

RAILWAY INVESTIGATION REPORT

R02Q0041

DERAILMENT

CANADIAN NATIONAL

YARD ASSIGNMENT NUMBER 1600

MILE 115.2, MONTMAGNY SUBDIVISION

LÉVIS, QUEBEC

22 JULY 2002

The Transportation Safety Board of Canada (TSB) investigated this occurrence for the purpose of advancing transportation safety. It is not the function of the Board to assign fault or determine civil or criminal liability.

Railway Investigation Report

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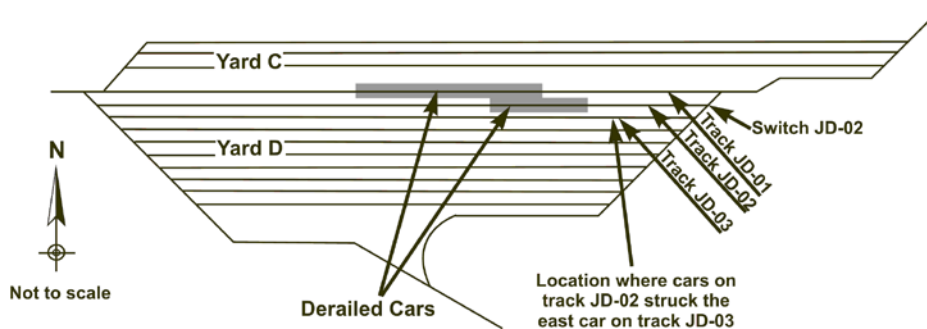
Summary

On 22 July 2002 at approximately 2050 eastern daylight time, Canadian National yard assignment No. 1600 derailed 52 cars while switching cars in Joffre Yard at Lévis, Quebec, at Mile 115.2 of the Montmagny Subdivision. A total of 51 empty tank cars, which had recently contained fuel oil (UN 1202) and gasoline (UN 1203), derailed and rolled over. An empty bulkhead flatcar derailed but stayed upright. Two switches and approximately 3600 feet of track were damaged. There were no injuries and no loss of product.

Ce rapport est également disponible en français.

Other Factual Information

On 22 July 2002 at approximately 2000 eastern daylight time (EDT),¹ the Joffre Yard crew, operating yard assignment No. 1600, went back to work following a break during severe weather conditions. Using a belt pack-controlled yard locomotive, several short cuts of cars were sorted onto track JD-02 (see Figure 1) through the west switch, shoved eastward to couple onto a cut of 30 cars, then pulled and brought to a controlled stop. As the cars stopped, the crew heard a loud noise and observed the cars they were coupled to, as well as the cars on the adjacent track, JD-01, rolling over and derailed. They advised the yard supervisor of the accident and performed the necessary emergency procedures. The crew determined that 34 tank cars on track JD-01, and 17 tank cars and 1 bulkhead flatcar on track JD-02, were derailed. The tank cars, all equipped with permanently locked shelf couplers, were lying on their side; the bulkhead flatcar was upright. There were no injuries and no product was spilled.



The crew of yard assignment No. 1600 consisted of a yard foreman and a helper. Both crew members were qualified for their respective positions and met fitness and rest standards, and were experienced in yard operations at Joffre. The crew went on duty at about 1530. They twice passed over the JD-02 east switch without incident and observed that the cars on track JD-01, a cut of 34 tank cars, and track JD-02, a cut of 17 tank cars and 13 bulkhead flatcars, were at the east end of the yard, and were clear of the switch and adjacent tracks. At approximately 1800, a meteorological alert was issued by Environment Canada for the Québec area. Between 1900 and 2000, average hourly wind speeds at the Québec International Airport reached 31 km/h and, at approximately 1922, winds gusted up to 79 km/h out of the west. Visibility was reduced by the inclement weather. At approximately 1928, Joffre yard assignment No. 1600 halted operations without performing any switching movements on track JD-02.

An inspection of the accident site revealed fresh wheel rim markings on the JD-02 east switch frog and on the ties beginning at the heel block of the JD-02 east switch and continuing westward for about 830 feet along the lead track through the JD-03 east switch and into track JD-03. The switch points of the JD-02 east switch showed signs of having been run-through. The ballast between track JD-02 and track JD-03 was disturbed. A roller from a truck side bearing was found approximately 60 feet west of the JD-02 east switch frog.

An inspection of the derailed rolling stock revealed that the trailing truck of the second car from the east end on track JD-02 was missing a roller from its north side and had fresh gouge markings on the rim of the lead wheel. The same car also showed fresh crease markings on the south side of its tank shell. The first car from the east end on track JD-02 showed signs of both trucks having been derailed and dragged. The most easterly car on track JD-03 had minor structural damage to its northeast corner. No pre-derailment defects that could have contributed to the derailment were noted on the derailed rolling stock.

¹ All times are EDT (Coordinated Universal Time [UTC] minus four hours).

