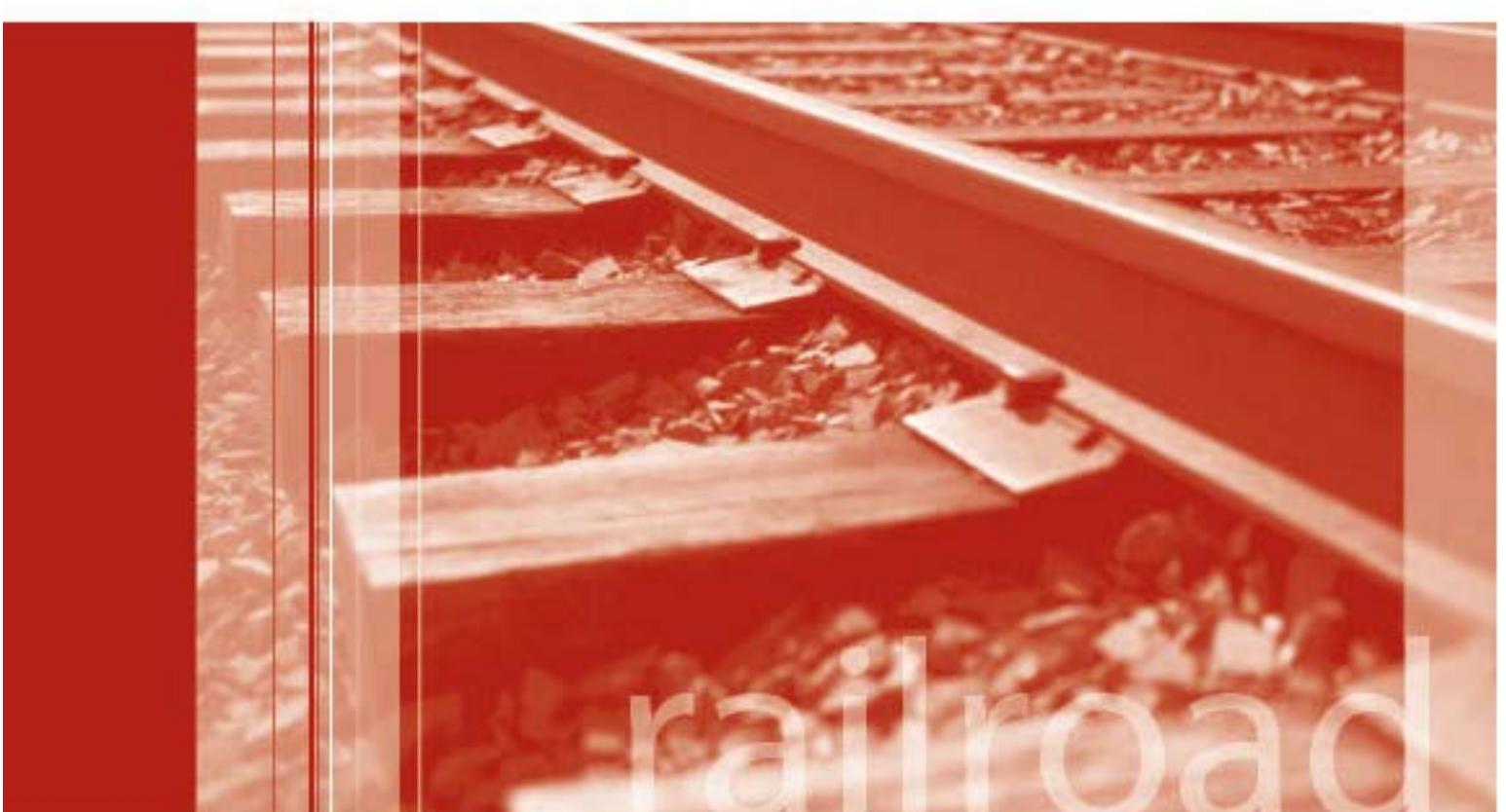


Collision Involving Three BNSF Railway Freight Trains
near Amarillo, Texas
September 25, 2013



Accident Report

NTSB/RAR-15/02
PB2015-105169



National
Transportation
Safety Board

NTSB/RAR-15/02
PB2015-105169
Notation 8618
Adopted June 25, 2015

Railroad Accident Report

Collision Involving Three BNSF Railway Freight Trains



National
Transportation
Safety Board

490 L'Enfant Plaza, S.W.
Washington, D.C. 20594

National Transportation Safety Board. 2015. *Collision Involving Three BNSF Railway Trains near Amarillo, Texas, September 25, 2013*. Publication Type NTSB/RAR-15/02. Washington, DC.

Abstract: On September 25, 2013, BNSF Railway train BLACWSP223A struck the rear end of standing BNSF train SLHTLPC223A near Amarillo, Texas. Several cars derailed and fell across the adjacent track. Approaching BNSF westbound train ZWSPSBD724L struck the derailed cars. The engineer and the conductor of one of the trains recalled passing signals warning them of the train ahead. However, the signal at milepost 543.65 was not lit because the bulb had burned out. Had the bulb not been burned out, the signal would have displayed a red aspect, which would have required them to stop the train before proceeding at restricted speed. When they passed this signal, neither crewmember noticed the dark signal. The engineer stated that he thought the dim headlight from the rear end locomotive helper unit was an approaching train on the adjacent track. The conductor thought the headlight had a yellow cast to it and was a wayside signal. Neither crewmember thought the headlight was on the rear of a standing train. Five of the six involved train crewmembers received injuries and were hospitalized. Estimated damage was \$4.4 million. Safety recommendations are made to the Federal Railroad Administration and BNSF Railway.

