RAILWAY OCCURRENCE REPORT

CN NORTH AMERICA
RUNAWAY TRAIN
MILE 175, GRANDE CACHE SUBDIVISION
LATORNELL, ALBERTA
18 JANUARY 1994

REPORT NUMBER R94V0006

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

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Synopsis

CN North America (CN) freight train No. 459-GP-18, en route from Grande Prairie, Alberta, to Jasper, Alberta, was proceeding at approximately 11 mph when it crested a hill at Mile 174.8 of the Grande Cache Subdivision. The train began to accelerate as it moved over the descending grade towards a 10-mph permanent speed restriction in effect from Mile 173.2 to Mile 169.7. Several futile attempts were made by the locomotive engineer to control the acceleration using the service brake when, at 16 mph, an attempt was made to bring the train to a stop with an emergency brake application. This proved unsuccessful and, when the train reached a speed of approximately 28 mph, the train crew abandoned the train. The unmanned train negotiated the 10-mph speed-restricted area and eventually came to a stop at about Mile 167. No injuries or damage resulted from this occurrence.

The Board determined that loss of control of the train occurred because the air brake system had not been periodically conditioned to nullify the effects of snow and ice build-up on the brake shoes, and because the dynamic braking system was inoperative. Contributing to the occurrence was the fact that at least part of such snow and ice and its effect, if any, on the brakes was not recorded by the inspector or revealed to the locomotive engineer prior to departure and the fact that the train departed without functioning dynamic brakes.

Ce rapport est également disponible en français.

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1.0 Factual Information

1.1 The Incident

On 18 January 1994, CN North America (CN) train No. 459-GP-18, designated Extra 4516 South (the train), departed Grande Prairie, Alberta, Mile 231 of the Grande Cache Subdivision at approximately 1215 mountain standard time (MST) destined for Jasper, Alberta. Grande Prairie had been the originating station.

At Mile 193.0, the train was brought to a stop and a roll-by inspection was performed by the train crew, as required for trains handling dangerous goods on subdivisions without Hot Box and Dragging Equipment Detectors. A heavy build-up of snow and ice on the brake rigging was noticed during this inspection. From this point and for approximately 51 minutes, the train traversed an ascending grade to Mile 175.6 while ploughing several inches of snow. As the train approached Mile 174.8, the locomotive engineer reduced the throttle and applied a minimum service brake application. At Mile 175.6, the grade changed to a descending grade. The train crested the top of the ascending grade at approximately 11 mph, approaching a 10-mph speed restriction from Mile 173.2 to Mile 169.7. The train began to accelerate and the locomotive engineer attempted to maintain the speed of 10 mph through throttle modulation and a minimum service brake application. As the train speed continued to increase, an additional service brake application was made in an attempt to arrest the acceleration.

The locomotive engineer, realizing that the service brake applications were unsuccessful, made an emergency brake application; however, the train continued to accelerate. When the train speed reached 28 mph, in the vicinity of Mile 173.4 at approximately 1504 MST, the crew members abandoned the train as they feared that it would not safely negotiate the 10-mph speed-restricted area. The crew, after jumping from the train, initiated an emergency broadcast on a portable radio, advising the rail traffic controller (RTC) in Edmonton, Alberta, of the abandoned runaway train.

The train travelled approximately 6.2 miles, reaching speeds of approximately 44 mph, before it came to a stop at about Mile 167.

The crew members were rescued by helicopter around 1700 MST, approximately four miles southward from the point where they had jumped from the train. They were not injured and the train had come to a stop without damage.

1.2 Train Information

The train, powered by three diesel locomotives, was hauling 63 loads, four empties, and was operated cabooseless. It weighed approximately 7,899 tons and was about 4,066 feet in length.

1.3 Personnel Information

The crew included a conductor and a locomotive engineer.

Both crew members were familiar with the subdivision, were qualified for the requirements of their respective positions and met fitness and rest standards established to ensure the safe operation of trains.

