Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada

RAILWAY INVESTIGATION REPORT
R05E0008

CROSSING ACCIDENT

VIA RAIL CANADA INC.
PASSENGER TRAIN NUMBER 1
MILE 92.26, EDSON SUBDIVISION
MACKAY, ALBERTA
31 JANUARY 2005

Canada

Railway Investigation Report

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Summary

On 31 January 2005 at 1310 mountain standard time, VIA Rail Canada Inc. passenger train No. 1, proceeding westward, was struck by a southbound logging truck on Secondary Highway 751 at the public crossing, Mile 92.26 of the Canadian National Edson Subdivision. The crossing was protected by flashing lights, signals and bells, and active advance warning signs located approximately 104 m in advance of the crossing. As a result of the collision, both locomotives and all nine passenger cars derailed. The driver of the truck sustained serious injuries and was transported to hospital. All 86 passengers and 16 crew were evacuated to the local community centre. One passenger and one passenger service crew member sustained minor injuries. Approximately 6500 litres of fuel was lost from the lead locomotive.

Ce rapport est également disponible en français.

Other Factual Information

VIA Rail Canada Inc. (VIA) passenger train No. 1, comprising two locomotives and nine passenger cars, departed Edmonton, Alberta, destined for Vancouver, British Columbia, on Canadian National's (CN) Edson Subdivision. There were 16 VIA personnel and 86 passengers aboard the train. Figure 1 shows the location of the accident site.

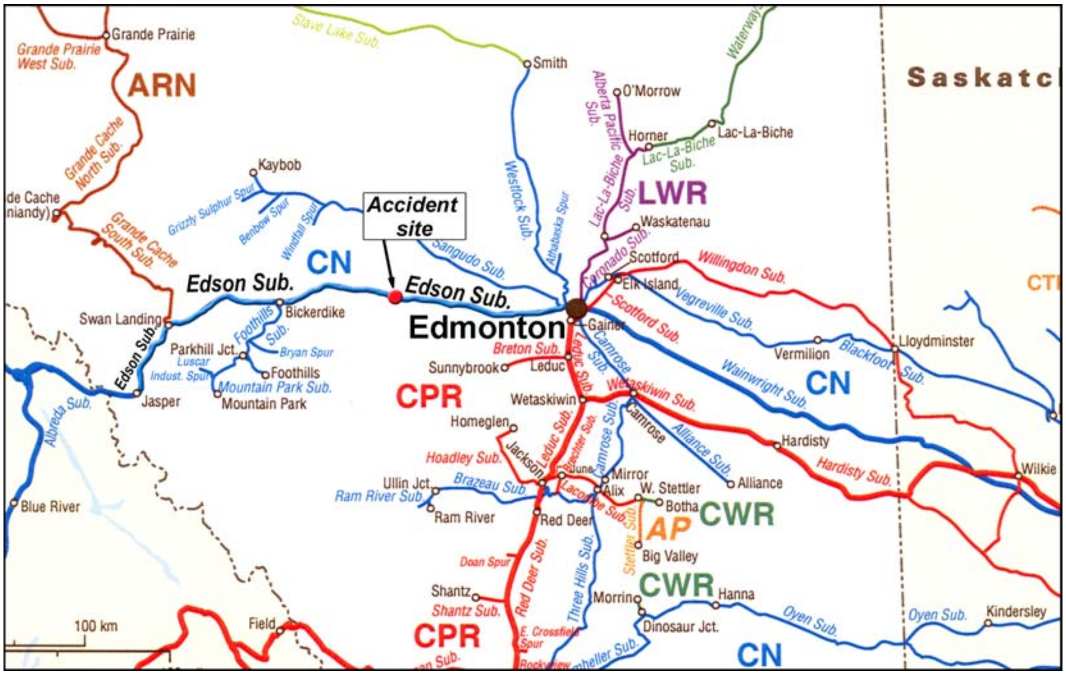

Figure 1. Map showing the location of the accident

The trip was normal until the train approached the public crossing at Secondary Highway 751 near MacKay, Alberta. As the train approached the whistle post,[1] the locomotive engineer observed a loaded logging truck on the highway approaching the crossing from the north. The train was travelling at 70 mph, which was the permitted subdivision speed for passenger trains. The truck did not appear to slow down as it approached the crossing. The locomotive engineer repeatedly sounded the train's horn to alert the driver. At the last second, as the train entered the crossing, the truck swerved west in an attempt to miss it. The truck collided with the north side of the cab of the lead locomotive, derailing the entire passenger train to the south side of the track.

The truck came to rest in the ditch north of the track. There were no marks on the pavement to indicate that the truck's brakes had been applied before impact.

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1 A whistle post is a sign on the right-of-way located at least one-quarter mile from the edge of all public crossings at grade, blind curves, and tunnels.

Once the train came to rest and the crew determined that it was safe to do so, the passengers were evacuated. Both passengers and VIA crew were transported a short distance to the MacKay Community Hall where an emergency shelter was set up. Ambulance crews were at the accident scene. They also set up a first-aid station in the hall and attended to all passengers as they arrived. Two minor injuries resulted from the collision. One passenger received a minor facial abrasion from luggage that fell from an overhead rack that was not enclosed or equipped with restraint netting. One VIA employee received a minor injury from a counter corner when he fell into it during the derailment. VIA organized alternate transportation for the passengers to their destination.

