



National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: January 30, 2008

In reply refer to: R-08-01 through -04

Mr. John Catoe
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The National Transportation Safety Board is an independent Federal agency charged by Congress with investigating transportation accidents, determining their probable cause, and making recommendations to prevent similar accidents from occurring. We are providing the following information to urge your organization to take action on the safety recommendations in this letter. The Safety Board is vitally interested in these recommendations because they are designed to prevent accidents and save lives.

The safety recommendations in this letter are derived from the Safety Board's investigation of two accidents—the first on May 14, 2006, and the second on November 30, 2006—in which Washington Metropolitan Area Transit Authority (WMATA) Metrorail trains struck and fatally injured Metrorail employees who were working wayside near main line track. The Safety Board also notes a previous accident that occurred on October 1, 2005, in which a WMATA employee was struck and killed by a train at the Braddock Road station in Virginia. The Safety Board would appreciate a response from you within 90 days addressing the actions you have taken or intend to take to implement our recommendations.

About 10:16 a.m. on Sunday, May 14, 2006, a southbound Metrorail Red Line subway train struck and killed a Metrorail employee as the train was about to enter the Dupont Circle station in Washington, D.C. The employee was an automatic train control system mechanic who had been working with two other mechanics at the interlocking just north of the Dupont Circle station. All three mechanics had moved between the two main tracks north of the interlocking in order to stay clear of a northbound train that was leaving the station. As the southbound accident train was arriving, the other two mechanics remained in the clear between the two trains as they passed and were not injured. According to signal system data logs, the southbound train was moving about 40 mph as it traveled past the interlocking.¹

¹ For more information, see <<http://www.nts.gov/publictn/2008/RAB0801.pdf>>, National Transportation Safety Board, *Washington Metropolitan Area Transit Authority Train Strikes Wayside Worker Near Dupont Circle Station, Washington, D.C., May 14, 2006*, Railroad Accident Brief NTSB/RAB-08/01 (Washington DC: NTSB, 2008).

The Safety Board determined that the probable cause of the Dupont Circle accident was the failure of the automatic train control system (senior) mechanic to stay clear of the approaching southbound train either because he was not aware of the presence of the train or because he lacked a physical reference by which to identify a safe area outside the train's dynamic envelope.

About 9:30 a.m. on Thursday, November 30, 2006, a northbound Metrorail Yellow Line subway train struck and fatally injured two Metrorail employees who were performing a routine walking inspection along an outdoor section of main track near the Eisenhower Avenue station in Alexandria, Virginia. The accident occurred as the northbound train was traveling along track normally used for southbound traffic.²

The Safety Board determined that the probable cause of the Eisenhower Avenue accident was the failure of the walking track inspectors to maintain an effective lookout for trains and the failure of the train operator to slow or stop the train until she could be certain that the workers ahead were aware of its approach and had moved to a safe area. Contributing to both accidents were Washington Metropolitan Area Transit Authority Metrorail right-of-way rules and procedures that did not provide adequate safeguards to protect the wayside personnel from approaching trains, that did not ensure that train operators were aware of wayside work being performed, and that did not adequately provide for reduced train speeds through work areas. Also contributing to these accidents was the lack of an aggressive program of rule compliance testing and enforcement on the Metrorail system.

Right-of-Way Procedures

Safety rules and procedures covering wayside work are in the *Metrorail Safety Rules and Procedures Handbook*. Although the rules and procedures address steps to be taken by Operations Control Center (OCC) controllers, by train operators, and by the wayside workers at any time work is to be performed on or near Metrorail tracks, the investigations determined that the rules and procedures in effect when the accidents happened placed ultimate responsibility for worker safety on the workers themselves.

For example, workers were required to notify the OCC and receive permission before beginning work wayside. The workers involved in both the Dupont Circle and Eisenhower Avenue accidents called the control center before going wayside and received the requisite permission to proceed. In both cases, control center controllers made blanket radio announcements to train operators notifying them of the work and the approximate location. However, only one radio announcement was made in each case, and train operators using the affected lines were not required to acknowledge receipt of the notification.

In the Dupont Circle accident, the single radio announcement was transmitted about 1 hour before the accident. The operator of the northbound train that departed the station at the time of the accident said that she did not recall having heard any radio announcements regarding

² For more information, see <<http://www.nts.gov/publictn/2008/RAB0802.pdf>>, National Transportation Safety Board, *Washington Metropolitan Area Transit Authority Train Strikes Wayside Workers Near Eisenhower Avenue Station, Alexandria, Virginia, November 30, 2006*, Railroad Accident Brief NTSB/RAB-08/02 (Washington DC: NTSB, 2008).

wayside workers near Dupont Circle. The operator of the southbound accident train recalled having heard an announcement about wayside workers but was not sure of the details.

