Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada

RAILWAY OCCURRENCE REPORT

PUBLIC CROSSING ACCIDENT

VIA RAIL CANADA INC.
TRAIN NO. 66
MILE 43.64, CANADIAN NATIONAL KINGSTON SUBDIVISION
RIVIÈRE-BEAUDETTE, QUEBEC
04 NOVEMBER 1994

REPORT NUMBER R94D0191

Canada

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Railway Occurrence Report

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Via Rail Canada Inc.
Train No. 66
Mile 43.64, Canadian National Kingston Subdivision
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Synopsis

On 04 November 1994, at approximately 2012 eastern standard time, VIA Rail Canada Inc. train No. 66 collided with a tractor-trailer at a public crossing in the municipality of Rivière-Beaudette, Quebec. The driver of the vehicle had slowed as he approached the tracks because a westward freight train was just clearing the crossing. He then continued when the automatic warning devices deactivated. As he entered the crossing, the warning devices reactivated because a passenger train was approaching. The truck driver abandoned his moving vehicle and ran to safety.

Upon impact, the leading truck of the locomotive derailed and the fuel tank punctured. A fire erupted at the rear of the locomotive. The train continued for approximately 4,000 feet before stopping. Railway employees fought the fire with on-board fire extinguishers.

The locomotive and club car were extensively damaged and the three coaches sustained minor damage. Two passengers and two locomotive engineers sustained minor injuries. The tractor-trailer was demolished.

This report must be considered in concert with the Board's report on the 20 November 1994 accident at Brighton, Ontario (TSB report No. R94T0357). In particular, the Board continues to be concerned about the safety of Canadians travelling by train where a collision induces a fuel-fed fire. The safety deficiencies relating to train operation identified in the respective accident reports are relevant in both cases.

Ce rapport est également disponible en français.

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1.0 Factual Information

1.1 The Occurrence

At approximately 2012[1], 04 November 1994, VIA Rail Canada Inc. (VIA) train No. 66 (VIA 66), carrying 197 passengers, was proceeding eastward on the south main track of the Canadian National (CN) Kingston Subdivision at approximately 94 mph. It struck a tractor-trailer carrying a loaded container travelling south on the Sainte-Claire public road crossing at Mile 43.64, in Rivière-Beaudette.

The driver of the tractor-trailer approached the two-track crossing while the gates were down and the flashing lights and bell were operating as a westward freight train was passing through the crossing on the north track. The truck driver timed his approach so that he would arrive at the crossing after the freight train had passed to avoid stopping the truck. When the freight train exited the crossing, the flashing lights and bell deactivated and the gates lifted. The truck driver proceeded as planned. Seconds later, however, the automatic warning devices reactivated and the gates started to lower because VIA 66 was approaching. The truck driver observed the passenger train and, believing that he would not have enough time to pass safely over the crossing, he jumped from the moving truck and ran from the right-of-way. Shortly thereafter, the train struck the abandoned truck near the area of its fifth wheel.

As VIA 66 approached the crossing, the locomotive engineer noticed a large object on the crossing. He initiated an emergency brake application, and both the engineer at the controls and the second locomotive engineer threw themselves on the floor of the locomotive operating cab. The train collided with the vehicle before the train brakes became effective.

The tractor cab, motor and frame separated and were hurled into the south-east quadrant of the crossing. A 15-foot section of the front-end of the trailer and the tractor frame were thrown to the north-east quadrant. The remaining portion of the trailer and the container fouled the north main track. Pieces of the tractor-

[1] All times are eastern standard time (EST) (Coordinated Universal Time (UTC) minus five hours) unless otherwise stated.

trailer struck and broke a locomotive window and projected the locomotive radio across the cab. Debris severed the cable supplying power from the locomotive to the cars. Debris also struck and damaged car windows as far back as the last car (fourth).

The leading truck of the locomotive derailed on impact. The derailed locomotive displaced a guard rail on the bridge over the Beaudette River, 250 feet east of the Sainte-Claire Road crossing, and travelled approximately 4,000 feet in a derailed condition. The impact from the collision severely jolted passengers, throwing several forward into seatbacks.

A locomotive fuel tank sustained two small punctures and approximately 600 gallons (2,700 L) of fuel leaked, feeding a fire in the area between the locomotive and the first car. The fire generated enough heat to cause the first two windows on the north side of the first car to burst. The fire was extinguished by VIA personnel and the local fire department with portable fire extinguishers shortly after the train stopped.

