Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada

RAILWAY INVESTIGATION REPORT

R04C0110

CROSSING ACCIDENT

CANADIAN PACIFIC RAILWAY

FREIGHT TRAIN 2nd 269-23

MILE 69.33, ALDERSYDE SUBDIVISION

NEAR BLACKIE, ALBERTA

24 OCTOBER 2004

Canada

Railway Investigation Report

Crossing Accident

Canadian Pacific Railway
Freight Train 2nd 269-23
Mile 69.33, Aldersyde Subdivision
Near Blackie, Alberta
24 October 2004

Report Number R04C0110

Summary

On 24 October 2004 at 0138 mountain daylight time, in thick fog, Canadian Pacific Railway freight train 2nd 269-23, travelling southward towards Lethbridge, Alberta, was struck by an eastbound, loaded cattle-liner truck at the Highway 23 crossing at Mile 69.33 of the Aldersyde Subdivision. Although the collision damaged and derailed a tank car carrying anhydrous ammonia and damaged five other tank cars carrying dangerous goods, there was no loss of product. The collision also caused train separation, the destruction of the tractor portion of the truck, an ensuing fire, serious injury to the driver, and fatal injury to the driver's helper. About 2060 feet (655 m) of track was damaged.

Other Factual Information

Train Operation

On 23 October 2004, Canadian Pacific Railway (CPR) train 2nd 269-23 (the train) departed Calgary, Alberta,[1] destined for Lethbridge. It was composed of 3 locomotives, 60 loaded and 5 empty cars. It weighed 8135 tons and was 4538 feet long. It had 39 tank cars loaded with dangerous goods, of which 28 carried anhydrous ammonia (UN 1005) and 11 carried liquefied petroleum gas (UN 1075).

The train crew consisted of a locomotive engineer and a conductor. They were qualified for their respective positions, and met fitness and rest standards.

The locomotive engineer sounded the horn when approaching the Highway 23 crossing. As they passed through the crossing, the train crew saw the flashing signal lights. After the train occupied the crossing, there was a train-initiated emergency brake application, and the train came to a stop. At 0141,[2] the train crew advised the rail traffic controller (RTC) that the train was stopped between Eltham and Brant, and that the conductor had begun inspecting the train.

Recorded Information

The locomotive event recorder indicated that the train was travelling at 45 mph. Whistle signal 14 L was sounded as the train approached the crossing. A train-initiated emergency brake application occurred at 0138:47, and the train stopped at 0139:57. The train travelled 2555 feet in emergency braking.

Details of the Accident

Farmers and their employees were using three cattle-liner trucks[3] to move their cattle from a summer range near Peace River to a winter range near Enchant (see Figure 1). On October 22, three drivers with three helpers drove 14 hours from Enchant to Peace River where they spent the night. The next day, they worked from 0800 rounding up, separating, and loading cattle into each trailer. They left Peace River at about 1500, refuelled at Valleyview, and stopped for dinner at Red Deer. At approximately 0138, October 24, they were eastbound on Highway 23 when they encountered thick fog. The three drivers set their headlights on low beam to optimize forward visibility.

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1 All locations are in Alberta.

2 All times are mountain daylight time (Coordinated Universal Time minus six hours).

3 Cattle-liner trucks are tractor-trailer combinations, equipped with air brake systems, that are designed to transport live cattle.

The lead driver, who was well ahead of the other two drivers, was warned of the rail crossing when his helper saw the advanced warning sign (AWS) through the fog as they passed it. He reduced speed from about 65 to 40 km/h because he knew from past experience that the crossing was rough.

The second driver could not see the lead truck's trailer lights. Concentrating on the traffic separation line and shoulder line to ensure that he stayed in his lane, he reduced speed on the long descending grade. He did not see the white X painted on the pavement or the AWS. When he saw something moving across the highway, he applied the brakes as hard as he could and turned the truck left into the westbound lane. He had almost stopped the truck before it struck the train.