The National Transportation Safety Board (NTSB) is an independent federal agency dedicated to promoting aviation, railroad, highway, marine, and pipeline safety. Established in 1967, the agency is mandated by Congress through the Independent Safety Board Act of 1974 to investigate transportation accidents, determine the probable causes of the accidents, issue safety recommendations, study transportation safety issues, and evaluate the safety effectiveness of government agencies involved in transportation. The NTSB makes public its actions and decisions through accident reports, safety studies, special investigation reports, safety recommendations, and statistical reviews.

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 C.F.R. § 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 U.S.C. § 1154(b).

For more detailed background information on this report, visit <http://www.nts.gov/investigations/dms.html> and search for NTSB accident ID DCA12FR003. Recent publications are available in their entirety on the Internet at <http://www.nts.gov>. Other information about available publications also may be obtained from the website or by contacting:

**National Transportation Safety Board
Records Management Division, CIO-40
490 L’Enfant Plaza, SW
Washington, DC 20594
(800) 877-6799 or (202) 314-6551**

NTSB publications may be purchased from the National Technical Information Service. To purchase this publication, order product number PB2015-105169 from:

**National Technical Information Service
5301 Shawnee Rd.
Alexandria, VA 22312
(800) 553-6847 or (703) 605-6000
<http://www.ntis.gov/>**

Contents

Figures and Tables	ii
Abbreviations and Acronyms	iii
Executive Summary	iv
1 Investigation and Analysis	1
1.1 The Accident.....	1
First Train - SLHTLPC223A (6746 East)	1
Second Train - BLACKSP223A (7891 East)	2
Third Train - ZWSPSBD724L (6943 West).....	5
1.2 Site Description.....	6
1.3 Operations	6
1.3.1 Applicable Operating Rules.....	7
1.3.2 Positive Train Control.....	10
1.4 Train Crew Information	10
First Train - (6746 East)	10
Second Train - (7891 East)	11
Third Train - (6943 West).....	11
Crew On- and Off-Duty Times.....	11
1.5 Non-Factors in the Accident	12
2 Conclusions	14
2.1 Findings.....	14
2.2 Probable Cause.....	14
3 Recommendations	15
Appendix A: Investigation	16
Appendix B: Previous NTSB Recommendations	17
References	19

Figures and Tables

Figure 1. Derailed cars from trains 7891 East and 6943 West.	1
Figure 2. Diagram of the tracks and signals at the accident site.	3
Figure 3. Day and night photos of signal at MP 543.65.	4
Figure 4. Lead locomotive of 6943 West.	6
Table 1. Work-Rest Time for Crewmembers.....	12

Abbreviations and Acronyms

CFR	<i>Code of Federal Regulations</i>
CP	control point
FRA	Federal Railroad Administration
GCOR	<i>General Code of Operating Rules</i>
MP	milepost
NTSB	National Transportation Safety Board
PTC	positive train control
SEPTA	Southeastern Pennsylvania Transportation Authority

Executive Summary

On September 25, 2013, at 4:17 a.m. central daylight time, BNSF Railway (BNSF) eastbound train BLACWSP223A (7891 East) struck the rear end of standing BNSF train SLHTLPC223A (6746 East) on main track no. 2 near Amarillo, Texas. Several cars from 7891 East derailed and fell across the adjacent track, main track no. 1. Approaching BNSF westbound train ZWSPSBD724L (6943 West) struck the derailed cars. (See figure 1.)

The engineer and the conductor of train 7891 East recalled passing signals warning them of the train ahead. However, the signal at milepost 543.65 was not lit because the bulb had burned out (also known as a dark or improperly displayed signal). Had the bulb not been burned out, the signal would have displayed a red aspect, which would have required them to stop the train before proceeding at restricted speed.¹ When they passed this signal, neither crewmember noticed that the signal was dark. A dark signal also required the crew to stop the train before proceeding at restricted speed.

The engineer stated that he thought the dim (low-beam) headlight from the rear end locomotive helper unit of 6746 East was an approaching train on the adjacent track. The conductor thought the headlight had a yellow cast to it and was a wayside signal. Neither crewmember thought the headlight was on the rear of a standing train.

Five of the six involved train crewmembers received injuries and were hospitalized. The weather was clear with 10-mile visibility, and the temperature was 59°F. Estimated damage was \$4.4 million.

The National Transportation Safety Board (NTSB) determines that the probable cause of the accident was the failure of the 7891 East train crew to comply with the requirement to stop and proceed at restricted speed when encountering a dark or improperly displayed signal. Contributing to the accident was the use of a dim headlight to indicate the rear end of the standing train, which the 7891 East engineer misinterpreted as the headlight of an opposing train on the adjacent track and the conductor misinterpreted as an upcoming yellow signal. Also contributing to the accident was the lack of a positive train control system that could have prevented the accident.

