Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada

RAILWAY INVESTIGATION REPORT

R99V0141

DERAILMENT

CANADIAN NATIONAL
TRAIN NO. G-815-41-15
MILE 10.7, CLEARWATER SUBDIVISION
MESSITER, BRITISH COLUMBIA
15 AUGUST 1999

Canada

The Transportation Safety Board of Canada (TSB) investigated this occurrence for the purpose of advancing transportation safety. It is not the function of the Board to assign fault or determine civil or criminal liability.

Railway Investigation Report

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Summary

On 15 August 1999, at approximately 1350 Pacific daylight time, Canadian National westward freight train No. G-815-41-15 derailed 40 cars of a 100-car grain train at Mile 10.7 of the Clearwater Subdivision, at Messiter, British Columbia. Two of the derailed cars came to rest in the North Thompson River. Approximately 5000 tons of mixed grains were spilled over the right-of-way and in the river. There were no injuries.

Ce rapport est également disponible en français.

Other Factual Information

Canadian National (CN) freight train No. G-815-41-15 originated in Saskatoon, Saskatchewan, and was travelling westward destined for Thornton Yard in Surrey, British Columbia. As the locomotives passed Mile 11.2, a train-initiated emergency brake application occurred, bringing the head end of the train to a stop at Mile 11.5. After conducting the necessary emergency procedures, the train crew determined that 40 cars, the 23rd car to the 62nd car, had derailed at and around Mile 10.7. Most of the 40 cars sustained extensive damage. Approximately 1500 feet of track was destroyed and an additional 3000 feet was damaged.

The temperature was 25 degrees Celsius. The skies were overcast, with heavy rains in the area.

The train, powered by 2 locomotives, was hauling 100 loaded cars of grain. It was approximately 5900 feet in length and weighed about 11 800 tons. The train received a pull-by inspection by the inbound train crew at Blue River, British Columbia, Mile 0.0, and no irregularities were noted. It had been scanned by a hot box and dragging equipment detector at Mile 3.8 with no heated bearings or dragging equipment noted. The train had also passed over two wheel impact detectors since leaving Edmonton, Alberta, with no excessive values noted.

In the area of the derailment, the subdivision is single main track and follows the shoreline of the North Thompson River. For the most part, the terrain is mountainous and slopes from the roadbed to the river, approximately 30 m below. The track structure consists of 136-pound continuous welded rail, manufactured in 1994 and laid in 1995. All track components were in good condition. There were marks on the ball of the rail and broken concrete ties beginning at Mile 10.2.

The authorized time table speed is 45 mph for passenger trains and 35 mph for freight trains. Traffic is controlled by the Centralized Traffic Control System authorized by the Canadian Rail Operating Rules and supervised by a rail traffic controller in Edmonton.

The event recorder data indicated that the train experienced a train-initiated emergency brake application while it was travelling at 40 mph with dynamic braking applied.

The last train inspection had been performed in Edmonton at 2200 Pacific daylight time (PDT)[1] on 14 August 2000; no exceptions were noted.

The L-1 wheel on the leading wheel set of the leading truck of car CNWX 111092 (the 23rd car from the head end and first derailed car) was observed to have been broken. Approximately 21 ½ inches of wheel tread was missing on the circumference of the wheel. The void was approximately 2 ½ inches wide tapering to a point and displayed battering. Two pieces of wheel tread filling most of the void were located at Mile 10.5.

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[1] All times are PDT (Coordinated Universal Time (UTC) minus seven hours) unless otherwise stated.

The broken wheel was a 36-inch, curved-plate, wrought steel, class 3 wheel manufactured in 1993. It is designed for service in light braking conditions and high wheel loads. The design (H-3) is a "one wear" wheel used on 100-ton cars. The wheel conformed to Association of American Railroads (AAR) metallurgical composition requirements.

The No. 1 wheel set, as well as the two tread pieces found in the area of Mile 10.5, were sent to the TSB Engineering Branch for analysis (report No. LP 098/99). The analysis concluded that:

1. The wheel failed as a result of a combination of shelling damage (rolling contact spalling fatigue) and the presence of a hard, cold worked surface layer which typically occurs during service. This resulted in the initiation and propagation of sub-surface cracks and the eventual separation of large portions of the wheel tread.

2. The shelling damage was within the AAR acceptable service limits and did not require removal of the wheel.

3. Detection of sub-surface cracks due to shelling is difficult since the cracks are not visible externally. Additional means of inspection, such as non-destructive testing, must be employed to detect these types of defect.

4. No thermal cracking was observed on the tread running surface, and metallurgical examination showed that there had been no wheel skidding. However, the heating band observed on both wheels indicated that they had been subjected to heavy brake applications. This may have been a factor in the creation of the hard surface layer observed.

5. Hardness values in the remainder of the wheel rim and plate were within the maximum allowable limits.

6. No manufacturing material deficiencies were observed which could have been a contributing factor in the failure.

The TSB Engineering Branch report also indicated that shelling generally leads to sub-surface cracking. The zone of shelling measured 9 cm long by 8 mm wide (3.5 inches by 0.3 inches). AAR Rule 41 of the *1999 Field Manual of the AAR Interchange Rules* ("Why Made Code 75—tread shelled") read:

> When the shell or spall is 3/4 inch [19 mm] in length and in width or larger and the shells or spalls are more or less continuous around the periphery of the wheel or whenever any shell or spall is 1 inch or more in length and in width, the wheel must be removed from service.

Since the subject spalled area was not continuous, but localized in a single area, nor was it greater than one inch in length and in width, the wheel was within acceptable service limits.

Analysis

Although the train was operated through the derailment area slightly in excess of the maximum posted speed limit, speed is not considered to have caused or contributed to the derailment sequence, but it may have significantly increased the property damage. The train was being controlled by dynamic braking, placing no loading on the brake gear and wheels. The track was tangent, again resulting in no undue stress in the area of the track-to-wheel interface points, and there was no indication of roadbed or track defects. It is concluded, therefore, that neither train handling nor track condition played a role in the derailment.

Markings on the track infrastructure, the location of the recovered wheel pieces and damage to the L-1 wheel on car CNWX 111092 indicated that the wheel, for reasons not attributable to the operating environment, began to break apart at Mile 10.2. The car travelled for approximately 0.5 mile, marking the rail and damaging ties until the entire truck derailed, ripping up the track and causing the following 39 cars to derail. The wheel failure is attributable to a combination of shelling and the presence of a hard, cold worked surface that led to the initiation and propagation of sub-surface cracks.

The wheel tread wear was well within AAR condemning criteria. The wheel showed signs of overheating but the marking was not beyond AAR service limits and would therefore not have attracted remedial or maintenance attention. The spalls at and near the point of fracture initiation did not exceed the established maximum limit for this type of defect. The developing sub-surface cracks were not detectable by routine inspections, and electronic wayside devices are not designed for such identification. It is apparent, therefore, that neither industry wheel condemning criteria nor railway wayside inspection systems could provide for the pre-failure detection of this defect.

Findings as to Causes and Contributing Factors

1. The derailment occurred after the fracture of the L-1 wheel of car CNWX 111092.

2. The wheel failed as a result of a combination of shelling damage and the presence of a hard, cold worked surface that led to the initiation and propagation of sub-surface cracks.

3. Neither industry wheel condemning criteria nor railway wayside inspection systems could provide for the pre-failure detection of the sub-surface defects.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 18 May 2001.