
***Federal Railroad Administration***
***Office of Railroad Safety***
***Accident and Analysis Branch***

# *Accident Investigation Report*
# *HQ-2015-1012*

***BNSF Railway Company (BNSF)***
***Louisville, NE***
***February 17, 2015***

***Note that 49 U.S.C. §20903 provides that no part of an accident or incident report, including this one, made by the Secretary of Transportation/Federal Railroad Administration under 49 U.S.C. §20902 may be used in a civil action for damages resulting from a matter mentioned in the report.***

| U.S. Department of Transportation<br>Federal Railroad Administration | **FRA FACTUAL RAILROAD ACCIDENT REPORT** | FRA File #HQ-2015-1012 |
|---|---|---|

## TRAIN SUMMARY

| 1. Name of Railroad Operating Train #1 | 1a. Alphabetic Code | 1b. Railroad Accident/Incident No. |
|---|---|---|
| BNSF Railway Company | BNSF | HQ-2015-1012 |

## GENERAL INFORMATION

| 1. Name of Railroad or Other Entity Responsible for Track Maintenance | 1a. Alphabetic Code | 1b. Railroad Accident/Incident No. |
|---|---|---|
| BNSF Railway Company | BNSF | NE-0215-108 |
| 2. U.S. DOT Grade Crossing Identification Number | 3. Date of Accident/Incident | 4. Time of Accident/Incident |
| | 2/17/2015 | 10:56 PM |

| 5. Type of Accident/Incident |
|---|
| Derailment |

| 6. Cars Carrying HAZMAT | 7. HAZMAT Cars Damaged/Derailed | 8. Cars Releasing HAZMAT | 9. People Evacuated | 10. Subdivision |
|---|---|---|---|---|
| 0 | 0 | 0 | 0 | Creston |

| 11. Nearest City/Town | 12. Milepost *(to nearest tenth)* | 13. State Abbr. | 14. County |
|---|---|---|---|
| Louisville | 26.02 | NE | CASS |

| 15. Temperature (F) | 16. Visibility | 17. Weather | 18. Type of Track |
|---|---|---|---|
| 13 °F | Dark | Clear | Main |

| 19. Track Name/Number | 20. FRA Track Class | 21. Annual Track Density *(gross tons in millions)* | 22. Time Table Direction |
|---|---|---|---|
| Main Track One | Freight Trains-60, Passenger Trains-80 | 144.53 | East |

U.S. Department of Transportation
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# FRA FACTUAL RAILROAD ACCIDENT REPORT

FRA File #HQ-2015-1012

## OPERATING TRAIN #1

| 1. Type of Equipment Consist: | 2. Was Equipment Attended? | 3. Train Number/Symbol |
|---|---|---|
| Freight Train | Yes | C-BKMKEBO-05A |

| 4. Speed (recorded speed, if available) R - Recorded E - Estimated | Code | 5. Trailing Tons (gross exluding power units) | 6a. Remotely Controlled Locomotive? 0 = Not a remotely controlled operation 1 = Remote control portable transmitter 2 = Remote control tower operation 3 = Remote control portable transmitter - more than one remote control transmitter | Code |
|---|---|---|---|---|
| 35 MPH | R | 16898 | | 0 |

6. Type of Territory

Signalization:

Signaled

Method of Operation/Authority for Movement:

Supplemental/Adjunct Codes:

| 7. Principal Car/Unit | a. Initial and Number | b. Position in Train | c. Loaded (yes/no) | 8. If railroad employee(s) tested for drug/alcohol use, enter the number that were positive in the appropriate box. | Alcohol | Drugs |
|---|---|---|---|---|---|---|
| (1) First Involved *(derailed, struck, etc.)* | GBRX 20262 | 20 | yes | | 0 | 0 |
| (2) Causing *(if mechanical, cause reported)* | GBRX 20262 | 20 | yes | 9. Was this consist transporting passengers? | | No |

