



Transportation
Safety Board
of Canada

Bureau de la sécurité
des transports
du Canada

Rail Transportation Safety Investigation Report R19C0038

NON-MAIN TRACK TRAIN COLLISION AND DERAILMENT

Canadian Pacific Railway
Freight train 118-09 and locomotive control system yard assignment CR01-09
Mile 172.0, Brooks Subdivision
Calgary, Alberta
09 March 2019

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The occurrence

At approximately 0905¹ on 09 March 2019, eastbound Canadian Pacific Railway (CP) distributed power freight train 118-09 was departing Alyth Yard in Calgary, Alberta, at approximately 10 mph when it was struck by eastbound locomotive control system (LCS)² yard assignment CR01-09 at the 50th Avenue crossover, Mile 172 of the CP Brooks Subdivision. The train and the yard assignment both derailed upright (Figure 1). As a result of the collision, 5 cars and 2 locomotives of the yard assignment derailed, as did 4 cars and 1 locomotive of the train. There were no injuries and there was no release of dangerous goods. The weather was clear and the temperature was approximately -4 °C.

¹ All times are Mountain Standard Time.

² CP uses the acronym LCS (locomotive control system) to denote that the assignment locomotives are remote controlled by the crew members.

Figure 1. Collision and derailment of train 118-09 (right) and yard assignment CR01-09 (left) (Source: TSB)



Train 118-09 and yard assignment CR01-09

Train 118-09 (train 118) consisted of 2 head-end locomotives and 1 remotely-controlled locomotive located 31 cars from the head end. It was handling 72 loaded cars and 41 empty cars, weighed 11 411 tons and was 10 162 feet in length. The crew for the train was composed of a locomotive engineer, a conductor, and a trainee conductor. All crew members were qualified for their respective position and met fitness and rest standards.

Yard assignment CR01-09 (the assignment) was a remote control yard assignment operating daily at the east end of Alyth Yard. At the time of the occurrence, it consisted of 2 yard locomotives, CP 4510 and CP 4437, pulling 58 cars, and measured approximately 3600 feet. The assignment crew was composed of a yard foreman and a helper who were qualified for their respective position and met fitness and rest standards.

Train 118 and the assignment were both required to operate within the same controlled track zone known as a point protection zone (PPZ).

Point protection zones

A PPZ is an area of track, with clearly defined limits, that is under the control of a single crew. Many yards have implemented PPZs in order to facilitate the safety and productivity of remote control locomotive system operations.

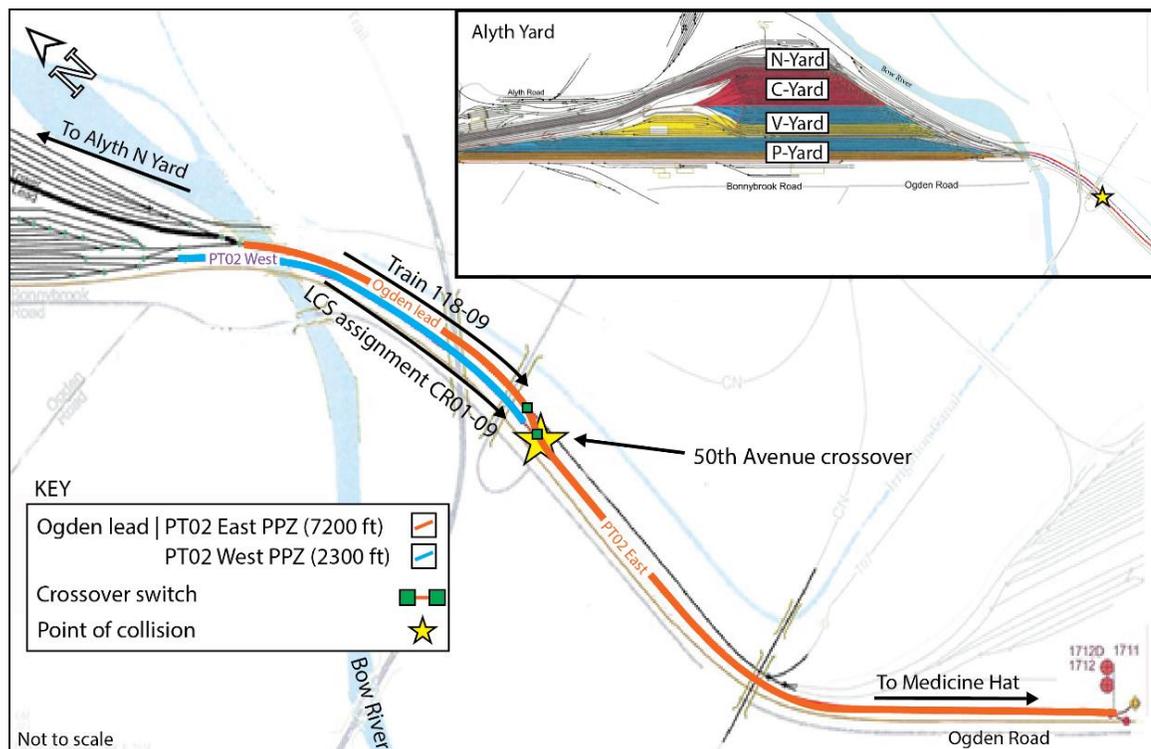
No other train movements may enter a PPZ without receiving permission directly from the crew who has it under control. When no other movements are authorized to enter the PPZ, the track can be considered as known to be clear,³ and it is not necessary to have a crew member on the leading end of a movement.