¹ *Restricted speed* means movement at a speed that allows stopping within half the range of vision short of a train, engine, railroad car, men or equipment fouling the track, stop signal, or a derail or switch lined improperly.

1 Investigation and Analysis

1.1 The Accident

On September 25, 2013, at 4:17 a.m. central daylight time, BNSF Railway (BNSF) eastbound train BLACWSP223A (7891 East) struck the rear end of BNSF train SLHTLPC223A (6746 East) on main track no. 2 near Amarillo, Texas.¹ Several cars from 7891 East derailed and fell across the adjacent track, main track no. 1. Approaching BNSF westbound train ZWSPSBD724L (6943 West) struck the derailed cars. (See figure 1.)

Five of the six involved train crewmembers received injuries and were hospitalized. The weather was clear with 10-mile visibility, and the temperature was 59°F. Estimated damage was \$4.4 million.



Figure 1. Derailed cars from trains 7891 East and 6943 West.

First Train - SLHTLPC223A (6746 East)

Train 6746 East departed Amarillo, Texas, at 3:38 a.m. The engineer and the conductor had gone on duty at 1:20 a.m. Both crewmembers stated that the train had slowed for a flashing yellow signal aspect (Approach Medium) at milepost (MP) 545.9 and for a yellow signal

¹ All times in this report are central daylight time.

aspect (Approach) at MP 543.65, and the train finally stopped at a red signal aspect (Stop and Proceed) near MP 541.06 on main track no. 2.²

While the train was stopped, the signal changed first to a yellow aspect and then to a flashing yellow aspect. The engineer told National Transportation Safety Board (NTSB) investigators that, before the brakes entirely released on the train, the signal changed to a green aspect (Proceed). Both crewmembers told investigators that the train was starting to move when they felt a surge forward and the train air brakes applied in emergency.

Meanwhile, train BNSF 6943 West was passing in the opposite direction on main track no. 1.

Second Train - BLACKSP223A (7891 East)

Train 7891 East departed Amarillo, Texas, at 3:49 a.m. The engineer and the conductor had gone on duty at 2:05 a.m. The engineer stated that he had seen the crew from 6746 East in the Amarillo crew room and knew that 7891 East would follow 6746 East when departing Amarillo on main track no. 2.

The engineer told NTSB investigators that most of the wayside signals were flashing yellow (Approach Medium) and that he did not recall the yellow signal at MP 545.9 or the dark signal (improperly displayed signal) at MP 543.65.³

According to the event recorder data, the engineer was operating the train conservatively and responding to the flashing yellow signals.⁴ The signal at MP 548.2 displayed a flashing yellow aspect, and the engineer was operating the train at 29 mph. The train passed a yellow aspect about 2 miles later, at MP 545.9, at 21 mph. The train passed the dark signal at MP 543.65 at about 25 mph. The distance between the yellow signal at MP 545.9 and the dark signal at MP 543.65 was common for this type of territory and the track speeds. However, by the time the train reached the rear end of the standing train, the train had traveled nearly 3 miles from the yellow signal. After passing the yellow signal, the crew was required to “be prepared to stop at the next signal” and should have been vigilant for the next wayside (dark) signal, and particularly watchful once exceeding the conventional signal spacing.

The train crew was qualified and experienced at operating over the territory. They were familiar with the characteristics of the territory, including the location of each signal. Although

² According to BNSF Railway – *Signal Aspects and Indications*, August 14, 2013, the requirements for an Approach Medium signal were: “Proceed prepared to pass next signal not exceeding 40 mph and be prepared to enter diverging route at prescribed speed.” The requirements for the Medium signal were, “Proceed prepared to stop at next signal. Trains exceeding 30 mph immediately reduce to that speed.” The requirements for the Stop and Proceed signal required the following, “Stop, then proceed at restricted speed.”

³ NTSB investigators confirmed that the signal at MP 545.9 displayed a yellow aspect and the signal at MP 543.65 was dark. Testing confirmed that only the signal lamp used to display a red aspect was burned out; The *General Code of Operating Rules*, Sixth Edition, Effective April 7, 2010, Rule 9.4, “Improperly Displayed Signals or Absent Lights,” requires that a dark signal be regarded as displaying the most restrictive indication.

⁴ The maximum train speed was 50 mph, and the flashing yellow signals allowed a maximum speed of 40 mph. Yet, most of the time, the train speed barely exceeded 30 mph.

the signal at MP 543.65 was dark, the crew should have expected a signal to be displayed at that location.