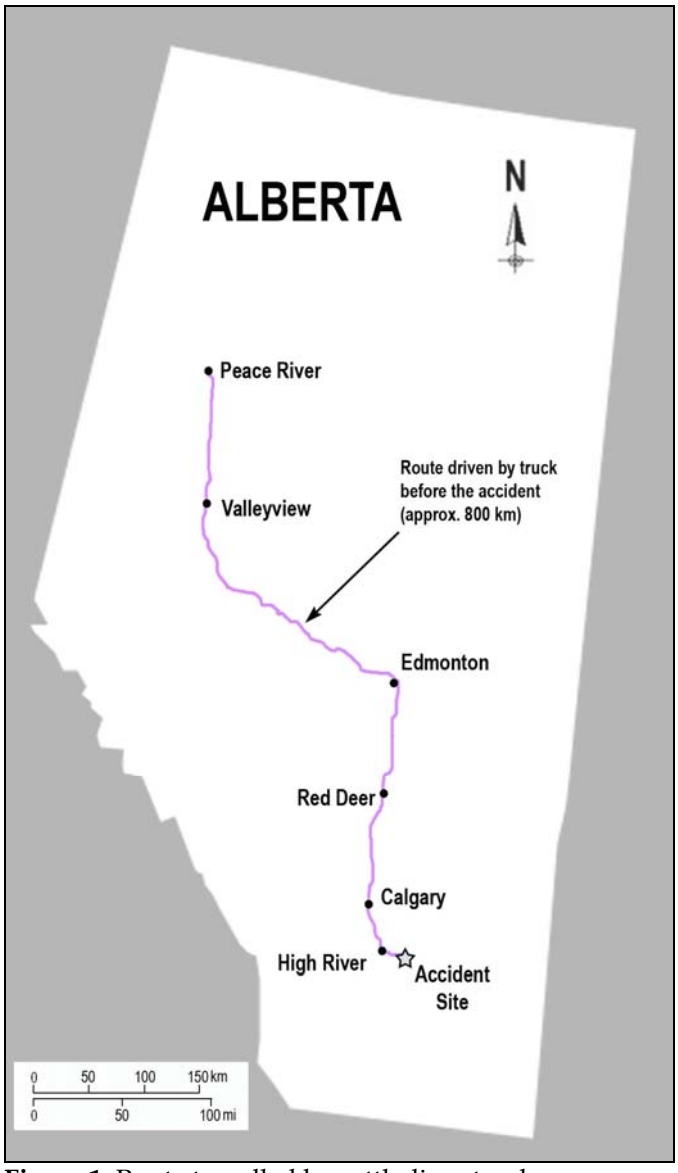

Figure 1. Route travelled by cattle-liner trucks

As the third truck neared the crossing, the third driver and his helper, his wife, saw flashing signal lights through the fog and saw the second truck's brake lights come on as it veered sharply to the left. They saw a fire followed by an explosion. They came to a stop near the fire. The third driver then backed his truck clear to avoid the fire and to avoid being struck by any approaching vehicle. Using a cell phone, he called the lead driver to advise him of the accident, then asked his wife to call 911. He then located the seriously injured helper on the ground about 10 feet (3 m) south of the crossing and the second driver in the tractor cab, which was sitting upright between the rails about 100 feet (30 m) south of the crossing. The second driver, who was seriously injured but not in danger, was left in the cab. The third driver and his wife made the seriously injured helper as comfortable as possible until help arrived.

Photo 1. Looking south at the damaged signal bungalow and the tractor cab

Photo 2. Looking west at the Highway 23 crossing, and the trailer and damaged tractor

Emergency Response

At 0144, the Foothills 911 operator[4] (the operator) received a call from an agitated caller using a cell phone, advising that a truck had hit a train east of Blackie and that the truck was on fire. The operator established that the truck had been travelling eastward towards Vulcan, but was unable to determine the caller's location.[5] At about 0146, the operator notified the High River and Blackie fire departments, and the High River ambulance service. He also advised Red Deer Royal Canadian Mounted Police (RCMP) dispatch and requested support. The operator then called CPR for information that might assist in dispatching emergency services to the right location.

Of the three CPR numbers he had, the operator elected to use the Crew Management Centre number. At 0148, the operator called, identified himself, and asked to be transferred to the south RTC. Because the call was transferred, the RTC received it as an internal CPR call. The RTC, who was issuing a clearance to a train, took the receiver off the cradle and completed the clearance, then took the operator's call. The operator did not re-identify himself. It was determined that there had been a train-truck collision, the truck was on fire, a train was in emergency east of Blackie, and the conductor was inspecting the train. Its exact location could not be determined because of the fog. Although the RTC advised that this train usually included dangerous goods cars, she did not specify the dangerous goods involved or their car locations. The operator advised the RTC to caution the train crew that the truck was on fire.

The RTC advised the Network Management Centre (NMC) manager of the accident. At 0155, the manager started calling railway officers to respond to the accident.

At 0204, the operator received additional information directly from the accident site, including the location of the crossing and the type of truck on fire, that two men were seriously injured, that the train was not in sight, and that the RCMP and firefighters were on site. The operator passed this information to the RTC and was advised that the train included 39 dangerous goods tank cars with two propane cars on the tail end. There was no mention of anhydrous ammonia.

The RTC received the train inspection report at 0214. There was about a 500-foot (152 m) separation between the 60th and 61st cars, and the trailing truck of the 61st car had derailed. The conductor did not smell ammonia or liquefied petroleum gas (LPG), but could smell diesel fuel on two of the damaged tank cars. Having completed his inspection of the train, he continued walking to the crossing, arriving at 0230. He gave the results of his inspection to the RCMP and to railway officers.

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4 The operator's official title is Communications Specialist.

5 Automatic number identification/automatic location identification is commonly available with conventional land lines, but not with cell phones.

A backup ambulance was dispatched from Nanton at about 0216, and at 0222, the operator advised the RTC that RCMP, fire, and ambulance services were on site. The RTC advised that a dangerous goods tank car had derailed, but that there were no leaks. However, information about the contents of the car—anhydrous ammonia—was not conveyed.

Although the RTC and the operator exchanged contact information, the RTC assumed throughout that the operator was a railway employee, while the operator assumed throughout that the RTC knew that he was the operator.