| 10. Locomotive Units (Exclude EMU, DMU, and Cab Car Locomotives.) | a. Head End | Mid Train b. Manual | Mid Train c. Remote | Rear End d. Manual | Rear End e. Remote | 11. Cars (Include EMU, DMU, and Cab Car Locomotives.) | Loaded a. Freight | Loaded b. Pass. | Empty c. Freight | Empty d. Pass. | e. Caboose |
|---|---|---|---|---|---|---|---|---|---|---|---|
| (1) Total in Train | 1 | 0 | 0 | 0 | 1 | (1) Total in Equipment Consist | 119 | 0 | 0 | 0 | 0 |
| (2) Total Derailed | 0 | 0 | 0 | 0 | 0 | (2) Total Derailed | 33 | 0 | 0 | 0 | 0 |

| 12. Equipment Damage This Consist | 13. Track, Signal, Way & Structure Damage |
|---|---|
| 2137340 | 1080000 |

14. Primary Cause Code

E61C - Broken rim

15. Contributing Cause Code

| Number of Crew Members | | | | Length of Time on Duty | |
|---|---|---|---|---|---|
| 16. Engineers/Operators | 17. Firemen | 18. Conductors | 19. Brakemen | 20. Engineer/Operator | 21. Conductor |
| 1 | 0 | 1 | 0 | Hrs: 3 Mins: 31 | Hrs: 3 Mins: 31 |

| Casualties to: | 22. Railroad Employees | 23. Train Passengers | 24. Others | 25. EOT Device? | 26. Was EOT Device Properly Armed? |
|---|---|---|---|---|---|
| | | | | Yes | Yes |
| Fatal | 0 | 0 | 0 | 27. Caboose Occupied by Crew? | |
| Nonfatal | 0 | 0 | 0 | | N/A |

| 28. Latitude | 29. Longitude |
|---|---|
| 40.992559000 | -96.215812000 |

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## CROSSING INFORMATION

| Highway User Involved | | Rail Equipment Involved |
|---|---|---|
| 1. Type | | 5. Equipment |
| 2. Vehicle Speed *(est. mph at impact)* | 3. Direction *(geographical)* | 6. Position of Car Unit in Train |
| 4. Position of Involved Highway User | | 7. Circumstance |
| 8a. Was the highway user and/or rail equipment involved in the impact transporting hazardous materials? | | 8b. Was there a hazardous materials release by |
| 8c. State here the name and quantity of the hazardous material released, if any. | | |

| 9. Type of Crossing Warning | 10. Signaled Crossing Warning | 11. Roadway Conditions |
|---|---|---|
| 1. Gates 4. Wig wags 7. Crossbucks 10. Flagged by crew<br>2. Cantilever FLS 5. Hwy. traffic signals 8. Stop signs 11. Other *(spec. in narr.)*<br>3. Standard FLS 6. Audible 9. Watchman 12. None | | |

| 12. Location of Warning | 13. Crossing Warning Interconnected with Highway Signals | 14. Crossing Illuminated by Street Lights or Special Lights |
|---|---|---|
| | | |

| 15. Highway User's Age | 16. Highway User's Gender | 17. Highway User Went Behind or in Front of Train and Struck or was Struck by Second Train | 18. Highway User |
|---|---|---|---|
| | | | |

| 19. Driver Passed Standing Highway Vehicle | 20. View of Track Obscured by *(primary obstruction)* |
|---|---|
| | |

| Casualties to: | Killed | Injured | 21. Driver was | 22. Was Driver in the Vehicle? |
|---|---|---|---|---|
| 23. Highway-Rail Crossing Users | | | 24. Highway Vehicle Property Damage *(est. dollar damage)* | 25. Total Number of Vehicle Occupants *(including driver)* |

| 26. Locomotive Auxiliary Lights? | 27. Locomotive Auxiliary Lights Operational? |
|---|---|
| | |

| 28. Locomotive Headlight Illuminated? | 29. Locomotive Audible Warning Sounded? |
|---|---|
| | |