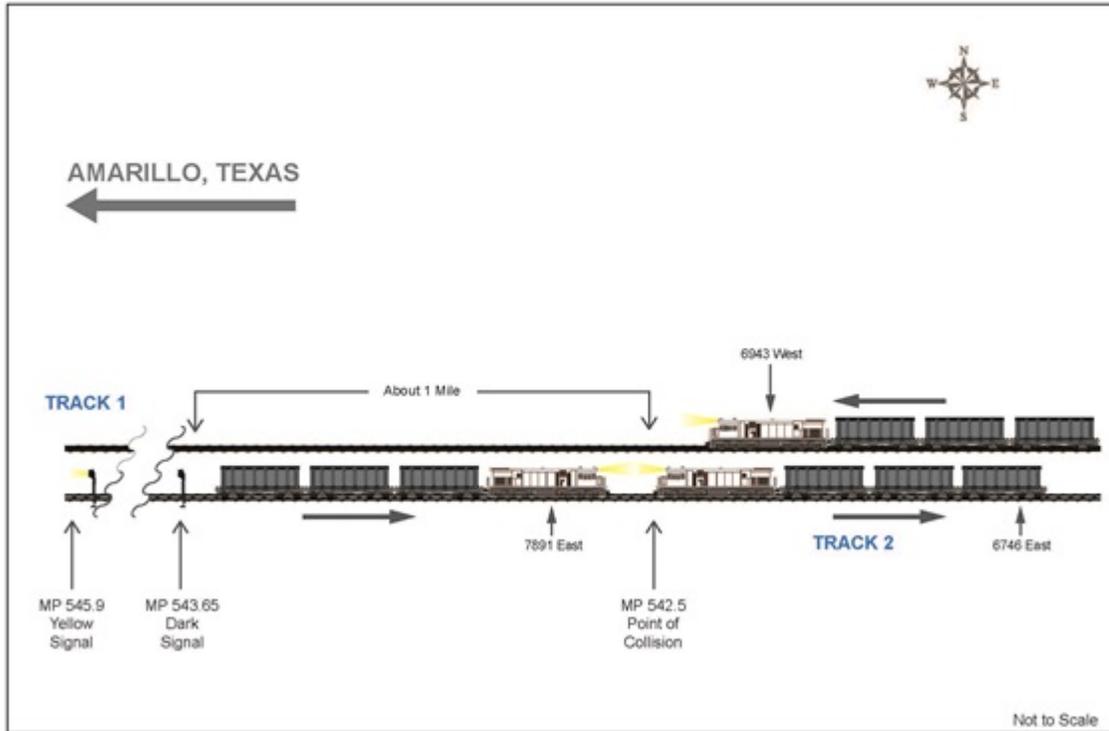


Figure 2. Diagram of the tracks and signals at the accident scene.

Investigators reviewed forward-facing video of the dark signal from the lead locomotive and determined that it was visible for about 2 seconds on approach. (See figure 3.)



Figure 3. Day and night photos of signal at MP 543.65. Photo on right is from the forward-facing camera of train 7891 East.

The engineer stated that he was confused about what had happened and believed he had been operating on flashing yellow signals up to the collision. He described the event as follows:

We got around the packing plant, which was up on a hill. That's when we—that's when I dimmed the light because I saw a train which I thought was a westbound train. I dimmed my lights and as we proceeded and got closer to the light, my conductor says ..., "That doesn't look right. Cut your lights on high." At that time, I put them on high and, before we know it, we were looking at less than 25 to 50 yards before the rear of the train.... And I immediately put the train in emergency and we continued to try to brace ourselves.

The conductor recalled talking with the 6746 East engineer at the on-duty point at Amarillo and following the train out of town. He also recalled the flashing yellow signal aspects and the more recent solid yellow signal aspect after leaving Amarillo. He did not recall seeing the dark signal at MP 543.65.

The conductor stated that, at some point prior to the collision, he recalled telling the engineer that, "something wasn't right." He said that after making this statement, they both started looking intently forward. The conductor recalled the event as follows:

We followed a stack train out of town on yellow and flashing yellow signals. I think outside of town there was a dark signal I found out later. We never saw it. We were traveling and we were looking for a signal. I think we both saw the ... headlight [on the rear of the train] was yellow. We took that as a signal. We were still concerned, both of us.

... I told [the engineer] to turn his headlight on, and by the time [the headlight was on] ... I could tell that it was not a yellow signal, it was a [headlight on the rear of the train], I [put the train into emergency braking] and hit the floor. And I hope the records show that the train was put in emergency from my side, probably as well as from his side, but we both did that. ...

I mean, we were alert, we were looking, we were paying attention, and we just took the—we would not have run past a red signal. We were looking for it, and we would not have hit a train with an end-of-train device on it. Period.

I don't know why the stack train was stopped up there. And we didn't hear any radio conversation about a dark signal from him.⁵

Before the collision, the engineer thought the dim headlight on the rear end locomotive helper unit of 6746 East was an approaching train on the adjacent track. The conductor thought the headlight had a yellow cast to it and was a wayside signal. Neither crewmember thought the headlight was on the rear of a standing train. The conductor pointed out that a standard end-of-train device which has a flashing red light, rather than the dim headlight of the helper unit on the rear of the train, would have warned them that there was a standing train ahead.

When the engineer and the conductor realized the headlight on the helper unit was not approaching on the adjacent track, both crewmembers applied the emergency brakes; this was about 9 seconds prior to the collision. The train speed reduced from 32 mph to about 26 mph at the time of impact.

After the train struck the rear of 6746 East, several cars behind 7891 East derailed and fell across the adjacent track. Once the train stopped, the conductor used the radio to call train 6943 West, which was approaching on track no. 1, to tell the crew to stop their train.