A local emergency response team member who lived adjacent to the right-of-way immediately reported the derailment to emergency services. The Royal Canadian Mounted Police (RCMP), CN police, an Edson fire department crew, ambulance crews from Edson, Drayton Valley, and Mayerthorpe, and air ambulance crews were immediately dispatched to the scene to provide assistance. The local MacKay residents set up the Mackay Community Hall as an emergency shelter, and supplied food and beverages to those affected by the derailment. The RCMP disaster services unit from Mayerthorpe also dispatched their trauma experts to help debrief anyone who may have been adversely affected by the accident scene.

The truck and its trailer were severely damaged. During the collision, the logs were thrown over the train, landing in the ditch and onto the south side of the main track. The driver was seriously injured and pinned in the truck. After rescue personnel extracted him from the truck by using the jaws of life, he was flown by air ambulance to a hospital in Edmonton.

The weather was approximately –5°C, and clear and sunny. The road surface was paved and dry. The sun was high in the sky and not in a position where it would have affected the driver’s view of the train or of the road signs and signals as he approached the public crossing.

Passenger Rail Cars Involved in the Occurrence

The train’s nine cars were numbered in this order from front to back:

8610 – Luggage car
8136 – Coach car
8504 – Skyline dome car
8335 – Mackenzie Manor with sleeping compartments
8408 – Empress kitchen car
8307 – Blair
8340 – Stuart Manor with sleeping compartments
8319 – Dawson Manor with sleeping compartments
8717 – Waterton Park/dome car with some sleeping compartments

Recorded Information from the Locomotives

Recorded information indicates that, immediately before the accident, the train was proceeding at 70 mph in throttle position 8. In accordance with Rule 14 (l) of the *Canadian Rail Operating Rules*, the locomotive engineer sounded the locomotive horn for approximately 15 seconds before entering the crossing. The bell was also sounded. When the locomotive engineer realized that the truck was not going to stop, he initiated an emergency brake application. The train decelerated from 70 mph to 0 mph in approximately 12 seconds. The head end of the train came to a stop approximately 255 m west of the crossing.

Damage to Track and Equipment

Both locomotives sustained significant damage that required removing them from service. The first three cars behind the locomotives came to rest at various angles and sustained significant damage. The remaining six cars stayed upright but derailed adjacent to the track, and all were damaged to some degree (see photos 1, 2, and 3).

Photo 1. View of damage to the north side of luggage car 8610

Photo 2. View of the derailment and associated track damage looking eastward from the crossing

Photo 3. View of the damage to the north side of the two locomotives

Approximately 245 m of track west of the crossing required replacement.

Accident History

TSB records indicate two previous accidents at this crossing: one in 1990 (R90E0286), which involved a heavy truck, and one in 1993 (R93E0015), which involved a logging truck. In occurrence R93E0015, CN freight train 404-XM-10, while travelling eastward, was struck by a logging truck between the second locomotive and the first car. There was minor damage to diesel unit 9497 and to the two following cars. No injuries were reported.

Crossing Design and Warning Devices

The highway approaches to the crossing from both directions are curved. The railway track intersects the highway at 90 degrees. The average daily highway traffic over the crossing in 2005 was 480 vehicles, including 50 heavy vehicles. The railway crossing was equipped with flashing lights and a bell, designed to provide around 23 seconds of warning before a train entered the crossing. On the highway approaches to the crossing, there were reduced speed zones, advance crossing warning signs, and cantilever-mounted active advance warning signs to alert motorists.

The allowable highway speed was posted at 100 km/h. For the safety of the MacKay community, the highway speed was reduced to a maximum of 50 km/h at 384 m from the crossing. This distance is approximately 3.2 times the stopping distance required for a heavy vehicle, such as a loaded logging truck, travelling at the speed limit.

Approximately 286 m from the crossing, an advisory 30 km/h speed sign was posted on the highway. This was located at approximately 4.8 times the stopping distance required for a heavy vehicle travelling at the advised speed.

The active advance warning signs were located 103 m from the crossing, which is within the recommended design specifications.[2] The lights were aimed tangentially to a point on the curve. The plan for the location of the sign required it to be "located inward toward the highway." This resulted in the sign pointing slightly to the left of approaching vehicles.

Guidelines for the location and orientation of active advance warning signs are contained in the *Manual of Uniform Traffic Control Devices for Canada* (MUTCD-C), which states that

> The signs should be installed in a conspicuous position adjacent to the travelled lanes, or above the travelled lanes at a distance from the crossing that takes into account roadway geometrics, vehicle types and operating speed.

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[2] These design specifications are set out in the *Manual of Uniform Traffic Control Devices for Canada* by the Transportation Association of Canada.

It further states that

> The Prepare to Stop at Railway Crossing sign indicates to drivers in advance of a railway crossing that there is a high probability of having to stop for railway crossing signals ahead.
>
> …the Prepare to Stop at Railway Crossing sign may be warranted at signalized crossings where one or more of the following conditions exist:
>
> - on roads with a speed limit of 90 km/h or greater;
> - where sight restrictions are present;
> - at the bottom of a hill or downgrade of considerable length; or
> - where environmental conditions frequently restrict visibility.

The MUTCD-C indicates that a tab sign (WB-5S) "Prepare to Stop" may be used to supplement the WB-5 roadway intersection sign. It may also be used to supplement the WB-6 railway crossing sign.

