RAILWAY INVESTIGATION REPORT
R02T0149

CROSSING COLLISION

VIA RAIL CANADA
TRAIN NUMBER 52
MILE 181.71, KINGSTON SUBDIVISION
KINGSTON, ONTARIO
13 MAY 2002

Railway Investigation Report

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Summary

On 13 May 2002, at approximately 0915 eastern daylight time, VIA Rail Canada passenger train No. 52, travelling eastward on the south main track of the Canadian National Kingston Subdivision, struck a loaded tractor-trailer at the public crossing at Mile 181.71, Kingston, Ontario. The locomotive engineer had applied the brakes in emergency, but the train 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 the impact. The operating locomotive engineer suffered minor injuries. No train passengers or on-train service crew were injured.

Ce rapport est également disponible en français.

Other Factual Information

The Accident

On 13 May 2002, VIA Rail Canada (VIA) train No. 52 (the train) was travelling eastward on the south main track at 77 mph. At approximately 0915 eastern daylight time,[1] approaching the whistle post, one quarter mile west of Coronation Boulevard, the train crew members observed a tractor-trailer carrying a large piece of equipment stopped on the south main track. The operating locomotive engineer also observed one of two pedestrians, standing on the crossing between the stopped truck and the approaching locomotive, waving his arms. The crew immediately applied the train brakes in emergency and sounded the locomotive horn. The pedestrians then ran to the north and west, away from the crossing.

The tractor-trailer, which was carrying a 12-ton hydraulic excavator, was struck by the front of the locomotive between the rear axle and the front portion 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 struck and demolished the crossing signal mast on the south-east side of the track. The large 270 kg connecting arm (gooseneck) attaching the trailer to the tractor was torn off and thrown east and southward approximately 550 feet (168 m). The train came to a controlled stop approximately 2700 feet (823 m) east of the crossing.

Weather

At the time of the accident, the weather was overcast with light rain, a visibility of 6.9 miles (11.2 km), a temperature of 8°C, and winds at 13.6 mph (22 km/h).

Train Information

The train, en route from Toronto Union Station to Ottawa, Ontario, consisted of two trains marshalled together, each with one locomotive and four passenger coaches, being controlled by lead locomotive VIA 903. Upon arrival at Brockville, Ontario, the practice is that train 52 is separated, with the leading portion going to Ottawa and the trailing portion continuing to Montréal, Quebec.

Personnel Information

The operating crew of the train, consisting of two locomotive engineers, were qualified for their respective positions. They met company and regulatory fitness and rest standards established to ensure the safe operation of trains.

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[1] All times are eastern daylight time (Coordinated Universal Time [UTC] minus four hours) unless otherwise indicated.

Kingston Subdivision

Train movements on the Kingston Subdivision are governed by the Centralized Traffic Control System of the Canadian Rail Operating Rules (CROR) and supervised by a rail traffic controller (RTC) located in Toronto, Ontario.

Particulars of the Track

In the area of Mile 181.71, the CN Kingston Subdivision consists of two main tracks identified as the north and south main tracks. 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 Light, Rapid, Comfortable (LRC) 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 on a daily basis. The Kingston Subdivision is one of the most heavily travelled and highest-speed lines in Canada.

Particulars of the Crossing

The crossing was equipped with flashing light signals, a bell and gates, which were operating as designed at the time of the accident. Stop lines were painted on the road surface approximately 24 feet from the crossing. An emergency 1-800 number was stencilled on the crossing sign. The crossing angle was approximately 80 degrees. The crossing surface between the most northerly and southerly rails consisted of rubber mat inserts and was in good condition. The view of the signals when approaching the crossing was unobstructed on both the north and south approaches.

Particulars of the Roadway

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 per cent ascending grade), a hump was created at the south crossing surface in the south-to-north direction. The hump is such that, over a horizontal distance of 60 feet, crossing elevation drops approximately 30 inches (76 cm). Road gradient on the north side of the track was a 2.4 per cent ascending grade. Signage on both 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 sign posts. 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.

