



Transportation
Safety Board
of Canada

Bureau de la sécurité
des transports
du Canada



RAIL TRANSPORTATION SAFETY INVESTIGATION REPORT R19M0018

MAIN-TRACK TRAIN DERAILMENT

VIA Rail Canada Inc.

Train 14

Mile 15.27, Canadian National Railway Company Newcastle Subdivision

Coal Branch, New Brunswick

04 April 2019

Canada^{🇨🇦}

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Citation

Transportation Safety Board of Canada, *Rail Transportation Safety Investigation Report R19M0018* (released 30 September 2020).

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Rail transportation safety investigation report R19M0018

Cat. No. TU3-11/19-0018E-PDF
ISBN: 978-0-660-36042-3

This report is available on the website of the Transportation Safety Board of Canada at www.tsb.gc.ca

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Summary

On 04 April 2019, at approximately 1235 Atlantic Daylight Time, VIA Rail Canada Inc. (VIA) passenger train 14 (VIA 14, or the train), travelling eastward at approximately 60 mph, derailed the 2 tail-end cars (VIA 7600 and VIA 8711) at Mile 15.27 of the Canadian National Railway Company (CN) Newcastle Subdivision. VIA 14 had been travelling over the Lakeville Road crossing when 2 passenger cars derailed upright. The train came to a stop with the head end at Mile 14.2. Three passengers sustained minor injuries. No dangerous goods were involved.

1.0 FACTUAL INFORMATION

At approximately 1015¹ on 04 April 2019, a CN foreman performing a track inspection in a hi-rail truck had passed through the area of the occurrence, with no abnormal track conditions reported. CN freight train 569, consisting of 1 locomotive and 3 cars, had also passed through the area at about 1038; no rough track conditions were reported by its crew.

VIA train 14 consisted of 2 head-end 6400-series locomotives (VIA 6418 and VIA 6421), 13 Renaissance passenger cars, and 1 head-end power (HEP) Park car² (or dome car). There were 94 passengers on board and 14 VIA employees.

¹ All times are Atlantic Daylight Time.

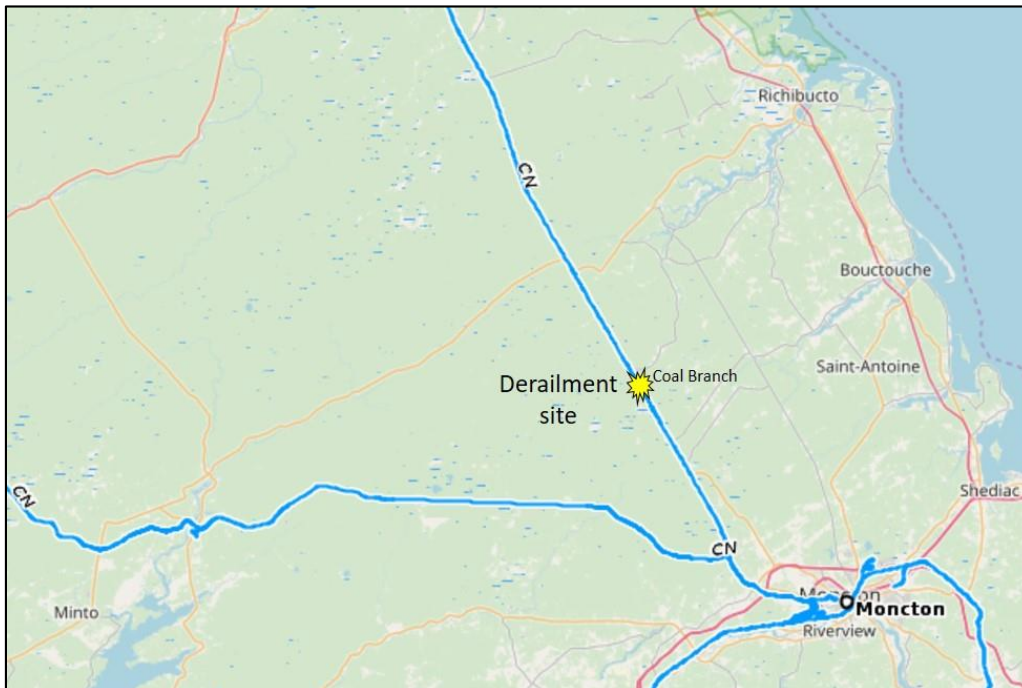
² These cars are referred to as Park cars, as each of these cars are named after a national or provincial park. They are also referred to as dome cars because of the glass dome at the top of the car.

At about 0750 on 04 April 2019, VIA 14 stopped in Campbellton, New Brunswick, for a crew change. The operating crew consisted of 2 qualified locomotive engineers: an operating locomotive engineer and an in-charge locomotive engineer. The operating locomotive engineer was positioned at the controls on the right side of the locomotive cab. The in-charge locomotive engineer was positioned on the left side of the cab and was responsible for various duties such as radio communications, copying authorities, and emergency response.

1.1 The occurrence

On 04 April 2019, at about 1235, while travelling eastward at approximately 60 mph, VIA 14 approached the Lakeville Road public grade crossing at Mile 15.27 of the Newcastle Subdivision, in Coal Branch, New Brunswick (Figure 1). As the locomotives travelled over the crossing, the operating crew experienced rough track conditions. Seconds later, they received a radio call from the service manager, who was located in the 4th car, reporting that there had been a hard impact. The operating crew discussed the situation and attributed the reported hard impact to the rough track conditions they had encountered a few seconds earlier, and considered reporting the issue to CN for follow-up.

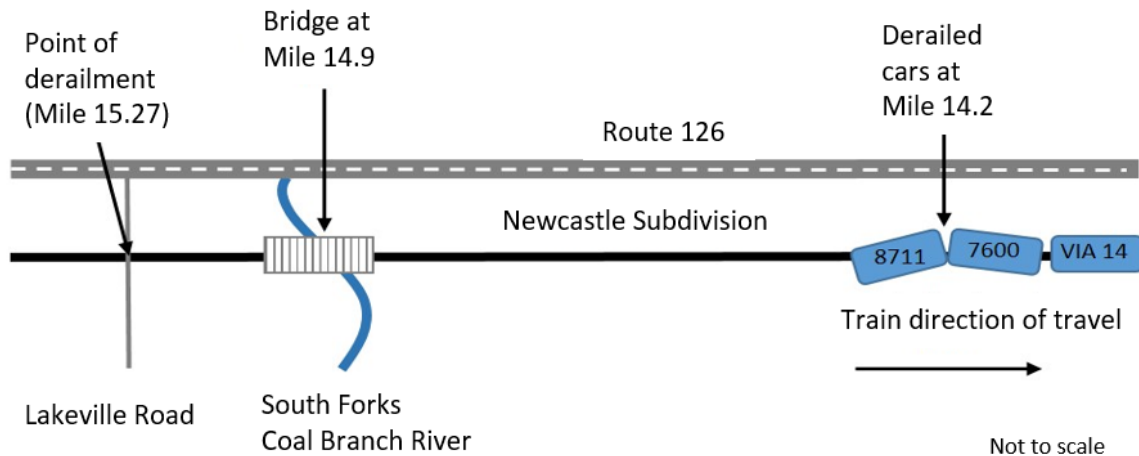
Figure 1. Occurrence location (Source: Railway Association of Canada, *Canadian Rail Atlas*, with TSB annotations)



As VIA 14 was approaching a bridge located at Mile 14.9, approximately 1950 feet east of the crossing, the throttle position was increased from notch 5 to notch 8 (full throttle). While the train was crossing the bridge, it unexpectedly started to slow down. The operating crew investigated the cause of the loss of speed and observed through the locomotive's side mirrors indications of a possible derailment at the tail end of the train. The crew initiated a brake application, bringing the train to a controlled stop at Mile 14.2,

just over 1 mile from the crossing (Figure 2). The initiation of the brakes occurred 1 minute and 9 seconds after the cars had derailed and the train had slowed to approximately 15 mph.

