National Transportation Safety Board

Office of Railroad, Pipeline and Hazardous Materials Investigations

Washington, D.C. 20594

New Jersey Transit

Collision with Bumping Post

Hoboken, New Jersey

September 29, 2016

NTSB Accident Number DCA16MR011

Signal Group Factual Report

A. ACCIDENT

Type:	Collision of Eastbound New Jersey Transit Train 1614 with Terminal Platform
Date and Time:	September 29, 2016 08:42 a.m.
Location:	Hoboken New Jersey
Carrier:	New Jersey Transit Rail Operations
Train:	New Jersey 1614
Fatalities:	One
Injuries:	108

B. Signal Group Members

R. Page
Railroad Accident Investigator
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C. Accident Summary

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

D. Details of the Investigation

1. Description of the Railroad Signal System

1.1 Station Bill MP 58.0 to Terminal Hoboken MP 0.0

New Jersey Transit used a traffic control system (TCS) in conjunction with an automatic Train control system to direct train movement between Station Bill and Hoboken Terminal.[1] Additionally, cab signals (CSS) and block signals apply within the TCS system. The interlocking limits of Terminal Tower extended to the east end of the Train Shed tracks.[2] The Terminal Dispatcher remotely controls Terminal, East End, West End, and Lower Hack Interlocking. Train Shed tracks 1 through 17, inclusive, in the Hoboken Train Shed were designated as main tracks with interlocking and CSS rules in effect. Trains and track cars must not exceed 10 MPH.

2. Signal Event Recorders

The terminal interlocking uses a train management and coordination dispatcher system (TMAC).

[1] The Federal Railroad Administration (FRA) defines a traffic control system in 49 *Code of Federal Regulations* (CFR) Part 236.828 as block signal system under which train movements are authorized by block signals whose indications supersede the superiority of trains for both opposing and following movements on the same track. The FRA defines an automatic train control system in the 49 CFR Part 236.825 as a system so arranged that its operation will automatically result in the following: (a) A full service application of the brakes which will continue either until the train is brought to a stop, or, under control of the engineman, its speed is reduced to a predetermined rate. (b) When operating under a speed restriction, an application of the brakes when the speed of the train exceeds the predetermined rate and which will continue until the speed is reduced to that rate.

[2] The Federal Railroad Administration (FRA) defines a cab signal in 49 CFR Part 236.805 as a signal located in engineman's compartment or cab, indicating a condition affecting the movement of a train and used in conjunction with interlocking signals and in conjunction with or in lieu of block signals. The FRA a block signal in the 49 CFR Part 236.804 as a roadway signal operated either automatically or manually at the entrance to a block.

The TMAC System recorded the route of train 1614. Table-1 represents sequence of events in chronological order as recorded by the TMAC System the day of the accident for train NJTR 1614.

Table 1. Sequence of events CP East End to Train Shed Track

EVENT	TRAIN	TIME
1. Terminal Home Signal 6E Displayed	NJTR 1614	8:38:37
2. Passes East End Home Signal 20E	NJTR 1614	8:38:39
3. Terminal Home Signal 26E Displayed	NJTR 1614	8:38:40
4. Passes Auto Signal MO6T3	NJTR 1614	8:39:04
5. Passes Terminal Home Signal 6E (enters Terminal Interlocking)	NJTR 1614	8:39:49
6. Enters approach circuit to Home Signal 26E	NJTR 1614	8:40:07
7. Passes Terminal Home Signal 26E	NJTR 1614	8:40:19
8. Enters approach circuit to Train shed track 5	NJTR 1614	8:40:51
9. Enters circuit (A40B) occupying Train shed track 5	NJTR 1614	8:41:17
10. Train 1614 fully occupies Train Shed Track circuit (A40B) # 5.	NJTR 1614	8:41:37

The On-board video of train 1614 and the recorded data from the TMAC System was used to duplicate the route and the signal aspects on the day of the accident for train 1614. (See Table 1.) Figures 1-4 illustrate the proper signal aspect, name, and the indication displayed to train 1614 on the day of the accident. Additionally, the applicable operating rule is defined with each signal indication on the day of the accident from the automatic M06T3 to the end of train shed track 5. Signals M06T3-Signal 26E were mounted on an overhead cantilever over the corresponding track. The last signal was a wayside dwarf signal mounted at the end of train shed track 5 and received damaged in the accident.

Figure 1. Signal at M06T3.

RULE	SIGNAL NAME	INDICATION
284	Approach Slow	Proceed approaching the next signal at slow speed. Trains exceeding medium speed must begin reduction to medium speed as soon as the engine passes the approach slow signal.

Figure 2. Signal at Terminal Interlocking Signal 6E.

