Transportation Safety Board of Canada
Bureau de la sécurité des transports du Canada

TRANSPORTATION SAFETY

REFLEXIONS

Issue 19 – November 2003

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Rick Robinson/CPR

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Damage to diner car and farm supply building. Note foundation wall and roof of building in centre of photograph.

Vandalized Switch

An investigation into the derailment of a Via Rail Canada (Via) passenger train 15 (Via 15) at Stewiacke, Nova Scotia, on 12 April 2001 revealed several safety deficiencies that were addressed by the Board through a series of rail safety advisories. — Report No. R01M0024

The westward train, consisting of two locomotives and 14 cars, travelling from Halifax, Nova Scotia, en route to Montréal, Quebec, derailed at a manually operated main-track switch, designated as TU-29, at Mile 46.45 of the Canadian National (CN) Bedford Subdivision. The two locomotives and the first two cars continued on the main track, but the following cars took a diverging route onto an industrial track adjacent to the main track. Nine of the cars derailed, and a farm supply building and the industrial track were destroyed. Four occupants of the building escaped injury before impact. There were 132 persons on board the train. Twenty-two persons were transported to hospitals in Truro and Halifax. Nine persons, including five on-train services (OTS) crew members, were seriously injured.

The emergency response to the derailment was the largest in Nova Scotia since the Swissair (Flight SR111) accident in 1998 and involved a number of municipal and provincial agencies. Following the occurrence, the agencies involved met under the auspices of the provincial emergency measures organization to review and evaluate the response activities. It was concluded that the emergency response was well coordinated, and no significant deficiencies

Map of Nova Scotia showing Stewiacke. (Source: RAC Atlas)

were identified that would have impacted on the handling of the passengers.

The Switch

The direct cause of the accident was not a matter of dispute, because the damages to the switch lock and its chain were a clear indication that the switch was unsecured due to tampering. The standard 31B model switch stand was equipped with a standard CN switch lock. The clasp mechanism was broken and the switch lock was hanging loosely, suspended by a chain that affixes the lock to the switch stand. The lock had numerous dents and deformations. A Royal Canadian Mounted Police investigation subsequently led to a local youth pleading guilty to "mischief endangering life".

Programs relating to the use of high-security switch locks and switch points vary.

Dynamic forces, generated by the equipment passing over the unsecured switch, resulted in the switch points moving under the train. Marks on the track infrastructure and an examination of the derailed equipment indicated that the lead truck of the fourth car took the diverging route, resulting in further switch point movement and derailment of the other cars.

Following this accident, CN and Canadian Pacific Railway reviewed their policies and practices regarding installation of high-security switch locks. As a result, several thousand high-security switch locks were installed on all manually operated main-track switches for signalled and non-signalled territories. Priority was given to those locations with passenger train operations and those prone to vandalism. Applicable sections of the respective railway standard practice circulars were revised to reflect the more stringent locking requirements.

Not all railway companies have taken such action. Programs relating to the use of high-security switch locks and switch points vary, and not all railways have programs in place. Given the safety risks posed by vandalism to switches, in August 2001, the TSB issued Rail Safety Advisory 06/01, titled *Switch Locks on Hand Operated Main Track Switches*, which concluded that

> in consideration of the safety risks posed to railway operations by vandalism to switches, Transport Canada (TC) may wish to review the differences between railways concerning the use of high-security switch locks, and the use of switch point locks, on hand-operated main track switches, paying particular attention to those railways over which passenger trains operate.

Damage to Skyline car due to contact with the foundation wall of the farm supply building.

TC advised that a cursory scan of the short-line railways indicated that most met the requirements of Order No. R-39910 or are upgrading to these requirements. TC advised that it had conducted a survey of all other railways on the use of high-security switch locks and switch point locks. The survey revealed that federally regulated railways have equipped main-track switches with proper high-security locking devices.

View from diner car looking toward rear of train.

The Railway Association of Canada (RAC) has since tasked its Operating Rules Committee to review, and possibly revise, the *Canadian Rail Operating Rules* to incorporate the principles of R-39910. Should any amendments to the operating rules be deemed necessary, the changes would apply to virtually the entire Canadian railway industry.

Switch Security

In Central Traffic Control (CTC) territory, there are devices, such as the railway signal system and the switch targets themselves, to provide train crews with advance warning of an unsafe main-track switch position. However, this investigation revealed that there are limitations in the level of safety provided by these devices.

When the security of a switch has been compromised, but the points have not moved 1/4 inch or more, the railway signal system continues to indicate that the switch condition is lined as intended. Also, if manually operated switch points are moved after a train has passed the last signal display, the signal does not communicate this change to the train crew. In such situations, an approaching train crew would be unaware of the unsafe switch position in front of them, as happened in this occurence.

Lateral movement of the interconnected switch points, switch rod, and switch handle is required in order to rotate the switch stand mast and,

Operating crews need information that reflects the actual switch conditions they will encounter.

thereby, display a red target and red tip assembly to an approaching crew, indicating that the switch is lined for the diverging route. However, when a switch stand handle is unlocked, or the switch points are even slightly open, the switch target will continue to display a normal (green) indication, providing false information to an approaching train.

Although the risk of switch tampering in signalled territory is low, the inability of either the railway signal system or switch targets to provide a reliable warning that a main-track switch is not properly locked puts train crews and the public at risk.

Operating crews need information that reflects the actual switch conditions they will encounter. Neither the signals system nor the switch target was capable of providing the crew of Via 15 with information that the TU-29 switch was not properly lined and securely locked. As a result, the approaching train did not receive an advance warning on the change of the switch position.

Safety Issues and Advisories

A detailed inspection of the rolling stock, crew and

Sleeper car and farm supply building.

passenger surveys, and a subsequent mail-in passenger survey led to the identification of a number of passenger safety issues.

Access to one emergency exit window was noted to be partially obstructed by the location of a box used for wheelchair storage. An examination of the Via fleet of 37 HEP 1 (head-end power) stainless steel coaches revealed that a similar condition existed in eight of the coaches. In other instances, the location of the wheelchair box obstructed access to the hammer used to break the emergency window glass.

In July 2001, the TSB issued Rail Safety Advisory 03/01 to TC, titled *Wheelchair Box on VIA HEP 1 Passenger Cars Obstructing Access to Emergency Exit Window and Hammer*, that concluded:

> in view of the safety risk this condition poses to both onboard railway staff and passengers during an evacuation, Transport Canada, in conjunction with VIA Rail, may wish to re-evaluate the current wheelchair box installations in all HEP 1 coaches.

As a result of this re-evaluation, Via relocated the wheelchair storage boxes and hammers.

The impact of the collision caused two beds in the roomettes of one sleeping car and one in another car to fall from the stowed position in the wall above the passenger seat, resulting in one passenger being struck on the head. An examination of the latching system revealed that the beds had most likely not been secured in position when they were last stowed.

This led to TSB Rail Safety Advisory 04/01, titled *Securement of Beds in VIA Sleeping Cars*, that concluded:

> Transport Canada may wish to advise VIA to review the locking procedures and have OTS employees ensure that all beds are correctly secured when in the stowed position.

TC replied on 08 August 2001 that a Via maintenance procedure, issued in April 1992, applied to this topic and OTS employees were reminded of the importance of ensuring that the maintenance procedure was followed. Via also instructed OTS employees to listen for the locking mechanism to "click" when securing beds in sleeping cars. TC also advised that, following this derailment, Via inspected (and where required, repaired) the locking mechanisms of all beds in its sleeping cars.