Third Train - ZWSPSBD724L (6943 West)

Train 6943 West departed Wellington, Kansas, at 12:09 a.m. The engineer and the conductor had gone on duty September 24, 2013, at 10:00 p.m. The engineer told NTSB investigators that, while operating on main track no. 1 and passing an eastbound train on main track no. 2 near MP 542.0, he heard the conductor from 7891 East announce on the radio “emergency, emergency, emergency.” He also heard the conductor on 7891 East advise him to stop the train. Just seconds later, he observed a railroad car lying crossways on main track no. 1. He applied the emergency brakes, and both crewmembers braced for impact. (See figure 4.)

⁵ The signal had three aspects—green, yellow, and red—illuminated by separate lamps. The only lamp that was burned out was the red aspect. If the previous train had either a yellow, flashing yellow, or green signal aspect, the crew would not have encountered the dark signal.



Figure 3. Lead locomotive of 6943 West.

1.2 Site Description

At the accident location, two main tracks ran parallel, relatively east and west. Facing east, the track on the right was main track no. 2 and the track on the left was main track no. 1. The maximum authorized speed for freight trains at this location was 70 mph.

1.3 Operations

Trains were authorized by signal indications of a traffic control system, managed by a train dispatcher in Fort Worth, Texas. The operating crews received authorization by signal indications at control points (CP) located throughout the territory. Between the CPs were automatic block signals governing train movements into a block by displaying its most restrictive aspect (Stop and Proceed) when any of the following conditions existed in the block (see Title 49 *Code of Federal Regulations* (CFR) 236.205):

- Occupancy by a train, locomotive, or car;
- When points of a switch are not closed in proper position;
- When an independently operating fouling point derail equipped with switch circuit controller is not in derailing position;

- When a track relay is in de-energized position or a device which functions as a track relay is in its most restrictive state; or when signal control circuit is de-energized.

1.3.1 Applicable Operating Rules

At the time of the accident, the crews were governed by the *General Code of Operating Rules* (GCOR).⁶ Rule modifications and specifics were provided in the timetable for the Kansas Division and specifically the Panhandle Subdivision.

The engineer and the conductor on 7891 East were required to be alert for signals and communicate the names of the signals to each other when the signals became visible. The GCOR states the following regarding the responsibilities of the train crew to observe and call signals they encounter:

1.47 Duties of Crew Members

C. All Crew Members' Responsibilities

2. Crew members in the engine control compartment must be alert for signals. As soon as signals become visible or audible, crew members must communicate clearly to each other the name of signals affecting their train. They must continue to observe signals and announce any change of aspect until the train passes the signal. If the signal is not complied with promptly, crew members must remind the engineer and/or conductor of the rule requirement. If crew members do not agree on the signal indication, regard the signal as the most restrictive indication observed.

In the event of an unlit signal, the GCOR states the following:

9.4 Improperly Displayed Signals or Absent Lights

Except as shown in block, cab, and interlocking signal aspects in the special instructions, if a light is absent, a white light is displayed where a colored or lunar light should be, or additional colored or lunar lights are displayed, regard a block or interlocking signal as displaying the most restrictive indication it can give. However, when the semaphore arm position is plainly seen, that aspect will govern.

According to the interviews, the two crewmembers had been calling the signals to each other; however, they did not observe the dark signal at MP 543.65. The dark signal at MP 543.65 required the train to stop and then proceed in the signal block beyond the signal at restricted speed. At restricted speed, the crewmembers in the operating cab would have been required to maintain a speed that would have allowed stopping the train in half the range of vision short of a stopped train, not exceeding 20 mph. The crew of 7891 East stated that they did not see the dark signal. The NTSB concludes that the crew of train 7891 East failed to observe the

⁶ The *General Code of Operating Rules* is a set of operating rules for railroads in the United States. Most railroads, including the BNSF are using the Sixth Edition, effective April 7, 2010.

wayside signal at MP 543.65 that was dark (improperly displayed) with a burned-out light for the red aspect.

The GCOR also governs rear end marking devices, also known as end-of-train markers, requiring trains to display markers that can be seen by other trains as follows:

5.10.1 Highly Visible Markers

Display a highly visible marker at the rear of every train as follows:

- From 1 hour before sunset to 1 hour after sunrise.
- When weather conditions restrict visibility to less than 1/2 mile.

... When an engine is operating without cars or is at the rear of the train, the trailing headlight illuminated on dim may be used as a marker.

Furthermore, the use of a dim headlight to mark the rear of a train is permitted by 49 CFR 221.14 (Marking Devices), which states in part:

As prescribed in section 221.13, passenger, commuter and freight trains shall be equipped with at least one marking device, which has been approved by the Federal Railroad Administrator in accordance with the procedures included in appendix A of this part, and which has the following characteristics:

* * * * *

(c) When a locomotive is operated singly, or at the rear of a train, highly visible marking devices may be provided by the use of:

- (1) At least one marking device that complies with paragraph (a) of this section; or
- (2) At least one illuminated red or amber classification light on the rear of the locomotive, provided it complies with paragraph (a) of this section; or
- (3) The rear headlight of the locomotive illuminated on low beam.

The struck train, 6746 East, had a headlight illuminated on dim facing backward (or toward following trains), at the rear of 6746 East to indicate the rear of the train. This was in accordance with 49 CFR 221.14, although a standard end-of-train device (a flashing red light) rather than the dim headlight of the locomotive helper unit on the rear of the train, would likely have warned them that there was a train ahead.