1.4 Particulars of the Track

The authorized speed on the Grande Cache Subdivision is 30 mph. From Mile 189.0 to Mile 175.6, the grade is ascending at approximately 1.0 per cent. At Mile 175.6, the grade crests and begins descending at 1.52 per cent for approximately 7.4 miles. Between Mile 173.2 and Mile 169.7, a permanent slow

order of 10 mph is in effect because of the descending grade and numerous curves.

1.5 Method of Train Control

Train movements on the Grande Cache Subdivision are governed by the Occupancy Control System authorized by the Canadian Rail Operating Rules and supervised by the RTC located in Edmonton.

1.6 Weather

The temperature was minus 29 degrees Celsius, and there were moderate winds. A heavy snow storm had just passed through the area depositing 11 to 15 cm of fresh snow.

1.7 Event Recorder Information

The event recorder transcript from the lead locomotive revealed that the No. 1 traction motor was cut out (disabled) before its departure from Grande Prairie. The transcript also revealed that, while en route, approximately 2.5 hours before this occurrence, an unusually high service brake application of 25 pounds per square inch (psi) was required to control train speed.

At a recorded time of 1455 MST and at a recorded speed of 11 mph, a minimum service brake application was made by reducing the brake pipe pressure 6 psi. This brake application was quickly followed by a succession of brake pipe pressure reductions while train speed is shown to continue to increase. As the recorded train speed reached 16 mph, the train brakes were placed in emergency.

The transcript indicated that, after the emergency brake application, the train reached recorded speeds of approximately 44 mph before stopping.

1.8 Tests and Research

Computer recreations of the occurrence were performed by CN. It was determined that, with 100 per cent effective brakes (and no dynamic braking), train speed on the descending grade could have theoretically been maintained at 10 mph with the service brake. When the occurrence was recreated with no brakes, the train reached theoretical speeds in excess of 90 mph. Once the recreation was adjusted to simulate actual speeds and conditions, the recreation indicated that the train was operating with approximately 32 per cent of its theoretical braking capability. The computer analysis also indicated that, had a service brake application and varying amounts of dynamic braking been made, even with a 32 per cent train braking capability, train speed could have been controlled on the descending grade.

1.9 Other Information

1.9.1 Air Brake Requirements

Before departing an originating terminal, a number of safety-related inspections and tests must be performed and appropriate forms and documents must be completed.

1.9.1.1 Inspection and Testing of Locomotives

In accordance with safe practice and the Railway Air Brake Minimum Inspection and Testing Standards (air brake standards), when taking charge of a locomotive consist that has been laid over or altered, the locomotive engineer must test the locomotive operating systems to determine that all brakes and safety controls are functioning properly. However, if the tests are performed by shop personnel, a copy of an appropriate form (outlined in the air brake standards as Schedule B) is to be completed and remain with the locomotive. This form is to advise the outgoing locomotive engineer that the locomotive air brakes have been tested and are functioning, relinquishing him from the responsibilities to ensure that the brakes are functioning.

At Grande Prairie, local instructions for a "ready train" concept have replaced the air brake standards requirement to have the departing locomotive engineer perform the locomotive tests. The required locomotive

consist tests are performed by the local yard locomotive engineer. The locomotive consist is then used for building the departing train and the train is left assembled, ready to depart. However, the successful completion of the air brake tests is not recorded on any form nor, in this case, was the information pertaining to the tests communicated to the departing locomotive engineer. Also, Transport Canada has given written instructions that, when the "ready train" concept is applied, the results of the locomotive tests may be recorded on CN Form 538-D. This form is used by CN to record locomotive defects found en route, and the form is to stay with the locomotive until it is serviced. A Schedule B form for this locomotive and CN Form 538-D, indicating that the appropriate brake tests were completed, were not completed.

