National Transportation Safety Board

Washington, D.C. 20594

Railroad Accident Brief

Accident No.:	DCA-10-FR-001
Location:	Falls Church, Virginia
Date:	November 29, 2009
Time:	4:28 a.m., eastern standard time[1]
Railroad:	Washington Metropolitan Area Transit Authority
Property Damage:	$9 million
Injuries:	3
Fatalities:	0
Type of Accident:	Rear-end collision

The Accident

On November 29, 2009, about 4:28 a.m. eastern standard time, Washington Metropolitan Area Transit Authority (WMATA) Metrorail train 902 struck the rear of a standing WMATA train at the West Falls Church rail yard, which is located in Falls Church, Virginia. No passengers were on board either train at the time of the collision; however, two WMATA maintenance department car cleaners were on board the struck train. The employees sustained minor injuries from the accident and were treated and released by a local hospital. The operator of train 902 also sustained minor injuries and was treated and released by a local hospital. Damage to train equipment was estimated to be about $9 million.

Accident Sequence

On November 28, 2009, at 5:55 p.m., the train operator started his shift at the West Falls Church station on the Metrorail Orange Line. He was transported to the New Carrollton station where he began operating a train in revenue service about 7:23 p.m. During his shift, which continued into the morning of November 29, 2009, he operated a series of trains on the Orange Line. He boarded train 902 at the Metro Center station and operated this train to the Vienna station, where it ended passenger service operations. He then moved to the rear of the train and operated the train in the opposite direction to the West Falls Church station where it was to be stored in the rail yard for the night.

When the train operator arrived at the West Falls Church station, he received a permissive signal and operated the train into the pocket track.[2] He again moved to the other end of the train

[1] All times in this brief are eastern standard time unless otherwise noted.

and operated the train in the opposite direction, past the pocket track signal, to the entrance of the West Falls Church rail yard. About 4:23 a.m., the train was stopped at the signal at the entrance to the rail yard. The train operator radioed the interlocking operator,[3] who gave him permission to enter the yard. The interlocking operator also instructed the train operator to store the train behind another train, which already was stored on the east end of yard track 9.

The train operator told National Transportation Safety Board (NTSB) investigators that he operated the train in the P1 throttle position[4] (and in the coast, or neutral, position) to maintain a speed below the 15-mph yard speed limit. The train operator said that as he operated the train on track 9, he saw the stored train and observed the bulkhead door open, the interior of the car illuminated, and several cleaning personnel on the train. He continued to operate his train toward the stored train and began to make a series of required safety stops.[5] Reportedly, he stopped about three car lengths from the stored train and blew the horn. The train operator told NTSB investigators that while making a third safety stop about 50 feet from the stored train, his train surged, or accelerated, forward. The train operator stated that "… it felt like to me, like something was in back of me pushing me, … faster than I wanted it to go." The train operator said that he went into a B5 braking mode,[6] but he did not think the train was going to stop in time to avoid a collision. The train operator told NTSB investigators that he released the master controller and pressed the emergency brake button.

Investigation

During postaccident interviews with NTSB investigators, the train operator stated that he was performing safety stops with the master controller in the P1 position when his train surged forward. However, according to a yard operator on scene at the time of the accident, the train operator had told him, "at the 50-foot mark [I] went to P2 or P3 and suddenly the train just took off on [me]."

The NTSB investigators reviewed the onboard event recorder data. The data indicated that train 902 was stopped about 1,386 feet from its final resting location and its yard horn was sounded. The train master controller then was placed in position P5 for about 4 seconds to initiate movement. The train accelerated to a speed of about 13 mph before the brakes were applied for the first safety stop at 4:28:06 a.m. The yard horn was again sounded, the master controller was placed in the P5 position for about 4 seconds at 4:28:16 a.m., and the train accelerated to a speed of 9 mph. A second safety stop was made at 4:28:27 a.m. During the final train movement, the yard horn was sounded and at 4:28:33 a.m., the master controller was again placed in the P5 position, this time for about 6 seconds. Train 902 had moved 85 feet when the

[2] A *pocket track* is a track segment, located between the No. 1 and No. 2 main tracks, that is used to store equipment, cross over a train from the two main tracks, or reverse the movement of a train.