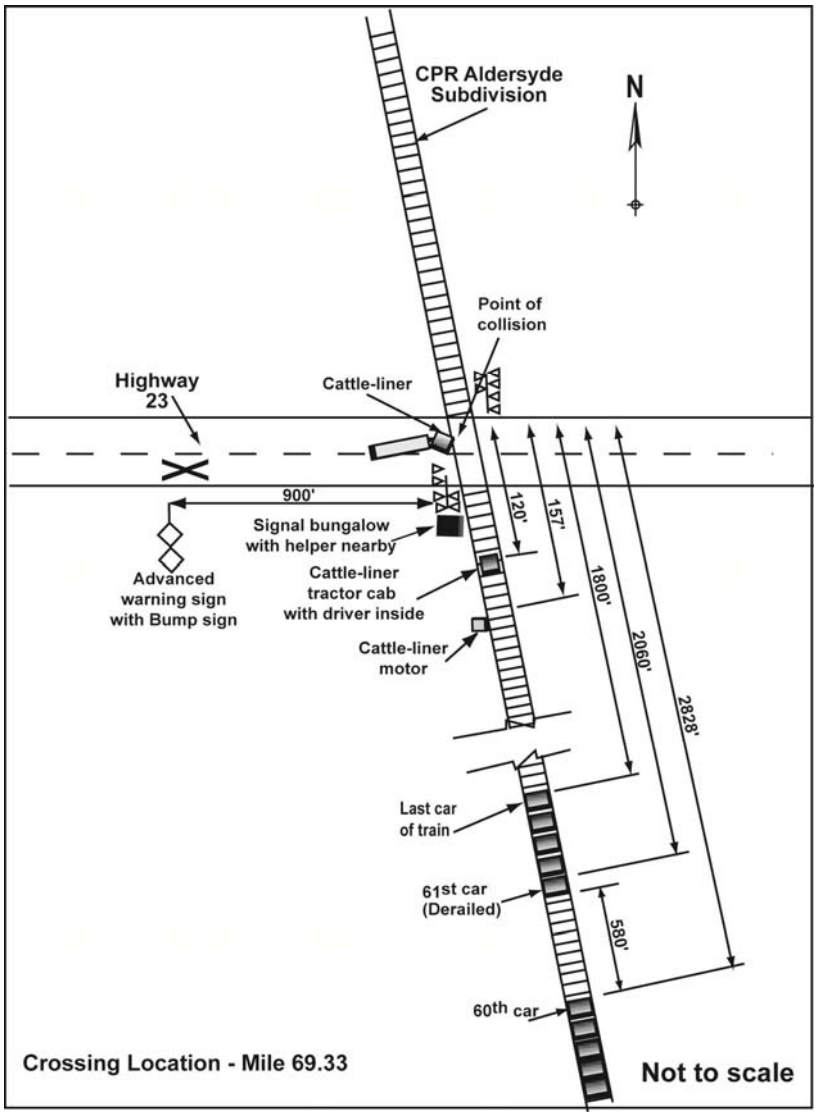

Figure 2. Diagram of accident site showing location of cattle-liner and train 2nd 269-23

First Responders

The Blackie firefighters arrived at the Highway 23 crossing shortly after 0200 followed by the High River and Nanton ambulances, High River and Vulcan firefighters, and the RCMP. The tractor fire was extinguished, and the injured men were taken to hospital by ambulance. There were about 25 emergency responders on site.

Injuries

The second driver and his helper sustained serious injuries and were transported to High River Hospital and later to Calgary Hospital. The helper died shortly after arrival.

Aldersyde Subdivision

The Aldersyde Subdivision is a single main track extending from Mile 2.9 at Lethbridge to Mile 86.6 at Aldersyde. Train movements, averaging seven freight trains per day, are governed by Occupancy Control System rules, authorized by the *Canadian Rail Operating Rules*, and supervised by an RTC located in Calgary.

At the time of the accident, the maximum authorized speed for freight trains was 45 mph.

Occurrence Site Information

Highway 23 Crossing

From the west at the top of the hill, the view of a southbound train is restricted by a curve and the view of a northbound train by the contour of the land. Flashing light signals and bell were installed at the crossing in 1959 because of the restricted view of trains, frequency of trains, volume of traffic (which included commercial vehicles and school buses), percentage of heavy vehicles, and the descending gradient on the west approach. The crossing was upgraded in 1982 by additional cantilever-mounted lights. There was an unobstructed view of the crossing signals from either direction.

The average daily traffic (2003 data) was 1210 vehicles. The highway speed was 100 km/h (60 mph). The traffic lanes and 10-foot (3 m) shoulders were paved. From the west, the highway descended at an approximately three per cent grade through the crossing. The highway and the track were both tangent (straight), and the track crossed the highway at an 82-degree angle.

On 24 October 2004, the Highway 23 surface was in good condition approaching the crossing. Following the accident, there were no skid marks on the pavement.

Advance Warning Sign

Nine hundred feet (287 m) west of the crossing, a yellow AWS was set in a ditch approximately 28 feet (9 m) laterally from the edge of the eastward traffic lane. Beneath the sign, on the same post, was a "bump" sign to warn drivers that the crossing surface was rough. Both signs were standard size (75 cm x 75 cm). Mounting two warning signs on the same post was not a recommended practice. Alberta Infrastructure and Transportation applied the "bump" sign below the AWS as a temporary measure. At this same distance, a large white X had been applied to the surface of the eastward traffic lane.

Following a previous accident at this crossing (TSB Occurrence No. R98C0152), the TSB sent a Rail Safety Information Letter (04/99) to Transport Canada (TC) concerning the conspicuity of AWS at grade crossings, particularly in thick fog. The location of the AWS did not comply with the guidelines in the *Manual of Uniform Traffic Control Devices for Canada* (MUTCDC), which prescribed that such signs be placed not less than 2 m or more than 4.5 m from the edge of the nearest traffic lane.[6] In Alberta, Saskatchewan, Manitoba, and New Brunswick, AWS are placed further away than MUTCDC prescribes so that snowploughs can clear a wider road

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[6] While the location of the AWS was not in accordance with the optimal standards recommended by the Transportation Association of Canada, they were installed in accordance with Alberta Infrastructure and Transportation's *Traffic Control Standards Manual,* which prescribes sign placement in the province.

area to prevent snow from drifting back onto the roadway. In these provinces, the more distant AWS location is regarded as more acceptable, in the interests of public safety, than the delay in re-installing signs destroyed by highway snowploughs.

