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

RAIL TRANSPORTATION SAFETY INVESTIGATION REPORT R21H0087

CROSSING COLLISION

VIA Rail Canada Inc.
Passenger train No. 53
Mile 11.75, Smiths Falls Subdivision
Richmond, Ontario
30 June 2021

The occurrence

On 30 June 2021, at about 1145,[1] VIA Rail Canada Inc. (VIA) passenger train No. 53 departed the train station in Ottawa, Ontario, destined for Toronto, Ontario. The train consisted of 1 head-end locomotive, 5 coach cars, and 1 tail-end locomotive. It weighed about 500 tons and was about 540 feet long. The train crew consisted of an operating locomotive engineer (OLE), an in-charge locomotive engineer (ICLE), and a 3rd locomotive engineer conducting a familiarization trip. All 3 crew members were qualified for their positions, met rest and fitness standards, and were familiar with the territory. A total of 120 passengers were on board the train.

At about 1210, a Westboro Utilities employee left work for home with a company cutaway van, a 2017 GMC 3500 (the vehicle). The company had permitted its employees to leave work early for the Canada

[1] All times are Eastern Daylight Time.

Day holiday the following day. The driver travelled his usual route home, southwest on Barnsdale Road, which is a 2-lane asphalt road in a rural area. The road traverses the Barnsdale Road public level crossing, which is equipped with flashing lights, bell, and gates.

At about 1216, the train was proceeding westward[2] at 85 mph with its headlights and ditch lights on, in accordance with *Canadian Rail Operating Rules* (CROR) Rule 17(a) and Rule 19, as it approached the Barnsdale Road public crossing. The crossing is located at Mile 11.75 on the Smiths Falls Subdivision[3] (Figure 1).

The flashing lights at the crossing activated at 1216:04.[4] The gates began to descend 7 seconds later and were fully down (horizontal) at 1216:20.

As the vehicle crested the hill about 1300 feet northeast of the crossing, the gates were fully down. The vehicle then started to descend the hill, which had an average gradient of 4% before levelling out about 475 feet from the crossing.

Figure 1. Map showing the occurrence location (Source: Railway Association of Canada, *Canadian Rail Atlas*, with TSB annotations)

At 1216:27, the OLE sounded the locomotive horn and bell, in accordance with CROR Rule 13(a)(iv) and Rule 14(l).[5] At 1216:33, when the vehicle was 132 feet from the crossing,[6] moderate braking was being applied by the driver, and the vehicle was travelling at 79 km/h.

At 1216:37, the vehicle speed had been reduced to about 20 km/h as the driver steered around the crossing gates. The OLE immediately sounded the emergency horn and applied the emergency brakes just before the train struck the vehicle. The vehicle was thrown to the southwest side of the crossing, colliding with the south-side signal mast.

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2 Train direction is established by the subdivision timetable.

3 The Smiths Falls Subdivision is owned and operated by VIA.

4 All event times in this report have been normalized to coincide with the time log of the locomotive event recorder.

5 CROR Rule 14 describes the required engine whistle signals. Item (l) requires that a locomotive horn be sounded with 2 long, 1 short, and 1 long whistle at public crossings at grade. The whistling is to commence at a whistle post located ¼ mile before each public crossing and to continue until the train fully occupies the crossing.

6 Estimated using speed information from the vehicle's event data recorder (EDR), which records vehicle data for the last 5 seconds before an impact.

The vehicle was destroyed and the driver was fatally injured. No passengers on board the train were injured; however, 2 on-train services employees located in the coach cars sustained minor injuries, 1 who required medical attention.

Although the train did not derail, the locomotive sustained substantial damage, including damage to its front door that resulted in the door opening during the collision, allowing some debris to enter the locomotive cab and striking the ICLE, who was sitting in the middle seat, in the face. The ICLE's safety glasses prevented injury and no medical treatment was required. The train and passengers were delayed for several hours while VIA arranged buses to transport the passengers to their destination.

At the time of the occurrence, the temperature was 29 °C. The skies were clear, visibility was good, and road surfaces were dry.

