



# National Transportation Safety Board

Washington, D.C. 20594

## Railroad Accident Brief

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<b>Accident No.:</b>	DCA-07-FR-004
<b>Transit System:</b>	Washington Metropolitan Area Transit Authority Metrorail System
<b>Train:</b>	Metrorail Yellow Line train
<b>Location</b>	Near Eisenhower Avenue Metrorail station, Alexandria, Virginia
<b>Date:</b>	November 30, 2006
<b>Time:</b>	9:30 a.m. <sup>1</sup>
<b>Fatalities:</b>	2
<b>Type of Accident:</b>	Train strikes wayside workers

### Synopsis

About 9:30 a.m. on Thursday, November 30, 2006, a northbound Washington Metropolitan Area Transit Authority (WMATA) 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.

### Events Preceding Accident

About 7:00 a.m. on November 30, 2006, two WMATA Metrorail track inspectors (track walkers) reported for duty at the Metrorail yard in Alexandria, Virginia. One of the track walkers was working his regular assignment; the other was filling a vacancy caused by the temporary absence of the regularly assigned employee. The track walkers' workday began with a routine safety meeting with the track supervisor, including a discussion of the area of track to be inspected that day.

The Metrorail system uses double main tracks, designated track 1 and track 2. The track walkers' assignment on this day was to inspect track 2 between the Huntington station in Alexandria (the southern terminus of Metrorail's Yellow Line) and the Crystal City station in Arlington, Virginia, a distance of about 5 miles. The track walkers were to work as a team, inspecting adjacent rails on the same track while jointly looking out for train movements.

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<sup>1</sup> All times in this brief are eastern standard time.

The tracks in this area generally run in a north-south direction. Southbound trains toward the Huntington station normally use track 2, which is the westernmost track, while trains traveling northward toward the Yellow Line's northern terminus at the Mt. Vernon Square station in Washington, D.C., normally use track 1.

About 7:41 a.m., as required by Metrorail rules and procedures, the walkers radioed the Metrorail Operations Control Center<sup>2</sup> to request permission to go wayside to perform their walking track inspection. Train controllers at the control center granted permission, then made a blanket radio announcement to all trains on the Blue and Yellow Lines<sup>3</sup> informing train operators that walkers would be on track between the Huntington and Crystal City stations. This was the only announcement made by the control center in regard to this work.

The *Metrorail Safety Rules and Procedures Handbook*, Rule 4.180.1, stated:

OCC [Operations Control Center] shall make periodic (20-minute) radio announcements to inform Train Operators of those locations at which corrective maintenance actions are being performed within the dynamic outline<sup>[4]</sup> of a train. These announcements shall be made as deemed necessary and as requested by the maintenance personnel performing the work.

Security camera video recordings showed the two track walkers on the Huntington station platform conversing with a train operator at 9:06 a.m.<sup>5</sup> About the same time, the morning rush period was ending,<sup>6</sup> and some southbound trains arriving at the Huntington station were being placed in “lay-up” status; that is, they were being removed from service and routed to the Alexandria Yard rather than returning northbound.<sup>7</sup>

The trains being placed in lay-up status would have normally traveled northbound along track 1 before diverting onto the track 1 westbound lead toward the Alexandria Yard. But because the westbound yard lead from track 1 was out of service (and had been out of service for the previous 3 months), trains bound for the yard were being routed northbound on track 2

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<sup>2</sup> The *Operations Control Center* coordinates and dispatches all train movements on the Metrorail system. The control center also receives written notice of the areas of track inspection at the beginning of each workday.

<sup>3</sup> Blue and Yellow Line trains share a portion of the main line tracks between the two stations.

<sup>4</sup> *Dynamic outline*, or dynamic envelope, refers to the total area occupied by a moving train. It not only incorporates the physical dimensions of the equipment but also accounts for suspension travel, overhang on curves, or lateral motion along the track.

<sup>5</sup> The whereabouts and activities of the two track walkers between 7:41 a.m., when they made their call to the control center, and 9:06 a.m. could not be determined. Interviews with other Metrorail employees indicated that track inspectors typically do paperwork or other indoor activities until the end of the morning rush period, when fewer trains are in service.

<sup>6</sup> WMATA defines the morning rush hours as 5:30 a.m. to 9:30 a.m. and the afternoon rush hours as 3:00 p.m. to 7:00 p.m.

<sup>7</sup> These trains would be available to replace malfunctioning trains, or they could be placed back in service for the afternoon rush hours.

(against the normal southbound flow of traffic) for about 3/4 mile until they could be routed onto the track 2 westbound yard lead just north of the Eisenhower Avenue station.

About 9:23 a.m., a train that was being removed from service departed the Huntington station on track 2 en route to the Alexandria Yard. Security camera videos showed that about 2 minutes later, the two walkers departed the Huntington station platform heading north along track 2.