The limits of a PPZ are set by a railway according to the operational needs of a given yard.

On the morning of the occurrence, the assignment crew was in possession of 2 different PPZs (Figure 2):

- The **PT02 West** PPZ, which extends 2300 feet from the west end of P-yard to the fouling point with the crossover switch at 50th Avenue.
- The **Ogden lead/PT02 East** PPZ, which extends 7200 feet from N-yard, through the crossover switch at 50th Avenue, and onto the east end of track PT02 as far east as Signal 1712B, where a positive stop protection system⁴ prevents an LCS from proceeding past the signal.

Figure 2. Map showing point protection zones, direction of movements, and point of collision. (Source: Canadian Pacific Railway, with TSB annotations)



In this configuration, different sections of track PT02 belong to different PPZs: PT02 track west of the 50th Avenue crossover is part of the PT02 West PPZ, while PT02 track east of the crossover is part of the Ogden lead/PT02 East PPZ.

³ Rule 115(b) of the *Canadian Railway Operating Rules* defines "known to be clear" as "seeing the portion of the track to be used as being clear and remaining clear of equipment and as having sufficient room to contain equipment being shoved."

⁴ Positive stop protection consists of sensors installed on yard tracks to prevent remote-controlled assignments from proceeding beyond their limits of operation.

Events leading to the collision

At 0700 on the morning of the occurrence, the assignment crew began switching cars at the east end of Alyth Yard.

On the same morning, train 118 was ordered for 0730. In preparation for departure to Medicine Hat, Alberta, the crew was instructed to double-over the head-end portion of the train (4996 feet) in track N14 onto a block of 83 cars in track N11. Train 118 required access to the Ogden lead/PT02 East PPZ to complete this movement and depart.

At approximately 0745, the crew of train 118 contacted the assignment crew by radio for permission to occupy the Ogden lead/PT02 East PPZ. In this radio communication, the crew of train 118 requested permission to use the Ogden lead/PT02 East PPZ up to the 50th Avenue crossover. This would give train 118 permission to proceed eastward as far as the fouling point with the crossover switch at 50th Avenue. However, the communication did not specify permission to foul the crossover and proceed east on track PT02 to complete the double-over move. The assignment crew granted the requested permission. The communication was not repeated back by the assignment crew to the crew of train 118, and therefore the train crew could not confirm the instructions from the yard crew, as required to ensure a common understanding.⁵

Following this communication, train 118 pulled forward to the crossover, lined the crossover switches, and, at approximately 0834, proceeded through the crossover about 1000 feet onto track PT02. For the next 30 minutes, the Ogden lead/PT02 East PPZ was fully occupied by train 118, while the assignment crew continued its switching operations using PT02 West PPZ.

At approximately 0859, the crew of train 118 was authorized to depart for Medicine Hat. The departure route proceeds from N-Yard, eastward through the Ogden lead/PT02 East PPZ, past the signals at 1712 and onto the main track. The crew members of train 118, based on the earlier radio communication with the assignment crew, believed that they were still authorized to fully occupy the Ogden lead/PT02 East PPZ.

At the same time, the assignment crew began its next switching movement, which required pulling 58 cars eastward from track V8 in V-Yard. Given the length of the cut of cars (about 3600 feet), the assignment crew needed to proceed beyond the limits of the PT02 West PPZ and occupy the east end of track PT02. The assignment crew members, based on the earlier radio communication, believed that they had granted train 118 permission to occupy the Ogden lead/PT02 East PPZ only up to 50th Avenue and that the assignment still had exclusive access to the portion of track PT02 east of the crossover.

The collision occurred at 0905 when the lead locomotive of the assignment struck the side of train 118 that was proceeding through the crossover onto track PT02 East.

⁵ Rule 123(c) of Transport Canada's *Canadian Rail Operating Rules* (18 May 2018) states: "Except when transmitted by an automated device, or as otherwise provided, when verbal instructions or information affecting the safety of a movement are received by radio, such information must be repeated to the sender."