Smiths Falls Subdivision and track information

The Smiths Falls Subdivision consists of a single main track that extends from Ottawa (Mile 0.0) to Smiths Falls, Ontario (Mile 34.4). Train movements on the subdivision are controlled by the centralized traffic control system, as authorized by the CROR, and are supervised by a RailTerm rail traffic controller located in Dorval, Quebec.

At the time of the occurrence, an average of 4 trains per day operated on the Smiths Falls Subdivision, with an additional 2 trains from Thursday to Sunday. In the year preceding the accident, VIA had reduced its schedule from the normal 12 trains per day due to the COVID-19 pandemic.

In the vicinity of the crossing, the track is rated as Class 5 according to the Transport Canada–approved *Rules Respecting Track Safety*. The authorized track speed for passenger trains is 100 mph; however, because of the combination of the locomotive and coach cars, the occurrence train was restricted to 95 mph.

Barnsdale Road public crossing

Barnsdale Road traverses the level crossing at an angle of approximately 38°.

A "Railway crossing ahead" sign and pavement markings (railway advance warning sign and "X" painted on the asphalt) on Barnsdale Road are located 1150 feet and 1125 feet, respectively, northeast of the crossing (Figure 2).[7]

Due to the speed of the trains in the area, the crossing is equipped with reflectorized signs, light-emitting diode (LED) flashing lights, bell and gates in accordance with Transport Canada's *Grade Crossings Standards*.[8] The gates were also equipped with 3 LED fixtures intended to identify the position of the gates in situations where there is inadequate light, particularly twilight or nighttime).

This crossing was designed to give drivers an approach warning time of 35 seconds, 10 seconds greater than the minimum of 25 seconds required.[9] However, because of the hill, a vehicle driver

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[7] The rail crossing was designed in accordance with the *Manual of Uniform Traffic Control Devices for Canada* (MUTCDC) at the time of its construction. An assessment of the crossing was performed in 2019 to correct any non-conformance with the standards in effect at the time of the assessment.

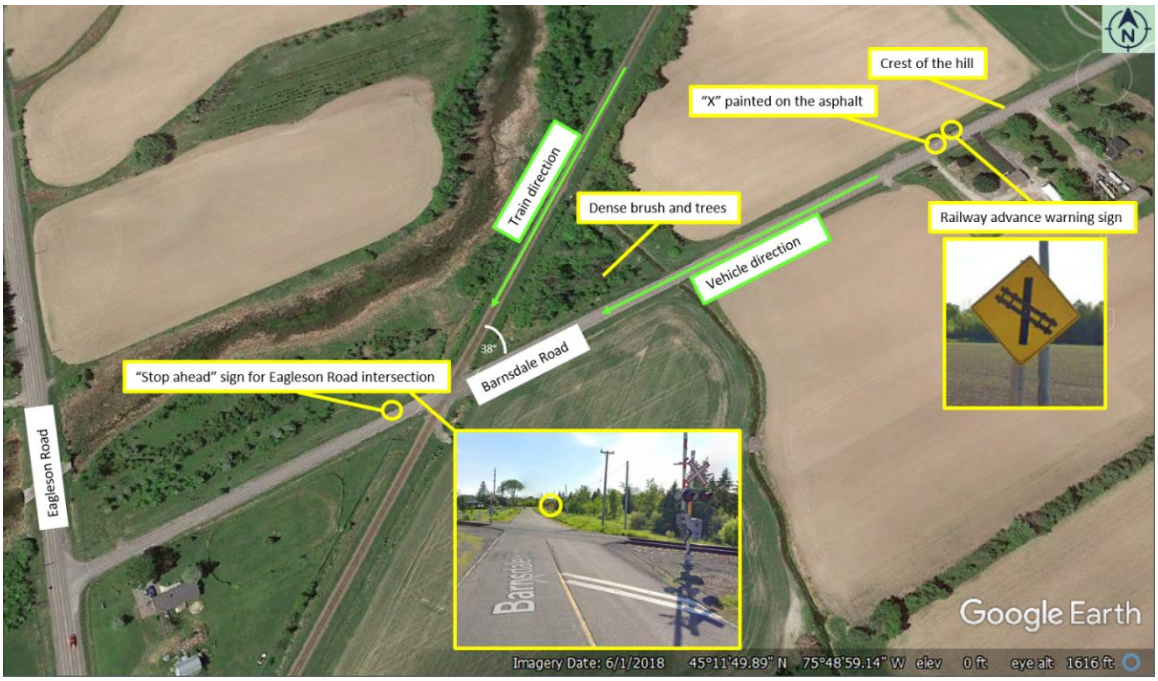
[8] Transport Canada, *Grade Crossings Standards* (01 January 2019), Section 9.2.