RULE	SIGNAL NAME	INDICATION
287	Slow Clear	Proceed at slow speed until entire train clears all interlocking or spring switches, then proceed at normal speed. In CSS territory with fixed automatic block signals, trains not equipped with operative cab signals must approach the next signal at medium speed once they have left interlocking limits.

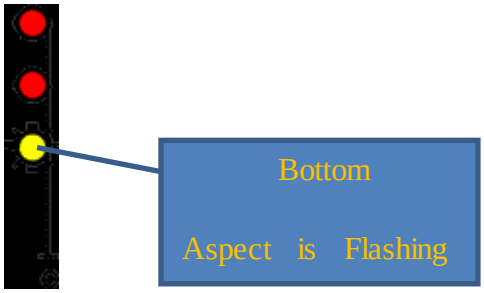

Figure 3. Signal at Terminal Interlocking Signal 26E.

RULE	SIGNAL NAME	INDICATION
288	Slow Approach	Proceed prepared to stop at next signal. Slow speed applies until entire train clears all interlocking or spring switches, then medium speed applies.

Figure 4. Signal at End Track Shed 5.

RULE	SIGNAL NAME	INDICATION
292	Stop Signal	Stop

3. Post-Accident Inspection/Testing

3.1 Wayside Signal Systems

The signal and train control group inspected the affected signal equipment and physical layout of the interlocking route of train No. 1614 from the automatic signal M06T3 MP .7 to train shed track 5 signal at MP 0.0. The dwarf signal at the end of Train shed track 5 and track circuit

A40B was not inspected because of damage to the signal, track, and terminal during the accident. However, forward-facing video proved the signal at the end of track 5 was illuminated and the aspect red. TMAC data retrieved proved that the A40B track circuit worked as designed. The remainder of track circuits were inspected, verified, and shunted sequentially to simulate a train taking the same route as train 1614. All signal locations were inspected and verified for proper operation. Signal circuits were free of grounds and all signal lamp units were working as intended with proper voltage levels. Signal route and signal aspect sequence testing was performed between the automatic signal M06T3 at MP .6 and terminal interlocking signal 26 E. Verification of the proper signal aspect and cab signal code rate at all locations found no deficiencies. Signal preview and signal spacing were of sufficient length to comply with the operating rules. No defects were found for the units inspected.

3.2 Railroad Maintenance and Test Records

Railroad Maintenance, inspections, and tests records were provided for monthly, quarterly, semi-annual, annual, 2 year, 4 year, and 10-year inspections for terminal interlocking signals 6E, 26E, shed track 5, and automatic signal M06 T3. Maintenance, inspections, and tests of the signal system and associated appurtenances were in accordance with the Federal Railroad Administration (FRA) requirements.

4. Damages to Signal System

Transcontrol manufactured the dwarf signal in train shed Track 5. It was equipped with a single signal head with a red lens and a 10-volt, 18w, clear bulb. The collision of train 1614 with the platform damaged the dwarf signal and connecting underground cable and track connections.

Figure 5 depicts damage to the dwarf signal in train shed track 5. The damage estimate to the signal system provided by NJT is $1,954.00.

Figure 5. Damaged Dwarf Signal Train Shed Track 5.

5. Positive Train Control, (PTC)

At present time, NJ Transit's PTC system is not operational. However, NJ Transit will be implementing a PTC system identical in function to that provided by Amtrak on the Northeast Corridor (NEC), referred to by Amtrak as the Advanced Civil Speed Enforcement System (ACSES II) with cab signal system (CSS). This PTC package is referred to by NJ TRANSIT as the Advanced Speed Enforcement System, second generation (ASES II). It provides identical features and functions and is fully compatible and interoperable with the Amtrak ACSES II/CSS PTC. The

existing CSS continues to provide train separation and signal speed enforcement while the ASES II system complements the CSS and provides the other required PTC functions. The two systems (CSS and ASES II) are functionally independent, although they do report status and transfer certain data between them. Federal regulation permits the exclusion of certain "mainline tracks" from PTC requirements. NJ TRANSIT designated certain line segments in their Positive Train Control Implementation Plan, (PTCIP) dated Jan. 2016 over which scheduled intercity and commuter passenger service is provided, as other than main line track. Terminal Interlocking at Hoboken was exempted from PTC requirements under CFR236.1019(b) through a main track exclusion addendum filed by NJTR under section 13.1 of their PTCIP dated January 2016. This terminal area includes 20 track terminus points (17 passenger platform tracks, extending from each end of track, each with an eastbound fixed inoperative Stop Signal; and, 3 additional tracks at the southern limits) to the eastbound home signals at Terminal. Completion of the PTC system is scheduled for December 2018.

End of Signal & Train Control Factual Report