NATIONAL TRANSPORTATION SAFETY BOARD

Office of Railroad, Pipeline, and Hazardous Materials Investigations
Washington, D.C. 20594

Mechanical Group Factual Report

Derailment of Train Number 7, Empire Builder
National Railroad Passenger Corporation (Amtrak)
BNSF Railway Hi Line Subdivision near
Joplin, Montana on
September 25, 2021

RRD 21 MR 017

Contents

A. ACCIDENT

NTSB Accident Number:	RRD21MR017
Accident Type:	Derailment
Date and Time:	September 25, 2021; 3:47 p.m. MDT
Location:	near Joplin, Montana
Track Owner:	BNSF Railway
Train Operator:	National Passenger Railroad Corporation (Amtrak)
Train Number:	Amtrak Train No. 7(24) – "Empire Builder"
Fatalities:	3
Injuries:	28

B. MECHANICAL INVESTIGATIVE GROUP

John Manutes
Rail Accident Investigator, Group Chair
National Transportation Safety Board
john.manutes@ntsb.gov

Zacarias Biagtan
Motive Power & Equipment Specialist
Federal Railroad Administration
zacarias.biagtan@dot.gov

David Skillman
Principal Mechanical Engineer
Amtrak
skilld@amtrak.com

Devon Parsons
Sr. Manager Rolling Stock Engineering
Amtrak
devon.parsons@amtrak.com

Jack Murray
General Foreman
BNSF Railway
jack.murray2@bnsf.com

C. ACCIDENT SUMMARY

On September 25, 2021 at approximately 3:47 p.m. MDT Amtrak Train No. 7 of the 24th (Westbound Empire Builder) derailed at Mile Post 1014.57 of the BNSF Railway Hi Line Subdivision near Joplin, Montana. Train No. 7 operates from Chicago to Seattle, Washington with a portion of the train removed at Spokane and continuing to Portland, Oregon as Train No. 27. At the time of the accident, the train consisted of 2 front locomotives and 10 cars. The rear four cars were scheduled to travel to Portland and the front six cars were scheduled to go to Seattle. As a result of the accident, 8 cars were derailed. Four cars derailed on their sides, 1 car derailed leaning, 2 cars derailed upright, and one car derailed the trailing truck. The locomotives and front 2 cars remained on the track. There were 141 passengers, 4 operating crew, and 9 on-board service personnel on board for a total of 154 people on the train. Three passengers who were riding in the lounge car were fatally injured. There were an additional 28 passengers and crew transported for injuries. Of those, 11 people required hospitalization. Damage to Amtrak equipment is estimated to be $21,947,116.

Parties to the investigation are FRA, Amtrak, BNSF Railway, BMWED, SMART, and BLET.

D. RAILROAD EQUIPMENT INVOLVED IN THE ACCIDENT

Train Consist

The train consisted of two locomotives and ten cars. The train was 988 feet in length and weighted 1,069 tons. The locomotive consist had a total of 8,500 horsepower.

	No.	Type	Condition
L1.	AMTK 74	Locomotive – GE P42DC	Not Derailed F-Leading
L2.	AMTK 38	Locomotive – GE P42DC	Not Derailed F-Leading
1.	AMTK 61034	Viewliner II Baggage	Not Derailed A-Leading
2.	AMTK 39019	SuperlinerII/Trans. Sleeper	Not Derailed B-Leading
3.	AMTK 32050	Superliner I/Sleeper	Trailing Truck Derailed A-Leading
4.	AMTK 32085	Superliner II/Sleeper	Derailed Upright B-Leading
5.	AMTK 38058	Superliner II/Dining	Derailed Upright B-Leading
6.	AMTK 34059	Superliner I/Coach	Derailed Leaning B-Leading
7.	AMTK 33049	Superliner II/Lounge	Derailed on Side B-Leading
8.	AMTK 34077	Superliner I/Coach	Derailed on Side A-Leading
9.	AMTK 31036	Superliner I/Baggage-Coach	Derailed on Side A-Leading
10.	AMTK 32007	Superliner I/Sleeper	Derailed on Side A-Leading