Figure 2. Diagram of the occurrence site (Source: TSB)



Upon inspection, the operating crew determined that the last 2 passenger cars had derailed upright and remained coupled to the train (Figure 3). There had been no train-initiated or occupant-initiated emergency brake application.

In accordance with the applicable regulatory requirements, the operating crew made an emergency call to the rail traffic controller. Emergency responders, consisting of the local Beersville-Harcourt Fire Department, paramedics, and the Royal Canadian Mounted Police, were dispatched, arriving at the site approximately 15 minutes later. Three of the passengers were assessed with minor injuries on site. Approximately 4 hours after the derailment, all passengers had been transferred from the site to buses as an alternate means of transportation.

At the time of the occurrence, the weather was 1 °C, overcast, with good visibility. The area had received 9 cm of snow the previous night.

Figure 3. The last 2 VIA passenger cars, derailed upright (Source: Canadian National Railway Company)



1.2 Site examination

At the Lakeville Road crossing, a section of the rail head approximately 119 inches long was missing from the north side of the track at Mile 15.27. This was determined to be the point

of derailment. The missing section of rail had broken into multiple fragments, the majority of which was recovered in the vicinity of the crossing. Ground scarring was observed on the crossing surface and on the field side of the track. Track gauge measured at the west end of the crossing was 57 inches, which is within the allowable gauge limit (57 ½ inches). Wear was observed on the base of the rail at the tie plates.

At Mile 14.9 of the CN Newcastle Subdivision, there was an open-deck steel bridge. The bridge was 133.5 feet in length, with 2 stone abutments, 2 stone piers, and a concrete bridge seat. On the bridge, the track consisted of 100-pound rail, with 100-pound guard rails (also called Jordan rails)³ installed at a 9-inch offset. The stone abutment on the northwest side of the bridge had sustained impact damage from one of the derailed cars. About 100 ties and the guard rails had also sustained damage during the occurrence (figures 4 and 5).

Figure 4. Bridge deck damage
(Source: TSB)



Figure 5. Bridge at Mile 14.9 with damaged ties (Source: TSB)



The 2 tail-end cars on VIA 14 were derailed:

- The 14th car (VIA 8711) had derailed all wheel sets, but remained upright. The wheel sets, the truck frames, the air reservoir tank, and various brake components had sustained damage. Impact marks were present on the B-end right-side corner, likely due to contact with the bridge abutment during the derailment.
- The 13th car (VIA 7600) had derailed its 2 trailing wheel sets, but remained upright. The underside of the car, the trailing wheels, the truck frame, and various brake components had sustained damage.

The remainder of the train had not derailed. All wheel sets from the 2nd to the 12th cars had impact marks on the north-side wheels, likely from contact with the broken rail (Figure 6). These markings were progressively less visible on the wheel sets of the cars

³ Jordan rails are guard rails placed parallel to the running rails in the centre of the track. They are typically used on bridges or in tunnels to help prevent derailed equipment from going off the side of the track.

toward the head end. On the locomotives and first car, no observable markings were present on the wheel sets.

Figure 6. Impact mark on wheel of the 10th car (Source: TSB)



The interior of the 14th car (VIA 8711) had sustained damage. Loose items such as coffee machines and folding chairs were displaced within the car. Folding benches and armchairs were dislodged, blocking a doorway to the sleeping quarters (Figure 7). Ceiling panels had partially dislodged over the panoramic seating area (Figure 8).

Figure 7. Blocked doorway on VIA 8711 (Source: TSB)



Figure 8. Partially dislodged ceiling panels on VIA 8711 (Source: TSB)



The vestibule bellows between the 14th car and the 13th car were compressed and off centre. However, the passageway between these 2 cars was not obstructed.

1.3 Evacuation of passengers in VIA 8711

During the derailment, the 6 occupants (5 passengers and 1 on-train services (OTS) employee) in the 14th car tried to avoid being thrown around by bracing themselves against the secured appliances. After the train came to a complete stop, the OTS employee in the 14th car issued emergency evacuation instructions verbally. As the forward car (13th car)

was derailed, the OTS employee initially considered evacuating the 5 passengers through the normal and emergency exits. However, the passengers did not feel comfortable exiting the train into the cold weather using the available doors and steps. After assessing the situation and with the service manager's assistance, the 5 passengers were evacuated from the 14th car through the 13th car and into the forward section of the train.

1.4 Train information

VIA 14 is a passenger train operating from Montréal to Halifax 3 times per week. On the day of the occurrence, it comprised 2 locomotives and 14 cars. The train had received a certified inspection prior to departing Montréal. Thirteen of the cars were Renaissance cars, some of which were configured for seated passengers and others as sleeping quarters, showers, and dining and baggage areas. The 13th car (VIA 7600), an empty Renaissance car, was being used as a transition⁴ car between the dome car and the other Renaissance equipment on the train.

The 14th car (VIA 8711), a dome car, was a sleeper car built by the BUDD company in 1954.

Each car in the train had emergency brake handles that could be used by car occupants to initiate emergency braking. The 14th car (VIA 8711) had 3 such brake handles. When any brake handle is activated, the emergency brakes are applied to every car and locomotive to stop the train.

1.5 Personnel information

1.5.1 Operating crew

The 2 locomotive engineers were qualified for their respective positions and met established fitness and rest requirements. They were both familiar with the territory and had begun their shift on VIA 14 in Campbellton at 0710 on 04 April 2019.

1.5.2 On-train services employees

OTS personnel consisted of 11 service staff: a service manager, a service coordinator, an assistant service coordinator, and 8 senior service attendants. An equipment maintenance employee was also on board. All employees were qualified for their respective duties and were familiar with the territory.

OTS employees, who are each assigned an area of the train, are responsible for passenger safety and comfort. Typically, it is the service manager who communicates with the operating crew by radio when required.

⁴ A transition car is required between the HEP and Renaissance rolling stock as they use different types of coupling systems.

1.6 Means of communication for on-train services personnel

OTS employees are each issued a personal handheld radio as well as a cellular telephone. The handheld radios, which provide an immediate communication capability by way of a push-to-talk button, are used by the OTS employees throughout their work shift to communicate with each other and with the service manager on a dedicated channel. These portable radios are also used in emergencies, in accordance with VIA's Emergency Communication Procedures.⁵

In this occurrence, the OTS cellular telephone did not have the operating crew members' numbers on speed dial.