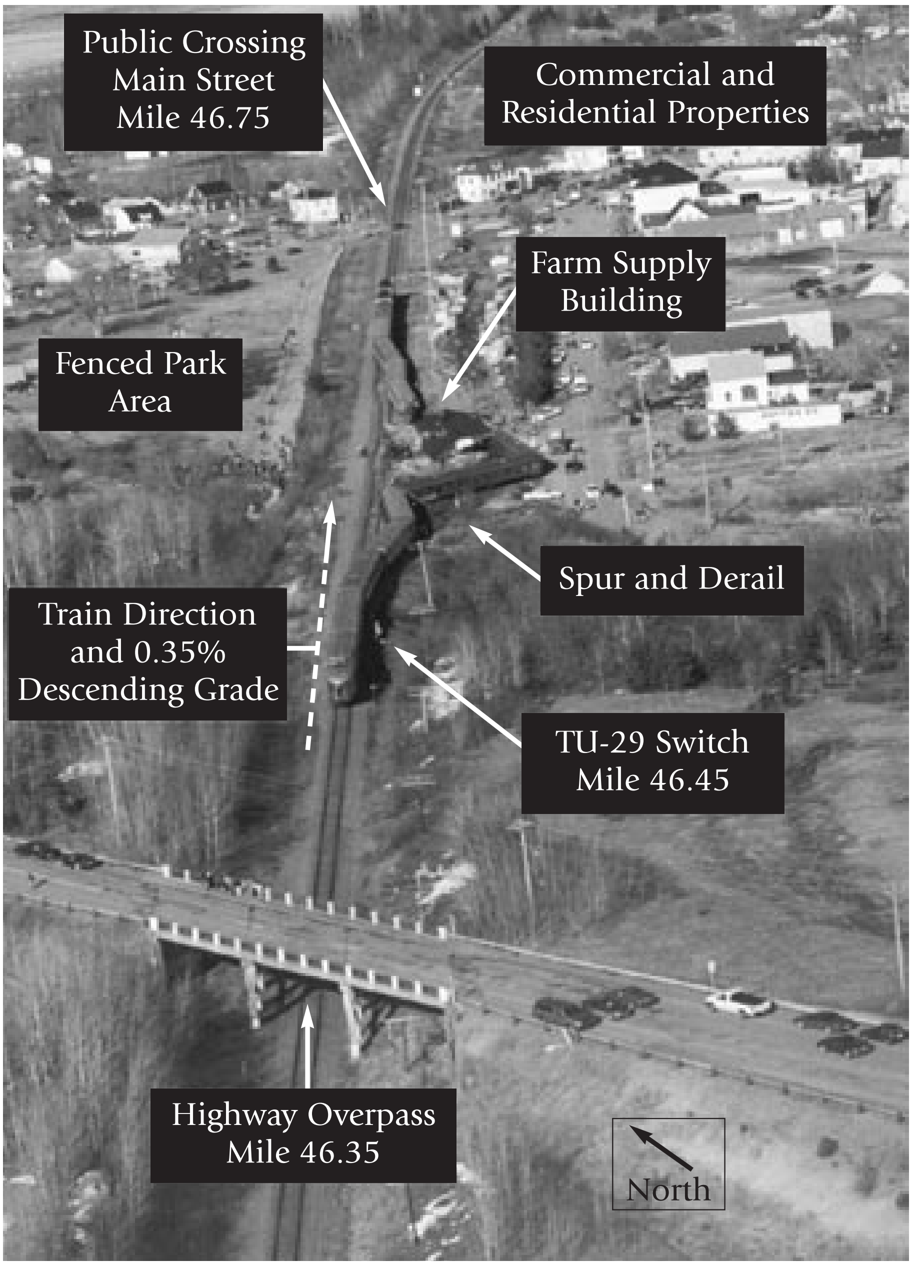
Other Safety Issues

Other issues identified in this investigation—unrestrained items (carry-on baggage, heavy items such as chairs and tables moving about in the cars, dinnerware, cooking utensils), broken glass, and contact with other sharp objects—were common to four other passenger train occurrences investigated by the TSB between July 1999 and April 2001. A separate examination encompassing all five accidents was undertaken to provide a better understanding of the passenger safety data and provide a more complete picture of the safety issues identified.

On 20 July 2001, the TSB issued Rail Safety Advisory 05/01 to TC, titled *Observations of Railway Passenger Safety in Canada*, concluding that many relatively minor safety issues relating to passenger safety remain unaddressed. On their own, these issues do not pose a significant risk but, when taken in combination, indicate a possible systemic risk situation. It stated:

> Transport Canada and industry may wish to examine these issues and, in view of the potential combined risk, evaluate the adequacy of their existing regulatory and safety management approaches in these areas.

TC advised on 10 September 2001 that departmental staff had met with Via staff a month previously. In addition, TC provided the RAC with a copy of the advisory in order that its other passenger-carrying railway companies could be apprised of these issues. Corrective action has been implemented and is monitored by TC.



Aerial view of the occurrence site as viewed in the direction of train travel.

Three OTS employees were trapped inside the kitchen area of the diner car. The emergency egress provisions for employees required to work in the diner car was the subject of a subsequent Occupational Health and Safety (OHS) investigation conducted by TC under Part II of the *Canada Labour Code*.

The investigation concluded that Via Rail did not provide protection to employees trapped in the kitchen/pantry area of the diner car, ensuring that there was an alternate access for first responders to enter and for the employees to exit from the car through the window in the kitchen. The company was directed to address the question of egress for the kitchen area. Via subsequently initiated a program to equip the kitchen area windows with breakout glass.

The OHS investigation report also stated:

1. That portable radios and radio monitors be securely attached to OTS employees at all times;

2. That glassware, dinnerware, kitchen utensils and cooking utensils be safely and securely stowed when not in use;

New standard switch lock.

Damaged switch lock. Note broken clasp mechanism (arrow).

3. That flashlights carried by employees be securely and permanently attached to their person at all times, in a case that would prevent the flashlights from being dislodged from the case; and

4. That the satellite phone be relocated in the last car of the train and that the employees be trained and qualified to use it.

Via agreed with and has taken action to address the first three items. As to the fourth observation, Via found that relocating the satellite phone would not be practicable; however, a training program was initiated to qualify OTS employees in its use.

Voice Recording

The locomotive engineer at the controls of Via 15 called the rail traffic controller (RTC) before the train arrived at Signal H443 to obtain an occupancy control system clearance, which was required for the train to enter the non-CTC portion of the Bedford Subdivision near Truro. The conversation was conducted on a cellular telephone. The background noises of the RTC centre and the locomotive cab (ex. engine sounds, whistle and bell, and in-cab voice sounds including radio transmissions heard in the cab) were recorded on the RTC tape recording, providing investigators with the equivalent of a cab voice recording. RTC tape-recording systems are installed at the railway's initiative; there is no regulatory requirement to record RTC conversations.

Since the mid-1990s, the TSB has been advocating the need for on-board voice recorders to supplement information captured by the locomotive event recorder. Too often, TSB investigators are unable to conduct a complete analysis of the events preceding an occurrence because there is not enough information available. While rail operations depend heavily on voice communications, there are no present means for recording and subsequently evaluating all sounds preceding an accident, potentially hindering the identification of risks to safety. In this accident, the existence of such a recording permitted the TSB to positively identify the train's location during a safety-critical communication (obtaining an occupancy control system clearance) for the duration of the conversation that occurred prior to the accident and materially assisted the investigation.

Top photographs show switch points open 3/16 inch, yet a green CTC signal is displayed to a train crew. Bottom photographs show an unlocked and partially raised switch handle, yet a green switch target.

Crossing at Mile 18.13 of the CPR Brockville Subdivision, facing east.

Crossing Care

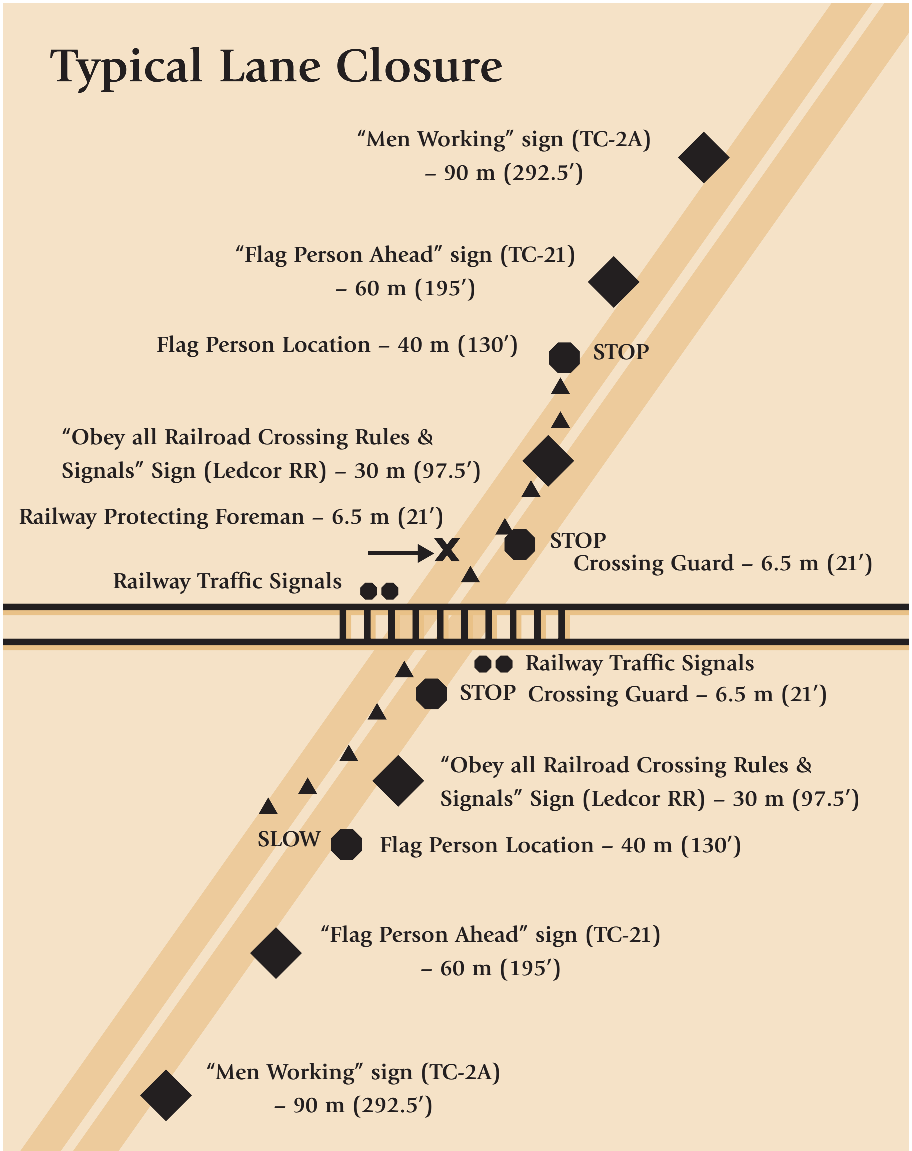
Two fatal crossing accidents in Ontario about 15 months apart raised TSB concerns about the protection of vehicular traffic when construction is being carried out at crossings.