Locomotives

The train was led by Locomotive No. AMTK 74 in the front position and AMTK 38 in the second position. Both locomotives are General Electric manufactured Genesis P42-8

passenger locomotives. This type of locomotive was manufactured between 1997 and 2001 as a single monocoque carbody design for aerodynamics and fuel efficiency. Amtrak purchased 207 units and VIA Rail Canada acquired 20 units. All Genesis locomotives can provide 480V AC head-end power (HEP) to the train drawn from an alternator powered by the main engine at a maximum rating of 800 kilowatts. These units produce 63,000 lbf of tractive effort from a 4250 horsepower 7FDL16 Diesel engine suppling 4 DC electric traction motors and 60Hz HEP transformer and regulator.

The Genesis locomotive operates on the standard gauge (56.5 inches) with a wheel diameter of 40-inches and two axle trucks. The unit's overall length is 69 feet and the height is 14-feet 4-inches. The unit weighs 268,240 pounds. The maximum rated speed is 110 m.p.h. and the fuel tank carries 2,200 gallons of diesel fuel. The brake system is a New York Air Brake Computer Controlled (CCB I) system. Amtrak uses the P42 as the main motive power for its off-corridor operations around the United States. The operating cab features an engineer's console that contains all the controls and indicators necessary for the operation of the locomotive, including three full-screen monitors, designated as Integrated Function Display (IFD) as well as a PTC I-ETMS Wabtec monitor. Also located in the operating cab are the windshield and wiper assembly, and the seats for the engineer and two additional seats for other crew members.

The P42-8 carbody is comprised of four major elements: platform, side walls, front cab, and three detachable roof sections (roof panel numbers 1, 2, and 3). It is designed to allow

compression forces of 800,000 lbs. (400 tons) of buff load and is equipped with Association of American Railroads (AAR) F-type couplers. Lighting for the P42-8 consists of an exterior and interior system. The exterior lights include headlights, marker lights, auxiliary lights, and step lights. The interior lights are made up of cab lights, machinery room lights, and console lights.

Figure 1. Post-accident image of Train No. 7 locomotives Near Joplin, MT

The majority of the P42-8 class for Amtrak are equipped with a forward-facing camera and a permanent core memory (PCM) event recorder.

Cars

The train was comprised of one baggage car positioned behind the locomotive and nine Superliner cars. The Superliner is a bilevel intercity passenger car used primarily in the western United States. Between 1975 and 1981 the Pullman-Standard Company built 284 cars known as the Superliner I. Between 1991 and 1996 Bombardier Transportation built 195 cars known as Superliner II. Superliner I cars ride on Waggon Union MD-76 trucks and Superliner II cars are equipped with GSI-G70 outboard bearing trucks.

Figure 2. Post-accident image of a Superliner I truck assembly.

Figure 3. Post-accident image of a Superliner II truck assembly.

E. PRE-DEPARTURE INSPECTION AND TESTING

Prior to the train's initial departure from Chicago, Illinois, Amtrak Qualified Mechanical Personnel (QMP) completed required Exterior and Interior Calendar Day Inspections and a Class I brake test. All inspections were completed on September 24, 2021. Locomotive AMTK 74 was approved for service at 11:05 a.m. CDT and locomotive AMTK 38 was approved at 11:15 a.m. The Class I brake test for the consist was completed at 12:30 p.m. CDT.

On September 25 the train arrived in Minot, North Dakota for a scheduled Class I brake test, as well as Interior and Exterior calendar day inspections. At Minot, Amtrak contracts with Drummac, Inc. to provide the necessary QMPs to complete the mechanical inspections and tests.

