Transportation Safety Board of Canada
Bureau de la sécurité des transports du Canada

Rail Transportation Safety Investigation Report R19E0150

MAIN-TRACK TRAIN DERAILMENT

Canadian National Railway Company
Freight train G86341-28
Mile 80.45, Vegreville Subdivision
Chipman, Alberta
29 September 2019

The occurrence

On 29 September 2019 at about 0405,[1] Canadian National Railway Company (CN) loaded unit grain train[2] G86341-28 was proceeding westward at about 41 mph on the Vegreville Subdivision when a train-initiated emergency brake application occurred. Once the train had stopped, the conductor performed a walking inspection and determined that 18 cars (the 69th to the 86th from the head-end locomotive) had derailed. The derailment occurred near Chipman, Alberta, in a rural area located about 36 km northwest of the town of Vegreville, Alberta (Figure 1).

The train crew did not notice any track or train-operating anomalies before the train-initiated emergency brake application. While en route, the train passed hot box and dragging equipment detectors at Mile 18.7, Mile 45.7, and Mile 70.4 on the Vegreville Subdivision with no alarms noted.

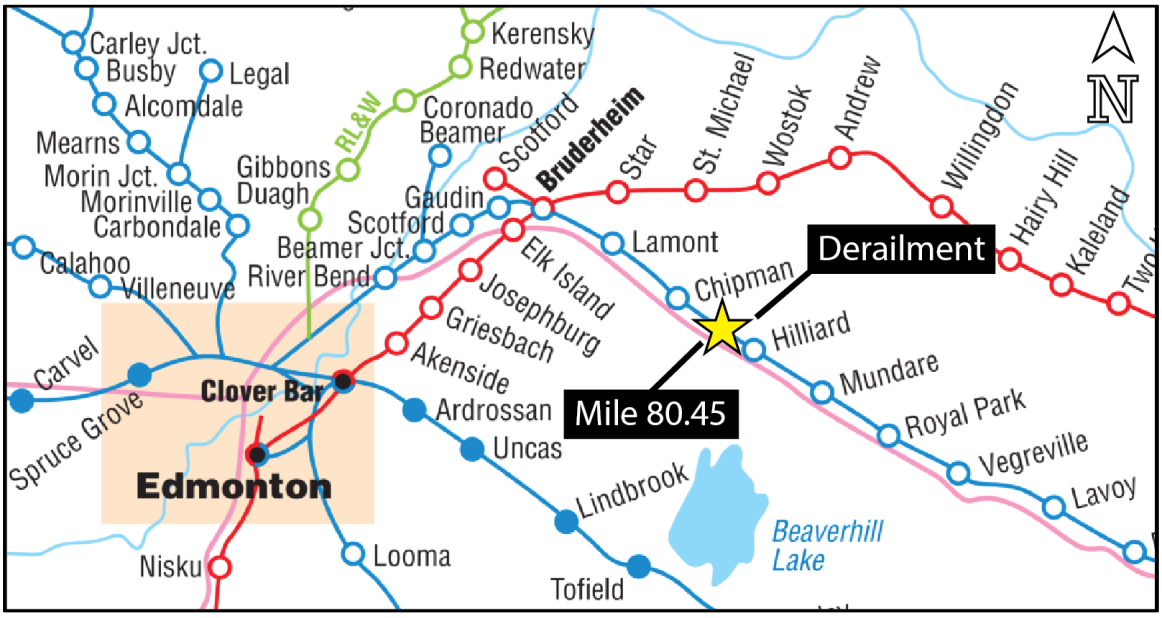
There were no injuries and no evacuations. At the time of the derailment, the temperature was approximately –1 °C with overcast skies.

[1] All times are Mountain Daylight Time.

[2] A unit train is a freight train carrying a single bulk commodity from a point of origin to a destination that does not switch cars en route. The rail cars are of the same design and loading, for example covered hopper cars loaded with grain. A unit train consist has uniformly distributed weight and length.