Normal lighting in the cars was lost just after impact. The emergency lighting system did not activate in any of the cars.

1.2 Injuries

Two passengers on the train sustained minor injuries and were taken to hospital; one had a broken nose and the other, a sore back. The two locomotive engineers received minor bruising.

1.3 Damage to Equipment

Impact and fire damage rendered the VIA locomotive unsalvageable. The club car suffered extensive fire damage and the three coaches sustained window and minor car side body impact damage.

1.4 Other Damage

The tractor-trailer was destroyed. Two gate arms were damaged.

1.5 Personnel Information

The operating crew of VIA 66 included two locomotive engineers, one conductor and one assistant conductor. They were qualified for their positions and met fitness and rest standards to ensure the safe operation of trains.

Four on train service (OTS) employees were located throughout the train and provided services to the passengers.

There were also four off-duty OTS employees and an off-duty CN police officer on the train.

1.6 *Train Information*

The train was powered by Light, Rapid, Comfortable (LRC) locomotive 6916. The consist included LRC club car 3452 and three LRC coaches (3344, 3300 and 3319). The club car was marshalled behind the locomotive with the "B" end (vestibule) leading.

1.7 *Method of Train Control*

The Kingston Subdivision is governed by the Centralized Traffic Control (CTC) system authorized by the Canadian Rail Operating Rules (CROR). Train movements at Mile 43.64 are supervised by a rail traffic controller (RTC) located in Montreal, Quebec.

1.8 *Weather*

There was a light rain falling with a 15 km/h north-east wind. The temperature was eight degrees Celsius.

1.9 *Recorded Information*

Event recorder data indicate that, at 2011:18.0, the train was proceeding at a speed of 95 mph with the throttle in position No. 8 and the brakes released. No change in operating information was shown for 20 seconds. At 2011:38.1, the speed was 94 mph, the throttle position and brakes condition were unchanged, and bell ringing was indicated. At 2011:40.0, whistling commenced. At 2011:43.5, the throttle was decreased and reached the "idle" position at 2011:46.5. At 2011:47.5, an operator-initiated emergency brake application was shown. At 2011:49.5, speed suddenly dropped from 94 mph to 38 mph and, one second later, registered 0 mph. The speed indication then continued to register 0 mph.

1.10 Occurrence Site Information

Sainte-Claire Road intersects the two main tracks in a north-south orientation at an angle of approximately 83 degrees. From the north, the road approach has an ascending gradient of approximately 7 per cent. (Railway-Highway Crossing at Grade Regulations provide for a maximum 5 per cent approach gradient.[2]) The crossing is equipped with automatic warning devices consisting of two signal units (flashing lights), short arm gates and a bell. The distance between the north and south gates is 40 feet. The design speed for the operation of the automatic warning devices is 95 mph which provides 23 seconds' warning time for vehicular

[2] Pursuant to General Order E-4 and the *Railway Act*, R.S.C 1970, Chapter R-2, the *National Transportation Act*, R.S.C. 1970, Chapter N-17, and the *Railway Safety Act*, 1988.

traffic before the train reaches the crossing.[3] The authorized speed for vehicular traffic on Sainte-Claire Road is 50 km/h. The sequence of events associated with the advance warning system is as follows:

Event	Time (seconds)
Signal starts (lights and bell activate)	0
Gate starts down	6
Gate half down	9
Gate full down	12
Train arrives	23

The train stopped at approximately Mile 42.85, in an unlit area. The track ballast on which the passengers detrained was rough and loose. The first crossing westward, Mile 43.48, was illuminated by street lights.

1.11 *The LRC Locomotive*

The LRC locomotive on VIA 66 was manufactured by Bombardier in 1980. The two underslung fuel tanks, which had a metal thickness of approximately 1/4 inch (6.3 mm), were on either side of the locomotive and had a combined capacity of 1,666 imperial gallons (7,597 L). The bottoms of the fuel tanks were approximately 6 ½ inches (16.25 cm) above the top of the rail. Neither the fuel tanks nor the three cross-feed lines between them were shielded against impact with foreign objects. Damage to the cross-feeds or the lower tank bodies can result in the entire load of diesel fuel draining to the ground. Electrical cables suspended beneath the fuel tanks were not protected against impact with foreign objects. The exterior of the locomotive was fabricated of aluminium alloy.

