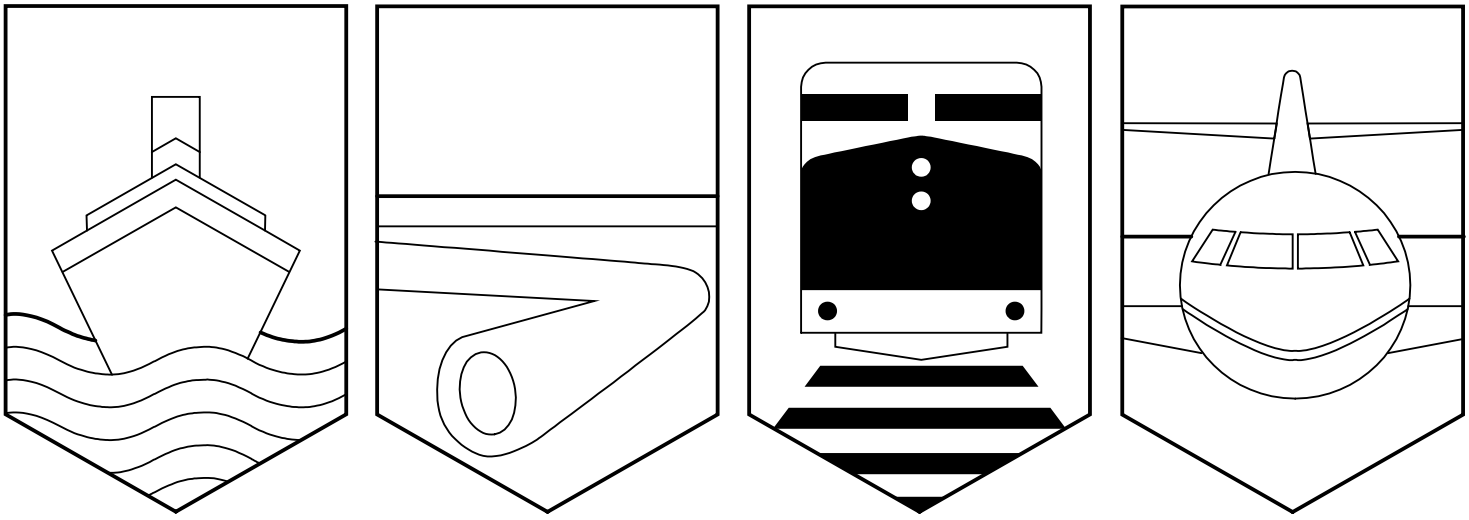
Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada



RAILWAY OCCURRENCE REPORT

DERAILMENT

ST. LAWRENCE & HUDSON RAILWAY (StL&H)
(A DIVISION OF CANADIAN PACIFIC RAILWAY)
TRAIN NO. 902-29
MILE 42.7, StL&H WINCHESTER SUBDIVISION
NEAR DALHOUSIE MILLS, QUEBEC
29 AUGUST 1996

REPORT NUMBER R96H0021

Canada

MANDATE OF THE TSB

The *Canadian Transportation Accident Investigation and Safety Board Act* provides the legal framework governing the TSB's activities.

The TSB has a mandate to advance safety in the marine, pipeline, rail, and aviation modes of transportation by:

- conducting independent investigations and, if necessary, public inquiries into transportation occurrences in order to make findings as to their causes and contributing factors;
- reporting publicly on its investigations and public inquiries and on the related findings;
- identifying safety deficiencies as evidenced by transportation occurrences;
- making recommendations designed to eliminate or reduce any such safety deficiencies; and
- conducting special studies and special investigations on transportation safety matters.

It is not the function of the Board to assign fault or determine civil or criminal liability.

INDEPENDENCE

To encourage public confidence in transportation accident investigation, the investigating agency must be, and be seen to be, objective, independent and free from any conflicts of interest. The key feature of the TSB is its independence. It reports to Parliament through the President of the Queen's Privy Council for Canada and is separate from other government agencies and departments. Its independence enables it to be fully objective in arriving at its conclusions and recommendations. Its continuing independence rests on its competence, openness, and integrity, together with the fairness of its processes.