1.9.1.2 Inspection and Testing of Train Consists

In accordance with safe practice and the air brake standards, and before a train departs the originating station, the air brake system on freight cars must be verified to be operating properly. This requires that each car be examined to ensure that the brakes are applied and that there is no binding or fouling of the brake levers or rods. Also, the piston travel must be within the prescribed limits of six to nine inches and the brake shoes must be in contact with the wheel treads. After the successful completion of this test, a form, as outlined in Schedule A of the air brake standards, is to be completed and provided to the departing locomotive engineer.

The required test for the train was performed by a qualified car inspector at Grande Prairie. The car inspector stated that he observed that the piston travels were within the prescribed limits, but the build-up of snow and ice on the trucks and brake rigging prevented him from determining if all brake shoes were contacting their respective wheel treads and if some of the levers or rods were fouled. The car inspector nevertheless completed the appropriate form indicating the successful completion of the air test and did not inform the departing locomotive engineer of the build-up of snow and ice on the brake shoes.

The car inspector also said that he was concerned about the excessive build-up of snow in the train yard between the tracks. He stated that the lack of snow removal hindered the ability of inspectors to observe the contact between the brake shoe and wheel tread.

1.9.1.3 Other Requirements

Upon departure from an originating station, the following must be performed:

- a running brake test of train brakes must be made when the train is in motion to ascertain that the brakes are operating properly;

- when en route, locomotive malfunctions must be reported to the RTC and all malfunctions must be recorded on Work Report 538-D;

- also, the locomotive engineer should make periodic use of the train air brakes at sufficient intervals to keep brake surfaces free of ice and snow.

1.9.2 Dynamic Brake Operation

Dynamic braking is an electrical brake installed on most main track locomotives to assist braking on descending grades. The dynamic brake reduces locomotive speed by converting the traction motors into generators. The faster the locomotive speed, the greater the dynamic brake effort. Although peak dynamic braking is produced at approximately 24 to 28 mph, the dynamic brake handle control mechanism is calibrated from 0 to 8 and the amount of dynamic braking varies accordingly.

1.9.3 Lead Locomotive CN5416

On 14 January 1994, locomotive CN5416 was released for service after an inspection and

repair at CN's Calder diesel shop in Edmonton. As part of the repair, the throttle controller was changed because of a faulty roller switch. The locomotive was marshalled in a three-locomotive consist which departed Edmonton for Jasper on 14 January. On 17 January, the three-locomotive consist was moved north into Grande Prairie. While at Grande Prairie, the three-locomotive consist was used for work in the area and, on 18 January, was placed on train No. 459-GP-18 with locomotive CN5416 in the lead position.

Before departing Grande Prairie, the locomotive engineer discovered that the dynamic brake handle on locomotive CN5416 could not be operated properly. The handle could not be moved past the No. 2 position. He also determined that the locomotive was not loading properly. To remedy the loading problem, he cut out the No. 1 traction motor, which allowed the power produced to be evenly directed to the remaining five traction motors. The locomotive could then be operated. This action, however, disabled the dynamic braking system in the lead locomotive but, as the dynamic brake handle was inoperative, this did not have an impact on the way the train was to be handled.

A post-accident inspection of the throttle controller assembly on locomotive CN5416 revealed that the throttle handle to the dynamic brake handle interlock mechanism had not been properly assembled. This improper interlock assembly fully activated the dynamic brake in the No. 1 position, but prevented the handle from being moved further. It gave the locomotive engineer the impression that the dynamic brake was defective. The construction of the throttle controller is such that it is a simple matter to inadvertently knock the cam drum, preventing it and the reverser cam from seating properly, resulting in the improper interlock. Although the functioning of the throttle was tested at Calder Yard on 14 January, no test is required to determine the condition of the dynamic brake and none was made.

An inspection of the high-voltage contactor revealed that the No. 1 traction motor would not operate properly because the No. 1 arc chute was out of place.

1.9.4 Train Brake Inspection

An inspection of the train immediately after the incident revealed that the brakes were in emergency and that piston travels on many cars exceeded standard travel lengths. An additional inspection, after the train was moved approximately 65 miles, revealed that the piston travels were acceptable because of the operation of the automatic slack adjusters. A build-up of snow and ice was evident on the trucks and brake rigging.