Information provided by the Ontario Ministry of Transportation indicated that somewhere between 3000 and 9000 gooseneck or low-boy trailers are registered provincially in Ontario. Although the minimum vertical ground clearance varies by trailer design, they are by nature low, as their purpose is to maximize vertical distance between the trailer floor and any potential overhead obstruction, such as a bridge or wires, and facilitate loading of equipment without the need for ramps and/or blocking of the trailer. The design clearance above grade for the underside of the loaded trailer involved in the accident was 7 inches (17.8 cm) minimum. The estimated 2002 traffic volume for Coronation Boulevard at the crossing was around 4000 vehicles per day; no data were available to indicate the proportion of heavy vehicles.

Recorded Information

Data extracted from the event recorder of the lead locomotive indicated that train 52 was travelling at 77 mph approaching the accident site, in throttle position No. 8 (maximum throttle), and that the locomotive horn was sounded at the same time as the emergency train brake application was made. The train stopped 1 minute and 15 seconds after the brake application. The ditch lights were on, and the headlights were on bright as required by regulation. The train had travelled 2409 feet from the time when the emergency brakes were applied to the point where it struck the truck. It continued another 2700 feet before coming to a stop.

Tractor Information

The truck (tractor) was a 1994 Freightliner, model FL 120, owned by Gervais Landscaping and Excavating (GLE). The tractor was licensed by the Province of Ontario and had passed its last annual Ministry safety inspection in August 2001. The truck had last been inspected and maintained on 09 May 2002, when minor repairs were made.

Trailer Information

The trailer was a 1976, 48-foot, low-boy trailer, model TC3, manufactured by Rogers Bros. Corp., and licensed by the Province of Ontario. It had just passed an annual Ministry inspection on 08 April 2002. The trailer was purchased by GLE two weeks prior to the inspection date. The trailer was inspected by GLE on 01 May 2002 and no mechanical defects were found. The trailer was designed to be lowered and raised for the purposes of loading and unloading equipment while disengaged from the tractor, and depended on a small pup engine mounted on the trailer to produce the power necessary to operate its hydraulic lifting mechanism.

Some newer model trailers do not have to be disengaged from the tractor and are designed so that the trailer height can be easily adjusted prior to encountering a clearance obstacle. However, the adjustment has to be made when the truck is stationary. The adjustment system operates off the tractor's air supply system.

Truck Operator Information

The truck driver had a valid class "A" licence qualifying him to operate a tractor-trailer of the type involved in this occurrence. In Ontario, possession of an "A" licence permits a person to drive any tractor-trailer combination. The driver had been operating heavy trucks, including tractor-trailers, for approximately 13 years. However, the low-boy trailer was new to his fleet. He had not previously hauled the trailer over the Coronation Boulevard crossing, although he was familiar with that crossing.

The driver's plan was to perform some earthmoving work at a private residence on the east side of Coronation Boulevard, just north of the CN tracks. He did not want to unload the excavator on the west side of the road, because that would require a flag person to move it across to the east side. The tracked excavator would likely cause damage to the road's asphalt surface. He therefore chose a circuitous route to unload the excavator on the east side of Coronation

Boulevard. The routing involved crossing the Kingston Subdivision twice: southward on Collins Bay Road, then northward on Coronation Boulevard. He was accompanied by one passenger and his truck was followed by a vehicle carrying other company employees.

On the approach to the Coronation Boulevard crossing, the driver reduced his speed, taking the uneven surface into consideration when preparing to negotiate the crossing. While on the crossing, the trailer bottom made contact with the road surface, the tractor came to a stop and the driver and passenger exited the cab. The passenger warned the following vehicle to stay back, noticing the crossing signals commence operation, and ran to the north-west side of the crossing. At that point, the tractor was in neutral gear, and the trailer's above-ground clearance was either minimal or non-existent. Neither vehicle occupant indicated they noticed the 1-800 emergency number posted on the crossing signboard. The train subsequently struck the truck.

Regulatory Requirements

Transport Canada's (TC) Railway Safety Directorate regulates railway safety in accordance with the *Railway Safety Act* (RSA). The objectives of the RSA are to:

> (a) promote and provide for the safety of the public and personnel, and the protection of property and the environment, in the operation of railways;
>
> (b) encourage the collaboration and participation of interested parties in improving railway safety;
>
> (c) recognize the responsibility of railway companies in ensuring the safety of their operations; and
>
> (d) facilitate a modern, flexible and efficient regulatory scheme that will ensure the continuing enhancement of railway safety.