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Railway Occurrence Report

Derailment

St. Lawrence & Hudson Railway (StL&H)
(A Division of Canadian Pacific Railway)
Train No. 902-29
Mile 42.7, StL&H Winchester Subdivision
Near Dalhousie Mills, Quebec
29 August 1996

Report Number R96H0021

Synopsis

On 29 August 1996, at approximately 1120 eastern daylight time (EDT), St. Lawrence & Hudson Railway (StL&H) freight train No. 902-29, proceeding eastward on the south track of the StL&H Winchester Subdivision, derailed 36 cars at Mile 42.7. One of the derailed cars, GATX 73738, turned on its side and released up to 1,900 litres (500 U.S. gallons) of hydrogen peroxide, a dangerous commodity. Two other cars caught fire. As a safety precaution, residents from about 40 homes in Dalhousie Mills, Quebec, were evacuated for approximately five hours. There were no injuries.

The Board determined that empty, open-top hopper car MSDR 81026 experienced a wheel climb derailment due to excessive car body roll and speed-induced truck hunting. The excessive car body roll and susceptibility to truck hunting were attributable to the fact that worn truck components are not recognized as safety defects.

Ce rapport est également disponible en français.

Other Factual Information

The Accident

The train, destined for Montreal, Quebec, while travelling at 64.4 mph on tangent track with a slight descending grade in the vicinity of Mile 42, experienced a train-initiated emergency brake application. The train came to a stop with the locomotives at about Mile 41.23. After conducting the necessary emergency procedures, the crew determined that 36 cars (21st to 57th from the head end) had derailed in the vicinity of Mile 42.7.

Although the initial point of derailment was in the province of Ontario, derailed cars came to rest in various positions, blocking both main tracks on both sides of the border between Ontario and Quebec. Thirty cars were damaged beyond economical repair and approximately 1,400 feet of track was extensively damaged.

A police officer arrived at the road crossing at Mile 41.66, in the village of Dalhousie Mills, Quebec, about one half mile east of the derailed cars, shortly after the occurrence. After conversing with the conductor and trainman about the fire and smoke coming from the cars, the police officer decided, as a safety precaution, to evacuate the residents from about 40 homes in the village. After approximately five hours, the residents were permitted to return to their homes.

The fire department from Lancaster, Ontario, arrived at the scene shortly after the derailment and extinguished fires in two empty, insulated box cars. The fires had started when the underslung tanks containing fuel for the heaters of the cars were punctured and the escaping product (methanol) had ignited.

A small fire also started near car GATX 73738, a derailed and overturned carload of hydrogen peroxide, class 5.1 (8) (UN 2015). Hydrogen peroxide can react with many common metals and ignite nearby combustible materials. It is also corrosive to human tissue, and its vapours are irritating to the eyes and mucous membranes. The fire, which was quickly extinguished by fire-fighters, started when the product, which was leaking from the safety vent and liquid eduction pipe, contacted ties, grass and shrubs. A small quantity of still leaking product was then caught in barrels by emergency response personnel.

There were two other carloads of dangerous goods on the train, but neither derailed.

Train Information

The train, powered by 2 locomotives, was hauling 41 loaded cars and 28 empty cars. It was approximately 4,000 feet in length and weighed about 5,500 tons.

Personnel Information

The crew included a locomotive engineer, a conductor and a trainman. They were familiar with the territory, were qualified for their positions and met fitness and rest standards established to ensure the safe operation of trains.

Particulars of the Track

At the accident site, the subdivision consists of two main tracks with a maximum authorized freight train speed of 60 mph. Train movements are governed by the Automatic Block Signal System (ABS) and Occupancy Control System (OCS) of the Canadian Rail Operating Rules (CROR) and are supervised by a rail traffic controller (RTC) in Toronto.

