U.S. Department of Transportation

Federal Railroad Administration

Office of Railroad Safety Summary Report

Derailment of Metro-North Passenger Train 8808

Spuyten Duyvil, Bronx, New York

December 1, 2013

Executive Summary

On December 1, 2013, at 7:16 a.m., EST, southbound Metro-North Railroad (MNCW) Passenger Train 8808 derailed near Spuyten Duyvil Station in Bronx, New York, on Main Track 2. Train 8808 originated in Poughkeepsie, New York, with a destination of Grand Central Terminal (GCT) in New York, New York. Train 8808 consisted of one cab car[1], six passenger cars, and one diesel electric locomotive at the rear in a push/pull configuration. The entire train derailed and came to rest on the west side of the tracks with the lead car stopping at the bank of the Harlem River. The derailment occurred on MNCW's Hudson Division in a 6.5-degree, left-hand curve where the maximum authorized speed was restricted to 30 mph. The locomotive event recorder data indicated the train was traveling at 82 mph when it derailed. The derailment resulted in 4 fatalities, 82 injuries, a fuel spill, equipment and track damage of $5,876,090, and disruption to MNCW's Hudson Division service for 2 days. The total number of passengers on the train was unknown, however, MNCW reports the average ridership for this train to be around 110. The weather at the time of the accident was clear and the temperature was 39 °F. The Federal Railroad Administration's (FRA) investigation determined the probable cause to be excessive speed. A contributing cause was determined to be the Engineer suffering from severe Obstructive Sleep Apnea (OSA).

CIRCUMSTANCES PRIOR TO THE ACCIDENT

Train 8808 was manned by a train crew of four certified and qualified MNCW employees which included a Locomotive Engineer, Conductor, and two Assistant Conductors. The Engineer and Conductor reported for duty at 5:04 a.m., EST, and an Assistant Conductor reported for duty at

[1] A passenger car that has controls for the Engineer to operate from when the locomotive is on the rear in push/pull configuration.

5:30 a.m., EST, at the Poughkeepsie Engine House, in Poughkeepsie, New York, which is their home-terminal. One Assistant Conductor joined the crew at Croton Harmon Station at 6:25 a.m., EST, in Croton-on-Hudson, New York. All crew members received more than the statutory off-duty rest period prior to reporting for duty.

Train 8808 consisted of Cab Car 6222 in the lead, six passenger cars and one diesel electric locomotive on the rear. The locomotive was providing the power for movement in a push mode at the rear of the train. The train departed Poughkeepsie on-time and made nine station stops en route to GCT. The equipment had received all required inspections and tests prior to starting its daily operating cycle.

As the train approached the derailment area, the Locomotive Engineer was seated at the controls on the right side of Cab Car 6222 facing the direction of movement. An Assistant Conductor was seated in the passenger area of the cab car, and the Conductor and second Assistant Conductor were seated in Car 6147.

In the area of the derailment, the Hudson Line consists of three main line tracks. The tracks are geographically oriented north to south and referenced by timetable direction as north to south and labeled east to west as track 1, 2 and 4. On Track 2, a curve begins at Milepost (MP) 11.38 and ends at MP 11.16. The length[2] of the curve is 1,198 feet. Timetable speed for the three main tracks through Spuyten Duyvil is 70 mph with a 30-mph permanent speed restriction between MP 11.5 and MP 9.9 as designated in MNCW's Timetable Number 1, effective April 7, 2013. The derailment occurred at MP 11.3. The method of operation at this location is Centralized Traffic Control (CTC)[3].

[2] Due to changes in track alignment, RR mileposts are not always exactly one mile apart.

[3] Centralized Traffic Control (CTC) is a method of operation, in which all train movements are authorized and governed by interlocking signals, cab signals and instructions issued by the Rail Traffic Controller.

Train 8808, per the event recorder data, departed Tarrytown Station at 7:02 a.m., EST, operating south on Main Track 2. The event recorder data also shows the Engineer manipulated the controls several times after leaving Tarrytown, New York. At 7:05:34 a.m., EST, the Engineer shut off the throttle after reaching the maximum authorized speed (MAS) of 70 mph. Train 8808 then coasted for 4 minutes and 35 seconds and slowed to 47 mph before the throttle was moved to position 8[4] at 7:10:19 a.m., EST. The Engineer then manipulated the controls several times to comply with speed restrictions and sounded the horn when required by MNCW rule, and Federal regulations. The last recorded action prior to the derailment occurred at 7:14:37 a.m., EST, when the Engineer placed the throttle in position 8.

