National Transportation Safety Board

Railroad Accident Brief

South Florida Regional Transportation Authority Highway-Rail Grade Crossing Collision

West Palm Beach, Florida

The Accident

On July 6, 2016, about 9:59 a.m. eastern daylight time, northbound Amtrak Silver Meteor train P09806 (train), operating on the South Florida Regional Transportation Authority (SFRTA) track, struck a 2004 white 4-door Mercury Sable (automobile) at the 25th Street highway-rail grade crossing (crossing) in West Palm Beach, Florida. (See figure 1.)[1] At the time of the collision, a VTMI signal employee was working in the crossing warning system bungalow.[2] The event recorder in the bungalow recorded a 1-second warning before the collision. The automobile driver was seriously injured.

The train was en route from Miami, Florida, to New York, New York. The train did not derail. The train crewmembers and passengers were not injured. The damages to the train were estimated at $16,300; the automobile was a total loss. At the time of the accident, the sky was clear, the visibility was 10 miles, and the temperature was 88°F.

[1] All times referenced in the report are eastern daylight time. The 25th Street crossing is located at milepost SX 968.32.

[2] VTMI is the proper registered name of this company, which was formerly known as Veolia Transportation Maintenance and Infrastructure. (VTMI is not an acronym for this company.)

Figure 1. The struck vehicle. (Photo courtesy of television station, WPBF Channel 25, West Palm Beach, Florida)

At the grade crossing, 25th Street is a four-lane street; it has two eastbound and two westbound traffic lanes. The automobile was traveling westbound in the outer traffic lane when it entered the highway-rail grade crossing. About 9:59:30 a.m., the engineer saw the automobile enter the grade crossing and activated the locomotive horn (the crossing was in a quiet zone) and initiated emergency braking.[3] About 1 second prior to the collision, the lights and bells of the crossing warning system activated; however, the gates remained in the upright position. The train struck the automobile at about 48 mph. The first responders transported the automobile driver to a hospital in West Palm Beach, Florida.

Investigative Factors

Prior to the accident, the train had received a *clear* signal at control point (CP) Coral.[4] As the train approached the crossing, it was traveling about 52 mph. The locomotive engineer noticed several vehicles were passing over the crossing and the crossing warning system was

[3] A *quiet zone* is a segment of rail line, within which is one or more consecutive public highway-rail crossings where locomotive horns are not routinely sounded.

[4] A *green-over-red-over-red aspect* is defined in the SFRTA Operating Rule 1281 as a clear signal with the indication of "proceed."

not functioning. The locomotive engineer applied the brakes, and the train began to slow. At that time, the engineer saw an automobile in the westbound outside lane enter onto the No. 2 track. He immediately placed the train into an emergency air brake application and sounded the horn on the lead locomotive. The train struck the automobile and pushed it north about 100 feet. The train stopped about 710 feet beyond the crossing. The engineer notified the train dispatcher of the accident and advised the train dispatcher that the crossing warning system did not activate.[5] After acknowledging the report, the dispatcher made an emergency notification to the trains in the immediate area.

Emergency Response

West Palm Beach police department personnel arrived at the accident scene at 10:02 a.m.; the fire rescue personnel from the City of West Palm Beach arrived at 10:08 a.m.

Railroad Operations

The train crew involved in the accident was governed by wayside signal indications, railroad operating rules, and Amtrak safety rules. The SFRTA, Amtrak, and CSX Transportation (CSX) operate trains through this crossing:

- SFRTA operates 50 trains each weekday and 30 trains each weekend day
- Amtrak operates four trains each day
- CSX operates an average of five freight trains each day

The train was comprised of 2 locomotives and 11 passenger cars. All crewmembers had received the required rest period prior to reporting for duty on the day of the accident. The locomotive crew consisted of a locomotive engineer, an assistant locomotive engineer, a conductor, and an assistant conductor. The train departed Miami Station on schedule at 8:10 a.m. Before the accident occurred, the last scheduled station stop was to be West Palm Beach. All Amtrak train crewmembers held current certifications for their assigned positions.[6]

Event and On-Board Image Recorder

The lead locomotive was equipped with a forward-facing track image recorder and a locomotive event recorder. At 9:59:36 a.m., the train approached the 25th Street grade crossing at 50 mph. The crossing signal bungalow was to the right of the track, and a white truck was parked adjacent to the bungalow (parallel to the tracks, on the grade crossing side). An eyewitness stated that he saw someone inside the signal bungalow at the time of the accident.

None of the crossing gates were down. (See figure 2.) At 9:59:37 a.m., a dark vehicle stopped prior to the tracks, while a white 2004 Mercury Sable continued across the grade crossing. At 9:59:38 a.m., the Amtrak train struck the Mercury while traveling 48 mph.

