RAILWAY INVESTIGATION REPORT
R00W0106

MAIN TRACK DERAILMENT

CANADIAN NATIONAL
FREIGHT TRAIN NO. E20531-15
MILE 154.4, REDDITT SUBDIVISION
WHITE, ONTARIO
16 MAY 2000

Railway Investigation Report

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Summary

At approximately 1525 Central daylight time on 16 May 2000, Canadian National freight train No. E20531-15, travelling westward from Sioux Lookout, Ontario, to Winnipeg, Manitoba, derailed 19 of its 136 cars in the vicinity of Mile 155.0 of the Redditt Subdivision. Four of the derailed cars contained dangerous goods but no product was released. The two crew members were not injured.

Other Factual Information

Canadian National (CN) freight train No. E20531-15 was an express train with an authorized speed of 50 mph. Before the emergency brake application at approximately 1525 Central daylight time (CDT),[1] the crew, which consisted of a locomotive engineer and a conductor, had not encountered any train-operating irregularities or track anomalies and had passed the hot box and dragging equipment detector at Mile 149.9 with no exceptions noted. The train consisted of 2 locomotives, 51 loaded cars, 85 empty cars, weighed about 9 440 tons and was approximately 8 800 feet long. The loaded and empty cars were evenly distributed throughout the train. The derailed equipment included the 60th car to the 78th car. The locomotives came to a stop at about Mile 156.6. Propane tank car PLMX 35612 was the first derailed car (60th car).

Tank car PLMX 35612, one of two derailed tank cars (residues—last contained propane, UN 1075), had extensive damage to the jacket and a scraped and dented tank; however, the tank integrity was not affected. Two derailed gondola cars contained packets of mixed nickel and cobalt sulphides, UN 3077, an environmentally hazardous material, but there was no release of this product.

The track in the vicinity of the derailment is a combination of tangent and curved track with a maximum authorized speed of 50 mph for express freight trains. A descending grade of 0.5 per cent extends from about Mile 152.5 to approximately Mile 153.0. At about Mile 153.0, the track levels somewhat to a descending grade of 0.2 per cent stretching to about Mile 154.0. At Mile 154.0, the track becomes level (zero grade) for approximately 0.4 mile before ascending shallowly at 0.1 per cent. There are three small curves between Mile 153.0 and Mile 153.5 and a long shallow curve stretches from about Mile 154.0 to about Mile 154.8. There was a 30 mph permanent speed restriction at Mile 157.8. In the derailment area, the tangent track consisted of 132-pound rail on softwood ties. The curved track consisted of 136-pound rail on hardwood ties. The ballast throughout was crushed rock. The track had been surveyed on 12 May 2000 by a track geometry car. An "urgent priority" warp defect was detected at Mile 154.21 and a "priority" warp defect was revealed at Mile 154.37. The "urgent priority" warp defect was immediately repaired as per CN's procedure, and the other warp defect was scheduled for repair in the evening of 16 May 2000. The assistant track supervisor had visually inspected the track on 16 May 2000; no track irregularities were observed.

Markings on the south rail head and gauge side base and spikes on the north rail were noted at Mile 154.37. The planking of the Hi-rail take-off stand, just east of the derailed cars at Mile 154.90, was heavily marked. Measurements taken by hand after the derailment revealed an approximate one-inch dip in the superelevation 31 feet before the rail marking that extended about 66 feet further eastward.

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[1] All times are CDT (Coordinated Universal Time [UTC] minus five hours) unless otherwise indicated.

The first derailed car, PLMX 35612, was determined to be without mechanical defects; however, the following car, empty gondola car CN 3888832, showed abnormal bolster bowl and body centre plate wear indicating that it had not been properly centred and may have had reduced truck mobility.

The crew members, consisting of a locomotive engineer and a conductor, were qualified for their positions and met established fitness and rest standards.

The weather was clear with a temperature of 10 degrees Celsius.

Train movements on the Reddit Subdivision are governed by the Centralized Traffic Control System and supervised by a rail traffic controller located in Edmonton, Alberta.