THE ACCIDENT

As Train 8808 approached the left-hand curve north of Spuyten Duyvil Station, the event recorder data indicates the train reached MAS of 70 mph at 7:15:41 a.m., EST. The Engineer took no action to prevent an over speed condition and continued to accelerate. At 7:16.45 a.m., EST, at MP 11.50, Train 8808 entered a segment of track where speed was restricted to 30 mph traveling 79 mph and took no action to reduce his speed. The train speed continued to increase to 82 mph at MP 11.3 at 7:16:53 a.m., EST, and the event recorder stopped recording at 7:16:56 a.m., EST, the recorded time of the derailment.

The derailment occurred at MP 11.35, in a 6.5-degree curve, where the leading west wheel of Cab Car 6222 climbed the west rail due to high lateral wheel forces. Simultaneously a high cant deficiency induced in the car resulted in complete unloading of the wheels on the east side rail, or low rail, allowing the car to turn onto its side. As the train continued forward, cars two

[4] Throttle position 8 is the maximum throttle position.

through seven derailed in the same manner. The first five cars rolled onto their right sides, then the fourth car rolled over coming to rest leaning to the left. Cars one and five up-righted themselves, while cars six and seven, as well as the locomotive, traveled through the debris field at a 45-degree angle and were slowed by plowing into the ballast. The train traveled approximately 880 feet from the point of derailment (POD) before coming to rest. When the train came to rest, the first car, Cab Car 6222, was upright. The second and third car, 6228 and 6345 respectively, were on their right sides. The fourth car, 6440, rolled over completely and was leaning at a 45-degree angle to the left. The fifth car, 6188, and the sixth car, 6147, were upright with their wheels buried deep in the ballast. The seventh car, 6156, and Locomotive 225, was leaning at a 45-degree angle on its right side. (*Figure 1*).

