National Transportation Safety Board

Railroad Accident Brief

Derailment of WMATA Metrorail Train in Interlocking Falls Church, Virginia

The Accident

On July 29, 2016, about 6:14 a.m. eastern daylight time, outbound (westbound) Washington Metropolitan Area Transit Authority (WMATA) Metrorail train 602 derailed while traversing a crossover in the East Falls Church interlocking, operating on the Silver Line in Falls Church, Virginia. About 63 passengers were on board the six-car passenger train, all of whom were evacuated out of the lead car, assisted by the Metro Transit Police Department. Three passengers reported injuries, including one who was hospitalized.

The Investigation

Crosstie Standards

Metrorail Train 602 derailed while traversing a crossover moving from track K1 to track K2. Two National Transportation Safety Board (NTSB) investigators noted the track gage measurement near the point of derailment (POD) was nearly 2 inches wider than acceptable by WMATA standards.[1] For tracks of similar construction to the accident area, WMATA requires that track gage in excess of 57-1/4 inches be removed from service—track gage near the POD measured 59 inches.[2] Investigators also identified many defective crossties in the area of the derailment. WMATA track standards require there be no more than 120 inches between nondefective rail fasteners for tracks of similar construction; however, in this accident area, investigators noted over 400 inches of track with no effective rail fasteners because of deteriorated crossties.[3]

WMATA has standards that address defective crossties; however, it was not apparent that the track structure in the accident area was consistently maintained to those standards. The Federal Transit Administration (FTA), which is responsible for the federal oversight of WMATA, does not prescribe minimum track safety standards. Although it was given authority to issue safety standard regulations through the Moving Ahead for Progress in the 21st Century Act (MAP-21), FTA has stated that it only intends to develop voluntary safety standards.[4] As a result of the investigation into the WMATA Metrorail smoke and arcing accident near L'Enfant Plaza Station on January 12, 2015, the NTSB issued urgent recommendations to the US Secretary of Transportation to transition the federal oversight of WMATA from the FTA to the Federal Railroad Administration (FRA).

[1] The NTSB did not lead the investigation or establish parties; *Track gage* is the spacing of the rails measured between the inner faces of the load-bearing rails.

[2] *Remove from service* means immediately prohibiting any movement on the track until the defect is corrected.

[3] Washington Metropolitan Area Transit Authority, *WMATA Track Maintenance and Inspection Manual*, Revision 6, TRST-1000, Section 2. (Washington, DC: Washington Metropolitan Area Transit Authority, 2015).

[4] Section 20021 of Public Law 112-141, July 6, 2012, codified at Title 49 *United States Code* (*USC*) § 5329.

FRA regulations also contain safety standards.[5] However, there are differences between the WMATA standards and the FRA standards. Table 1 outlines the characteristics of defective crossties, based on the respective standards.

Table 1. Characteristics of Defective Crossties.

WMATA	FRA
Broken through between the field ends of the tie plates	Broken through
Split or impaired to the extent that it cannot hold spikes or ballast can work through the tie	Split or otherwise impaired to the extent the crossties will allow the ballast to work through, or will not hold spikes or rail fasteners
Plate-cut more than 1 inch	So deteriorated that the tie plate or base of rail can move laterally 3/8 inch relative to the crossties
Deteriorated such that the tie plate or base of the rail can move laterally more than 1/4 inch relative to the crosstie	Cut by the tie plate through more than 40 percent of a crosstie's thickness
Spike-killed to the extent it can no longer effectively hold spikes or plate hold down fasteners	N/A
There are less than two spikes along each rail except in cases of special tie plates design	N/A

Note: WMATA designates six characteristics, while FRA designates four.

East Falls Church Accident Investigation

Investigators determined that the POD was in the connection track between the switch and the diamond.[6] In the derailment area, the rail was fastened through tie plates to standard wooden crossties with conventional six-inch cut track spikes. The ties were nominally spaced 27 inches on center. The spiking pattern used by WMATA prior to the derailment consisted of one rail-holding spike on the gage side of the rail, and one rail-holding spike and one anchor spike on the field side of the rail.[7] The *WMATA Track Maintenance and Inspection Manual* requires "no fewer than seven nondefective crossties within 40 feet," and requires that track with more than 120 inches between nondefective rail fasteners be removed from service.

