

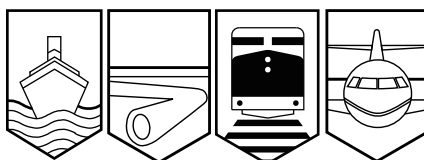
Transportation Safety Board
of Canada



Bureau de la sécurité des transports
du Canada

RAILWAY INVESTIGATION REPORT

R02C0022



MAIN-TRACK COLLISION AND DERAILMENT

CANADIAN PACIFIC RAILWAY
TRAIN 671-038 AND TRAIN 177-24
MILE 26.9, MOUNTAIN SUBDIVISION
GLENOGLE, BRITISH COLUMBIA
24 MARCH 2002

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

At 1215 Pacific standard time, on 24 March 2002, Canadian Pacific Railway freight train 671-038 (train 671) travelling westward on the Mountain Subdivision, near Glenogle, British Columbia, struck train 177-24 (train 177) that was stationary on the main track. The two lead locomotives of train 671 and the last three cars of train 177 derailed. The locomotive engineer suffered minor injuries. There was minor track damage.

Ce rapport est également disponible en français.

Other Factual Information

At 1112 Pacific standard time,¹ train 671-038 (train 671) departed Field, British Columbia, Mile 0.0, destined for Coquitlam, British Columbia. The train consisted of 3 locomotives, 126 loads of potash, weighed 17 929 tons and was 6142 feet in length. At 1200, the train passed signal 215 at the east switch at Palliser, British Columbia, which displayed a "Clear Signal" indication. The train was travelling at 27 miles per hour (mph) in a maximum allowable speed zone of 25 mph. At 1207, train 671 encountered a "Clear to Stop" signal² indication at signal 233, located at the west switch at Palliser. A "Restricting Signal"³ indication was displayed by signal 249. The train's speed at this location was 27 mph. The train's speed was reduced to 17 mph in advance of a slide detector fence at Mile 26.7; the train crew assuming that the "Restricting Signal" indication was displayed as a result of a rock fall or slide.

Having passed the slide detector without observing any obstructions, train 671 continued at 17 mph around a five-degree right-hand curve. The forward sight distance on the curve was approximately 420 feet. As the train negotiated the curve, the conductor situated on the left-hand side of the locomotive noticed, and indicated to the locomotive engineer, that there was a train stopped ahead on the main track. The locomotive engineer and the conductor both initiated an emergency brake application. At 1215, train 671 struck the tail end of train 177-24 (train 177), derailing the two lead locomotives of train 671 and the last three cars of train 177. The last car on train 177 was derailed, ending up perpendicular to the main track and down the embankment, with the east end partially submerged in the Kicking Horse River. The adjacent two cars remained upright on the right-of-way and parallel to the track. The locomotive engineer on train 671 sustained minor injuries to his head as a result of an impact with the cab's electrical cabinet. There were no dangerous goods involved.

Train 177 consisted of 2 locomotives, 42 loads, weighed 4130 tons and was 6286 feet in length. Train 177 was stationary with its head end portion in the siding at Glenogle and the rear portion extending onto the main track to Mile 26.9.

Train 471 consisted of 2 locomotives, 6 loads, 65 empties, weighed 2250 tons and was 4854 feet in length. Train 471 was stationary with its head end at the west end of the Glenogle siding and the rear portion extending to the middle of the siding.

¹ All times are Pacific standard time (Coordinated Universal Time minus eight hours) unless otherwise stated.

² The *Canadian Rail Operating Rules* (CROR) define a "Clear to Stop" signal as "Proceed, preparing to stop at next signal."

³ The CROR define "Restricted Speed" as "A speed that will permit stopping within one-half the range of vision of equipment, also prepared to stop short of a switch not properly lined and in no case exceeding SLOW SPEED. NOTE: When moving at restricted speed, be on the lookout for broken rails." ["SLOW SPEED" is "A speed not exceeding fifteen miles per hour."]

