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Collision - BNSF
Red Oak, Iowa
April 17, 2011

Operations Group Factual

National Transportation Safety Board

Operations Factual

Operations Working Group

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Synopsis

On April 17, 2011, about 6:55 a.m. central daylight time[1], eastbound BNSF coal train C-BTMCNM0 26A, BNSF 9159 East, collided with the rear end of standing BNSF maintenance of way (M of W) equipment train U-BRGCRI5 15G, BNSF 9470 East, near Red Oak, Iowa. The accident occurred at milepost (MP) 448.3 on the number two track on the Creston Subdivision of the BNSF Nebraska Division. The BNSF 9159 East (coal train) was travelling about 23 mph when it struck the standing train.

The coal train consisted of 130 loaded coal cars, weighed 18,529 tons, and was 7,122 feet long with two locomotives on the head end of the train and one distributed power locomotive on

[1] All times in the remainder of this report will be central daylight time.

the rear end of the train. The maintenance of way equipment train consisted of 21 loaded cars, 13 empty cars, weighed 2,635 tons, and was 3,170 feet long with one locomotive on the head end.

As a result of the collision, the two coal train locomotives derailed along with the first two coal cars. The locomotive crew cab of the striking train was damaged and involved in a subsequent diesel fuel fire. Seven additional coal cars were also damaged but did not derail. Ten cars of the standing M of W train derailed. Both the engineer and conductor on the coal train were fatally injured. The two crew members on the locomotive of the M of W equipment train submitted injury reports to the BNSF following the accident. Damages were estimated at $8 million. The reported weather at the time of the accident was 5 miles visibility with mist at Red Oak Airport which is about two and one half miles east of the accident location.

Locomotive event recorder data from the BNSF 9159 East indicated that just before the collision, train speed increased and the throttle was decreased as the train crested a hill west of the accident site. The coal train emergency brakes were not applied before impact.

Parties to this investigation are the Federal Railroad Administration, the BNSF railway, Electro Motive Diesel (the manufacturer of the lead locomotive on the coal train), the Brotherhood of Locomotive Engineers and Trainmen, and the United Transportation Union.

Accident Narrative

Struck Train – BN 9470 East

The crew (engineer and conductor) of the M of W train, BN 9470 East, took charge of their train in Lincoln, Nebraska, at 1:15 a.m., and departed at approximately 3:15 a.m. According to the crew interviews the trip up until the collision was unremarkable.[2]

At control point (CP) 4664 the BN 9470 East entered the No. 2 main track behind two coal trains. They had stopped at the red signal at CP 4535 because the two trains were ahead of their train on the No. 2 main track and the first coal train had stopped at the end of the multiple main tracks at CP McPherson, MP 447.5.

The first coal train was allowed to enter the single track and leave CP McPherson. The second coal train continued their movement on the No. 2 main track and stopped at CP McPherson. The BNSF 9470 East followed up behind with a yellow signal at CP 4535 (the crossovers) and about three miles later encountered the red automatic block signal with an attached "G" plate[3]. According to the interviews, the crew of the M of W train said they stopped their train approximately 300 feet behind the coal train that was stopped at CP McPherson.

[2] The engineer and conductor of the struck train were interviewed on April 19, 2011, at Shenandoah, Iowa. The transcripts from these interviews are in the public docket.
[3] BNSF Railway – SIGNAL ASPECTS AND INDICATIONS, Effective April 7, 2010, indicates under Rule 9.1.13 that an automatic block signal with a "G" plate attached to the mast is a *Restricting* signal which when displaying a red aspect would allow a train to continue past the signal without stopping at restricted speed.

While these two trains were stopped at the end of the multiple main tracks on the No. 2 main track, Amtrak No. 6, ATK ENG 198 (California Zephyr) passed them eastward on the No. 1 main track at approximately 6:22 a.m.

The coal train departed CP McPherson and followed Amtrak No. 6. The BNSF 9470 East then advanced to CP McPherson and stopped at the red signal. The engineer said that he attempted to contact the train dispatcher after he felt enough time had elapsed for the previous train to reach a point that the signal at CP McPherson should have changed to a proceed. The train dispatcher did not answer, which the engineer said he credited the non-response to the train dispatcher shift change that was coming up at 7:00 a.m.