In August 1998, a *Best Practices Train Handling Guide* was issued for the Reddit Subdivision. This guide was developed to assist operating crews of long trains (6 000 feet or longer) in choosing the most economic train handling methods for this subdivision. Locomotive engineers were to "utilize 'forward planning' in consideration of territory profiles, planned stops, required speed adjustments and slack control, avoiding aggressive use of the locomotive throttle and train braking systems." Throttle manipulation was to be used as the primary means of controlling speed with dynamic braking used as the initial braking force. Power braking, the practice of keeping a train stretched by use of the train air brake system while keeping the locomotive throttled up, had to be avoided, and when unavoidable, the lowest throttle position had to be used. The intent of the guide was to ensure less wear and damage to equipment while improving fuel efficiency.

As indicated in the guide, the train handling procedure from Mile 149.6 to Mile 168.5, an area of mostly ascending gradient for westward trains, is throttle modulation. The company routinely monitored event recorder information to ensure that train operation on this subdivision was being conducted in accordance with this guide.

Based on the stopping point of the locomotives (Mile 156.6), the event recorder data indicated that the train was travelling at 45 mph, with the locomotives in the vicinity of Mile 155.4, when the locomotive engineer began preparations to comply with the upcoming speed restriction by reducing the throttle from position No. 8 (maximum setting) to idle. When the locomotives were at approximately Mile 155.80, while travelling at 41 mph, the brake pipe pressure suddenly decreased from 82 pounds per square inch (psi) to 0 psi indicating a train-initiated emergency brake application. This occurred at the time the 60th car was at about Mile 154.4.

The operating crew members indicated that, due to the size (weight and length) of the train and the changing gradient and track curvature in the derailment area, they were unable to reach their authorized train speed of 50 mph. They also indicated that it is difficult to handle such large trains with slack action continually running in and out and that this train had been particularly rough due to more run-in than usual.

Analysis

As no one element points to the cause of the derailment, it is most likely that a combination of factors precipitated this accident. The analysis will explore the cumulative nature of the in-train forces having an impact on the train as it moved through the area, the track geometry, the equipment irregularity, and train handling issues, to arrive at an explanation.

Marks on the track structure at Mile 154.37 were indicative of a wheel climb derailment and it is likely that car PLMX 35612, the first derailed car in the train, derailed a wheel set to the south or outside of the curve at that point. The damage to the planking of the Hi-rail take-off stand at about Mile 154.90 indicates that car PLMX 35612, after travelling in a derailed condition for approximately 0.5 miles before striking this structure, completely derailed and then displaced the track and subsequently derailed another 18 cars.

The locomotive engineer began to reduce train speed to comply with the upcoming 30 mph speed restriction by throttle reduction as required by company policy. At this time, the rear of the 8 800-foot train was negotiating a 0.5 per cent descending grade as the head end of the train, at about Mile 154.4 in an area of a 0.1 per cent ascending grade leading to level track, began to slow. Although the curves between Mile 153.0 and Mile 153.5 would have had a minor retarding effect on the movement, it is most probable that the trailing portion of the train, previously stretched by the effort of the locomotive consist with maximum power applied, began to run in on the descending grade. The force of this run-in, applied to the slowing head end, converged on the curve in the vicinity of Mile 154.4 where the brief stretch of level track changed to an ascending grade. At this point, the resultant lateral force to the outside of the curve, possibly interacting with the identified dip in the superevaluation just east of Mile 154.37 and the mechanical irregularity in CN 3888832, initiated the wheel lift derailment of car PLMX 35612.

While the purpose of CN's policy to restrict the use of a train air brake system and avoid the practice of power braking is well understood, the use of the air brake system or power braking in this circumstance might have prevented or diminished the force of the run-in. Strong discouragement of air brake use may remove a potential means for better controlling a long train by ensuring a more even distribution of in-train forces.

Findings as to Causes and Contributing Factors

1. The train experienced a wheel climb derailment of one car at Mile 154.4 leading to track destruction and ultimately the derailment of another 18 cars in the vicinity of Mile 155.0.

2. The wheel climb derailment at Mile 154.4 was a result of lateral forces in a curve created by the retarding effect of a throttle reduction and a run-in of the rear portion of the train on a descending grade possibly interacting with a dip in superelevation and a mechanical irregularity of the following car.

Other Findings

1. A strong discouragement on the use of the train air brakes may effectively remove a potential means for both controlling a long train and ensuring a more even distribution of in-train forces.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 12 April 2002.