BROTHERHOOD OF MAINTENANCE OF WAY EMPLOYES

A DIVISION OF THE INTERNATIONAL BROTHERHOOD OF TEAMSTERS, RAIL CONFERENCE

BEFORE THE NATIONAL TRANSPORTATION SAFETY BOARD

NTSB Accident Number: RRD21MR017 Class: Major
September 25, 2021

Proposed findings, probable cause, and safety recommendations, in connection with the derailment of Amtrak Passenger Train No. 7, near Joplin, Montana

Director of Safety Roy Morrison

Final Submission

The Brotherhood of Maintenance of Way Employes (BMWED), a division of the International Brotherhood of Teamsters ("IBT"), was granted party status by the Board in the above-referenced investigation. BMWED respectfully submits these proposed findings, probable cause, and safety recommendations to the Board for consideration.

Accident Synopsis

On September 25, 2021, at approximately 3:56 p.m. Mountain Standard Time ("MST"),[1] Amtrak Passenger Train No. 7 derailed near Joplin, Montana. A total of eight (8) railcars derailed. The train consisted of two (2) locomotives and ten (10) cars. There were 141 passengers, four (4) operating crew members, and nine (9) onboard personnel for a total of 154 people on the train. Three (3) passengers riding in the lounge car were fatally injured.[2]

An additional twenty-eight (28) passengers and crew members were transported and treated for injuries, with eleven (11) requiring hospitalization. According to local weather reports, the weather was partly cloudy and approximately 85°F.

[1] All times throughout this report will be Mountain Standard Time.

[2] A "lounge car" (sometimes referred to as a buffet lounge, buffet car, club car, or grill car) is a type of passenger car on a train in which riders can purchase food and drinks.

Figure 1 – Aerial photo of derailment *(Photo courtesy of Fox 4 – WDAF TV)*

Accident Narrative

Train Information:

Amtrak Train No. 7 had two (2) locomotives and ten (10) passenger cars, with the Amtrak (“ATK”) No. 74 being used as the controlling locomotive. The train was 988 feet in length and weighed 1,069 tons.

Amtrak Train No. 7 typically operates between Chicago, Illinois, and Seattle, Washington. The train's rear four (4) cars are removed at Spokane, Washington. These four (4) cars continue to

Portland, Oregon, as Amtrak Train No. 27, with the remaining portion of the train continuing towards its final destination of Seattle, Washington. Amtrak Train No. 7's operating crew consisted of a Locomotive Engineer, Assistant Locomotive Engineer, Conductor, and Assistant Conductor.

Track Description:

Amtrak Train No. 7 was operating on the Hi-Line Subdivision on the Montana Division of the Burlington Northern Santa Fe ("BNSF") transportation network.[3] The Hi-Line Subdivision extends from milepost ("MP") 964.8 in Havre, Montana to MP 1217.5 in Whitefish, Montana. This Subdivision consists of a mostly single main track with multiple siding tracks. Centralized Traffic Control ("CTC"),[4] and the entire Hi-Line Subdivision has active Positive Train Control ("PTC"),[5] which governs train authority and movements. The maximum authorized speed ("MAS") for passenger trains on this portion of the track is 79 miles per hour ("MPH"). The derailment occurred on a single main track between MP 1012.00 (Joplin) and MP 1014.70 (East Buelow). The track where the accident occurred was constructed with wood crossties that measured 9 inches by 7 inches, measuring 8'6" long. The crosstie center-to-center spacing measured 19.5" from the point of derailment located at MP 1014.57, back east to the private railroad crossing at MP 1014.00. Investigators counted and measured about 45 older existing crossties center-to-center measurements ranging between 16 inches to 22 inches due to skewed and off-center running rails.