All track components were in good condition. Track geometry measurements taken west of the point of derailment revealed minor gauge and cross-level variations; however, the track variations were within StL&H track geometry standards. The relieving assistant track maintenance supervisor inspected the track by Hi-rail on 29 August 1996, before the occurrence, and no irregularities were noted. A rail flaw detection car tested the rail on 06 June 1996 and no defects were identified.

Occurrence Site Information

At Mile 42.7, marks were noted on the head of the south rail eastward for approximately 39 feet. Marks were then observed on the rail anchors eastward for a short distance where the car fell on the field side of the south rail. Tie damage between the rails commenced at about Mile 42.4. Four farm crossing surfaces were damaged between Mile 42.4 and Mile 41.8. A displaced crossing plank was found just east of car MSDR 81026, the easternmost derailed car and 21st car from the head end of the train. Both main tracks were destroyed between Mile 42.2 and Mile 41.8.

The train had passed a Hot Box and Dragging Equipment Detector at Mile 52.1, approximately 10 miles before the derailment, with no exceptions noted.

Recorded Information

Event recorder data indicated that the train was travelling at a recorded speed of 61.7 mph at a recorded time of 1121:34 when a train-initiated emergency brake application occurred. The train came to a stop at a recorded time of 1123:09. Before the derailment, the locomotive

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times are eastern daylight time (Coordinated Universal Time (UTC) minus four hours) unless otherwise
ed.

engineer had been manipulating the throttle to control the speed of the train. At the time of the emergency brake application, the throttle was in position No. 6.

Car MSDR 81026

The trucks of car MSDR 81026, a 48-foot, empty, open-top hopper car equipped with bottom discharge gates and marshalled with the "B" end leading, were stripped from the car in the derailment. The trucks, as well as the No. 1 and No. 4 wheel sets, were recovered. The other two wheel sets, the truck springs and friction wedges were strewn about the derailment site with components from other derailed cars and could not be matched to car MSDR 81026.

The wheel tread surfaces as well as the front and back of the wheel plates of the L-1 and R-1 wheels of car MSDR 81026 revealed a large number of scuff marks and abrasions around the entire circumference. The vertical surfaces of the truck bolster gibs and truck side column guides were bright and shiny in appearance. Similarly, both body and truck centre plates had shiny horizontal and vertical surfaces. The car was not equipped with constant contact side bearings; however, each spring nest was equipped with one hydraulic snubber.

The truck bolster friction pockets on the "A" end were worn between 3 3/16 inch and 1/4 inch. Wear in the bolster friction pockets on the "B" end was between 1/8 inch and 3/16 inch. At truck restoration, wear of more than 1/8 inch requires repair.

The truck side column guide spacing on the "A" end measured between 17 7/16 inches and 17 1/2 inches. Measurements on the "B" end were between 17 3/8 inches and 17 inches. Wear on these surfaces would reduce the ability of the suspension damping components to control car body roll, and the ability of the truck to resist parallelogramming. Wear beyond 17 5/16 inches requires repair at truck restoration.

Immediately following the accident, Canadian Pacific Railway (CP) inspected and gauged two identical MSDR cars on its system and found them to be within Association of American Railroads (AAR) wear limits.

Wear between the truck side frame columns and the bolster gibs ranged from 1 9/16 inches to 1 7/8 inches on the "A" end and 1 7/16 inches and 1 11/16 inches on the "B" end. The AAR rules require that trucks be repaired at the time of wheel change-outs or when trucks are dismantled when the total clearance between these two parts reaches 1 1/2 inches. Wear in the bolster pockets and truck side frame columns, as measured on the leading truck of car MSDR 81026, was calculated by the CP Test Department to reduce damping by 83 per cent.

Repair Record

The most recent repair record for this car was on 05 July 1996 when a bottom outlet gate received attention at a CP repair facility in Lethbridge, Alberta. The most recent wheel- or truck-related repairs were performed on 20 March 1995 in Joliet, Illinois, U.S., when a wheel and brake beam were changed on the "A" end truck.