On 05 June 1999, at approximately 1413 eastern daylight time, eastbound Via Rail Canada passenger train 642 (Via 642) struck a motor vehicle at the public crossing at Mile 18.13 of the Canadian Pacific Railway (CPR) Brockville Subdivision near Bellamy, Ontario, fatally injuring the two vehicle occupants. Ledcor Communications Ltd., an independent company under contract to CPR, was engaged in laying a conduit for fibre optic cable across the roadway near the tracks and providing motor vehicle control through the construction area. — Report No. R99T0147

On 28 September 2000, at approximately 0745 eastern daylight time, Via train 85, proceeding westward on the Goderich–Exeter Railway Company (GEXR) Guelph Subdivision, struck a motor vehicle at the public crossing at Mile 33.54, near Limehouse, Ontario, fatally injuring the three vehicle occupants. At the time, contractors were at the crossing preparing to lay a conduit for fibre optic cable, under the railway, near the tracks. — Report No. R00T0257

The First Collision

At Bellamy, road traffic was restricted to a single lane under the direction of two Ledcor control persons and rail traffic was under the direction of a CPR Rule 42 foreman. While stopped at Brockville station, approximately 10 miles from the crossing, the crew of Via 642, destined for Ottawa, requested and received permission to enter the Rule 42 limits. The Rule 42 foreman then instructed the Ledcor foreman to clear equipment and personnel from the construction area. Although all construction



had stopped at the site, Ledcor traffic control persons continued to flag vehicular traffic through the site, in accordance with Ledcor's standard practice. An idle equipment operator had temporarily relieved the westernmost Ledcor control person of flagging duties at the traffic control person's request. At 1410, the Rule 42 foreman cleared the train through his limits with no restrictions. At approximately 1413, the automatic warning devices activated. About this time, the relieving traffic control person flagged three waiting vehicles through the site. The train sounded its horn and bell while approaching the crossing at 82 mph. Upon entering the crossing, the train struck the lead vehicle.

The Ledcor traffic control persons were positioned 68 m (approximately 223 feet) east of the crossing and 106 m (approximately 348 feet) west of the crossing. The Ledcor foreman and the traffic control persons chose these locations because they estimated that, when nearer to the crossing, driver sight distance for approaching road traffic was unsafely restricted by road curvature and gradient. The traffic controllers were equipped with reflectorized vests, pole-mounted stop signs, and portable radios for communication with each other and with the Ledcor foreman. The Ledcor foreman's radio could also be tuned to the Rule 42 foreman's channel if required. Similarly, the Rule 42 foreman could tune his radio to the Ledcor radios. Although the Rule 42 foreman was in continuous radio contact with the crew of the approaching train, he did not communicate train arrival time or other information to the Ledcor foreman or the traffic control persons, nor was he required to do so under CPR and Ledcor procedures. Had the Ledcor traffic controllers been informed of the train arrival time, or had they been instructed to stop vehicles on the road as soon as the instruction was given to clear equipment and personnel, there would have been a greater margin of safety.

As the owner of the crossing and with experience in such matters, CPR—through its employee at the site, the Rule 42 foreman—was in a position to evaluate the impact of Ledcor's flagging procedures on the safety of motor vehicles at the crossing. However, under CPR's agreement with Ledcor, the Rule 42 foreman's duties excluded the protection of vehicular traffic from trains. CPR chose not to participate with Ledcor or give direction to Ledcor regarding development of traffic control plans for such projects. CPR, therefore, reduced safety by relegat-

The Rule 42 foreman's duties excluded the protection of vehicular traffic from trains.

ing responsibility for vehicular traffic protection to Ledcor.

The traffic controllers understood the danger of flagging vehicles into the work zone with the automatic warning devices activated, but they apparently did not recognize that, because of the distances involved, vehicles could be between flagging positions and tracks when the signals activated. Slow-moving vehicles (10 km/h) proceeding east from the west flagging position would take 37 seconds to reach the tracks. Considering that the signals activated about 30 seconds before the arrival of a train, the probability of motorists having passed the flagging position upon signal activation and driving into the path of a train was high. Although the Ledcor employees stated that they felt motorists would and should be guided by the automatic warning devices in such circumstances, it appears that this concept was not given any consideration before the occurrence. Ledcor's traffic control methodology and traffic control person placement, therefore, jeopardized the safe transit of vehicles over the crossing.

Although the equipment operator who relieved the original traffic controller had not been instructed to stop vehicular traffic when the warning devices activated, it was his intention to do so. The accident might have been averted had the equipment operator been aware that the warning devices were activated. The equipment operator was facing the oncoming cars when he signalled them to proceed. Thus, he could not see the flashing lights and did not hear the activated bell or the approaching train's whistle and bell. Despite his admitted minor hearing problem, his inability to hear these clues is attributable to other factors: the 100-m distance from the crossing considerably lessened the bell's loudness; he had possibly incurred a temporary threshold shift (caused by high sound pressure; complete recovery may take up to 24 to 48 hours) from the previously elevated noise levels while operating his machine at the crossing; and he was near three idling motor vehicles.

In a rail safety advisory sent to Transport Canada (TC) on 28 July 1999, the TSB described the circumstances of this accident and indicated that the scenario encountered by motorists at this crossing constituted a risk to their safety. The advisory suggested that TC might wish to take remedial action concerning the protection of vehicular traffic during construction at a grade.

TC responded on 18 October 1999, concurring with the TSB's concerns and advised that its proposed Grade Crossing Safety Regulations will cover safety issues regarding the safe passage of vehicles at such locations. TC also advised that the Railway Association of Canada (RAC) is developing general guidelines for flagging procedures at grade crossings.

TC's proposed Grade Crossing Safety Regulations and associated manual will require the responsible authority to ensure that adequate traffic controls are in place so that construction work does not adversely affect safety at crossings. However, the Board is concerned that these regulations are not yet in force and, on 11 September 2001, recommended that

> *The Department of Transport expedite the promulgation of new grade crossing regulations.*
> ***R01-05***

The accident might have been averted had the equipment operator been aware that the warning devices were activated.

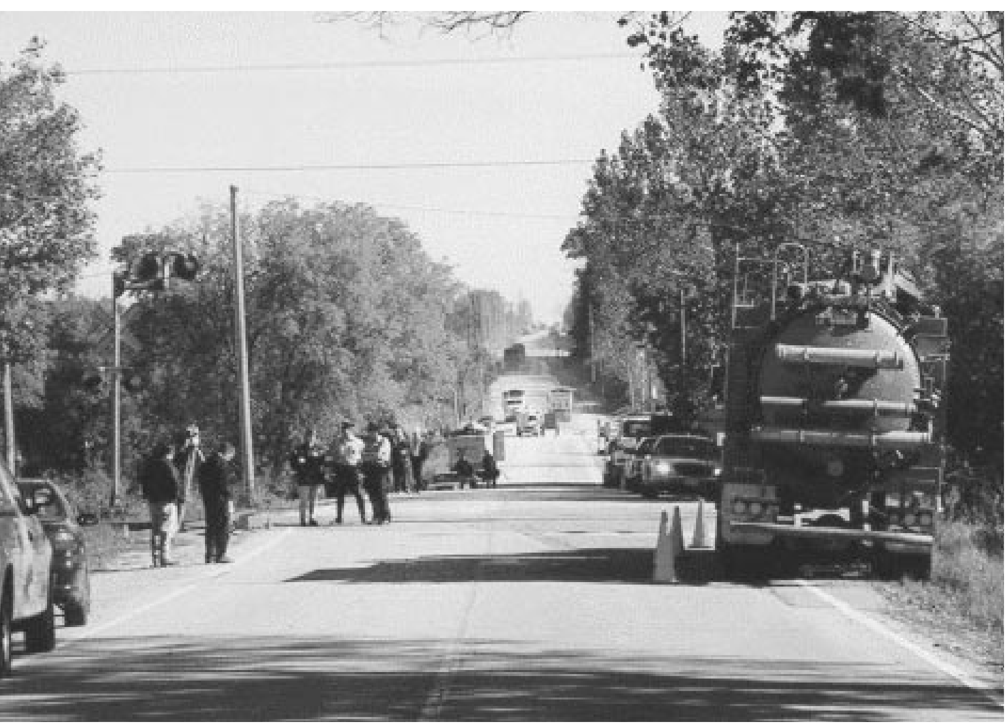
Moreover, the Board is concerned that, once the regulations come into force, a variety of procedures will likely be established site by site and a piecemeal approach may not ensure that a secondary defence to automatic warning devices is placed at all crossings under construction.

The Second Collision

The TSB final report on the crossing accident at Limehouse was released on 22 January 2003. Referring to Recommendation R01-05, the Board said that the very slow pace of the regulatory process in addressing this issue means that motorists continue to be placed at risk. Consequently, the Board recommended that

> *The Department of Transport implement new grade crossing procedures without delay irrespective of the status of the proposed regulations.*
> ***R03-03***

360networks of Mississauga had entered into an agreement with Canadian National (CN) to operate a fibre optic cable system on the Guelph Subdivision right-of-way. (GEXR has the running rights.) CN agreed to provide site supervision to protect 360networks equipment and crews from train movements, while 360networks would abide by all provincial traffic laws and regulations. When the project began on 03 May 2000, CN was providing personnel to give track occupancy permit (TOP) protection (that is, to protect the 360networks crew from train traffic).



Location of Ontario Excavac Inc. truck, looking southward.