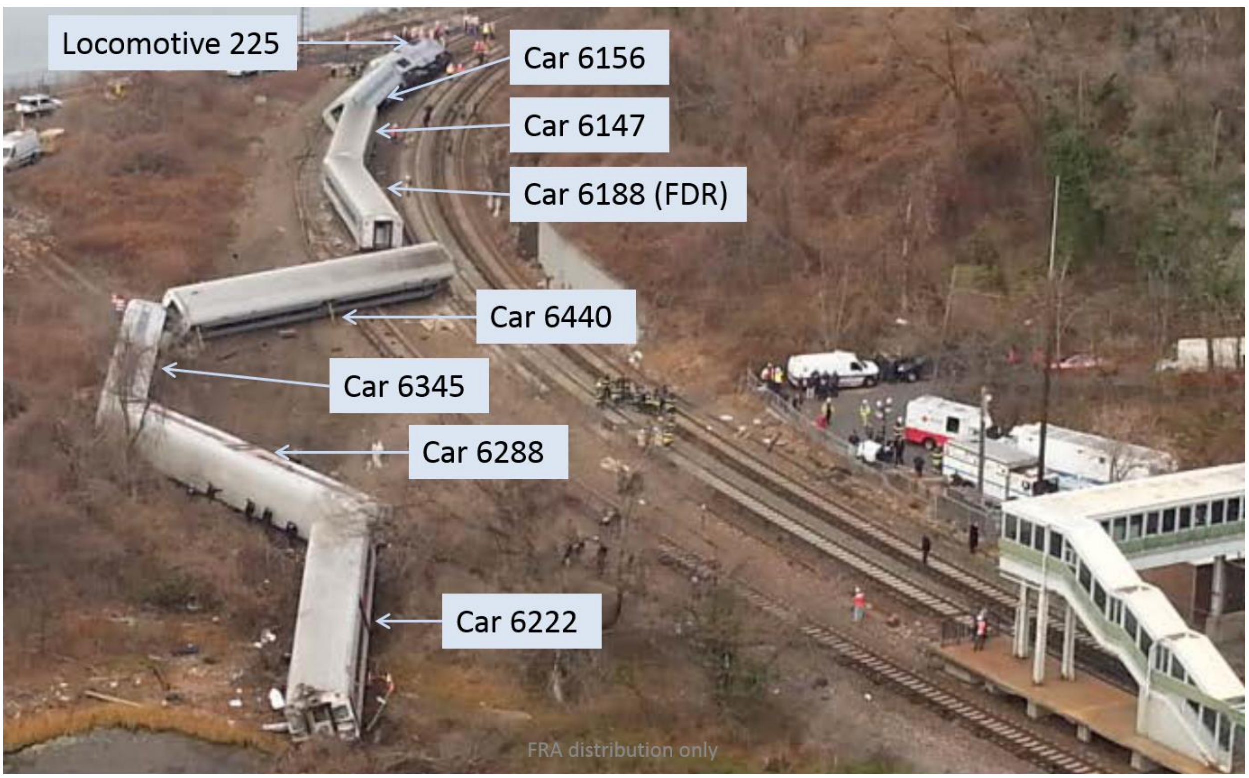

Figure 1: Aerial view of MNCW Passenger Train 8808 derailment

INVESTIGATION FINDINGS AND ANALYSIS

FRA investigators arrived on-scene at 8:30 a.m., EST, on December 1, 2013, and the field investigation concluded on December 9, 2013. FRA's investigation team was comprised of a Chief Inspector, who served as the Inspector in Charge, and inspectors from the Motive Power and Equipment (MP&E), Operating Practices (OP), Track, and Signal and Train Control disciplines.

FRA's investigation included an inspection of the equipment, a review of records of tests and maintenance performed on the equipment prior to the accident, an inspection of the signal system to include a review of records of tests and maintenance performed prior to the accident, a review of the train operation for compliance with the railroads applicable rules and timetable instructions, and the crew's status regarding physical exams, training, and hours of service.

Measurements of the post-accident track geometry were made and previous automated track geometry records in the area of the derailment were reviewed and analyzed. MNCW's track inspection reports, periodic continuous wielded rail (CWR) joint bar inspection reports, and rail inspection records were reviewed.

Track

FRA investigators reviewed the derailment site and determined the POD to be located on Track 2, west rail, at MP 11.35. Investigators observed a continuous mark beginning at the inside corner of the west rail that traveled in a southerly direction and diagonally across the top of the rail surface. This is indicative of the point of derailment.

Measurements of the post-accident track geometry and review of previous automated track geometry records near the POD by investigators confirmed the track geometry was in compliance with FRA track safety standards. Review of MNCW track inspection reports, periodic CWR joint bar inspection reports, and rail inspection records revealed MNCW indicated compliance with the minimum required frequency of inspections, reporting exceptions, and taking the required remedial action on exceptions. Investigators determined the track, rail, surface, ties, and drainage were not a factor in this derailment.

MP&E

Investigators performed detailed post-accident inspections and testing of the equipment and carefully reviewed pertinent records of tests and maintenance performed on the train prior to the accident. All equipment functioned as designed and records were in compliance with Federal regulations. Cab Car 6222 was ordered on November 8, 2000, and placed in service on September 5, 2002. The cab car was not, nor was it required to be, equipped with an alerter device[5]. No equipment-related contributing causes were found.

Signal System

The signal systems were inspected for proper operation. Inspection records for both interlockings, the track and the Supervisory Control and Data Acquisition (SCADA)[6] event recorder were reviewed. It was determined the signal system displayed the proper wayside and onboard signals up to the time of the derailment and was not a contributing factor in this derailment.

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[5] A device that sounds an audible alert if no action is taken by the Engineer in a specified time limit.
[6] An In-Cab signal system that displays information that controls the movement of trains.

OP

The OP investigation included review of training and compliance records, interviews, sight distance evaluation, fatigue analysis, review of toxicology testing results, and review of event recorder data.

Review of Operating Rules and Training Records

FRA investigators reviewed MNCW Operating Rules and determined the Engineer of Train 8808 failed to operate the train in compliance with MNCW operating rules, and in violation of Title 49 Code of Federal Regulations (CFR) Section 240.305(a)(2) which states it shall be unlawful to "[o]perate a locomotive or train at a speed which exceeds the maximum authorized limit by at least 10 miles per hour." The investigation found the Engineer of Train 8808 was certified and qualified on the territory where the derailment occurred and required training was current.

Sight Distance Evaluation

A simulated reenactment of the Engineer's view approaching the 30-mph speed restriction at MP 11.5 from the cab of Train 8808 was performed. The reenactment used train equipment similar in design to the equipment involved, at the approximate time of the accident, with similar weather conditions, and a certified and qualified crew. The purpose of the test was to determine the sight distance where the curve, and its 30-mph speed restriction, could be confidently identified by the operating engineer. The test concluded the Engineer could view the approaching curve, and its speed restriction, with ample time to apply the trains braking system to comply with the speed restriction before entering the curve, consistent with good train handling.