Investigators noted a plug rail on the low side of the curve located between MP 1014.554 and

MP 1014.55 with two bolted suspended rail joints that measured 19’6” long. The 19’6” plug rail comprised of a 132-pound—RE—CC—USS—Illinois—manufactured in January 1982. The bolted plug rail was secured to the existing low side running rail with standard six-hole joint bars measuring 36” long. Each plug rail joint was drilled for in-track welding, and had four-6.5” standard bolts, nuts and locking washers securing the joint bars. Investigators noted that the east suspended plug rail joint had evidence of train wheel flange contact at the top surface of the gauge side joint bar. (See figure 2)

Figure 2 – *East low/north plug rail joint showing indication of wheel flange contact Photo courtesy of NTSB*

The 19'5" plug rail was installed on July 23, 2021, due to a 10% rail weld defect discovered by BNSF's rail flaw detection car. The east suspended plug rail joint had evidence of train wheel flange contact at the top surface of the gauge side joint bar. As discovered during post-accident track inspections, investigators noted that the east low-side suspended plug rail joint was hanging out of the crosstie plates about 1-inch, with evidence of an additional 1-inch of underloading. As discovered during post-accident track inspections, investigators noted that the east low-side suspended plug rail joint was hanging out of the crosstie plates about 1-inch, with evidence of an additional 1-inch of underloading vertical deflection (movement up and down) measured on the sides of the crossties. Investigators also noted during post-accident track inspections that the west low-side suspended plug rail joint was also hanging out of the crosstie plates about 5/8" (.625 inches), with an additional ½" (.50 inches) of vertical deflection measured on the sides of the crossties. (See figure 3)