It is not unusual for the service manager to use a different dedicated radio channel for communicating with the operating crew when required. Other OTS personnel can also contact the operating crew directly in an emergency by switching their portable radio to the appropriate channel.

These portable radios have an integrated belt clip (Figure 9).

VIA also makes available to OTS employees different types of radio holsters and carriers (Figure 10). These accessories, used at the discretion of individual VIA employees, protect the radios from external shocks and help secure the radio to the employees.

In this occurrence, the OTS employee located in the 14th car had his portable radio clipped to his belt using the integrated plastic belt clip. The car's derailment created significant dynamic forces, which caused the radio to unclip from the employee's belt, fly out of reach, and lose its battery. This left the employee with only the cellular telephone and no means of immediately communicating with the operating crew.

Following the derailment and while the train was still moving, the OTS employee held onto a fixed appliance and was unable to reach any of the car's emergency brake handles.

Figure 9. Portable radio used by VIA (Source: VIA Rail Canada Inc.)



Figure 10. Portable radio holsters/carriers available to OTS personnel (Source: VIA Rail Canada Inc.)



⁵ VIA Rail Canada Inc., *OTS Radio Protocol Certification: Leader's Guide* (March 2015, last update May 2018), Radio Protocol Certification: Rule 125 – Emergency Communication Procedures, p. 15.

Since 1997, the TSB has investigated 3 other occurrences involving issues relating to radio securement (Appendix A).

1.7 Subdivision information

The CN Newcastle Subdivision is a single main track that extends between Catamount, New Brunswick (Mile 0.0) and Campbellton (Mile 173.2). Train movements are governed by the occupancy control system (OCS), as authorized by the *Canadian Rail Operating Rules* and supervised by an RTC based in Montréal. OCS territory is non-signalled (also referred to as dark): movements are controlled through the use of clearances, track occupancy permits, general bulletin orders, and other instructions. As there is no centralized system monitoring track integrity in OCS territory, broken rails are not systematically detected in real time. The system therefore relies on track inspections⁶ and operating crew reports to identify locations with potential track issues.

Rail traffic in the area of the crossing consists of an average of 2 trains per day (passenger and freight), with an annual average of approximately 1.1 million gross tons.⁷

1.8 Particulars of the track

The track is maintained as Class 3, according to the Transport Canada (TC)-approved *Rules Respecting Track Safety*, also known as the Track Safety Rules (TSR). The track consists mostly of 100-pound continuous welded rails lying on wooden crossties and ballast. The maximum authorized speed is 60 mph for passenger trains and 40 mph for freight trains.

1.9 Lakeville Road crossing

The Lakeville Road crossing at Mile 15.27 is a public crossing protected with standard railway crossing signs (crossbucks) and stop signs. The crossing is constructed of lumber planks, 100-pound rail, rubber mudguard, and an asphalt surface. It is located approximately 100 feet away from a 2-lane highway. This highway is frequently salted and sanded during winter conditions.

⁶ CN has various hi-rail and track inspection vehicles as well as vehicle/track interaction locomotives that are used to identify track surface irregularities. CN has also implemented an autonomous track inspection program using autonomous track inspection cars to monitor for developing track conditions.

⁷ In Canada, there are about 6500 crossings located in federally regulated subdivisions with an annual average tonnage of 1.1 million gross tons or less. (Source: Transport Canada)

1.10 Track inspections and maintenance

1.10.1 Regulatory and company requirements for track inspections and maintenance

The TSR outline the minimum track maintenance standards and related track inspection requirements. The rules state, “[e]ach railway company shall have written requirements establishing maximum railwear limits [...]”.⁸ They do not include specific provisions regarding rail corrosion.

To provide further guidance for track inspections and maintenance, CN has developed its Engineering Track Standards, which meet or exceed the TSR requirements. These standards do not contain specific requirements concerning rail corrosion in general, or corrosion of the rail web in particular.

Although regulators in North America do not specifically require the inspection for corrosion, a regulator in Australia lists corrosion as a visual inspection item for its railways in its defect handbook,⁹ but does not specify condemning limits.

1.10.2 Track inspections and maintenance on the Newcastle Subdivision

CN’s track inspections for the Newcastle Subdivision were performed at predetermined frequencies, in accordance with the TSR.

In the vicinity of the Lakeville Road crossing, the most recent track inspections were the following:

- A visual inspection by hi-rail vehicle on 04 April 2019. No defects were noted.
- An ultrasonic rail flaw inspection on 28 December 2018 by Herzog Services, Inc. No internal rail defects were noted for the area.
- A track geometry inspection on 04 October 2018. No anomalies were noted.

The investigation was not able to determine when the Lakeville Road crossing was last rehabilitated.

1.10.3 Track inspection techniques

Visual inspections are designed to detect visible flaws in the track structure such as broken rails or wide gauge. They are performed by a qualified track inspector, normally from a hi-rail vehicle. As the vehicle travels over the rails, the inspector will visually inspect the track components and listen for any anomalies. A more detailed visual inspection can also be performed on foot, when warranted. At road crossings, due to the presence of the crossing

⁸ Transport Canada, *Railway Track Safety Rules* (effective 25 May 2012), subpart D: Track Structure, section X: Rail Wear, p. 26.

⁹ New South Wales (NSW) Government, NSW Transport RailCorp, *Engineering Manual – Track: Rail Defects Handbook* (June 2012, Version 1.2), section C10-2.9: Excessive web corrosion, p. 75.

structure, only the head of the rail is typically exposed for visual inspection. The web and base of the rail are generally not visible unless the crossing structure is removed.

Ultrasonic rail flaw inspection is the primary method used to detect internal rail defects. This type of inspection is performed using specialized rolling stock or modified hi-rail vehicles. Ultrasonic waves are introduced into the rail from above to scan for internal defects. The data collected are then analyzed and submitted to the railway for appropriate action. This type of inspection is not currently designed to identify rail web and base corrosion at crossings.

Track geometry inspections are performed to measure several elements of the track geometry such as alignment, cross-level, surface, gauge, and rail wear. These inspections can be performed by a specialized hi-rail vehicle, a self-propelled rolling stock, or a modified rail car.

None of these track inspection techniques are specifically designed to measure the thickness of the web of the rail.

1.10.3.1 Ultrasonic rail flaw detection testing

Ultrasonic testing provides a cost-effective and efficient way to test for flaws in the rail. A regularly scheduled ultrasonic testing program will help minimize the number of rail breaks that occur during train operations, by identifying defects before they progress to failure. The technology for ultrasonic inspection (i.e., hardware, software and flaw detection algorithms) is continuously evolving, resulting in improved capabilities to detect defects of interest.

The American Railway Engineering and Maintenance-of-Way Association (AREMA) *Manual for Railway Engineering* presents a recommended minimum performance guideline for ultrasonic rail testing.¹⁰ This guideline is often used as the basis for an agreement between the rail testing supplier and the railway for a minimum acceptable performance standard.

