NATIONAL TRANSPORTATION SAFETY BOARD

Office of Railroad, Pipeline and Hazardous Materials Investigations
Washington, DC

Long Island Rail Road
Train 2817 Collision at the End of Track
Atlantic Terminal
Brooklyn, New York
January 4, 2017

NTSB Accident Number DCA17FR002

TRACK & ENGINEERING FACTUAL REPORT

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Train No. 2817 Collision at the End of Track
Atlantic Terminal
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Accident

NTSB Accident Number:	DCA17FR002
Date of Accident:	January 04, 2017
Time of Accident:	8:18 a.m. (EST)
Railroad Owner:	LIRR
Train Operator:	LIRR
Type of Train and No:	Passenger Train ID: 2817
Crew Members:	1 Engineer, 1 Conductor, 1 Assistant Conductor
Fatalities:	0
Injuries:	108
Location of Accident:	Brooklyn, NY

Accident Summary

For a summary of the accident, refer to the *Accident Summary* within this docket.

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Track Description

The Atlantic Terminal, formerly Flatbush Avenue, in Downtown Brooklyn, New York was originally constructed in 1907. It was modified around 1971-72 to accommodate the new 85-foot long M1 cars. The original terminal building (but not the platforms) was demolished in 1988. The current terminal building was constructed between 2004-2010. The platforms were rehabilitated, but not completely reconstructed. No changes to the tracks or switches occurred during this construction period.[1]

There were six LIRR station tracks in the Atlantic Terminal. They were numbered station track #1 through station track #6, with station track #6 being the southernmost track. Each track terminated at a bumping post, designated as milepost (MP) 0.00.[2] A roof and walls fully enclosed all tracks in the Atlantic Terminal which prevented exposure to the elements. The Atlantic Terminal was part of the Track Subdivision 1 of the West Division. Station track #6 was subject to about 2.1 million gross tons (mgt) per year, consisting exclusively of electric multiple unit (MU) passenger trains.[3] (For more information on the train equipment, see the *Mechanical Group Factual Report* in the docket.)

1 The construction drawing showed the bumping post on station track #6 remained the same.
2 A bumping post is a braced post, block, or obstruction placed at the end of stub or spur track that halts car movement and prevents cars from going off the rails.
3 Mgt is the total weight, including the weight of lading, cars, and locomotives that traverse over a section of track for a year.

The LIRR inspected and maintained the tracks in Atlantic Terminal on this portion of the Atlantic Branch to the Federal Railroad Administration (FRA) track safety standards (TSS) for Class 1 track, which allowed a maximum operating speed of 15 mph for passenger trains.[4] However, due to the curvature within the terminal and the geometry of the interlocking and station track lead switches, the maximum authorized speed was 5 mph, as designated in the LIRR Timetable Special Instruction 1038-B included in General Order 203, effective November 14, 2016.

In the direction of travel, train #2817, the accident train, traversed a descending grade from switch 33E at MP 0.19 in Brook 1 Interlocking to station track #6. The LIRR reported a 1.0% descending grade from MP 0.19 to MP 0.15, then a vertical curve from MP 0.15 to MP 0.04, and finally an ascending 1.0% grade from MP 0.04 to the end of the track at MP 0.00.

From Brook 2 Interlocking to Brook 1 Interlocking, the train traversed tangent track. See Figure 1 for a schematic drawing of Brook 2 and Brook 1 with the route of train #2817 into station track #6 traced in green. Figure 2 is a schematic drawing of Brook 1. Immediately after entering Brook 1 Interlocking, the train crossed over to from main track Atlantic #1 to main track Atlantic #2 over the #21 crossover switch, which are No. 10 turnouts. The train then traversed tangent track for a short distance until it traversed a left hand curve at the 33E switch (first interlocking switch).

4 Reference 49CFR213.9 for the operating speed limits for classes of track.

After traversing three switches, the train entered station track #6. After traversing a triple compound curve (maximum curvature 14 degrees) at the east end of the platform, the train traveled on tangent track the remaining 350 feet to the bumping post.

Train #2817 impacted the bumping post at the west end of the station track #6 at 12 mph. See Figure 3 for a picture of the bumping post that was on station track #6. Upon impact, the lead car #7553 destroyed the bumping post, slid onto the concrete flooring and entered and destroyed a secure hallway area that is used only by employees, and apparently stopped as it struck two vertical steel columns.5 The lead car went 13 feet 6 inches past the bumping post faceplate, and a segment of the running rail attached to the bumping post pitched upward and pierced the floor of car #7553 and entered the electrical closet directly behind the engineers control cab.