There were 18 crossties in 40 feet of track near the POD. Of those, 16 were not in compliance with WMATA standards or FRA track safety standards, resulting in about 400 inches of unsupported rail. The deteriorated crosstie condition allowed for a total dynamic track gage

[5] Title 49 *Code of Federal Regulations* (*CFR*) 213.109(c). The Federal Transit Administration (FTA), which currently has oversight over WMATA, has no regulation for minimum track safety standards.

[6] A *diamond* is a track structure used where one track crosses another at grade.

[7] Railroad rails have two sides—referred to as the gage side and the field side. The gage side of the rail faces toward the inside of the track structure, the space between the rails. The field side of the rail faces toward the outside of the track structure and away from the center of the track.

measurement of 59 inches.[8] When track gage is too wide, the proper wheel-rail interface cannot be maintained and derailment is likely. (See figure 1.)

Figure 1. Equipment wheel misalignment and rail head discoloration.

The area where the train derailed should have been easily identified by WMATA and FTA as an area of concern because discoloration on the running surface of the north rail was visible, indicating that the wheels of the passenger vehicles were not properly aligned with the running rails. (See figures 1 and 2.)

[8] *Dynamic track gage* is acquired by adding any lateral movement of the rails to the static track gage measurement. This reflects the overall distance between the two rails when normal lateral forces are exerted during train movements.

Figure 2. Deteriorated crossties at accident location. The gage rods were added postaccident.

Also, the lateral movement of the tie plate in relation to the crosstie was noted throughout the derailment area. Investigators observed a static track gage measurement of 58-1/4 inches, with an additional lateral movement of 3/4 inch, totaling 59 inches of dynamic track gage.[9]

On August 6, 2015, a similar accident occurred on the WMATA system. A nonrevenue employee train, WMATA Metrorail train 412, derailed on approach to track 2 of the D02 (Smithsonian) Interlocking. Three of the six cars derailed; none of the derailed cars had reached the switch points of the interlocking. WMATA's investigation into the derailment revealed that on July 9, 2015, a WMATA track geometry vehicle inspected track measurements through the area where the train derailed. This inspection revealed a gage defect of 58-1/16 inches at chain marker D2-22+41, the area where train 412 derailed less than 1 month later. This gage exceeded WMATA's maximum gage standard.

WMATA guidelines required immediately removing the track from service, based on the wide gage measurement, until repairs are completed. WMATA continued to run revenue service

[9] *Static track gage* is acquired by measuring the distance between the rail heads at right angles to the rail in a plane 5/8 of an inch below the top of the rail head.

trains over the track, with no reduction in speed or other mitigation action, for the 27 days between the discovery of the gage defect and the derailment on August 6, 2015.

WMATA Track Inspection

The *WMATA Track Maintenance and Inspection Manual* provides instruction for track maintenance and inspection procedures on the WMATA rail system. According to the manual, all main tracks and secondary tracks will be examined on foot by qualified track personnel twice each week with an interval of a least 1 calendar day between inspections. Similarly, FRA regulations require that track of similar construction and geometry characteristics to the track involved in this accident be inspected twice weekly with at least 1 calendar day interval between inspections. Further, FRA inspectors routinely review track inspection records for compliance with FRA regulations and railroad rules and procedures.

NTSB investigators reviewed transcripts of interviews with WMATA track inspectors and track supervisors and learned that WMATA only inspected some crossover switches, such as the one involved in this derailment, on a monthly basis. The WMATA general manager instructed the Metro Transit Police Department to open a parallel investigation with the WMATA Safety Department due to conflicting information from employee interviews, inspection reports, rail defect tracking, and video recordings.[10]

NTSB investigators reviewed WMATA's monthly switch inspection reports from January 2015 to July 2016.[11] Investigators noted that all of the inspection reports for the crossover involved in this accident documented a defective condition of "15 deteriorating ties in the diamond area." Based on this initial assessment, investigators requested documentation of all reported defective track conditions that were awaiting approval. WMATA provided a report that showed a total of 16,828 open track defects, some going back to October 2008, that were still waiting to be repaired.

