

Transportation Safety Board
of Canada



Bureau de la sécurité des transports
du Canada

**RAILWAY INVESTIGATION REPORT
R14Q0047**



CROSSING COLLISION

**A VEHICLE AND
VIA RAIL CANADA INC.
PASSENGER TRAIN NUMBER P60321-05
MILE 120.18, ST-MAURICE SUBDIVISION
PARENT, QUEBEC
05 DECEMBER 2014**

Canada

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Railway Investigation Report R14Q0047

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Railway Investigation Report R14Q0047

Crossing collision

A vehicle and

VIA Rail Canada Inc.

Passenger train P60321-05

Mile 120.18, St-Maurice Subdivision

Parent, Quebec

05 December 2014

Summary

On 05 December 2014, at approximately 1735 Eastern Standard Time, passenger train P60321-05, travelling westward, struck a northbound vehicle at a private crossing at Mile 120.18 of the St-Maurice Subdivision. One of the vehicle occupants was fatally injured, two others were seriously injured and another sustained minor injuries.

Le présent rapport est également disponible en français.

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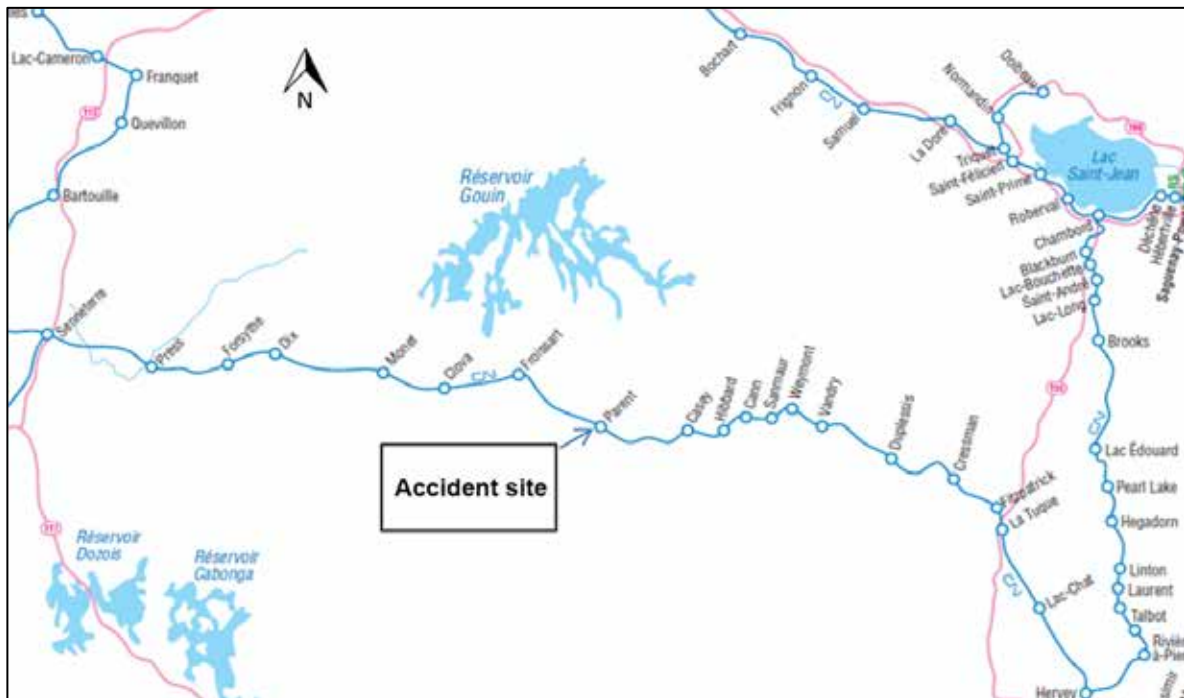
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1.0 Factual information

1.1 The accident

On 05 December 2014, VIA Rail Canada Inc. (VIA) passenger train P60321-05 (VIA 603) departed Montréal, Quebec, for Senneterre, Quebec, on the Canadian National (CN) St-Maurice Subdivision (Figure 1). The train consisted of a locomotive, a baggage car and a coach. It weighed approximately 227 tons and measured 227 feet in length. The locomotive was equipped with a forward-facing video camera. There were 3 passengers on board.

Figure 1. Accident site (Source: Railway Association of Canada, *Canadian Railway Atlas*, with TSB annotations)



The train crew consisted of an operating locomotive engineer and an in-charge locomotive engineer. Both were qualified for their respective positions and met rest and fitness standards.

About 5 minutes after departing the Parent Station, VIA 603, which was approaching the des Sources Street private crossing at Mile 120.18 at a speed of 43.2 mph, sounded its horn, as required by regulation. The ditch lights were illuminated and the headlights were on bright. The crew noticed a northbound pick-up truck (vehicle) that seemed to slow down but that then accelerated to enter the crossing.