Flashing Signal Lights and Bell

The crossing was equipped with flashing signal lights and bell on cantilever arms and masts. The front and back signals were focused on the highway in both directions. The four front signals were focused for 1000 feet (330 m) and the four back signals were focused for about 50 feet (16 m). Standard reflectorized crossing signs were installed on the signal masts. These signs were in good condition. Yellow stickers applied to the crossing signs identify the location of the crossing and CPR's emergency 1-800 telephone number.

Track maintenance personnel inspected the crossing signals weekly. The last inspection before the accident was on 18 October 2004 with no exceptions noted. The last monthly highway-crossing warning system inspection performed by a railway signal maintainer before the accident was on 14 October 2004 with no exceptions noted. On 24 October 2004, the train crew saw the signals as they approached the crossing, and emergency responders saw that they were operational after the accident. Post-accident testing of the flashing signal lights and bell determined that they were functioning as intended.

Accident History of the Crossing

The TC and TSB databases had records of seven collisions at this crossing since 1975. Four collisions occurred before the installation of cantilever signals in 1982. Two collisions involved the train striking the vehicle and five involved the vehicle striking the train. The last three accidents resulted in four injuries and one fatality. All three of these collisions occurred during thick fog.

Train-in-Crossing Collisions Study

A TSB study[7] determined that train-in-crossing (TIC) collisions account for 12 per cent of all crossing accidents and 17 per cent of all fatalities. One in every 22 TIC collisions resulted in derailment. Approximately 20 per cent of the TIC collisions involved semi-trailers or heavy trucks. Since 1996, there have been 31 TIC collisions in fog. Nearly two-thirds of these happened at night. Of these, one-third occurred at crossings equipped with flashing signal lights and bell.

TIC collisions occur when the driver cannot see the train in time to react and stop the vehicle clear of the crossing. Most TIC collisions occur at night when poor driver reaction may be due to low rail car and crossing protection conspicuity. Impaired visibility accounted for about 22 per cent of TIC collisions. There were insufficient data to determine if fatigue might have been a factor.

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7 *An Accident-Based Examination of Factors Associated with Train-in-Crossing Collisions*. Transportation Safety Board of Canada Macro-Analysis Division, August 2003.

The TSB study concluded that several countermeasures currently being implemented could potentially reduce the number of night-time TIC collisions. One such countermeasure is upgrading retro-reflective material on rail cars, and on crossing signs and posts. It is anticipated that this will improve the conspicuity of trains and railway crossings.

Weather

At the time of the accident, thick fog had reduced visibility to about 30 feet (9 m).

On the day of the accident, between 0100 and 0200, both the temperature and dew point were close to -4°C with a slow breeze from the south. Environment Canada advised that these were perfect conditions for generating fog. Further, several bodies of water near the crossing (Frank Lake, McGregor Lake, and the Bow River) contribute moisture and, when combined with the appropriate temperature and dew point, generate fog. During fall and spring, fog occurs in this area two to three times each month.

Train Accident/Incident Emergency Response Training

First responders (emergency personnel who will be the first to arrive at the scene of an accident) must identify during the initial response phase the hazards of any dangerous goods present to protect themselves and the general public. The initial response phase is the period from notification of the accident to arrival of first responders at the site. Trained emergency responders seek specific information about any dangerous goods as soon as possible by contacting the railway, the shipper, or Canutec[8] before they arrive at a railway accident site.

The safety precautions outlined in the *2004 Emergency Response Guidebook* (page 6) include:

- approach cautiously from upwind,
- secure the scene,
- identify the hazards,
- assess the situation,
- obtain help,
- establish a command post, and
- maintain control of the site.

After a number of occurrences involving dangerous goods, CPR personnel developed and presented an emergency response training package to town councillors and first responders in a number of communities across the CPR system. Gradually, the course was scaled back until it was provided only upon request. The training had been presented in High River on 30 September 2004. The High River Fire Department had been asked by CPR to forward the invitation to surrounding firefighting, RCMP, and emergency medical service (EMS) detachments.

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[8] Canutec is the Canadian Transport Emergency Centre operated by Transport Canada to assist emergency response personnel in handling dangerous goods emergencies.

The train (which included those cars that had separated) had cleared the crossing and was not visible from Highway 23. Although the first responders had not been told which crossing was involved, they surmised that it was the Highway 23 crossing. They did not know that the train had dangerous goods tank cars nor what kind of products either the tank cars or the truck were carrying. They were unaware of the extent of damage or of the derailment.

Neither the volunteer firefighters, the RCMP, the Foothills EMS (paramedics) personnel on site, nor the Foothills Regional Communications Centre (the operator) personnel had been formally trained to respond to railway accidents.

Dangerous Goods

The train had 39 cars carrying dangerous goods: 28 carrying anhydrous ammonia and 11 carrying LPG.

Although anhydrous ammonia is a pungent, colourless, poisonous gas that is also flammable (in the presence of air or other oxidizers, it can also detonate in a fire situation), it is shipped as Class 2.2, UN 1005, non-flammable and non-toxic gas. Accordingly, on the night of the accident, these tank cars displayed green placards with a white compressed gas cylinder graphic.[9]

LPG is a colourless gas with mercaptan, an odorous gas, added so that leaks can be detected by smell. It is a highly dangerous fire hazard. It is shipped as Class 2.1, UN 1075, flammable gas. Accordingly, on the night of the accident, these tank cars displayed red placards with the symbol of a flame.

Railway Equipment

The last 16 cars of the train (cars 50 through 65) comprised 14 cars loaded with anhydrous ammonia and two cars loaded with LPG. Cars 60 and 61, loaded with anhydrous ammonia, were the first cars to be struck by the truck. The impact caused them to separate and resulted in the derailment of the trailing truck of car 61. The trailing four tank cars sustained minor damage.