Safety Recommendations R-15-31 and -32

The information in this section was originally stated in the report, *Washington Metropolitan Area Transit Authority L'Enfant Plaza Station Electrical Arcing and Smoke Accident, Washington, D.C., January 12, 2015*, which was adopted by the NTSB on May 3, 2016.[12] On January 12, 2015, about 3:15 p.m. eastern standard time, WMATA Metrorail Yellow Line train 302 stopped after encountering an accumulation of heavy smoke while traveling southbound in a tunnel between the L'Enfant Plaza station and the Potomac River bridge in the District of Columbia.

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[10] Washington Metropolitan Transit Authority, "Metro Transit Police open derailment investigation," news release, August 18, 2016, https://www.wmata.com/about_metro/news/PressReleaseDetail.cfm?ReleaseID=6155&mobile=1, accessed October 11, 2016.

[11] Although requested by NTSB investigators, the inspection reports for January 2016 and March 2016 were not provided by WMATA.

[12] NTSB Safety Recommendations R-15-31 and -32, September 30, 2015. The recommendation letter can be found through the Safety Recommendations Search feature at http://www.ntsb.gov/safety/safety-recs. National Transportation Safety Board, *Washington Metropolitan Area Transit Authority L'Enfant Plaza Station Electrical Arcing and Smoke Accident, Washington, DC, January 12, 2015*, RAR-16/01 (Washington, DC: National Transportation Safety Board, 2016).

About 400 passengers were on board the six-car passenger train at the time of the accident. Some passengers self-evacuated from the train, while others were assisted by emergency responders. The smoke originated from an arcing event near the third rail about 2,000 feet south of the L'Enfant Plaza station. Smoke filled the L'Enfant Plaza station causing an evacuation of the station. District of Columbia Fire and Emergency Management Services reported that 86 people were treated and transported from the scene; another 9 passengers self-transported to medical facilities. There was one passenger fatality.

On June 23, 2015, the NTSB convened a 2-day investigative hearing to gather additional factual information for the ongoing investigation of the accident. The investigative hearing focused on the following areas:

- State of WMATA's infrastructure
- Emergency response efforts
- WMATA's organizational culture
- FTA and Tri-State Oversight Committee (TOC) efforts for public transportation safety

The NTSB has initiated 14 accident investigations on the WMATA rail system over the past 36 years.[13] In total, these accidents and incidents have resulted in 18 fatalities.[14] Many of the NTSB accident investigations determined that WMATA's inadequate management of its operation