[9] Paragraph 16.1.1(a) of the *Grade Crossings Standards* requires that crossings with a clearance distance of 85 feet provide a minimum of 25 seconds of warning.

receives only about 18 seconds of warning (with the crossing in full view) if travelling at the posted speed limit of 80 km/h.

Because of the angle of the track and the dense brush and trees between the road and the track, a train approaching from the northeast is not visible to road users approaching from the east. Due to the visual cues provided by the warning system, which included gates, there were no sightline requirements, in accordance with section 22 of the *Grade Crossings Regulations*.

Figure 2. Aerial view of the Barnsdale Road crossing showing the direction of travel of the train and the vehicle, with inset photos of the railway advance warning sign and the "Stop ahead" sign for the Eagleson Road intersection (Source of main image: Google Earth, with TSB annotations. Source of inset images: Google Street View)



Vehicle inspection

The vehicle was owned by Westboro Utilities and was assigned to the driver who was responsible for identifying maintenance issues and arranging for them to be addressed at the cost of the company. By design, the vehicle cab does not have a rear window; therefore, the driver only has a 90° view through the passenger-side window.

A TSB review[10] of the vehicle and maintenance records indicated that it was in a mechanically sound state, and that it had received timely and appropriate service and maintenance.

City of Ottawa speed study

Following the occurrence, the City of Ottawa conducted a speed study over 8 days[11] to determine the average speed of traffic approaching the Barnsdale Road crossing. The speed study identified that

[10] TSB Engineering Laboratory Report LP104/2021, VIA Rail Collision at Barnsdale: Mechanical Inspection.

[11] The speed study was conducted from 31 August to 07 September 2021 (City of Ottawa, Speed analysis result).

vehicles increased their speed to 84 km/h as they approached the 4% descending grade, slowing down to 72 km/h at the rail crossing stop line and maintaining that speed through the crossing to the "Stop ahead" sign for the Eagleson Road intersection.[12]

Driver expectation

When a driver becomes familiar with a particular level crossing or with a particular type of level crossing, and where the driver has never, or seldom, encountered an approaching train at the level crossing, the driver will tend to not expect to encounter a train.[13] Since the driver in this occurrence was familiar with the crossing and had likely seldom encountered any trains there, he would likely have formed the expectation that there would not be a train at the crossing.

When drivers receive information contrary to their expectations, their performance tends to be slow or inappropriate.[14]

On-site simulation

The TSB conducted an on-site simulation after the accident to examine the conspicuity[15] of the crossing protection, the sightlines from a driver's perspective approaching the crossing from the east, stopping distances, and driver behaviour.

During the simulation, the TSB noted that, once the crossing gates were fully down, they blended into the background, and that the bright daylight conditions diminished the conspicuity of the gate lights. Consequently, the crossing gates and gate lights were not conspicuous from a distance, nor were they designed to be.

Furthermore, because of the acute angle of the crossing to the northeast (the driver's right), the dense brush and trees in that direction, and the limited visibility to the sides of and behind the vehicle cab, the train could not be seen by the driver.

The occurrence vehicle's speed as it approached the crossing was 70 km/h, consistent with the driver's anticipation of the stop sign at Eagleson Road. The fact that the brakes were applied so close to the crossing suggests that the driver likely perceived the activated crossing warnings only as he approached the crossing stop line. The driver's attempt to steer around the lowered crossing gates further suggests that he was likely unaware of how close the train was to the crossing and may have been taking evasive action to avoid a collision. Road testing using an exemplar vehicle indicated that the occurrence vehicle likely had adequate braking capacity to be able to stop, with full braking application, in time to avoid a collision.