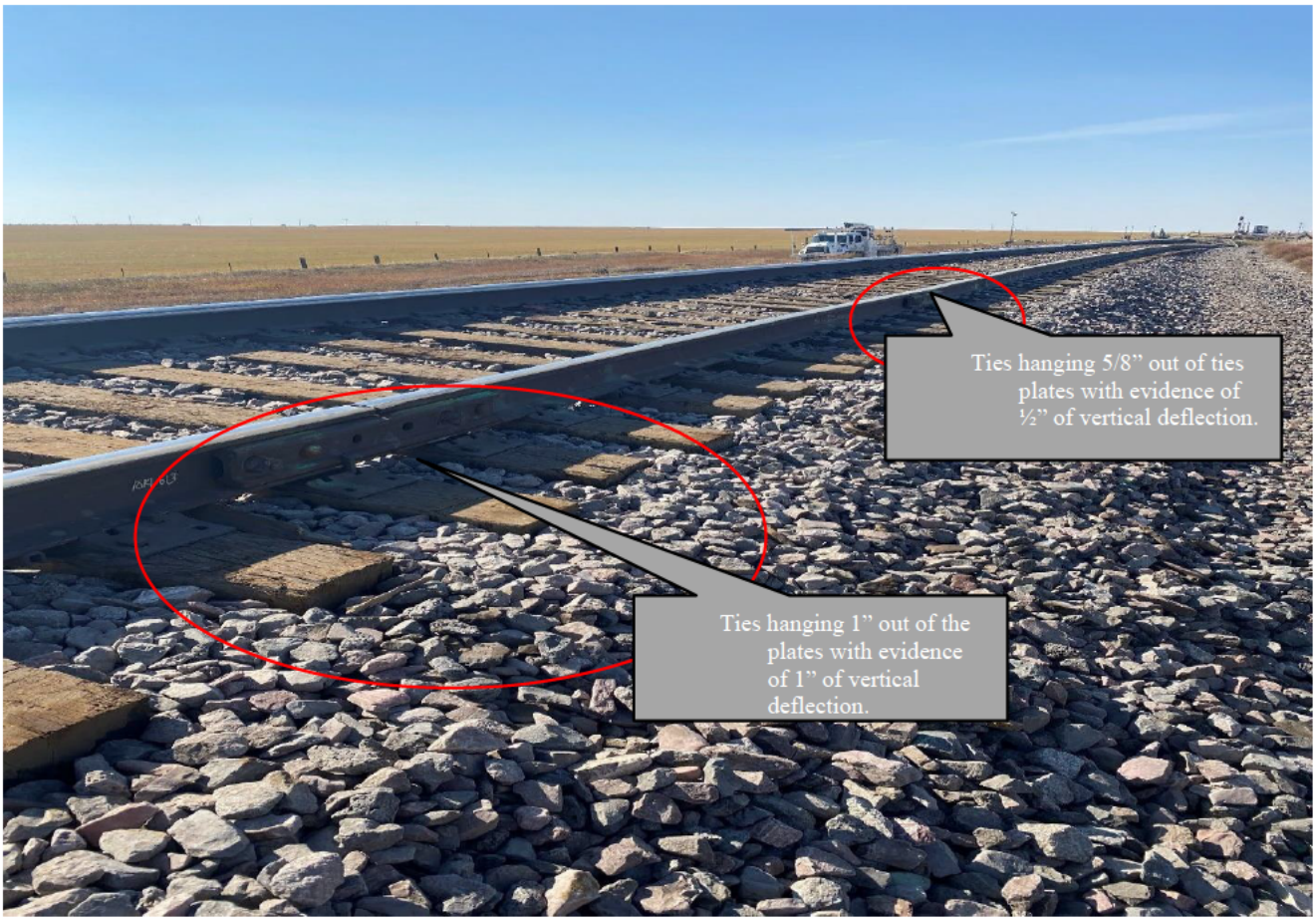


Figure 3 – "As found" by investigators - non-supporting ties under suspended plug rail joint

Continuous Welded Rail (CWR)

CWR is defined as a continuous rail length that exceeds 400 feet. When rail is installed as CWR, it remains CWR regardless of whether a rail joint or plug rail is installed after the initial installation of the CWR rail. This mainly applies to temporary rail joints and plug rails that have been installed for safety and maintenance purposes due to rail flaw defects, or rail maintenance work. Variations in ambient temperatures does affect the length of CWR rail, whereas rail expands (lengthens) when heated, and contracts (shortens) when cooled.

CWR Rail Temperatures

A rail's "Rail neutral temperature" (RNT) is defined as the temperature at which a rail is neither in tension, nor compression. To safely control CWR rail tension and compression forces (rail longitudinal movement), BNSF has established CWR rail "target neutral temperatures" (TNT's), or target rail laying temperatures (TRLT's), which provides a specific desired rail neutral temperature to prevent track buckling occurrences. When installing or adjusting CWR rail, BNSF rail maintenance and construction crews utilize a regional map that references the different TRLT's for specific regions or territories. BNSF's CWR policy allows rail to be installed or adjusted ±20°F when utilizing the TRLT regional map for locations. For rails being installed or adjusted in tunnels greater than 800 feet in length, the policy states that rails are to be installed and maintained at tunnel ambient temperature, rather than referring to the TRLT regional map for that location.

Figure 4 *– Air or Ambiant / Rail Temrature throuut the day of the accedent*

Date and time	Predicted Rail-Temp (F)	Air-Temp (F)	Wind-Speed (MPH)	Solar-Radiation (Watts/m^2)
09/25/2021 0:00	53.9	54.68	4.64	0
09/25/2021 0:30	52.8	53.6	4.51	0
09/25/2021 1:00	53.3	56.84	4.18	0
09/25/2021 1:30	53.2	55.94	4.47	0
09/25/2021 2:00	52.9	54.68	4.55	0
09/25/2021 2:30	52.4	54.14	5.28	0
09/25/2021 3:00	51.8	53.24	6.89	0
09/25/2021 3:30	51.1	52.34	7.26	0
09/25/2021 4:00	50.3	51.62	6.95	0
09/25/2021 4:30	49.4	50.54	6.37	0
09/25/2021 5:00	48.5	49.46	5.77	0
09/25/2021 5:30	47.6	48.74	5.08	0
09/25/2021 6:00	46.8	47.84	4.59	0
09/25/2021 6:30	46.3	47.3	4.47	0
09/25/2021 7:00	48	52.16	4.59	0
09/25/2021 7:30	49.1	52.52	5.53	0
09/25/2021 8:00	49.8	52.52	6.41	0
09/25/2021 8:30	50.4	52.16	7.02	5.2
09/25/2021 9:00	52.4	52.7	7.66	18.1
09/25/2021 9:30	55.2	54.32	6.3	147.7