[3] The *interlocking operator*, located in the West Falls Church yard tower, routes trains in the rail yard using wayside color light signals and power-operated switches.

[4] The available power modes, or throttle positions, on the train are P1 through P5, with P1 the lowest power mode and P5 the maximum power mode.

[5] Train operators are required to make a series of stops when approaching stationary objects, including when they approach other trains while storing a train.

[6] B5 is the maximum service braking mode that is available, with the exception of emergency braking.

train speed exceeded 15 mph and a B5 brake application was initiated. The speed of the train continued increasing to 17 mph. The event recorder data show the train traveled about 37 feet before registering a speed of 0 mph at 4:28:43 a.m.

Location of Incident and Description of Track

The tracks are owned, inspected, maintained, and operated by WMATA. The West Falls Church rail yard is located in Falls Church, Virginia, and is the service, inspection, and storage facility for WMATA Metrorail trains at one end of the Orange Line.[7] The rail yard has tracks that lead to the service and inspection shops, but also has yard tracks where trains are stored when they are not operating in revenue service.

An electrified third rail, about 750 volts, supplies traction power to the trains. The top of the third rail is shielded or covered to prevent accidental contact; however, it allows the contact rail shoes affixed to the moving cars to make contact with the top of the third rail. Near the accident location, the third rail is located to the south of the track structure and yard track 9 is level and straight. At the end of yard track 9 is a concrete platform for accessing stopped trains. This platform has a bumping post to protect it from railcar intrusion. The bumping post is affixed to the rail with track bolts and is designed to absorb the shock of a collision with the post. As a result of the accident, the bumping post on yard track 9 showed scraping and loss of paint on the piston ram element, which were consistent with evidence of contact. In addition, the bumping post was displaced backward, and the rails and ties were raised in an arch; however, all remained attached. After the accident, the deformed rails and ties were replaced, and the bumping post was reinstalled and returned to service.

Train Operation and Signal Information

The *Metrorail Safety Rules and Procedures Handbook* (MSRPH) designates the maximum authorized speed in rail yards at 15 mph; however, the maximum authorized speed on curves, switches, roadway crossings, and storage track entrances in rail yards is 10 mph. The MSRPH also designates the normal operating mode in yards as Mode 2-Level 2. Trains operating in Mode 2-Level 2 are in manual mode with a maximum 15-mph speed limit that is enforced by the train control system; however, the system does not provide train separation.

The WMATA training program for train operators includes moving equipment through rail yards. A WMATA rail training instructor explained that train operators are taught to operate trains in the P1 master controller position (and, on occasion, in the P2 position for some eight-car trains) while operating in the yard. He further stated that master controller positions P5, P4, and P3 are not necessary in the rail yard, although it is not a violation to operate in those modes.

Train operators are required to make safety stops when approaching stationary objects, including other trains. This is illustrated in the following rule from the MSRPH.

[7] The West Falls Church rail yard is located adjacent to the West Falls Church station, which is three stations (about 5 miles) from the terminus of the Orange Line.

> Rule 3.88 - Safety stops shall be made as prescribed in Rule 3.89 when approaching another rail vehicle, bumping post, or obstruction.
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> Rule 3.89 - Safety stops, when required, must be made three car lengths, then two car lengths, then 50 feet, then 10 feet and then proceed at a speed not to exceed 3 mph until final stop is made.