10. Signaled Crossing Warning

1 - Provided minimum 20-second warning
2 - Alleged warning time greater than 60 seconds
3 - Alleged warning time less than 20 seconds
4 - Alleged no warning
5 - Confirmed warning time greater than 60 seconds
6 - Confirmed warning time less than 20 seconds
7 - Confirmed no warning
N/A - N/A

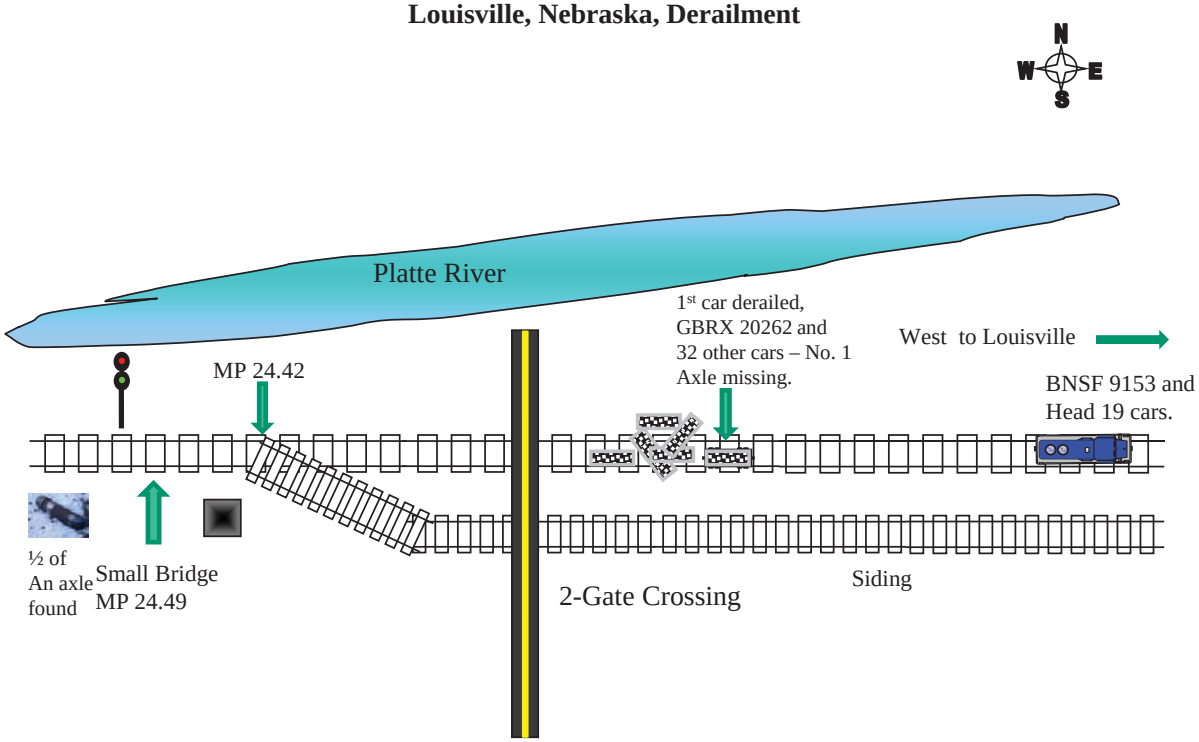
Explanation Code

A - Insulated rail vehicle
B - Storm/lightning damage
C - Vandalism
D - No power/batteries dead
E - Devices down for repair
F - Devices out of service
G - Warning time greater than 60 seconds attributed to accident-involved train stopping short of the crossing, but within track circuit limits, while warning devices remain continuously active with no other in-motion train present
H - Warning time greater than 60 seconds attributed to track circuit failure (e.g., insulated rail joint or rail bonding failure, track or ballast fouled)
J - Warning time greater than 60 seconds attributed to other train/equipment within track circuit limits
K - Warning time less than 20 seconds attributed to signals timing out before train's arrival at the crossing/ island circuit
L - Warning time less than 20 seconds attributed to train operating counter to track circuit design direction
M - Warning time less than 20 seconds attributed to train speed in excess of track circuit's design speed
N - Warning time less than 20 seconds attributed to signal system's failure to detect train approach
O - Warning time less than 20 seconds attributed to violation of special train operating instructions
P - No warning attributed to signal systems failure to detect the train
R - Other cause(s). Explain in Narrative Description