[5] The train dispatcher was at the SFRTA dispatching facility in Pompano, Florida.

[6] Locomotive engineer certification requirements are in 49 *Code of Federal Regulations (CFR)* Part 240; conductor certification requirements are in 49 *CFR* Part 242.

Figure 2. Photo from the locomotive video showing the grade crossing with gates in the upright position.

25th Street Highway-Grade Crossing and Warning System

The 25th Street crossing in West Palm Beach, Florida is on the northern end of the 72-mile SFRTA rail corridor. (See figure 3.) Three tracks (two main and one industry) traverse the grade crossing in a north-south direction.

Figure 3. 25th Street crossing. (Photo courtesy of Google Maps.)

At the accident crossing, 25th Street is a four-lane undivided highway oriented in an east-west direction with a speed limit of 30 mph. The crossing is marked with stop lines (on the pavement) and warning signs. The crossing warning system is equipped with four quadrant gates, lights, bells and two cantilever structures for over-lane lighting. There are

four quadrant gates at the location, because it is an approved quiet zone. All flashing units have 12-inch lights equipped with Light Emitting Diodes (LED). The exit gates are at the southeast and northwest quadrants. The signal bungalow is located at the southeast quadrant. A Safetran Grade Crossing Predictor (GCP) GCP-3000 D2 unit is used as the primary warning control for both main tracks. The crossing predictor was operating in the primary mode. The standby unit was fully functional. There was no internal recorder module in the unit, but an external North American Signal (NAS) recorder was on-site. Upon inspection, the NAS external recorder was in the off position (in maintenance mode), and the circuit board for the central processing unit (CPU) was missing. (See figure 4.) All other control functions of the crossing warning system are made by using electro-mechanical relays in conjunction with the GCP.

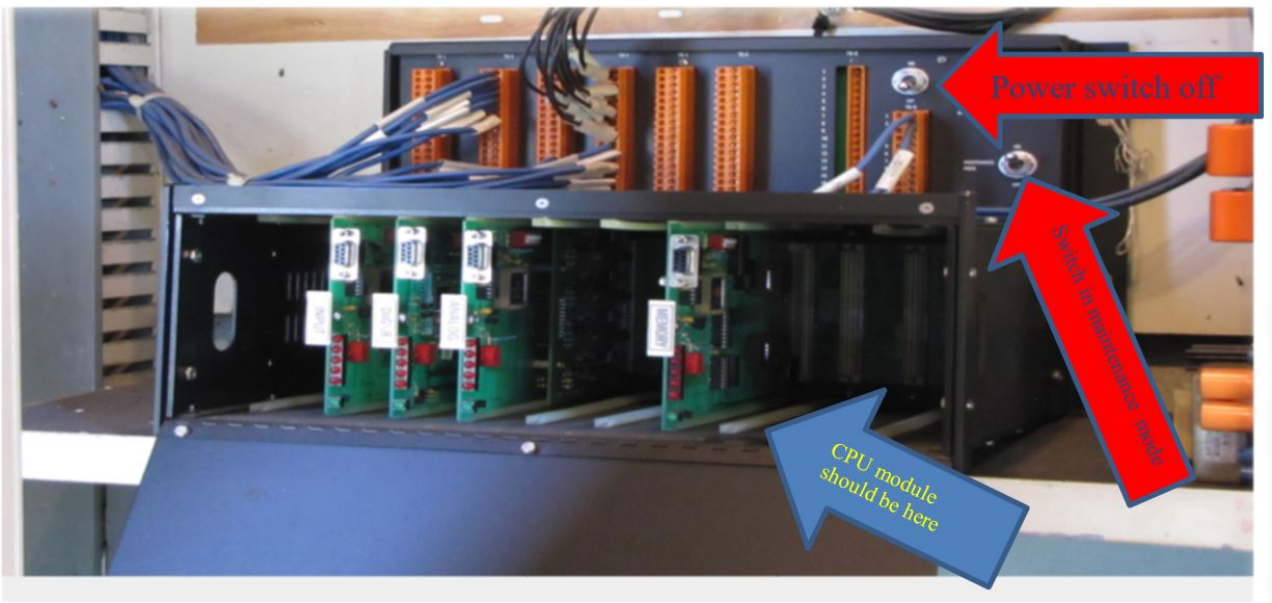

Figure 4. The external NAS event recorder and position of switches and missing CPU module.