The MUTCD-C does not provide detailed guidance on locating signs when they are on or near curves, but does indicate that the signs should face approaching traffic at approximately right angles to the direction of the traffic that they are intended to alert. The advance warning sign could be observed through the trees on the inside of the curve approximately 480 m along the highway from the crossing. It became clearly visible about 280 m from the crossing.

All railway crossing warning signals were tested after the accident and were found to be in good working order. The active advance warning signs were synchronized to activate at the same time as the warning lights and bell at the crossing.

Crossing circuits are designed to fail-to-safe, that is, any malfunction results in activating the crossing protection system. During the two weeks preceding the accident, the crossing circuit malfunctioned twice, resulting in the continuous operation of the crossing warning devices.

After the accident, TSB investigators observed a motorist drive through the active crossing at approximately 50 km/h just three or four seconds ahead of a freight train. The driver stated that she had observed the crossing lights functioning without a train present and so had less confidence in the warning provided. During a subsequent study of the crossing, when the crossing lights were discreetly activated to simulate nuisance operation, several motorists drove through the active warnings without stopping.

Logging Truck and Log Trailer

The truck was a 1994 Freightliner conventional cab with a tandem rear axle. In addition to the normal braking system, it was equipped with a Jacobs engine brake. The Jacobs engine brake is a hydro-mechanical device mounted under the engine valve cover. Once activated from the cab, it changes the timing of the engine exhaust valves, converting the engine into an air compressor. The resulting retarding power is proportional to engine rpm. It is typically used on heavy-duty commercial vehicles to enable safer vehicle speed control in various driving conditions, from flat lands to steep downhill descents. This feature uses the engine to slow the vehicle without overheating its wheel brakes.

The 40-foot log trailer was a Peerless Page HRL Tri-Dem with a 75 000-pound suspension rating with three axles rated at 22 500 pounds each. Although the vehicle brake system was originally equipped with automatic slack adjusters, they had been replaced with manual slack adjusters. The tare, or empty, weight of the trailer was approximately 15 000 pounds.

Mechanical Inspections, Permits, and Vehicle Inspection Requirements

Both the truck and trailer had a valid inspection certificate as required by the Alberta Transportation Commercial Vehicle Inspection Program. The last annual inspections performed on the truck and trailer took place on 06 July 2004 and 30 November 2004, respectively. Because of the truck inspection results, repairs were made to the No. 2 axle slack adjuster on the right side. The trailer inspection did not reveal any defects.

A Transport Officer of the Alberta Transportation Vehicle Safety Branch conducted post-accident mechanical inspections of both the truck and the trailer. The truck inspection revealed that the 10-speed transmission was wedged in sixth gear as a result of the collision, which equates to an operating speed of between 50 km/h and 60 km/h. Further mechanical inspection of the truck revealed no mechanical or braking anomalies.

Two mechanical inspection tests were performed on the trailer braking system. These tests revealed the following problems:

- The No. 1 right axle was stroked out of adjustment, meaning that no pressure could be applied to the brake drum by the shoes.
- The No. 3 left axle brake pot (cylinder) was inoperative due to diaphragm failure. Furthermore, there was no spring brake at the No. 1 axle (right) and No. 3 axle (left).
- There was a missing plug at the caging access opening that allowed contaminants to fill the spring brake cavity.
- There was a service air leak at the No. 3 left axle, meaning that full service brake applications would not have been possible on the trailer.
- There was poor slack adjuster functioning, which would have reduced the effectiveness of the trailer brakes.

The Alberta Transportation Vehicle Safety Branch concluded that there would not have been sufficient air pressure to adequately apply a full service brake application on the trailer. It was also concluded that the service brakes would have had little braking effect on the loaded trailer because two wheels had no action, which then would have rendered the remaining four wheels ineffective.

Drivers are responsible and accountable for the safety and maintenance of their equipment, and operators must have a proactive safety and maintenance program. Regulations require that, before taking their trucks out on the road, drivers perform a pre-trip inspection that includes looking under the hood and in the cab, and walking around the vehicle. During regular rest stops, drivers should perform a short inspection to ensure that their rigs are still in good condition and that the load is still secure. According to the *Traffic Safety in Alberta* Web site, the driver must ensure that "The air brake pressure build up time is adequate and the air pressure drops by an acceptable amount when you apply the brakes." Further, according to AR 118/89s2; 115/2003 "Inspections":

> 3(1) The driver of a commercial vehicle shall inspect it prior to operating it at the beginning of a work shift and after he ceases to operate it at the end of a work shift. (2) An inspection carried out under subsection (1) must include an inspection of the following equipment:
>
> . . . (e) the service brake, including the trailer brake connections.

Although carriers are required to implement safety and maintenance plans, these were not in place. Currently, verification of these programs is carried out by Alberta Infrastructure and Transportation through random audits and cause investigations.

In Canada, the Road Check 2005 Survey,[3] a three-day inspection event for trucks and buses, resulted in 17.4 per cent of the inspected vehicles being removed from service. Brake system problems were identified in 55 per cent of these vehicles.

Truck Event Data Recorders

The 1994 Freightliner truck was equipped with an Electronic Control Module (ECM), referred to as an event data recorder (EDR) or "black box." The ECM model in this truck was a DDEC III that connects to the Detroit Diesel Series 60 engine. The EDR stores data for three months. It also has a trip file that can be reset after the information has been extracted. There is a battery-powered, internal clock/calendar, which tracks time and time stamps event-based occurrences, such as fault codes, hard-braking incidents, and last stop records. This type of information is extremely beneficial to the accident investigation process.