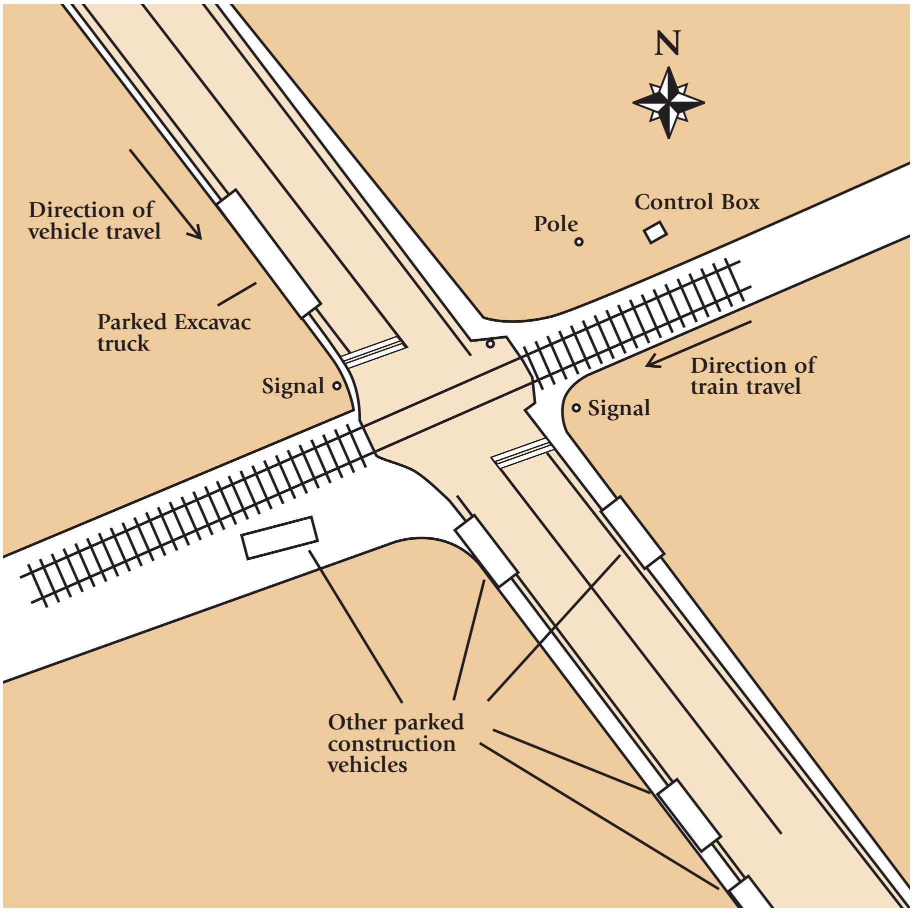
In the agreement between the parties, there was no mention of responsibility for traffic control at crossings. CN's policy is that TOP foremen act to protect trains from construction activity and construction crews from train movements. When notified by the crew of an approaching train, the foreman would clear all workers and machinery from the track before issuing permission for the train to pass through the work limits. TOP foremen were not instructed to protect vehicular traffic from trains.

An incident on 12 June 2000 (TSB Occurrence No. R00T0302) involving a GEXR train and 360networks work crew, protected by CN, and a passenger train accident on 09 July 2000 related to switch handling and 360networks equipment (TSB Report No. R00T0179) led to GEXR informing CN on 19 July 2000 that CN personnel would no longer be issued work clearances (TOP), effectively bringing the project to a stop.

Because the on-site personnel believed that traffic control was only required after work had begun, no TCP was in position.

Discussions regarding project resumption then took place between CN, GEXR, and 360networks. GEXR explained that, at that time, it was unable to provide the required protection with its available resources. GEXR offered to provide this protection to 360networks if given funding for additional personnel and training. 360networks then indicated that it would take on the protection responsibility itself.

360networks was supplied with a list of retired railway employees from whom to hire personnel to carry out TOP responsibilities. The selected personnel were to be further instructed on GEXR operating practices. Based on the selected persons' *Canadian Rail Operating*



Layout of the accident site.

Rules certification and experience and after further orientation regarding GEXR safety policies, GEXR rescinded the work stoppage. When work resumed on 19 September 2000, nine days before this occurrence, 360networks had assumed all train control and motor vehicle flagging duties to complete the installation of the fibre optic cable. In addition, the 360networks' supervisors were responsible for implementing safety procedures at this construction site.

On the day of the occurrence, a job and safety briefing had been planned for 0630 in Acton (Mile 5.3) with the 360networks TOP foreman, a 360networks sub-foreman and another 360networks employee, three A. van Egmond Construction Ltd. employees, and a CN signal maintenance person. The briefing was rescheduled, however, and was to be held at the work site. The nine workers travelled to the work site in six vehicles—five light trucks and a truck belonging to Ontario Excavac Inc., hired by A. van Egmond Construction Ltd. The light trucks were parked to the south of the crossing—four on the west side of the roadway and one on the east side. The Ontario Excavac Inc. truck was parked and left running just to the north of the crossing. As per company policy, the driver placed pylons on the roadway to direct vehicular traffic around the truck. This situation meant that southbound highway drivers would have to use part of the northbound lane to pass the Ontario Excavac Inc. truck.

At 0716, the crew of westbound Via 85 requested clearance to enter the TOP limits. Because equipment and personnel had not yet arrived at the site, the TOP foreman authorized the crew of Via 85 to pass through his limits at track speed with no restrictions.

Shortly after their arrival, the A. van Egmond Construction Ltd. foreman instructed his two employees to place construction warning signs on the roadway. They immediately began to place signage to the south of the crossing, while the foreman and other workers began to gather at the south side of the crossing for the job briefing. No signage had yet been placed to the north of the crossing. Because the on-site personnel believed that traffic control was only required after work had begun, no traffic control person was in position.

Construction activity at crossings requires a comprehensive plan to be in place, from the

A construction employee, realizing that the vehicle was being driven into the path of the train, moved towards the tracks waving his arms.

time equipment and personnel arrive at the crossing, to ensure the safe passage of motorists through the construction site.

At approximately 0745, as a vehicle slowly approached the crossing from the north, the crossing protection activated. As the vehicle passed the parked truck, the driver's attention appeared to have been focused to the west on the south side of the crossing, where most of the vehicles and construction personnel were located. A construction employee, realizing that the vehicle was being driven into the path of the train, moved towards the tracks waving his arms as an indication to stop, but was apparently not noticed by the driver. The train approached the crossing from the east at 60 mph with the whistle sounding and the bell activated and, upon entering the crossing, struck the vehicle.

The absence of an effective secondary defence has the potential to place Canadian motorists at risk.

A re-enactment of the accident on 29 September 2000 determined that the Ontario Excavac Inc. truck obstructed the sight lines of the warning signs on the right side of the roadway. When a vehicle was approaching from about 122 m (400 feet) from the crossing, the flashing lights appeared to be part of the truck's lighting system until approximately 6.1 m (20 feet) from the crossing, where the lights were totally blocked out by the truck. The conspicuity of the lights on the southeast mast was reduced by the rising sun and there was an indication that the conspicuity of the approaching train would also have been reduced at the last moment.

TSB Report No. R99T0147 included the following comments on the adequacy of procedures to ensure the public's safety where there is construction underway at railway grade crossings.

> The particularly dangerous and unforgiving nature of collisions between motor vehicles and trains has long been recognized. To lessen this risk, reliance has traditionally been placed upon protection provided by automatic warning devices. However, when there is construction activity at a crossing, drivers may be confused by contradictory stimuli and may not view the automatic warning devices as a clear instruction to stop. Neither the Transportation Association of Canada's *Manual of Uniform Traffic Control Devices*, an RAC circular entitled *Recommended Practices for Manual Flagging at Railway/Road Grade Crossings* nor TC's current regulations address this risk. The absence of an effective secondary defence has the potential to place Canadian motorists at risk.

The introduction of secondary defences is not a complicated matter but it will require a concerted effort on the part of government and industry. The Board is of the opinion that this effort could come from Direction 2006. This program, sponsored by TC and the RAC, is described as "a partnership between all levels of government, railway companies, public safety organizations, police, union and community groups whose objective is to reduce grade crossing collisions and trespassing incidents by 50 per cent by the year 2006."

The Board believes that there is an opportunity for TC and the RAC, through Direction 2006, to develop a uniform set of standard procedures that will ensure the safety of motorists approaching grade crossings undergoing construction activity. These standards could ensure that motor vehicles are given advance warning of oncoming trains and a clear and unequivocal instruction to stop. Once developed, Direction 2006 would be able to distribute these procedures to all railways in Canada and encourage their implementation.

Simulation of truck crossing the tracks at point of grounding-out.

Low Truck, High Track

The presence of thousands of low-boy truck trailers on the Canadian highway network, combined with the number of superelevated railroad crossings, presents a risk of trucks becoming immobilized at crossings, with the resulting risk of collision and derailment of trains. — Report No. R02T0149

Such a collision occurred on 13 May 2002 at Kingston, Ontario. Eastbound Via Rail Canada (Via) train 52 (Via 52) struck an immobilized low-boy trailer at the Coronation Boulevard crossing at Mile 181.71 of the Canadian National (CN) Kingston Subdivision. The locomotive engineer had applied the brakes in emergency, but the train, which was travelling at 77 mph before brake application, was unable to stop before colliding with the tractor trailer. The two truck occupants exited the tractor before impact and escaped unharmed. The two locomotive engineers crouched on the floor of the locomotive and braced for impact. The operating locomotive engineer suffered minor injuries. No train passengers or on-train service crew were injured.

The tractor trailer, which was carrying a 12-ton hydraulic excavator, was hit by the front of the locomotive between the rear axle and the front part of the trailer. The tractor separated from the trailer and was pushed into the east ditch beside the north main track, while the trailer was pushed onto the roadway embankment beside the south main track. The excavator slid off the trailer and demolished the crossing signal mast on the southeast side of the track. The large 595-pound (270-kg) connecting arm (gooseneck) attaching the trailer to the tractor was torn off and thrown eastward and southward approximately 550 feet (168 m). The train came to a controlled stop approximately 2700 feet (823 m) east of the crossing.

The level crossing was located in a four-degree superelevated (banked) section of track with a one-degree horizontal curvature. The authorized timetable speed was 85 mph for LRC (light, rapid, comfortable) passenger trains, 80 mph for all other passenger trains, and 60 mph for freight trains. Approximately 30 freight trains and 24 passenger trains operated over the tracks daily. The Kingston Subdivision is one of the most heavily travelled and highest-speed lines in Canada.

Crossing Details

Coronation Boulevard is a two-lane, undivided arterial roadway with a posted speed limit of 50 km/h. Due to the banking of the railway tracks and the gradient of the roadway (a 4.1% ascending grade) a hump was created at the south crossing surface in the north-to-south direction.