Train operators are instructed to operate their trains in the P1 master controller position from the three-car-length distance to the 10-foot marker. For the last 10 feet, the train operators are instructed to coast the train in the car wash mode[8] before storing the train. Trains stored on adjacent tracks in the yard provide visual cues that can help train operators estimate these distances.[9]

Signal and train control data indicate that train 902 was routed from the West Falls Church station platform to yard track 9. The interlocking operator selected a route for train 902 that did not involve any crossover movements. The train operator did not report any problems with the signals directing train 902 to proceed to yard track 9. The track occupancy data and the recorded radio conversations were reviewed by NTSB investigators. The data indicate that all track circuits were occupied and vacated in proper sequence.

Train Information

Train 902 consisted of six railcars configured as three "married pair"[10] cars: 5056 and 5057, 1171 and 1170, and 3223 and 3222. Car 5056 was the leading car, and car 3222 was the rear car. The railcars for train 902 were coupled on Friday, November 27, 2009, about 11:22 p.m.; and they remained together until the collision.

The standing train was a six-car train consisting of three married pair cars: 5138 and 5139, 1107 and 1106, and 3216 and 3217. Car 5138, the leading car, was located nearest to the bumping post at the end of the track. Car 3217 was the rear car.

A postaccident mechanical inspection of train 902 by NTSB investigators indicated that the braking system was in working order. All undercarriage inspections were up to date. No mechanical defects had been noted on the maintenance records for either train.

The master controller indications sent to the onboard recorders were verified and found to be in accordance with the physical position of the master controller handle. NTSB investigators performed acceleration and braking tests using the lead pair involved in the accident and similar series trailing railcars. Neither braking anomalies nor mechanical anomalies were identified from this testing.

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[8] In *car wash* mode, the train advances more slowly than in throttle position P1.

[9] In accordance with the procedures used to train operators in the classroom-based training.

[10] In revenue service, sequentially numbered pairs of Metrorail cars are semipermanently coupled together and operate only in "married pair" railcar sets.

The results from the NTSB investigation indicated that the speed of the striking train at the time of the collision was about 16 mph. Car 1171 of train 902 and cars 1106 and 1107 of the standing train sustained significant end-structure damage. Car 1106 also experienced substantial outward bowing of its sidewall. On July 27, 2010, the NTSB addressed the crashworthiness of the WMATA 1000-series cars as a result of the June 22, 2009, collision of WMATA trains 112 and 214 near the Fort Totten station in Washington, D.C.[11] All six of the railcars of train 112 on the day of that accident were 1000-series cars. On train 214, the four cars in the lead were 3000-series cars and were followed by two 5000-series cars. The NTSB investigation found that the structural design of the 1000-series railcars offered little occupant protection against a catastrophic loss of survival space in a collision, which contributed to the severity of the occupant injuries and fatalities. Following the Fort Totten accident, WMATA began "bellying" the 1000-series cars (that is, placing the 1000-series cars in the middle of trains with cars of a later design on either end). This practice was intended to reduce the vulnerability of the cars to catastrophic damage during a collision. In the Fort Totten accident report, the NTSB concluded that the WMATA practice of bellying the 1000-series railcars does not provide appreciable crashworthiness benefits and is not an acceptable substitute for removing the cars from service. As a result of the Fort Totten investigation, the NTSB made the following safety recommendation to WMATA:

> Remove all 1000-series railcars as soon as possible and replace them with cars that have crashworthiness collision protection at least comparable to the 6000-series railcars. (R-10-20)

WMATA informed the NTSB on July 26, 2010, that it had awarded a contract to Kawasaki to replace the 1000-series railcars with cars having crashworthiness comparable to, or better than, the 6000-series railcars. Kawasaki was given a Notice to Proceed on August 16, 2010. NTSB Safety Recommendation R-10-20 is classified "Open—Acceptable Response."

Train 902 Operator

The train operator was hired by WMATA in July 2007 as a bus operator. In August 2008, he began working as a train operator. After completing the 12-week training program, he was qualified as a train operator in November 2008. On the day of the accident, the train operator had operated trains into the West Falls Church rail yard for about 3 months. The train operator was in good health and had normal hearing and vision.