While waiting at CP McPherson the crew on the M of W train said they felt a strong impact from the rear and it shoved the train forward about 75 to 100 feet (event recorder data actually showed about 17 feet). The engineer said he knew his train had been rear ended by another train. He left the cab and ran back toward the rear of the train. As he watched the rear of the train he saw fire and a plume of smoke that he described as the shape of an atomic explosion. When he reached the collision, the lead locomotive (BNSF 9159 East) was on fire, and the engineer called 911 on his cell phone and reported the train collision and subsequent fire. According to radio conversations between the BNSF 9470 East conductor and the train dispatcher, the conductor stated that the emergency responders were on scene at 7:11 a.m. [4]

Striking Train – BNSF 9159 East

The crew (engineer and conductor) of the striking train, BNSF 9159 East, went on duty at Lincoln, Nebraska, at 2:31 a.m. and departed at approximately 3:45 a.m.

Interviews with the Amtrak engineer[5] on Amtrak No. 6 confirmed that he had passed the striking train, BNSF 9159 East, at 79 mph at Balfour, MP 467.9, at 6:08 a.m. The passenger engineer was able to see the employee on the conductor's side of the cab of the locomotive. That employee was in a reclined position. The passenger engineer also commented that he did not observe anyone on the ground providing an inspection of his passing Amtrak train.[6]

After being passed by Amtrak, BNSF 9159 East proceeded eastbound and entered the multiple main tracks at CP 4664 on the No. 2 main track. At MP 466.4 operating crews were required to change from radio channel 87 to radio channel 53.

[4] Train Dispatcher radio recordings, 30 minutes prior to and 30 minutes after 6:55 a.m. on the Creston Subdivision.
[5] The Amtrak engineer provided a phone interview on April 21, 2011. The summary of interview is in the Public Docket.
[6] General Code of Operating Rules, Sixth Edition, Effective April 7, 2010, **Rule 6.29.1 Inspecting Passing Trains,** "When a train is stopped and is met or passed by another train, crew members must inspect the passing train. The trainman's inspection must be made from the ground if there is a safe location." (BNSF Amended)

BNSF 9159 East passed a signal at CP 4535 and an automatic block signal at MP 450.38[7] that protected the rear end of the standing BNSF 9470 East. Re-enactments and signal information determined that the signal at CP 4535 had a yellow aspect and the upcoming automatic block signal with a G plate attached located at MP 450.38 had a red aspect.

According to the event recorder data the BNSF 9159 East had passed CP 4535 at approximately 30 mph in throttle 1 position. The train was on an ascending grade and the speed dropped to approximately 12 mph and the throttle was in throttle 7 position when the train passed the red grade signal at MP 450.38. At MP 449.8 the grade changed to descending. For a mile after the grade signal the train speed stayed between 11 mph and 12 mph and then at MP 449.4 the train started accelerating from 12 mph to 23 mph until the collision occurred at MP 448.3. The throttle was in throttle 4 position. (The range is from Idle to throttle 8 position.)

Following is a table developed from the event recorder data from the BNSF 9159 East that shows when the engineer manipulated the controls of the locomotive between CP 4535 and the point of collision and the distance traveled between each activity.

Time	Activity	Speed MPH	Distance Traveled In Feet Since Last Activity
6:36:11 – 63614	Throttle 3 to 2 to 1	34	(Start near CP 4535)
6:38:25	Throttle 1 to 2	27	5,801
6:38:33	Throttle 2 to 3	27	245
6:40:22 – 6:40:42	Long, Long, Short, Long - Horn Pattern		3,928
6:40:48	Alerter Reset by Alerter Reset Button	22	192
6:40:54	Throttle 3 to 4	21	186
No activity for 2 minutes 2 seconds			
6:42:56 – 6:43:02	Alerter Alarm Begins 7 Second Duration 5 Seconds Flashing Light 2 Seconds Light And Horn Alerter Reset by Alerter Reset Button	16	3,400
6:43:05	Throttle 4 to 5	16	69
6:44:02 -6:44:05	Throttle 5 to 4 to 5	14	1,283
6:44:22	Throttle 5 to 6	13	338
6:46:10	Throttle 6 to 7	12	1,999
6:47:07	No Activity Passing Grade Signal	13	
No activity for 2 minutes 1 seconds			

[7] The mileposts were descending in the eastward direction; as the accident train proceeds towards the point of collision, the MP's will be a lower number.

6:48.11 – 6:48:18	Alerter Alarm Begins 8 Second Duration 5 Seconds Flashing Light 3 Seconds Light And Horn Alerter Reset by Alerter Reset Button	13	2,224
6:48:55	Throttle 7 to 6	13	689
6:49:42	Throttle 6 to 5	12	845
6:50:48	Throttle 5 to 6	10	1,053
6:51:00	Manual Sand Ends	11	186
No activity for 2 minutes 2 seconds			
6:53:02 – 6:53:09	Alerter Alarm Begins 8 Second Duration 5 Seconds Flashing Light 3 Seconds Light And Horn Alerter Reset by Alerter Reset Button	17	2,452
6:53:11	Throttle 6 to 5	18	52
6:53:12	Throttle 5 to 4	18	27
No activity for 1 minute 53 seconds			
6:55:05	Collision	23	3,344

The event recorder indicated that the striking train continued between 511 to 542 feet after the point of collision. The event recorder readout also showed that following the point of collision, the train speed dropped from 23 mph to 21 mph, and then the brakes were applied with an emergency brake application. The event recorder data did not indicate an engineer induced emergency (EIE).