There was no signage restricting truck traffic or advising of the hazards the crossing might pose to low-ground-clearance vehicles.

The hump is such that over a horizontal distance of 60 feet (18.29 m), crossing elevation drops approximately 30 inches (76 cm). Road signage on the north and south approaches consisted of a railway crossing advance warning sign, depicting a single set of railway tracks. A pictorial bump warning sign was installed on the same signpost. There was another bump sign immediately before the crossing. However, there was no signage restricting truck traffic or advising of the hazards the crossing might pose to low-ground-clearance vehicles.

Regulations regarding the construction of a railway grade crossing can be found in General Order 1980-8 RAIL *Railway-Highway Crossing at Grade Regulations*. Section 8, Crossing Approaches, requires that, "At all crossings the gradient of the approaches of the highway shall not be greater than 1 m of rise or fall for every 20 m of the horizontal length of the approaches." This represents a 5% gradient. The regulations make no reference to signage requirements (other than signboards at the crossing), nor are there any references to the profile of roads at crossings or to the profile of the crossing surface. The Coronation Boulevard crossing met the requirement of the General Order.

The trailer involved in this accident was a 1976, 48-foot (14.6 m), low-boy trailer, model TC3 manufactured by Rogers Bros. Corp. and licensed by the Province of Ontario. The trailer was designed to be lowered and raised for the purposes of loading and unloading equipment while disengaged from the trailer. The design clearance above grade for the underside of the loaded trailer was 7 inches (17.8 cm).

Simulation

The TSB conducted a simulation at the crossing using a similar tractor-trailer combination. The trailer was manufactured by the same company, had similar dimensions, and the same minimum design clearances.

In both directions, the tractor trailer combination was foul of both main tracks.

The vehicle operator was instructed to drive over the crossing in both directions, with the trailer at the normal driving height, and to be prepared to stop on command. In both directions, the trailer made contact with the asphalt roadway surface and came to a stop in the crossing area. It was only able to proceed after the trailer was raised. In both directions, the tractor trailer combination was foul of both main tracks.

A truck driver approaching a highway railway crossing with any type of large vehicle understands that the presence of an uneven surface requires that the tracks be crossed at a

What may not be so readily understood, and perceived as a hazard, are the effects that road alignment in a banked railway track can create for low-clearance vehicles.

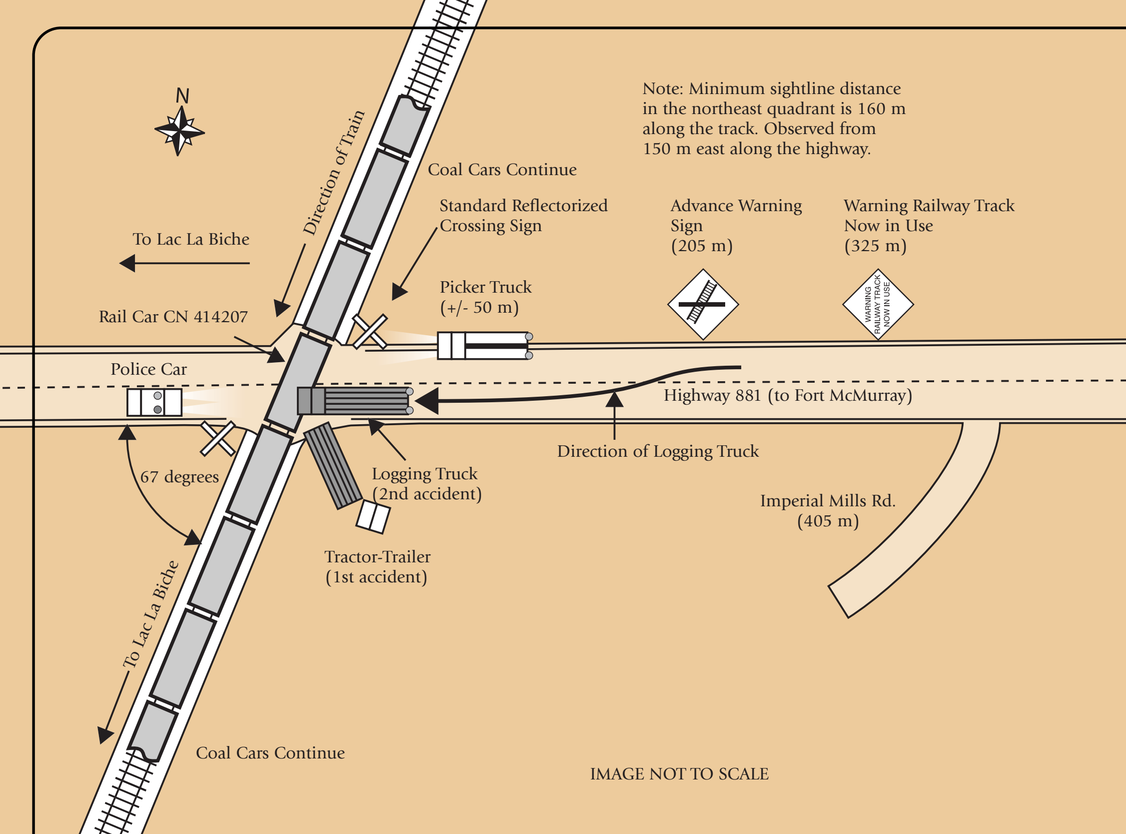
reduced speed. What may not be so readily understood, and perceived as a hazard, are the effects that road alignment in a banked railway track can create for low-clearance vehicles. The driver of the occurrence vehicle, having operated the low-clearance trailer for only seven weeks, was not familiar with the trailer's clearance and did not understand how the low clearance would interact with the geometrics of the crossing. The truck driver was aware of the uneven (rough) crossing surface and reduced his speed to minimize the effects of the rough surface on the load he was carrying. However, he did not expect the trailer to hang up.

Safety Action

As a result of this occurrence, the TSB issued an advisory to the appropriate regulatory and municipal agents, informing them of the risks associated with low-boy trailers with minimal clearance at the Coronation Boulevard crossing. The possibility of hazards involving other crossings with similar alignment and operating conditions was also noted. CN, Transport Canada, and the two road authorities met to discuss safety issues related to low-clearance vehicular traffic at this crossing. Subsequent to the meeting, the road authorities installed signs restricting movement of low-boy trailers along Coronation Boulevard.

CN Rail added contact information to its corporate web site (www.cn.ca/RiskManagement/CrossingSafety/en_vehicles.shtml) to allow operators of low-clearance equipment to review routings that include the need to travel over CN railway crossings and to arrange for special flagging equipment if required.

A draft version of the Canadian Road/Railway Grade Crossing Safety Assessment Guide was completed in July 2002. The guide will assist road and rail authorities to conduct detailed safety assessments as required by the proposed grade crossing regulations. When the regulations come into force, it is proposed that a training plan be implemented to educate road/rail authorities on the regulations and standards. The guide will be a reference tool for these authorities. The regulations are expected to be published in the *Canada Gazette*, Part I, in 2004 and the guide will be published around the same time.



Crossing layout at Mile 138.07.

Inaccurate Assumptions

The effectiveness of a passively protected highway/railway interface is based upon the expectation that drivers will behave as if such crossings are occupied or are about to be occupied by a train until confirmed otherwise. This premise appears to be inaccurate. — Report No. R00C0159

That was one of the findings from a TSB investigation of a crossing accident at Imperial Mills, Alberta, on 19 December 2000. At approximately 2037 mountain standard time, Athabasca Northern Railway Ltd. (ANR) freight train 590-19 (ANR 590-19), travelling southward over the Highway 881 crossing at Mile 138.07 of the Waterways Subdivision, experienced a train-initiated emergency brake application. The locomotive engineer immediately reported the incident to the Royal Canadian Mounted Police (RCMP) and the rail traffic controller. The responding RCMP officer arranged for notification of the emergency medical services (EMS) and fire department at Lac La Biche and placed a second officer on standby pending assessment of the situation. The train conductor determined that the 21st car, an empty box car, had been struck by a westbound semi-trailer on Highway 881. As a result of the collision, the train was disabled; the body of the box car was lifted off the wheel assembly at one end and the car uncoupled from the trailing gondola car. The damaged box car came to a stop approximately 245 m south of the crossing, with the trailing portion of the train blocking the crossing. The separation between the 21st and 22nd cars was about 35 m.

The First Collision

The truck driver was familiar with the general area but had not driven on this section of road for a number of years. He was travelling at 90 km/h—the posted speed limit was 80 km/h—when he noticed the advance warning signs (AWS) for the railway crossing and slowed down to approximately 80 km/h to avoid damage to his truck in the event that the crossing was uneven. At an estimated 200 m from the crossing, the truck driver noticed the train wheels going over the crossing. He immediately tried to stop, but the road surface was slippery and covered with snow and ice. When it appeared as though the truck would not stop in time to avert collision with the train, he steered the truck into the ditch. As a result, the truck spun 180 degrees and the rear of the empty trailer struck the train. The driver was not injured.

The RCMP officer arrived at the scene from the west at approximately 2115, followed shortly by EMS and a fire department crew from Lac La Biche. The RCMP patrol car was stationed approximately 60 m west of the crossing in the eastbound lane, with the flashing beacon operating and the headlights on bright, facing the train. Upon determining that the highway was impassable, motorists began using Imperial Mills Road (approximately 400 m east of the blocked crossing), which reconnected with Highway 881 approximately 2 km west of the crossing. EMS and fire crews were released from the site when it was determined that there were no injuries.

After determining that vehicles were stopping safely, the RCMP officer elected not to require additional staff at the scene for traffic control purposes. He was satisfied that the flashing red lights and bright headlights from his car, parked on the west side of the crossing, and the stationary vehicles, with their hazard lights and beacons flashing, on the other side of the crossing, were providing adequate illumination so that approaching traffic would stop safely. When vehicles began voluntarily detouring through Imperial Mills Road, this strengthened the notion that these measures were adequate.