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[12] The "Stop ahead" sign is located 106 feet west of the crossing, and the Eagleson Road intersection is 564 feet beyond that sign.

[13] R. E. Dewar and P. L. Olson, "Railroad grade crossing accidents," in R. E. Dewar and P. L. Olson (eds.), *Human Factors in Traffic Safety* (Lawyers & Judges Publishing Company, 2002), pp. 507–523.

[14] G. J. Alexander and H. Lunenfeld, FHWA-TO-86-1, *Driver Expectancy in Highway Design and Traffic Operations* (U.S. Department of Transportation, May 1986).

[15] Characteristics of objects that are likely to increase conspicuity and attract a driver's attention include: objects that differ greatly from their backgrounds in terms of brightness, colour and texture; flickering or flashing stimuli; objects of large size; and objects that are moving. (Source: D. Krauss, A. Tavassoli, and P. Olson, "Driver eye movements and visual attention," in *Forensic Aspects of Driver Perception and Response*, 4th edition (Lawyers & Judges Publishing Company, 2015), pp. 47–56).

Driver attention to visual cues and advanced warning

After the occurrence, data from the driver's electronic devices found on site were analyzed and it was determined that the devices were not in use at the time of this occurrence.[16]

Drivers periodically shift their focus to look further ahead or closer to their vehicle depending on several factors such as the presence of upcoming intersections, traffic density, time of day, weather, their own vehicle speed, and road geometry. Drivers continually perform visual scans to the left and to the right to monitor the outside environment, particularly the road signs. Up to 90% of drivers' visual attention is spent looking at elements directly ahead in their view, given that these are objects with which they are most likely to interact.[17]

While travelling west along Barnsdale Road toward the Eagleson Road intersection, drivers must shift their focus from the road ahead to the "Railway crossing ahead" sign and pavement markings (railway advance warning sign and "X" painted on the asphalt). The purpose of these warning signs is to attract drivers' visual attention toward the upcoming crossing so that they are more ready to respond to an active signal. If drivers are unable to see an approaching train or hear its horn, safety at the crossing relies solely on the conspicuity of the crossing signals.

Expectancies relate to a driver's readiness to respond to situations, and influence how quickly information is perceived and an appropriate course of action is selected. If a westbound driver on Barnsdale Road were not expecting a train, the driver's visual and cognitive attention would likely be focused on the "Stop ahead" sign and the intersection with Eagleson Road beyond the crossing. This focus away from the crossing would tend to increase driver reaction time to crossing warnings of an approaching train. The driver's delayed reaction in this occurrence was consistent with such an expectation.

Safety action taken

Following the occurrence, Transport Canada conducted a regulatory inspection of the crossing. The crossing met regulatory requirements with regard to visibility, sightlines, and crossing warning time.

Safety messages

A driver's familiarity with a railway crossing where trains are rarely encountered may lead, over time, to an increased expectation that there will be no train. It is important that all drivers, especially those who are familiar with a given railway crossing, attend to all visual cues in the forward roadway when approaching railway crossings with the expectation that they may encounter a train.

Eye injuries in the workplace are common and often preventable. In this occurrence, potentially serious injuries were prevented because the locomotive engineer was wearing safety glasses in the locomotive. Proper eye protection on the job is the best defence against eye injuries.

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[16] TSB Engineering Laboratory Report LP086/2021, NVM Data Recovery.

[17] D. Krauss, A. Tavassoli, and P. Olson, "Driver eye movements and visual attention," in *Forensic Aspects of Driver Perception and Response*, 4th edition (Lawyers & Judges Publishing Company, 2015), pp. 47–56.

This report concludes the Transportation Safety Board of Canada's investigation into this occurrence. The Board authorized the release of this report on 16 March 2022. It was officially released on 06 April 2022.

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.

ABOUT THIS INVESTIGATION REPORT

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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