[3] General Order E-6 stipulates that automatic protection devices be activated at least 20 seconds before the arrival of a train operating at the maximum specified track speed. This is a long-standing industry standard in North America, the minimum warning time criteria of which may be increased to take into account longer clearance distances caused by multiple tracks, sharp crossing angle or other factors. Generally, however, the actual warning times are as close to the minimum as possible to minimize the chance of some drivers assuming that no train is approaching and taking inappropriate action.

1.12 The Motor Vehicle

The tractor (1987 Mack) was apparently in good mechanical condition. It had a 12-speed manual transmission. The truck driver reported that the truck was in Lo-Hi gear through the time leading up to the collision. The maximum operating speed in Lo-Hi gear was approximately 5 mph at 2,050 rpm (maximum governed rpm was 2,100). The fifth wheel was located 20 feet behind the front bumper. The tractor and trailer were 66 feet long and were carrying a 20-foot container loaded with 81,548 pounds of foundry sand. The truck driver was familiar with the crossing.

1.13 Tests

1.13.1 Speed, Time and Distance Testing

Tests using an identical tractor-trailer with a similar load were conducted at the crossing by the TSB Engineering Branch (Report LP 066/95).[4] It was assumed that, at the low truck speeds preceding the accident, the truck could have been stopped within one truck length (about 70 feet) upon brake application[5]. Based on this assumption, the tests did not involve instances where the truck was further than 70 feet from the gates when the signals activated. Since the truck driver could not indicate the location of the truck when he jumped out nor the speed of the truck at that time, several possible scenarios were explored. The TSB Engineering Branch concluded, in part, that:

1) The truck's maximum possible speed in the Lo-Hi gear was about 5 mph.

2) When the driver jumped out of the truck, it slowed down or stopped such that the average truck speed over the 23-second interval before the collision was 1 to 3 mph.

3) The truck's position, when the warning devices reactivated, could not be determined more precisely than

[4] This report is available upon request from the Transportation Safety Board of Canada.

[5] This does not mean to suggest that it would have taken 70 feet to stop. Depending on reaction time and initial speed, the stopping distance for this truck can be up to 55 feet at 7 seconds reaction time and 5 mph initial speed on a flat grade.

to say that it was somewhere within 50 feet of the north gate.

4) If the truck was too close to the north gate when the signals reactivated, there may not have been sufficient distance to stop. The stopping distance may have been effectively increased by the confusion suffered by the driver when he saw the signals stop and then start again.

5) If the truck was less than 30 feet from the north gate when the signals reactivated, it most likely could have continued safely through the crossing in the Lo-Hi gear.

1.13.2 Truck Acceleration Study

In May 1995, a *Truck Acceleration Study*, commissioned by Transport Canada - Surface, was released. The study was undertaken to determine the time various types of trucks (i.e., straight trucks, tractor-trailers and tractor trains) take to cross one to four railway tracks from both standing starts and various initial speeds. The study compiled the time, speed and distance measurements of approximately 215 vehicles.

Of particular interest to this investigation was the determination of the time required for trucks of all configurations to cross two tracks from a standing start. Based on observations of four straight trucks, it was determined that the slowest could negotiate a double main track crossing in 8.17 seconds and the fastest, in 5.79 seconds. The observation of 163 tractor-trailers revealed that the slowest could cover the required distance in 36.06 seconds and the fastest, in 6.78 seconds. The median time was 13.06 seconds. Tractor trains presented similar results although the slowest tractor train was measured as crossing two tracks over six seconds faster than the slowest tractor-trailer. Three- and four-track distances provided times for the slowest vehicles that ranged from 33.42 to 44.8 seconds.

It is noted that the testing occurred with the drivers exerting a concerted effort to achieve minimum times on a flat, smooth and dry roadway (a weight scale area). Therefore, the recorded times reflect optimum truck performances. The study also demonstrated that, if the various types of trucks do not stop before moving over the crossing, times to traverse tracks are significantly reduced, and the time differences between the fastest and slowest of truck types are very close. It was noted that, at a starting speed of 10 km/h, tractor-trailers negotiated the two-track distance in 12.57 to 13.50 seconds.