Safety Inspections

Car MSDR 81026 entered Canada at Windsor, Ontario, as an empty car on 28 July 1996 and travelled to London, Ontario. It travelled to the StL&H Toronto Yard the same day. The first safety inspection it received in Canada was performed by certified StL&H car inspectors in Toronto at 1645 on 28 July 1996. No defects were noted.

The car left Toronto on 30 July 1996 for Smiths Falls, Ontario, where it remained until 29 August 1996. No other safety inspections were performed after it left Toronto.

The safety inspection criterion contained in Transport Canada's Railway Freight Car Inspection and Safety Rules, section 4.1 states that ". . . a railway company shall ensure the freight cars it places or continues in service are free from all safety defects . . . ." Section 14 states that a railway company may not place or continue a car in service if a truck is equipped with an ineffective damping mechanism. It outlines six indicators, including such items as broken springs, missing side frame plates and missing or worn friction wedges. Bolster pocket wear and truck side frame wear are not mentioned.

The CP Mechanical Instruction Manual (CM 418) requires that the inspection and gauging of both truck side frames and bolsters when either is "worn to a point where ride control characteristics of the truck are adversely affected." This information is included in the package used to train CP's certified car inspectors.

Train Consist

The train crew was not in possession of an up-to-date computer-generated consist when the train left Smiths Falls. They had the consist that accompanied the train from Toronto which identified 26 cars to be set off the rear at Smiths Falls. The crew also had a "cut list", or partial consist, generated at Smiths Falls, that contained 27 cars which were added to the head end at Smiths Falls. Car GATX 73738 was identified in the consist as a carload of hydrogen peroxide; however, additional information in the special handling section for this car showed it as "residue." "Residue" as defined in the Transportation of Dangerous Goods Regulations ". . . means that dangerous goods have been removed to the greatest extent possible . . . ."

Car GATX 73738 was shown as the 24th car from the head end on the consist from Toronto; however, as a result of the cars added at Smiths Falls, it was the 51st car from the head end at the time of the derailment. This change was not noted on the consist or on the "cut list." During the derailment, car GATX 73738 rolled on its side, and leaked product through its top fittings. There was initial confusion at the accident site and also with the RTC in Toronto trying to determine the identity of the cars that were involved in the derailment.

Radio Communications

When the brakes applied in emergency, the crew determined that the westward track was blocked and, as the train was coming to a stop, the trainman made an "Emergency" call on the stand-by radio channel to alert other trains that might be in the area. However, there were only two other trains and they were both west of the derailed cars. When the train stopped, the trainman went east and the conductor went west to provide flag protection. The locomotive engineer assumed radio responsibilities and attempted to contact the RTC on the appropriate radio call-in channel for about four or five minutes, but was unsuccessful. He then radioed a nearby track maintenance foreman who advised the RTC on his cellular phone that train crew members at Dalhousie Mills were trying to contact him. The RTC then radioed the train crew and provided them with relief of flag protection on the adjacent main track. This allowed the conductor and trainman to go inspect the derailed cars.

The RTC stated that there were no radio communication problems on the Winchester Subdivision on the day of the occurrence. The radio towers at Saint-Lazare, Quebec, Mile 23.7, and Apple Hill, Ontario, Mile 58.0, one of which would have picked up the radio signal from the train crew, were checked subsequent to the accident and no defects were found. The locomotive radio was also checked and was found to be operating properly.

There was no evidence on the RTC radio tape to indicate that an emergency call had been made to the RTC on the emergency channel. The RTC was at his workstation at the time of the derailment. When an emergency call is made, an indication appears in yellow printing, framed in red, on the computer screen. The RTC stated that none appeared on the screen.

The cellular phone call from the track maintenance foreman was answered immediately by the RTC.