The EDR can provide reports on

- trip activity
- monthly activity for the current month and the two previous months
- speed/rpm
- load/rpm
- overspeed/rpm
- periodic maintenance (PM): three PM items
- hard-brake incidents: the last two events

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[3] The Road Check 2005 Survey was performed by the Commercial Vehicle Safety Alliance.

- last stop record
- diagnostic records: last three fault codes
- daily engine usage: last 30 days
- life of engine to date

Event data recorders are programmed to record data before and during an accident. These EDRs provide safety investigators with accurate, objective crash information. Commercial highway vehicles are the only major mode of freight transportation in Canada without an EDR standard or regulation.

The truck's ECM was removed and taken to an authorized Detroit Diesel dealer in Edmonton for inspection and data retrieval. However, the ECM data pages[4] had not been activated; therefore, no data were available.

Truck Driver

The driver had regularly driven the route since December 2004. He was aware of the location and the intent of the railway crossing signs and lights. He was also aware of the dangers associated with railway crossings and train movements. He first became aware of the train when he was within 100 m of the crossing, a location just past the active advance warning sign. He did not apply the brakes before swerving in an attempt to avoid the collision.

Driver Fatigue and Dehydration

The night before the accident, the driver had been unwell, leading to loss of sleep and poor quality sleep. He had at most three hours of normal sleep before being woken by gastrointestinal sickness. When he returned to bed, he had at most three hours of sleep before his alarm went off. He telephoned a colleague to say that he would not drive his first load. He then returned to sleep intending to drive his second and third loads of the day. After three hours, his supervisor phoned to ask why he had not yet started work. The driver informed his supervisor of his condition and committed to driving his second and third loads of the day.

Typically, fatigue can have the following effects:[5]

- decreased ability to maintain psychomotor vigilance
- decreased information processing abilities
- increased reaction time

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[4] Data pages are memory units in the ECM that record operating information about the engine and the vehicle.

[5] M. Rosekind et al., "Crew Factors in Flight Operations X: Alertness Management in Flight Operations," NASA Technical Memorandum DOT/FAA/RD-93/18, NASA Ames Research Center, 1994.

Dehydration due to flu-like symptoms is known to affect cognitive ability and visual acuity. It can result in degraded cognitive performance.[6] There is no information to suggest that the driver replaced his fluid loss with additional fluid intake. The only fluid intake noted was a soft drink with his lunch shortly before the occurrence.

Driver Diabetes

The driver was diagnosed with diabetes mellitus[7] in 1992. He was prescribed oral medication and advised to use diet to control his blood sugar levels. Medical records indicated that the driver neither took his medication regularly nor tested his blood sugar levels regularly and that he often had high blood sugar levels. He had not taken his medication during the week before the accident nor reportedly for the last six months.

The driver did not eat breakfast on the day of the accident and ate a high-carbohydrate lunch within an hour before the accident. The air ambulance team took a blood sample immediately after the accident, and it was tested upon arrival at the hospital. The test showed a high blood sugar level. The driver's blood sugar levels remained high and uncontrolled during his recovery time in hospital.

The most significant symptoms of hyperglycaemia are blurred vision, reduced cognitive performance,[8] fatigue, and dehydration. Changes in vision can degrade the distance at which a person can focus by as much as a factor of three (dioptres).[9] Any of these impairments can reduce driving performance.

Public awareness documents concerning the risks of driving with diabetes focus on the risks of low blood sugar. Recent research on the effects of high blood sugar on cognitive performance under laboratory conditions is not yet mentioned in diabetes awareness literature.

A specialist contracted by the TSB to analyze the medical information relevant to the occurrence concluded that the driver's ability to safely operate a motor vehicle was most likely reduced. The specialist further concluded that any one or combination of the factors above could have led to the driver's failure to perceive and react to the warnings of the train approaching the crossing. The specialist also concluded that

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6 M. Wilson and J. Morley, "Impaired Cognitive Function and Mental Performance in Mild Dehydration," *European Journal of Clinical Nutrition,* 57, Suppl. 2, 2003, S24–S29.

7 Type 2 diabetes is a condition in which the body either cannot produce enough insulin or cannot use its insulin properly (insulin is a hormone produced by the pancreas). Low blood sugar is known as hypoglycaemia and high blood sugar is known as hyperglycaemia.

8 G. Gwinup and A. Villarreal, "Relationship of Serum Glucose Concentration to Changes in Refraction," *Diabetes,* 25, 1976, 29–31.

9 The unit of measure is a dioptre, which is a unit of refractive power equal to the reciprocal of the focal length (in metres) of a given lens. Typical over-the-counter reading glasses, for example, are rated at +1.00 to +3.00 dioptres.

- The driver of the truck had a medical condition (diabetes mellitus) that could affect his ability to operate a motor vehicle safely.

- His diabetes was not in control at the time of the incident.

- Symptoms resulting from his diabetes may have adversely affected his performance in operating his motor vehicle.

- The driver complied with the appropriate regulations and informed the physician who examined him for his vehicle licence about his medical condition.

- Current medical requirements for operating a commercial motor vehicle in Alberta do not fully address the issue of control for drivers with diabetes.