1.14 Other Information

1.14.1 Train Operating Crew

After the collision, the conductor, who was in the second coach (third car from the locomotive), attempted to contact the crew in the locomotive by train radio. He was unsuccessful as the locomotive radio had been damaged in the collision. He then contacted the RTC in Montreal by cellular phone and obtained protection against other trains on the adjacent main track. The conductor then detrained to determine the cause of the stop and ascertain the condition of the crew members on the locomotive.

After observing that the locomotive engineers had exited the locomotive and that the fires had been brought under control, the conductor walked toward the rear of the train. He determined that all the passengers had been evacuated and then walked back to the first crossing westward to see if the passengers could safely walk on the right-of-way. Returning from the crossing, he met passengers walking away from the train. Although he indicated to them that they should stay with the train, they could not be deterred from continuing toward the crossing. They indicated that someone, apparently in authority and a member of the train crew, had advised them to walk to the crossing. At about that time, police and fire-fighters began arriving on the scene.

1.14.2 *LRC Public Address System*

The public address (PA) system on LRC cars was designed to provide communication throughout the train, or within each individual car, while the train was either moving or stationary, with normal electrical power provided by the locomotive.

The PA system did not function on emergency power (which did not activate in any event) and there was no auxiliary method such as a megaphone on board the train that could have been used to instruct the passengers to safety.

1.14.3 *LRC Emergency Lighting and Power*

Passenger car emergency battery power of 60 volts direct current (DC) was designed to activate automatically when the normal power supplied by the locomotive was cut out. Normal power was lost when the cable from the locomotive was severed; however, the emergency power did not activate as designed.

The batteries (two banks of five 12-volt batteries) were contained in compartments under each passenger car. They were designed to supply power to emergency lights located under aisle seats on one side of the car, and to overhead lights located in the galley, vestibule and washroom areas. This power supply was also designed to operate the vestibule doors. The design standard stipulated that the batteries maintain emergency lighting for two hours at 20 degrees Celsius. The system provided that emergency power be shut off if the voltage level dropped below 55 volts -- a feature designed to prevent complete battery discharge and subsequent freezing damage in cold weather. At the time of the occurrence, there was no schedule in place to replace batteries; they were only changed when they failed to function.

There was no exterior emergency lighting to provide illumination for passengers detraining from the equipment into darkness nor was there any emergency portable lighting (flashlights), other than that carried by VIA employees, available to assist passengers in the event of an emergency. The emergency features, such as pictograms, signage, emergency break-out hammers, exit windows and manual vestibule door handles, were not lit.

The OTS employees were each equipped with pocket-size pen-lights.

The operating crew each carried a standard two-battery flashlight. The pen-lights were particularly ineffective; neither type provided adequate lighting in the circumstances of this occurrence.

1.14.4 Evacuation of Passengers

Each car was equipped with three corridor doors; two at the "B" end and one at the "A" end. Vestibule doors (one on each side) with exit and entry steps were installed on the "B" end between the corridor doors. With the loss of normal power and the failure of emergency power, the vestibule and corridor doors had to be opened manually. Although a mechanical problem initially delayed opening one vestibule door (north side) in the coach immediately behind the club car, VIA employees encountered no problems in manually opening doors to evacuate the passengers.

Fire and smoke from the burning diaphragm and connecting cables between the locomotive and the club car prevented the club car passengers from evacuating through the vestibule doors. In the absence of instructions, passengers at the rear of the club car were not immediately aware of the fire when the train came to a stop and tried to retrieve their luggage which was stored at the front end of the car. This impeded other passengers trying to make their way to the rear of the car.

Some passengers stated that they were confused while trying to leave the train, not knowing why it had stopped. The OTS employees coordinated the evacuation of the passengers. Some passengers left the train without hearing instructions from the operating crew or OTS employees.

The four off-duty OTS employees and the CN police officer provided assistance by helping to extinguish the fire, helping passengers to exit the train and guiding passengers to the crossing.

Passengers who were unable to walk the entire distance to the crossing were eventually transported by all-terrain vehicles. Passengers were later transported to their destinations by buses.

1.14.5 An Accident with Similar Consequences

On 20 November 1994, a VIA train travelling at 96 mph struck a piece of rail deliberately placed on the tracks in Brighton, Mile 242.7 of the Kingston Subdivision. The piece of rail punctured the locomotive fuel tanks, damaged two cross-feed lines and severed traction motor electrical cables. The releasing diesel fuel ignited, engulfing the train and forming a fireball. The spilling diesel fuel lubricated the rail and brake components, prolonging the stopping distance and increasing the train's and passengers' exposure to the fireball. Forty-six passengers were injured as a result of this accident (TSB report No. R94T0357).