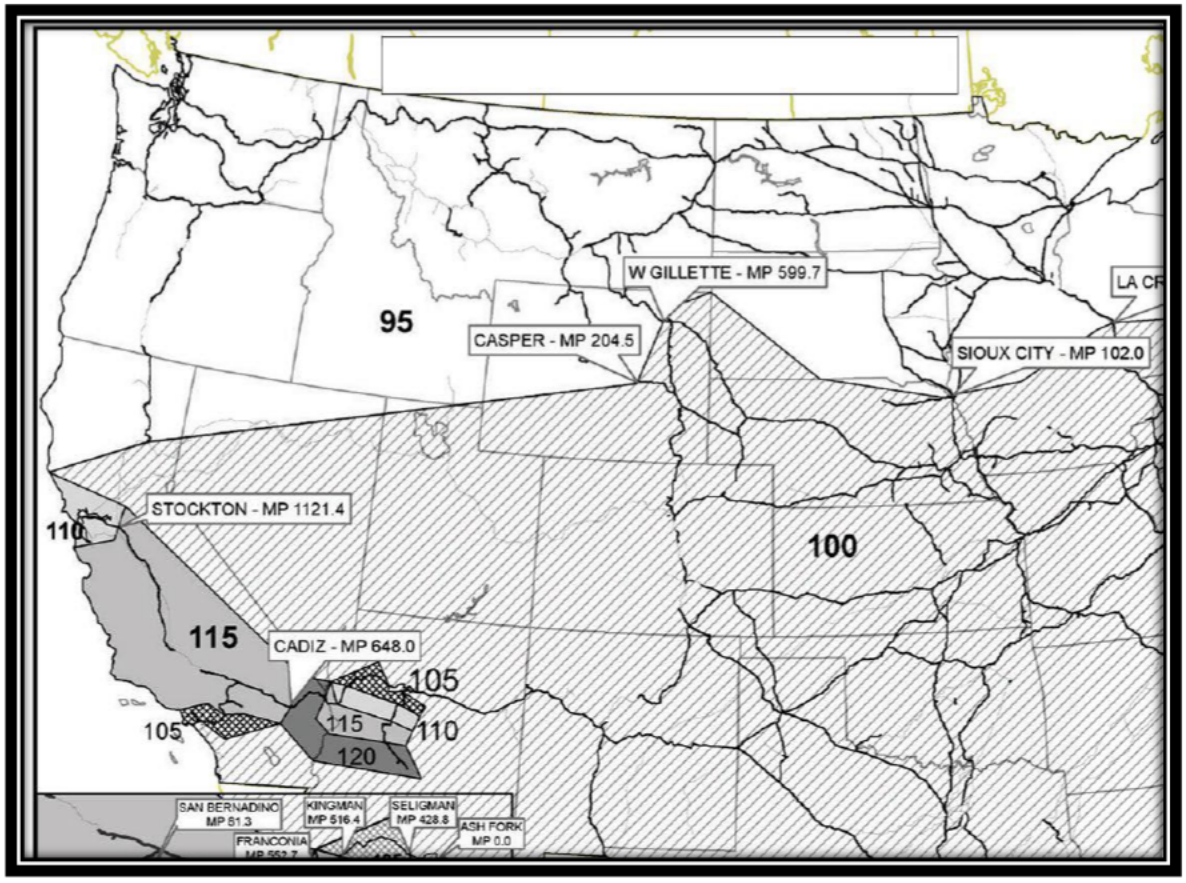
09/25/2021 10:00	57.8	56.66	5.95	147
09/25/2021 10:30	62.9	58.46	6.02	165
09/25/2021 11:00	69.6	62.42	6.97	441.7
09/25/2021 11:30	75.5	65.84	7.31	498.1
09/25/2021 12:00	80.6	69.26	8.35	557.4
09/25/2021 12:30	84.8	71.78	9.04	603.9
09/25/2021 13:00	88.7	78.26	7.38	465.9
09/25/2021 13:30	92.1	79.7	7.45	548.6
09/25/2021 14:00	95.4	81.68	8.11	557.4
09/25/2021 14:30	97.8	83.66	8.72	645.8
09/25/2021 15:00	98.8	84.2	9.66	625.2
09/25/2021 15:30	98.8	84.74	9.25	584.2
09/25/2021 16:00	97.4	85.1	9.99	539.3
09/25/2021 16:30	95.1	83.84	11.37	471.5
09/25/2021 17:00	92.4	82.94	11.61	408.9
09/25/2021 17:30	89.4	81.86	11.9	326.5
09/25/2021 18:00	86.4	80.6	11.35	235.3
09/25/2021 18:30	82.9	79.52	10.07	157.9
09/25/2021 19:00	78.5	75.02	4.99	65.7
09/25/2021 19:30	74.3	71.42	5.24	6.6
09/25/2021 20:00	71.1	69.44	5.37	0
09/25/2021 20:30	68.6	67.82	5.29	0
09/25/2021 21:00	66.4	66.2	5.27	0
09/25/2021 21:30	64.6	64.76	5.6	0
09/25/2021 22:00	63.2	63.68	6.62	0
09/25/2021 22:30	62.1	62.78	6.65	0
09/25/2021 23:00	61.3	62.42	6.24	0
09/25/2021 23:30	60.8	61.88	5.47	0