The mechanical group requested and reviewed lead locomotive event recorder data showing the Class I test at Minot. During the review, investigators noted several discrepancies. First, the locomotive pressure maintaining feature cut-in action was not clearly observed. This observation is consistent with the pressure maintaining feature not being first cut out for the test, and therefore train brake pipe leakage could not be conducted properly as required by Amtrak rules and FRA regulations. Second, only 24-seconds elapsed from the final air brake release to the service brake application used to secure the train before departure. Amtrak rules and Federal regulations require that QMPs observe each brake on the train to ensure that it has properly released. Additionally, brake rigging and brake indicators must be observed to be functioning properly. The train had 10-cars to inspect, and the event recorder shows only 24-seconds were provided to complete these steps. The event recorder data is consistent with Drummac, Inc not conducting the brake test properly.

Despite the failure of Drummac to perform a brake test as required at Minot, the failure to test the brakes properly did not affect the ability of the brakes to function properly. The locomotive engineer did not report any issues with the train's brakes. Subsequent station stops at Stanley, ND; Williston, ND; Wolf Point, MT; Glasgow, MT; Malta, MT; and Havre, MT were performed with no exceptions taken to the brake system. At the time of the derailment the train was pulling up a grade with the brakes released. During the accident, the train's emergency brakes functioned normally.

F. ACCIDENT SEQUENCE

According to data recovered from the on-board event recorder and BNSF Railway Track Profile Charts, the train was traveling westbound at 77 m.p.h. while negotiating a 1-degree 33-minute right hand curve pulling up a 0.95% grade on single main track. The reverser was in the forward position, the throttle was in notch-8, and the brakes were fully released.

At mile post 1014.57 the train derailed along the high (south/left) rail in the curve. Evidence such as final resting position and total damage and witness marks are consistent with Car No. AMTK 32085 derailing the lead axle first, followed by Car No. AMTK 38058 also derailing to the high side. Subsequently, the rear three cars (AMTK 34077, 31036, 32007) tipped over onto their right sides and came to rest apart from the rest of the train. A broken knuckle was found on the trailing end of Car No. AMTK 33049. This car came to rest on its right side on the north side of the track past the siding switch for East Buelow. Evidence found inside the car, components from a wayside switch heater fan, is consistent with this car riding on its side prior to and through the area of the switch points. Car No. AMTK 34059 was derailed leaning, with its trailing truck on the north side of the right of way and the leading end trucks essentially straddling the siding and main track rails. Car No. AMTK 38058 was derailed upright. The rear truck was also straddling the siding and main track rails. The leading truck was position off the tracks to the south side, favoring the siding track. Car No. AMTK 32085 was also derailed upright. The trailing truck was also primarily on the heavily damaged siding track. The leading truck came to rest more in-line with the main track, right wheels were between the gauge of the main track. Car No. 32050 was on the main track with only the rear wheels derailed. The remainder of the train was not derailed.