The driver held a valid Alberta Operator's Licence, Class 1. In support of this licence, he was required to undergo periodic medical examinations by a physician. He had declared that he had diabetes, was on oral medication, and had not suffered any significant hyperglycaemic episodes. Both the driver and the physicians completing the examination complied with the provincial regulations. There was no requirement on the form (Medical Examination for Motor Vehicle Operators) to report symptoms other than hypoglycaemic episodes. Furthermore, the forms did not require a declaration by the driver or an indication by the physician that a driver's diabetes was uncontrolled due to episodes of, for example, hyperglycaemia.

Drivers undergo a medical examination to satisfy the licensing authority, and ultimately the public, that they are medically fit to perform the required tasks at the time of the examination and that there is a high probability that they will remain fit for the validity period of the examination.

For the medical conditions that are identified on Alberta's Medical Examination for Motor Vehicle Operators form, it is the degree of control of the symptoms of those conditions that determine whether the individual can be licensed, or must be restricted in some way or prohibited completely from operating a motor vehicle.

The Canadian Medical Association guide entitled *Determining Medical Fitness to Operate Motor Vehicles*[10] also addresses the issue of control. This guide states that

> Patients with diabetes mellitus that is well controlled by diet alone or by a combination of diet and oral medication are at minimal risk of either diabetic coma or a severe hyperglycemic reaction. Therefore, they can usually drive all types of motor vehicles with relative safety provided:
>
> - they have a good understanding of their condition,
> - they follow their physician's instructions about diet, medication and the prevention of complications, including hyperglycemia,
> - they remain under regular medical supervision to ensure that any progression in their condition or development of complications does not go undetected.

In the case of diabetes, the most common risk is that individuals may suffer an episode of hyperglycaemia while driving that will degrade their performance, or even result in loss of consciousness.

Alberta's Medical Examination for Motor Vehicle Operators form (Form ATU 3050 (99/11)) addresses the hyperglycaemia issue with the question: "Date of last hyperglycaemic episode_________."

The Canadian Council of Motor Transport Administrators (CCMTA) is a non-profit organization comprising representatives of the provincial, territorial, and federal governments of Canada, which, through the collective consultative process, makes decisions on administrative and operational matters dealing with licensing, registration, and control of motor vehicle transportation and highway safety. Based on the Canadian Medical Association guide entitled *Determining Medical Fitness to Operate Motor Vehicles,* the CCMTA produces medical standards for drivers[11] that are designed to guide Canadian regulators in the legal aspects of assessing driver fitness.

The CCMTA document emphasizes the risks of hypoglycaemia, particularly if the driver is unaware of the onset of the symptoms, and mentions that drivers who are following a non-insulin-based treatment need to follow the appropriate diet and testing requirements. However, it does not emphasize the need to control the condition, as does the Canadian Medical Association document, nor does it mention the risks of hyperglycaemia.

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10 Canadian Medical Association, *Determining Medical Fitness to Operate Motor Vehicles,* sixth edition, 2000.

11 Canadian Council of Motor Transport Administrators, *Medical Standards for Drivers,* July 2004.

Each Canadian provincial and territorial regulator creates its own form for physicians to document the results of their assessment of the fitness to drive. A review of these forms used across Canada showed that none of them indicate that the level of control must be assessed using medically validated information, such as the results of an haemoglobin A1C test (HgbA1C) or a review of glucose testing logs, rather than driver self-reports. Instead, they rely on driver self-reports. Some of the forms simply provide a check box to indicate whether diabetes is present. Few of the forms require a record of whether the diabetes is under control, and none of the forms require a record of any hyperglycaemic episodes. However, the form used in Prince Edward Island does contain in-depth questions about each risk factor to guide data collection.

While incidents of hypoglycaemia are one indicator of poorly controlled diabetes, the absence of hypoglycaemic episodes, as in this case, does not necessarily indicate good control of the individual's diabetes.

The risks associated with uncontrolled diabetes due to hyperglycaemia fall into three categories:

- short-term sub-acute effects that degrade performance
- increased risk of developing complications that can be present during the validity period of the licence
- acute life-threatening conditions

Laboratory tests can be used to determine if a patient's blood sugar has been uncontrolled over an extended period.[12] The Alberta medical licensing form did not require that these tests be conducted or that previous test results be mentioned. These tests were, however, performed after the accident. They indicated that the driver's diabetes had not been adequately controlled.

Driver's Understanding of his Condition

The driver knew that he was required to control his diabetes with diet and medication and that he was required to perform regular testing. While he knew that his blood sugar was regularly above normal, he did not perceive this condition to be a matter of concern relating to the control of his diabetes or to his ability to safely operate a motor vehicle. For personal reasons, the driver had not been able to do a daily test or to access his medication during the six months before the accident. Before that period, he was accustomed to taking his medication only when he thought that he needed it.

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12 The HgbA1C test is an accepted measure of the control of diabetes. It measures glycosylated haemoglobin, which is a form of haemoglobin used to identify glucose concentrations in blood over time.

Driver Distraction

Driver distraction is a relatively common cause of crossing accidents.[13] A study of 100 drivers over a 12- to 13-month period using specialized observation equipment found that nearly 80 per cent of all crashes and 65 per cent of all near crashes involved driver inattention within three seconds before the collision.[14]

In this occurrence, there were potential sources of distraction in the cab of the truck. For example, the driver chose to eat his lunch while driving. In addition, and in spite of the fact that the company manual stated that animals are not allowed in the vehicle, his dog was with him in the cab of the truck.

Occupant Safety

In the past 11 years, there have been five derailments involving VIA HEP 1 stainless steel passenger coaches. As a result of these derailments, there were 27 serious injuries and one fatality. The TSB investigated each of these occurrences.