1.14.6 Employee Safety Suggestions

Several safety suggestions were made to the TSB, including:

- radios in the cabs of LRC locomotives should be better secured to prevent the radio becoming a projectile during an impact (as in this occurrence);
- portable radios and telephones are essential for *all* train crews;
- ladders of sufficient length should be available in LRC locomotive cabs to aid in evacuation from window exits;
- the on-board fire-fighting equipment should be sufficient to gain control of sizeable fires;
- off-duty OTS personnel and any CN police officers should be identified to the train crew and placed in key locations on the train to assist in emergencies; and
- axes, pry bars and hammers positioned in locomotive cabs would assist the operating crew in facilitating emergency passenger evacuation.

1.14.7 Views of the Trucking Industry

The Canadian Trucking Association submitted that commercial vehicles daily face the reality of the "no option zone" at crossings as demonstrated in this occurrence. This has been a concern to the industry for many years because, although the actual number of accidents is low, the potential consequences are significant.

The industry notes that, in its opinion, the lengthening of the time between warning signal activation and train arrival would aid commercial vehicle operators in negotiating the "no option zone" safely. However, it unfortunately may result in an increase in the frequency of impatient drivers circumventing the signals. It points out that research and development efforts are under way to provide electronic solutions to the problem.

1.14.8 Views of Transport Canada

Transport Canada (TC) submitted that truck acceleration in studies shows that some trucks in certain circumstances may have a "no option"[6] dilemma.

There are too many unknowns to recreate exactly the vehicle operation in respect of:

- the location and initial speed of the truck when the signal indicating the approach of the VIA train first could have been seen;
- when the driver first realized that the VIA train was approaching; and
- when he decided to take action.

However, the facts support the following:

- the driver did not intentionally place himself and his vehicle in jeopardy;
- he did not correctly interpret the situation in time to avert the collision, if indeed he was in a position to stop before the south track or accelerate over it before the VIA train arrived when he first realized that the train was approaching;

[6] The zone before a crossing where a driver can neither stop before the crossing nor accelerate safely over the crossing before a train arrives at the crossing.

- for some trucks in certain circumstances, when approaching a crossing, the driver can be in a situation where he can neither stop nor accelerate over and clear of the track.

2.0 Analysis

2.1 Introduction

The train was operated in accordance with government safety standards and railway operating instructions. The automatic warning devices activated as intended. The train stopped in a distance nearly typical for such a movement even though the locomotive was derailed. The crew members were immediately able to receive protection for their train from the RTC.
Railway employees quickly brought the fire under control and evacuated the train without incident.

Although this accident resulted in only minor injuries to four individuals, the potential for multiple deaths and injuries existed. The impact derailed the locomotive which fortunately remained upright and, guided by the tracks, crossed the bridge over the Beaudette River and beyond. Damage to the bridge or deviation from the tracks could have precipitated a catastrophic pile-up of the train or could have resulted in it plunging into the river.

Pieces of the tractor-trailer punctured a fuel tank and severed an electrical connection between the locomotive and the club car. The severed electrical cable or sparks from truck debris ignited the leaking fuel which in turn burned the locomotive and club car, a situation similar to the VIA accident at Brighton 16 days later. It would seem that only the lesser rate of fuel loss prevented a larger life-threatening fire.

Although the passengers detrained without incident and were able to make their way to safety, many of the safety deficiencies identified in this accident were the same as those identified and extensively analysed in the Board's report on the Brighton accident (TSB report No. R94T0357).

2.2 Consideration of the Facts

2.2.1 Road Gradient

It is noted that the gradient of the road approaching the crossing from the north exceeded the recommended standard by 2 per cent. The added gradient would have increased the time required for trucks to negotiate this crossing from a standing start and would have increased deceleration on braking, but decreased acceleration on throttle application from a rolling condition.