The crew continued to sound the locomotive horn and placed the throttle in idle. The train was unable to slow down enough before the crossing and struck the right side of the vehicle at approximately 1735.¹ The emergency brakes were applied immediately after the collision. The locomotive of the passenger train sustained minor damage and the track was not damaged.

One of the vehicle occupants was fatally injured, two others were seriously injured and another received minor injuries. No one on board VIA 603 was injured.

At the time of the collision, the temperature was -9°C , with a wind chill index of -14 , and the sky was overcast. The sun had set at approximately 1640.

1.2 *Site examination*

In the accident area and in both directions of traffic, des Sources Street is considered an access road and its surface is gravel. It turns sharply to cross the railway track at a right angle (Figure 2). Each approach to the crossing has road signs, including a stop sign, a private crossing sign² and a standard reflectorized crossing sign (cross buck). There is no stop line on either side of the crossing, nor is one required by regulation. The speed limit on des Sources Street is 50 km/h.

At the time of the accident, visibility was good. The road surface at the south approach was snow covered. No skid marks were observed in the snow before the crossing.

The cross buck and stop sign on the south side of the track were visible to northbound vehicles from about 100 feet.³ The stop sign was bent and leaning and one of the cross buck arms was hidden by the private crossing sign (Figure 2).

¹ All times are Eastern Standard Time.

² Under a private crossing agreement between the railway and Kruger (Parent sawmill) signed in 1996, des Sources Street was an access road. The railway was responsible for installing and maintaining private crossing warning signs on the approaches. Kruger was responsible for maintaining crossing and road signs over a distance of 500 feet on both sides of the crossing. Groupe Rémabec is now responsible for maintaining crossing approaches since it purchased Kruger on 24 April 2015.

³ Northbound vehicles must negotiate an S curve before reaching the crossing.

Figure 2. Path of vehicle in relation to the des Sources Street crossing and arrangement of road signs



The sightlines at the stop sign of the south crossing approach were about 950 feet given the left-hand curve, the covered rail cars parked at the Kruger plant and the pile of snow-covered wood chips. The Kruger plant's outside lights and parking lot lights were illuminated.

Marks in the snow northwest of the crossing showed that, after impact, the vehicle (2011 Dodge Ram) was displaced laterally to the west, and crashed into the cross buck on the north side of the track before falling into a ditch. It then rolled over several times and came to a stop on the driver's side at the bottom of the ditch. The vehicle was completely destroyed in the accident.

1.3 Subdivision information

The CN St-Maurice Subdivision consists of a single main track that connects the Fitzpatrick Station at Mile 0.0, near La Tuque, Quebec, to Senneterre, Quebec, at Mile 257.2. It is a Class 3 track according to the Transport Canada (TC)-approved *Railway Track Safety Rules*. The subdivision maximum allowable speed is 50 mph for passenger trains and 40 mph for freight trains.

Train movements are controlled by the Occupancy Control System in accordance with the *Canadian Rail Operating Rules* (CROR) and supervised by a CN rail traffic controller located in Montréal, Quebec.

In the accident area, the track is considered a subdivision track. The CROR defines a subdivision track as

[a] Non-Main Track so indicated in the time table method of control column that is an extension of the main track, and the through track at that location, defined with subdivision mile posts. REDUCED speed is applicable to a maximum speed as indicated in the time table.⁴

Reduced speed is “a speed that will permit stopping within one-half the range of vision of equipment.”⁵ According to CN’s time table for the St-Maurice Subdivision, movements on subdivision tracks are governed by CROR Rule 105(c).⁶

According to the CN time table in effect, the maximum allowable speed is 45 mph for passenger trains and 40 mph for freight trains between Mile 118.9 (Parent) and Mile 119.2. There is a permanent slow order of 10 mph for passenger and freight trains from Mile 119.2 to Mile 120.0. The maximum allowable speed is 45 mph for passenger trains and 40 mph for freight trains from Mile 120.0 to Mile 121.1.

At the time of the accident, rail traffic on this subdivision consisted of 1 VIA passenger train⁷ and 2 CN freight trains (1 in each direction) per day.

1.4 Track information

The track consisted of 100-pound bolted rails, dating back to 1969, joined together with 4-hole joint bars, laid on 14-inch double-shouldered tie plates, fastened with 6 spikes per tie and anchored every third tie. There were approximately 3200 wooden ties per mile of track. The ballast consisted of crushed rock and the cribs were full. The railway track was in good condition.

⁴ Transport Canada, TC O-0-167, *Canadian Rail Operating Rules*, Definitions.

⁵ Ibid.

⁶ Transport Canada, TC O-0-167, *Canadian Rail Operating Rules*, Rule 105(c) – Operation on non-main track: “In addition to moving at REDUCED speed, a movement using a non-signalled siding or using other non-main tracks so designated in special instructions, must operate at a speed that will allow it to stop within one-half the range of vision of a track unit.”