## SKETCHES

HQ-2015-1012 Sketch

**Report No. HQ-2015-1012, BNSF**
**Louisville, Nebraska, Derailment**



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## SYNOPSIS

On February 17, 2015, at 10:56 p.m., CDT, BNSF Railway (BNSF) Train C-BKMKEB0-05A derailed 33 loaded coal cars, Line Numbers 20 through 52 inclusive. This train consisted of 119 loaded coal cars, 16,898 trailing tons, was 6,465 feet in length, and was traveling eastward at a recorded speed of 35 mph in throttle position 8. This derailment occurred on the BNSF's Nebraska Division, Creston Subdivision, near Louisville, Nebraska, Milepost (MP) 26.02 Main Track Number 1.

Through the derailment area, BNSF operates east and west on a single main track over the Creston Subdivision, which extends from Creston, Iowa, to Lincoln, Nebraska. The method of operation is via a traffic control system, remotely controlled by a BNSF dispatcher located in the BNSF's Network Operations Center in Fort Worth, Texas. The maximum authorized speed through this area is 50 mph. Estimated damages include $2,137,340 to equipment and $1,080,000 for track and signal, totaling $3,217,340. The weather was calm and 13 degrees F at the time of the derailment.

The Federal Railroad Administration's (FRA) investigation revealed the probable cause to be E61C, a broken rim on the wheel at the left, Number 1 location on Car Number GBRX 20262, which was Line Number 20 in the train consist. The left, Number 1 wheel rim broke, causing the wheel to crack down to the hub, which then allowed the wheel to come loose on the wheel seat, and the Left Number 1 wheel dropped to the inside of the rail at MP 26.02, which is the point of derailment causing damage to over 1.5 miles of concrete ties and breaking the rail in numerous places before the other 32 cars were derailed at about MP 24.5.

## NARRATIVE

Circumstances Prior to the Accident

The crew of Train C-BKMKEB0-05A included a locomotive engineer and a conductor. On February 17, 2015, the crew, after receiving the required statutory off-duty rest period, reported for duty at 7:25 p.m., CDT, at their away-from-home terminal at BNSF Railway's (BNSF) Hobson Yard in Lincoln, Nebraska.

Their assigned freight train consisted entirely of 119 loaded coal cars and 0 empties. There were two locomotives, one on the head-end, and one distributed power unit (DPU) on the rear of the train. The train was 6,465 feet long, and 16,898 tons. A Class 1 extended haul air brake test was conducted in Alliance, Nebraska, prior to their departure from Alliance, and arriving at Lincoln at about 6:15 p.m. The train departed Lincoln at 9:29 p.m., on February 17, headed Timetable east toward Creston, Iowa, which was the crew's home terminal.

The trip was uneventful prior to this incident. The Engineer was seated at the controls on the south side of the lead locomotive, and the Conductor was seated on the north side of the lead locomotive at the conductor's seat. As the head-end of the train approached Louisville, Nebraska, at Milepost (MP) 23.1, the Engineer was in throttle position 8 at a recorded speed of 35 mph, when the train experienced an undesired emergency (UDE) application of the train's brakes.

Prior to the derailment, Train C-BKMKEB0-05A traversed over two grade crossings, one public and one private, on a slight descending grade with several right and left-hand curves following along the Platte River. At South Bend, Nebraska, MP 27.3, the track transitions from two main tracks to a single main track. The track at the point of derailment (POD) consists of 136-pound continuous welded rail (CWR) rolled in 1996. It is laid on concrete cross ties in a 2-degree, 58-minute left-hand curve, held in place with elastic fasteners. The general roadbed, ballast, and geometry conditions at the POD were all in sound condition.