As with all non-destructive test methods, ultrasonic testing has limitations. While the technology is generally successful at detecting flaws in the head of the rail, it is less effective at detecting defects located deeper in the web or in the base of the rail. The detectability of defects depends on their size and orientation and can be influenced by rail surface conditions such as the presence of grease or dirt on the rail head, which is common at crossings.

Ultrasonic testing could be used to detect material loss, such as corrosion, in the web by repositioning the scanners, but it is not currently designed to do so. For example, this technology could be used in locations where one side of the rail web is accessible. Current ultrasonic testing cannot be used to detect material loss in the web of the rail at a crossing without removing the crossing surface.

¹⁰ American Railway Engineering and Maintenance-of-Way Association (AREMA), *Manual for Railway Engineering*, Chapter 4, section 4.3.2.

1.11 Examination of failed rail

In this occurrence, a section of rail head, approximately 119 inches in length was missing from the north side of the Lakeville Road crossing (Mile 15.27). This section of rail had broken into several pieces during the derailment, the majority of which was recovered in the vicinity of the crossing. Approximately 7 inches of the rail base, 12 inches of the rail head, and some segments of the web could not be found. The recovered broken rail pieces were sent to the TSB Engineering Laboratory in Ottawa for detailed examination (Figure 11).

Figure 11. Recovered rail fragments (Source: TSB)



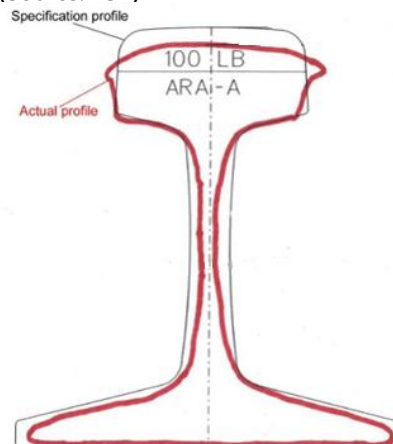
The rail was 100-pound continuous welded rail manufactured by Sydney in 1989. The following was noted:

- Of the multiple rail pieces recovered, 1 piece, located between 40 and 46 inches from the easternmost fracture point of the rail, had a deep gouge on the field side.
- All rail fragments exhibited severe generalized corrosion, particularly on the web and base of the rail.
- Significant material loss had occurred (Figure 12). The rail web had corroded to about 0.16 inch (4 mm) at its thinnest point near the centre of the crossing, which was less than one third of its original thickness of 0.56 inch (14.28 mm) (Figure 13).
- The web of the broken rail was approximately 0.43 inch (11 mm) thick at its eastern extremity and approximately 0.28 inch (7 mm) thick at its western extremity.

Figure 12. Fragments of recovered rail (Source: TSB)



Figure 13. Profile overlay of occurrence rail (Source: TSB)



The laboratory examination did not identify any pre-existing internal defects in the rail. External impacts were ruled out based on the direction and shapes of impact markings on the rail.

Examination of the fracture surfaces suggested that the rail head fragments in the eastern portion of the broken rail had fallen to the gauge side of the rail, while the rest of the rail head fragments had fallen to the field side. All the fracture surfaces on the rail fragments had a rough granular appearance typical of overstress fracture. No signs of fatigue were present.

Corrosion scale from the occurrence rail was analyzed by energy dispersive x-ray spectrometry in a scanning electron microscope. It was noted that:

- One analyzed region contained mostly iron oxide with traces of sodium and chlorine.
- Other regions contained numerous elements extraneous to both steel and iron oxide: sodium, silicon, chlorine, magnesium, aluminum, potassium, and calcium.

These extraneous elements are typically found in sands and salts, which are generally applied by the road authority to control snow and ice, and are often transferred from the road surface.

The thinning of the rail web, which affected the ability of the rail to withstand vertical and lateral loads, was the result of corrosion. Rail corrosion occurs when carbon steels react to environmental conditions, resulting in oxidization. Carbon steels have lower corrosion rates in dry open atmospheres but the rate of corrosion increases in the presence of moisture, chlorides, or saline environments.

At crossings, the rail can be exposed to road debris such as salt and sand that is deposited by passing vehicles, creating a corrosive environment.

1.12 Cues and indicators of a derailment to operating crew members

For the operating crew to become aware that one or more cars on the train has derailed, the first indication is often a train-initiated emergency brake application or an emergency brake application initiated by a car occupant (i.e., passenger or service employee). When such a brake application does not occur, operating crew members must rely on train handling indications or on information from other sources such as OTS personnel or wayside railway employees.

In this occurrence, the 2 cars that derailed had remained upright and coupled; the second-to-last car stayed mostly in line with the rest of the train, while the last car had become visibly skewed. The flexible air hose that connected the derailed rolling stock did not separate, and consequently there was no train-initiated emergency brake application.

In a car occupant-initiated emergency brake application, an occupant would pull one of the emergency brake handles in the passenger car, causing the emergency brakes of the train to automatically apply. In this occurrence, the occupants of the 14th car, including the OTS

employee, had braced against secured appliances to avoid being thrown around by the significant dynamic forces during the derailment and so were unable to reach and pull any of the emergency brake handles.

As the train travelled over the crossing, the operating crew members experienced a rough ride and subsequently received a report of a hard impact from the 4th car. The operating crew attributed these events to rough track conditions at the crossing and did not immediately consider that a derailment had occurred. At that time, the train was travelling up a 1.0% grade and its throttle was gradually increased to full throttle as it approached the bridge. When the train started to lose speed, the crew initially suspected a loss of power from the second locomotive. As there were no alarms or warnings to indicate this, the crew began to investigate the situation. Using the locomotive's side mirrors, the crew observed indications of a possible derailment at the rear of the train. They then initiated a brake application, which brought the train to a slow and controlled stop. The brakes were applied 1 minute and 9 seconds after the cars had derailed and the train had slowed to approximately 15 mph.

The operating crew was not promptly informed of the derailment by the OTS employee in the 14th car. This employee had lost his radio during the derailment and had no means of communicating immediately with the rest of the crew.

Since 1991, the TSB has investigated 4 other occurrences involving the derailment of a VIA train that continued to travel down the right-of-way without the operating crew being immediately aware of the derailment (Appendix B).¹¹

In other jurisdictions such as Europe, research and development of electronic and mechanical technologies for the identification of pre-derailment conditions and the detection of derailments have been ongoing over the past few years. The development of electronic systems that can identify and mitigate pre-derailment conditions is ongoing, but mechanical systems that can be retrofitted to truck frames of existing rolling stock are available.¹² Such pneumatic-based mechanical devices include the Knorr-Bremse EDT101, which can be used on both freight and passenger operations,¹³ and the Wabtec MDV100, which can be used on freight operations. These devices, which will initiate an emergency brake application upon the detection of a derailment and do not require any electrical power, are currently being used by several European railways, although their implementation is not mandatory. No dedicated on-board derailment detection systems are currently in use in Canada.

¹¹ TSB railway investigation reports R91H0006, R95Q0014, R96T0095, and R08M0015.

¹² European Union Agency for Railways, ERA-WKG-015, "Guidelines concerning the use of derailment detectors," available at https://www.era.europa.eu/sites/default/files/activities/docs/guidelines_from_eu_agency_for_railways_use_derailment_detectors_en.pdf (last accessed 16 September 2020).