Reflectorization of Railway Equipment

Cars 56 and 57 were black with five yellow reflective discs, four inches in diameter, along the side of each tank. These discs were in poor condition and dirty. Car 58 was white with no reflectors. Cars 59 through 65 were black with no reflectors.

In the United States, the Federal Railroad Administration (FRA) has issued a rule requiring the reflectorization of freight rolling stock to enhance the visibility of trains. This rule establishes a schedule for the application of retro-reflective material and prescribes standards for the construction, performance, application, inspection, and maintenance of the material. The effective date of the rule was 28 November 2005. All rail cars operating in the United States

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[9] TSB has previously recommended (R02-01) reclassification of anhydrous ammonia and its safety markings commensurate with the risk that it poses to the public.

must be upgraded within 10 years of that effective date. Since almost all Canadian-owned and privately owned rail cars are interchanged with the United States, they are also being reflectorized, many at a faster rate than specified by the FRA. In accordance with TC's Ministerial Orders, all federally regulated railway companies had until 02 January 2006 to submit a reflectorization rule for review and consideration by the Minister. The rule was approved, subject to conditions, and will come into effect on 01 May 2006.

911 Call Answering Services

The Foothills Regional Communications Centre is a division of the Foothills Regional Emergency Services Commission, which is a municipal commission as designated by the Province of Alberta. At the time of the accident, the centre served seven municipalities for 911 call answering, and EMS and fire call processing. It dispatched 11 EMS/ambulance service locations and 39 fire departments in southern Alberta. There are no federal or provincial standards or procedures for 911 services.

In Alberta, there are 37 call answering services providing 911 services. The Alberta E-911 Advisory Association (comprising representation from the Alberta Ambulance Operators Association and the Alberta Fire Commissioners Office) recommends service guidelines. These guidelines state that a 911 service should determine the appropriate emergency response agency and initiate transfer of the call within 10 seconds of answering the call, 98 per cent of the time. The 911 services also have a contracted emergency response coordination and monitoring function until each emergency response is complete, and a contracted responsibility to produce a detailed record of their activity on each response.

Inspection and Maintenance of Farmer-Operated Vehicles

Before leaving Enchant, the second driver checked his vehicle's lights and signals, but not its brakes.[10] At Peace River, he did not inspect the vehicle before going off duty nor did he inspect it before leaving on the return trip. En route, the truck's trailer brakes were not tested independently to determine the trailer's braking effectiveness.

After the accident, an inspection by RCMP and Alberta Infrastructure and Transportation inspectors determined that only one of the six trailer brakes was within working adjustment. Also, one tire was worn out. The inspectors concluded that the trailer had no effective brakes.

The truck's tractor was so badly damaged that the inspectors could not determine the effectiveness of its brakes. However, the brake linings were almost new, and the automatic slack adjusters were greased and properly adjusted, which indicated that the tractor brakes were in good condition.

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[10] Alberta Regulation 118/89 prescribes the inspection requirements at the start and end of each shift.

Under the provincial regulations, a vehicle that is hauling agricultural products is exempted from having to comply with the following trucking regulations when being operated by a farmer or an employee of a farmer:

- Reg. 314/2002–Safety Fitness Certificate. There was no requirement for a Safety Fitness Certificate for the accident vehicle.

- Reg. 414/91–Commercial Vehicle Inspection Regulation. There was no requirement for an annual commercial vehicle inspection for the accident vehicle.

- Reg. 118/89–Commercial Maintenance Standards Regulation. This regulation has a comprehensive checklist. There was no requirement for the driver of the accident vehicle to inspect it before and after a work shift.

Consequently, there were no safety fitness inspection records available from the Transportation Safety Services of Alberta Infrastructure and Transportation for either the tractor or the trailer.

Saskatchewan and Manitoba also exempt farmers and their employees from having to comply with commercial trucking regulations.

Truck Stopping Distances

Using computer simulations, the TSB Engineering Laboratory determined, for various speeds, the critical distance from which a driver must see the train to be able to react, start braking, and brake a truck to a stop clear of a crossing (TSB Engineering Laboratory report LP 028/05). The report studied scenarios with all the truck's brakes working or with only the tractor brakes working, on good pavement. Most alert drivers perceive a problem and react in about 2.5 seconds.[11] However, to analyse this occurrence, a slower reaction time (3.75 seconds) was used because the accident happened after midnight and the driver was likely fatigued, the road and the crossing were unfamiliar, and the train and signals were obscured by fog.

The most relevant scenario for this accident involved a crossing approach in good condition, slow truck speed, ineffective trailer brakes, and a driver most likely fatigued, which implies a slower-than-normal reaction time. Using an approach speed of 20 km/h, the difference in stopping distance between a fatigued driver with ineffective trailer brakes and an alert driver with fully effective trailer brakes was 25 m (82 feet) as compared with 16 m (52 feet). In this example, a truck with failed trailer brakes and a fatigued driver would travel 56 per cent further. The higher the approach speed, the greater the distance required to stop (see Appendix A for details).

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[11] *Impact of Heavy Vehicles on Crossing Safety, Development of an Adapted Design Tool* (TP 14172E), Transport Canada.

Experience of the Second Truck Driver

The driver had been licensed as a Class I driver for two years. The majority of his driving experience had been in other types of trucks hauling produce locally, and he had no prior experience hauling cattle. However, he knew that he had to avoid hard braking to limit the chance of injury to the livestock. Hard braking is avoided by gearing down the transmission and using the engine brake (Jake Brake). He had never undertaken the journey to Peace River nor had he ever driven a semi-trailer for that distance. He was not familiar with Highway 23 and was working as a replacement driver. In an attempt to compensate for his unfamiliarity with the route, the other drivers placed him in the middle of a three-truck convoy. They used cell phones in portable two-way radio fashion to communicate between the vehicles. The more experienced drivers had planned the route and the driving schedule.