The track through the entire accident area from MP 27.5 to MP 24.5 is a mixture of 132- and 136-pound CWR on primarily concrete ties (wood ties used in grade crossings, bridges and turnouts). There are seven curves in the entire accident area, ranging between 1 and 3 degrees. Other than the damage caused from the broken wheel, the overall track condition was found to be in compliance with all FRA Part 213 Track Safety Standards during a hi-rail and walking inspection by an FRA Track Safety Inspector just hours after the accident.

The Accident

As Train C-BKMKEB0-05A approached West Louisville, the Engineer was operating the train at 35 mph in throttle position 8 with no dynamic braking. The speed and throttle position were verified by the event recorder download from Lead Locomotive BNSF 9153, which also matched the DPU Locomotive BNSF 8428 event recorder download.

According to the recorded radio conversations, at 11:00 p.m., the train dispatcher called the Engineer on Train C-BKMKEB0-05A and asked if they had noticed anything wrong with their signals. Then at 11:01 p.m., the Engineer informed the train following them that their train had gone into emergency. The crew then notified the dispatcher their train had gone into emergency at West Louisville, and that the conductor was going back to investigate the cause.

The Conductor discovered a broken knuckle on Car Number BNSF 652064, Line Number 19 from the head-end of the consist, and after the knuckle was replaced, he instructed the Engineer to make a reverse move (Timetable west), to couple into the rest of the train. As the head 19 cars approached the remaining cars, the Conductor noticed cars were derailed at the west siding switch (WSS) at Louisville, and Car Number GBRX 20262 was missing the first set of wheels. He notified the Engineer who then notified the dispatcher.

Further investigation by BNSF and FRA revealed distinct marks on the head of the rail at about 8-foot, 3-inch intervals, with the first one found at MP 27.5 and continued for about 1 1/2 miles. The first broken rail was discovered at MP 27.24, and there were 4 more broken rails found between MP 27.3 and MP 26.02. There was also significant concrete tie damage discovered between MP 26.02, the POD and MP 25.2; where the DPU came to rest east of South Bend and continued until just shortly before the 30-car derailment at MP 24.5, which is the WSS at Louisville.

The first marks on the ties were discovered at MP 26.02, which is where the shattered rim had now cracked the wheel down to the hub from constant impacts with the head of the rail, and became loose on the wheel seat, then dropped to the inside of the rail and was now spinning on the axle near the center. This condition caused excessive pressure on the center of the axle, which eventually lead to it breaking and the wheel which was supporting the weight of the car had now came off of the left portion of the axle. The left portion of the axle was found in a ditch on the south side of the main line just prior to the 33-car pile-up, and the L-1 wheel was not present.

Estimated damages include $2,137,340 to equipment and $1,080,000 for track and signal, totaling $3,217,340.

Analysis and Conclusions

Analysis - Locomotive Inspection Records: A records inspection was conducted of the recent daily inspections made to Locomotive Number BNSF 9153 and the DPU BNSF 8428 which were in the consist of Train C-BKMKEB0-05A, and the FRA F 6180.49A forms in both of the units for any defects or inspections and testing not up-to-date.

Conclusion: No defects were noted by FRA on the daily inspections performed by BNSF, and all of the FRA F 6180.49A forms were up-to-date. No defects were noted arising from the locomotive inspection histories, and neither of the locomotives was involved in the cause of the derailment.

Analysis - Equipment History: Truck performance detector, wheel impact load detector (WILD) readings, and results from BNSF's R&D Lab in Topeka, Kansas, for Car Number GBRX 20262 were analyzed: Car Number GBRX 20262 had not been on a repair track since October 14, 2014, where BNSF's Alliance Car Shop replaced the B-end coupler pin carrier and the L-4 wheel for the Association of American Railroads' (AAR) Why Made Code of 75, which designates a shelled tread condition. Also on July 9, 2014, in Springfield, Missouri, the R-2 wheel was replaced for AAR Why Made Code 65, which designates a high impact wheel over 90-kilo pounds (kips). The WILD at Aurora, Nebraska, was reviewed for impact readings. The L-1 wheel was found and sent to BNSF's lab in Topeka for analyzing.