¹³ The Knorr-Bremse EDT101 is used for passenger cars in Europe. (<https://www.knorr-bremse.at/en/railvehicles/products/trainsafety/edt101.jsp>).

1.12.1 Operating crew mental model

Although mental models and assumptions about the environment are useful to help a person filter, organize, and act on large amounts of information quickly and without error, there can be discordance when a mental model and the actual situation do not match. For example, when an individual receives information contrary to their expectations, their response tends to be slower or inappropriate.

It is not unusual for operating crews to experience rough track conditions during freeze-thaw cycles, which can occur at the same time of year as in this occurrence. When operating trains in such circumstances, the crews' mental models and expectations would likely be conditioned according to their previous experiences and training. The crews' default action would therefore be to continue normal train operations.

When an engine experiences a loss of power on a track incline, the train slows down and warnings and/or alarms are displayed in the locomotive cab. When operating trains on a track incline, crew members would base their reaction on their previous experiences and training.

1.13 Railway passenger safety

1.13.1 Regulatory requirements for passenger handling in emergencies

The Transport Canada *Railway Passenger Handling Safety Rules*¹⁴ prescribe the minimum requirements for the safe handling of passengers by railway companies. These rules require that a written plan be in place to ensure passenger safety in an emergency, and include a reference to the Railway Association of Canada (RAC)'s Circular O-6 entitled *Passenger Train Handling Safety and Emergency Procedures*.¹⁵

The RAC circular outlines the method for evacuation during an emergency. It states the following:

12.2 Method of Evacuation

The method of evacuation to be selected, is the one that offers maximum passenger safety and minimum inconvenience. Evacuation to roadbed should be avoided unless no other means of evacuation is possible. The preferred methods of evacuation, in priority order are:

¹⁴ Transport Canada, *Railway Passenger Handling Safety Rules* (31 March 2000).

¹⁵ Railway Association of Canada, Circular O-6, *Passenger Train Handling Safety and Emergency Procedures* (31 March 2000).

- a) from one car to another car;
- b) from train to station platform;
- c) from train to public or private crossing;
- d) from one train to another;
- e) from train to roadbed¹⁶

According to the RAC circular, on-board personnel are required to be trained, tested, and qualified on the railway's passenger handling safety plan, including first aid and the safe handling and evacuation of passengers during an emergency.

VIA's emergency preparedness and response procedures are included in the company's *Guide On Train Services* document.

1.13.2 Regulatory requirements for passenger safety

TC's *Railway Passenger Car Inspection & Safety Rules*¹⁷ prescribes the minimum safety standards for passenger cars operated by railway companies in trains at speeds not exceeding 125 mph (200 km/h). These regulatory requirements apply to new equipment ordered after 01 April 2001 and include provisions related to the securement of passenger seating.¹⁸

1.13.3 VIA Rail Canada Inc. dome cars

VIA currently operates approximately 110 head-end power (HEP) cars for specialized services such as dining, and sleeping, as well as dome cars. HEP cars in the VIA fleet are older cars built between the 1940s and 1960s. As such, they are not subject to the modern safety standards set in place by the *Railway Passenger Car Inspection & Safety Rules*.

Older cars in VIA's fleet, including dome cars, have had several upgrades over the years. Safety upgrades in dome cars included installation of emergency exit windows, securement of various furniture items, and installation of restraint systems for carry-on baggage. However, folding chairs and other seating items are still unsecured.

In 2018, VIA launched the "Heritage Program" in order to renovate and modernize a large portion of its fleet, including some of the HEP cars. The fleet of dome cars, which VIA expects to keep in service for up to another 25 years, is not part of this renovation program.

¹⁶ Ibid., subsection 12.2: Method of Evacuation, p. 9.

¹⁷ Transport Canada, *Railway Passenger Car Inspection & Safety Rules*, TC-O-0-26 (08 November 2001).

¹⁸ Unless otherwise specified in the Transport Canada *Railway Passenger Car Inspection & Safety Rules* (TC-O-0-26), "new equipment ordered after 01 April 2001 shall be designed and constructed in accordance with the Safety Standards of the latest revision in effect at the time of order of the 'American Public Transit Association (APTA) Manual of Standards And Recommended Practices For Passenger Rail Equipment', or equivalent standard."

Each dome car in the VIA fleet includes 3 sleeping quarters, 24 fixed permanent seats in the dome (6 rows of 2 pairs of forward-facing seats), and a panoramic lounge at the rear. Seating in the rear panoramic lounge generally consists of 10 lounge chairs arranged facing inwards. Each lounge chair is unsecured and weighs approximately 60 pounds. Sleeping quarters generally include a secured folding bench as well as 2 individual folding chairs which are unsecured.

There are 4 emergency doors in each dome car:

- 2 are located by the stairs on both sides at the front of the car;
- 1 is located directly through the vestibule door at the front end of the car; and
- 1 is located at the rear of the car.

Several emergency window exits are located in the sleeping quarters, the buffet lounge and the upper dome section.

1.13.4 Previous TSB investigations involving occupant safety issues on passenger trains

Since 1997, the TSB has investigated 6 railway occurrences where a number of occupant safety issues were identified (Appendix C).¹⁹ These issues included unsecured furniture, loose baggage, and inaccessible or insufficient emergency exit routes.

Although VIA has not made any major retrofits to older cars since the 1990s, it has upgraded the carry-on baggage restraint systems and installed a greater number of emergency exits. Improvements were also made to emergency response procedures and instructions. These actions were deemed by TC to be acceptable changes to address the safety issues.

1.14 TSB laboratory reports

The TSB completed the following laboratory report in support of this investigation:

- LP088/2019 – Failed Rail Examination

¹⁹ TSB rail transportation safety investigation reports R97H0009, R99S0100, R00M0007, R01M0024, R05E0008, and R06V0119.

2.0 ANALYSIS

The analysis will focus on the corrosion of the rail, track inspection methods, radio use by on-train services (OTS) employees, and passenger safety.

2.1 The occurrence

The derailment occurred as the train travelled over the public grade crossing at Mile 15.27 of the Canadian National Railway Company (CN) Newcastle Subdivision, and the rail broke beneath the train. At the crossing, while the train was travelling at approximately 60 mph, the operating crew members experienced rough track conditions. Rough track conditions at crossings are not unusual during the freeze-thaw cycle, because the ground density changes, slightly altering the track geometry. As the 4th car travelled over the crossing, a hard impact was experienced by its occupants. The service manager on board that car immediately reported the hard impact to the operating crew by radio. The operating crew attributed the reported hard impact to the previously experienced rough track conditions and continued operating the train normally.

The north rail had progressively fractured under the normal forces exerted by the rolling stock as the train was travelling over the crossing, and the 13th and 14th cars derailed. The derailed cars, which remained coupled and upright, continued travelling over the track structure for over a mile.