The train conductor determined that a crane would be required to set the car body back on its truck to allow a coupling with the 22nd car to clear the crossing. He further indicated to the RCMP officer that this task would take two to three hours.

The damaged rail car was moved to the Imperial Mills Road crossing where repairs could be made. ANR personnel protected this site by flagging the highway traffic at this crossing while repairs were taking place.

There are no specific requirements for railway employees to protect motor vehicles from coming into contact with a train that has fully occupied a public crossing and become disabled.

The damaged truck and trailer were removed from the ditch by approximately 2200. By 2315, only two vehicles remained at this crossing: on the west side, the RCMP vehicle with headlights and flashing beacon on, and on the east side, a picker truck (a tractor-trailer unit with a mounted crane), with headlights and four-way flashers on. The train was still occupying the crossing.

The *Canadian Rail Operating Rules* state that no part of a train or engine may be allowed to stand on any part of a public crossing at a grade, for a period longer than five minutes, when vehicular traffic or pedestrian traffic requires passage. There are no specific requirements for railway employees to protect motor vehicles from coming into contact with a train that has fully occupied a public crossing and has become disabled.

The train crew members did not take part in providing traffic control at the Highway 881 crossing; however, they provided traffic control at the Imperial Mills Road crossing,

The assumption behind the passive crossing system is that a driver will see the AWS and immediately adjust driving behaviour to be prepared to stop short of the crossing if a train is detected.

where the damaged box car was being repaired. Consistent with standard railway operating philosophy, it was not the ANR crew's responsibility to protect traffic once the train had fully occupied Highway 881. In rural areas under night conditions, it is conceivable that the train crew might be the only able-bodied people capable of setting up hazard warning devices or flagging until a traffic control authority arrives.

The Second Collision

At approximately 2347, a westbound truck partially loaded with logs approached the crossing. The truck, which was equipped with an event recorder, was travelling at approximately 92 km/h and then reduced speed to approximately 88 km/h approximately 15 seconds before impact. The truck driver steered around the picker truck parked on the shoulder of the westbound lane and drove into the standing train. A brake application was made approximately four seconds before the collision. The recorded speed at impact was approximately 68 km/h. The driver was pinned in the wreckage until extricated from the truck cab by recalled EMS crews at approximately 0305. He did not survive his injuries.

The crossing at Mile 138.07, which is under the jurisdiction of Lakeland County, was protected by a standard reflectorized crossing sign, which was installed in 1990. A red retroreflective strip, 4 inches wide by 4 feet 6 inches high, was installed on the back of the crossing sign posts in 1998. The AWS, in the direction that the trucks were travelling, was approximately 200 m east of the crossing. In addition, there were warning signs stating "WARNING: RAILWAY TRACK NOW IN USE" 325 m east of the crossing. White crossing markers were painted on the pavement immediately preceding the crossing and at the AWS locations, in both directions, but they were obscured by snow and ice. There was no nighttime illumination at this crossing.

Invalid Assumptions

The assumption behind the passive crossing system is that a driver will see the AWS and immediately adjust driving behaviour to be prepared to stop short of the crossing if a train is detected. In other words, the system requires that the driver always expect a train. The reality is that many situations actually create the opposite expectation, that is, that a train will not be present. This situation was likely prevalent in the Lac La Biche area, due to the low frequency with which trains operated (generally less than one a day), and the recent history (August 2000) of train operations starting up on this territory. This situation existed despite measures taken by ANR and Alberta-Pacific Forest Industries Ltd. to alert the public and commercial truck operators that railway operations had resumed.

Some highways have additional warning signs pertaining to crossings; however, the application is inconsistent among highway authorities.

The AWS at this crossing did not indicate to drivers what action must be taken. In particular, the signs did not communicate to drivers that the crossing protection was passive, nor did they indicate the distance to the crossing or a safe driving speed. The situation found at Lac La Biche is very common across Canada. Some highways have additional warning signs pertaining to crossings; however, the application is inconsistent among highway authorities. For example, some highway authorities may post the distance to the crossing, and still others may post yield or "expect a train" signs. Under nighttime conditions, the information conveyed by these additional signs may be particularly beneficial to the driver, as there are so few visual cues available to alert the driver to a train occupying the crossing. In this accident, the visual cues available to the drivers in both collisions regarding the presence of the train on the crossing were not sufficiently compelling to modify their expectation of an unoccupied crossing in time to avert a collision.

Changes must be made to the underlying philosophy of railway/highway interfaces to take into account the reality of driver expectations.

The passive grade crossing system (sight distances, approach warnings, pavement markings, and crossbuck signs) has not significantly changed over the years. Bearing in mind the number of passive public crossings that exist—15 700 under federal jurisdiction in Canada—and will continue to exist for years to come, situations such as the one that occurred in this accident will recur unless significant action is taken. Changes must be made to the underlying philosophy of railway/highway interfaces to take into account the reality of driver expectations—that drivers do not expect a train. Some approaches to improve the situation through modifying driver expectations are: intelligent transportation systems technology (which can alert a driver to an approaching train) and standardization of traffic control devices associated with crossings (such as information notifying a motorist of the distance to the crossing, an appropriate speed at which to approach, and crossing reflectorization requirements). In addition to efforts to modify driver expectations, methods to enhance the conspicuity of trains, such as a standardized configuration (ex. size and pattern) and minimum reflective intensity requirements of reflectorized decals, would enhance the overall safety at the railway/highway interface.

There are a number of engineering guides available to help road authorities determine safe vehicle speed and location for installing traffic devices, such as signs. The Transportation Association of Canada (TAC) publishes the *Manual of Geometric Design Standards for Canadian Roads*. Alberta Infrastructure publishes a *Highway Geometric Design Guide*. Transport Canada has a draft Road/Railway Grade Crossings—Technical Standard and Inspection, Testing and Maintenance Requirements. Transport Canada and TAC recommend a stopping sight distance (SSD) of 140 m for automobiles travelling at 80 km/h, and a SSD of 210 m for trucks travelling at 80 km/h. The Alberta Infrastructure guide suggests a SSD of 140 m for automobiles and trucks. In addition, TAC recommends that designers should use decision sight distances whenever information may be perceived incorrectly, decisions are required, or where control actions are required. In this case, the recommended SSD for automobiles would be 225 m and for trucks 405 m.

The Board is concerned that the 1999 *Highway Geometric Design Guide* used by the province of Alberta for SSDs does not differentiate between automobiles and trucks.

Inadequate Reflectors

ANR 590-19 consisted of two locomotives, 41 hopper cars loaded with coke, and one empty box car. The hopper cars were painted black with white identification letters and white owners' emblems. There were four-inch-diameter reflectorized discs on each of the hopper cars. On the car that was struck by the logging truck, two markers on the leading edge of the car had been painted over with black paint. The markers, which would have been in view of the truck driver, were installed in 1975, the manufacture date of the car. Subjective evaluation of the discs indicated a significant amount of dirt and very limited visibility; they likely offered little benefit to the drivers in detecting the presence of the train from a distance. The benefits of reflectorization can best be met by industry if specifications are provided, including the minimum reflective intensity and configuration.

The benefits of reflectorization now appear greater than the cost.

Studies conducted in the U.S. by the Federal Railroad Administration (FRA) to assess the impact of age and dirt on the reflective intensity of the engineering-grade retroreflective material indicated that the average reflectivity was reduced to 5% of its initial value after two years of service. A recent FRA cost/benefits analysis supports the conclusion that the decline in the cost of reflective material, in combination with better performance and lower maintenance costs, has created a situation in which the benefits of reflectorization now appear greater than the cost.

TSB statistics indicate that there were a total of 209 nighttime accidents at passively protected crossings under federal regulation between 1996 and 2000, resulting in 25 fatalities and 27 injuries. The TSB is concerned that many rail cars are operating over passively protected crossings at night with inadequate reflectorization to help alert motorists to their presence. The TSB believes that the hazard could be reduced substantially with the application and maintenance of modern reflective materials to all rail cars.

Railway Occurrence Statistics

	2003 (Jan.–Aug.)	2002	2001	1997–2001 Average
Accidents	**699**	**984**	**1060**	**1089**
Main-track train collisions	5	8	7	10
Main-track train derailments	110	116	127	129
Crossings	159	261	278	281
Non-main-track train collisions	70	112	86	105
Non-main-track train derailments	255	347	385	377
Collisions/Derailments involving track units	15	11	18	19
Employee/Passenger	5	8	8	10
Trespassers	49	73	79	86
Fires/Explosions	19	24	36	43
Other	12	24	36	28
Incidents	**207**	**303**	**322**	**373**
Dangerous goods leaker	111	167	194	221
Main-track switch in abnormal position	9	9	9	13
Movement exceeds limits of authority	65	93	94	104
Runaway rolling stock	10	19	10	14
Other	12	15	15	20
Million train-miles*	**59.20**	**92.42**	**89.51**	**89.89**
Accidents/million train-miles	**11.81**	**10.65**	**11.84**	**12.11**
Accidents Involving Dangerous Goods	**152**	**221**	**205**	**241**
Main-track train derailments	30	24	17	25
Crossings	2	6	7	8
Non-main-track train collisions	24	48	40	51
Non-main-track train derailments	89	130	128	144
Other	7	13	13	14
Accidents with a Dangerous Goods Release	**7**	**4**	**5**	**7**
Accidents Involving Passenger Trains	**45**	**67**	**76**	**71**
Fatalities	**50**	**96**	**99**	**100**
Crossings	15	46	41	36
Trespassers	31	50	56	60
Other	4	0	2	4
Serious Injuries	**62**	**71**	**91**	**87**
Crossings	37	42	47	45
Trespassers	17	21	22	25
Other	8	8	22	16

* Train-miles estimated. (Source: Transport Canada)
Figures are preliminary as of 03 October 2003.
All 5-year averages have been rounded. The totals sometimes do not coincide to the sum of these averages.

