



National Transportation Safety Board

Washington, DC 20594

Safety Recommendation Report

Using Technology to Protect Maintenance-of-Way Employees

Accident Number:	DCA16FR007
Operator:	Amtrak
Accident:	Amtrak/Backhoe Collision
Location:	Chester, Pennsylvania
Date:	April 3, 2016
Recommendation Numbers:	R-18-024 and -025
Adopted:	September 28, 2018

On April 3, 2016, about 7:50 a.m. eastern daylight time, southbound Amtrak (National Railroad Passenger Corporation) train 89 struck a backhoe at milepost (MP) 15.7 near Chester, Pennsylvania. Train 89 was authorized to operate on track 3 at the maximum authorized speed of 110 mph. Two days prior to the accident, Amtrak had started track-bed restoration at MP 15.7 on track 2 in this portion of the Northeast Corridor. Track 2 was taken out of service between control points Baldwin (MP 11.7) and Hook (MP 16.8) for the 55-hour duration of the track restoration project.

As train 89 approached the work zone, the engineer saw railroad equipment and employees on and near track 3 and initiated an emergency brake application. The train speed was 106 mph before the emergency brake was applied, and 99 mph when train 89 struck the backhoe. Two maintenance-of-way (MOW) employees were killed, and 39 other people, mostly passengers, were injured.

The National Transportation Safety Board (NTSB) report on the Chester, Pennsylvania, accident detailed numerous safety deficiencies that existed at the Amtrak work site immediately prior to the accident.¹

The National Transportation Safety Board determines that the probable cause of the accident was the unprotected fouled track that was used to route a passenger train at maximum authorized speed; the absence of supplemental shunting devices, which Amtrak required but the foreman could not apply because he had none; and the inadequate transfer of job site responsibilities between foremen during the shift change that resulted in failure to clear the track, to transfer foul time, and to conduct a job briefing. Allowing these unsafe actions to occur were the inconsistent views of safety and safety management throughout Amtrak's corporate structure that led to the company's deficient system safety program that resulted in part from

¹ National Transportation Safety Board, *Amtrak Train Collision with Maintenance-of-Way Equipment, Chester, Pennsylvania, April 3, 2016*, RAR-17/02 (Washington, DC: National Transportation Safety Board, 2017).

Amtrak's inadequate collaboration with its unions and from its failure to prioritize safety. Also contributing to the accident was the Federal Railroad Administration's failure to require redundant signal protection, such as shunting, for maintenance-of-way work crews who depend on the train dispatcher to provide signal protection, prior to the accident.

This investigation found that Amtrak's safeguards to protect MOW employees failed at a number of levels, including: the MOW night foreman released his track authority improperly, the MOW day foreman did not conduct a safety briefing, and none of the work crews used supplemental shunting devices to provide redundant protection to the MOW employees, as well as other issues. These failures highlight problems with solely relying on procedural safeguards to protect MOW employees who foul tracks.

A clear understanding of how signal and train control systems affect their safety and how to avoid interfering with their proper functioning is vital to allow MOW personnel to use all available tools so there is redundant protection. Title 49 *Code of Federal Regulations (CFR)* 236.1049, "Training Specific to Roadway Workers" and 214.319, "Working Limits, Generally" directs railroads to identify, implement, and comply with the method(s) of providing redundant protections in its on-track safety program. The failure of Amtrak safeguards to protect MOW employees in these accidents highlight the importance of redundant roadway worker protection and the importance of understanding the role of signal and train control equipment to establish redundant levels of protection. These redundant levels of protection guard against the potential error by dispatching control center personnel or roadway workers-in-charge (RWIC) to remove work zone authorities without knowing if tracks are fouled by MOW crewmembers.

In March 2018, the Federal Railroad Administration (FRA) issued the *Track and Rail and Infrastructure Integrity Compliance Manual* to help FRA inspectors, specialists, and railroads to understand Roadway Worker Protection (RWP) rules and applications.² But there is no FRA guidance on RWP regulations that help railroads identify, implement, and comply with the method(s) of providing redundant protections in its on-track safety program. Therefore, the NTSB recommends that the FRA, in addition to compliance inspection activities, issue a guidance document that railroads can use to assess their on-track safety program to ensure it encompasses the role of signal and train control equipment, including redundant protection, such as supplemental shunting devices to protect roadway workers and their equipment.

Positive Train Control Technology

Positive Train Control Technology (PTC) is a technology-based system intended to reliably and functionally prevent train-to-train collisions, overspeed derailments, incursions into established work zone limits, and movements of trains through a switch left in the wrong position. PTC is designed to prevent many types of train accidents caused by human error. For PTC systems to provide redundant protection for MOW employees, a RWIC of on-track safety for a work group must establish working limits with the dispatcher. When working limits are established, PTC

² Federal Railroad Administration, *Track and Rail and Infrastructure Integrity Compliance Manual*; Volume III Railroad Workplace Safety, Chapter 3, "Roadway Worker Protection" (March 2018).

enforces the limits using the railroad's method of authorizing train movements.³ Methods of on-track safety that do not establish working limits rely solely on human awareness instead of the redundant protection that PTC provides.