The *Metrorail Safety Rules and Procedures Handbook*, Rules 4.163 through 4.199, stated, in part:

4.166 When on the right-of-way, employees shall be responsible for their own safety.

4.167 Employees shall look in each direction before entering upon or standing close to a track.

4.180 When it is necessary for employees to walk beyond the platform end gate where the walkway is not protected by a handrail, or to walk or work on tracks around moving trains or track equipment, they shall [abridged]:

a. Expect rail vehicle movement at any time, in either direction, on either track.

b. Prior to entering the track area, contact OCC for mainline access and/or the appropriate tower for yard access, indicating the work area and the purpose of the work. If required, a request shall be made for OCC or the Interlocking Operator to make periodic radio announcements to Train Operators....

e. Maintain a careful lookout in both directions to ensure that approaching trains and track equipment are seen before they become hazards.

f. Walk against the direction of traffic when possible.

g. When a rail vehicle approaches, STAY CLEAR...acknowledge all vehicle horns with the appropriate hand signals.

About 9:27 a.m., another southbound train (the accident train) arrived at the Huntington station on track 2. The Huntington terminal supervisor also placed this train in lay-up status and called the control center to notify train controllers that the train should be routed to the

Alexandria Yard. The controllers lined the yard lead switch and set the signals, and the Huntington terminal supervisor radioed the train operator to take the train northbound on track 2, without passengers, to the Alexandria Yard.

According to the *Metrorail Safety Rules and Procedures Handbook*:

3.13.1 Prior to leaving a supervised terminal, train operators shall contact the terminal supervisor one (1) minute prior to their scheduled dispatch time and request permission to leave the terminal.

3.13.2 Upon receiving the request, terminal supervisors shall visually check the interlocking panel and verify that the train has a lunar signal and correct alignment for the desired route. The train operator will then be granted permission to leave by the supervisor.

A review of radio audio recordings revealed that the operator of the accident train did not request permission to leave the Huntington station before departing the station northbound on track 2.<sup>8</sup> She told investigators she was not able to hear all of the instructions from the terminal supervisor because of a “thumping” noise that was interfering with communications on the train radio. The Huntington terminal supervisor said that the signals and switches were properly lined for the yard and that, based on the actions of the train operator, she concluded that the train operator had heard the instructions to take the train into the yard. Operations center controllers did not, and were not required to, warn the track walkers that a train would be approaching the area they were inspecting and that this train would be coming from the south, moving against the normal flow of traffic.

## Accident Sequence

The accident train departed the Huntington station with no passengers at about 9:29 a.m. The train was being operated in manual mode 2, meaning that the train operator manually initiated acceleration and braking.<sup>9</sup> After clearing the interlocking<sup>10</sup> just north of the Huntington station, the operator gradually accelerated the train to about 38 mph. (The maximum authorized speed was 45 mph.) At the same time, the two track walkers were walking, one behind the other, along the west side of an outdoor section of track 2 just south of the Eisenhower Avenue station.

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<sup>8</sup> Investigators reviewed the accident train operator's cell phone records and determined that a 50-second call was received as the train either approached or stopped at the Huntington station. Records indicate that no call was made as the train moved from Huntington station to the accident site.

<sup>9</sup> In normal revenue service, Metrorail trains operate in automatic mode with little or no control input from the train operator. In manual mode 2, the operator controls acceleration and braking, but maximum speed is limited by the automatic train control system.

<sup>10</sup> An *interlocking* is a crossover track that allows trains, when necessary, to move from one main track to the other.

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.

The operator stated that she saw the two track walkers ahead and sounded the train horn. The train's data recordings confirmed that the train horn had been sounded when the train was about 698 feet (about 15 seconds) from the track walkers' location.<sup>11</sup> Postaccident sight-distance tests showed that the two workers would have been visible to the train operator from this location but that the operator would not have been able to tell whether the walkers were on track 1 or track 2. Postaccident tests also confirmed that the train horn would have been audible to the workers at this location and at this distance.

The operator stated that the walkers responded to the train horn with a variation of a move-forward hand signal. Specifically, she said, the walkers responded with an "over the shoulder" vertical hand movement while facing away (facing north).

According to the *Metrorail Safety Rules and Procedures Handbook*:

3.146 Employees engaged in work that can obstruct the safe passage of trains must be provided with flagging protection.

3.167 Hand signal indication and aspects are:

e. Move Forward – Move hand, flag, or light up and down in a vertical motion.

The accident train continued, and at 241 feet (about 4 seconds) from the walkers' position, the train operator again sounded the train horn. Sight-distance tests confirmed that the walkers were visible from the train operator's position at this location and that the operator could have determined whether the walkers were either clear of or fouling track 2. Also at that point, the track walkers would have been able to determine that the approaching train was operating on track 2.

The operator stated that the walkers acknowledged the train horn and were walking northward on the safety walkway along the west side of the track as the train approached. But,

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<sup>11</sup> According to postaccident train braking calculations, at the speed the train was traveling at the time the track walkers were visible, the train could not have stopped before it reached their location.

the train operator said, as her train passed the location of the walkers, she heard the train strike something, after which she activated maximum service braking.

The investigation revealed that the left front side of the train had struck the track walkers as they were walking northward, one behind the other, just outside the west rail of track 2. When the train struck, it was going about 35 mph. Video images from the Eisenhower station platform security camera showed no reaction to the train from the lead track walker just before the accident. The regularly assigned track walker, who was walking behind the other walker, was struck first and knocked clear of the train. He survived 7 days before succumbing to his injuries. The other walker died at the scene. No evidence was found to indicate that drug or alcohol use by the train operator or the track walkers was causal or contributory to the accident.