This is not the first accident investigated by the NTSB in which a rear end marker light, or the absence of such a light, was causal or contributory.⁷ In 1972, the NTSB investigated an

⁷ See appendix B for details of the previous NTSB accident investigations and safety recommendations.

accident that involved the collision of two Illinois Central Gulf Railroad commuter trains at the 27th Street Station in Chicago, Illinois, that was due to the lack of an “attention-getting marker light” at the rear of a train (NTSB 1973). The NTSB made the following safety recommendation to the Illinois Central Gulf Railroad and the Chicago South Suburban Mass Transit District:

R-72-37

Install attention-getting marker lights, which are effective in all light conditions, and provide definitive attention-getting colored markings at the ends of trains made up of Highliner cars. These actions should be considered also for other commuter passenger cars of generally dark coloration.

The two companies involved responded to the recommendation, making changes to their equipment, and the NTSB classified recommendation R-72-37 “Closed—Acceptable Action.”

In 1980, the NTSB investigated another accident that involved confusion over the visibility of the rear end of a train (NTSB 1980). In that accident, Southeastern Pennsylvania Transportation Authority (SEPTA)-Consolidated Rail Corporation (Conrail) commuter train No. 472 struck the rear of SEPTA-Conrail commuter train No. 406 while it was standing on the No. 2 track east of the station at North Wales, Pennsylvania. The brakeman in the striking train saw the lighted headlight of a train ahead. He later stated that at the time he could not distinguish which track the train was on or whether it was moving toward or away from him. The NTSB concluded that the use of a white light on the rear of certain trains, rather than a red or amber light which is required to be displayed on the rear of most trains, creates confusion and unsafe conditions. As a result, the NTSB made the following safety recommendation to SEPTA:

R-81-36

Install approved rear marking devices on its commercial cars and discontinue the use of rear-facing headlights for that purpose.

The NTSB classified the recommendation as “Closed—Acceptable Action” on September 22, 1986.

The NTSB also made the following safety recommendation to the FRA:

R-80-54

Amend [Title 49 *Code of Federal Regulations*] 221.15(c) [since recodified as section 221.14(c)] to prohibit the use of the white rear headlight as a marking device on any train.

The FRA responded that it did not intend to amend 49 CFR 221.15(c) because “requiring all railroads to immediately retrofit all trains with red or amber rear lights would seriously disrupt commuter passenger service and result in unwarranted costs to the railroads.” The NTSB classified R-80-54 “Closed—Unacceptable Action.”

The BNSF collision in Amarillo, Texas, is another example of the use of a white light on the rear of a train causing confusion and creating a hazard for following trains. Both crewmembers on train 7891 East were confused by the rear-facing headlight; the engineer thought it was a train on the adjacent track, and the conductor thought it was a wayside signal. The NTSB concludes that had the standing train been equipped with a standard, highly visible end-of-train device that clearly identified the rear of the train, and not a white headlight, the crewmembers would have likely been able to determine that there was a standing train in front of them on the same track. Therefore, the NTSB recommends that the FRA prohibit the use of a white light as a marking device on the rear of a train. The NTSB also recommends that the BNSF discontinue the use of a white light as a marking device on the rear of a train.

1.3.2 Positive Train Control

A positive train control (PTC) system was not active when this accident occurred. However, investigators noted that all of the wayside signals had the necessary components for a PTC system. The PTC components were being beta tested at the time of the accident. The BNSF Railway is currently making similar signal installations throughout their railroad, as well as modifying their locomotives with the necessary equipment for PTC implementation, as required by the Railroad Safety Improvement Act of 2008.

The current design of PTC includes automatic block signal locations. Although the lamp was burned out in this particular signal, the signal circuitry would have identified this as a stop location. A PTC system would have warned the engineer in the locomotive cab of the upcoming restrictive signal. If the engineer had not responded, the PTC system would have automatically applied the brakes and stopped the train before the train passed the signal at MP 543.65. Therefore, the NTSB concludes that had the territory been equipped with PTC, the train would have been stopped at the signal at MP 543.65, regardless of the light's being burned out.

1.4 Train Crew Information

BNSF records indicated that all six crewmembers from all the involved trains had taken and passed numerous railroad training courses. The courses covered various aspects of railroad operations, and were meant to ensure employees' knowledge and application of, and compliance with, railroad rules, regulations, and instructions. BNSF records contained no disciplinary actions taken against any crewmember during the year prior to the accident.

First Train - (6746 East)

The BNSF 6746 East engineer was 59 years old. He was hired by the BNSF on April 23, 1973. BNSF records indicated that he passed his most recent physical examination on June 1, 2013, which included vision and hearing tests, to operate as an engineer. Supervisors had observed the engineer 11 times the previous year. On one of those occasions, a supervisor spoke with the engineer concerning his failure to clear the main track as soon as practical when requested by the train dispatcher.

The 6746 East conductor was 40 years old. He was hired by the BNSF on March 23, 1998, and was certified as a conductor on October 10, 2010. Supervisors had observed the conductor 19 times the previous year properly complying with operating and safety rules.

Second Train - (7891 East)

The 7891 East engineer was 58 years old. He was hired by the BNSF on October 3, 1977. BNSF records indicated that he passed his most recent physical examination on June 1, 2012, which included vision and hearing tests, to operate as an engineer. Supervisors had observed him 39 times the previous year properly complying with operating and safety rules.