(Table courtesy of FRA)

The Table from FRA shows a 37.44° F, 9-hour Air or Ambiant temperature fluctuation and a 52.5°F predicted rail temp differential.

The curve at MP 1014 had had multiple maintinance procedures performed over the last year that had dramatic affects on the RNT. In BNSF's CWR Adjustment log as of 10/20/21, the RNT of the derailment area was somewhere between 114°- 117° F. At the maximum values allowed per BNSF Procedures for Installation, Adjustment, Maintenance, and Inspection of the CWR program as required by CFR §213.118 Effective March 4, 2021. Further inspections showed indications of track lateral movement on both ballast shoulders by the indications of ballast voids at the ends of the crossties

in the east tangent area of the track. Investigators measured ballast voids in the undisturbed portions of the curve to be up to 2" in length on both ends of the crossties, that's a total of 4" of lateral movement.



(Figure 5 – BNFS target rail laying temperature reference map)

Point of Derailment:

The point of derailment ("POD") was measured and confirmed to be at MP 1014.57 and all eight (8) of the derailed railcars came to rest to the west of that approximate location. The POD was located 100' west of the west plug rail bolted joint and 119.5' west of the eastern bolted rail joint. At 79 MPH, Amtrak Train No. 7 would have covered this distance in about 1 second. (See figure 5)

