Report--*Collision and Derailment of Maryland Rail Commuter MARC Train 286 and National Railroad Passenger Corporation Amtrak Train 29, near Silver Spring, Maryland, on February 16, 1996* (NTSB/RAR-97/02)

The Safety Board has long advocated a positive train separation (PTS) control system and since 1970² has issued safety recommendations concerning train collision prevention. A PTS control system can prevent trains from colliding by automatically interceding in the operation of a train when an engineer does not comply with the requirements of the signal indication.

The Safety Board has investigated numerous train collisions in which the probable cause or contributing cause was the inattention of the traincrew to wayside signals. In its investigation of the head-on collision of two freight trains near Kelso, Washington,³ the Safety Board attempted to determine again why one traincrew did not comply with the signal indication of an intermediate signal. The Safety Board reported its concerns about a systemic safety issue: the adequacy of passive wayside signals to reliably capture traincrews' attention when competing sources of attention are present, and it urged the railroad industry to recognize that human vigilance has limits and that wayside signals do not ensure safe train operations. The FRA emergency order (EO) 20, notice no. 2, concluded that "certain current conditions and practices on commuter and intercity passenger railroads pose an imminent and unacceptable threat to public and employee safety. Of greatest concern are push-pull and MU [multi-unit] operations lacking the protection provided by cab signal, automatic train stop, or automatic train control systems." After its investigation of the Thedford, Nebraska,⁴ accident, the Safety Board stated that had a PTS control system been in place it could have detected that the engineer was not responding appropriately to the signal indications and could have slowed and stopped the train, thus preventing the collision.

The FRA newly required rule for calling signals has basically the same instructions as the existing CSXT operating rule 34. The signal calling that the FRA requires likely occurred in the Silver Spring accident, and at least one crewmember was in the cab control car with the engineer and is believed also to have seen the signal. The accident still happened because such a rule does not adequately compensate for human capabilities and crew interaction. The Safety Board concurs with the FRA EO 20, notice no. 1, that:

Since most train collisions on the railroad result from human factors, the most effective preventive measure is a highly effective train control system. Cab signal systems serve an important safety purpose because they provide a constant display of the governing signal indication. This provides a corrective measure should an engineer fail to note, forget, or misread a restrictive wayside signal indication. Even greater security is provided by a train control system capable of intervening should the engineer fail to observe signals and operating rules for whatever reason....Such systems are referred to as automatic train control or automatic train stop.

Since the collision at Georgetown Junction, MARC has undertaken a project, for which the MTA has hired a consultant and provided funding, to develop and evaluate an intermittent cab signaling system (ICSS) that features both civil speed enforcement and positive train stop technology. In addition, the supplier of track circuit equipment is estimating the cost for upgrading the equipment to continuously inductive automatic cab signals that will be compatible with the automatic train control equipment currently installed on MARC locomotives and cab control cars. The CSXT is also involved in the project because its wayside signal equipment and locomotives will be directly affected by the installation of any

²Railroad Accident Report--*Head-on Collision between Penn Central Trains N-48 and N-49 at Darien, Connecticut, August 20, 1969* (NTSB/RAR-70/03).

³Railroad Accident Report--*Head-on Collision and Derailment of Burlington Northern Freight Train with Union Pacific Freight Train, Kelso, Washington, on November 11, 1993* (NTSB/RAR-94/02).

⁴Railroad Accident Report--*Collision and Derailment Involving Three Burlington Northern Freight Trains near Thedford, Nebraska, on June 8, 1994* (NTSB/RAR-95/03).

changes proposed to the current signal system.

The Safety Board is encouraged by the efforts of the MTA/MARC project to develop and evaluate an ICSS; however, ICSS should only be an interim solution until a PTS control system can be fully implemented. A PTS control system is a major step for the railroad industry to provide a redundant system where an unacceptable threat to public and employee safety exists. Pending the FRA issuance of regulations that require a PTS control system installation, railroads remain responsible for a PTS control system development and installation. Consequently, the Safety Board believes that the CSXT should develop and install a PTS control system on its track segments that have commuter and intercity passenger trains.

The confusion between the CSXT and the Montgomery County Fire and Rescue Services (MCFRS) at the accident site and the untimely notifications between the CSXT and MARC of the collision resulted because neither the CSXT nor MARC had a formal emergency management plan available that contained procedures for dispatchers and traincrews to notify emergency responders of train movements near an accident site. When the AU dispatcher authorized the engineer of CSXT train Q401 to move his locomotive closer to assist in evacuating passengers, the MCFRS incident commander was not advised that the train would be approaching the accident site. The movement of trains toward an accident area should have been addressed by the CSXT and MCFRS dispatchers. The Safety Board concluded that the confusion during the initial emergency response resulted because the CSXT and MARC lacked a formal emergency management plan to follow. The implementation of an emergency management plan that addressed communications and training would have eliminated the confusion between the CSXT and MARC. Therefore, the Safety Board believes that CSXT should develop and implement a formal emergency management plan that contains procedures specific to employee responsibilities and interaction with emergency response agencies and other transportation entities.