Truck Hunting

Previous TSB investigations (i.e., R91D0045, R95W0117 and R96T0231 - Safety Advisory 04/96, issued 06 September 1996) indicated that some empty or lightly loaded cars are susceptible to truck hunting when operated at speeds over 50 mph. In order to reduce the severity of truck hunting, trucks can be equipped with features such as constant contact side bearings, centre plate extension pads, hydraulic snubbers or frame bracing. The restoration of worn truck components also mitigates truck hunting.
In 1986, CP conducted tests on empty bulkhead flatcars 51 feet 6 inches in length to determine possible reasons for derailments, and also to improve the ride characteristics of the cars. The tests verified that truck hunting increased in severity at train speeds above 50 mph when conducted on cars with worn truck components.

Train Speed Verification

Event recorder data indicate that the speed at the time of derailment was 61.7 mph. This is also the speed

that would have been indicated in the locomotive cab. However, the indicated speed is determined from wheel revolutions per unit of time, and it is subject to calibration error. In this case, when adjusted for actual wheel diameter, the corrected speed was 64.4 mph, 4.4 mph above the maximum authorized speed of 60 mph. The locomotive engineer checked the speedometer at the designated speed check "measured mile" locations leaving Smiths Falls and did not notice any discrepancy.

Weather Information

At the time of the derailment, the sky was clear with variable light winds. The temperature was 22 degrees Celsius.

Analysis

Marks on the rail anchors on the field side of the south rail and damage to the wheel tread and wheel plate indicate that the leading wheel of the leading truck (L-1 location) of open-top, empty hopper car MSDR 81026 climbed the south rail and derailed at Mile 42.7. The car continued in a derailed condition for 1,968 feet, traversing four farm crossings, before the derailed truck destroyed the track and initiated the general derailment of the following 35 cars.

The extent of the wear on the car's truck components reduced the ride control characteristics of the empty car, including its ability to resist and control car body roll. As the car body rolled from side to side, it unloaded the wheels on the opposite side of the roll. This unloading made it easier for the wheel flange to climb the rail and derail on the side that was unloaded.

The worn suspension components on the truck would have also reduced the truck's ability to resist parallelogramming. As the parallelogramming increased, the wheel flange-to-rail angle of attack would also have increased. This would have resulted in a sharper angle between the wheel flange and the rail, increasing the wheel's propensity to climb the rail. The amount of wear at bolster gib locations, and the bright shiny wear patterns on both the gibs and centre plate surfaces are consistent with truck hunting wear. Because the train was travelling well in excess of 50 mph on tangent track, truck hunting severity may have been increased.

The truck component wear described had not reached condemnable limits for cars in service and is difficult to identify during routine car inspections. The cumulative effect of the wear (83 per cent loss of damping capability) would have, however, rendered the damping “ineffective” and therefore constituted a defect as outlined in the Railway Freight Car Inspection and Safety Rules.

The extent of wear on the truck components indicates that the worn condition existed for a considerable period of time before the derailment. During the safety inspection in Toronto, the only inspection the car received after arriving in Canada, no defects pertaining to the worn condition of the trucks were noted. An “ineffective damping mechanism” is considered a safety defect; however, the Railway Freight Car Inspection and Safety Rules do not reference excessive wear of the truck bolsters or side frames as one of the indicators of this defect.

Although car GATX 73738 was shown as a load in the consist, information in the special handling section incorrectly stated that it was a “residue.” This information, combined with a consist that created problems determining the actual cars in the derailment, could have resulted in serious safety concerns for response personnel attending the occurrence.

It is not known why immediate radio communication could not be made between the train crew and the RTC. Considering all the available information, the most plausible explanation is that the crew members became excited when they realized that both main tracks were blocked as a result of their train being derailed and used incorrect radio procedures.
The inability to immediately contact the RTC by radio would have been more serious if the derailment had occurred in a suburban area or during hours when an employee with a cellular phone was not available to relay information.