⁷ VIA was operating 1 westbound train between Montréal and Senneterre on Mondays, Wednesdays and Fridays. The same train was returning eastbound to Montréal on Tuesdays, Thursdays and Saturdays. There was no train service on Sundays.

1.5 *Crossing design and sign requirements*

At the time of the accident, in Canada, roadway signs and markings, including those at railway crossings, had to comply with the guidelines of the *Manual of Uniform Traffic Control Devices for Canada* (MUTCDC). According to the MUTCDC,

- a basic requirement for the effectiveness of signs is to command the respect of road users; and
- a high standard of maintenance is essential, and well maintained signs have more credibility as traffic control devices.

The des Sources Street private crossing⁸ met the sightline requirements of the *Grade Crossings Regulations*⁹ and *Grade Crossings Standards*.¹⁰

In 2006, another accident occurred at the same crossing (TSB occurrence R06Q0071). A VIA train had struck a vehicle; no one was injured.

1.6 *Wayside signs in the accident area*

Railway signs are located along the track to allow locomotive engineers to operate trains according to the rules. These signs include, among others, mile posts, whistle posts for crossings and permanent or temporary slow order area signs.

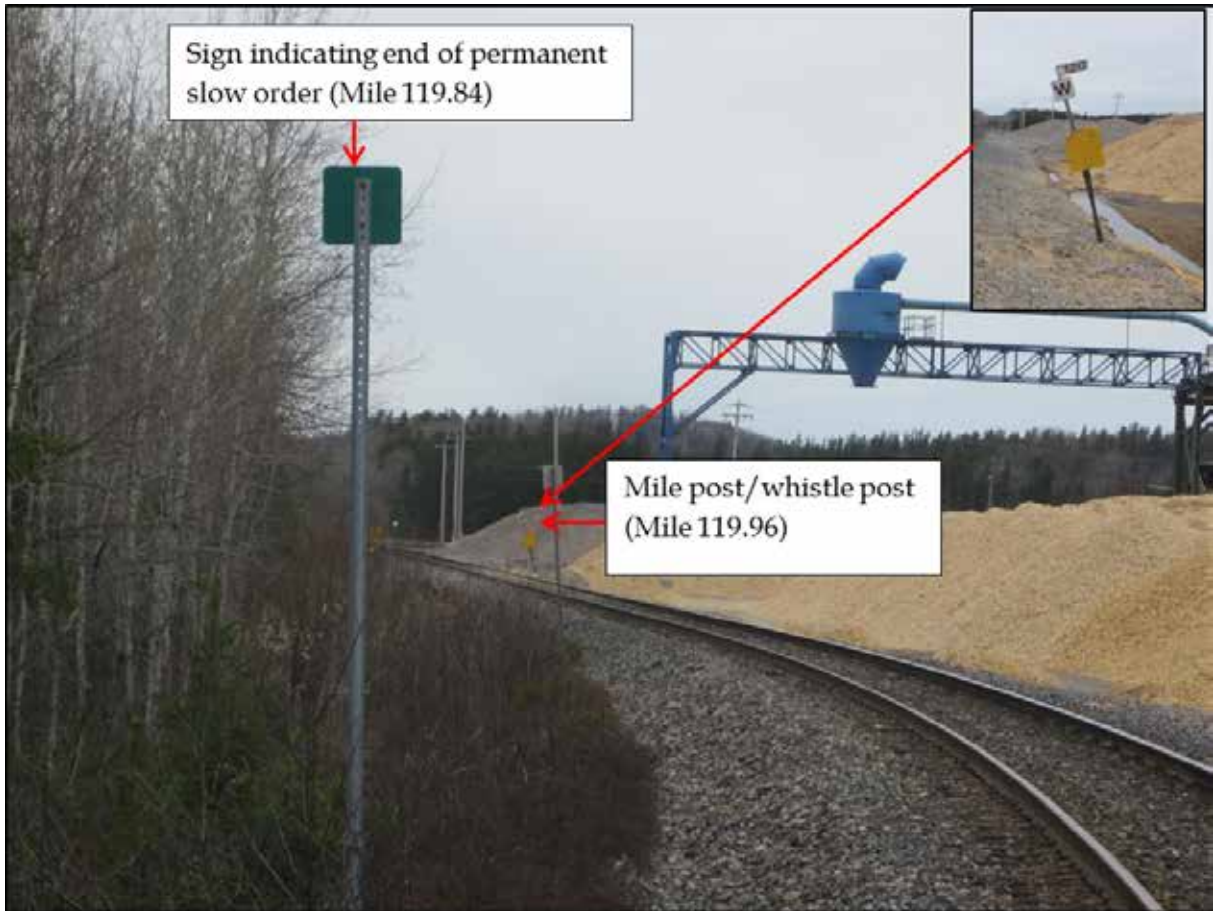
In this accident, the sign indicating the end of the permanent slow order (green square) was at Mile 119.84 and the whistle post, along with the Mile 120 sign, was positioned at Mile 119.96. The Mile 120 sign was somewhat bent and at an angle (Photo 1).