Conclusion: Car Number GBRX 20262 did not have any known defects. The last WILD reading was on February 17, at Aurora, which is about 75 miles west of Lincoln, and about 110 miles west of the derailment site. The detector only noted the R-3 wheel as having an impact reading of 59.52 kips on a 90-day history of this car, which is nowhere near an alarming condition.

The findings from the Topeka Lab revealed the failure of L-1 wheel was due to a shattered rim type failure. A shattered rim is a fatigue crack which originates at an inclusion or void in the steel, which in this case grew parallel to the tread surface underneath the tread surface. This shattered rim grew to an approximate length of 12 inches before breaking out towards the outer tread surface, which eventually led to the wheel breaking all the way down to the hub on the axle seat, and loosening up the wheel, allowing it to move off of the axle seat to the approximate middle of the Number 1 axle, where it traveled for approximately 1 1/2 miles. During this 1 1/2 miles, high axial stress caused by the wheel in the middle of the axle bearing the weight of the car, caused rapid deterioration of the axle, which led to the failure (break) of the axle.

Analysis - Inspection of Non-Derailed Cars and Locomotives: FRA was not present until the next day; however, the head 19 cars, and the lead locomotive were inspected for defective conditions. The inspection revealed two minor defects to the coal cars. Lead Locomotive BNSF 9153 was found to have a defective throttle controller, which would go into "N1" without the reverser in place. The locomotive was tagged noncomplying and sent back to Lincoln for repairs. Repairs to the cars were made by mechanical employees at the derailment site.
Conclusion: None of the remaining cars or locomotives had any defective conditions which would have contributed to the cause of the derailment (Form FRA F6180.96 - RMM-34).

Analysis - Recent Track Inspections: A records examination of recent track inspections were made and there had not been any exceptions noted by BNSF's Track Inspector prior to the derailment in the MP's between the POD and the derailment of the other 32 cars.

Conclusion: There was one known defect at MP 22.83 consisting of two broken plates in a turn-out, but not part of the cause because it is several miles east of the derailment site. Track did not contribute to the cause of the derailment.

Analysis - Locomotive Engineer Operating Performance:  Both the lead and DPU locomotives were equipped with a speed indicators and operative event recorders.  The manager of operating practices downloaded the event recorders from both units at the derailment site.  They were analyzed by BNSF officials and FRA.

Conclusion: The locomotive engineer was found to be operating the train in compliance with both Federal regulations and BNSF operating rules.

Analysis - Toxicological Testing:  FRA post-accident forensic toxicology result reports indicate that the two employees tested had negative test results.

Conclusion:  Impairment due to alcohol or drug usage was not a factor in this accident.

Analysis - Fatigue Analysis:  FRA obtained information from the BNSF pertaining to the 10-day period preceding this accident, including the 10-day work history (on-duty/off-duty cycles) for the train crew involved.

Conclusion:  Upon analysis of the information obtained, FRA concluded fatigue was not probable, and is not a contributing factor in this accident.

Overall Conclusions

After analyzing the information contained in the analysis and conclusions section of this report, it was determined that the left, Number 1 wheel became loose on the axle due to a shattered rim prior to the derailment.

Probable Cause and  Contributing Factors

The Federal Railroad Administration’s (FRA) investigation revealed the probable cause to be E61C, a broken rim on the wheel at the left, Number 1 location on Car Number GBRX 20262, which was Line Number 20 in the train consist.  The left, Number 1 wheel rim broke, causing the wheel to crack down to the hub, which then allowed the wheel to come loose on the wheel seat, and the Left Number 1 wheel dropped to the inside of the rail at MP 26.02, which is the point of derailment causing damage to over 1.5 miles of concrete ties and breaking the rail in numerous places before the other 32 cars were derailed at about MP 24.5.