Fatigue

Two days before the accident, the three drivers travelled from Enchant to Peace River and were on duty for about 14 hours. At Peace River, they had 9 hours of rest, from approximately 2200 to 0700, which included the driver's normal rest time. After 0800 on October 23, the drivers worked about 7 hours and then drove for 11 hours. They had been awake and on duty for 19 hours when the accident happened. The accident occurred when the driver would normally have been sleeping.

Typical Effects of Fatigue

Fatigue can affect a person's ability to respond to normal, abnormal, or even emergency stimuli. The result can be slowed reactions or even failure to respond at all. In a fatigued state, it can take longer to perceive stimuli, longer to interpret or understand them, and longer to react to them once they have been identified. Fatigue affects the ability to judge distance, speed, and time.

Studies[12] have shown that while time-on-task (in this case driving) has an effect on fatigue, the overall time awake and circadian rhythm generally have a larger effect. In addition, experimental studies have demonstrated that even moderate sleep deprivation can produce decrements in driving performance that are as serious as those produced at legal limits of alcohol consumption.[13]

Drivers' Hours of Service

In Alberta, the *Drivers' Hours of Service Regulation* (Reg. 317/2002) prohibits drivers from exceeding, or carriers from permitting their drivers to exceed, 13 hours of driving time or driving at any time after the driver has been on duty for 15 consecutive hours (with certain

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12 *Best Practices Compendium of Fatigue Countermeasures in Transport Operations* (TP 13620E), Transport Canada.

13 N. Lamond and D. Dawson, "Quantifying the Performance Impairments Associated with Fatigue," *Journal of Sleep Research,* 1999, 8:255–262.

exceptions). Duty time includes participating in the loading or unloading of a vehicle. The regulation exempts farmers who own or produce the agricultural product being transported or an employee of that farmer.

Saskatchewan and Manitoba also exempt farmers and their employees from having to comply with drivers' hours of service regulations.

Safety Communications

Rail Safety Advisory 07/05

On 26 May 2005, the TSB forwarded Rail Safety Advisory (RSA) 07/05 to the Province of Alberta and Transport Canada concerning the "conspicuity of advance warning signs at grade crossings."

On 27 June 2005, Alberta Infrastructure and Transportation responded that its lateral sign placement standard for rural signs is 6 m from the edge of the travelled lane and was established about 30 years ago when the department started constructing three-metre-wide highway shoulders. This standard was introduced when the department adopted the American Society for Testing and Materials Type III high-intensity reflective sheeting over Engineering Grade Type I sheeting. The Transportation Association of Canada (TAC) guideline for the lateral placement of signs was developed based on a less reflective sign sheeting standard. Therefore, Alberta Infrastructure and Transportation recommends that the TAC revisit the lateral placement guidelines in the MUTCDC since the range of 2 to 4.5 m for lateral placement may be too restricted.

On 15 July 2005, TC responded to RSA 07/05. With reference to Rail Safety Information Letter 04/99, TC advised that the issue of conspicuity of AWS was discussed at the 25 September 1999 meeting of the National Committee on Uniform Traffic Control. However, "the issue was not included in the committee's work" and "to date there has been no change in the committee's position on the matter." Although TC's draft road/railway crossing standard requires adherence to the MUTCDC with respect to the location of signs, TC advised that the final authority for road sign location currently rests with the province. TC supports the initiative put forward by Alberta Infrastructure and Transportation to initiate a project with TAC to review the MUTCDC's ground-mounted sign placement guideline, and TC would be pleased to participate in this endeavour.

Rail Safety Advisory 08/05

On 28 June 2005, in consideration of the risk of emergency response personnel not receiving immediate and accurate information during a safety-critical emergency response, the TSB issued RSA 08/05 to the Province of Alberta concerning "emergency response numbers for railway occurrences." The advisory raised several issues.

- The use of the wrong railway telephone number to contact the railway had a number of negative consequences on the operator's ability to coordinate a response.

- The emergency response was delayed because the operator was unable to promptly confirm the location of the accident.

- Information about the dangerous goods on the train was not available to the first responders before they arrived at the site nor for some time after.

- Information about the condition of the tank cars carrying the dangerous goods was not available to the first responders before they arrived at the site nor for some time after.

Alberta Infrastructure and Transportation replied on 17 August 2005 stating that it will work with emergency response centres, and federal and provincial railways operating in Alberta with respect to this issue, as highway and public safety is a high priority of the department.

Analysis

The collision occurred in thick fog that obscured the driver's view of the AWS and the flashing signal lights. The driver approached the crossing unaware of its presence and at a rate of speed that did not permit him to stop once he recognized the need to stop. The fog also rendered the reflectorized elements of the crossing warning system and the limited reflectorization of the rail cars ineffective. The operation of the train had no bearing on the accident. The emergency response was timely under the circumstances, but the emergency responders did not have information about the train's dangerous goods cargo until after they arrived at the crossing.

The following matters will be considered in the analysis:

- Decision to continue driving
- Accident driver's operating practices
- Fatigue
- Fog
- Exemption of farmer-operated vehicles
- Advance warning sign placement
- Crossing signal system
- Reflectorization of railway equipment
- Emergency response
- Training for first responders to railway accidents
- Truck stopping distances

Decision to Continue Driving

The three drivers entered thick fog, but chose to continue driving. As the convoy approached the crossing, a gap opened between the lead driver and the second driver, who was not familiar with the road. The need to remain in convoy to benefit from the other driver's experience may have influenced the second driver to continue driving and driving at a rate of speed inappropriate for the visibility. Their familiarity with the route and the relatively short distance

to Enchant may have influenced the other drivers to continue driving in the fog even though they recognized that it was hazardous. The need to unload, feed, and water the cattle may also have been motivation to continue.