There was no train- or occupant-initiated emergency brake application. While the 14th car was travelling in the derailed condition, the occupants, who had braced themselves against secured appliances to avoid being thrown around, were unable to reach any of the car's emergency brake handles. The OTS employee who was located in the 14th car was not able to immediately communicate with the operating crew to alert them of the derailment, because his portable radio was thrown out of his reach when the derailment occurred.

Unaware that the last 2 cars had derailed, the operating locomotive engineer continued to operate the train normally, keeping it at full throttle in order to maintain speed on the ascending grade. Eventually, the dragging forces due to the 2 derailed cars started to slow the train. With the train continuously losing speed, the operating crew began investigating the situation.

The locomotive engineer continued to operate the train normally until the operating crew became aware of the derailment, at which time the locomotive engineer initiated a brake application, bringing the train to a controlled stop.

2.2 Assessment of rail conditions at crossings

Road crossing structures are exposed to road debris such as salt and sand that can be deposited by passing vehicles. These structures inherently hold moisture and debris, creating an environment where rail can be more susceptible to corrosion than if they are located in an open atmosphere environment. Over time, this corrosion can lead to the thinning of the rail web.

In Canada, there are approximately 6500 federally regulated crossings in low annual tonnage subdivisions, where the annual average train traffic is 1.1 million gross tons or less. As part of normal railway maintenance practices, rail at crossings located in high annual tonnage subdivisions likely need to be replaced due to normal wear before corrosion affects the rail strength. At crossings located in low annual tonnage subdivisions, such as the Lakeville Road crossing, the rail is generally not required to be replaced as often because of slower rail wear.

2.2.1 Web thickness

Rail fragments recovered from the occurrence site exhibited severe generalized corrosion, particularly on the web and base. The laboratory examination did not identify any pre-existing internal defects in the recovered fragments. However, the rail web had corroded to approximately 4 mm at its thinnest point, less than $\frac{1}{3}$ of its original thickness.

Such a significant loss of web material due to corrosion affected the ability of the rail to withstand the dynamic vertical and lateral loads associated with wheel-rail interaction. The web of the rail that fractured had thinned due to corrosion to a point where it could no longer support normal train forces.

The Lakeville Road crossing is approximately 100 feet away from a 2-lane highway. The highway is frequently salted and sanded in winter conditions. These abrasives were likely transferred by vehicles travelling from the highway over the Lakeville Road crossing and migrated into the crossing structure, creating a corrosive environment within the structure. Over time, the environmental conditions at the crossing and the effects of winter road salt in particular caused the rail web to corrode at an accelerated rate.

2.2.2 Track inspections and maintenance

The Transport Canada (TC)-approved *Rules Respecting Track Safety*, also known as the Track Safety Rules (TSR), outline the minimum track maintenance standards and related track inspection requirements. The TSR do not include specific provisions for identifying and assessing rail corrosion, including corrosion or thinning of the rail web, which are particularly important at railway crossings where the crossing structure can hold corrosive substances (e.g., road salt) and moisture and obstruct inspection of the rail web.

The regulatory requirements included in the TSR are the minimum provisions that railways are required to follow. Individual railway companies can set additional inspection requirements tailored to their particular operations.

CN's Engineering Track Standards (ETS) provide further guidance that meets or exceeds the TSR requirements, including additional inspection requirements tailored to CN's operations. However, CN's ETS do not include specific provisions concerning rail corrosion, including corrosion of the rail web.

CN's track inspections for the Newcastle Subdivision were performed at their predetermined intervals according to TC's TSR, in accordance with the applicable

regulatory requirements and the ETS. However, the corrosion of the rail web at the crossing had not been identified by the visual or ultrasonic track inspections, because the web of the rail was hidden by the crossing surface. In order to assess the condition of the web and base of rail sections at crossings, portions of the crossing structure may need to be removed periodically.

If rail web thinning due to corrosion is not assessed at appropriate intervals, particularly at crossings, which are more susceptible to the effects of saline environments, rail with compromised web sections can go undetected, increasing the risk of an in-service failure.

2.3 Communications during emergencies

During emergency situations, the ability of OTS personnel and operating crews to communicate with each other is paramount to ensure safety.

Every OTS employee is issued a portable radio that is their primary means of communication. The radio of the OTS employee who occupied the dome car had been secured to his person using the integrated plastic belt clip. Due to the significant dynamic forces experienced in the car during the derailment sequence, the OTS employee's radio became unclipped from his belt and was thrown out of reach, depriving him of his primary means of communicating instantly with the other employees. As a result, the employee was not able to immediately alert the operating crew of the derailment.

The plastic belt clip integrated into the radio was not sufficient to ensure that the radio remained secured to the employee during this emergency event. As a result, the employee was not able to advise the operating crew of the emergency in a timely manner. He did not use one of the various types of radio holsters and carriers that VIA made available to its employees, and which could have prevented the radio from becoming separated from the employee.

2.4 Derailment cues and indications

To identify a derailment involving one or more cars in a train consist, operating crew members rely primarily on a train-initiated emergency brake application or a car occupant-initiated emergency brake application.

In a derailment where there is a train-initiated emergency brake application, the flexible air hose sections that connect the rolling stock separate, which causes the emergency brakes of the train to apply. However, not all derailments trigger an emergency brake application: for example, when a few cars in a train consist derail but stay upright and coupled to the rest of the train, the flexible air hose connecting the rolling stock does not always separate. In this occurrence, the flexible air hose connecting the rolling stock did not separate.

In a car occupant-initiated emergency brake application, an emergency brake handle located in the passenger cars would be pulled by an occupant, causing the emergency brakes of the train to automatically apply. In this occurrence, the significant dynamic forces during the derailment resulted in the occupants of the 14th car having to brace themselves

against secured appliances to avoid being thrown around. They were therefore unable to reach any of the emergency brake handles.

In the absence of a train-initiated or occupant-initiated emergency brake application, operating crews must rely on other available indications to identify train operation issues. Such indications include changes in train dynamics affecting handling, as well as information from other sources such as radio calls from on-board personnel or wayside railway employees.

In this occurrence, as the locomotives travelled over the crossing at approximately 60 mph, the operating crew members experienced a rough ride, which they attributed to rough track conditions, in line with their mental model and expectations. Seconds later, they received a radio call from the service manager, who was located in the 4th car, reporting that a hard impact had been experienced. The operating crew discussed the situation and, in line with their mental model and expectations, attributed the reported hard impact to the rough track conditions they had experienced a few seconds earlier.

The operating crew did not immediately recognize that a derailment had occurred. When the train, travelling up a 1.0% grade at full throttle, started to slow down, the crew, in line with their mental model and expectations, initially attributed the loss of speed to a possible power loss from the second locomotive. As there were no alarms or warnings to indicate this, and as the train was continuing to lose speed, the crew began investigating the situation. Using the locomotive's side mirrors, they observed indications of a possible derailment at the rear of the train. A brake application was then initiated, and the train was brought to a controlled stop.

If an operating crew does not immediately recognize that a derailment has occurred, appropriate actions may not be taken in a timely manner, increasing the risk of consequential damages and occupant injury.