VTMI Signal Inspector

VTMI, which is an infrastructure and maintenance subsidiary of Transdev North America Inc., was contracted to inspect, maintain, and repair all signal systems on the SFRTA. VTMI hired the signal inspector in March 2015. The signal inspector was previously employed by CSX from August 1996 to March 2015 in various signal positions. On January 21, 2014, his job title changed from a signal maintainer to a contract maintenance-of-way foreman. While employed as a foreman, he fulfilled the duties of a signal inspector. His training records show that on February 3, 2016, he was tested and passed a SFRTA operating rules exam. Additionally, on June 20, 2016, a few weeks before the accident, he had received annual training on the VTMI Signal and Communication Jumper policy. This policy prohibits any action "that alters the normal operation of the equipment" without positive protection.[7] In addition, the inspection of relays is governed by VTMI Test No. 6, Relays, Section 1.0, which states, "When making test of relays, approved instruments

[7] *Positive protection* is defined as as a method to either prevent trains from accessing a section of track or provide a message for the train so it can provide its own protection.

must be used and it must be known that no unsafe conditions are set up by the application of the test instrument."

The inspector had been off duty for 16 hours prior to reporting for duty at 7:00 a.m. on the day of the accident. VTMI vehicle 1224 was assigned to the signal inspector. The Global Positioning System (GPS) on that vehicle indicated it had arrived at the 25th Street crossing on July 6, 2016, at 8:27:45 a.m. The signal inspector called the SFRTA dispatcher at 9:23:30 a.m. to inform him that he would be performing relay tests on the crossing warning system at 25th Street. At that time, positive protection for either highway users or trains was neither discussed nor provided. According to Title 49 *Code of Federal Regulations* (*CFR*) Part 234, relays must be tested periodically to ensure that electro-mechanical relays meet certain operational standards. Evidence retrieved at the 25th Street crossing showed that the signal inspector had completed the testing of the first relay.

Crossing Warning System Event Recorder

The crossing warning system bungalow at 25th Street was equipped with a NAS event recorder. The recorder monitors some of the electro-mechanical relays, the crossing warning system operation, and island relay input voltage.[8] This process of recorded events includes warning system activation, light activation, light flash rate, gate movement, train occupancy of the crossing, and crossing warning time. However, the NAS recorder does not monitor the control relay output of the GCP. The event recorder was found in the "off" position and in "maintenance mode" during the postaccident inspection. The CPU card was missing. Investigators used a replacement CPU card to retrieve the data. The event recorder showed that the crossing warning time was 1 second before the train struck the vehicle.[9] (See Figure 5.)

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07/06/16 06:33:26 LOG   GATE 1 MOVEMENT TIME DOWN (sec) 015
07/06/16 06:33:26 LOG   AGDPR RELAY POSITION UP
07/06/16 06:33:20 LOG   GATE 2 MOVEMENT TIME DOWN (sec) 009
07/06/16 06:33:20 LOG   BGDPR RELAY POSITION UP
07/06/16 06:33:11 LOG   XPPR RELAY DELAY (sec) 005
07/06/16 06:33:11 LOG   XPPR RELAY POSITION DOWN
07/06/16 06:33:07 ALARM  CROSSING WARNING TIME (sec) 001
07/06/16 06:33:07 LOG   ISL2 RELAY POSITION DOWN
07/06/16 06:33:06 LOG   XR1 RELAY POSITION DOWN
07/06/16 06:33:06 LOG   GPPR RELAY POSITION DOWN
07/06/16 06:32:38 LOG   ALL GATES MOVEMENT TIME UP (sec) 010
07/06/16 06:32:38 LOG   GPPR RELAY POSITION UP
07/06/16 06:32:32 LOG   BGDPR RELAY POSITION DOWN
07/06/16 06:32:29 LOG   XPPR RELAY POSITION UP
07/06/16 06:32:28 LOG   XR1 RELAY POSITION UP
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Figure 5. NAS recorder data shows actual warning time to be 1 second. (Yellow highlight was added.)

Dispatcher Audio Files

Investigators reviewed the SFRTA dispatcher audio files. The signal inspector called the dispatcher and informed him that he would be performing relay tests at the 25th Street

[8] The American Railway Engineering and Maintenance-of-Way Association defines an *island circuit* as "a short, defined track circuit which spans a grade crossing."

[9] The clock of the NAS event recorder was not set correctly.

crossing. At 9:59:10 a.m., the Amtrak engineer reported to the dispatcher that they had struck an automobile. Additionally, the engineer reported that the crossing gates at 25th Street did not activate. The dispatcher asked the engineer if there was a VTMI maintenance truck at the crossing. The engineer replied, "Yes."