Review of Event Recorder Data

Review of the event recorder data determined the train was not operated in compliance with the railroad's applicable rules and timetable instructions. The event recorder data confirmed an overspeed event was the primary cause of the derailment.

Fatigue Analysis Study

FRA performed a fatigue analysis using the Fatigue Avoidance Scheduling Tool (FAST)[7]. FRA uses an overall effectiveness rate of 77.5 percent as the baseline for fatigue analysis. At or above this baseline, FRA does not consider fatigue as probable for any employee. Inputs into the FAST software vary according to information obtained from each employee. Based on the results of the FAST analysis, FRA concluded that fatigue was not probable for the Engineer and Conductor of Train 8808.

Voluntary post-accident sleep disorder medical tests of the Engineer were performed. It was reported these tests indicated the Engineer suffered from severe OSA.

Toxicological Testing

This accident met the criteria for Title 49 CFR Part 219, Subpart C, Post Accident Toxicological Testing. The entire crew on Train 8808 and the two Rail Traffic Controllers were tested under FRA guidelines for the use of alcohol and drugs with negative results for all employees tested. Investigators determined that neither drug nor alcohol use was a factor in this accident.

[7] FAST is designed to identify fatigue based on work-rest cycles from inputs from the subjects and is not intended to diagnose medical conditions.

Interviews

In an interview with the investigators, the Engineer stated all equipment operated normally and he "didn't take any exceptions" during the trip. He stated he began to feel "dazed and hypnotized" looking ahead at the track leading up to the accident site, and the "feeling of the train" shook him out of this state. The Engineer also stated that no one was in the operating compartment with him the entire trip.

The Engineer told investigators that he had been working this assignment since November 18, 2013, and he has been working nights consistently for the last 2.5 years. The Engineer categorized his overall health to investigators as "excellent".

Forensics Team

FRA dispatched a separate team to analyze damaged passenger cars and to make a correlation between the nature and extent of injuries with the equipment damage involved. This team noted the windows and gaskets were torn from their frames while the cars were sliding on their sides. The Forensics Team determined the fatally injured passengers were ejected from the train via windows during the derailment. The causal mechanism of these fatalities was most likely the lack of glazing securement during car body derailment and rollover. Victims appear to have been pulled out when they contacted the ground through window openings, as the cars continued to slide. (*Figure 2*). Nearly all the polycarbonate window panes remained substantially intact, as did the car sidewalls.