In this occurrence, a brake application was initiated by the operating crew only after they became aware of the derailment, approximately 1 minute and 9 seconds after the initial point of derailment. Several railways across Europe have begun the implementation of derailment detection systems aboard existing rolling stock. These non-mandatory systems help detect pre-derailment indicators on freight and high-speed passenger trains. No on-board derailment detection systems or devices are currently in use in Canada.

2.5 **Railway passenger safety**

The *Railway Passenger Car Inspection & Safety Rules* apply to equipment ordered after 01 April 2001. These rules do not include any specific requirement regarding interior furnishings of older equipment still in use in passenger service.

The design of VIA's dome cars has remained largely unchanged since their original construction approximately 70 years ago. VIA expects to keep these cars in service for up to another 25 years, but there are no plans to modernize any of these cars in the near future.

In this occurrence, the derailed cars remained upright and coupled to the train. The interior of the dome car sustained damage during the derailment sequence, in which many unsecured items abruptly shifted or became displaced. Furthermore, unsecured folding furniture blocked doorways of sleeping quarters.

Unsecured items on a passenger rail car can cause secondary impact injury and potentially impede passenger evacuations. While some of the occupant safety issues identified in previous TSB investigations relating to loose items on passenger equipment have been addressed by VIA (such as securement of various furniture items and installation of restraint systems for carry-on baggage), the securement of loose items such as folding chairs has yet to be addressed. If loose items on passenger cars are not properly secured, the items could become displaced during an emergency and impede evacuation, increasing the risk of occupant injury.

3.0 FINDINGS

3.1 Findings as to causes and contributing factors

These are conditions, acts or safety deficiencies that were found to have caused or contributed to this occurrence.

1. The derailment occurred as the train travelled over the public grade crossing at Mile 15.27 of the Canadian National Railway Company (CN) Newcastle Subdivision and the rail broke beneath the train.
2. The north rail had progressively fractured under the normal forces exerted by the rolling stock as the train was travelling over the crossing and the 13th and 14th cars derailed.
3. The web of the rail that fractured had thinned due to corrosion to a point where it could no longer support normal train forces.
4. The corrosion of the rail web at the crossing had not been identified by the visual or ultrasonic track inspections, because the web of the rail was hidden by the crossing surface.
5. While the 14th car was travelling in the derailed condition, the occupants were unable to reach any of the car's emergency brake handles.
6. The on-train services employee who was located in the 14th car was not able to immediately communicate with the operating crew to alert them of the derailment, because his portable radio was thrown out of his reach when the derailment occurred.
7. The locomotive engineer continued to operate the train normally until the operating crew became aware of the derailment, at which time the locomotive engineer initiated a brake application, bringing the train to a controlled stop.

3.2 Findings as to risk

These are conditions, unsafe acts or safety deficiencies that were found not to be a factor in this occurrence but could have adverse consequences in future occurrences.

1. If rail web thinning due to corrosion is not assessed at appropriate intervals, particularly at crossings, which are more susceptible to the effects of saline environments, rail with compromised web sections can go undetected, increasing the risk of an in-service failure.
2. If an operating crew does not immediately recognize that a derailment has occurred, appropriate actions may not be taken in a timely manner, increasing the risk of consequential damages and occupant injury.

3. If loose items on passenger cars are not properly secured, the items could become displaced during an emergency and impede evacuation, increasing the risk of occupant injury.

3.3 Other findings

These items could enhance safety, resolve an issue of controversy, or provide a data point for future safety studies.

1. Over time, the environmental conditions at the crossing and the effects of winter road salt in particular caused the rail web to corrode at an accelerated rate.
2. The *Track Safety Rules* do not include specific provisions for identifying and assessing rail corrosion, including corrosion of the rail web, which are particularly important at railway crossings where the crossing structure can hold corrosive substances (e.g., road salt) and moisture and obstruct inspection of the rail web.
3. No on-board derailment detection systems or devices are currently in use in Canada.

4.0 SAFETY ACTION

4.1 Safety action taken

4.1.1 Transportation Safety Board of Canada

On 13 May 2019 the TSB issued Rail Safety Advisory (RSA) 06/19 entitled “Ensuring effective and consistent rail condition monitoring practices at railway crossings.” The RSA stated the following:

Given the challenges with detecting rail defects at railway crossings, Transport Canada may wish to review how rail condition monitoring is performed at railway crossings and provide guidance (as necessary) to ensure that these inspections are conducted in an effective and consistent manner.

Transport Canada’s response dated 17 June 2019 stated the following:

[...] the Railway company is responsible to:

- Conduct a valid search for internal defects, or
- Reduce class of track to bring the track into compliance until such time as a valid search for internal defects can be made, or
- Remove the rail from service.

4.2 Safety concern

4.2.1 Rail web thinning due to corrosion

Road crossing structures are exposed to road debris such as salt and sand that can be deposited by winter road maintenance and passing vehicles. These structures inherently hold moisture and debris, creating an environment where rail can be more susceptible to corrosion than if it is located in an open atmosphere environment. This corrosion can, over time, could lead to the thinning of the rail web. As part of normal railway maintenance practices, rail at crossings located in high annual tonnage subdivisions would likely need to be replaced due to normal wear before corrosion affects the rail strength. At crossings located in low annual tonnage subdivisions, such as the Lakeville Road crossing, the rail is generally not required to be replaced as often because of slower rail wear. In Canada, there are approximately 6500 federally regulated crossings with an annual average of 1.1 million gross tons or less. In this occurrence, the rail at the Lakeville Road crossing, which had been in service for approximately 30 years, had corroded to a point where the rail web was unable to withstand vertical and lateral loads, causing it to fail in service.

The Transport Canada (TC)–approved *Rules Respecting Track Safety*, also known as the Track Safety Rules (TSR), which set the regulatory provisions for track inspection and maintenance, do not specifically require the identification and assessment of rail corrosion, including corrosion of rail web. Track inspection methods currently implemented by the

railway industry include visual rail inspections and ultrasonic rail flaw detection. These methods are not specifically designed to identify rail web and base corrosion at crossings, and their detection capability is impeded by crossing structures. In order to be able to perform a full assessment of the condition of the rail at a crossing, it is necessary to expose the entire rail by removing the crossing structure.

The lifespan of a road crossing varies and is affected by multiple variables such as traffic, weather conditions, and winter road maintenance practices. Railways generally have programs in place to regularly inspect the condition of crossing components in order to determine whether a rehabilitation is warranted. During rehabilitation, the crossing structure is usually removed, which exposes the rail and provides an opportunity to examine and assess the condition of the rail and the rail web. A thorough fitness-for-service assessment of the rail should include an inspection for possible deterioration due to corrosion. Since there is no reference to this type of inspection in the TSR, it may not be systematically performed in the field. Therefore, the Board is concerned that track inspection provisions at crossings do not include a requirement to assess for corrosion of the rail web; consequently, there may be rail web corrosion at other crossings, which could result in in-service rail failures.

This report concludes the Transportation Safety Board of Canada's investigation into this occurrence. The Board authorized the release of this report on 26 August 2020. It was officially released on 30 September 2020.

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.