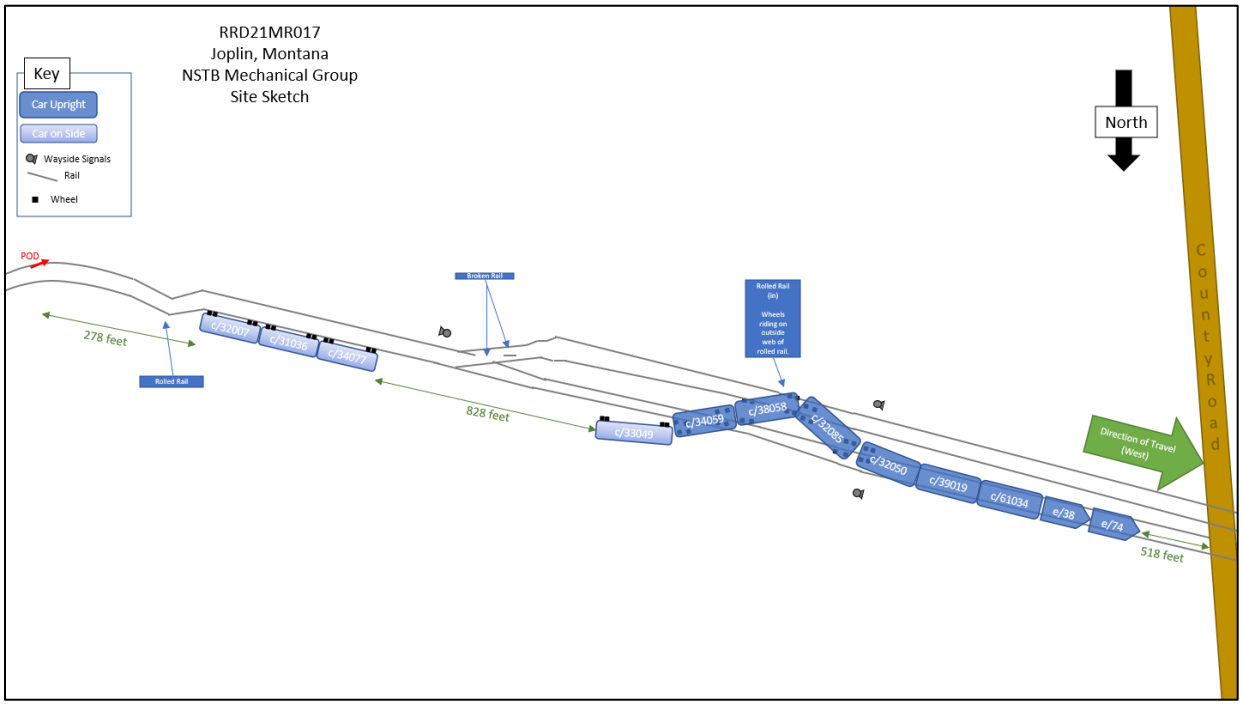


Figure 4. Site sketch of the Amtrak Train No. 7's final resting positions.

G. POST-ACCIDENT EQUIPMENT DESCRIPTION

Throughout this report, investigators will use the direction of travel to orient the reader. Therefore, 'Right' is the north side of the train, 'Left' is the south side of the train. Leading and Front are the west end of the train and trailing or rear are the east end of the train.

Investigators recorded wheel measurements for all wheels on the train. There were no pre-accident defects identified on the wheels.

AMTK 74 (GE P42DC)

The lead locomotive was not derailed in the accident. The last periodic inspection was conducted July 20, 2021.

AMTK 38 (GE P42DC)

The second locomotive was not derailed in the accident. The last periodic inspection was conducted June 9, 2021.

AMTK 61034 (Viewliner II – Baggage)

The first car in the consist was not derailed in the accident.

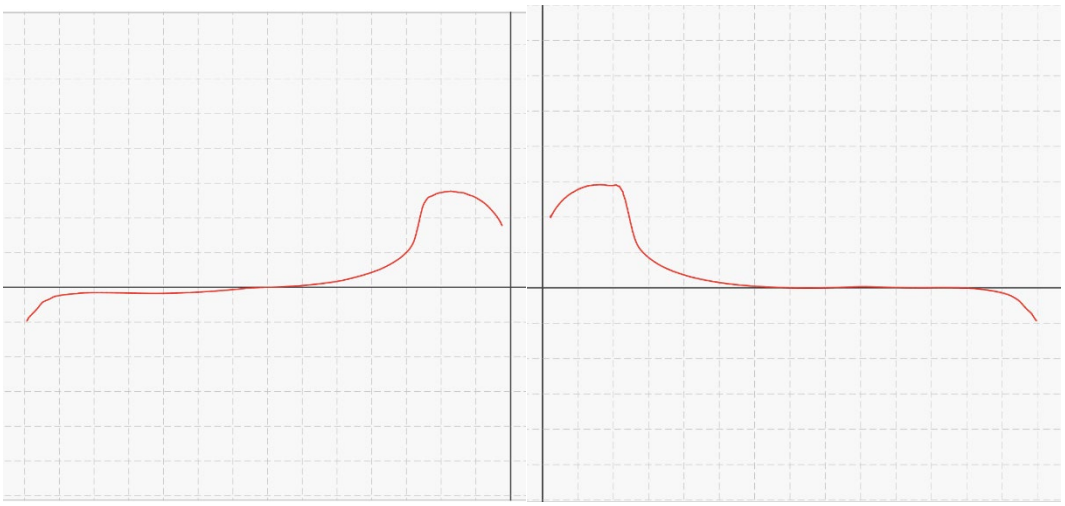
AMTK 39019 (Superliner II – Transition Sleeper)