⁸ Des Sources Street is the main road used to travel to Clova, Quebec.

⁹ Department of Justice, *Grade Crossings Regulations*, SOR/2014-275 (came into force on 27 November 2014).

¹⁰ Transport Canada, *Grade Crossings Standards* (July 2014).

Photo 1. Westward view of sign indicating the end of the permanent slow order in relation to the whistle post (Source: VIA)

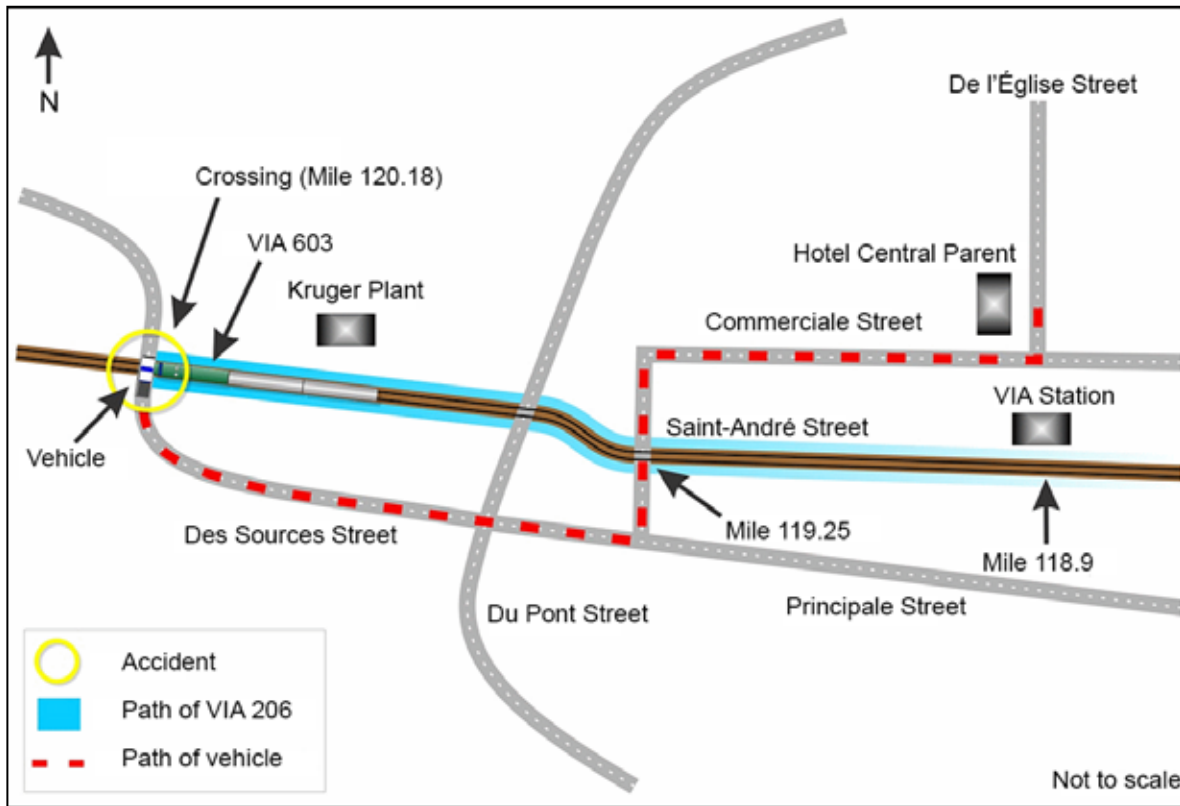


1.7 *Vehicle occupants*

On the day of the accident, the 4 vehicle occupants were travelling to Lac-Simon, Quebec, about 3 hours from Parent, Quebec. At about 1630, the occupants stopped for about an hour at a restaurant located in front of the Parent Station.

Upon leaving the restaurant, only the driver buckled her seatbelt. The vehicle passed over the Saint-André Street crossing at Mile 119.25 and continued travelling westward (Figure 3). At the approach of the des Sources Street crossing, the vehicle slowed to 7 km/h. The front passenger would have looked to the east (right) and then told the driver that she had time to go over the crossing. The vehicle accelerated and reached a speed of 14 km/h at the time of the collision. The vehicle's windows were closed and the heating and radio were on. The driver had used this crossing about 4 times in the past, the last time being about 1 year ago.

Figure 3. Path of VIA 603 and of the vehicle



1.8 Toxicology testing

In the hour before the accident, the driver had consumed cocaine and the front passenger, alcohol.