The 7891 East conductor was 58 years old. He was hired by the BNSF on August 1, 1973. He was certified as a conductor on October 21, 2012. Supervisors had observed the conductor properly complying with operating and safety rules 16 times the previous year.

Third Train - (6943 West)

The 6943 West engineer was 45 years old. He was hired by the BNSF on May 16, 1994. BNSF records indicated that on December 1, 2012, he passed his most recent physical examination, which included vision and hearing tests, to operate as an engineer. Supervisors had observed the engineer 32 times the previous year properly complying with operating and safety rules.

The 6943 West conductor was 40 years old. He was hired by the BNSF on August 24, 1994. He was certified as a conductor on October 21, 2012. Supervisors had observed the conductor 16 times the previous year properly complying with operating and safety rules.

Crew On- and Off-Duty Times

The on-and off-duty times of all crewmembers indicated they had adequate time to obtain rest. Crewmembers on the second train (7891 East) had difficulty recalling their specific sleep cycles while off duty. However, both the engineer and the conductor had extended periods of time off—57 hours 47 minutes and 62 hours 36 minutes respectively—before the accident trip, and the accident occurred less than 30 minutes after beginning the trip.

The table below illustrates the work/rest cycles of crewmembers involved in this accident.

Table 1. Work-Rest Time for Crewmembers.

Crewmember	Date	Rest Time	On Duty	Off Duty
First Train – 6746 East				
Engineer	9/21		1750	0550 (9/22)
	9/24	42h 11m	0001	1201
	9/25	13h 19m	0120	0417 ^a
Conductor	9/21		0636	1536
	9/24	54h 25m	0001	1201
	9/25	13h 19m	0120	0417 ^a
Second Train – 7891 East				
Engineer	9/21		0427	1137
	9/22	17h 03m	0440	1618
	9/25	57h 47m	0205	0417 ^a
Conductor	9/20		2331	1336 (9/21)
	9/21	10h 04m	2340	1139 (9/22)
	9/25	62h 36m	0205	0417 ^a
Third Train – 6943 West				
Engineer	9/21		0439	1234
	9/23	53h 26m	1800	0031 (9/24)
	9/24	21h 29m	2200	0147 (9/25)
Conductor	9/21		0505	1250
	9/23	29h 10m	1800	0245 (9/24)
	9/24	19h 15m	2200	0417 ^a

^a Time of accident.

1.5 Non-Factors in the Accident

The locomotives and the railroad cars passed postaccident mechanical inspections. A review of preaccident testing and maintenance records for all three trains did not reveal any problems.

The weather at the time of the accident was clear, with no visual impairments.

The postaccident toxicological tests for crewmembers of the three trains were negative for illicit drugs and alcohol.

In addition to the fact that the crewmembers had an adequate time to obtain rest, both the engineer and conductor said that they felt rested before starting their shifts. The engineer had worked on this territory 2 years earlier, and then returned and had worked there for the previous 7 months. The conductor had worked out of Amarillo for over 25 years.

Trains 6756 East and 6943 West were traveling authorized routes at allowable speeds.

Cell phone records were obtained for crewmembers on the three trains. There was no phone use that would have interfered with train operations.

The on- and off-duty times of all crewmembers indicated they had adequate time to obtain rest. Crewmembers on the second train (7891 East) had difficulty recalling their specific sleep cycles while off duty. However, both the engineer and the conductor had extended periods of time off—57 hours 47 minutes and 62 hours 36 minutes, respectively—before the accident trip, and the accident occurred less than 30 minutes after beginning the trip.

The NTSB, therefore, concludes that mechanical conditions, weather, drug and alcohol impairment, territory inexperience, cell phone use, and fatigue were not factors in this accident. Further, the NTSB concludes that the actions of the 6756 East crew and the 6943 West crew were not factors in this accident.

2 Conclusions

2.1 Findings

1. The crew of train 7891 East failed to observe the wayside signal at milepost 543.65 that was dark (improperly displayed) with a burned-out light for the red aspect.
2. Had the standing train been equipped with a standard, highly visible end-of-train device that clearly identified the rear of the train, and not a white headlight, the crewmembers would have likely been able to determine that there was a standing train in front of them on the same track.
3. Had the territory been equipped with positive train control, the train would have been stopped at the signal at milepost 543.65, regardless of the light's being burned out.
4. Mechanical conditions, weather, drug and alcohol impairment, territory inexperience, cell phone use, and fatigue were not factors in this accident. Further, the actions of the 6756 East crew and the 6943 West crew were not factors in this accident.

2.2 Probable Cause

The National Transportation Safety Board (NTSB) determines that the probable cause of the accident was the failure of the 7891 East train crew to comply with the requirement to stop and proceed at restricted speed when encountering a dark or improperly displayed signal. Contributing to the accident was the use of a dim headlight to indicate the rear end of the standing train, which the 7891 East engineer misinterpreted as the headlight of an opposing train on the adjacent track and the conductor misinterpreted as an upcoming yellow signal. Also contributing to the accident was the lack of a positive train control system that could have prevented the accident.