Location	**Report Number**
Blue River	R95V0089
Biggar	R97H0009
Hornepayne	R99H0009
Stewiacke	R01M0024
MacKay (this investigation)	R05E0008

These derailments provided opportunities to investigate and improve occupant safety. Although this equipment demonstrated its sturdiness, and the outcome was favourable from a safety perspective in this occurrence, this investigation provided another opportunity to study and improve occupant safety.

Based upon a combination of site investigation data, interviews, and responses from a passenger safety questionnaire, a number of occupant safety issues were identified concerning

- 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;

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13 Transport Canada, *Impact of Heavy Vehicles on Crossing Safety: Development of an Adapted Design Tool – Project Summary*, TP 14172E, 2003.

14 V.L. Neale et al., “An Overview of the 100-Car Naturalistic Study and Findings,” *Enhanced Safety of Vehicles*, 2005.

- ineffective emergency signage;
- insufficient distribution of passenger information pamphlets;
- communications between crew members and with passengers; and
- secondary impact injury potential.

The majority of these issues were previously identified by the TSB and have been addressed in detail in Rail Safety Advisory 05/06 sent to the regulator and copied to the industry in July 2006. Issues not previously identified are detailed in this report.

Accessibility of Emergency Exit Windows

Specially designed windows provide occupants with emergency egress alternatives to the exit doors at the ends of the cars. Emergency exit windows are intended to remain freely accessible at all times. The armchair design increased the risk that an emergency exit would not be accessible. These large, heavy folding armchairs (weighing in excess of 66 pounds each) were not secured to the floor and slid around the sleeping compartments in cars 8717, 8340, and 8319. These chairs could have barricaded the doors, which are inward opening, and could have restricted access to the emergency exit windows in some of the sleeping compartments (see Photo 4).

Photo 4. Sleeping compartment with folding chairs

In addition, not all sleeping compartments were equipped with emergency exit windows. Compartments A through F, which are sleeping compartments with closed doors, do not have emergency windows (see Figure 2).

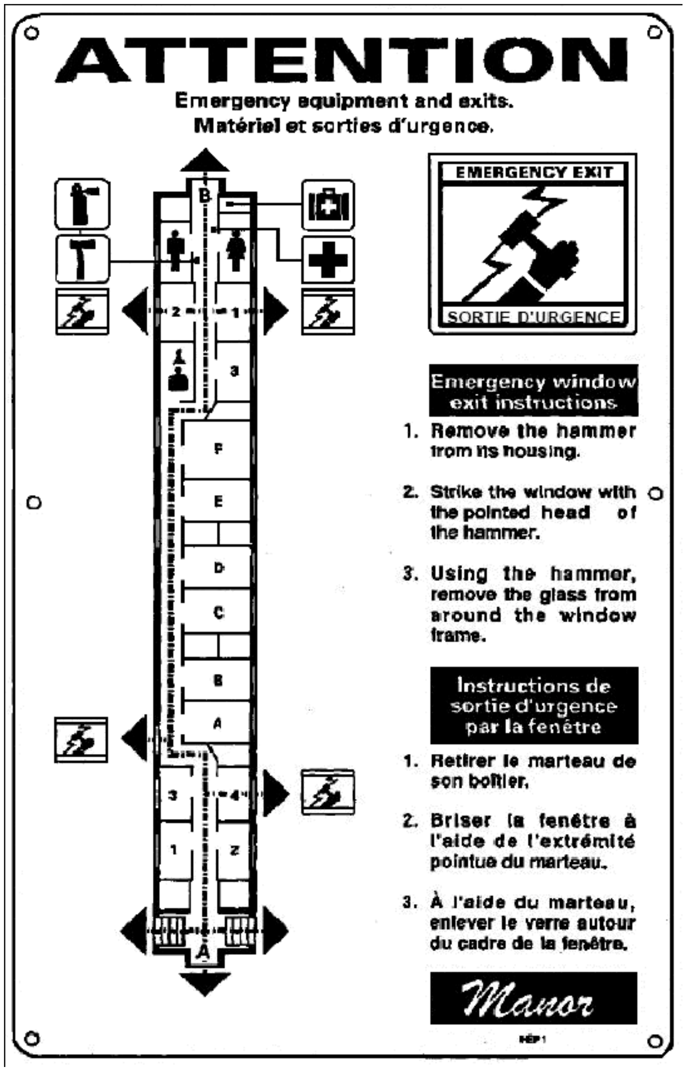

Figure 2. Placard showing emergency equipment and exits

Analysis

It was determined that the operation of the train was not causal in this occurrence. The crossing warning system was determined to be functioning as designed. The accident occurred under the following conditions: clear visibility; sun high above the horizon; good road conditions; well-designed crossing warning system operating as intended; and a clear view from the truck to the train for the last ¼ mile (13 seconds) before the train entered the crossing. The train horn was sounded for ¼ mile before entering the crossing. Furthermore, the driver had travelled this road regularly, and understood both the dangers of the crossing and the meaning of the signals.

Despite the functional crossing warning systems and the clear sight-lines of the approaching train, the truck collided with the side of the train with no apparent attempt by the driver to stop or avoid a collision until the last moment. Therefore, this analysis will focus on

- driver behaviour
- medical fitness and driver licensing
- emergency response
- train equipment damage
- truck event data recorders
- crossing warning systems
- condition of the logging truck and trailer brakes
- train occupant safety

Driver Behaviour

The accident occurred when the driver reportedly neither noticed the warning signals nor identified the approaching train until it was too late to avoid the collision.