RAILWAY Occurrence *Summaries*

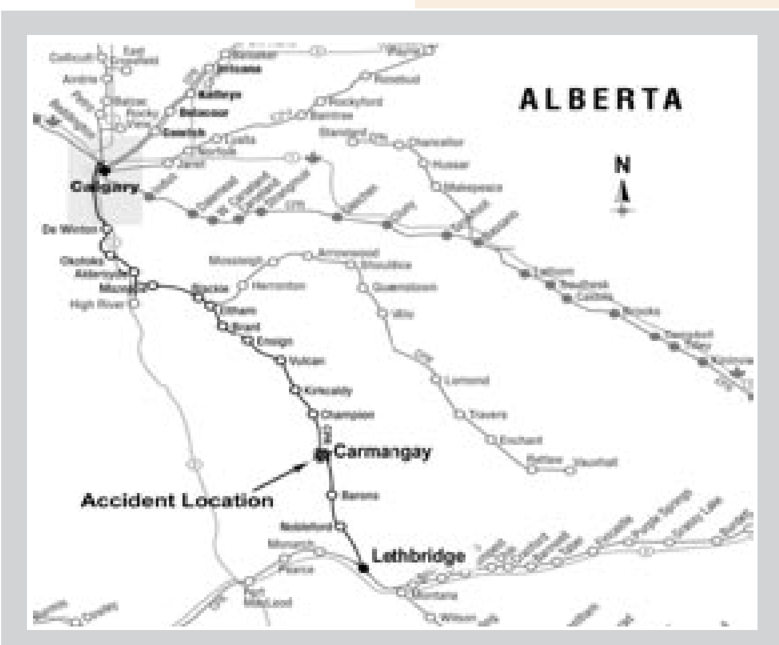
DERAILMENT AFTER RAIL FAILURE

Ten loaded freight cars on a Canadian Pacific Railway train derailed on 03 March 2002 after a rail failed under the load of the train.
— Report No. R02C0013

Train 275-03 was travelling southbound and passing over the Carmangay turnout, Mile 30.2, of the Aldersyde Subdivision in southern Alberta when it experienced a train-initiated emergency brake application and the locomotive engineer observed rail cars derailing to the west side of the track. At the time of the accident, the train speed was 26 mph, the throttle was in position No. 3, and the train brakes were released.

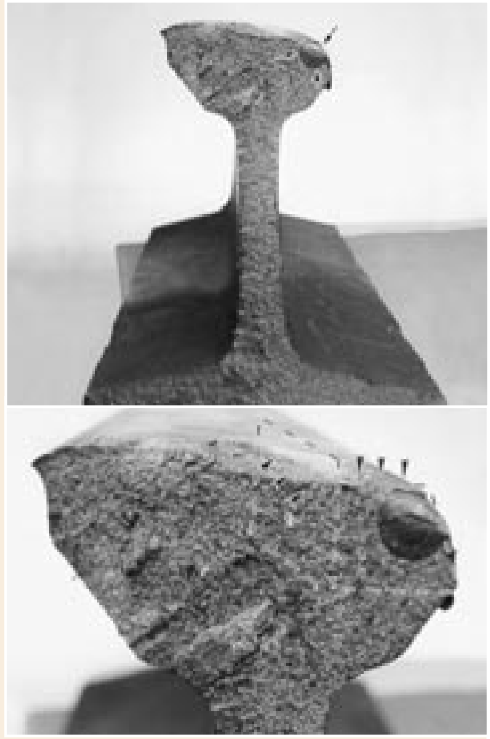
Of the 10 derailed cars, seven were tank cars containing propane (UN1075), two were covered hopper cars carrying ammonium nitrate (UN1942), and one was a covered hopper car carrying potash. Five tank cars and three hopper cars were destroyed, spilling about 10 tonnes of potash and 90 tonnes of ammonium nitrate; no propane was released.

The clean-up of the accident site began the next day. Because the spill was about 750 feet south and 450 feet east of the Little Bow River, a silt barrier was constructed in the ditches to prevent any spilled material from reaching the river during the spring run-off. The propane was transferred to other tank cars. All of the spilled ammonium nitrate was recovered. Confinement and control of the dangerous goods and the clean-up and control of the derailment site were carried out in a timely and effective manner.



Map of southeastern Alberta.

Through the derailment area, the track is tangent and ascends at a 0.32% gradient in the direction of train travel. It consists of 100-pound per yard jointed rail manufactured in 1947, laid on No. 1 softwood ties and anchored every tie. In 2001, the single-shoulder tie plates were replaced with double-shoulder tie plates between Mile 28.5 and Mile 30.2.



Transverse defect representing 5% of the rail fracture surface area.

Transverse defect representing 3% of the rail fracture surface area.

In the Carmangay area, the last visual inspection of the track was conducted by the track maintenance foreman on 01 March 2002; no irregularities were noted. The turnout was last inspected by the track maintenance foreman on 14 February 2002 and was reported to be in satisfactory condition. Rail surface defects were not noted during monthly visual inspections because there are no provisions in the report to record them. The last track geometry car inspection was carried out on 13 September 2001; no defects were identified. The last ultrasonic and induction inspection was conducted on 16 January 2002; no internal defects were detected. However, a signal response recorded at Mile 30.2 was indicative of surface defects.

A signal response recorded at Mile 30.2 was indicative of surface defects.

When the double-shoulder tie plates were installed and the rail cant was reduced, contact stresses from wheel loading shifted onto the gauge side of the rail, accelerating the propagation of surface cracks. Further development of these cracks, and the excessive rail head wear, reduced the ability of the rail section to resist crack growth. Subsequently, surface cracks formed subsurface cracks that turned downward and developed into two transverse defects. Rail failure occurred when one of these transverse defects reached a critical size.

Reliability of the testing equipment to detect small internal defects is reduced when surface defects are present.

Although the two transverse defects represented up to 5% of the total rail head fracture surface, they were likely smaller when the rail flaw detector car carried out ultrasonic and induction tests 46 days before the accident. Reliability of the testing equipment to detect small internal defects is reduced when surface defects are present. Surface defects were present on the rail in 1998 when a grinding program was scheduled (grinding of the Carmangay turnout was not performed due to a potentially extreme fire hazard) and had propagated since then. When the rail flaw detector car tested the track in 2002, surface defects concealed the presence of transverse defects. In the absence of a grinding program, surface defects are not corrected and reduce the ability of a rail flaw detector car to detect internal rail defects. Canadian Pacific Railway completed the grinding of all the main-track switches on the Aldersyde Subdivision in May 2002.

DERAILED BY A DOOR

> *Twenty-one cars of a Canadian National (CN) freight train derailed when a bulkhead door on a rail conveyor car tore away, bounced off a passing freight train, and came to rest jammed against the track, which shifted 11 inches (28 cm). — Report No. R01T0255*

The door, which measured 1.4 m by 3 m and weighed 450 kg, was one of two installed on CN 46570, the 37th car on train M337-31-24 (train 337) travelling northward on the west main track of the CN Bala Subdivision near mile 20.0 in Richmond Hill, Ontario, on 24 September 2001. The car was the trailing end and bulkhead door end car of a 34-car rail transporter consist.

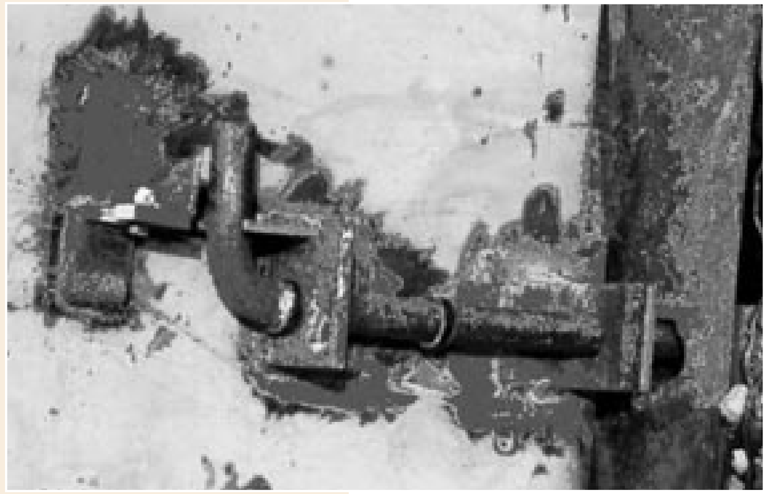
The door had been supported by three hinges. The hinge well areas were shiny and rust free, indicating that they had recently been torn off. The door locking device consisted of two brackets welded to the door face with a pin that slides through the brackets into the car floor.

The door brackets and the locking pin were missing and the weldment areas for the brackets were rust covered. It was determined that a piece of piping with a small valve attached had been inserted into the car floor in front of the door as a means of securement for an undetermined period of time. This makeshift device was not recovered. The door stop, welded to the side of CN 46570 to restrict door swing, was missing and the weldment area was rust covered.

In the six months before the accident, this car had seen service in Manitoba, Saskatchewan, Quebec, and Ontario, transporting scrap rail to Winnipeg and returning with new rail, thereby posing a hazard over a wide geographical area for some time. Many railway employees would have had occasion not only to observe the defects but to work with the jury-rigged retaining mechanism, yet this equipment remained in service with this safety defect.

End doors.

Aside from bulkhead door end cars on rail transporters and box cars, the TSB knows of no other type of rail car equipped with doors that could present a danger to adjacent equipment if not properly secured. Including malfunctioning door securement for this type of car as a defect in the *Railway Freight Car Inspection and Safety Rules* would ensure that this defect is inspected for and that identified cars are required to be immediately removed from service.