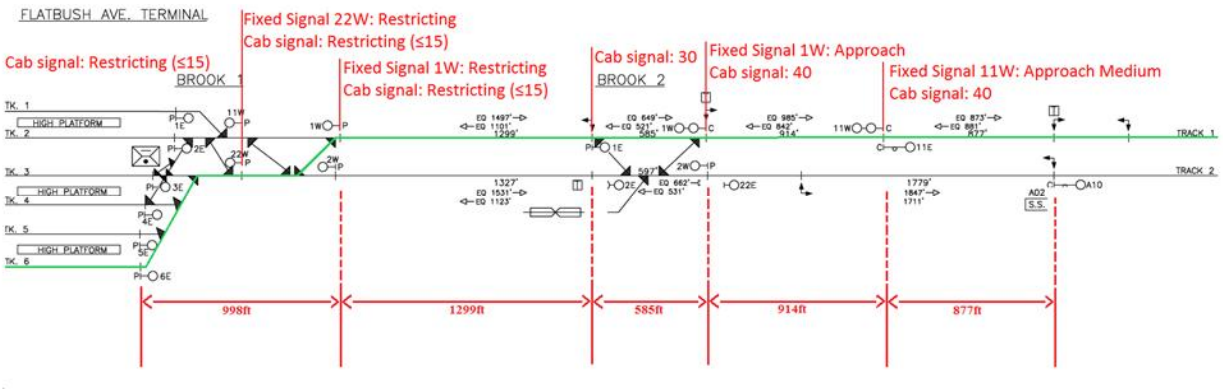

Figure 1. Route of train #2817 into Atlantic Terminal

5 The area of the secured hallway that was struck was wider than the hallway design on the construction diagram and could also be used for storage.

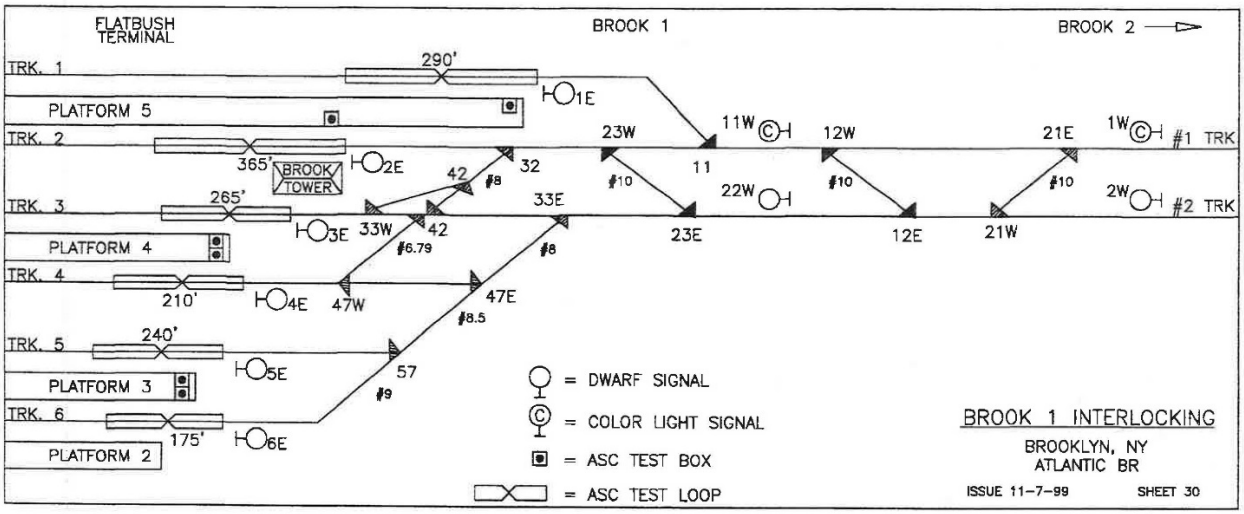

Figure 2. Brook 1 Interlocking.

The six station tracks had three passenger platforms that were shared by two tracks each. Station tracks #1 and #2 shared; station tracks #3 and #4 shared; and station track #5 and #6 shared. See Figure 2 for the platform configurations. Note that platform #2 is no longer in use, and the above illustration shows that platform to the south of station track #6. The platform has a glass block wall on it and is not accessible from a train.