2.2.2 *Crossing Protection Activation*

The investigation on this accident, the TSB Engineering Branch tests and the TC study demonstrate that, in circumstances where vehicles have stopped before a crossing, some tractor-trailers and tractor trains cannot negotiate two or more tracks within the current 20 seconds' minimum advance warning device activation time. Not only does it seem that a certain number of vehicles take longer than 20 seconds to traverse such crossings, it also follows that, in circumstances where there is hesitation or other complicating issues (e.g., rough crossings, a gradient, surging liquid product), the capabilities of more trucks would fall short of requirements. The current minimum warning activation time (20 seconds) may not provide sufficient time to allow the safe passage for all trucks that have stopped before entering all crossings.

The “no option zone” would be theoretically of different length and location for different trucks and road conditions. Such a zone exists for some if not all heavy commercial trucks at many multi-track crossings. Thus, even for trucks that have not stopped before entering the crossing, the current automatic warning device activation time and/or advanced warning signage may not provide sufficient time and/or advanced warning to allow the safe passage for all trucks, especially if the truck speed is not maintained through the crossing (e.g., if signal activation causes driver hesitation).

It should be noted that many crossings equipped with automatic warning devices present restricted sight-lines in one or more quadrants. Such crossings make the visual determination of safe transit criteria difficult, and truck drivers in such circumstances therefore must rely on the automatic warning devices to avert a collision with the passing or oncoming train.

2.3 *The Fire*

Pieces of the truck punctured a locomotive fuel tank and severed the cable supplying electrical power to the cars. Sparks from dragging debris or the severed power cable ignited the leaking, wind-whipped fuel.

The relatively small punctures and the low fuel load (2,700 L or 600 gallons) limited the fire. However, it is believed that the situation was close to that which developed with VIA 66 at Brighton when a large fireball from leaking fuel exposed many passengers to a real and immediate risk to their well-being. Many identified fire issues flowing from that accident (i.e., fuel tank protection, fuel loss prevention measures, passenger car emergency escape features) apply to this accident.

2.4 Emergency Power

Since the emergency power system in each car operates independently, it is considered highly unusual that the emergency power systems would be inoperative on all the cars. The 55-volt minimum shut-off feature was in all likelihood the reason for such failures which in turn could be attributable to weak or defective batteries. Therefore, inappropriate maintenance procedures are viewed as an underlying cause, and the appropriateness of the shut-off feature must also be questioned.

2.5 Post-Accident Events

When the train stopped, the OTS personnel and operating crew members were able to open the corridor and vestibule doors manually, and the passengers detrained quickly without incident. The fire was not perceived as being an immediate threat to their well-being. However, railway employees and passengers alike were affected by several shortcomings in car design.

The emergency lighting did not function, increasing anxiety, complicating detraining, and making movement around the train difficult. The small flashlights supplied to railway employees were insufficient in number and luminescence to provide much help.

The PA system did not function on emergency power (although emergency power was not functioning in any event) and could not provide railway employees with the ability to communicate basic evacuation instructions to passengers (i.e., to leave their luggage on the train, to alert them to move to the south of the right-of-way or to announce instructions on when and how to proceed to safety). The railway employees could not impart information respecting the conveyance of those who could not proceed on their own or provide basic information on luggage pick-up or busing instructions. Passengers and railway employees alike indicated that the lack of public broadcast capability was a major shortcoming.

Detrained passengers received conflicting instructions from different and largely unidentified individuals. It is suspected that most people giving directions were railway employees, but the lack of lighting and identifying features on the clothing of railway employees precluded such identification. However, it was apparent that no one employee took control and that no pre-determined plan was in effect.

2.6 General

This report must be considered in concert with the Board's report on the 20 November 1994 accident at Brighton (TSB report No. R94T0357). In particular, the Board continues to be concerned about the safety of Canadians travelling by train where a collision induces a fuel-fed fire. The safety deficiencies relating to train operation identified in the respective accident reports are relevant in both cases.

3.0 Conclusions

3.1 Findings as to Cause and Contributing Factors

1. VIA 66 was being operated in accordance with company procedures and government safety standards.

2. The automatic warning devices functioned as intended.

3. When the automatic warning devices reactivated (for the VIA train), the truck driver either did not correctly interpret the situation in time to avert the collision or he was unable to do so.

4. The truck driver abandoned his vehicle when he felt that he did not have sufficient time to accelerate over and clear of the south track.

5. Maintaining forward momentum when approaching crossings lessens potential exposure to trains and increases safety for some trucks once past the point where the truck cannot stop before the crossing.