[13] National Transportation Safety Board, *Derailment of Washington Metropolitan Area Transit Authority Train No. 410 at Smithsonian Interlocking, January 13, 1982,* RAR-82/06 (Washington, DC: National Transportation Safety Board, 1982); National Transportation Safety Board, *Collision of Washington Metropolitan Area Transit Authority Train T-111 with Standing Train at Shady Grove Passenger Station, Gaithersburg, Maryland, January 6, 1996,* RAR-96/04 (Washington, DC: National Transportation Safety Board, 1996); National Transportation Safety Board, *Collision Between Two Washington Metropolitan Area Transit Authority Trains at the Woodley Park-Zoo/Adams Morgan Station in Washington, D.C., November 3, 2004*, RAR-06/01 (Washington, DC: National Transportation Safety Board, 2006); National Transportation Safety Board, *Derailment of Washington Metropolitan Area Transit Authority Train near the Mt. Vernon Square Station, Washington, D.C., January 7, 2007,* RAR-07/03 (Washington, DC: National Transportation Safety Board, 2007); National Transportation Safety Board, *Washington Metropolitan Area Transit Authority Metrorail System Red Line Train Strikes Wayside Worker Near Dupont Circle Station, Washington, D.C., May 14, 2006,* RAB-08/01 (Washington, DC: National Transportation Safety Board, 2008); National Transportation Safety Board, *Washington Metropolitan Area Transit Authority Metrorail System Yellow Line Train Strikes Wayside Worker Near Eisenhower Avenue Metrorail Station, Alexandria, Virginia, November 30, 2006,* RAB-08/02 (Washington, DC: National Transportation Safety Board, 2008); National Transportation Safety Board, *Collision of Two Washington Metropolitan Area Transit Authority Metrorail Trains Near Fort Totten Station, Washington, D.C., June 22, 2009,* RAR-10/02 (Washington, DC: National Transportation Safety Board, 2010); National Transportation Safety Board, *Washington Metropolitan Area Transit Authority Rear-End Collision, Falls Church, Virginia, November 29, 2009,* RAB-12/04 (Washington, DC: National Transportation Safety Board, 2012); National Transportation Safety Board, *Washington Metropolitan Area Transit Authority Hi-Rail Maintenance Vehicle Strikes Two Wayside Workers Near the Rockville Station, Rockville, Maryland, January 26, 2010,* RAR-12/04 (Washington, DC: National Transportation Safety Board, 2012); National Transportation Safety Board, *Washington Metropolitan Area Transit Authority Derailment, Washington, D.C., February 12, 2010,* RAB-12/05 (Washington, DC: National Transportation Safety Board, 2012); National Transportation Safety Board, *Washington Metropolitan Area Transit Authority L'Enfant Plaza Station Electrical Arcing and Smoke Accident, Washington, D.C., January 12, 2015,* RAR-16-1 (Washington, DC: National Transportation Safety Board, 2016); Investigative Hearing on Washington Metropolitan Area Transit Authority Arcing/Smoke Event with Passenger Evacuation, L'Enfant Plaza Station, Washington, DC, January 12, 2015, held June 23, 2015.

[14] There is one additional fatality that occurred during the federal government shutdown in October 2013 that the NTSB did not investigate.

contributed to the events, and based on the repeated and ongoing deficiencies identified during its investigations of accidents and incidents involving WMATA, the NTSB concluded that neither the regulatory changes the FTA can make as a result of MAP-21 nor the proposed creation of a Metro Safety Commission (MSC) would likely resolve the deficiencies identified in safety oversight of WMATA.

As a result of the accident investigation of the 2015 incident in L'Enfant Plaza, the NTSB issued urgent Safety Recommendations R-15-31 and -32 to the US Secretary of Transportation on September 30, 2015. Both of these recommendations are currently classified as "Open—Unacceptable Action."

> Seek an amendment to Title 45 *United States Code* Section 1104(3) to list the Washington Metropolitan Area Transit Authority as a commuter authority, thus authorizing the Federal Railroad Administration to exercise regulatory oversight of the Washington Metropolitan Area Transit Authority's rail system. (R-15-31) (Urgent)
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> After Title 45 *United States Code* Section 1104(3) is amended to include the Washington Metropolitan Area Transit Authority, direct the Administrator of the Federal Railroad Administration to develop and implement a plan to transition the oversight of the Washington Metropolitan Area Transit Authority's rail system to the Federal Railroad Administration within 6 months. (R-15-32) (Urgent)

The US Secretary of Transportation responded to these recommendations in a letter dated October 9, 2015. In this letter, he stated that until a fully capable State Safety Oversight (SSO) agency is in place, the FTA would lead all oversight, inspections, and enforcement activities over WMATA. He stated:

> Through the Moving Ahead for Progress in the 21st Century Act (MAP-21) legislation, Congress provided the Federal Transit Administration (FTA) with greatly enhanced, independent safety oversight authority, which augments the enhanced authority of State Safety Oversight Agencies (SSOA), and if necessary, allows FTA to assume those same authorities in the absence of an effective SSO agency. FTA has the capability to assert this authority and, at my direction, will do so immediately. This increased oversight means that FTA will now directly enforce and investigate the safety oversight of WMATA Metrorail until the District of Columbia, Maryland, and Virginia establish a fully functioning and capable SSOA.

In a letter to the NTSB dated May 3, 2016, the US Secretary of Transportation stated:

> The Federal Transit Administration (FTA) has existing legal authority, as provided by Congress in the Moving Ahead for Progress in the 21st Century Act of 2012, to undertake temporary and direct safety oversight of WMATA Metrorail. … In a short time, FTA has provided more thorough safety oversight over WMATA than it has ever received before.