Accident Driver's Operating Practices

Before starting the trip, the driver made a cursory inspection of the trailer lights and turn signals, but did not check the brakes. If a brake inspection had been performed, as is mandatory for commercial vehicles in Alberta, the defective trailer brakes would likely have been identified.

Drivers are required to know the handling characteristics of their vehicle under load. The driver knew that he needed to moderate the vehicle braking to transport the cattle safely. As a result, he avoided using the vehicle brakes and slowed the vehicle by using the transmission or engine brake. Therefore, he had little experience with the vehicle's braking performance on the return journey from Peace River. Although the trailer brakes were ineffective, the driver did not identify this problem and continued as if the brakes were fully functional.

Fatigue

Given the length of time the driver had been awake (approximately 19 hours) and the continuous time he had spent driving (11 hours), the driver was likely fatigued. The additional stress of driving in thick fog at night, combined with his lack of familiarity with the route, would have exacerbated his fatigue. Since his normal sleep period would have been between 2200 and 0700, at the time of the accident, he was approaching a low point in his circadian rhythm when drowsiness and the effects of fatigue would have been more severe. Each of these factors acted in aggregate to significantly impair his driving.

Fog

The extent to which this location is prone to thick fog is evident from the crossing's accident record. Upgrades to the crossing's warning system had been made in response to previous accidents. Although the level of automatic protection (flashing signal lights and bell) was significant, its overall effectiveness was limited by the dense fog.

Exemption of Farmer-Operated Vehicles

The drivers' on-duty hours exceeded the maximum on-duty hours as established in Alberta's commercial regulations for Class I drivers. However, since the regulatory requirements do not apply to farmers and their employees, they may place themselves and the public at risk by driving while fatigued. Likewise, the exemption of farm vehicles from provincial regulations for the inspection and maintenance of commercial vehicles did not help to ensure that the mechanical condition of the cattle trailer was sound.

While the regulatory framework plays a role, it should be noted that exemptions from regulations do not mean that an exempted vehicle will be neglected or that an exempted driver will drive while fatigued. Regardless of the presence or absence of such regulations, the decisions to delay or forego maintenance and inspection, and to continue driving while fatigued are voluntary.

Advanced Warning Sign Placement

The AWS was further away from the road than recommended by current Canadian standards.[14] It was not sufficiently conspicuous in the fog and was not noticed by the three drivers, although it had been observed by the helper in the first vehicle. This farther placement of the AWS increased the risk of it not being clearly visible, particularly in dense fog.

Having a bump sign on the same post may dilute the AWS message that the driver should be prepared to stop. The bump sign warns a driver only to slow down for a rough crossing. Therefore, a driver may be more concerned about slowing down for the rough crossing than being prepared for the possibility of a train approaching or occupying the crossing.

Crossing Signal System

From the inspection and maintenance records, post-accident testing, and train crew, driver, and emergency responder information, it can be concluded that the flashing signal lights and bell were operating as intended on the night of the accident.

In the thick fog, the driver noticed neither the flashing signal long lights nor the short lights because his attention was on the traffic separation line, which was down and to his immediate left. Similarly, he did not notice the back lights on the signal mast and cantilevers on the far side of the crossing. The moving train obscured the view of the lower set of lights. It was only when he saw the movement of black tank cars in the thick fog that he reacted by hard braking. While the driver saw the relatively inconspicuous train on the crossing, he could not recall having seen the flashing lights of the automatic warning devices. This can be attributed to his concentration on the traffic separation line to ensure that he stayed in his lane and to the obstruction of the flashing lights by fog. Although he did not hear the bell as he approached the crossing, this is not considered contributory as the bell is intended as a supplemental warning for pedestrian traffic.

Reflectorization of Railway Equipment

Although some of the tank cars had reflective markings, they provided little additional warning that a train was on the crossing. The vehicle headlights were on low beam, and the black tank cars on a black asphalt road in thick fog were difficult to see. The railway industry is proceeding with the reflectorization of freight rolling stock to enhance the visibility of trains. Although this initiative will improve the visibility of trains proceeding over crossings at night, its benefits in heavy fog may be limited.

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14 *Manual of Uniform Traffic Control Devices of Canada*, Section A1.7.2 (d)

Emergency Response

Foothills 911

Despite efforts by the operator, he was initially unable to obtain specific information from the railway about the location of the accident and the dangerous goods on the train. Although he had several railway telephone numbers, he did not have the NMC emergency number, and it is the NMC that coordinates emergency response within the railway.

Although the operator passed preliminary information to the emergency response agencies and contacted the railway, first responders arrived on site without knowing that there were dangerous goods on the derailed train.

Rail Traffic Controller

The operator made an emergency call to the RTC through the Crew Management Centre. However, because the operator did not identify himself a second time and because the call was received as an internal call (having been transferred), the call was believed to be a regular business call. When this emergency call was not received in the established manner, railway communication practices did not facilitate the prompt redirection of this vital information to the designated person, the NMC manager. While information provided by the operator gave clues as to his identify, the RTC did not make the connection.

Initial Emergency Response

Although the responders did not have all the necessary safety-critical information before they arrived at the crossing, they extinguished the fire and assisted the injured men in an exemplary manner.