Crossing Warning System

After the accident, a stop-and-flag protection order was issued for all trains at the crossing, and the crossing warning system bungalow was sealed.[10] The warning times of the last ten trains that included the accident train were recorded and photographed. The warning time of the GCP for the accident train that was recorded in the display module was 39 seconds. The NAS recorder indicated actual warning time of the control relay to be 1 second.[11]

Postaccident testing included shunt tests on both main tracks. The termination shunts were removed to ensure proper operation and approach distance. Battery tests and ground tests were performed on the crossing warning system. Trains were observed in both directions on both tracks at track speed to verify warning times. All applicable warning system tests, as required by federal regulations, were performed; the systems operated appropriately. Additionally, on August 23, 2016, the NTSB investigators and Federal Railroad Administration (FRA) inspectors observed the tests conducted on the NAS event recorder by the NAS technicians at the manufacturer's test facility in Gainesville, Florida. The equipment worked as designed.

An Amtrak train was used to perform two simulations of a train approaching the 25th Street crossing. During the first simulation, the sight distance from the locomotive to the crossing, warning system detection, and island relay detection were measured. The second simulation was performed at accident speed to obtain warning time, gate descent time, light verification, and bell activation. The warning system functioned as designed during both simulations.

Toxicology Testing

The signal inspector was drug and alcohol tested in accordance with the FRA regulations. All test results were negative. The train crew was not tested, which was in accordance with the FRA regulations specified in 49 *CFR* Part 40.

Interviews

Investigators interviewed an eyewitness, Amtrak crewmembers, VTMI managers, and employees. Interview transcripts can be found in the NTSB's docket. The eyewitness stated there was a man standing in the bungalow at the doorway waving cars through the

[10] A train that has either a Form EC-1 instruction or a dispatcher message indicating the malfunction of the automatic warning devices at a highway-rail grade crossing must comply with special instructions provided by SFRTA Rule 314.1.

[11] Although the GCP could detect the approaching train, the control relay could not have activated the lights and gates if either a jumper wire was applied to it or it was bypassed by another means during testing by the signal inspector.

intersection. The NTSB investigators attempted to interview the signal inspector several times, but he refused.

Cell Phone Records

The cell phone records of the signal inspector's phone were reviewed for cellular and data usage. The phone was last used to call the dispatcher on July 6, 2016, at 9:23 a.m. to inform the dispatcher that he would be testing relays.

Highway-Grade Crossing Warning System Trouble/Remedy Tickets

NTSB investigators requested and reviewed the 19 Warning System trouble/remedy tickets logged by the SFRTA Public Safety Coordination Center for the 25th Street crossing for the 12-month period preceding the accident. Five of the tickets were for false activations, which means the crossing warning system activated without the presence of a train. The remaining 14 trouble tickets were for gate issues, such as broken or damaged gates. No credible reports were found of an activation failure (that is, a train was present, and the crossing warning system did not activate). Additionally, the tickets reflected that VTMI and SFRTA provided an alternate means of warning highway users at the crossing while these railroad crossing malfunction reports were being investigated and repaired.

Federal Oversight

The FRA provides the safety oversight for the SFRTA and Amtrak. Title 49 *CFR* Section 234.209, "Interference with normal functioning of system," requires that the normal functioning of any crossing warning system shall not be interfered with in testing or otherwise without first taking measures to provide for the safety of highway traffic. Interference includes, but is not limited to, "Not providing alternative methods of maintaining safety for the highway user while testing or performing work on the warning systems or on track and other railroad systems or structures which may affect the integrity of the warning system."

Previous NTSB Recommendations

On February 28, 2012, at 11:57 a.m., southbound Amtrak train 301-28, traveling on Union Pacific Railroad (UP) Springfield Subdivision main track 2, collided with an eastbound vehicle at the Bissell Street highway-rail grade crossing in Madison, Illinois.[12] Two UP signal employees were working in the UP warning system signal bungalow for the crossing when the accident occurred. Locomotive video recorder data indicated that the crossing warning system did not activate before or during the collision. The vehicle driver died.

The NTSB determined that the probable cause of the accident was the failure of the UP signal inspector and signal technician to provide for the safety of train movements and highway users prior to disabling the highway-rail grade crossing warning system at the Bissell Street crossing. Contributing to the accident was the failure of UP Railroad

[12] National Transportation Safety Board, *Railroad Accident Brief, Madison, Illinois, February 28, 2012*, RAB-14/01 (Washington, DC: National Transportation Safety Board, 2014).

management to ensure proper procedures were followed during the software upgrades to provide for the safety of train movements and highway users.