Alyth Yard operating practices for the use of point protection zones

The requirements for trains to operate within the PPZs at Alyth Yard are contained within CP's *Prairie Division Time Table No. 32*, CP's summary bulletin for the Prairie Division, and the *Canadian Rail Operating Rules* (CROR).

Section 11.2 of CP's *Prairie Division Time Table No. 32*, Calgary Terminal General Footnotes, states:

All movements entering, departing, or working within the Alyth yard, must contact the Calgary Terminal Trainmaster or Assistant for instructions.⁶

CP's summary bulletin for the Prairie Division, which came into effect on 01 October 2018, states:

ALL CREWS (Road and Yard) entering Point Protection Zones (PPZ) and Process:

1. Movements requiring access into the zones listed above and movements within the yards that require access to a PPZ must contact the Terminal Trainmaster and be governed by instructions received.
2. Instructions must include whether the PPZ on the route to be used are active or inactive. If zone is inactive crews will operate as per CROR, user manual and special instructions. When the PPZ is active instructions must include the remote-control assignment and radio channel to contact the remote-control assignment directly for instructions concerning the use of the active PPZ.
3. In an ACTIVE PPZ the movement will be governed by the instructions received directly from the Remote-Control Assignment:
 - Ensure there is a clear understanding of the instructions made before proceeding.
 - When practicable crews entering the PPZ will restore all switches used to the same position as previously encountered. When switches are left in other than previously encountered crews MUST communicate to the remote-control assignment the position the switches have been left.
 - Crews MUST communicate with the remote-control assignment when clear or done working within the zones.
4. All Crews (road and yard) within the Remote-Control Assignments limits are reminded that CROR, user manual and special instructions still remain in effect when operating within the zones.⁷

Configuration of the point protection zones involved in the occurrence

The Ogden lead/PT02 East PPZ is used by train crews to build their trains prior to departure. In addition, trains departing east must travel through the PPZ to leave the yard.

The PT02 West PPZ is used by yard crews for switching operations that require headroom.⁸ When yard crews are handling cuts of cars that exceed the length of the PT02 West PPZ, as in this occurrence, they must go beyond the limits of the PPZ to complete their movement and occupy track PT02 east of

⁶ Canadian Pacific Railway, *Prairie Division Time Table No. 32, Module 40 Calgary Terminal, General Footnotes* (19 December 2016), item 11.2, p. 4.

⁷ *Ibid.*, *Prairie Division – Alberta Summary Bulletin* (effective 01 October 2018), p. 12.

⁸ Headroom refers to the track required for the head end of a switching movement or train when the tail end of the movement must be moved clear of a particular location, usually a switch.

the 50th Avenue crossover. Since this section of track is part of the Ogden lead/PT02 East PPZ, these movements must in fact occupy both PPZs simultaneously. However, there is no track signal or other physical means to alert crews of the crossover switch position.

To accommodate the requirement to use track PT02 East for yard switching movements, it was common for yard crews to exclude this section of track when granting permission to occupy the Ogden lead/PT02 East PPZ.⁹

There are no specific rules, instructions, or procedures at Alyth Yard for situations where a yard crew must occupy 2 PPZs simultaneously. There are also no instructions authorizing or prohibiting the practice of granting the crew of another movement access to only a portion of a PPZ.

Administrative and physical defences

Yard switching operations need robust defences to prevent accidents. Defences can be administrative or physical. For example, administrative defences are regulations, operating procedures, supervision, and training. Such defences rely on crews to follow them, but provide no additional assurance of safety if, for whatever reason, a crew does not comply. Physical defences could include track signals or a physical means of stopping the train.

At Alyth Yard, the defences for trains operating within PPZs are mostly administrative in nature. In other yards, in addition to administrative defences, companies have engineered physical defences to alert a yard crew to an unexpected PPZ incursion. For example, at the CN MacMillan Yard in Vaughan, Ontario, track signals alert yard crews building trains if a crossover switch is lined into the PPZ.

Safety message

As this occurrence demonstrates, collision or derailment may occur as a result of unclear PPZ communications between conflicting train movements, particularly in the absence of physical defenses to prevent overlapping authorities within PPZ. It is important that crews follow prescribed verification procedures and repeat back transmissions of safety-critical information to ensure common understanding.

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 16 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.

⁹ Canadian Pacific Railway, email responding to TSB information request (16 October 2020).

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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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Citation

Transportation Safety Board of Canada, *Rail Transportation Safety Investigation Report R19C0038* (released 16 March 2021).

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Rail transportation safety investigation report R19C0038

Cat. No. TU3-11/19-0038E-PDF

ISBN: 978-0-660-37858-9

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