Toxicology testing showed

- the presence¹¹ of cocaine in the driver's blood;
- a blood alcohol level of 142 mg/100 ml (0.142) and the presence of cocaine in the deceased front passenger's blood.

Cocaine use produces excitement, can cause disorientation and reduces the level of attention and concentration. In addition, cocaine has an impact on reaction time, often resulting in faster but less reasoned, more impulsive responses and increased risk taking.¹² Alcohol

¹¹ "Presence" is indicative of a therapeutic concentration while "trace amount" denotes a lower concentration.

¹² Organisation for Economic Co-operation and Development, "The effects of drugs on safe driving performance," *Drugs and Driving: Detection and Deterrence*, OECD Publishing (08 October 2010), pp. 19-23, available at: http://www.oecd-ilibrary.org/transport/drugs-and-driving_9789282102763-en (last accessed on 02 February 2016).

consumption impairs abilities, in particular the ability to track objects. Perceptual abilities and reaction time can be impaired at blood alcohol levels of 0.03 and 0.04 respectively.¹³

1.9 Recorded information

1.9.1 Locomotive VIA 6413 event recorder

The data in Table 1 were taken from the event recorder of locomotive VIA 6413.

Table 1. Sequence of events that led to the collision

Time	Event
1724:37	VIA 603 stops at the Parent Station (Mile 118.9).
1730:06	VIA 603 leaves the Parent Station.
1730:43	At Mile 119.03, VIA 603 is travelling at 17.4 mph, and its throttle is brought to position 2 in preparation for the 10 mph permanent slow order from Mile 119.2 to Mile 120.0.
1731:17	At 17.4 mph, with the throttle in idle, VIA 603 enters the 10 mph permanent slow order area (Mile 119.2).
1731:30	VIA 603 passes over the Saint-André Street crossing at Mile 119.25.
1731:39	VIA 603 reaches a speed of 10 mph, which is consistent with the permanent slow order (Mile 119.28).
1734:18	VIA 603 starts to accelerate while still in the permanent slow order area (Mile 119.78).
1734:32	Travelling at 20.4 mph, with the throttle in position 5, the tail end of VIA 603 reaches the sign indicating the end of the slow order located at Mile 119.84.
1734:45	VIA 603 begins sounding its horn as it approaches the des Sources Street crossing.
1734:56	At 37.1 mph, with the throttle in position 6, the tail end of VIA 603 reaches the Mile 120 sign (where the permanent slow order actually ends).
1735:07	At 42.1 mph, VIA 603 continues to sound its horn and the throttle is placed in idle (Mile 120.17).
1735:08	At 43.2 mph, VIA 603 strikes the vehicle at Mile 120.18.
1735:09	At 43.2 mph, the train emergency brakes are applied.
1735:35	VIA 603 comes to a stop (Mile 120.38).

1.10 Recording from forward-facing video camera on locomotive VIA 6413

The recording from the forward-facing camera on locomotive VIA 6413 was examined. It was determined that the vehicle had slowed down and then accelerated to enter the crossing.

¹³ United States Department of Transportation, Federal Railroad Administration, DOT/FRA/ORD-08/03, *Driver Behavior at Highway-Railroad Grade Crossings: A Literature Review from 1990–2006* (October 2008).

1.11 Vehicle control module

The vehicle control module download was reviewed. It was determined that, about 5 seconds before impact, the vehicle was travelling at 18 km/h and its brakes were applied. About 3 seconds before impact, the vehicle brakes were still applied and the vehicle speed had reduced to 7 km/h. Then, 0.1 second before the collision, the vehicle had accelerated to 14 km/h and its brakes were released. According to the same module, the driver's seatbelt was fastened.

1.12 Seatbelts

Since the early 1970s, TC has required that seatbelts be fitted in all new motor vehicles. All provincial and territorial governments have then adopted legislation requiring the use of seatbelts by all occupants.¹⁴

Today, about 95% of Canadians wear their seatbelts. The seatbelt usage rate is lower in rural areas (92%) than in urban areas (95.8%).¹⁵

Correctly worn seatbelts can reduce the risk of death in a collision by 47% and the risk of serious injury by 52%.¹⁶ In the event of an accident, drivers and passengers not wearing their seatbelts can become projectiles and injure themselves or other vehicle occupants.¹⁷

In 2013, the percentage of driver fatalities and serious injuries where victims were not wearing their seatbelts was 32% and 11.7% respectively. That same year, the percentage of passenger fatalities and serious injuries where victims were not wearing their seatbelts was 30.7% and 18.5% respectively.¹⁸ In this accident, the driver was wearing her seatbelt, but the 3 passengers were not.

¹⁴ Canadian Public Health Association, "Reducing Deaths and Injuries on our Roads," available at: <http://www.cpha.ca/en/programs/history/achievements/07-mvs/roads.aspx> (last accessed on 02 February 2016).