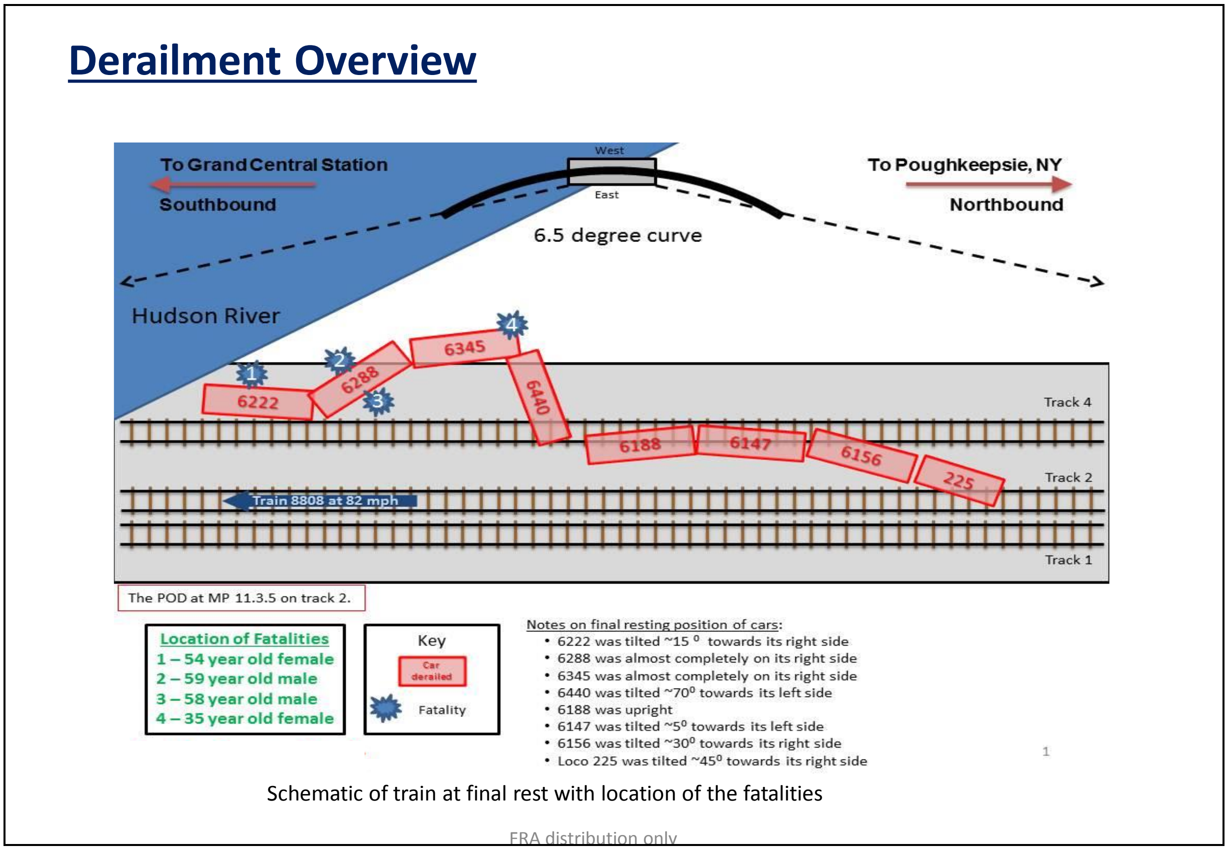

Figure 2: Derailment car and fatality locations

CONCLUSIONS

1. The cause of the derailment was excessive speed. The train entered the curve at 82 mph within the 30-mph restriction. Train 8808 was not operated in compliance with the railroads applicable rules and timetable instructions.
2. Equipment was not a contributing factor in this derailment. Of note, Cab Car 6222 was not required to be equipped with an alerter. Had the cab car been equipped with an alerter device, the Engineer would have been provided a safeguard to prevent loss of situational awareness.
3. Fatigue, as determined by FRA's FAST model, was not probable for the crew of Train 8808.

4. A separate sleep evaluation external of FRA investigation reportedly concluded the Engineer suffered a sleep disorder, specifically severe OSA.

FRA ACTIONS

On December 11, 2013, FRA issued an Emergency Order (*EO-29*) requiring MNCW to take certain actions to control passenger train speed at any location on main track where there is a reduction of more than 20 mph from the maximum authorized train speed. On December 11, 2013, FRA issued a Safety Advisory (*SA-2013-08*) which urged railroads to provide additional training, increase the frequency of operational testing, and reinforce the importance of communication between crew members. FRA also initiated *Operation Deep Dive*, a safety assessment of MNCW's operations and safety compliance on December 16, 2013. FRA worked closely with MNCW in developing their remedial actions. FRA's Administrator met with the Metropolitan Transit Authority's Board Chairman regarding the accident. Following the derailment, FRA conducted assessments, to include a forensics investigation of side window loss and occupant expulsion.

Forensics Investigation

The forensics investigation determined all the fatally injured passengers were ejected from the train via windows during the derailment. All train occupants that were contained within the cars survived the derailment. Results of the forensics investigation indicate the rubber gaskets holding the window panes in place were pulled out when the cars slid on their sides and the windows were pushed inside the cars creating openings.

In addition to functioning as a window, glazing systems are also expected to be impact-resistant, provide emergency egress and access, be fire-resistant, and provide occupant containment. FRA is conducting research on glazing integrity, including assessing the performance of current glazing systems in meeting all expectations. Specifically, occupant containment, developing modifications for improving safety performance, and comparing the performance of conventional and modified glazing systems are being studied. The objective of FRA's glazing integrity research is to comprehensively describe all the engineering requirements placed on glazing systems and to develop effective strategies for balancing all safety demands.

RAILROAD ACTIONS

MNCW made circuit changes to the signal system near the Spuyten Duyvil station on December 9, 2013. The signal system will now enforce the 30-mph permanent speed restriction on the curve near the Spuyten Duyvil station. MNCW also implemented similar changes at five other critical curves and five moveable bridges. MNCW acted to install alerter devices in all cab cars not previously equipped. After the accident, MNCW established a significant shift in the functional responsibilities of their Office of System Safety. Their focus was to improve the railroad's overall safety culture by implementing meaningful safety enhancements. The enhancement includes reorganizing the Safety Department to create a Data Analysis Unit and a separate Incident Investigation Unit. Additionally, MNCW revised their System Safety Program Plan (SSPP) to include a hazard assessment component and has implemented communications and training programs in the SSPP, as well as entered into an Implementing Memorandum of Understanding with the labor unions and FRA to participate in the Confidential Close Call Reporting System.