6. Some tractor-trailers and tractor trains, upon signal activation, when moving slowly within a certain range of distances from the tracks or starting from a standing start, cannot negotiate two or more tracks before the train reaches the crossing.

7. Crossing transit times will be lengthened where the driver hesitates or experiences other complicating factors and this will increase the probability that trucks will not be able to clear two or more tracks in the available time between warning device activation and the arrival of the train at the crossing.

8. Debris from the truck punctured a locomotive fuel tank and severed the electrical cable supply power to the cars.

9. Leaking fuel, dispersed in the air, was ignited either by sparks from dragging debris or by the severed power cable.

10. The potential risk to the well-being of passengers and

crew members was mitigated by the relatively small punctures and low fuel load, coupled with train braking within near-normal parameters.

11. The public address (PA) system did not function on emergency power, denying VIA employees the means to effectively direct and manage both the evacuation of the train and passengers congregated on the right-of-way.

12. The lack of outside emergency lighting, the unavailability of portable lighting (i.e. flashlights) and the fact that VIA employees did not wear any type of clothing that made them easily identifiable in the darkness, impaired train evacuation and occurrence site organization and movement.

13. The emergency power system could not be relied upon to function, has no performance standard for low temperatures, and is not maintained to ensure maximum performance.

14. Many of the safety issues identified in this accident were the same issues identified by the Board in its report of the 20 November 1994 accident at Brighton, Ontario.

4.0 Safety Action

4.1 Action Taken

4.1.1 Railway Passenger Safety

During the investigation into the occurrence at Brighton, Ontario, on 20 November 1994 (TSB report No. R94T0357), several safety deficiencies with respect to passenger safety were identified. As a result, the Board made specific recommendations regarding the emergency egress hammers (in December 1994) and the overall standard and regulatory oversight of passenger safety in the railway industry (in July 1996). The TSB also forwarded five Rail Safety Advisories to Transport Canada (TC) and Via Rail Canada Inc. (VIA) in February 1995 with respect to several other safety deficiencies.

In response to the identified safety deficiencies, VIA initiated several actions with respect to emergency egress and the provision of passenger safety information. However, by late summer 1997, some of these proposed measures had not been fully implemented, and it appeared that many previously identified deficiencies had put the safety of passengers and railway employees at risk in the fatal VIA accident that occurred near Biggar, Saskatchewan, on 03 September 1997.

Shortly after the accident at Biggar, the Minister of Transport announced a delay in the re-introduction of the proposed amendments to the *Railway Safety Act* in order to determine whether further adjustments to the legislation were required. (It is understood that modifications to the Act will include provisions for passenger safety and the implementation of an effective regulatory regime to enforce these provisions.) TC also took regulatory action under the *Railway Safety Act*, and issued notices to VIA regarding:

- Emergency exit information for passengers on VIA trains
- Number and accessibility of trauma kits on VIA trains
- Passenger safety cards for VIA transcontinental fleet
- Emergency signage for emergency exits.

In the course of the TSB's investigation into the Biggar occurrence, the examination of the wreckage, post-accident interviews, and a survey of the passenger safety features of other VIA train operations confirmed that a number of significant shortcomings persisted in the current passenger safety practices. Notwithstanding the immediate measures taken by TC, and recognizing that the effective implementation of comprehensive standards for rail passenger safety would take time, the Board believed that many other safety measures could be implemented immediately, such as:

- Standardized passenger safety briefings prior to departure
- Passenger safety cards demonstrating emergency procedures
- Conveniently located emergency window exit hammers, with unequivocal signage and instructions for effective use
- Sufficient numbers of appropriately equipped and readily accessible trauma kits
- Readily accessible flashlights
- Emergency signage for all emergency exit routes, and equipment which is both understandable and legible under emergency conditions
- Exterior emergency signage to assist first responders
- Effective emergency public announcement systems
- Effective emergency lighting systems
- More secure stowage of, or restrictions on, carry-on baggage
- Completion of standardized training for all train crew and on train service (OTS) personnel on emergency procedures.

Therefore, the Board recommended, as a matter of urgency, that:

> The Minister of Transport require that VIA Rail complete its implementation of those short-term measures necessary to improve rail passenger safety (as outlined above) within 30 days.