The CSXT traincrews of MARC passenger trains had minimal guidance, compared with the Amtrak manual of on-train instructions for conductors and assistant conductors, to properly perform passenger train functions. Since the CSXT operation in 1985 of the MARC passenger service, the CSXT had not maintained a comprehensive passenger program that would provide guidance to traincrews for passenger train functions. The CSXT produced *Passenger Service Bulletins* as needed, but it offered little guidance on responding to passenger train emergencies. The CSXT passenger traincrews reported that they had not received any emergency training in passenger train operations and in passenger responsibility in emergencies. The Safety Board concluded that the CSXT personnel operating MARC passenger trains are not adequately trained to understand and therefore execute their responsibilities for passengers in emergencies. The CSXT and MARC have been working since 1993 to complete the *Passenger Conductor's Manual*, which was unfinished at the time of the accident. A review of this unfinished manual shows that it is much less comprehensive than the Amtrak manual of on-train instructions for conductors and assistant conductors. The Safety Board believes that the CSXT and MARC should develop and implement, in cooperation, a complete training agenda for all CSXT passenger traincrews that provides experience in the correct use of emergency equipment, in emergency communications procedures, and in passenger evacuation and assistance in an emergency and also includes the distribution of a comprehensive employee guidance manual.

Since the accident MARC has informed the Safety Board that it, in cooperation with Amtrak and the CSXT, has developed video materials for training emergency responders and the Amtrak and CSXT

traincrews who operate MARC commuter trains.⁵ However, such passive training may not be as effective as training that requires traincrews to actively participate and practice what is being demonstrated. To achieve the protocols and procedures described in any emergency management plan, emergency drills should be performed in conjunction with local emergency management agencies and with the railroad to reinforce training, to test communications, and to determine whether procedural changes are needed. Therefore, the Safety Board believes that the CSXT and the MTA/MARC, in cooperation with the emergency management agencies of Baltimore County, of the city of Baltimore, of the Metropolitan Washington Council of Governments, and of Jefferson and Berkeley Counties in West Virginia, should conduct periodic disaster drills to assess their emergency management plans, to reinforce and evaluate their emergency training, and to test the communications with the organizations.

Accident survivors who had been in the passenger compartment of the cab control car placed all three crewmembers in the cab control car after the Kensington station stop. Clearly, both crewmembers were in the cab control compartment with the engineer for most, if not all, of the trip segment after signal 1124-2 from Kensington to Georgetown Junction. Additionally, the survivors did not note any unusual activity from the crewmembers until the accident appeared imminent. MARC train 286 had not been operated in accordance with the APPROACH indication during that segment of the trip. The other crewmembers apparently had not taken action when the engineer did not operate the train according to the last signal indication.

The explanation for their behavior may be found in the normal operating practice. Rule 34, to acknowledge the signals, is a required activity for crewmembers that occurs many times each day. As such, the assistant conductor may have acknowledged the signal when the engineer did, and the conductor may also have done so. Once the signal is called and acknowledged, however, only the engineer has a physical activity to perform. The other crewmembers have only a passive oversight responsibility to do something under rule 34C should the engineer fail in his responsibility. Since adhering to signal indications is fundamental to safe rail operations, such failures are rare. Personnel practices further sanctify signal compliance, as engineers who fail to adhere to signals are usually disciplined or fired. The other crewmembers have the responsibility to be vigilant for a rare event and to take corrective action. Actually taking a corrective action, such as using the emergency brake handle, is even more rare and not likely to occur in a crewmember's entire career. Thus, because the engineer has an active task to perform with every signal and does so routinely, and the other crewmembers have only a passive responsibility that is rarely, if ever, exercised, it is not difficult to conceive that the crewmembers in this accident deferred to the engineer and did not monitor his compliance with the signal indication during the interval from the Kensington station stop to the emergency brake application.

It is possible that one crewmember or both told the engineer that he was not complying with the APPROACH signal. However, they may have deferred to the engineer's recollection of the signal aspect as CLEAR in the absence of an independent source of information, such as cab signals, to advise them otherwise. This is perhaps an unlikely possibility because a prudent engineer would probably accept the most restrictive signal aspect and act accordingly. Nevertheless, no actions were taken by the conductor or assistant conductor to counteract the actions of the engineer as required by rule 34C. This occurred even though the conductor and assistant conductor were competent, experienced personnel, which calls into question whether it is reasonable to rely on the vigilance of a person to compensate for the error of another person in the same circumstances. The Safety Board concluded, therefore, that neither the con-

⁵Before the accident, Amtrak was providing training for MARC traincrews on the Penn Line and hands-on as well as audio-visual training for emergency responders in areas near the Penn Line.

ductor nor the assistant conductor while in the cab control compartment appeared to have effectively monitored the engineer's operation of MARC train 286 and taken action to ensure the safety of the train. The Safety Board believes that the CSXT should inform all operating train crewmembers of the circumstances of this accident and emphasize the crew responsibility while in the operating compartment for the safe operation of the train.