Train movements on this subdivision are governed by the Centralized Traffic Control System (CTC), authorized by the *Canadian Rail Operating Rules (CROR)*, and supervised by a rail traffic controller (RTC) in Calgary, Alberta. The RTC had set up a meet between three westward trains (471, 177 and 671) and one eastward train (472). The RTC had routed the first train (471) into the siding at Glenogle; the second train (177) into the siding behind train 471; and the third train (671) was expected to follow up behind train 177. The eastward train (472) would remain on the main track between the switches at Glenogle to allow the three westward trains to proceed westward via the Glenogle siding. Both train 471 and train 472 had switching to perform at Golden. Because this required the use of the same track at Golden, the RTC chose Glenogle for the meet.

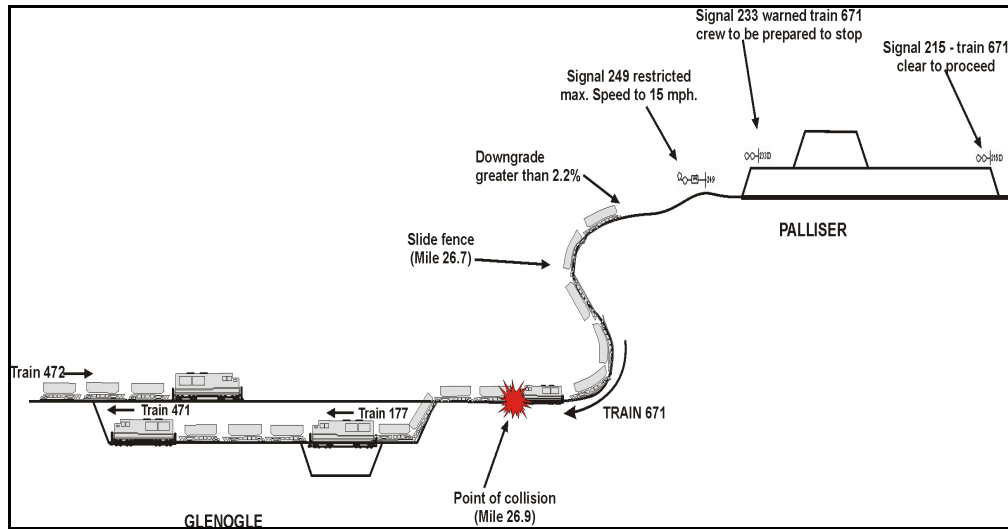


Figure 1. Sketch showing position of trains and signals

The RTC had informed trains 471 and 177 that there would be a meet at Glenogle. However, train 671 was not informed that trains 471 and 177 were waiting to meet train 472 at Glenogle. There is no requirement for RTCs to communicate to train crews where train meets are to take place, as train movements are controlled by signal indication. However, it is a common practice for RTCs to inform train crews of intended meets. CROR Rule 90, "Communication Between Crew Members," establishes communication requirements between crew members when there is a crew member located in other than the cab of the lead locomotive. Canadian Pacific Railway (CPR) System Special Instruction 2 makes it a requirement for CPR train crews to announce the requirements of CROR Rule 90 over the standby radio channel when all crew members are located in the cab of the lead locomotive. Train crews are not required to, and might not always, communicate with other trains when they are stopped or delayed, unless they are stopped due to an emergency or an abnormal condition. Furthermore, due to the volume of radio traffic on the standby channel, radio announcements made as per CROR Rule 90 are often inaudible.

CROR Rule 85, "Reporting Delays," states:

The conductor of each train will ensure that the RTC is promptly advised of any known condition which may delay the train.

Currently, the railways do not interpret CROR Rule 85 as requiring train crews to report to the RTC or broadcast their position when they are stopped within a block⁴ for reasons other than for an emergency or an abnormal condition delaying the train.

The track in the vicinity of Mile 26.9 is a single main track with a steep descending grade and numerous curves that can impede a crew's sight-line ahead, making it a difficult area in which to handle heavy tonnage trains. The grades between signal 249 and the point of derailment vary from 2.20 per cent to 0.95 per cent with numerous changes. The authorized speed through this section of the subdivision is 25 mph for passenger trains and 20 mph for freight trains. When signal 249 displays a "Restricting Signal" indication, the speed between Mile 25.0 and Mile 27.3 is limited to 15 mph or a slower speed that will allow stopping within one-half the range of vision. Calculations performed by the TSB determined that, in order to stop within one-half the range of vision (210 feet), the train speed could not exceed 9.5 mph, and the stopping distance for train 671 travelling at 17 mph would be approximately 540 feet.