Since there were no indications of evasive braking or steering until immediately before the collision, the analysis will focus on why the driver did not react in time to the clear danger. In particular, the physical state of the driver and the potential distractions in the cab will be examined to explain his actions. The factors considered in analyzing the driver's physical state were his blood sugar level, fatigue, and dehydration.

The driver had been diagnosed with diabetes mellitus, Type 2, a condition that requires vigilance in lifestyle maintenance and, sometimes, regular medication. It was determined that his blood sugar level had often been high and uncontrolled. He had not been managing his diet, measuring his blood sugar level, or taking his medication as required. Immediately after the accident, his blood sugar level was high. While he did not perceive this as problematic, and current licensing requirements for diabetic drivers do not recognize hyperglycaemia (high blood sugar levels) as a risk factor, there are known consequences to hyperglycaemia, for example, reduced performance of mental tasks and reduced visual acuity.

The driver's lack of attention to his diabetic condition placed him in a physical and mental condition that likely impaired his ability to drive.

Although the driver attempted to sleep properly during the nine hours before beginning work, only the first three hours were likely to have been restorative. The next three hours were disturbed by a gastrointestinal illness and, after waking briefly to make a phone call, the subsequent three hours of sleep occurred at a time when he would normally have been awake. The driver was very likely suffering from fatigue at the time of the accident.

In addition to the fatigue, his gastrointestinal illness was probably dehydrating. It is likely that the combination of hyperglycaemia, fatigue, and dehydration acted either separately or in aggregate to impair his performance. The truck driver's physiological condition (hyperglycaemic, fatigued, dehydrated) was such that it likely impaired his ability to recognize and react to the warning signals and approaching train in time to avert the collision.

Furthermore, given the potential distractions in the cab, it is likely that misplaced attention was also a factor in this accident.

Medical Fitness and Driver Licensing

The driver complied with the appropriate licensing regulations and advised the examining physician of his medical condition. The physician filled out the appropriate medical review forms as required by the present regulations. However, Alberta's Medical Examination for Motor Vehicle Operators form does not require the physician to identify uncontrolled diabetes, only incidences of hypoglycaemia. Also, the form does not require that the family doctor perform the examination or be contacted. Furthermore, the doctor is not required to validate any statements that are made during the examination. Current medical requirements, including the reporting form, for operation of a commercial motor vehicle in Alberta do not fully address the issue of symptomatic control for drivers with diabetes, and drivers with uncontrolled symptoms of diabetes may still be licensed to operate a motor vehicle in Alberta.

The TSB's medical assessment determined that the driver did not have his diabetes under control and did not meet the conditions recommended by the Canadian Medical Association. He was not following his physician's instructions to take medication, test his blood sugar level regularly, and follow an appropriate diet.

While the dangers of low blood sugar levels (hypoglycaemia) are commonly addressed in public awareness documents concerning diabetes and driving, recent laboratory studies indicate that high blood sugar levels (hyperglycaemia) can lead to reduced cognitive performance and vision. The absence of public information on the dangers of hyperglycaemia while driving increases the risk of accidents due to impaired driving performance. Increased public awareness of this risk would likely lead to an increase in safety.

Although the Canadian Medical Association provides guidelines to assist doctors in assessing a person's fitness to drive given existing medical conditions, individual provinces create the form for capturing this information. Alberta Transportation's medical assessment form does not include an area for identifying the risk factor of uncontrolled diabetes due to hyperglycaemia. In addition, by not requiring medical validation of the degree of control of a driver's diabetes, the risk that drivers will continue to be licensed to operate motor vehicles when their medical condition may lead to driving impairment is increased.

People with diabetes need to know and understand their condition so that they can effectively manage their lifestyle, treatment, and the risks associated with diabetes. One way to ensure proper education about diabetes is the distribution of public information documents. Recent research on the effects of high blood sugar levels on cognitive performance under laboratory conditions is not yet mentioned in diabetes awareness literature. Wide publication of these early findings may make diabetics more aware of the dangers of driving while hyperglycaemic, thus decreasing the risk of accidents due to impaired driving performance.

Emergency Response

VIA personnel, emergency measures representatives from the community, and emergency first responders conducted an effective evacuation in a professional manner that limited subsequent injuries and comforted passengers.

Train Equipment Damage

The relatively slow deceleration of the derailed train and the robust nature of the stainless steel rolling stock minimized passenger and crew injuries, and damage to equipment.

Truck Event Data Recorder

It was not possible to make definitive statements about all braking actions, changes in speed, sequence of gear changes, and other critical aspects of the truck's operation because this information was not recorded by the EDR.

According to the Alberta Motor Association,[15]

> . . . investigators' reports are still based on limited, mostly post-crash data and cost a great deal to prepare. Not only is data collected from EDRs more accurate than conventionally derived data, EDRs are able to record data prior to and during the crash event which would provide crash investigators with a quantum increase in accurate, objective crash information at a portion of the cost. Data collected from EDRs will not only significantly augment current information observed from crashes, it will also provide additional, supplemental information that has not been readily available before.

The use of EDRs in trucks would ultimately result in increased public safety. The TSB actively advocates the use of event recording devices in all modes of transport to advance transportation knowledge and safety.