Following the accident, and in accordance with Title 49 *Code of Federal Regulations* (CFR) Part 655, the train operator took a breathalyzer test for alcohol and provided a urine specimen for drug analysis. The result of the breathalyzer test was negative. Due to procedural errors during the collection of the urine specimen at the WMATA headquarters, the first specimen was not tested and was discarded. The train operator was asked to provide a second urine specimen for which he consumed about 40 ounces of water to aid the process. This

[11] See *Collision of Two Washington Metropolitan Area Transit Authority Metrorail Trains Near Fort Totten Station in Washington, D.C., June 22, 2009*, Railroad Accident Report NTSB/RAR-10/02 (Washington, D.C.: National Transportation Safety Board, 2010), which is available on the NTSB website at <http://www.ntsb.gov/>.

specimen was collected on November 29, 2009, at 12:48 p.m. (about 8 hours 20 minutes after the accident). However, the WMATA collector was concerned that this specimen may have been too diluted, and on December 1, 2009, requested that the train operator return to WMATA headquarters to provide another urine specimen. The train operator returned on that date and produced a urine specimen at 1:11 p.m. (about 60 hours 43 minutes after the accident). Postaccident toxicological testing was conducted on both urine specimens. The results were negative for the DOT/SAMHSA[12] standard five panel test.

Fatigue

The NTSB explored the potential that the train operator's performance toward the end of his shift was affected by fatigue. Specifically, investigators examined the amount of time he was awake, how much sleep he had received, and the times he had worked during the days prior to the accident.

On Thursday (November 26, 2009), the train operator awoke between 8:30 a.m. and 9:00 a.m. He departed for work at 3:00 p.m.[13] The train operator went on duty at 4:38 p.m., and he worked until 12:48 a.m. (Friday). After work, he arrived at home between 1:15 a.m. and 1:30 a.m. He spent about 30 minutes on the computer, and then he went to bed between 2:00 a.m. and 2:30 a.m.

On Friday (November 27, 2009), the train operator awoke between 11:00 a.m. and 12:00 p.m. He departed for work at 3:15 p.m. and was on duty from 4:18 p.m. until 4:03 a.m. (Saturday). He arrived home between 4:30 a.m. and 4:45 a.m., and he went to bed. He could not recall with certainty how long he slept; he estimated it to be between 3 and 6 hours.[14]

On Saturday (November 28, 2009), he went on duty at 5:55 p.m. and worked until the accident.

At the time of the accident, the train operator had been awake for more than 17 hours. Moreover, the accident occurred about the time the train operator had gone to bed the day before and the time that he would have been asleep on several consecutive days prior to the accident. The train operator received a limited amount of sleep the night before the accident, and he told NTSB investigators that he needs between 6 and 7 hours of sleep each night to feel rested. Based on these findings, the train operator likely was fatigued at the time of the accident.

On the day of the accident, the train operator operated his train through the West Falls Church rail yard and conducted the required safety stops in a manner that was inconsistent with his training. He was aware that WMATA teaches train operators to place the

[12] U.S. Department of Transportation/Substance Abuse and Mental Health Services Administration.

[13] The train operator typically leaves his house 2 hours before the start of his shift. At the completion of his shift, he commutes from work to his home with a co-worker or a relative. This commute typically takes about 30 minutes.