The platform lengths for the six station tracks were:

- Station track #6 north side is 419 feet
- Station track #5 south side is 522 feet
- Station track #4 north side is 656 feet
- Station track #3 north side is 650 feet
- Station track #2 north side is 711 feet
- Station track #1 south side is 684 feet

Station track #6 consisted of 100-pound PS (Pennsylvania Standard) jointed rail, with rail lengths of about 39 feet. Ties were 8 foot 6 inch (except for every fifth tie which was 9 foot 6 inches and supported the third rail.), 9 inches wide by 7 inches tall, and spaced at 21 inches on center. Track fasteners were a combination of Pandrol e-clips and conventional double shoulder plates with cut spikes, hair pin fasteners, and lag screws. The track was fully ballasted with granite stone.[6] The track sat on a combination of concrete slab over the New York City Transit Authority facilities below and natural ground.

In 2015, the LIRR engineering management asset group inventoried all bumping posts in passenger yard tracks, including Atlantic Terminal. The bumping post at the west end of station track #6 was a Western Cullen Hays, Inc., model WDC. Figure 3 shows the actual bumping post that was located at the end of station track #6. Calculations provided by the manufacturer show that the bumping post had a maximum impact capacity of 415,000 pounds. This force equaled six partially loaded M7 class multiple unit passenger cars moving at approximately one mph.

6 Track is fully ballasted when the 1 ½ inch stone fills the void between the ties and extends onto the shoulder about 16 inches

Figure 3. Bumping Post on Station Track #6.

The distance from the bumping post face to the Atlantic Terminal wall/floor structure on station tracks #6, #5, #4, #2, and #1 was 5 feet. The distance from the bumping post face to the wall on station track #3 was 25 feet.

A rail lubricator was located on main track Atlantic #1, just east of the Brook 1 Interlocking. Investigators noted on January 6, 2017 that this lubricator was non-operational.7 The top of rail friction coefficient on station track #6 following the derailment was measured on January 04, 2017, using a Salient Systems Tribometer. Prior to use on the subject track, the calibration of the device was tested behind the LIRR's Maintenance of Way Repair Shop located in Hollis, NY. The testing behind the shop noted that the coefficient of friction readings of 0.33 to 0.36 were recorded on dry track. The application of lubrication to the railhead decreased readings to 0.23. The readings on station track #6 are tabulated in Table 1 and indicate a dry rail condition.

Table 1. Coefficient of Friction Measurements on Station Track #6.

Footage	North Rail	South Rail
-4 feet, 6 inches	7074 coupler	7074 coupler
7 feet		0.36
12 feet	0.33	
14 feet, 8 inches		0.35
23 feet	0.36	0.33
43 feet	0.38	
63 feet		0.33
76 feet	0.34	
79 feet	0.38	
81 feet		0.32
90 feet		0.40

7 The Long Island Rail Road representative said the rail lubricator was intentionally taken out of service due to the on-going Vanderbilt Yard construction.

98 feet	0.42	
100 feet		0.46
111 feet, 6 inches	Point of Frog (POF) 57 SW	POF 57 SW

Pre-Accident Track Maintenance and Inspections

Track maintenance was conducted as dictated by various track inspections and reported deficiencies on an as necessary basis. The LIRR had not conducted scheduled program track maintenance on station track #6 in the 10 years prior to this accident.8

The LIRR main tracks Atlantic #1 and #2, approaching the terminal, are designated as Class 3 passenger train tracks with a maximum authorized speed of 45 mph. Based on that designation, the FRA track safety standards required the main tracks be inspected twice weekly. Atlantic Terminal station tracks were designated as Class 1, other than main tracks, with a maximum authorized speed of 5 mph. Based on that designation the TSS requires the "other than main tracks" to be inspected monthly.[9]

Even though the LIRR station tracks were required to be inspected monthly, the LIRR conducted visual track inspections in the station weekly. The last visual track inspection before

8 Scheduled program track maintenance typically includes large scale replacement of rail and/or cross ties, or rail grinding or surfacing the track.
9 See 49 CFR Part213.233 for more information.

the accident for the Atlantic station tracks were conducted on January 3, 2017. There were no exceptions to the FRA standards recorded for station track #6. Also, the LIRR recommended practice was to use the geometry car on a semiannual basis to inspect the station tracks. Prior to the accident, the last geometry car inspection on station track #6 was on April 19, 2016, with no recorded defects. The ongoing Vanderbilt (VD) rail yard construction being conducted adjacent to the Atlantic Terminal prevented completion of the second semiannual geometry car inspection in 2016.