Locking pin.

On 17 January 2002, the TSB issued a rail safety information letter to Transport Canada (TC), relating the details of this accident. It was also indicated that the defective condition of the door was well known to railway employees and that the current rules and company policies, procedures, and guidelines did not appear to cover door defects for this equipment.

TC indicated that there is a general provision of the *Railway Freight Car Inspection and Safety Rules* that states "a railway company shall ensure the freight cars it places or continues in service are free from all safety defects described in Part II of these rules." TC indicated that, while not specifically addressing rail transporter cars, sound inspection principles based on these rules provided for the defective condition of the subject car to be identified.

TC stated that CN has now inspected all of its rail transporter cars and completed a program to repair and modify the locking pin mechanisms. CN has also reiterated its loading and unloading inspection program for these cars to their mechanical inspectors and advised them to pay particular attention to the door locking mechanisms and doorstops.

THROTTLE OR BRAKES?

> *A strong discouragement on the use of train brakes may effectively remove a potential means for controlling a long train and ensuring a more even distribution of in-train forces.*
> *— Report No. R00W0106*

Canadian National freight train E20531-15 was travelling westward from Sioux Lookout, Ontario, to Winnipeg, Manitoba, on 16 May 2000 when 18 of the 136 cars on the train derailed near Mile 155.0 of the Redditt Subdivision.

The track in the derailment area is a combination tangent and curved track with a maximum authorized speed of 50 mph for express freight trains. A descending grade of 0.5% extends from about Mile 152.5 to approximately Mile 153.0, after which the track levels somewhat to a descending grade of 0.2% stretching to about Mile 154.0. At Mile 154.0, the track becomes level (zero grade) for approximately 0.4 mile before ascending at 0.1%. There are three small curves between Mile 153.0 and Mile 153.5, and a long shallow curve stretches from about Mile 154.0 to about Mile 154.8. There was a 30-mph permanent speed restriction at Mile 157.8.

The locomotive engineer began to reduce train speed to comply with the upcoming 30-mph speed restriction by throttle reduction as required by company policy. That policy required locomotive engineers "to utilize 'forward planing' in consideration of territory profiles, planned stops, required speed adjustments and slack control, avoiding aggressive use of the locomotive throttle and train braking systems." Throttle manipulation was to be used as the primary means of controlling speed and dynamic braking used as the initial braking force. Power braking, the practice of keeping a train stretched by use of the train air brake system, was to be avoided. When unavoidable, the lowest throttle position was to be used. The intent of the policy was to ensure less wear and damage to equipment while improving fuel efficiency.

At the time the train speed was reducing, the rear of the 8800-foot-long train was negotiating the 0.5% descending grade while the head end of the train began to slow at about Mile 154.4 in the area of 0.1% ascending grade leading to level track. Although the curves between Mile 153.0 and Mile 153.5 would have had a minor retarding effect on the movement, it is most likely that the trailing portion of the train, previously stretched by the effort of the locomotive consist with maximum power applied, began to run in on the descending grade. The force of the run-in, applied to the slowing head end, converged on the curve near Mile 154.4, where the brief stretch of level track changed to an ascending grade. At this point, the resultant lateral force to the outside of the curve, possibly interacting with a dip in the superelevation just east of Mile 154.9 and a mechanical irregularity (abnormal bolster bowl and body centre plate wear indicating that it had not been properly centred and may have had reduced truck mobility), initiated a wheel lift derailment.

The operating crew indicated that, due to the size (weight and length) of the train and the changing gradient and track curvature in the derailment area, they were unable to reach their authorized train speed of 50 mph. They also indicated that it is difficult to handle such large trains with slack action continually running in and out and that this train had been particularly rough due to more run-in than usual.

While the purpose of Canadian National's policy to restrict the use of a train air brake system and avoid the practice of power braking is well understood, the use of the air brake system or power braking in this circumstance might have prevented or diminished the force of the run-in.

Investigations

The following is *preliminary* information on all occurrences under investigation by the TSB that were reported between 01 August 2002 and 31 August 2003. Final determination of events is subject to the TSB's full investigation of these occurrences.

DATE	LOCATION	COMPANY	EVENT	OCCURRENCE NO.
AUGUST 2002 04	Medicine Hat, Alta.	Canadian Pacific Railway	Main-track derailment	R02E0114
13	Milford, N.S.	Canadian National	Main-track derailment	R02M0050
OCTOBER 24	Hibbard, Que.	Canadian National	Main-track derailment	R02D0113
JANUARY 2003 20	Saint-Charles, Que.	Canadian National	Collision involving track unit	R03Q0003
21	Agincourt, Ont.	Canadian Pacific Railway	Non-main-track collision	R03T0026
FEBRUARY 04	Toronto, Ont.	Canadian National	Dangerous goods leaker	R03T0047
05	Port Moody, B.C.	Canadian Pacific Railway	Non-main-track derailment	R03V0019
13	Shawanaga, Ont.	Canadian Pacific Railway	Main-track derailment	R03T0064
21	Lonsdale, Ont.	Canadian Pacific Railway	Main-track derailment	R03T0080
MARCH 28	Lennoxville, Que.	St. Lawrence & Atlantic (Quebec) Inc.	Main-track derailment	R03D0042
MAY 12	Manseau, Que.	Canadian National	Main-track derailment	R03Q0022
14	McBride, B.C.	Canadian National	Main-track derailment	R03V0083
21	Brechin East, Ont.	Canadian National	Main-track derailment	R03T0157
21	Green Valley, Ont.	Canadian Pacific Railway	Main-track derailment	R03T0158
JULY 30	Villeroy, Que.	Canadian National	Main-track derailment	R03Q0036

Final Reports

The following investigation reports were approved between 01 August 2002 and 31 August 2003.
*See article or summary in this issue.

DATE	LOCATION	EVENT	REPORT NO.
99-01-19	Trenton, Ont.	Train passed a signal indicating stop	R99T0017
99-11-09	Limehouse, Ont.	Crossing collision / Derailment	R99S0100
99-12-30	Mont-Saint-Hilaire, Que.	Derailment and collision	R99H0010
00-04-19	Maple Ridge, B.C.	Main-track derailment	R00V0060
00-05-22	Cressman, Que.	Main-track derailment	R00Q0023
00-06-20	Near Chalk River, Ont.	Main-track derailment	R00H0004
00-07-09	Rockwood, Ont.	Diversion/Derailment	R00T0179
00-09-28	Limehouse, Ont.	Crossing accident	R00T0257*
00-11-30	Near Winnipeg, Man.	Main-track derailment	R00W0246
00-12-09	Blue Bell, N.B.	Main-track derailment	R00M0044
00-12-10	Marysville, Ont.	Main-track derailment	R00T0324
00-12-11	Shabaqua, Ont.	Derailment	R00W0253
00-12-12	Lone Rock, Sask.	Derailment	R00E0126
00-12-13	Martel, B.C.	Collision	R00V0206
01-01-08	Near Bowker, Ont.	Derailment	R01W0007
01-02-02	Red Deer, Alta.	Derailment	R01E0009
01-03-12	Bonfield, Ont.	Derailment	R01H0005
01-04-12	Stewiacke, N.S.	Main-track derailment	R01M0024*
01-09-24	Richmond Hill, Ont.	Main-track derailment	R01T0255*
02-01-12	Whitby, Ont.	Collision with object	R02T0008
02-03-03	Carmangay, Alta.	Derailment	R02C0013*
02-05-13	Kingston, Ont.	Crossing collision	R02T0149*

TRANSPORTATION SAFETY
REFLEXIONS
RAIL

Issue 19 – November 2003

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Gatineau, Quebec K1A 1K8

Tel.: (819) 994-3741
Fax: (819) 997-2239
E-mail:
communications@tsb.gc.ca

TSB Recruitment Campaign

Interested in advancing your career and transportation safety? From time to time, the TSB is looking to fill investigator and technical positions. Need more information? Want to apply? Go to **www.jobs.gc.ca**.

THE CONFIDENTIAL
TRANSPORTATION SAFETY REPORTING PROGRAM

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Here's how you can reach SECURITAS

SECURITAS
P.O. Box 1996, Station B
Gatineau, Quebec J8X 3Z2

e- Securitas@tsb.gc.ca

1-800-567-6865

FAX (819) 994-8065

Transportation Safety Board of Canada
Bureau de la sécurité des transports du Canada

1770 Pink Road
Gatineau, Quebec K1A 1L3

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Transportation Safety Board
Rail Occurrence Reporting Service

TSB rail regional offices can be reached during working hours (local time) at the following phone numbers:

HEAD OFFICE
GATINEAU, Quebec*
Phone: (819) 994-3741
Fax: (819) 997-2239

GREATER HALIFAX, Nova Scotia*
Phone: (902) 426-2348
Fax: (902) 426-5143

MONTRÉAL, Quebec*
Phone: (514) 633-3246
Fax: (514) 633-2944

QUÉBEC, Quebec*
Phone: (418) 648-3576
Fax: (418) 648-3656

GREATER TORONTO, Ontario
Phone: (905) 771-7676
Fax: (905) 771-7709

WINNIPEG, Manitoba
Phone: (204) 983-5548
Fax: (204) 983-8026

EDMONTON, Alberta
Phone: (780) 495-3865
Fax: (780) 495-2079

CALGARY, Alberta
Phone: (403) 299-3911
Fax: (403) 299-3913

GREATER VANCOUVER, British Columbia
Phone: (604) 666-5826
Fax: (604) 666-7230

After-hours emergency reporting: (819) 997-7887

* Service available in English and French.

Services en français ailleurs au Canada :
1-800-387-3557