Training for First Responders to Railway Accidents

Railway first response training encourages responders to determine if dangerous goods are involved before approaching a railway accident site. Broader distribution of a railway train accident/incident emergency response training program targeted at all emergency responders, especially volunteer firefighters, police, and 911 operators, would reduce the risks associated with responding to railway accidents.

Truck Stopping Distances

The TSB's analysis of truck stopping distances suggests that a vehicle approaching the crossing in approximately 28 feet (9 m) of visibility could not be stopped in advance of the crossing even with an alert driver using fully effective trailer brakes driving on good pavement.

Findings as to Causes and Contributing Factors

1. The severe fog conditions precluded observation of the advance warning sign, the crossing signal warning system, and the limited reflectorization of the rail cars traversing the crossing.

2. The need to remain in convoy to benefit from the other driver's experience may have influenced the second driver to continue driving and to drive at a rate of speed inappropriate for the visibility conditions.

3. Continuous wakefulness, circadian low point, time on task, and the added stress of night driving in thick fog all acted in aggregate to significantly impair the driver's ability to drive.

4. Approaching the crossing at 20 km/h, the truck could not be stopped in advance of the crossing, even with an alert driver using fully effective trailer brakes on good pavement, given the visibility (approximately 9 m) that existed at the time of the accident (see Appendix A).

Findings as to Risk

1. As the regulatory requirements do not apply to farmers or their employees, they may place themselves and the public at risk by driving when fatigued. Likewise, the exemption of farm vehicles from provincial regulations for the inspection and maintenance of commercial vehicles did not help to ensure that the mechanical condition of the truck's trailer was sound.

2. Although the 911 service passed preliminary information to the emergency response agencies and contacted the railway, first responders arrived on site without knowing that there were dangerous goods on the derailed train.

3. The lateral displacement of the advance warning sign at the Highway 23 crossing increased the risk of it not being clearly visible to the driver as he approached the crossing in reduced visibility.

4. The active targeting of communities (such as Blackie) by rail accident/incident emergency response training programs would better prepare first responders to determine the presence of dangerous goods and assess the associated risks before arriving at an occurrence site.

Safety Action Taken

Representatives of Canadian Pacific Railway (CPR), Alberta Infrastructure and Transportation, and Transport Canada have met and agreed that automatic advanced warning signals should be installed at this location.

The Foothills 911 call services now have emergency telephone numbers for CPR's Network Management Centre and Canadian National's Network Operations Centre.

Federally regulated railways had until 02 January 2006 to submit a reflectorization rule for review and consideration by the Minister of Transport. The rule was submitted 28 December 2005 and was approved, subject to conditions, and will come into effect 01 May 2006.

Members of the Transportation Association of Canada (TAC) Traffic Operations and Management Standing Committee recommended that a project be undertaken to review the guidelines in the *Manual of Uniform Traffic Control Devices for Canada* (MUTCDC) regarding the lateral placement of traffic signs. Once funding is available, TAC's Chief Engineers' Council will review the current practices for lateral sign placement within 12 months and recommend changes to the MUTCDC, as necessary, and determine the optimal lateral sign placement distance for rural highways.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 07 March 2006.

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Appendix A – Comparison of Truck Stopping Distances

The Transportation Safety Board of Canada Engineering Laboratory performed an analysis of truck stopping distances (LP 028/05). Using computer simulations, the Engineering Laboratory determined, for various speeds, the critical distance from which a driver must see a train to be able to react, start braking, and brake to a stop clear of a crossing. The analysis covered scenarios with all the truck's brakes working and with only the tractor brakes working, on good and poor pavement. Most drivers perceive a problem and react within a range of 3 to 4.5 seconds in situations of complex or inconspicuous stimuli. For this occurrence, although a conservative time of 3.75 seconds was used, the driver's reaction time was likely longer because it was after midnight, he was fatigued, the road and the crossing were unfamiliar, and the train and signals were obscured by fog.

The three drivers stated that Highway 23 was in good condition to the crossing. The RCMP and Alberta Infrastructure and Transportation inspectors found no skid marks from the cattle-liner truck on the pavement. Although the second driver did not look at his speedometer, he said that because the fog was very thick he reduced speed to a slow speed so he could see the road's traffic separation line in the low beam headlights.

At 20 km/h on good pavement, with a normal perception and reaction time (2.5 seconds) and effective brakes, the driver would have had to have seen the train a minimum of 16 m (52 feet) from the crossing to have stopped clear of it (see Table A-1).

At the same speed on good pavement, with a slow perception and reaction time (3.75 seconds), but with ineffective trailer brakes, the driver would have had to have seen the train a minimum of 25 m (82 feet) from the crossing to have stopped clear of the crossing. This is the scenario that approximates the conditions of the accident.

Table A-1. A Comparison of Truck Stopping Distances on Good Pavement with Effective Brakes or Ineffective Trailer Brakes at Normal and Slow Perception and Reaction Times at Different Speeds

	Effective Brakes		**Ineffective Trailer Brakes**	
	Perception and Reaction Times			
Vehicle Speed (km/h)	**Normal (2.5 seconds)**	**Slow (3.75 seconds)**	**Normal (2.5 seconds)**	**Slow (3.75 seconds)**
60	60 (197)	81 (265)	80 (262)	100 (330)
50	48 (156)	65 (213)	61 (201)	79 (258)
40	36 (118)	50 (164)	45 (147)	59 (192)
30	25 (83)	36 (118)	30 (100)	41 (134)
20	16 (52)	23 (75)	18 (60)	25 (82)
10	8 (25)	11 (36)	8 (26)	11.5 (38)

Note: All distances are given in metres with feet in parentheses.