1.9.5 Snow Removal

Snow ploughing is implemented when snow accumulation reaches a point where the pilot of a locomotive begins to fill previously cleaned switches, results in the restriction of train or yard movements, or results in extreme unsafe walking conditions. In the Grande Prairie area, a ballast spreader is used as a snow plough. Snow conditions requiring ploughing existed in the yard and the Grande Prairie Subdivision when the train left Grande Prairie.

When a Stage 3 Winter Operation is declared, transportation, equipment, and engineering departments ensure that appropriate measures are implemented, and snow-removal equipment ordered. The conditions requiring implementation of a Stage 3 Winter Operation are moderate snowfall with the accumulation of 6 to 20 cm, wind velocity of 25 to 50 km/h, temperature between minus 20 and minus 30 degrees Celsius, and the reduction of operating ability (i.e. train length, siding availability and switches filled-in, etc.).

The Alberta District Winter Operation Plan Manual is a guideline. It specifies that the track supervisor and the RTC are responsible to obtain daily weather forecasts from Environment Canada and any updates that may be required.

On 17 January 1994, at approximately 1200 MST, a routine Hi-rail

patrol was made by a roadmaster on the Grande Cache Subdivision. Insufficient snow was apparently encountered to require the dispatching of snow-removal equipment. On the same day, the last northward train on the Grande Cache Subdivision had encountered some snow but the crew members experienced no difficulties handling their train. Therefore, there was no report on snow conditions submitted by the northward train crew.

Between the time that the roadmaster and the last northward train had traversed the Grande Cache Subdivision and the time of departure of train No. 459-GP-18, a snow storm with high winds had occurred. This apparently rapidly changed the snow conditions on the track. Had the roadmaster been aware of the change in conditions, a Stage 3 Winter Operation might have been placed into effect and the Grande Cache Subdivision would have been ploughed before train No. 459-GP-18 departed.

2.0 Analysis

2.1 Introduction

The train was abandoned when the crew felt that their lives were at risk as the train continued to accelerate, in an area of curves, to a speed at which a derailment appeared to have been inevitable. Although the initially ineffective air brakes eventually stopped the movement without mishap, the investigation determined that a series of events compromised the braking ability of the train. The analysis will therefore focus on those areas that affected the crew's ability to slow the train.

2.2 Consideration of the Facts

2.2.1 Initial Brake Inspection

The train air brake system was functioning when the train departed Grande Prairie; however, the effectiveness of the air brakes was less than ideal because of the snow and ice build-up that was noted by the car inspector on the trucks, brake shoes and brake rigging. A clear view of the brake rigging on some types of freight cars could have been restricted because of the build-up of snow between the tracks in the train yard. Also, the build-up of snow and ice on the trucks could have restricted the inspector's view to determine whether the brake shoes were in direct contact with the wheel tread of each wheel, making it impossible to determine whether the brakes were functioning. The car inspector could not verify brake shoe to wheel tread contact. He provided an Air Brake Schedule A Form to the locomotive engineer on train No. 459-GP-18, indicating that the train brakes were functioning properly. He did not relate to the locomotive engineer on the train that there was a build-up of snow and ice on the brakes and brake rigging.

2.2.2 Running Brake Test

On departure and when in motion, a running brake test must be conducted to verify train braking capability. The negative effects the build-up could have had on the braking capability of the train would have been detectable as a result of a running brake test. The locomotive engineer would have quickly realized, upon departure, that the braking effectiveness was substantially reduced and, at that time, taken appropriate action to melt off the build-up.

2.2.3 Locomotive Brake Tests

Certain departing air brake tests, completely separate from the freight car brake tests, are to be performed on the locomotive consist. At Grande Prairie, the tests are to be performed when the train is made up by the yard engineer and the results of these tests are to be recorded on a CN Form 538-D. The CN Form 538-D had no entry to indicate that the locomotive consist brakes had been successfully tested, and the locomotive engineer on the train was not informed of the successful completion of the test. Under these circumstances, the departing locomotive engineer is required to perform tests himself.