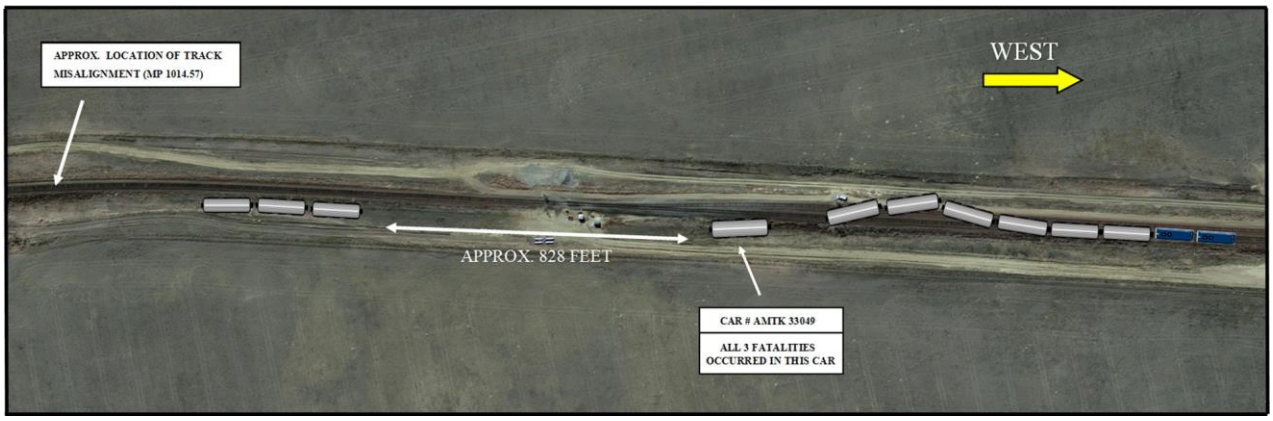


Figure 6 – Schematic of accident site

Track Image Recorder ("TIR") / Outward Facing Camera Footage:

The investigative group observed the TIR or outward facing camera footage from the lead locomotive of Amtrak Train No. 7 (ATK locomotive No. 74), as well as outward facing camera footage from two (2) BNSF trains that traveled through the area prior to Amtrak Train No. 7.

The first footage was from eastbound train BNSF Q PTLCHC3 23, which traversed the area at approximately 2:47 p.m. while traveling at a speed of 35 MPH. At approximately MP 1014.5, an alinement[3] deviation in the track was recorded. As the train traversed the misaligned track, there was a lateral rocking of the locomotive that was apparent.

[3] The horizontal **alinement** is done by using a predefined length of string line (such as 62-foot in the US and 20 meters in Australia) to measure along the gauge side of the reference rail. It is the distance (in inches or millimeters) from the midpoint of the string line to the gauge of the reference rail. The design horizontal alignment for tangent track is zero (perfect straight line on the horizontal layout). The design horizontal alignment on the curved track in the United States is 1 inch for each degree of curvature. Any other readings indicate deviations.

The second footage was from the eastbound train BNSF Z SSECHC7 24, which traversed the area at approximately 2:30 p.m. traveling at 40 MPH. The footage verified the misaligned track. When the train traversed the track misalignment, the train experienced similar lateral movement.

Lastly, the group observed the outward facing camera footage from Amtrak Train No. 7. which shows Amtrak Train No. 7 approaching the same area and, it was apparent that the alinement deviation had worsened. While attempting to pass over the area, Amtrak Train No. 7 shook

Figure 7 – Still image taken from the outward facing camera footage from the lead locomotive of Amtrak Train No. 7. This image was taken seconds before the train derailed.

(Photo courtesy of Amtrak)

laterally to the right, then left, then right again. At this point the train began to slow, and eventually stopped.

Track Inspection and Maintenance:

The track inspection and maintenance of the BNSF Hi-Line subdivision is done by the Engineering Track Maintenance Department. This maintenance area was about 170 miles long and consisted of 26 positions to inspect and maintain this section of track. In the interviews of the local track maintenance forces, it became clear several of these safety sensitive positions had gone vacant for long periods of time over the last year. This required existing forces to cover the territory with fewer workers. One (1) employee stated that understanding the Montana Division is hard and is a tough division to work due to the changing of the seasons/weather. Temperature swings can average up to 60° differences in the course of the day. When asked about his track coverage, the employee stated that he inspects 70-80 miles of track per day. He stated that he has been covering the entire Shelby roadmaster territory, the entire Hi-Line subdivision, and portions of Conrad, line segment 134, Malta 67 up to the Sweet Grass border, and Malta's 138.8. Employee stated that he works a lot of 7-day weeks. The same employee later stated that regarding the Hi-Line, curves with joints that have surface deviations do not get magically better. So, it is best to weld the joints up sooner than later, especially when a welder is in the area, have them weld the joints and tighten up the ties.