¹⁵ Transport Canada, "Seatbelt use continues to rise: Transport Canada surveys," (26 January 2011), available at: http://news.gc.ca/web/article-en.do?nid=616509&_ga=1.32092541.271943212.1446646486 (last accessed on 02 February 2016).

¹⁶ D.E. Stewart, H.R. Arora and D. Dalmotas, TP 13110E, *Estimation Methodologies for Assessing Effectiveness of Seat Belt Restraint Systems and the National Occupant Restraint Program*, Transport Canada, Road Safety, Ottawa (1997).

¹⁷ Canada Safety Council, "National Road Safety Week: Safety on the road ahead," 03 May 2013, available at: <https://canadasafetycouncil.org/news/national-road-safety-week-safety-road-ahead> (last accessed on 02 February 2016).

¹⁸ Transport Canada, TP 3322, in cooperation with the Canadian Council of Motor Transport Administrators, *Canadian Motor Vehicle Traffic Collision Statistics 2013* (2015), available at: http://www.tc.gc.ca/media/documents/roadsafety/cmvts2013_eng.pdf (last accessed on 02 February 2016).

Airbags offer effective protection against injury. However, the deployment of air bags can aggravate injuries in passengers not correctly wearing seatbelts. In this accident, the airbags were deployed.

1.13 *Vehicle driver behaviour at crossings*

The decision to cross railway tracks in front of an approaching train requires drivers to estimate the time they have to cross and their ability to get across in that time. Visual cues, auditory cues, and the perception of risks associated with crossing in front of a train also play a role.

A stop sign at a crossing or intersection requires that drivers come to a complete stop. From a stopped position, drivers are expected to look in both directions to ensure that the way is clear (i.e., there are no approaching trains or vehicles) before proceeding.

Through a number of driver behaviour studies, it has been determined that there are varying degrees of driver compliance with stop signs.^{19, 20, 21} While most drivers come to a complete stop and look in both directions (high degree of compliance), some drivers do not reduce their speed and neglect to look for approaching trains at an intersection (low degree of compliance).

1.14 *Emergency response*

The hospital closest to the accident site is in La Tuque, about 200 km from Parent. In addition, the Haut-Saint-Maurice health and social services centre (CSSS) has a point of service in Parent.

The crew members immediately reported the accident to the CN rail traffic controller and went to help the victims until the first responders arrived. Some Kruger plant employees arrived at the scene shortly after the accident. At about 1755, 911 services requested that first responders and an hydraulic spreader be sent for a vehicle-train accident. A CSSS nurse²² arrived at the site around 1800, and volunteer firefighters arrived around 1810, about 35 minutes after the accident.

The passenger who was sitting behind the driver and who sustained minor injuries was able to get out of the vehicle on her own. When they arrived, the Parent volunteer firefighters

¹⁹ S.J. McKelvie, "An opinion survey and longitudinal study of driver behaviour at stop signs," *Canadian Journal of Behavioural Science*, Volume 18, Issue 1 (January 1986), pp. 75-85.

²⁰ F.H. Allport, "The J-Curve Hypothesis of Conforming Behavior," *Journal of Social Psychology*, Volume 5 (May 1934), pp.141-183.

²¹ N.D. Lerner and L. Tucker, *Traffic-Control Devices for Passive Railroad-Highway Grade Crossings*, National Cooperative Highway Research Program (NCHRP) Report 470, United States Transportation Research Board, Washington, DC (2002), pp. 24-26.

²² The health and social services centre (CSSS) point of service in Parent was closed at the time of the accident. It is open Monday to Friday from 0830 to 1630. A nurse is on call outside these hours.

used manual tools (spreaders) to try to extricate the other 3 injured passengers, but without success. With the help of Kruger employees and additional tools from the plant, they were able to remove them from the vehicle.

The victims were all transported by ambulance to the CSSS point of service in Parent, where another nurse, who had been called to open the premises, took charge of the injured. The CSSS point of service in Parent did not have enough equipment or medication to treat multiple victims. The 3 survivors were stabilized and prepared for transport to the La Tuque Hospital. The rear passenger who sustained minor injuries was transported by ambulance while the driver and the other rear passenger, who were seriously injured, were transported by helicopter.

1.15 *TSB Watchlist*

1.15.1 *Railway crossing safety is a 2014 Watchlist issue*

The Watchlist is a list of issues posing the greatest risk to Canada's transportation system; the TSB publishes it to focus the attention of industry and regulators on the problems that need addressing today.

As this occurrence demonstrates, the risk of trains and vehicles colliding at crossings remains too high.

In the Watchlist 2014, the TSB urges TC to implement new grade crossing regulations, develop enhanced standards or guidelines for certain types of crossing signs, and continue its leadership in assessing crossing safety and funding improvements. A comprehensive solution must also include consultation with provincial authorities and further public driver education on the dangers at railway crossings.