Crossing Warning Systems

The design of the overall crossing warning system and signage was a very good fit for the particular geometrics of the approach to the crossing. Active advance warning signs are well recognized as effective at crossings such as the one at MacKay.

Although these systems are very effective, their usefulness can be degraded by nuisance, or excessive, operation. While excessive operation was not the critical issue in this particular accident, driver exposure to nuisance operation of signals can degrade the effectiveness of the signals.

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15 Alberta Motor Association, "Event Data Recorders," June 2004.

The Condition of the Logging Truck and Trailer Brakes

The truck and trailer had the required provincial inspection certificates, mechanical inspections, and permits. However, a post-incident mechanical inspection found that the trailer's brake system was deficient.

The driver stated that he did not brake before colliding with the train. It is probable that, had he attempted to brake, the poor braking performance of the log trailer would have left the driver with no alternative other than swerving to avoid a collision.

Provincial regulations required a regular inspection and maintenance program. However, there were no records to indicate that the owner had a formal, proactive safety maintenance and inspection program in place. If the driver had had proper instruction from the owner, and properly executed pre- and post-trip inspections had been made, and if regular inspections and maintenance had been efficiently performed, the irregularities in the braking system should have been detected and rectified. The absence of an effective vehicle maintenance and inspection program increased the risk that the truck would degrade to an unsafe condition.

The results of the Road Check 2005 Survey indicate that brake system problems are a potential systemic problem in Canada.

Train Occupant Safety

Canadian rail occupant safety issues have been previously documented.

- 20 July 2001, TSB Rail Safety Advisory (RSA 05/01), Observations of Rail Passenger Safety in Canada;
- 10 September 2001, Transport Canada Response to RSA 05/01;
- 15 October 2003, Transport Canada Update to RSA 05/01.

In the United States, similar rail occupant safety issues have been documented.

- 18 April 2002, Railroad Accident Report NTSB/RAR-03/02 (Washington, DC: National Transportation Safety Board, 2003);
- 15 August 2003, National Transportation Safety Board, Safety Recommendation R-03-09 through R-03-11.

While numerous issues were identified during this investigation, the majority of these issues are addressed in detail in Rail Safety Advisory 05/06 sent to the regulator and copied to the industry. The following analysis will discuss the occupant safety issues identified in this occurrence that were not previously identified in the documents listed above.

Access to the emergency windows may be restricted by unsecured armchairs that are moved in front of sleeping quarter doors by forces generated during a derailment or collision. If the sleeping compartment is unoccupied or if the occupant is incapacitated, the chairs, especially the 60-pound unsecured chairs, can effectively barricade a sleeping compartment door, preventing egress from that emergency window.

Furthermore, in that situation, emergency response crews would not be able to reach an incapacitated occupant because, unlike the emergency windows on Amtrak passenger cars, the VIA passenger car emergency exit windows cannot be easily entered from outside the train.

In addition, many of the sleeping compartments did not have emergency windows. Unsecured chairs and sleeping compartments without emergency windows present an unnecessary risk to passenger safety.

Findings as to Causes and Contributing Factors

1. The accident occurred when the driver reportedly neither noticed the warning signals nor identified the approaching train until it was too late to avoid the collision.

2. The truck driver's physiological condition (hyperglycaemic, fatigued, and dehydrated) was such that it likely impaired his ability to recognize and react to the warning signals and approach of the train.

3. The driver's lack of attention to his diabetic condition placed him in a physical and mental condition that likely impaired his ability to drive.

4. In addition to the effects of his physiological condition, there were a number of distractions within the cab that likely reduced his attention to the road ahead.

Findings as to Risk

1. Current medical requirements, including the reporting form, for operation of a commercial motor vehicle in Alberta do not fully address the issue of symptomatic control for drivers with diabetes. Drivers with uncontrolled symptoms of diabetes may still be licensed to operate a motor vehicle in Alberta.

2. Lack of public knowledge about the dangers of hyperglycaemia while driving increases the risk of accidents due to impaired driving performance.

3. Driver exposure to nuisance operation of signals can degrade the effectiveness of the signals.

4. The absence of preventive safety maintenance and effective inspection programs increases the risk that trucks will degrade to unsafe conditions.

5. Unsecured chairs and the lack of emergency exit windows in some sleeping compartments present potential risks to passenger safety.

Other Findings

1. Valuable information concerning the operation of the motor vehicle before the collision was not available because the event recording device on the truck had not been activated.

2. Installation of operational event recording devices on commercial highway vehicles would significantly increase information observed from crashes, which would ultimately result in increased public safety.

3. The condition of the trailer brakes indicated that the vehicle would not have had sufficient braking power to stop the loaded vehicle in an emergency situation.

4. The relatively slow deceleration of the derailed train and the robust nature of the stainless steel rolling stock minimized the injuries to passengers and the damage to equipment in this occurrence.

5. VIA Rail Canada Inc. personnel, emergency measures representatives from the community, and emergency first responders conducted an effective evacuation in a professional manner that limited subsequent injuries and comforted passengers.

Safety Concerns

This investigation revealed three significant safety issues: educational requirements for diabetic drivers, the lack of event data recorder requirements for commercial vehicles, and the lack of a robust inspection system for commercial vehicles. In each of these areas, there is no indication that the agents of change, whether federal or provincial, are making a strong effort to address the deficiencies noted. The Board is concerned that the risks posed to the travelling public by not addressing them is significant.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 09 January 2007.