3 Recommendations

Based on its investigation, the National Transportation Safety Board issues the following new safety recommendations:

To the Federal Railroad Administration:

Prohibit the use of a white light as a marking device on the rear of a train.
(R-15-26)

To the BNSF Railway:

Discontinue the use of a white light as a marking device on the rear of a train.
(R-15-27)

Appendix A: Investigation

The National Transportation Safety Board (NTSB) was notified on September 25, 2013, of the collision and derailment that involved three BNSF Railway trains near Amarillo, Texas. The NTSB launched an investigator-in-charge and five other investigative team members from its headquarters in Washington, DC, and regional offices.

Parties to the investigation included the Federal Railroad Administration, Burlington Northern Santa Fe Railway, the Brotherhood of Locomotive Engineers and Trainmen, and the International Association of Sheet Metal, Air, Rail and Transportation Workers.

Appendix B: Previous NTSB Recommendations

In 1972, the NTSB investigated an accident that involved the collision of two Illinois Central Gulf Railroad commuter trains at the 27th Street Station in Chicago, Illinois, that was due to the lack of an “attention-getting marker light” at the rear of a train (NTSB 1973).

Based on the circumstances of that accident, the NTSB made the following safety recommendation to the Illinois Central Gulf Railroad and the Chicago South Suburban Mass Transit District:

R-72-37

Install attention-getting marker lights, which are effective in all light conditions, and provide definitive attention-getting colored markings at the ends of trains made up of Highliner cars. These actions should be considered also for other commuter passenger cars of generally dark coloration.

The two companies involved responded to the recommendation, making changes to their equipment, and the NTSB classified recommendation R-72-37 “Closed—Acceptable Action.”

Several years later, in 1980, the NTSB investigated another accident that involved confusion over the visibility of the rear end of a train (NTSB 1980). In that accident, Southeastern Pennsylvania Transportation Authority (SEPTA)-Consolidated Rail Corporation (Conrail) commuter train No. 472 struck the rear of SEPTA-Conrail commuter train No. 406 while it was standing on the No. 2 track east of the station at North Wales, Pennsylvania. The brakeman in the striking train saw the lighted headlight of a train ahead. He later stated that at the time he could not distinguish on which track the train was or if it was moving toward or away from him. He said he did not see red marker lights displayed to the rear. SEPTA-Conrail commuter trains are equipped with white headlights at both the front and the rear. At the time of the accident, the rear of the trains were also equipped with small red marker lights, but they were not visible from a distance during daylight. The NTSB concluded that the use of a white light on the rear of certain trains, rather than a red or amber light which is required to be displayed on the rear of most trains, creates confusion and unsafe conditions.

As a result, the NTSB recommended SEPTA take the following action:

R-81-36

Install approved rear marking devices on its commercial cars and discontinue the use of rear-facing headlights for that purpose.

SEPTA implemented a change to its rear-marking devices. In 1986, SEPTA completed installing the new markers and discontinued the use of headlights on the rear of trains. The NTSB classified the recommendation as “Closed—Acceptable Action” on September 22, 1986.

As a result of the SEPTA accident investigation, the NTSB also recommended that the FRA:

R-80-54

Amend [Title 49 *Code of Federal Regulations*] 221.15(c) [since recodified as section 221.14(c)] to prohibit the use of the white rear headlight as a marking device on any train.

The FRA responded as follows:

The Federal Railroad Administration permits the use of a locomotive headlight as a rear end marking device to accommodate certain train operations such as helper service and push-pull commuter passenger trains where locomotives are routinely operated at the rear of the train. This enables railroads with this type of operation to have a highly visible marking device at the rear of a train without undue disruption to normal train operations. Requiring all railroads to immediately retrofit all trains with red or amber rear lights would seriously disrupt commuter passenger service and result in unwarranted costs to the railroads. The FRA does not intend to amend 49 CFR Part 221.15(c).

The NTSB disagreed with the FRA argument and intent not to change the regulation. The FRA responded again and contended, “The accident resulting in this recommendation occurred under unusual circumstances....” The NTSB responded with this final correspondence:

The FRA’s response appears to address only passenger operations. However, the confusion which can be created by the use of the white rear headlight can arise just as easily in freight operations, especially for train crews operating in multi-track territory. The Board notes FRA’s statement that a few regions reported the use of a dim headlight on a helper or light locomotive. This appears to be in conflict with the objective of the recommendation. In view of FRA’s continued reluctance to implement the recommendation, R-80-054 has been placed in a “Closed—Unacceptable Action” status. The [NTSB] will continue to address this safety issue in future pertinent accident investigations.

References

General Code of Operating Rules, Sixth Edition, effective April 7, 2010.

NTSB (National Transportation Safety Board). 1973. *Collision of Illinois Central Gulf Railroad Commuter Trains, Chicago, Illinois, October 30, 1973*. RAR-73-05. Washington, DC: NTSB.

_____. 1980. *Rear-End Collision of Southeastern Pennsylvania Transportation Authority-Consolidated Rail Corporation Train Nos. 406 and 472 on Conrail Track, North Wales, Pennsylvania, July 17, 1980*. RAR-80-11. Washington, DC: NTSB.

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

CHRISTOPHER A. HART
Chairman

ROBERT L. SUMWALT
Member

T. BELLA DINH-ZARR
Vice Chairman

EARL F. WEENER
Member

Adopted: June 25, 2015