The second car in the consist was not derailed in the accident.

AMTK 32050 (Superliner I – Sleeper)

The lead truck of the third car in the consist did not derail. All four wheels of the trailing truck derailed. The third wheel, left side in the direction of travel, had impact witness marks

consistent with contact with rail spikes. The other wheels on this truck had light ballast marks consistent with a relatively short time derailed as compared to other wheels in the train. The brake disks, axles, and bearings did not have significant damage. The stabilizer roll bars had evidence of sliding on the rail and were bent consistent with the weight of the car riding directly on the roll bars. The rear left coupler bump stop was broken. The right rear car body/truck stop was broken consistent with a violent turning of the car body. The trailing end right side truck frame had signs of dragging. The trailing end right side spring saddle had signs of dragging. Wheel profiles from the trailing truck were taken using a digital miniprof handheld device. The third axle, right side wheel, showed signs of uneven wear to the flange. The wheel was in compliance with Amtrak and Federal requirements.



AMTK 32085 (Superliner II – Sleeper)

All eight wheels of the fourth car in the consist derailed. The leading wheel on the right side had distinctive saw tooth witness marks embedded in a 7-inch long flat spot in the flange.

This is nearly identical to marks found on the trailing right side wheels of Car No. 38058. The lead truck equalizer seats were missing with the exception of the leading right side. The equalizer beams were also missing with the exception of the lead-right-inboard beam. The right side shock absorber was missing. The leading brake top rod was bent. Two tread brake units were broken on the right side. The trailing left side coupler bumper block was missing. The trailing left equalizer springs were missing. All brake disks were worn extensively from wearing on the truck bolster. This is consistent with the loss of the equalizer beams during the derailment sequence, which allowed the bolster to fall on the brake disks and wheels, in this case, while the wheels were turning at speed. The wheel flanges wore witness marks into the trucks and brake rigging for the same reason. Both truck castings appear to be spread in a manner consistent with the derailed wheels encountering diverging rails, such as at switch, while derailed. The wheel profiles were all recorded with a digital miniprof handheld device. All wheel profiles were in compliance with Amtrak and Federal requirements.

AMTK 38058 (Superliner II – Dining)

All eight wheels of the fifth car in the consist derailed, with the car remaining upright. The two leading right side wheels had ‘saw tooth’ flange wear, about 6-inches long and nearly identical to those found on car 32085. The damage to this car is relatively less than car 32085, but still significant. The wheels show significant rail burn, ballast and damage from the wayside and trucks. Leading truck left side equalizer beams, springs, beam seats were all in place. Leading truck right side outer equalizer beams were missing, beam seats out of position, springs

missing. Trailing truck left side outer equalizer beam missing. Beam seats were out of position. Trailing truck right side outer equalizer beams missing. Beam seats were out of position. The trailing left bumper block was broken. The trailing left outer equalizer beam was missing. The left leading brake disk has plate wear. The trailing brake pipe cut out cock was damaged. The leading coupler bumper stops were missing. The trailing left side coupler bumper stops were damaged.