He added that the FTA-WMATA Safety Oversight team (FWSO), composed of multidisciplinary subject matter experts across the Department of Transportation—primarily from the FTA, but also from the FRA, the Federal Motor Carrier Safety Administration, the Federal Aviation Administration, and the Office of the Secretary— is overseeing WMATA.

On August 8, 2016, FTA issued a report documenting the 12 findings from an FWSO investigation conducted from March through June 2016 into the integrity of the Metrorail track system.[15] The findings noted by FWSO in the report are as follows:

1. [WMATA] Track inspectors receive inadequate training

2. There is insufficient time for track inspection

3. Excessive wear and deficient crosstie condition in special track work is not being identified and addressed

4. The TGV [track geometry vehicle] is underutilized as part of WMATA's track inspection program

5. The TRST 1000 [*WMATA Track Maintenance and Inspection*] Manual is not a field document focused on inspection safety limits

6. WMATA does not have a clear process in place for track inspectors and supervisors to impose and remove speed restrictions

7. WMATA fails to use inspection data to inform and prioritize track maintenance

8. Maintenance managers require additional training and resources to act on inspection data

9. Current inspection and maintenance activity does not adequately address tunnel drainage system

10. Additional supervision is needed for both track inspection and track maintenance

11. WMATA does not apply the same quality control testing program to its force account installed fasteners that it would apply to those installed by a contractor while building a new line segment

12. In certain instances, WMATA uses welding practices inconsistent with its construction standards to install cables to ensure train control and electrical continuity around mechanical joints

The report also described 12 required actions WMATA must take to address the FWSO's findings.

[15] Federal Transit Administration, *Safety Directive Under 49 U.S.C.§ 5329 Required Actions to Address Findings from Federal Transit Administration Investigations Conducted at the Washington Metropolitan Area Transit Authority [Safety Directive No. 16-4, Notice No. 1]* (Washington, DC: US Department of Transportation, Federal Transit Administration, 2016).

On April 13, 2016, senior FTA officials testified before the US House of Representatives Committee on Oversight and Government Reform, Subcommittees on Transportation and Public Assets and Government Operations. In a prepared statement, FTA officials stated that WMATA is responsible for the safe operation of the Metrorail system. The officials added that FTA's role is to verify WMATA's progress on implementing corrective action plans and remedial actions, and to ensure that WMATA is effectively carrying out its own critical maintenance, operations, and safety training programs. The statement also mentioned that FTA's role is temporary and that Virginia, Maryland, and the District of Columbia must create a new SSO agency that complies with federal law.

Maryland, Virginia, and the District of Columbia entered into a memorandum of understanding on February 25, 2016, which restated their commitment to establishing the MSC.[16] However, legislation is still needed to do so. If the three jurisdictions fail to establish a new SSO agency before February 9, 2017, they collectively risk the withholding of $15 million through the Urbanized Area Formula Funding program from public transportation systems in their jurisdictions.[17]

The memorandum of understanding further states that until a new SSOA is capable of carrying out its responsibilities, the FTA will continue to provide safety oversight, conduct inspections, monitor WMATA operations, and perform other activities to ensure the safety of WMATA's riders and workers.

Discussion

Crossties

Crossties do not deteriorate in a matter of days—to the extent they are unable to hold fasteners, restrict lateral rail movement, or maintain gage—but do so over time. The useful service life of crossties varies greatly depending on track geometry characteristics, rail vehicle interaction, and equipment axle loads exerted on the track. For this reason, proper inspection of crossties requires visual inspection and performance-based measuring with accurate records to identify these changes. These areas of noncompliance with WMATA safety standards were identified during WMATA track inspections, however no remedial action was taken at that time.