## **Actions Taken Since Accident**

Effective February 22, 2007, WMATA issued Special Order 07-01, which modified the *Metrorail Safety Rules and Procedures Handbook*, Safety Rules 4.165, 4.180, and 4.180.1 and Operating Rule 3.87. On April 16, 2007, WMATA issued Special Order 07-02, which replaced 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 that the control center grant permission before employees could enter the right-of-way or cross tracks. The revised rules generally expanded the procedures to be followed by train controllers, train operators, and maintenance/wayside workers while personnel were on the right-of-way.

On August 16, 2007, WMATA issued a memorandum to all track walkers with the subject “Increased Safety of Track Inspections.” The memorandum directed that one member of a two-person inspection team be designated to provide watchman/lookout protection while the other team member performed the track inspection. The memorandum further specified that the watchman/lookout should walk approximately 50 feet (or a “sufficient distance”) from the inspector to be able to warn of approaching trains. The watchman/lookout is required to have all prescribed personal protective equipment, including a communications radio, a Metrorail-issued cell phone, a flashlight, a whistle, an air horn, and a shunt. On September 13, 2007, WMATA issued another memorandum confirming its previous oral instructions that track walkers inspect track only during non-rush hours, except in an emergency, or after revenue service is over.

On November 9, 2007, WMATA replaced Special Order 07-02 with Special Order 07-06, which had additional modifications. Special Order 07-06 also consolidated all the previous modifications and presented them both in detail and in summary. The summarized procedures follow:

Rule 4.180: Employees entering the right-of-way:

- Carry a portable radio and wear the approved safety vest.

- Contact [and receive permission from] OCC prior to entering the right-of-way.
- Notify Terminal Supervisors [with information regarding scheduled track inspections].
- Request [radio] announcements.
- Keep OCC informed of your location. [Request/confirm that OCC has established prohibits and track-block protection in the area of the planned walking inspection.]
- Maintain a careful lookout for approaching vehicles on any track, from any direction.
- Walk against the direction of traffic when possible.
- When a vehicle approaches, stay clear and acknowledge the vehicle with the prescribed hand signals.
- Designate a lookout when required [while working at a stationary location].
- Use one of the prescribed methods of protection for the work crew [For example, insertion of a switch crank, application of a shunt strap, etc.]
- Clear the right-of-way when notified of a single tracking operation.
- Inform OCC when leaving the right-of-way.

Rule 4.80.1: OCC actions with personnel on the right-of-way:

- Make appropriate announcements at regular intervals. [Minimum of 20-minute intervals unless more frequent announcements are requested by work crews.]
- Take appropriate steps to protect work crews. [For example, set prohibits and blocked-track commands.]
- If communication is lost with work crew, take steps to determine the crew's whereabouts. [Until crew location is identified, limit train speeds to 10 mph through work area.]

Rule 3.87: Rail Vehicle Operators when personnel are on the right-of-way:

- Maintain a constant lookout in the direction of travel.
- Operate the train in Mode 2, Level 1, at a speed no greater than 35 mph.
- Slow to no greater than 10 mph and sound mainline horn when work crew is spotted.
- Come to an immediate stop if the appropriate proceed hand signal is NOT observed and notify OCC.
- Return to the prescribed operating mode after clearing the work area.

## Probable Cause

The National Transportation Safety Board determines 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 the accident were Washington Metropolitan Area Transit Authority Metrorail right-of-way rules and procedures that did not provide adequate safeguards to protect wayside personnel from approaching trains, that did not ensure that train operators were aware of the wayside work being performed, and that did not adequately provide for reduced train speeds through work areas. Also contributing to the accident was the lack of an aggressive program of rule compliance testing and enforcement on the Metrorail system.

## Recommendations

As a result of its investigations of this accident and a May 14, 2006, fatal accident involving the striking of a wayside worker by a Metrorail Red Line train,<sup>12</sup> the National Transportation Safety Board made the following safety recommendations to the Washington Metropolitan Area Transit Authority. (For more information about these recommendations, see the safety recommendation letter issued to the recipient.<sup>13</sup>)

### To the Washington Metropolitan Area Transit Authority:

1. 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.

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<sup>12</sup> National Transportation Safety Board, *Washington Metropolitan Area Transit Authority Train Strikes Wayside Worker Near the Dupont Circle Station, Washington, D.C., May 14, 2006*, Railroad Accident Brief NTSB/RAB-07/XX (Washington DC: NTSB, 2007). <<http://www.ntsb.gov/publictn/2008/RAB0801.pdf>>

<sup>13</sup> The recommendation letter are available on the Safety Board's Web site at <<http://www.ntsb.gov/>>.

- 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)
- 2. Establish a systematic program for frequent unannounced checks of employee compliance with Metrorail operating and safety rules and procedures. (R-08-02)
- 3. 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)
- 4. 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)

## **BY THE NATIONAL TRANSPORTATION SAFETY BOARD**

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