An examination of the belt pack locomotive download indicated that, when operations recommenced, no long eastward shove was made on track JD-02 prior to the eastward movement to couple the locomotive to the cut of 30 cars. The cars to be switched on track JD-02 included two loaded tank cars marked "Group 4, flammable gases," requiring greater care in manoeuvring. Consequently, coupling onto or with these cars had to be performed at a speed not exceeding 7.5 mph. The distances and speeds shown on the download correspond to these handling constraints and to the requirements of the work plan. The distance covered to couple onto the cut of 30 cars was 1003 feet. Once coupled, the movement proceeded westward for a distance of about 830 feet, at a maximum speed of 10 mph, then came to a stop.

The yard track consisted of 115-pound continuous welded rail, laid on double-shouldered tie plates with four spikes per tie and anchored every third tie. There were approximately 3000 hardwood ties per mile. The crushed rock and gravel ballast had 16-inch shoulders. The ties and the ballast were in a fair condition.

Conventional flat switching yards are designed as a bowl, with the extremities of each track at the switches higher than the centre section, which is normally flat. For instance, on track JD-02, there is a slight grade varying from 0.1 per cent to 0.2 per cent between the superelevated extremities and the middle of the track. The track is 3917 feet long and has a capacity of 80 50-foot cars.

The yard operating speed in switching zones and yard tracks is restricted by the *Canadian Rail Operating Rules* (CROR) to 15 mph. In performing flat switching, the cars are switched at low speeds without the use of train air brakes. This requires that the cars have any residual brake cylinder air bled off in order to release the brakes. During switching movements, cars roll at low speed into the yard tracks and remain unsecured, sometimes for extended periods. Standing cuts of cars switched in this manner will normally have considerable amounts of free slack.

Railway terminal operating manuals and time tables contain instructions concerning the application of CROR Rule 112 regarding car securement. There was no requirement for hand brake use in effect in the Joffre D yard tracks at the time of the derailment. In most yards where a low risk of potential runaway rolling stock is perceived, hand brakes are not required. Where there is a higher risk of runaway rolling stock, or where there is a necessity for protection against rolling stock movement, hand brakes are used. For yards governed by rolling stock securement instructions, or where the yard supervisor so requires, yard crews and road crews arriving with freight trains are required to apply hand brakes on their trains or cuts of cars.

In some locations throughout Canada, several types of rolling stock have been known to run out of control due to high winds. This happens most often with empty bulkhead and centre-beam flatcars, but can also happen with other types of cars, such as empty grain cars or covered hopper cars, empty open top coal hopper cars, empty open top iron ore hopper cars, empty hi-cube box cars, empty multi-level automobile carriers, and lightly loaded intermodal cars.

There were 10 reported occurrences of wind-induced runaway rolling stock between 1985 and July 2002. Two of these incidents occurred in the Joffre Yard (TSB occurrence R96Q0006 on 20 January 1996 and TSB occurrence R97D0229 on 10 October 1997). Some of these incidents, which involved long cuts of cars, have given rise to railway directives that require car securement by hand brakes. Canadian National (CN) has such a directive in effect for its Symington Yard in Winnipeg, Manitoba. Quebec North Shore and Labrador Railway has operating instructions at its Sept-Îles terminal requiring all unit ore train dumping and ore stacking operations to cease and rolling stock to be secured with hand brakes when wind speeds exceed 72 km/h.

CN subscribes to a weather alert service. Alerts issued at a regional or local level are normally used by engineering and track maintenance personnel to trigger an inspection for potential risks resulting from severe environmental conditions. Although weather alerts may initiate supplementary track and infrastructure inspections, there were no directives issued for rolling stock securement at the time of the accident.

An evaluation of the probability of initiating wind-induced motion in a standing cut of 30 cars left without their brakes applied, similar to those in track JD-02, was performed by the TSB Engineering Laboratory (report LP 077/2002). It was determined that, on an ascending grade of 0.2 per cent, the entire cut would require a wind speed of 40 mph (64.4 km/h) to be set in motion when the slack is loose or stretched, and a wind speed of 49 mph (79 km/h) when the slack is compressed or bunched (see Appendix A).

Analysis

As the condition of the track was fair and there were no pre-derailment defects noted on the derailed rolling stock, the analysis will focus on the risks of runaway rolling stock, car securement practices in yards during weather alerts, and tank car coupling devices.

The damage observed to the rolling stock and track is consistent with that of cars running through a switch and derailed. Furthermore, the distance from the damaged switch to the east end of the derailed cars on track JD-02 corresponds to the recorded distance the cut of cars was pulled by yard assignment No. 1600. Therefore, it is likely that the cut of 30 cars on track JD-02 travelled through the JD-02 east switch, and then was pulled, in a westward direction, back over the switch by yard assignment No. 1600. The two easterly cars derailed either when they travelled eastward through the switch or when they reversed their direction and travelled back over the switch. The derailed cars were pulled between track JD-02 and track JD-03 until they struck the most easterly car on track JD-03. They rolled over northward and caused the other tank cars on track JD-02 to derail northward. The derailed cars on track JD-02 struck the cars on track JD-01 and caused them to derail northward.