There is a slide detector at Mile 26.7, which is used to detect debris that has fallen onto the tracks. The slide detector consists of a series of poles with an interlaced array of wires that provide both overhead and side detection. Falling debris activates the slide detector when it breaks one or more of the wires. When the slide detector is activated, the interconnected track signals display a "Restricting Signal" indication (CROR Rule 426). The signal, also electronically transmitted to the RTC in Calgary, allows the RTC to initiate a trouble report through the Signals and Communications Department. While the slide detector is designed to be activated by falling rocks, trees and ice, it is often activated by passing animals or rock climbers. There is a higher frequency of slide detector activation in the spring, associated with thawing conditions.

The slide detector at Mile 26.7 was activated during the previous night. The locomotive engineer on train 671 had been advised by another locomotive engineer that, during a trip earlier that day, the slide detector was activated resulting in a "Restricting Signal" at Mile 25.0. Unknown to the locomotive engineer, Signals and Communications personnel had returned the slide detector to service at 1004 on 24 March 2002.

On 01 March 1998, Canadian National (CN) train No. A-447-51-01 collided with the rear end of stationary CN train No. C-771-51-28 at Mile 165.4 of the CN Edson Subdivision, near Obed, Alberta. The TSB investigation report (R98C0022) addressed the issue of rear-end collisions and the subject of collision avoidance systems. There are numerous new technologies, which are intended to ensure the safe separation of trains or trains and other rolling stock. The Board was concerned that the risk of train collisions due to inadequate safe distances between rolling stock still remains. As a result, the Board issued the following recommendations:

The Department of Transport ensure that an assessment is made of the technologies designed for the safe separation of railway rolling stock movements, with the intent of establishing a minimum safety standard.

(R00-02, issued March 2000)

⁴ The CROR define a "Block" as "A length of track of defined limits, the use of which by a train or engine is governed by block signals, cab signals, or both."

and

The Department of Transport ensure that an assessment is made of the suitability of current Canadian Rail Operating Rules and railway instructions concerning the immediate reporting of operating delays to all concerned when there is a safety risk.

(R00-03, issued March 2000)

In response to recommendation R00-02, Transport Canada (TC) Rail Safety replied that it was continuing with an ongoing assessment of the technologies designed for positive train separation, as per the second phase of its research and development program on new train control systems technology. TC has recently completed an assessment of a new technology system called "Indusi - Automatic Train Control," which has been installed on the new Bombardier Talent Trains (manufactured in Germany). As a pilot project, this system was installed on the Capital Railway (OC Transpo), which has operated a revenue passenger service in Ottawa, Ontario, since early 2002. TC has completed its assessment of this system and has established minimum safety requirements for the Capital Railway.

TC continues to participate in the development of the new Standard for Positive Train Control Systems by the Federal Railroad Administration in the United States, and also participates in a number of working groups examining the implications of such technologies. TC also continues to participate in the development of new Communications-Based Train Control Systems Standards, undertaken by the Rail Transit Vehicle Interface Standards Committee of the Institute of Electrical and Electronics Engineers.

The effective and safe operation of a railway is largely dependent upon accurate and timely communications between the RTC and others whose work may affect or be affected by train operations. The interpretation of "prompt advising," as per existing rules, does not always promote timely notification to the RTC and others in the vicinity when a train is being delayed and poses a safety risk.

In response to recommendation R00-03, TC advised that it continues to work with the Railway Association of Canada (RAC) to ensure that the requirements of the CROR provide the highest level of safety and clarity for the railway industry. CROR Rule 85 has not yet been reworded but TC did raise the issue with the RAC Rules Revision team in October 2002.

Analysis

The analysis will focus on the factors that may have influenced the operation of train 671, the train crew's mental model, communications and operation of heavy tonnage trains in this region of the Mountain Subdivision.

The crew of train 671, having passed the slide detector at Mile 26.8, continued to proceed westward at 17 mph without further reduction of train speed. The crew's mental model was based upon the premise that the "Restricting Signal" indication was generated by the activation of the slide detector. The crew developed and confirmed this model for the following reasons:

- the locomotive engineer had been informed by another locomotive engineer that the slide detector had been activated several hours earlier;
- the crew was unaware that the slide detector had been placed back in service at 1004 on the day of the occurrence;
- this slide detector activated frequently, particularly at that time of the year.