Congress mandated implementation of a PTC system on each rail line over which intercity passenger or commuter service is operated or over which poison- or toxic-by-inhalation hazardous materials are transported. In 2008, Congress required the affected railroads to implement PTC by December 31, 2015. But, in late 2015, Congress extended the deadline by at least 3 years to December 31, 2018. According to the FRA's public PTC dashboard, the majority of affected railroads are implementing the necessary infrastructure to support PTC.⁴ Nonetheless, a representative of the U.S. Government Accountability Office (GAO) recently testified to the U.S. Senate Committee on Commerce, Science, and Transportation that the 41 affected railroads had significant work remaining before realizing full implementation of PTC.⁵

The Amtrak accident in Chester, as well as the other investigations, show that procedural-based protections for MOW employees are fallible to human error. Recent NTSB investigations show that MOW employees and RWIC are not likely to follow all rules without exception, and mistakes are made for a variety of reasons. Moreover, these procedural safeguards can be supplemented with PTC protections by requiring the establishment of working limits whenever the track must be fouled in controlled track territories. When working limits are established using the signal and train control systems, PTC provides a redundant level of safety by enforcing the working limits. Title 49 *CFR* Part 236, Subpart H, "Standards for Processor-based Signal and Train Control Systems" mandates that PTC prevent trains from entering into established working limits.

Recent NTSB Investigations of MOW Employee Fatalities

The NTSB has several other investigations involving failures in planned safeguards to protect MOW employees. Recent MOW employee fatalities have occurred when work groups used TAW as their method of on-track safety.⁶ These incidents have occurred on signaled tracks where MOW employees could have established working limits with the controlling dispatcher and would have benefited from PTC's redundant protection.

On January 17, 2017, about 10:09 a.m. mountain standard time, a BNSF Railway train struck and killed two MOW employees at MP 477 on the Black Hills subdivision in

³ The use of other methods of on-track safety, such as train approach warning (TAW) or individual train detection, require employees to detect an approaching train and notify coworkers in sufficient time to clear the tracks safely prior to the train's arrival at their work location.

⁴ FRA's PTC Implementation Status by Railroad dashboard is available on the Internet at <https://www.fra.dot.gov/app/ptc/>, accessed on August 18, 2018.

⁵ United States Government Accountability Office, *Positive Train Control: Many Commuter Railroads Still Have Significant Additional Implementation Work and Opportunities Exist to Provide Federal Assistance*, Testimony of GAO director of Physical Infrastructure before the United States Senate Committee on Commerce, Science, and Transportation, GAO-18-367T, March 1, 2018.

⁶ *Train approach warning* is a method of establishing on-track safety by warning MOW employees of approaching trains in ample time for them to move or to remain in a place of safety in accordance with the requirements of 49 *CFR* 214, "Railroad Workplace Safety".

Edgemont, South Dakota.⁷ The MOW employees were clearing ice and snow from a track switch. The crew of the striking train gave audible warnings and applied the emergency braking after observing the work crew, but the train could not stop before reaching the work location. Prior to the application of the emergency brake, the train was traveling about 35 mph. MOW employees in this accident were using TAW as their method of on-track protection.⁸

On June 10, 2017, about 10:12 a.m. eastern daylight time, a Long Island Rail Road train on track 3 of a four-track main line approached five MOW employees in Queens Interlocking, near Queens Village, New York. The work crewmembers, consisting of a foreman, followed by two MOW employees and a watchman, were walking single file in track 1, which ran parallel to track 3. Another MOW employee was walking along the track right-of-way.⁹ The surviving MOW employees confirmed that the watchman warned of the approaching train by raising his hand-held banner, but they disagreed about the timing of the warning. A security video revealed that the MOW employees made no attempt to clear the tracks as the train passed their location, suggesting that the watchman did not provide the warning in sufficient time for the MOW employees to clear the track safely. The two MOW employees and the flagman remained in the wayside of track 1, but the foreman moved into the path of the train. The train was traveling about 78 mph when the engineer applied emergency braking, immediately before impact with the foreman. Investigators determined that the MOW employees were using TAW as their method of on-track safety.¹⁰

Contemporary safety engineering principles advocate for the development and use of procedures and practices that protect MOW employees through layered and redundant safeguards; in other words, through concurrent and overlapping safety measures that ensure the health and safety of personnel in workplaces. Resilient and self-enforcing safety measures are key countermeasures to prevent accidents and injuries. An example of this multifaceted approach is to identify high-risk work activities that warrant focused attention and then implement complementary safety controls. The NTSB believes that, based on its investigations of accidents involving failures of individuals to follow prescribed rules and procedures, the use of layered safety protections beyond rule compliance is warranted. Therefore, the NTSB recommends that the FRA study available technologies that automatically alert MOW workers fouling tracks of approaching trains, then require that such technology be implemented as a redundant protective measure.

⁷ National Transportation Safety Board, *BNSF Railway Roadway Worker Fatalities, Edgemont, South Dakota, January 17, 2017*, RAR-18/01 (Washington, DC: National Transportation Safety Board, 2018).

⁸ For more information about this accident, see docket number DCA17FR004.

⁹ *Right-of-way* refers to a strip of land owned by the railroad on which railroad tracks are built for the operation of trains. The entire strip of land owned by the railroad is considered right-of-way, both where tracks exist and where no tracks exist. Persons are on the right-of-way when they are on railroad property whether in the foul of tracks or not.

¹⁰ For more information about this accident, see docket number DCA17FR009.

Recommendations

As a result of these investigations, the National Transportation Safety Board makes the following safety recommendations:

To the Federal Railroad Administration:

Issue a guidance document railroads can use to assess their on-track safety program to ensure it encompasses the role of signal and train control equipment, including redundant protection, such as supplemental shunting devices to protect roadway workers and their equipment. (R-18-024)

Study available technologies that automatically alert maintenance-of-way workers fouling tracks of approaching trains, then require that such technology be implemented as a redundant protective measure. (R-18-025)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

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