[14] During interviews with NTSB investigators, the train operator stated that he was unclear how much sleep he had received. He first believed that he had slept until 10:00 a.m. or 11:00 a.m. (that is, 5 to 6 hours). Later he stated that he thought he had slept 3 to 4 hours.

throttle no higher than the P2 position while operating in the rail yard. The train operator, however, had placed the throttle in the P5 position while he was moving the train through the yard and while performing his safety stops. The train operator also had moved the throttle to the P5 position toward the end of the safety stops, when he was just over one car length away from the stored train directly ahead of him. This throttle control action caused his train to accelerate quickly, and the train operator was unable to stop his train before it collided with the stored train. The train operator's erratic train handling and slow reaction time suggest that his performance may have been impaired due to the effects of fatigue. Since fatigue is known to degrade human judgment and decision-making, reduce alertness, and slow reaction times, fatigue may have been a factor underlying the observed poor train-handling behavior exhibited by the train operator.

On March 23, 2006, the NTSB addressed the importance of adequate rest between shifts for transit train operators as a result of the November 3, 2004, collision of two WMATA trains at the Woodley Park-Zoo/Adams Morgan (Woodley Park) station in Washington, D.C.[15] As a result of the Woodley Park investigation, the NTSB made the following safety recommendation to the Federal Transit Administration (FTA):

> Require transit agencies, through the system safety program and hazard management process if necessary, to ensure that the time off between daily tours of duty, including regular and overtime assignments, allows train operators to obtain at least 8 hours of uninterrupted sleep. (R-06-3)

In December 2009, the FTA forwarded draft legislation to Congress that included the authority to promulgate regulations and to issue orders that would grant it the authority to require hours-of-service limits for rail transit operators. The FTA also has been working to add a fatigue management section to the System Safety Program Plan in its next revision of 49 CFR Part 659. Moreover, the FTA has provided financial support to the American Public Transportation Association that has developed and issued an industry standard for train operators to address Safety Recommendation R-06-3, which is classified "Open—Acceptable Response."

The NTSB notes that the train operator had a history of safety violations during the year he had operated trains. Specifically, the train operator had four significant violations, not including the West Falls Church incident: (1) a station overrun, (2) operating past a red signal, (3) opening the train doors while one car was not at the platform, and (4) failing to service a station while operating in manual mode. Each violation resulted in a suspension of between 1 day and 30 days and, in some instances, retraining. WMATA did not disqualify the train 902 operator based on his prior work record before the accident.

[15] See *Collision Between Two Washington Metropolitan Area Transit Authority Metrorail Trains at the Woodley Park-Zoo/Adams Morgan Station in Washington, D.C., November 3, 2004*, Railroad Accident Report NTSB/RAR-06/01 (Washington, D.C.: National Transportation Safety Board, 2006), which is available on the NTSB website at <http://www.ntsb.gov/>.

WMATA Postaccident Actions

Since this accident, WMATA has modified its process of reviewing work records. Specifically, WMATA has implemented management training that places greater emphasis on conducting reviews of an employee's entire work record, not only after an incident or accident or when an employee transfers to a new area of responsibility, but also at regular intervals. WMATA has taken actions affecting train operators, especially where corrective action is appropriate. WMATA has examined its current policy on progressive discipline as it relates to repeated serious violations.

In addition, WMATA has met with the local union to discuss near-miss reporting policies and to review options for improvement. WMATA also has held discussions with the U.S. Bureau of Transportation Statistics, the National Aeronautics and Space Administration, and the New Jersey Transit Corporation to obtain insight on their near-miss reporting programs and processes. WMATA and the union are working on establishing a memorandum of understanding and have already agreed to cover all departments within WMATA during the pilot near-miss reporting program. The initial time frame for the pilot program will be 2 to 3 years.

WMATA further indicated that it is studying the issue of fatigue. Specifically, a Tri-State Oversight Committee and WMATA joint study on managing fatigue in the Metrorail system was completed and presented to WMATA's Safety Committee in November 2011. WMATA is targeting a pilot program that will explore reducing the maximum working day, including overtime, from 16 hours to 14 hours for certain operations. WMATA also is planning to review fatigue avoidance scheduling tools for use in its rail and bus operations.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the accident was the failure of the train operator to control the movement of his train as it approached the standing train, possibly due to his fatigue.

Adopted: May 17, 2012