The *Grade Crossings Regulations* came into force in November 2014. These regulations implement several outstanding recommendations concerning railway crossing safety.

2.0 Analysis

Track examination showed that there was no track geometry defect before the accident. The analysis will focus on the driver behaviour at the crossing, the train operation, crossing design, the use of seatbelts and the emergency response.

2.1 The accident

The stop sign was visible to northbound vehicles and the sightlines at that sign met the requirements of the *Grade Crossings Regulations* and *Grade Crossings Standards*. From the stop sign, it was possible to see the locomotive headlights from a distance of 950 feet. A number of TSB investigations have concluded that the effectiveness of the horn can be compromised due to the ambient noise within the vehicle.²³ In this occurrence, it would have been difficult to hear the locomotive horn since the vehicle windows were closed and the heater and radio were on. The fact that the vehicle slowed down (from 18 km/h to 7 km/h as it approached the crossing) suggests that there was an attempt to determine whether it was safe to pass over the crossing. However, visual cues are very different depending on whether the vehicle is moving or stopped. The fact that the driver did not come to a complete stop is indicative of unsafe driving. The front passenger, who looked to the right, the direction from which the train was coming, either underestimated how much time it would take for the train to reach the crossing or did not know whether the headlights he was seeing in the dark came from the plant or the approaching train. Given that the front passenger would have told the driver that she had time to go over the crossing, it is most probable that the passenger came to the wrong conclusion that there was enough time to cross before the train arrived. The driver reacted accordingly and drove past the stop sign. The vehicle did not stop at the stop sign and entered the crossing into the path of the train. The driver and front passenger mistakenly thought that there was enough time to get ahead of the train. The front passenger's confusion probably originated from an underestimation of the train speed and train arrival at the crossing or from the possibility that he thought that the train headlights were lights from the plant.

The crew could not take measures to avoid the collision and the locomotive struck the vehicle on the passenger side and pushed it into the ditch. The emergency brakes were applied immediately after the collision.

It seems that the train and vehicle departed at about the same time and from about the same location. It is therefore possible that the front passenger estimated the train speed based on what he had noticed earlier in the village (i.e., a slow-moving train). However, it has to be noted that it is difficult to accurately estimate the speed of an approaching train, especially at

²³ TSB railway investigation reports R13T0192, R13D0001, R13W0083, R12W0182, R11T0175, R10W0123, R08M0002, and R04H0014.

night, given the observer's frontal perspective.²⁴ Moreover, such an estimate would be distorted if the person's abilities were impaired by alcohol, particularly if the person's blood alcohol concentration is relatively high. The negative effects of alcohol and illicit substances on the behaviour are well documented, particularly on risk perception and risk taking. The use of an illicit substance (driver and front passenger) and alcohol (front passenger) probably contributed to the decision to drive the vehicle past the stop sign while the train was approaching the crossing.

2.2 *Train operation*

The locomotive horn was sounded for 20 seconds before the train reached the crossing. VIA 603 was travelling above the maximum allowable speed in the permanent slow order area and had started accelerating before Mile 120. However, at the crossing, the train was travelling at 43.2 mph, below the maximum allowable speed of 45 mph.

Given that the mile post and the sign indicating the end of the slow order should have been located at Mile 120 and that the whistle post should have been located at Mile 119.93, the incorrect location of these signs caused confusion among the crew members with respect to the train operation. As a result, the train was travelling at 37.1 mph when its tail end reached the end of the 10 mph slow order. To ensure the safe operation of trains, rail signs should be correctly placed and visible so they can be clearly identified. Rail signs that cannot be properly identified or that are not properly located can lead to confusion among train crew members and/or to an inconsistent application of the rules, which increases operating risks, especially in the vicinity of crossings.

2.3 *Locomotive forward-facing video camera*

The railway industry's adoption of forward-facing video cameras has proven to be a valuable tool in previous investigations. For this investigation, an analysis of the recorded video provided reliable, independent, and objective information to establish the sequence of events. The presence of a forward-facing video camera on locomotive VIA 6413 and reliable recording from that camera were instrumental in understanding the circumstances leading to this accident.

2.4 *Maintenance of road signs in the vicinity of crossings*

The road signs were not maintained as per *Manual of Uniform Traffic Control Devices for Canada* (MUTCDC) standards. In addition, since the road surface was gravel, there were no markings to serve as a stop line. Such factors compromise driver compliance with signs at crossings. If road signs at a crossing are poorly maintained, vehicle driver compliance with crossing signs may be affected, which increases the risk of vehicle-train collisions.

²⁴ United States Department of Transportation, Federal Railroad Administration, DOT/FRA/ORD-08/03, *Driver Behavior at Highway-Railroad Grade Crossings: A Literature Review from 1990–2006* (October 2008), pp. 9–10.