In the Eisenhower Avenue accident, the only radio message to train operators about the presence of wayside track inspectors was made almost 2 hours before the accident. It was a general announcement notifying train operators that track walkers would be inspecting track between the Huntington and Crystal City stations, a distance of about 5 miles. No additional announcements were made when the work was actually begun or as it progressed. The operator of the accident train indicated that she was not aware of the presence of the workers until she saw them along the right-of-way about 15 seconds before impact.

The *Metrorail Safety Rules and Procedures Handbook*, Rule 4.180b, stated:

Prior to entering the track area, [work crews shall] contact OCC for mainline access . . . indicating the work area and the purpose of the work. **If required, a request shall be made for OCC . . . to make periodic radio announcements to Train Operators.** [Emphasis added.]

A related rule, Rule 4.180.1, stated:

OCC shall make periodic (20-minute) radio announcements to inform Train Operators of those locations at which . . . maintenance actions are being performed within the dynamic outline of a train. **These announcements shall be made as deemed necessary and as requested by the maintenance personnel performing the work.** [Emphasis added.]

As shown by the emphasized text, the rules placed responsibility on the workers for requesting that the control center keep train operators apprised of their presence. Further, even when such requests were made, the rule left it to train controllers to determine when such announcements were “deemed necessary.” These practices are not sufficient to protect wayside workers.

In both the Dupont Circle and Eisenhower Avenue accidents, train operators ran their trains as if no workers were present or were likely to be present along their routes. The rules and procedures in effect at the time did not require that trains be operated in manual mode or at reduced speeds through work areas, either of which would have given the train operators a better opportunity to respond if wayside workers failed to move into the clear at the approach of a train.

The *Metrorail Safety Rules and Procedures Handbook*, Rule 3.87, stated:

Rail Operators shall maintain a constant lookout in the direction in which vehicles are moving. When rail operators observe persons on the right-of-way, they shall use the horn to warn those persons of the vehicles approach. If an appropriate acknowledgement of the horn signal is not received, the vehicle shall be brought to an immediate stop.

This rule did not account for the fact that, depending on the sight distance and as shown in both the Dupont Circle and Eisenhower Avenue accidents, trains being operated at normal speeds may not be able to stop short of wayside workers who are unaware of the train's approach and have failed to move to a safe area. The rules did permit wayside workers to request that the control center reduce train operating speeds in the areas in which they were working, but interviews with WMATA maintenance supervisors indicated that such requests were discouraged by train controllers and thus were seldom made.

The *Metrorail Safety Rules and Procedures Handbook* did not require that the leader of a work crew conduct job briefings before beginning wayside work or when the nature of the work or the number of workers changed. In the Dupont Circle accident, the number of workers wayside changed during the course of the work, as did the nature of the task. With each change, the crew should have discussed the work that was to be done and who would do it. Such a discussion would have included identifying a person to serve as lookout and establishing the procedures to be used to ensure that all members of the work crew were aware of the approach of a train from either direction and were in the clear before the train arrived. The discussion also would have included identifying the worker who would be responsible for signaling *all clear* to approaching trains, as well as the manner of the signal.

For walking track inspectors, Metrorail's rules and procedures did not require that a lookout be assigned to help protect the walkers during their work. The track walkers were expected to perform their inspection while simultaneously watching for the arrival of trains from either direction at any time.

Actions Taken Since Accidents

On June 26, 2006, following the Dupont Circle accident, WMATA issued Special Order No. 06-05, which revised *Metrorail Safety Rules and Procedures Handbook* Safety Rule 4.180 by providing for reduced train speeds in areas where workers were at a stationary location for more than 3 minutes. On February 22, 2007, after the Eisenhower Avenue accident, WMATA issued Special Order No. 07-01, which superseded Special Order No. 06-05. Special Order 07-01 modified Safety Rules 4.165, 4.180, and 4.180.1 and Operating Rule 3.87. The modified rules revised and expanded the requirements for track inspectors to report their activities and locations to the control center before entering and while working wayside. The rule modifications also required that radio announcements be made every 20 minutes (or more often if requested by the work crew) regarding personnel working on the right-of-way. The rule modifications also required that speeds be reduced for trains approaching and traveling through work areas.