AMTK 34059 (Superliner I – Coach)

The sixth passenger car in the consist derailed all wheels and came to rest leaning with the lead truck oriented for the siding and the trailing end resting on the north side of the main track. The trailing coupler was coupled to the Car No. 33049 and severely rotated in the coupler pocket. The coupler bumper stops on both ends were damaged. The trailing end had damage consistent with being drug through the ballast.

AMTK 33049 (Superliner II – Lounge)

The seventh passenger car came to rest on its right side, to the north of the main track. The switch heater fan was found inside the car with significant damage, indicating the car was on its side while derailed at speed past the switch points. The trailing coupler knuckle was broken. The leading coupler shank was twisted. The right side wheels show more ballast damage than the relatively undamaged left side wheels.

AMTK 34077 (Superliner I – Coach)

The eighth car came to rest on its right side, on the north side of the main track, east of the East Beulow siding. The trailing coupler horn was broken, but still attached. The leading right coupler bumper block missing. The trailing coupler bumper blocks missing. The A1 air brake reduction replay missing.

AMTK 31036 (Superliner I – Baggage/Coach)

The ninth car came to rest still coupled to the cars ahead and behind, on its right side. The leading end coupler blocks missing. The trailing end bumper blocks damaged. The trailing axle left brake rotor bent.

AMTK 32007 (Superliner I – Sleeper)

The tenth car came to rest still coupled to the car ahead, on its right side. The leading left coupler bumper stop damaged. The leading right axle brake rotor was damaged.

H. INTERVIEWS

A commercial truck driver contacted investigators and stated that he witnessed the accident train pass approximately 100-miles east of the derailment location. He was interviewed by the Mechanical Working Group on Wednesday, January 12, 2022 via Microsoft Teams and telephone. A transcript of the interview is available in the docket.

I. POST-ACCIDENT INSPECTIONS AND TESTING

Air Brake Test

On September 26, 2021 FRA inspectors conducted a Class I Air Brake Test on the non-derailed portion of the train. There was one defect noted during the inspection, Car No. AMTK 32050 had a defective brake indicator light, however the brakes operated as intended.

J. EVIDENCE COLLECTED

The Mechanical Group retained Car Nos. AMTK 32050, 32085, and 38058 for further detailed inspection. The cars and components were shipped to Amtrak facilities at Beech Grove, Indiana. The evidence presented in this report is from on-scene investigation, the Beech Grove inspection, and document review.

K. POST ACCIDENT ACTIONS

Amtrak initiated actions to ensure Drummac, Inc. QMPs perform proper air brake tests at Minot, ND. Amtrak managers interviewed employees and provided corrective coaching. They also increased the number of observations of completed air tests including remote download and analysis of event recorder data from Minot air brake tests.

L. DOCUMENTATION

The Mechanical Group reviewed the following documents.

- Train list/consist
- Diagrams & photos of accident scene
- Equipment drawings and diagrams and descriptions
- Equipment Damage Estimates
- Air brake test inspection certificate
- Event Recorder data download showing the air brake test at Minot, ND
- FRA form F6180-49A (blue card) records for both locomotives. Include the on-board and "office" copy.
- 10-years of overhaul records ("Beach Grove Records") for all cars, including the scope of work for the overhaul.
- Locomotive maintenance records, past 6-months
- For each car, MAP-21 repair records, 92-days
- Interior and Exterior Calendar Day inspection records (Minot and Chicago)

M. ACKNOWLEDGEMENT SIGNATURES

The undersigned designated Group Member to the Investigation representatives attest that the information contained in this report is a factually accurate representation of the information collected during the on scene phase of this investigation, to the extent of their best knowledge and contribution in this investigation.

_____ Date:_____
John Manutes
National Transportation Safety Board

_____ Date:_____
Zacarias Biagtan
Federal Railroad Administration

_____ Date:_____
David Skillman
Amtrak

_____ Date:_____
Devon Parsons
Amtrak

_____ Date:_____
Jack Murray
BNSF Railway