2.2.4 Brake Performance Before Mile 174.5

The braking effectiveness of this train was less than ideal upon leaving Grande Prairie and was further lessened throughout the journey as the train was passing over freshly fallen snow. The out-of-standard piston travels found on the train immediately after the runaway indicated that the automatic slack adjusters had adjusted the piston travel on the cars to compensate for the snow and ice between the brake shoes and the wheel tread. Once the snow and ice build-up melted off, the increased piston travel impaired the effectiveness of the train brakes. This would also indicate that the amount of snow and ice on the brake shoes had been substantial.

Periodic use of the train air brakes is required to ensure the brake/wheel tread contact is possible; the brake shoes are otherwise conditioned. The train crew continued to proceed for approximately

51 minutes on a 1.0 per cent ascending grade without conditioning the brake shoes.

2.2.5 Impact of No Dynamic Braking on Speed Control

It should be noted that not all locomotives are equipped with dynamic brakes, although their presence could indeed as in this case be crucial to train control.

The loss of train brake effectiveness because of snow and ice was exacerbated by the absence of dynamic braking on the train. Computer-generated recreations of the runaway indicated that, had the dynamic brake been functioning, it would have likely controlled the speed of the train until the snow and ice melted off after the service application, and before the train reached a speed that would have placed the crew in danger.

3.0 Conclusions

3.1 Findings

1. The completion of the pre-departure air brake tests by the yard engineer was not communicated to the departing locomotive engineer.

2. The locomotive engineer did not perform the air brake tests.

3. The car inspector qualified the train brakes although unable to see all the brake shoes in contact with the wheel treads due to snow and ice build-up.

4. The inspector did not advise the departing engineer of the snow and ice build-up.

5. Snow removal did not take place before the departure of the train because the sudden snow and wind conditions were not known to those who dispatch the snow-removal equipment.

6. Snow and ice build-up between the brake shoes and wheel treads of the freight cars reduced the train brake effectiveness to about 32 per cent of ideal.

7. The dynamic brake on lead locomotive No. CN5416 was not re-assembled correctly, resulting in the engineer's inability to use this feature.

8. The train's acceleration could not be controlled because of the reduced brake efficiency and because the dynamic brake was not functioning.

9. Notwithstanding the existing circumstances, a proper functioning dynamic brake system would likely have controlled the train's acceleration.

3.2 Cause

Loss of control of the train occurred because the air brake system had not been periodically conditioned to nullify the effects of snow and ice build-up on the brake shoes, and because the dynamic braking system was inoperative. Contributing to the occurrence was the fact that at least part of such snow and ice and its effect, if any, on the brakes was not recorded by the inspector or revealed to the locomotive engineer prior to departure and the fact that the train departed without functioning dynamic brakes.

4.0 Safety Action

4.1 Action Taken

4.1.1 Dynamic Brake Testing

Locomotive CN5416 was released to service with the dynamic brake not operating properly after inspection and repair at the Calder diesel shop. Post-accident inspection revealed that, after the repair, the dynamic brake had not been reassembled properly. In order to prevent recurrence, the Calder diesel shop has developed a new procedure to inspect and test the dynamic brake system after repairs have been completed.

4.1.2 Alberta District Winter Operating Plan

As a consequence of this occurrence, the Alberta District reviewed their winter operating plan with respect to the capability to recognize the effects of adverse weather on winter operations. As a result of the review, the Alberta District now uses data from Environment Canada regarding forecasted weather disturbances to determine appropriate responses to the winter operating plan.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board, consisting of Chairperson, John W. Stants, and members Gerald E. Bennett, Zita Brunet, the Hon. Wilfred R. DuPont and Hugh MacNeil, authorized the release of this report on 28 February 1995.