Regulations respecting the construction of a crossing of a railway and a highway at grade can be found in General Order 1980-8 RAIL, *Railway-Highway Crossing at Grade Regulations*. These regulations contain information on the design and construction of crossings. 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 per cent gradient. The regulations make no reference to signage requirements outside of crossing signboards at the crossing, nor is there any specific reference to the profile of roads at crossings or profiles of the crossing surface. This crossing met the requirements of the General Order.

Regulations respecting the installation and testing of signals at highway crossings at grade can be found in General Order No. E-6, *Highway Crossings Protective Devices Regulations*. These regulations include the minimum length of operating circuit, length of gate arms, speed for which the operating circuits are designed, quantity and type of warning lights, and placement of signal masts. Some pertinent criteria include:

> 12.(1) Signals shall operate for not less than 20 seconds before the crossing is entered by a train at a speed in excess of 10 m.p.h.;

16(l) circuits for operation of the gate shall be arranged so that the gate arms
(i) start their downward motion not less than 3 seconds after the signal lights start to operate,
(ii) reach full horizontal position before any train on a main track reaches the crossing, and
(iii) remain down until the train has cleared the crossing.

Post-occurrence testing determined that the signals were functioning as designed. Inspection of the weekly testing requirements and maintenance records found no deviation from the requirements for testing and reporting of defective conditions.

TC has been developing new, comprehensive regulations for the last 14 years. The draft regulations and related technical manual present far more detail on crossing design than exists in current requirements. Although the technical standard outlines design issues for heavy equipment, it is silent on ground clearances. There are details regarding superelevated (banked) track for new crossings. The technical manual recommends that "At vehicular grade crossings incorporating superelevated track, the difference between the gradient of the grade crossing surface on superelevated track and the gradient of the adjacent road shall not exceed the limits specified in the *Geometric Design Guide*."[2] The *Geometric Design Guide* specifies minimum requirements for the construction and maintenance of railway/road grade crossings. These guidelines state that every effort should be made to avoid construction of crossings at such locations and, if this is not practicable, to include measures that will mitigate their effect on the crossings' safety. The guide does state that the vertical alignment should produce acceptable geometry necessary to prevent low-clearance vehicles from becoming caught on the tracks.

Accident Records for Coronation Boulevard

There is no record of any previous accident at the crossing.

Crossing Occurrences Involving Heavy Trucks

For the purposes of this report, heavy trucks refers to tractor-trailer units, vehicles such as large delivery vans, and tank trucks carrying dangerous goods (DG), such as fuel delivery vehicles. Since 1995, a total of 359 crossing accidents involving heavy trucks were reported to the TSB. Four involved DG tank trucks, 171 involved heavy trucks, and 184 involved tractor-trailers. Several of these involved accidents where the trucks were either immobilized or moving very slowly over the crossing.

TSB Simulation

The TSB conducted a simulation at the crossing using a similar tractor-trailer (low-boy) loaded with a similar trailer to the one involved in the accident. Due to the age of the trailer involved in the accident (27 years), it was not possible to obtain an identical trailer. The trailer used for the simulation was a newer model, shorter in length with a lower load capacity. However, it was manufactured by the same company and had similar dimensions, and the same minimum design clearances.

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[2] *Geometric Design Guide for Canadian Roads*, Transportation Association of Canada, September 1999.

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

The TSB Engineering Laboratory (report LP 037/2002) examined the crossing surface, geometric and vertical road alignment and the tractor-trailer combination unit, and concluded the following:

- There was nothing unique about the vehicle involved in the accident that would have differentiated it from the thousands of other similar vehicles travelling on North American roadways. The trailer's ground clearance and wheelbase were typical for this unit type.

- Based on scale drawings and the simulation test, it was considered that the bottom of the accident trailer could have contacted the roadway.