(R97-07, issued October 1997)

The Board is pleased to note that immediately following the release of this recommendation, VIA announced that, in light of the Board's interim recommendation, VIA was committed to completing, within the next 30 days, the initiatives commenced as a result of the Board's recommendations stemming from the Brighton accident.

Furthermore, the Board understands that TC has approved the "Railway Passenger Car Inspection and Safety Rules" submitted by The Railway Association of Canada (RAC). The Rules are to come into effect on 01 February 1998 and contain provisions on emergency exits, signage, instructions, securement of baggage, and provide for "fail-safe" design of public address (PA) systems and emergency lighting. An industry rule respecting emergency evacuation and response is also being considered. The RAC has put together a working group that will develop "Passenger Safety Rules" for final consideration before the end of March 1998.

4.1.2 Crashworthiness of Locomotives

4.1.2.1 Fuel Tanks

Given the risk posed to the travelling public by the limitations in the crashworthiness of existing passenger locomotive fuel tanks, in its report on the Brighton accident, the Board made recommendations addressing the short-term and long-term design of the fuel tanks. In the short term, the Board recommended that:

> The Department of Transport assess the design of the current passenger locomotive fuel tanks and require, in the short term, that measures be taken to improve their Crash worthiness, including limiting fuel spillage.
> (R96-05, issued July 1996)

For the long term, the Board recommended that:

> The Department of Transport require that design standards for new passenger locomotives take into consideration the need for crash-resistant fuel tanks and fuel systems.
> (R96-06, issued July 1996)

In response, TC indicated that since the LRC locomotive fuel tanks are an intricate part of the frame, VIA had no plans to modify the configuration of fuel tanks on the seven locomotives remaining in service. The response did not address other types of locomotives in passenger service. However, the submission from The Railway Association of Canada (RAC) on the "Railway Locomotive Inspection and Safety Rules" was approved by the Minister of Transport on 18 September 1997, to come into effect on 18 March 1998. Crashworthiness of the locomotive fuel tanks is now covered under Rule 19.1, which states: "Fuel tanks, on new locomotives purchased subsequent to the approval of this rule, are to be high impact resistant design which meet or exceed current Association of American Railroads Manual of Standards and Recommended Practices (RP-506)."

4.1.2.2 Electrical Cables

Given the risk posed by the present location of the electrical power cables on LRC locomotives, and to minimize the risk of having these cables damaged if struck by objects on the tracks or as result of other types of accidents, the Board recommended that:

> The Department of Transport assess the routing of the electrical cables on LRC passenger locomotives and require that measures be taken to minimize the vulnerability of the cables to accidental damage.

(R96-07, issued July 1996)

TC held discussions with VIA concerning the feasibility of re-routing the high-power electrical cables, and VIA has indicated that it has reviewed the possibility of re-routing these cables and found that it would not be possible. Instead, VIA has put in place a program to retrofit the LRC locomotives; each locomotive will be pulled out of service and a steel cover plate will be added to the underside of the locomotive so that the cables are no longer directly exposed. The first locomotive is currently being modified and the modification process should be completed in early 1998.

4.1.3 LRC Batteries

All batteries on LRC cars have been replaced by more appropriate batteries and an annual maintenance and renewal program has been instituted. Reportedly, the emergency power system on all LRC equipment was to be modified by fall 1997.

4.1.4 Crossing Protection for Commercial Trucks

TC will communicate its analysis of the issues arising from the its *Truck Acceleration Study* to the Canadian Council of Motor Transport Administrators and to the RAC. It will also modify the provisions of the proposed "Railway Highway Grade Crossing Manual" to include that consideration is to be given to large trucks when determining the sight-line requirements and timing of automated warning signals operation.

4.2 Safety Concern

4.2.1 Accelerate-Stop Distances

The Board notes the dilemma of the trucking industry (see Section 1.14.7) with respect to the "no option zone" encountered by some commercial truck operators at railway crossings. The Board understands that TC's plans to modify the sight-line and automatic warning signal timing provisions of its proposed "Railway Highway Grade Crossing Manual" will only apply to new crossings. Therefore, the Board is concerned that some commercial truck operators will remain vulnerable to the hazards of the "no option zone" at existing crossings, and as such, the Board will continue to monitor this issue in its investigations of railway crossing occurrences.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board, consisting of Chairperson Benoît Bouchard, and members Maurice Harquail, Charles Simpson and W.A. Tadros, authorized the release *of this report on 16 December 1997.*