In addition, the LIRR has a long-standing waiver from the FRA dated July 23, 1975, that allowed them to visually inspect the main tracks once per week, with the addition of using a track geometry car for inspections on a quarterly basis. The last geometry car inspection prior to the accident on both main track Atlantic #1 and main track Atlantic #2 was on November 15, 2016, up to the terminal area. The following were the geometry car results:

- On main track Atlantic #1, the nearest exception measured was a 0.53 tight gage at MP 4.3 (about 4.3 miles from the end of track)
- No geometry exceptions were measured on main track Atlantic #2, between Jay Interlocking (Jamaica) and Brook Interlocking

Title 49 *Code of Federal Regulations* (CFR) Part 213.237, required:

> …each track owner shall conduct internal rail inspections sufficient to maintain service failure rates per rail inspection segment in accordance with this paragraph (a) for a 12-month period, as determined by the track owner

> and calculated within 45 days of the end of the period. Internal rail inspections on Class 4 and 5 track, or Class 3 track with regularly scheduled passenger trains or that is a hazardous materials route, shall not exceed a time interval of 370 days between inspections or a tonnage interval of 30 million gross tons (mgt) between inspections, whichever is shorter. Internal rail inspections on Class 3 track that is without regularly-scheduled passenger trains and not a hazardous materials route must be inspected at least once each calendar year, with no more than 18 months between inspections, or at least once every 30 mgt, whichever interval is longer, but in no case may inspections be more than 5 years apart.

The LIRR inspected the rail for internal defects on a semiannual basis. The last inspection for internal rail defects on station track #6 was on August 19, 2016, and no internal rail defects were detected. On August 22, 2016, one internal rail defect (transverse defect 10%) was found on main track Atlantic #2 at MP 3.5 (about 3.5 miles from the end of track) on the south rail.

Post-Accident Inspection of Track/Records

On January 06, 2017, the track group conducted a walking inspection and examination of the track that the accident train had traversed. The inspection/examination began at the crossover switch from main track Atlantic #1 to main track Atlantic #2 at the east end of Brook 1

Interlocking. Based on the findings of this inspection, the FRA Railroad Safety Inspector (Track) completed an FRA inspection report. The report noted no exceptions of the TSS.

After pulling the rear four cars away from the train, investigators noted that station track #6 was misaligned consistent with track moved by train induced forces resulting from sudden impact at the end of track. See Figure 4 for a picture of the track misalignment.

Figure 4. Track 6 misalignment with accident train removed.

The FRA railroad safety inspector (track) conducted an inspection of the LIRR's track inspection records to determine compliance with the FRA regulations. The portion of the track inspection records reviewed were for the period from June 28, 2016, to January 03, 2017, and covered the Atlantic Terminal area which is designated as Flatbush Station on the inspection reports. The weekly inspection records were complete. There were no problematic conditions reported for station track #6.

The records showed that the last inspection of the track leading to the accident site was on January 3, 2017, by a LIRR qualified track inspector. The inspection record indicated no FRA defects for station track #6.

Regulatory Track Inspection History

On November 19, 2015, an FRA track safety inspector conducted a routine walking inspection at the Brook 1 and Brook 2 Interlocking; including the VD Yard lead. The inspection report did not note any track exceptions. The most recent track inspection he conducted on the LIRR was during a headend train ride on December 27, 2016, from Port Washington to New York City and from New York City to Jamaica. The inspection noted no exceptions regarding the quality of the train interaction with the track structure, on-ground personnel, and train operation during the 46-mile train ride.

Damage Estimates

The total engineering damage cost including track, structures, signal and third rail was $947,329.00, of which, the cost of track damage was $226,000.

Other Information

There is a difference between the uses of a bumping post at the stub end of a track in passenger service compared to its use in freight service. In passenger service, the goal is to not to have an abrupt stop so passengers are not injured and to have the impact confined to the cars body anti-climber so the cars stay in line. In freight service, when the coupler strikes the bumping post face, the cars can also be stopped abruptly which can cause damage to lading, or at times the bumping post is destroyed, at which point the cars can carom into unprotected areas. There are no anti-climbers on the body frame of freight cars to keep them in line.10 The president of H.J. Skelton Ltd., 165 Oxford Street E., London, Ontario, Canada N6A 1T4 gave an informative interview describing the use, design, installation, and maintenance of bumping posts.[11] More information about the use, design, installation, and maintenance of bumping posts can be found in

10 There are no Federal Regulations for bumping posts.
11 H.J. Skelton is a manufacturer and supplier of Rawie designed bumping posts and buffer posts.

the Special Investigation Report for this accident and the Hoboken, New Jersey bumping post override accident.

**********END**********