On March 8, 2013, the NTSB issued Safety Recommendations R-13-3 and -4 to the FRA. The recommendations requested that the FRA issue safety advisories containing the best practices for managing jumper wire use as well as a discussion of the circumstances of this and another railroad accident involving improper use of jumper wires. Although the FRA requested that the NTSB classify Safety Recommendations R-13-3 and R-13-4 as "Closed—Acceptable Action," the FRA agreed that Safety Advisory 2002-01 should be revised and published an updated Safety Advisory 2013-04 in the *Federal Register* on June 3, 2013. The FRA, as part of its 2009 National Safety Program Plan, created two projects dealing with two issues: HQ-S&TC-03-09 and HQ-S&TC-02-1. The first, HQ-S&TC-03-09, was a focused review of railroads' highway-rail grade crossing active warning system disabling procedures. This project was a detailed review of the warning system disabling procedures and the actual practices of the major railroads. Any deficiencies or instances of noncompliance were handled with the railroad for correction. The second, HQ-S&TC-04-09, involved collecting and analyzing human factor-correlated information in conjunction with accidents, false-proceed signal failures, and activation failures. The FRA continued this project into the following year, under HQ-S&TC-02-1, to collect and analyze the data submitted by the FRA regional offices. The results of this project were distributed to the FRA regional offices to note the trends. On the basis of this action, the FRA requested that safety recommendations R-13-3 and R-13-4 be closed. The FRA continues to address human factor-caused incidents with the railroads.

Federal Railroad Administration Safety Advisory

On June 3, 2013, the FRA issued Safety Advisory 2013-04, *Importance of Clear Safety Procedures for Temporary Removal From Service of Highway-Rail Grade Crossing Warning Systems and Wayside Signal Systems*.[13] The safety advisory referenced the NTSB accident investigation into the Madision, Illinois, accident, and reemphasized the importance of ensuring the safety of the traveling public and railroad employees when crossing warning systems and wayside signal systems are temporarily removed from service for the purpose of testing, inspection, maintenance, or repair. The safety advisory contained recommended actions for railroads to follow to ensure safety.

Contracted Signal Maintenance

VTMI was contracted by the SFRTA to perform all signal maintenance in compliance with all applicable federal regulations and in compliance with the safety policy of the SFRTA. The safety oversight consisted of a hierarchical safety policy with VTMI, along with the use of consulting firms that reviewed processes, procedures, and observations in the field of the SFRTA and the contractor employees. VTMI was responsible for compliance of the SFRTA system safety plan. VTMI management was responsible for ensuring the compliance of the SFRTA system safety plan and the system safety plan of VTMI, which included training, rule compliance, and the safety oversight of employees performing required duties.

[13] *Federal Register* 78, No. 106 (June 3, 2013): 33146-33148.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the accident was the failure of the VTMI signal inspector to provide for the safety of train movements and highway users prior to disabling the highway-rail grade crossing warning system at the 25th Street highway-rail grade crossing while performing tests. Contributing to the accident was the failure of the South Florida Regional Transportation Authority and VTMI management to ensure proper procedures were followed during testing to provide for the safety of the train movements and the highway users.

Recommendation

As a result of its investigation, the NTSB makes the following safety recommendation:

To the South Florida Regional Transportation Authority and to VTMI:

> Issue updated instructions to your signal employees that incorporate the best practices outlined in the Federal Railroad Administration's Safety Advisory 2013-04 by (1) advising the signal employees of the circumstances of this accident, (2) highlighting the importance of adhering to the specified industry best practices regarding the use of jumper wires and the application of test equipment, and (3) instructing signal employees that when they are testing a system to not interfere with the normal functioning of any system unless measures are taken to provide for the safety of highway traffic. (R-17-16)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

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Adopted: November 1, 2017

For more details about this accident, visit the NTSB Website and search for NTSB accident identification number DCA16FR009.

The NTSB has authority to investigate and establish the facts, circumstances, and cause or probable cause of a railroad accident in which there is a fatality or substantial property damage, or that involves a passenger train. (49 U.S. Code § 1131 - *General authority*)

The NTSB does not assign fault or blame for an accident or incident; rather, as specified by NTSB regulation, "accident/incident investigations are fact-finding proceedings with no formal issues and no adverse parties … and are not conducted for the purpose of determining the rights or liabilities of any person." 49 *Code of Federal Regulations*, Section 831.4. Assignment of fault or legal liability is not relevant to the NTSB's statutory mission to improve transportation safety by investigating accidents and incidents and issuing safety recommendations. In addition, statutory language prohibits the admission into evidence or use of any part of an NTSB report related to an accident in a civil action for damages resulting from a matter mentioned in the report. 49 *United States Code*, Section 1154(b).