Notwithstanding the requirement to comply with the “Restricting Signal,” once established, a mental model is difficult to overcome without strong refuting external cues. As the crew was confident that the “Restricting Signal” indication was due to the slide detector activation, once they confirmed that there were no obstructions in the vicinity of the slide detector, they proceeded without a further reduction in speed.

Although there is no requirement to communicate the sequencing of trains, the RTC had communicated the meet to the second train—train 177. He then attended to other duties and omitted to tell train 671 of the upcoming meet. In the absence of an external cue to alert the crew that their assessment of the “Restricting Signal” was incorrect, the train crew proceeded without reducing speed. In this occurrence, had the crew of train 671 been aware of the location of stationary train 177, it is unlikely that the collision would have occurred, as the crew would have attributed the “Restricting Signal” to the presence of train 177, rather than to faulty slide detector activation.

While the safety deficiency associated with the lack of communication of the location of delayed or stopped trains was identified previously in other occurrences and a recommendation was issued in 2000, the Board is not aware of any enduring safety action taken to mitigate this risk.

While the RTC in Calgary receives a distinct indication that a specific slide detector has been activated, in the field, this information is relayed to the crew in the form of a “Restricting Signal.” In the field, the signal indications do not differentiate between activation of the slide detector, track discontinuities, or track occupancy. A separate and distinct indicator apprising crews of the activation of the slide detector could assist crews in discriminating between foreign objects on the tracks in high rock fall areas and track occupancy or discontinuities. Distinct and separate slide detector indicators are presently being employed by CN.

Findings as to Causes and Contributing Factors

1. Given the mental model that the “Restricting Signal” was generated by the slide detector, and the fact that train 671 was not aware of the impending meet, the crew did not further reduce their speed to be able to stop within one-half the range of vision of train 177 as they negotiated the curve at Mile 26.8.

Other Findings

1. As "Restricting Signal" indications are used to allow multiple trains to simultaneously occupy the same block, there is an increased risk of collision in the absence of communication between trains and the rail traffic controller (RTC) regarding train sequencing and stoppage.
2. A separate and distinct indicator apprising train crews of the activation of the slide detector could assist crews in distinguishing between foreign objects on the tracks and track occupancy or track discontinuities.

Safety Action Taken

On 11 April 2003, Canadian Pacific Railway (CPR) reissued Rule of the Week 373, titled "Promptly Reporting Delays, CROR Rule 85," to operating crews in the Vancouver and Interior Service Areas. The document describes a situation in which a train must stop as a result of an alarm on a hot box and dragging equipment detector system requiring the train to stop and be inspected. A series of questions follows in which it is determined that the rail traffic controller (RTC) must be advised when the train is stopped for the required inspection.

On 10 July 2002, CPR issued the following information to operating crews:

Subject: Controlled Block/Advanced Signals voiced over the Standby Radio Channel

Effective at 0001, Monday July 15, 2002 on the Shuswap and Mountain subdivisions, all controlled block signals and their advanced signals must be voiced over the standby radio channel. The broadcast must include:

- the train designation and the name of the advanced signal to the control location; and
- the train designation and the name of the signal at each controlled location.

In addition, after broadcasting a Stop signal, a crew member must also broadcast the name of the signal when LEAVING the controlled location.

On 05 August 2002, CPR issued Rule of the Week 452 concerning the application of CROR Rule 90 when all crew members are located in the cab of the lead locomotive. The Rule of the Week stated in part:

VOICE COMMUNICATION - CONTROLLED LOCATIONS IN SINGLE TRACK

Item 2 of System Special Instructions to Rule 90:

2. When all crew members are located in the operating cab of the lead locomotive: a crew member will make such announcement on the Standby radio channel designated in the time table.

Safety Concern

The risk posed by the dependence on strict adherence to the "Restricting Speed" rule resulted in a train collision. The Board acknowledges that the safety action taken by the industry may reduce the risk to some limited extent. However, the Board remains concerned that the CROR and railway instructions are inadequate concerning the immediate notification of operating delays to all concerned when there is a safety risk.

This report concludes the TSB's investigation into this occurrence. Consequently, the Board authorized the release of this report on 18 June 2003.

Visit the TSB's Web site (www.tsb.gc.ca) for information about the TSB and its products and services. There you will also find links to other safety organizations and related sites.