Canada

Figure 1. Occurrence location (Source: Railway Association of Canada, Canadian Rail Atlas, with TSB annotations)



The train was powered by a single locomotive at the head end and a single distributed power remote-controlled locomotive at the tail end. The train consisted of 100 covered hopper cars loaded with grain.[3] It was 6168 feet in length including the locomotives, and it weighed 14 205 tons.

The train originated at North Battleford, Saskatchewan, Mile 0.0 on the Blackfoot Subdivision with 55 loaded cars. Forty-five additional loaded cars were added to the train at Lloydminster, Saskatchewan, Mile 84.4 on the Blackfoot Subdivision.

Site examination

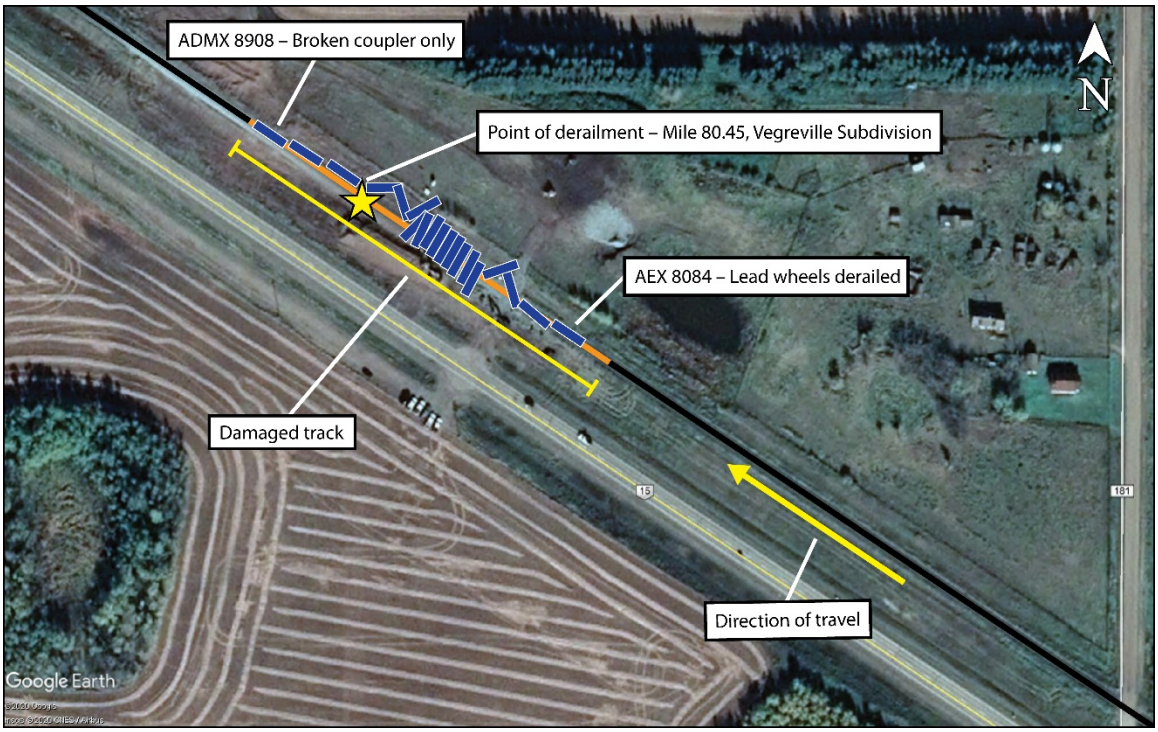
The 68th car (ADMX 8908) had a broken coupler on its "B" end[4] but had remained on the track. The next 17 cars (the 69th to the 85th) had derailed on their sides and had released product. The 86th car (AEX 8084) was upright with only the lead wheels derailed.