The Safety Board stopping distance tests indicated that had the MARC train 286 engineer not used the reverser, thereby retaining dynamic braking until impact, MARC train 286 would have impacted Amtrak train 29 at a speed of about 34 mph as opposed to the actual impact speed of about 38 mph. The additional deceleration of MARC train 286 would have resulted in an additional 0.3 seconds of elapsed time before impact, which in turn would have resulted in Amtrak train 29 moving approximately 14 feet farther into the crossover before impact. Thus, with MARC train 286 operating at the speed of 66 mph and going into emergency braking 1,407 feet before impact, a collision was inevitable regardless of the reverser use by the MARC train 286 engineer.

Despite the CSXT instructions that the reverser only has limited utility and its intentions that the reverser be used only under specific conditions, the use of the reverser having a retarding effect is implied in the instructions. The MARC train 286 engineer may have drawn from that implication and used the reverser about 1,000 feet into his emergency braking sequence out of desperation when he realized emergency braking would not prevent the impending collision. Nevertheless, because the reverser use eliminated the additional braking provided by the locomotive dynamic brakes, the Safety Board concluded that the MARC train 286 engineer's use of the reverser during the emergency brake application resulted in a marginally increased stopping distance for MARC train 286. Therefore, the Safety Board believes that the CSXT should inform its engineers of the circumstances of this accident and caution them not to use the reverser during emergency brake applications for those trains on which the use of the reverser will eliminate the dynamic braking, thus increasing stopping distance.

Therefore, the National Transportation Safety Board recommends that the CSXT Transportation Inc.:

Develop and install a positive train separation control system on track segments that have commuter and intercity passenger trains. (R-97-26)

Develop and implement a formal emergency management plan that contains procedures specific to employee responsibilities and interaction with emergency response agencies and other transportation entities. (R-97-27)

Develop and implement, in cooperation with Maryland Mass Transit Administration/Maryland Rail Commuter, a complete training agenda for all CSX Transportation Inc. passenger train-crews that provides experience in the correct use of emergency equipment, in emergency communications procedures, and in passenger evacuation and assistance in an emergency and also includes the distribution of a comprehensive employee guidance manual. (R-97-28)

Conduct, in cooperation with Maryland Mass Transit Administration/Maryland Rail Commuter, the Baltimore County Emergency Management Agency, the City of Baltimore Emergency Management Agency, the Metropolitan Washington Council of Governments, the Jefferson County Commissioners, and the Berkeley County Commissioners, periodic disaster drills to assess their emergency management plans, to reinforce and evaluate their emergency training, and to test the communication with the organizations. (R-97-29)

Inform all operating train crewmembers of the circumstances of this accident and emphasize the crew responsibility while in the operating compartment for the safe operation of the train. (R-97-30)

Inform your engineers of the circumstances of this accident and caution them not to use the reverser during emergency brake applications for those trains on which the use of the reverser will eliminate the dynamic braking, thus increasing stopping distance. (R-97-31)

Also, the Safety Board issued Safety Recommendations R-97-9 through -21 to the FRA; R-97-22 through -25 to the FTA; R-97-32 through -35 to the MTA; R-97-36 to the U.S. Department of Transportation; R-97-37 to the Federal Emergency Management Agency; R-97-38 to the Governor and the General Assembly of Maryland; R-97-39 through -42 to the Association of American Railroads; R-97-43 to the Montgomery County Emergency Management Agency; R-97-44 to the Baltimore County Emergency Management Agency, the Baltimore City Emergency Management Agency, the Metropolitan Washington Council of Governments, the Jefferson County Commissioners, and the Berkeley County Commissioners; and R-97-45 to the American Short Line Railroad Association, the Brotherhood of Locomotive Engineers, the United Transportation Union, the International Brotherhood of Teamsters, and the American Public Transit Association. The Safety Board also reiterated Safety Recommendations R-87-16, R-92-10, and R-93-12 to the FRA; R-92-16 to the General Electric Company; and R-92-17 to the Electro-Motive Division of General Motors.

The National Transportation Safety Board is an independent Federal agency with the statutory responsibility "to promote transportation safety by conducting independent accident investigations and by formulating safety improvement recommendations" (Public Law 93-633). The Safety Board is vitally interested in any action taken as a result of its safety recommendations. Therefore, it would appreciate a response from you regarding action taken or contemplated with respect to the recommendations in this letter. Please refer to Safety Recommendations R-97-26 through -31 in your reply. If you need additional information, you may call (202) 314-6430.

Chairman HALL, Vice Chairman FRANCIS, and Members HAMMERSCHMIDT, GOGLIA, and BLACK concurred in these recommendations.

By: 
Jim Hall
Chairman