- It was not determined whether the tractor would have had sufficient power and traction to successfully pass through the crossing with the bottom of the trailer dragging on the ground.

Analysis

Introduction

The train operation was normal and uneventful until just before the accident. Although the crew made an emergency brake application once they identified the truck on the crossing and someone waving in front of it, the train was unable to stop short of the collision. The accident occurred when the train struck the immobilized trailer at a crossing where low-clearance trailers
had a high probability of grounding out. The analysis will focus on issues related to driver behaviour, low-clearance highway vehicles, including trailers, the geometric design of highway/ railway crossings and truck driver awareness of safety issues related to these designs.

Risks Associated with Low-Clearance Vehicles

It is not known exactly how many crossings, public or private, have equivalent alignment problems to the Coronation Boulevard crossing. However, there are thousands of vehicles in Canada that are currently operating with low above-ground clearances when under load. It is arguable that this number may increase in view of the trucking industry's growing operational and productivity needs. The presence of thousands of low-boy trailers on the Canadian highway network, combined with the number of crossings where tracks are superelevated, presents a risk of trucks becoming immobilized at crossings with the resulting risk of collision and derailment of trains.

Approaches to and Clearances at Railway Crossings

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 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 approximately seven weeks, was unfamiliar with the trailer's clearance and was therefore unable to understand how the low clearance would interact with the geometrics of the crossing. He chose a sub-optimal route from a rail safety perspective, crossing the Kingston Subdivision twice en route to his destination. 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. The combination of the irregularity of the surface profile, formed by the intersection of the two superelevated tracks through the road's vertical curvature, created a hazard for low-clearance truck trailers and, in this case, the loaded trailer hung-up.

Perception and Awareness of Danger

Although the driver was familiar with this crossing, he had not previously negotiated it with the low-boy trailer. His familiarity with the crossing using other vehicles had alerted him enough to realize that a reduction in speed was necessary. However, this low-clearance trailer presented new risks that he did not immediately recognize. Although there was a bump sign, there were no signs to indicate a low-clearance crossing, and he had no advanced warning of the hazard ahead.

Roadway Requirements

Large vehicles using public roadways have a number of visual aids to assist them in determining a safe course of action. Roadways with overhead bridges normally advise a driver that a restriction limits the height of their tractor unit and/or the load they are hauling. Oversized loads require special permits from the Ministry of Transportation, at which time specific routes are mapped out and special arrangements are made to accommodate the oversized load passage. This driver was not given any visual warning that trailer clearance would be a consideration when using this roadway, nor was truck traffic restricted from this route. The only visual warning that this driver encountered was an advanced railway crossing sign depicting a single set of tracks and a bump sign suggesting that the crossing could be rough to cross.

Findings as to Causes and Contributing Factors

1. The accident occurred when the train struck the immobilized trailer at a crossing where low-clearance trailers had a high probability of grounding out.

2. The combination of the irregularity of the surface profile, formed by the intersection of the two superelevated tracks through the road's vertical curvature, created a hazard for low-clearance trailers and, in this case, the loaded trailer hung-up.

3. Although there were bump signs, there was no clear indication that the crossing would present a risk to low-clearance vehicles.

4. The truck operator, who was unfamiliar with the clearance capabilities of the low-boy trailer, chose a sub-optimal route to his intended destination and crossed the Kingston Subdivision twice en route to his destination.

Findings as to Risk

1. The presence of thousands of low-boy trailers on the Canadian highway network, combined with the number of crossings where tracks are superelevated, presents a risk of trucks becoming immobilized at crossings with the resulting risk of collision and derailment of trains.

Safety Action Taken

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 the safety issues related to low-clearance vehicular traffic at this crossing. Subsequent to the meeting, the road authorities installed signs restricting movement of any low-boy trailers along Coronation Boulevard.

CN is presently adding contact information to its corporate Web site to allow operators of low-clearance equipment to review routings that include the need to traverse CN crossings and to arrange for special flagging protection where 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 in conducting 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

and rail authorities on the regulations and standards. The guide will be a reference tool for those authorities. The regulations are expected to be published in *Canada Gazette*, Part I, in 2003 and the above guide will be published around the same time.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 07 January 2003.

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