Most of the derailed cars were in a jackknife position, consistent with a sudden, catastrophic rail failure. The point of derailment was determined to be about Mile 80.45 of the Vegreville Subdivision. Approximately 600 feet of track was damaged or destroyed, with repairs needing to be made an additional 20 feet beyond both ends of the derailment site (Figure 2).

[3] Each car fully loaded weighed about 138.5 tons or about 34.6 tons per axle.

[4] The "B" end of a car is where the hand brake is situated. In this instance, it was the east or trailing end of the car.

Figure 2. Satellite image of derailment location (Source: Google Earth, with TSB annotations)



Examination of the derailed equipment and review of train handling revealed no anomalies. Two pieces of broken rail were recovered from the occurrence site for further examination.

One lane of vehicular traffic on Highway 15 was disrupted in the westward direction. Traffic was controlled by CN police while wrecking equipment was on site and the track was being restored.

Derailed rolling stock was pushed to the side and the track was reconstructed. The track reopened to train operations at 1830 on 29 September 2019. Site remediation and removal of the derailed rolling stock was completed on 27 October 2019.

Crew information

The crew consisted of a locomotive engineer and a conductor. Both crew members were qualified for their respective position, met established fitness and rest requirements, and were familiar with the territory.

Subdivision information

The Vegreville Subdivision runs east–west between Mile 0.0 at Vermilion, Alberta, and Mile 127.3 at East Junction Station[5] in Edmonton, Alberta, where it connects to the Wainwright Subdivision. It is part of CN's Prairie North Line, a secondary mainline that extends for 769 miles from Portage la Prairie, Manitoba, to Edmonton over 6 subdivisions (Gladstone, Togo, Margo, Aberdeen, Blackfoot, Vegreville).

[5] East Junction Station is the junction connecting the Vegreville and Wainwright subdivisions. East Junction Station on the Wainwright Subdivision is located at Mile 263.3, about 1.4 track miles east of Walker Yard in Edmonton.

Train movements on the Vegreville Subdivision are controlled by the occupancy control system, as authorized by the *Canadian Rail Operating Rules*, and supervised by a rail traffic controller located in Edmonton.

Train traffic on the Vegreville Subdivision (measured in gross ton-miles per million train miles [GTM/M]) was 15.8 GTM/M in 2017, 17.5 GTM/M in 2018, and 18 GTM/M in 2019. In the vicinity of the derailment, the maximum authorized speed for freight trains was 40 mph, making it Class 3 track according to the Transport Canada–approved *Rules Respecting Track Safety*, which are also known as the Track Safety Rules (TSR).[6]

Recorded information

The locomotive event recorder information from the head-end locomotive was reviewed. The data from this recorder indicated that the brakes were released, the throttle was in idle and the dynamic brake[7] (DB) was engaged in DB position 2 when the train was approaching the occurrence location.

The lead locomotive was equipped with a forward-facing video camera,[8] but it was inoperative at the time of the occurrence. Forward-facing video footage from a previous train passing this location was obtained.[9] Based on a review of this recording, a track anomaly was visible, but the details of the defect were indiscernible (Figure 3). In addition, a sound was detected as the locomotive passed the point of derailment, corroborating the existence of a track anomaly.

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6 The TSR outline the minimum maintenance standards and track inspection requirements for each class of track.

7 The dynamic brake is a locomotive electrical braking system that converts the locomotive traction motors into generators to provide resistance against the rotation of the locomotive axles. When the dynamic brakes are used, compressive forces are created within the train. Dynamic brake control is a rheostat that provides progressively stronger braking from handle position 1 (minimum) to handle position 8 (maximum).

8 Locomotives equipped with a forward-facing camera, known as a locomotive digital video recorder (LDVR), capture video footage that is stored digitally on board the locomotive.

9 The forward-facing video screenshot was from locomotive CN8925, the lead locomotive from train G86651-27. This train passed through the derailment location at about 1345 MDT on 28 September 2019. This was the penultimate train to pass through the derailment location before the occurrence train.