On April 16, 2007, WMATA issued Special Order No. 07-02, which superseded Special Order 07-01 and further modified Safety Rules 4.165, 4.180, and 4.180.1 and Operating Rule 3.87. The rule modifications required employees to obtain the OCC's permission before entering the right-of-way or crossing tracks, and the modifications expanded the procedures that the OCC, train operators, and maintenance/wayside workers must follow while personnel are on the right-of-way.

On November 9, 2007, WMATA replaced Special Order 07-02 with Special Order 07-06, which contained additional modifications. Special Order 07-06 also consolidated all the previous modifications and presented them in both a detailed and a summary format.

The Safety Board also notes that WMATA, in 2007, issued two memorandums concerning walking inspections. The first of these directed that one member of a two-person inspection team be a watchman/lookout while the other member performs the inspection. The second confirmed that walking inspections are to be done only during non-rush hours or after revenue service has ended.

While none of the rule changes and procedural revisions relieve wayside workers of the responsibility for their own safety, the additional requirements placed on train controllers and train operators by the revisions could enhance safety by providing additional layers of worker protection. The Safety Board notes, however, that these revisions were made in direct response to the circumstances of the Dupont Circle and Eisenhower accidents and were intended to address the specific deficiencies in the rules and procedures handbook that had contributed to those accidents. The Board is concerned that additional deficiencies may exist that have not been addressed.

The Safety Board believes that WMATA should review its *Metrorail Safety Rules and Procedures Handbook* and revise it as necessary to create additional layers of protection for wayside workers, including: adding requirements for wayside pre-work job briefings to ensure that all workers are informed of their duties, of their respective roles in work crew safety, and of the areas that are to be used to stay clear of trains; requiring that when train operators request permission to either enter a main track, or when a train is turned for a return trip, the train operators along the affected lines must acknowledge receipt of the updated radio announcement from the control center regarding wayside workers; and establishing procedures to be used for members of a work crew to acknowledge a lookout's warning that a train is approaching on a particular track from a particular direction before a lookout gives an *all clear* signal to a train.

Safety Rules Compliance Audits

In addition to deficiencies in Metrorail's right-of-way safety rules and procedures, the Safety Board's investigation of these two accidents revealed deficiencies in employee rule compliance. In the Dupont Circle accident, the workers violated *Metrorail Safety Rules and Procedures Handbook* Rule 4.181, which required that the workers discuss and have a clear understanding of where each would go to remain clear of passing trains.

In the Eisenhower Avenue accident, the accident train operator did not request permission of the terminal supervisor to depart the station and enter the main line as required by Rule 3.13.1. Also in the Eisenhower Avenue accident, if one of the track walkers did give a hand signal to the operator of the approaching accident train, the signal was not as described in the rules and procedures. The train operator apparently misinterpreted the walker's actions as being an *all clear* signal even though it was not an appropriate signal as provided for in the rules. Further, even though the track walkers obviously did not maintain an effective lookout and move to an area that was in the clear of the approaching train, the train operator took no action to slow or stop the train before the accident occurred.

In general, compliance with Metrorail operating and safety rules and procedures was required by management but was not consistently monitored or enforced. Metrorail managers did not conduct frequent unannounced rules compliance field audits, commonly referred to in the railroad industry as “efficiency tests,” to determine whether or how well employees were complying with Metrorail rules and procedures. Such tests, which typically involve unannounced field observations, job site interviews, and inspections of equipment, can provide supervisors with the opportunity to acknowledge a job well done, as well as to correct unsafe practices. Efficiency testing programs have been proven effective in the railroad industry and are required by the Federal Railroad Administration.

The American Public Transportation Association has a standard for rule compliance that outlines the basic elements of a rules compliance program for transit agencies. This standard states that each rail transit agency shall develop a formal process of observations to evaluate and verify that rules are followed. It also states that the auditing requirements include the following elements:

- Evaluation Process
- Organizational Responsibility
- Evaluation Cycle / Definition of the Frequency of Compliance Checks
- Method of Verification
- Record Keeping
- Corrective Action

Further, as a result of its investigation of two rear-end collisions involving Chicago Transit Authority rapid transit trains in Chicago, Illinois, on June 17 and August 3, 2001,³ the Safety Board issued the following recommendation⁴ to the Chicago Transit Authority:

R-02-22

Develop and implement systematic procedures for performing and documenting frequent management checks to ensure all operating personnel are complying with Chicago Transit Authority operating rules, including speed restrictions and signal rules.