2.5 *Seatbelts*

It is well documented that wearing a seatbelt can reduce the risk of injury and fatality in the event of an accident. In this accident, in addition to being struck by the train, the vehicle rolled over several times before coming to a stop, causing the unbuckled passengers to be tossed around inside the vehicle. Moreover, the deployment of the airbags may have exacerbated the injuries to the front passenger, who was not wearing his seatbelt. The injuries were likely exacerbated by the fact that the passengers were not wearing their seatbelts.

2.6 *Emergency response*

A successful emergency response must be well planned and prepared. To this end, first responders must have received proper training, the necessary equipment must be available and well maintained, and drills must be conducted periodically.

In this accident, the first to arrive at the scene were the train crew members and employees from the Kruger plant. When the first responders (volunteer firefighters) arrived, they had manual extrication tools but had to use additional tools from the Kruger plant to remove the injured from the vehicle. Furthermore, the health and social services centre (CSSS) point of service in Parent did not have enough equipment or medication to treat multiple victims at the same time.

Given the remote area, some aspects of the emergency response may not always be implemented in an optimal manner. However, if the first responders on site do not have the proper equipment to carry out the emergency response, there are risks that this could lead to longer delays and lower survival rates.

3.0 Findings

3.1 Findings as to causes and contributing factors

1. The vehicle did not stop at the stop sign and entered the crossing into the path of the train.
2. The driver and the front passenger mistakenly thought that there was enough time to get ahead of the train.
3. The front passenger's confusion probably originated from an underestimation of the train speed and train arrival at the crossing or from the possibility that he thought that the train headlights were lights from the plant.
4. The use of an illicit substance (driver and front passenger) and alcohol (front passenger) probably contributed to the decision to drive the vehicle past the stop sign while the train was approaching the crossing.
5. The injuries were likely exacerbated by the fact that the passengers were not wearing their seatbelts.

3.2 Findings as to risk

1. Rail signs that cannot be properly identified or that are not properly located can lead to confusion among train crew members and/or to an inconsistent application of the rules, which increases operating risks, especially in the vicinity of crossings.
2. If road signs at a crossing are poorly maintained, vehicle driver compliance with crossing signs may be affected, which increases the risk of vehicle-train collisions.
3. If the first responders on site do not have the proper equipment to carry out the emergency response, there are risks that this could lead to longer delays and lower survival rates.

3.3 Other findings

1. The presence of a forward-facing video camera on locomotive VIA 6413 and reliable recording from that camera were instrumental in understanding the circumstances leading to this accident.

4.0 *Safety action*

4.1 *Safety action taken*

4.1.1 *VIA Rail Canada Inc.*

Upon completion of the internal investigation into this accident, VIA Rail Canada Inc. (VIA) managers went to the site and noted that the signs were not properly located. VIA communicated this information to the track owner, Canadian National (CN).

4.1.2 *Canadian National*

After being informed by VIA that the signs were not properly located, CN went to the site and moved the signs to the proper location, just before Mile 120.18.

Following a Transport Canada (TC) inspection at the St-Maurice Subdivision crossing on 15 July 2015, CN installed the railway crossing sign, the private crossing sign and the stop sign on a single post to avoid obstructing the view of other signs.

4.1.3 *Rail Safety Information Letter*

On 10 July 2015, the TSB sent TC Rail Safety Information Letter 05/15 concerning signage for train crews on the St-Maurice Subdivision. In this letter, the TSB stated that the proper identification of railway signs is essential to safe train operations and that rail signs that cannot be properly identified or are not properly located can lead to confusion among crew members and/or to an inconsistent application of the rules. The TSB informed TC that it is unknown whether all other track-side signs for train crews along the St-Maurice Subdivision are properly located or optimally positioned for train crew visibility.

On 12 August 2015, TC responded that the visibility and integrity of warning signs are monitored by its track monitoring program and that, if corrective measures are required, TC inspectors will contact CN.

4.1.4 *Haut-Saint-Maurice Centre de santé et de services sociaux*

Since the accident, more medical equipment and medication are available at the Haut-Saint-Maurice health and social services centre point of service in Parent so that several patients can be treated at the same time.

4.1.5 *La Tuque fire department (Parent area)*

Following a meeting during which the response and needs were examined and analysed, the La Tuque fire department (Parent area) acquired hydraulic spreader extrication equipment, extensible poles and various small tools. Once that equipment was received, a qualified instructor certified by the École nationale des pompiers du Québec delivered classroom and practical training to all personnel on the equipment use and different extrication methods.

This report concludes the Transportation Safety Board's investigation into this occurrence. The Board authorized the release of this report on 27 January 2016. It was officially released on 15 February 2016.

Visit the Transportation Safety Board'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 transportation safety issues that pose the greatest risk to Canadians. 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.