There had also been several System Production Crews (SPG)[4] working in this area throughout the summer, resulting in replacement of a large amount of the ties throughout the area. As a result of the new tie installation, the curve had been resurfaced several times; the last time being September 2, 2021. The local surfacing foreman stated that he was called on September 2, 2021, to final surface

[4] These are larger production work crews specializing in one (1) aspect of track maintenance. Crew types can vary from tie gangs, rail gangs, curve rail gangs, and track surfacing crews.

the accident curve that Crew TP-05 had just worked installing ties and had performed a rough surface or first surfacing pass through the area. The foreman stated that the surfacing work on September 2nd, took place during the day, and that the machines were working eastward, starting near CP East Buelow. He went on to say that he showed up to the job site, had the tamper plot the curve, and he walked along the side of the tamper as it plotted the curve. He also collected the data from the curve stakes and noticed that the curve was downhill. When asked about how far the curve was downhill, he stated that he did not know particularly how far the curve was downhill, but he knew that what he was looking at and what they wrote on the rails was off, and it did not make any sense. He stated that he called the foreman of the TP-05 tie crew as well the TP-05 surfacing crew foreman. He was unable to collect any data from the TP-05 work group. The local surfacing foreman stated that the TP-05 surfacing crew used the reference measurements that were pre-marked on the rails. So, he asked the TP-05 crew who placed the reference measurements on the rails but received no feedback. As a result, the local surfacing foreman called his Roadmaster and informed him of the situation. He stated that he told his Roadmaster that the best thing is to plot the curve and see what comes out.

Probable Cause

BMWED concludes that the probable cause of the September 25, 2021 derailment of Amtrak Passenger Train No. 7 was the combination of the plug rail being left in the track in excess of 60 days, as well as a 52.5° F 9 hour predicted rail temperature differential. Allowing the track at the accident scene extreme thermal movement (track moving downhill in cooler temperatures of the morning and uphill in hotter temperatures of the afternoon) as evidenced in the 4” cupping noted on the ends of the crossties.

BMWED believes the alinement deviation that existed at the time of the accident was formed when the curve moved downhill in the cooler temperatures of the night and started to move up as the heat of the day climbed. In combination with the heavy lateral forces applied to the joints existing on the plug rails as multiple heavy trains traversed the location, created a point of track much more firmly set in place and less vulnerable to thermal movement than the track surrounding it (Frozen). This location approximately 100' from the POD stayed in place as the rest of the curve started to travel uphill as the ambient temperature rose creating the alinement deviation that existed at the time of the accident.

BMWED feels pending FRA modeling will show the location of the combination of the alinement deviation to the low rail and the 2" vertical deflection at the joints existing in the spiral[5] out of the curve played a crucial role allowing Amtrak Train No. 7 travelling at the maximum authorized speed of 79 MPH suspension system to fail to pass through the affected area safely.

Passenger trains on freight tracks has been a safety concern of the industry for years. It is apparent that the condition of the affected track deteriorated when the two (2) freight trains passed over the area in the hour preceding the arrival of Amtrak Train No. 7 at MP 1014.57. The FRA requires that main tracks be inspected twice per week with at least one (1) day between the two (2) required inspections. FRA regulations are minimum requirements. In the absence of technology or an appliance that could alert an operating crew to compromised track or its infrastructure, more

[5] **A curve spiral can be used to provide a gradual transition between tangent sections and circular curves**. While a circular curve has a radius that is constant, a spiral curve has a radius that varies along its length.

frequent inspections where regular passenger operations are scheduled over freight tracks is indicated.