Figure 3. Forward-facing camera view of the point of derailment from a previous eastbound train, showing the track anomaly (Source: Canadian National Railway Company, with TSB annotations)

Track information

The derailment occurred on tangent track near the end of a westward 0.3% to 0.5% descending grade. In the vicinity of the occurrence, the track consisted of 100-pound continuous welded rail manufactured by Sydney Steel Corporation in 1971, mounted on 14-inch tie plates, fastened to wood ties with 3 spikes per plate. Every other tie was anchored. The ballast was crushed rock with 18-inch to 20-inch shoulders. The ties were replaced in 2017.

The rail had 4 mm of head wear, which is within the allowable wear limit of 10 mm specified in CN's Engineering Track Standards.[10]

Track inspection

In the area of the derailment, track inspections were performed regularly in accordance with the TSR. CN's most recent inspections in the vicinity of the occurrence were as follows:

- On 27 September 2019, the assistant track supervisor conducted a visual inspection. No defects were found in the area of the derailment.
- On 20 September 2019, ultrasonic rail flaw testing was performed.[11] No defects were detected in the area of the derailment.

[10] Canadian National Railway, Engineering Track Standards, Track Standard 1.0 (Rail), Section 23, Table 7B.

[11] Ultrasonic testing is performed to find internal rail flaws and defects that cannot be detected visually.

- On 10 September 2019, a track geometry test was conducted. No urgent or near-urgent track geometry defects were identified near the area of the derailment.

Examination of the recovered pieces of broken rail

Several pieces of broken rail were recovered from the derailment site near the point of derailment. Visual examination of the fracture surface did not reveal any pre-existing defects.

One of the pieces was observed to have rail end batter consistent with a number of wheels having impacted the rail head (Figure 4). Rail end batter generally occurs when a piece of rail has fractured, allowing successive wheels to contact the exposed head of the remaining rail.

Figure 4. Broken rail showing rail end batter (Source: Canadian National Railway Company)

The investigation was unable to conclusively determine why the rail broke. This piece of rail was not examined by a laboratory, and therefore it is unknown if a more detailed examination would have found pre-existing anomalies.

The typical causes of broken rail can include:

- non-metallic inclusions (more common in older rail fabricated to specifications that predate modern clean steel requirements);
- transverse detail defects that originate from rolling contact fatigue-related rail surface conditions and eventually progress transversely; or
- vertical impact-related fractures that are generally caused by loaded cars with wheels that have developed an "out-of-round" condition.

The track had been inspected and maintained as required by railway and regulatory requirements. The rail head had only 4 mm of wear and no anomalies had been observed in the vicinity of the point of derailment either through visual or ultrasonic testing. Temperatures were only slightly below zero.

Audio and video footage from the forward-facing video camera on a previous train supports the suspected presence of a track anomaly. It is therefore possible that a wheel impact at the location of the track anomaly caused the rail to break.

Wheel impact load detectors (WILDs) can identify wheels that exceed impact thresholds. At the time of the occurrence, there were no WILDs along CN's Prairie North Line between Portage la Prairie and Edmonton.

Safety action taken

After the derailment, CN inspected the Vegreville Subdivision with a heavy track geometry inspection car and found no defects. On 11 September 2020, CN installed a WILD on its Prairie North Line, at Mile 18.2 of the Blackfoot Subdivision.

This report concludes the Transportation Safety Board of Canada's investigation into this occurrence. The Board authorized the release of this report on 10 March 2021. It was officially released on 31 March 2021.

Visit the Transportation Safety Board of Canada's website (www.tsb.gc.ca) for information about the TSB and its products and services. You will also find the Watchlist, which identifies the key safety issues that need to be addressed to make Canada's transportation system even safer. In each case, the TSB has found that actions taken to date are inadequate, and that industry and regulators need to take additional concrete measures to eliminate the risks.

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This report is the result of an investigation into a class 4 occurrence. For more information, see the Policy on Occurrence Classification at www.tsb.gc.ca

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