Operating Documents

The crews were governed by the General Code of Operating Rules, effective April 7, 2010. The territory was designated as the BNSF Nebraska Division, Creston Subdivision. At the time of the accident, the current timetable was Nebraska Division Timetable No. 7, effective 8:00 a.m. Central Continental Time, Wednesday, May 12, 2010.

The applicable supplements to the operating rules and instructions were:

System Special Instructions – Dated 4/7/11
Air Brake and Train Handling Rules – Dated 4/7/11
TY & E Safety Rules – Dated 10/30/05 with revisions through 3/1/11
United States Hazardous Material Instructions for Rail – Dated 7/29/09
System General Order No. 76 - Dated 3/21/11
Nebraska General Order No. 31 – Dated 3/24/11
Nebraska General Notice No. 977 – Dated 4/13/11

Further, each train was issued work orders and track bulletins for the Creston Subdivision that covered any unique speed restriction or other requirements specific to the date of the accident.

Method of Operations

Train movements were governed and authorized by signal indication. The territory was Centralized Traffic Controlled (CTC) with the train dispatcher stationed at Network Operations Center (NOC), Ft. Worth, Texas.

At the accident site there were two main tracks, each signaled for train movements in both directions and part of a Centralized Traffic Control system. The tracks were primarily parallel and situated compass east and west. The northern most track was designated the No. 1 main track. The southernmost track, the site of the collision, was designated the No. 2 main track. BNSF identifies this configuration as multiple main tracks.[8]

Maximum track speed at the accident location was 79 mph for passenger trains and 60 mph for freight trains. BNSF 9159 East was a loaded coal train with a further speed restriction of 45 mph maximum because the tons per operative brakes (TOB) exceeded 100 TOB (the actual was 142.5 TOB).[9]

Grade Signal Description

Within the General Code of Operating Rules, **Rule 9.1.13, Signal Aspects and Indications**, multiple signal aspects are given that allow the trains to pass the signal without stopping but proceed at restricted speed. These signals are all named "restricting." Their indication is "proceed at restricted speed." When trains are governed by these aspects the engineer is not required to stop the train before passing the signal but must reduce the speed of the train to restricted speed before entering the signal block beyond the signal.

Restricted speed is a defined speed and requires the crew on the locomotive to be particularly attentive and watch for any obstruction that may be encountered in the segment of track protected by the block signal with the red aspect. Following is the operating rule defining restricted speed:

> Rule 6.27 **Movement at Restricted Speed**[10]
>
> When required to move at restricted speed, movement must be made at a speed that allows stopping within half the range of vision short of:

[8] BNSF Nebraska Division Timetable, No. 7, effective May 12, 2010, Creston Subdivision, page 13.
[9] BNSF System Special Instructions No. 1, effective April 7, 2010, "1. Speed Restrictions… Maximum Speeds Permitted …Trains 100 TOB and over…….45 MPH", page 4.
[10] General Code of Operating Rules, Sixth Edition, Effective April 7, 2010

- Train.
- Engine.
- Railroad car.
- Men or equipment fouling the track.
- Stop signal.

or

- Derail or switch lined improperly.

When a train or engine is required to move at restricted speed, the crew must keep a lookout for broken rail and not exceed 20 MPH.

Comply with these requirements until the leading wheels reach a point where movement at restricted speed is no longer required.

BNSF Management Oversight

Efficiency Testing

The Code of Federal Regulations contains specific requirements[11] for the testing and observing of operating employees while they perform their duties. The BNSF maintained an operational testing program to monitor the performance and rules compliance of the employees operating trains on the BNSF system.

The BNSF provided data for both engineers and conductors of the trains involved in the collision. The records indicated supervisors had performed operational tests involving those employees.

Data was also provided to summarize all of the operational testing that was performed for the 12 months prior to the accident on the Creston Subdivision.[12] Between April 2010 and April 2011, 4,669 operational tests were performed. Of those, the data showed 45 failed events for a 1% failure rate. The data also indicated when the tests were performed and segregated by day, night and weekends. The observations were distributed between those designations. Further, data was shown by milepost to indicate that the tests were spread over the Subdivision and were not performed in one area.