Noncontributory Areas of Concern

Severe understaffing in the region has created a culture of maintenance where employees focus on the most critical track defects. This kind of culture keeps employees from conducting true maintenance procedures historically practiced keeping tracks to a high level of reliability. This understaffing created a situation where the track inspector assigned to the derailment area has been working 100 hours[6] a week throughout the summer. Although the track inspector always met his FRA mandated frequencies BMWED feels 100 hours a week to cover multiple territories is excessive.

Proposed Recommendations

To BNSF:

1. Increase frequency for main track visual inspections where regular passenger operations as well as high-hazard flammable trains are scheduled over BNSF tracks to twice the federally required minimums.
2. Increase the use of Autonomous Track Geometry Measurement Systems where regular passenger operations as well as high-hazard flammable trains are scheduled over BNSF tracks to twice monthly.
3. Perform an audit of all CWR joints in the BNSF system and confirm compliance with CWR joint protocols.

[6]September 28, 2021 - Interview of BNSF Track inspector, Page 21, line 10

4. Create a policy of welding all rail joints including plug rails in CWR located within 100' of a curve within 60 days of installation.
5. Enhance the method and training of staking curves to ensure a uniform method that is easily understood between employees.

To Amtrak:

1. Enhance the training program to include the post-accident actions of the crew of Amtrak Train No. 7 as an example.
2. Develop and implement a program to ensure all emergency medical equipment (rubber medical gloves, gauze, etc.) is supplied in sufficient quantities to treat multiple passengers in case of emergency.
3. Expand emergency training to inform operating crews and on-board employees of the behavior of the passengers following this accident.

To the Federal Railroad Administration:

1. Adjust the language in FRA Track and Rail and Infrastructure Integrity Compliance Manual: Volume II - Chapter 1, page 2.1.89 to remove the language allowing plug rails to exist in track longer than 60 days exempt from all joint installation and maintenance procedures. As demonstrated below:

   §213.119(c)

   (2) In the case of a bolted joint installed during CWR installation after October 21, 2009, the track owner shall either, within 60 days—

   (i) Weld the joint;

(ii) Install a joint with six bolts; or

(iii) Anchor every tie 195 feet in both directions from the joint; and

Guidance: This section applies to major installations of CWR, such as more than 400 feet. ***~~It is not intended for plug rails~~****. Note that the applicability date published in the final rule for this section (August 25, 2009) was corrected via the amendment published on October 21, 2009, at 74 FR 53889.*

2. Increase frequency for main track visual inspections where regular passenger operations as well as high-hazard flammable trains are scheduled to twice the current federally required minimums.

3. Audit all Class 1 railroads to ensure compliance with approved CWR plans. With a focus on compliance regarding destressing of rail, as well as the ability to insure proper maintenance of the rail neutral temperature.

4. Change 49 CFR §213.119 - Continuous welded rail (CWR); plan contents to require welding all rail joints in CWR located within 100' of a curve within 60 days of installation.

5. Perform a safety study evaluating the effects on tracks located in curves that carry both freight as well as passenger trains. Specifically, evaluate the impact of track geometry designed for maximum speed passenger trains and the effects of carrying long heavy freight trains that often navigate the curves at much lower speeds putting excess pressure on the low rails.

CERTIFICATE OF SERVICE

I certify that on March 14, 2022, I have electronically served upon Mr. James Southworth (southwj@ntsb.gov), Investigator in Charge, National Transportation Safety Board, a complete and accurate copy of these proposed findings regarding the September 25, 2021, derailment of Amtrak Train No. 7 near Joplin, MT (NTSB Docket No. RRD21MR017). An electronic copy of same was also forwarded to the individuals listed below in this certificate of service, as required by 49 CFR § 845.27 (Proposed Findings).

Mr. James Southworth

Investigator-in-Charge, RRD21MR017

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Respectfully submitted,

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