Given the distances travelled and the speeds used during the initial switching movements on track JD-02, the total lengths and types of the cars involved when performing this switching at the west end of track JD-02, and the coupling restrictions for cars carrying special dangerous goods, it is unlikely that any of the cars being switched at the west end were kicked or shoved into the standing cut of cars. The distance travelled during the final eastward movement to couple onto the cut of 30 cars indicates that there was sufficient space for switching to be performed at the west end of track JD-02 without striking the cut of 30 cars. Therefore, the cut of cars was not set in motion by a switching impact.

Prior to the storm, the crew noted twice that the switch was clear. During the storm, the wind was blowing from the west and its measured maximum speed was 79 km/h, exceeding the levels required to overcome the static resistance of the unsecured cars on track JD-02. As there was no eastward shove performed on track JD-02

from that time until the time that the cars derailed, it is likely that the cut of 30 cars in track JD-02 was put in motion by the high winds and travelled through the JD-02 east switch.

All but one of the derailed cars were unit train tank cars equipped with permanently locked shelf couplers. These couplers provide enhanced protection during derailments by ensuring that the cars remain coupled, thus minimizing the potential risk of tank car punctures. However, in this particular occurrence, the severity of the derailment was increased by the use of shelf couplers as the rollover of one car consequently provoked a rollover of the similarly equipped, adjacent cars.

There were no instructions for the use of hand brakes on the D yard tracks during weather alerts. While the absence of hand brakes in yard bowls may speed up operations, it exposes empty or light weight cars to the risk of wind-induced movement. TSB Engineering Laboratory report LP 077/2002 revealed that relatively modest wind levels, i.e. 54 km/h, can induce motion in light weight standing cuts of cars, especially bulkhead flatcars. The number of reported occurrences, and the varied types of rolling stock involved, indicates that there is a continuing risk of wind-induced runaways. Empty or light weight cars with large exposed sides and end sectional areas are vulnerable to wind-induced motion at moderate wind velocities when not secured with hand brakes.

The Environment Canada report for the Québec area, recorded at the Québec International Airport, shows that wind speeds in July 2002 reached a maximum mean of 39 km/h, with gusts of up to 79 km/h. Such levels of wind are common enough to merit consideration when assessing risks related to potential runaways and the necessity for car securement. The weather alert had been communicated at Joffre Yard but was not acted on, as there were no directives for rolling stock securement at Joffre Yard. CN and other railways are aware that car securement requirements in yard tracks during weather alerts would reduce the risks of wind-induced runaways; however, such provisions are not in force in all locations where high wind speeds occur.

Findings as to Causes and Contributing Factors

1. The initial derailment occurred when the cut of unsecured cars in track JD-02 was put in motion by the high winds and went through the east switch. The cut of cars subsequently rolled back or ran through the switch, derailing two cars, which then collided with cars on adjacent tracks.

Findings as to Risk

1. The lack of hand brake use in yard tracks, during weather alerts, increases the risk of wind-induced runaways.

Other Findings

1. Empty or light weight cars with large exposed sides and end sectional areas are vulnerable to wind-induced motion at moderate wind velocities when not secured with hand brakes.

Safety Action Taken

Following the occurrence, the Canadian National (CN) local safety committee analyzed the incident. Car securement rules were amended to take into account weather alert situations. Motion detectors were installed on the yard's eastern switches to prevent any untimely movement of cars.

CN notified Transport Canada that new procedures had been put in place a few days after the occurrence, on 26 July 2002, to prevent any similar occurrences during high winds at the Joffre Yard.

In addition to amending the operations manual for the Joffre Yard, CN transmitted the following instructions to all yardmasters by e-mail on 26 July 2002:

[Translation]

In the future and until such time as a more complete circular is issued, when winds are strong enough to move cars, such cars must be secured by coupling them to other cars or by applying a number of hand brakes. In addition, if it is suspected that cars might roll onto a switching lead, an employee must ensure that the switches of the lead are set appropriately before attempting to switch the cars.

Furthermore, CN advised that, when high winds will occur in the Joffre Yard, trainmasters will be directed immediately to proceed themselves to set the hand brakes of any cars they feel might possibly be set in motion. The directive was also sent to the yardmaster on duty and to the employees involved. The railway has installed an anemometer at the Joffre Yard to improve employee reaction time whenever high winds occur.

Transport Canada continues to pay particular attention to the Joffre Yard and will take whatever regulatory action is necessary if safety deficiencies are identified.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 07 July 2004.

Visit the Transportation Safety Board's Web site (www.tsb.gc.ca) for information about the Transportation Safety Board and its products and services. There you will also find links to other safety organizations and related sites.

Appendix A – Wind Speed Required to Set Cars in Motion

	Track Grade	
	Slack Loose	Slack Compressed
Cut of 30 empty tank cars	level 34 mph (54 km/h)	44 mph (70.8 km/h)
Cut of 30 empty tank cars	0.2 per cent ascending 40 mph (64.4 km/h)	49 mph (79 km/h)
One empty bulkhead flatcar	level 21 mph (33.75 km/h)	
One empty tank car	level 36 mph (57.9 km/h)	