Metrorail informed the Safety Board that in January 2007, rail supervisors on all lines were given “smart phones” that can record rail quality checks electronically and that rail quality check and station spot check forms were developed to record the results of in-service performance of operators. These checks, previously recorded by hand, include evaluations of train handling, announcements, rule adherence, and understanding of train operations. Supervisors can then download the stored data to a central server from their reporting locations

³ For more information, see <<http://www.nts.gov/publictn/2002/SIR0201.pdf>>. National Transportation Safety Board, *Two Rear-End Collisions Involving Chicago Transit Authority Rapid Transit Trains at Chicago, Illinois, June 17 and August 3, 2001*, Special Investigation Report NTSB/SIR-02/01 (Washington DC: NTSB, 2002).

⁴ Safety Recommendation R-02-22 was classified "Closed—Acceptable Action" on April 15, 2004.

for review. Initial reporting tools allow supervisors to monitor performance and to identify those operators who require follow-up checks, as well as those who are due an in-service inspection.

While the Safety Board is encouraged by these efforts, the Board believes that WMATA should establish a systematic program for frequent unannounced checks of employee compliance with Metrorail operating and safety rules and procedures. The Safety Board also believes that WMATA should perform periodic hazard analyses on the deficiencies identified by unannounced checks of employee compliance, and use the results to revise its training curricula or enforcement activities, as necessary, to improve employee compliance with operating and safety rules and procedures.

Technologies for Wayside Worker Protection

Technology can provide additional protection for wayside workers, especially in a work environment in which a lapse of attention can quickly result in serious injury or death. In June 2006, the Federal Transit Administration provided funding to a manufacturer for early alarm system technology to automatically alert wayside workers of approaching trains, to alert train operators when they are approaching wayside work areas, and to detect train overspeed if the train operator does not respond appropriately to the work zone notification. There are two versions of early alarm technology presently available from this manufacturer.

One version utilizes a portable track-mounted unit that can alert wayside crews of approaching trains, but it does not alert the train operator. This system uses a portable train detector that is attached to the running rail near the track work area. The train detector communicates with a portable warning light/horn unit located near the work crew or flagman/lookout. The train detector also communicates with a personal pocket device that can be carried by each wayside worker. When the portable track-mounted unit detects a train on the track, the warning light/horn unit and the personal pocket devices are activated to alert the wayside workers of the approaching train.

The other version, mounted in the cab of the train, provides alerts to the train operator and the wayside workers. The system provides train operators with an audible and a visual alarm when they are approaching wayside workers who are near the tracks and are wearing a personal pocket device. The system provides overspeed detection and alerts the wayside workers wearing a personal pocket device that the train is approaching. Pilot projects have been tested on several transit properties. The Massachusetts Bay Transportation Authority and the Maryland Transit Administration are installing this early alarm equipment system-wide.

The Safety Board believes that WMATA should promptly implement appropriate technology that will automatically alert wayside workers of approaching trains and will automatically alert train operators when approaching areas with workers on or near the tracks.

Therefore, the National Transportation Safety Board makes the following safety recommendations to the Washington Metropolitan Area Transit Authority:

Review your *Metrorail Safety Rules and Procedures Handbook* and revise it as necessary to create additional layers of protection for wayside workers, including:

- Adding requirements for wayside pre-work job briefings to ensure that all workers are informed of their duties, of their respective roles in work crew safety, and of the areas that are to be used to stay clear of trains.
- Requiring that when train operators request permission to either enter a main track, or when a train is turned for a return trip, the train operators along the affected lines must acknowledge receipt of the updated radio announcement from the control center regarding wayside workers.
- Establishing procedures to be used for members of a work crew to acknowledge a lookout's warning that a train is approaching on a particular track from a particular direction before a lookout gives an *all clear* signal to a train. (R-08-01)

Establish a systematic program for frequent unannounced checks of employee compliance with Metrorail operating and safety rules and procedures. (R-08-02)

Perform periodic hazard analyses on the deficiencies identified by unannounced checks of employee compliance in response to Safety Recommendation R-08-02, and use the results to revise Metrorail training curricula or enforcement activities, as necessary, to improve employee compliance with operating and safety rules and procedures. (R-08-03)

Promptly implement appropriate technology that will automatically alert wayside workers of approaching trains and will automatically alert train operators when approaching areas with workers on or near the tracks. (R-08-04)

Please refer to Safety Recommendations R-08-01 through -04 in your reply. If you need additional information, you may call (202) 314-6177.

Chairman ROSENKER, Vice Chairman SUMWALT, and Members HERSMAN, HIGGINS, and CHEALANDER concurred in these recommendations.

[Original Signed]

By: Mark V. Rosenker
Chairman