The procedure to verify train speed by comparing the time at measured mile locations can provide a general check of train speed; however, it is not a precise method of verifying speedometer accuracy. The

locomotive engineer thought that the train was being operated within the authorized maximum speed of 60 mph; however, the speedometer reading on the lead locomotive was inaccurate and the train was being operated slightly in excess of the maximum authorized speed. Speed may have increased the severity of the truck hunting on car MSDR 81026.

The competent and professional actions of emergency response personnel reduced the possibility of danger to local residents.

Conclusions

Findings

1. The derailment was caused by truck hunting of car MSDR 81026.

2. The suspension damping components on car MSDR 81026 were worn to the extent that their ability to resist car body roll was reduced.

3. The worn truck components on car MSDR 81026 increased truck parallelogramming, which increased the angle of attack between the wheel flange and the rail.

4. The train was travelling at a speed that may have increased the severity of the truck hunting.

5. The unavailability of an accurate consist increased the difficulty to locate and quickly evaluate a derailed dangerous goods car in the train.

6. The crew could not immediately contact the RTC by radio on the appropriate channel and relied on a nearby track maintenance foreman to make contact for them.

7. Car MSDR 81026 received only one safety inspection after its arrival in Canada on 28 July 1996 and no defects were identified.

8. An ineffective damping mechanism is considered a safety defect; however, the Railway Freight Car Inspection and Safety Rules do not identify excessive wear at the bolsters and side frames as a safety defect.

9. Emergency response procedures were executed in a competent and professional manner.

Cause

Empty, open-top hopper car MSDR 81026 experienced a wheel climb derailment due to excessive car body roll and speed-induced truck hunting. The excessive car body roll and susceptibility to truck hunting were attributable to the fact that worn truck components are not recognized as safety defects.

Safety Action

Action Taken

Calibration of Speedometers

Canadian Pacific Railway (CP) issued instructions on 29 October 1996 to all shop personnel reiterating the importance of proper wheel measurement and speedometer calibration.

Speed Restrictions on Cars

In order to reduce the probability of empty, 48-foot hopper cars experiencing excessive truck hunting and subsequent wheel climb derailments, CP/St. Lawrence & Hudson Railway (StL&H) issued notice No. 116, stating "Effective 02 September 1996, Attention: Trains handling empty hoppers AAR car type K340 with MSDR markings. 50 mph speed restriction applies."

Train Consist Errors

The unavailability of an accurate train consist increased the difficulty of locating and quickly evaluating a derailed dangerous goods car in this occurrence. StL&H is currently modifying its training package for clerical staff to improve the level of knowledge with shipping control systems and reduce shipping record errors. In addition, Automatic Equipment Identification readers have been installed at all crew change locations on the StL&H to assist in verification of train consists, even when lifts and set-offs occur en route.

Transport Canada is rewriting the Transportation of Dangerous Goods Regulations, and is proposing that the crew of a train have a consist when the train includes one or more large means of containment that require a placard to be displayed on them. The information in the consist must be accurately maintained by the crew and kept with the shipping document.

Communications

StL&H has revised its timetable instructions to reflect the proper 911N keypad feature for initiating emergency calls. In addition, stickers with the emergency call information are being placed in all locomotive cabs. StL&H has also conducted two safety blitzes with the operating employees and has made proper radio communications an issue at monthly safety meetings.

Rail Industry Initiatives

On 26 June 1997, an industry meeting was held in Montreal concerning truck component wear, with representation from Canadian National, Canadian Pacific Railway, Transport Canada, the Transportation Safety Board of Canada, and the Association of American Railroads (AAR). The

spokesperson for the AAR described the scope of initiatives being undertaken by the AAR Strategic Research Group in the areas of vehicle track systems, mechanical and engineering to determine the optimum maintenance procedures for conventional three-piece trucks and critical suspension components. The initiatives are ongoing.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board, consisting of Chairperson Benoît Bouchard, and members Maurice Harquail, Charles Simpson and W.A. Tadros, authorized the release of this report on 17 February 1998.