Employee Review Process (ERP)

The BNSF has a formal process to identify employees that may need additional assistance from a supervisor to improve their performance called the Employee Review Process.

[11] **"CFR 49 Part 217.9 Program of operational test and inspections; recordkeeping.** …Each railroad to which this part applies shall periodically conduct operational tests and inspections to determine the extent of compliance with its code of operating rules, timetable, and timetable special instructions,…"
[12] BNSF - Post Accident Supervisors Operations Testing Review, Creston Subdivision, 4/16/2010 to 4/17/2011

An employee may be identified or selected for the program by "multiple criteria". The examples include:

1. Injury history.
2. Human factor rail equipment incidents.
3. Operations testing failures or a combination of the above.
4. New employees with incidents or injuries.
5. Other supervisor's knowledge of employee performance concern.

Once an employee is identified and placed in the program, their first-line supervisor meets with the employee at least once a month to discuss their job performance.

Engineer's Scorecard

The BNSF also has a program that specifically addresses the performance of locomotive engineers. The program uses many factors to assist the locomotive engineer's supervisors to identify engineers that could improve on their performance. This program is called the Engineer's Scorecard.

All of the BNSF engineers (approximately 9,000) start with 100 points. The system combines inputs from decertification events, performance check rides, efficiency test failures, train separation events, alerter penalty events, train handling caused derailments and other defined inputs of unacceptable performance.[13] When these inputs are entered into the engineers scorecard points are subtracted from the 100 point total. For example: a decertification would be -30 points, and train handling derailment would be -5 points, etc. An engineer with these two events would have a scorecard of 65. After one year of a clean record, points are added back to the scorecard so that an engineer may return to 100 points over time.

Event Recorder Monitoring

Furthermore, specific to locomotive engineers, the event recorder downloads are audited at the NOC.[14] If an exception is identified by the auditing system (either by a computer program or human review) an alert is sent to the locomotive supervisor who can contact that locomotive engineer and further investigate the exception that was noted from the event recorder.

Alerters

The BNSF road locomotives are equipped with an "electronic alertness device." With minor differences between those on the Electro Motive Diesel model locomotives and the

[13] This information was taken from a BNSF screen printout of Locomotive Engineer Points Scoring which can be found in the NTSB Public Docket.
[14] When a BNSF locomotive passes a download station, the event recorder data is transmitted to the NOC, Ft. Worth, Texas. The download stations are located throughout the BNSF rail system.

General Electric model locomotives, the alerter is designed to maintain the vigilance of the crew members in the locomotive cab.

Following is the BNSF description and instructions provide in the Air Brake and Train Handling Rules, effective April 7, 2010:

104.12 Electronic Alertness Device

An electronic alertness device stops the train with a service rate brake application if the engineer does not respond properly.

It functions as follows:

1. The device begins functioning when locomotive brake cylinder pressure falls below 25 psi.
2. At this point, the device monitors the operator's alertness.
3. It resets when the operator changes the position of or operates one of these locomotive controls:
    - Throttle
    - Horn
    - Bell
    - Dynamic Brake
      or
    - Device reset button
    - Radio transmit (on some alerter types)
4. If the device is not reset within the reset cycle (varies relative to speed):
5. A warning light flashes.
6. A warning horn sounds off and on for 10 seconds and then continuously for 10 seconds.
7. If the device is no reset within 20 seconds after the warning light and horn begin operating, the train brakes will automatically be applied at a service rate (Penalty Brake).

As noted in item 4, the instructions make reference to a "reset cycle." The Electro Motive Diesel model locomotives, like the one on the head end of the striking train, have a reset cycle as follows: Alerter Inactivity is 120 seconds for speeds 0 – 40 mph. For speeds greater than 40 mph the following formula is used to establish the time in seconds: 120*(40/Speed in mph).

The General Electric model locomotives that BNSF uses have a reset cycle as follows: Alerter Inactivity is 120 seconds for speeds 0 – 20 mph. For speeds greater than 20 mph, the following formula is used to establish the time in seconds: 2,400/Speed in mph.

Because the striking train's (BNSF 9159 East) speed did not exceed 40 mph, the alerter was set to cycle every 120 seconds without engineer activity for more than 30 minutes prior to the time of the collision. This would have included the time after the BNSF 9159 East had passed the red automatic block signal with the G plate that required restricted speed.