APPENDICES

Appendix A – Previous TSB investigations involving issues relating to radio securement

Occurrence	Date	Summary	Injuries
R97H0009	1997-09-03	VIA Rail Canada Inc. (VIA) train No. 2, travelling eastward at 67 mph, derailed at Mile 7.5 of the Canadian National Railway Company (CN) Wainwright Subdivision, near Biggar, Saskatchewan. A locomotive bearing failure caused the derailment of 13 of the 19 cars and the 2 locomotives. The radios of the operating crew members became dislodged during the derailment. After the derailment, only 1 of the 2 portable radios could be found. On-train services employees did not carry radios with them, making radio communication difficult.	1 fatal and 13 serious (passengers)
R99H0007	1999-04-23	VIA train No. 74, travelling eastward on the north main track at Thamesville, Ontario, encountered a reversed switch, crossed over to the south main track and derailed at Mile 46.7 of the CN Chatham Subdivision. Two employees located in the passenger cars who had access to two-way communication lost their portable radios and a cellular phone during the accident. Both the two-way radio and the cellular phone supplied to the service manager were equipped with belt clips. Both belt clips opened during the derailment and collision, and the radio and the phone were lost. A locomotive engineer who was sitting in the club car at the time of the accident had removed his radio from his belt and placed it on the armrest. During the accident, the second locomotive engineer lost his radio when it was projected forward through the car.	4 serious (1 crew and 3 passengers) and 2 fatal (crew)
R01M0024	2001-04-12	VIA train No. 15, consisting of 2 locomotives and 14 cars, derailed at a manually operated main-track switch at Mile 46.45 of the CN Bedford Subdivision in Stewiacke, Nova Scotia. A standard CN switch lock used to secure the switch had been tampered with. The 2 locomotives and the first 2 cars continued on the main track, but the following cars took a diverging route onto an adjacent track. Nine of the cars derailed and a farm supply building, as well as the industrial track, were destroyed. Portable radios had become dislodged during the derailment.	9 serious (passengers)

Appendix B – Previous TSB investigations involving passenger trains continuing to travel in a derailed state with the operating crew unaware of the derailment

Occurrence	Date	Summary	Injuries
R91H0006	1991-01-31	VIA Rail Canada Inc. (VIA) train No. 37, travelling at 30 mph and carrying 137 passengers, derailed at Mile 72.9 of the Canadian National Railway Company (CN) Alexandria Subdivision due to a failed axle on the 1st car. The train travelled 1.5 miles with the operating crew unaware of the derailment until the derailed car caused the locomotive to derail.	None
R95Q0014	1995-02-23	VIA train No. 15 derailed car VIA 8709, a dome car, and sideswiped an empty boxcar at Mile 86.07 of the CN Montmagny Subdivision in Saint-François, Quebec. The operating crew was unaware of the derailment until notified by on-train services employees on the radio. The dome car had travelled approximately 1 mile while derailed.	None
R96T0095	1996-03-21	VIA train No. 60, travelling eastward at approximately 30 mph, derailed coach No. 3336 at Mile 301.4 of the CN Kingston Subdivision. The brake actuator failed, dragging the wheel and creating a 15-inch flat spot. The train travelled with the derailed car for nearly 1 mile before the operating crew was notified by a wayside track employee.	None
R08M0015	2008-03-12	VIA train No. 15 derailed 5 cars due to a broken rail at Mile 23.32 of the CN Mont-Joli Subdivision and came to a stop on a bridge. The train travelled approximately 3200 feet before the operating crew realized that it was not reacting normally. The train was stopped and, upon inspection, the crew realized that 5 cars had derailed.	None

Appendix C – Previous TSB investigations involving occupant safety issues on passenger trains

Occurrence	Date	Summary	Injuries
R97H0009	1997-09-03	<p>VIA Rail Canada Inc. (VIA) train No. 2, travelling eastward at 67 mph, derailed at Mile 7.5 of the Canadian National Railway Company (CN) Wainwright Subdivision, near Biggar, Saskatchewan. A locomotive bearing failure caused the derailment of 13 of the 19 cars and the 2 locomotives. After the derailment, debris and loose items within the cars impeded the evacuation and furthered passenger injury.</p> <p>A number of occupant safety issues were identified in this investigation, including:</p> <ul style="list-style-type: none"> • Unsecured folding chairs • Blocked egress routes • Secondary impact injuries 	1 fatal and 13 serious (passengers)
R99S0100	1999-11-09	<p>VIA train No. 85 collided with a dump truck at a crossing at Mile 33.54 of the Goderich-Exeter Railway Guelph Subdivision and derailed.</p> <p>A number of occupant safety issues were identified in this investigation, including:</p> <ul style="list-style-type: none"> • Unsecured storage items • Blocked egress routes • Secondary impact injuries 	2 serious
R00M0007	2000-01-30	<p>VIA train No. 14, proceeding eastward on the New Brunswick East Coast Railway, was diverted from the main track within the city of Miramichi, New Brunswick, by a crossover switch that was lined and locked in the reverse position. The train entered the adjacent yard track and, while proceeding at approximately 29 mph at Mile 65.1 of the CN Newcastle Subdivision, collided with 11 stationary cars.</p> <p>A number of occupant safety issues were identified in this investigation, including:</p> <ul style="list-style-type: none"> • Loose items in egress routes • Secondary impact injuries 	7 serious
R01M0024	2001-04-12	<p>VIA train No. 15, consisting of 2 locomotives and 14 cars, derailed at a manually operated main-track switch at Mile 46.45 of the CN Bedford Subdivision in Stewiacke, Nova Scotia. A standard CN switch lock used to secure the switch had been tampered with. The 2 locomotives and the first 2 cars continued on the main track, but the following cars took a diverging route onto an adjacent track. Nine of the cars derailed and a farm supply building, as well as the industrial track, were destroyed.</p> <p>A number of occupant safety issues were identified in this investigation, including:</p> <ul style="list-style-type: none"> • Unsecured baggage • Unsecured furniture (beds and chairs) • Loose items in dining area • Blocked egress routes • Secondary impact injuries 	9 serious

Occurrence	Date	Summary	Injuries
R05E0008	2005-01-31	<p>VIA train No. 1, proceeding westward, was struck by a southbound logging truck at the public crossing at Mile 92.26 of the CN Edson Subdivision. As a result of the collision, both locomotives and all 9 passenger cars derailed.</p> <p>A number of occupant safety issues were identified in this investigation, including:</p> <ul style="list-style-type: none"> • Egress from sleeping compartments when the doors are blocked • Heavy chairs that can block exit routes • Unsecured furniture that can be projected during a derailment or collision, or even under emergency braking conditions • Secondary impact injury potential 	2 minor and 1 serious
R06V0119	2006-05-28	<p>Rocky Mountaineer passenger train RMV 1-28 derailed 5 passenger cars and 2 staff cars at Mile 68.3 of the Canadian Pacific Railway Mountain Subdivision.</p> <p>A number of occupant safety issues were identified in this occurrence:</p> <ul style="list-style-type: none"> • Rotated seats that could impede passenger and staff movement or cause injuries • Unsecured furniture, garbage bins, coolers, boxes, storage units, cleaning equipment, and luggage strewn about during the derailment, cluttering evacuation routes • Secondary impact or post-accident injury potential 	Minor