Track Inspection

The *WMATA Track Maintenance and Inspection Manual* provides instruction for track maintenance and inspection procedures on the WMATA system. According to the manual, all main tracks and secondary tracks will be examined on foot by qualified track personnel twice each week with an interval of a least 1 calendar day between inspections.[18] NTSB investigators reviewed transcripts of interviews with WMATA track inspectors and track supervisors and learned that WMATA inspected crossover switches, such as the one involved in this derailment, on a monthly

[16] "Memorandum of Understanding for Cooperation in the Establishment of the Metro Safety Commission," signed February 25, 2016, https://governor.maryland.gov/wp-content/uploads/2016/03/Metro-Safety-Commission-MOU.pdf. (accessed October 19, 2016).

[17] Title 49 *U.S.C.* § 5307.

[18] Washington Metropolitan Area Transit Authority, *WMATA Track Maintenance and Inspection Manual*, Revision 6, TRST-1000, Section 2.1.2. (Washington, DC: Washington Metropolitan Area Transit Authority, 2015).

basis. After the accident, WMATA representatives told investigators that the Safe Track maintenance plan required increased use of crossovers in the accident area.[19] Despite this increased use, crossovers on the Silver Line were still only receiving monthly inspections. Not until after this accident did WMATA take measures to ensure that all crossovers on the system were inspected twice weekly—in accordance with its written instructions.

Had WMATA been subject to the FRA regulations, WMATA track inspectors would have been required to report any conditions that did not meet FRA minimum safety standards and implement remedial actions. There is no exception under FRA regulation that would allow for a track with a defective condition, such as the one in East Falls Church, to remain in service beyond 30 days when loaded passenger trains operate over the track.

Oversight

As the NTSB previously pointed out, the FRA has clearly established inspection, oversight, and enforcement authority. Title 49 *Code of Federal Regulations* (*CFR*) Part 209 describes the procedures used by the FRA in its enforcement of federal railroad safety statutes and regulations. According to appendix A to Part 209, those statutes include the Federal Railroad Safety Act of 1970, a group of statutes enacted before 1970 referred to as the "older safety statutes." Other such statutes include the Rail Safety Improvement Act of 2008, which raised the maximum civil penalties available under railroad safety laws and made individuals liable for willful violations of those laws.[20]

Under the requirements of the FRA Track Safety Standards (TSS), 49 *CFR* Part 213, the conditions identified following the July 29, 2016, derailment near East Falls Church station would have required that the track be removed from service and repaired as soon as the deficiencies were discovered, thereby eliminating the accident.

The FRA administers and enforces the federal laws and related regulations designed to promote safety on railroads and exercises jurisdiction over all areas of rail safety, such as track maintenance, inspection standards, equipment standards, and operating practices. It also administers and enforces regulations enacted pursuant to railroad safety legislation for locomotives, signals, safety appliances, power brakes, hours of service, transportation of explosives and other dangerous articles, and the reporting and investigation of railroad accidents. The FRA inspects railroad and related industry equipment, facilities, and records, and reviews required reports.

Summary

Regulatory assurance of compliance with standards provides an increased measure of safety across all modes of transportation. The FTA oversight model lacks minimum safety standards, expertise, and the resources to provide assurance that corrective action plans are completed. Unlike the FRA, the FTA cannot issue civil penalties, individual liability penalties, compliance orders, or emergency orders. The only tools available to the FTA are issuing safety

[19] *SafeTrack* is an accelerated track work plan to address safety recommendations and rehabilitate the Metrorail system to improve safety and reliability.

[20] Public Law 110-432, division A, October 16, 2008.

directives and directing or withholding funds. Following testimony from representatives of the FTA during the June 23, 2015, investigative hearing on the January 12, 2015, WMATA Metrorail accident, the NTSB concluded that neither the regulatory changes the FTA can make as a result of MAP-21 nor the proposed creation of the MSC will resolve the identified deficiencies in safety oversight of WMATA.

Probable Cause

The National Transportation Safety Board determines that the probable cause of this accident was a wide track gage condition resulting from the sustained use of deteriorating wooden crossties due to Washington Metropolitan Area Transit Authority's ineffective inspection and maintenance practices and inadequate safety oversight.

For more details about this accident, visit www.ntsb.gov/investigations/dms.html and search for NTSB accident ID **DCA16FR010**.

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