Crew Information **(See Also Human Performance Group Factual Report)**

Engineer of BNSF 9159 East (Striking Train)

The engineer of the BNSF 9159 East was originally hired by BNSF on July 14, 1997 as a brakeman in Lincoln, Nebraska. He was promoted to engineer on February 28, 1999. Other than three brief periods in Kansas City, Missouri, and once in Lincoln, Nebraska, he had primarily worked out of Creston, Iowa, since May 2003.

Operational Testing

The engineer's records indicated operational tests were performed by two different supervisors. One supervisor entered 75 observations from January 2010 to April 2011, with no failures noted. The other supervisor entered 62 observations from April 2010 to April 2011, with no failures noted. He had been observed complying with restricted speed (Rule 627) on March 12, 2010.

Training and Engineer Certification

Records indicated that he had received rules examinations on a regular basis and assorted safety training classes every year. The engineer was current with the requirements of 49 CFR Part 240 Engineer Certification and he was due for his triennial performance and knowledge exams before the end of 2011.

Discipline

He had received a 30-day suspension in December of 2009, for failing to control the speed of his train and exceeding the maximum authorized speed when entering a turnout. He also received a 10-day suspension in February 2011 for "laying off" after being called for a train.

Employee Review Process and Engineer's Scorecard

The engineer was part of the Employee Review Process, and had a lower score on the engineer's scorecard system.[15] Documents indicated that the locomotive supervisor counseled the engineer frequently and entered those sessions into the ERP system. The required observations were also documented.

[15]The BNSF Superintendent said that it is common that an engineer is part of both programs since the qualifying events are similar if not the same.

Conductor – BNSF 9159 East (Striking Train)

The conductor of the BNSF 9159 East was originally hired by BNSF on November 11, 2004 as a brakeman in Lincoln, Nebraska. She was promoted to engineer on January 21, 2007. She had worked about half of her career out of Lincoln, Nebraska, and the other half out of Creston, Iowa. She had been at Creston since July 2008.

Operational Testing

The conductor's records indicated operational tests were performed by two different supervisors. One supervisor entered 21 observations from January 2010 to October 2010,[16] with no failures noted. The other supervisor entered 12 observations from April 2010 to October 2010, with no failures noted. She had been observed complying with restricted speed three times on January 26, 2010, on March 13, 2010, and on June 18, 2010.

Training and Engineer Certification

Records indicated that she had received rules examinations on a regular basis and assorted safety training classes every year. She was current with the requirements of 49 CFR Part 240 Engineer Certification.

Discipline

She had received discipline in connection with an excessive speed violation June 23, 2009 when she had been working as a conductor.[17]

Engineer – BNSF 9470 East (Struck Train)

The engineer of the BNSF 9470 East was originally hired by BNSF on September 9, 1994 as a brakeman. He was promoted to engineer on April 16, 1995 in West Burlington, Iowa. He continued to work at West Burlington, Iowa until October 2008 when he relocated to Creston, Iowa.

Operational Testing

The engineer's records indicated 49 observations from a single supervisor from October 2010 until March 2011, with no failures noted. He had been observed complying with restricted speed on July 24, 2010.

Training and Engineer Certification

[16] There were no recent efficiency tests for the conductor because she had been on medical leave from November 2010 to March 21, 2011.
[17] The conductor shares responsibility with the engineer for the train not exceeding the authorized speed.

Records indicated that he had received rules examinations on a regular basis and assorted safety training classes every year. The engineer was current with the requirements of 49 CFR Part 240 Engineer Certification.

Discipline

He had been censured for arriving late for work in September 1999 and more recently had received a 10-day suspension for "absenting himself from duty without proper authority" in October 2009.

Conductor – BNSF 9470 East

The conductor of the BNSF 9470 East was originally hired by BNSF on February 2, 2004, as a brakeman/conductor in Los Angeles, California. He was issued his engineer's certification on December 14, 2006, and performed his promotion trip on December 19, 2006. For the first six months of 2008, the conductor was in Creston, Iowa, and then went back to Los Angeles until August 2008, when he relocated to Creston, Iowa.

Operational Testing

The conductor's records indicated efficiency tests were performed by two different supervisors. One supervisor entered 29 observations between February 2010 and March 2011; with no failures noted. The other supervisor entered 19 observations between August 2010 and March 2011; with no failures noted. There were no observations for compliance with restricted speed recorded.

Training and Engineer Certification

Records indicated that he had received rules examinations on a regular basis and assorted safety training classes every year. The engineer was current with the requirements of 49 CFR Part 240 Engineer Certification and he was due for his triennial performance and knowledge exams before the end of 2011.

Discipline

The conductor had received a 30-day suspension in 2005, for "running while performing switching operations". In February 2009, he had a 10-day suspension for a "missed call" to show up for work.

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