Transportation Safety Board
of Canada

Bureau de la sécurité des transports
du Canada

RAILWAY INVESTIGATION REPORT
R99Q0019

MAIN-TRACK TRAIN DERAILMENT

CANADIAN NATIONAL
TRAIN NO. U-781-21-13
MILE 105.5, MONTMAGNY SUBDIVISION
BÉGIN, QUEBEC
13 APRIL 1999

Canada

Railway Investigation Report

Main-Track Train Derailment

Canadian National
Train No. U-781-21-13
Mile 105.5, Montmagny Subdivision
Bégin, Quebec
13 April 1999

Report Number R99Q0019

Synopsis

On 13 April 1999, at approximately 1540 eastern daylight time, Canadian National petroleum product unit train U-781-21-13, travelling from the Ultramar Canada Inc. refinery at Saint-Romuald, Quebec, to Montréal, Quebec, derailed 10 loaded tank cars of gasoline at Mile 105.5 of the Montmagny Subdivision near Bégin, Quebec. Approximately 230 litres (50 gallons) of gasoline was spilled. There were no injuries, and the spilled product was recovered without any permanent environmental damage.

Ce rapport est également disponible en français.

5.0 Appendices

1.0 Factual Information

1.1 The Accident

At approximately 1510 eastern daylight time (EDT)[1] on 13 April 1999, train No. U-781-21-13 (train 781), destined for Montréal, Quebec, departed the Ultramar Canada Inc. (Ultramar) spur at Saint-Romuald, Quebec, Mile 119.9 of the Montmagny Subdivision, travelling eastward. While travelling at a recorded speed of 34 mph with the throttle in the No. 5 position and the air brakes released on tangent single main track near Bégin, Quebec, Mile 105.5, a train-initiated emergency brake application brought the train to a stop. Before the emergency brake application, the crew had not noticed any train handling or track irregularities.

After following the required emergency procedures, the crew determined that 10 cars, the 51st to the 60th, had derailed. The flexible loading hose couplings between some of the derailed tank cars had pulled apart. There was a slight drip of product coming from the 10-inch valve on one end of a derailed tank car where the hose was torn off and the elbow connections sheared off. The valves between the other cars remained closed and intact. The tank car shells were not breached.

The local police and fire departments and the emergency response team from Ultramar responded to the incident. The contaminated area was isolated and access was controlled by Canadian National (CN) police. CN established a command post approximately one mile (1 600 m) east of the derailment site.

The contents of the derailed tank cars were transshipped into rail tank cars. During the transfer of the product, approximately 230 litres (50 gallons) of gasoline was spilled into the ditch and marsh on the north side of the track. Site clean-up and restoration was performed as required.

No one was injured.

1.2 Damage

The 10 derailed cars experienced damage to their underframe, trucks, body bolsters, and brake rigging. Eight of the tanks had minor shell denting. Another car, which did not derail, was lightly damaged.

A total of 450 feet of track was destroyed, and another 300 feet of track was damaged.

---

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

1.3 *Personnel Information*

The operating crew members, a conductor and a locomotive engineer, were familiar with the physical characteristics of the subdivision and met fitness and rest standards.

1.4 *Method of Train Control*

Train movements on the Montmagny Subdivision are governed by the Centralized Traffic Control System (CTC) authorized by the Canadian Rail Operating Rules (CROR) and CN Special Instructions. All train movements are supervised by a rail traffic controller (RTC) located in Montréal.

1.5 *Train Information*

The train is known as an "Ultratrain." It is based on the "TankTrain" concept, and was developed by the General American Transportation Corporation (GATX) of Chicago, Illinois, U.S. and its Canadian subsidiary, Canadian General Transportation Company (CGTX) of Montréal, to meet CN's and Ultramar's requirements for a captive service to haul fuel between Québec and Montréal. The 153 tank cars were constructed in 1995 and 1996 under a permit granted by Transport Canada (TC), in compliance with Association of American Railroads Standard S-259-94.

The cars are permanently coupled in 17-car blocks, with piping and related equipment that allows loading or unloading of the entire block from a single connection at one end. The tank cars are equipped with roll-over protection for the isolation valves located on the top of the tank. The interconnecting hoses are designed to break when the cars separate. Also, the attachment area of the overhead rigid elbows is designed to break before the isolation valves. Skids protect bottom washout areas.

The train was made up of 68 loaded tank cars, in four blocks. The first two blocks were loaded with heating oil (UN 1202), and the last two blocks with gasoline (UN 1203). The train was powered by two locomotives, measured approximately 4 040 feet in length, and weighed about 8 170 tons.

A train inspection and brake test were performed before departure from the Ultramar spur at Saint-Romuald. No exceptions or defects to the rolling stock were noted.

1.6 *Particulars of the Track and Roadbed*

The track at Mile 105.5 was tangent single main track categorized as Class 3.[2] The rail was 100-pound jointed in 39-foot (11.9 m) lengths, manufactured and laid in 1949. Combined head and flange wear was minimal, well within wear tolerances. Appendix A shows a diagram of infrastructure components.

There were approximately 3 200 No. 2 hardwood ties per mile. The tie plates were double-shouldered, with four spikes per tie. A cluster of 10 ties in the immediate derailment area showed signs of decay and water saturation, and lateral tie plate movement of approximately 2.5 cm (1 inch).

CN's Standard Practice Circular (SPC) 3300 and TC's *Railway Track Safety Rules*[3] require that each 39-foot segment of Class 3 track shall contain at least 10 non-defective ties (that is, up to 58 per cent can be defective); these non-defective ties shall be effectively distributed to support the entire 39-foot segment.

Between Mile 105.0 and Mile 106.0, three rail joint bars were noted to have only one bolt per rail end and the joint bars were observed to be loose. *Railway Track Safety Rules* require a minimum of two bolts per rail end.

The rail was box-anchored every third tie. Marks on the base of the rail in the vicinity of Mile 106.5 indicated that, over time, the rail had moved up to 20.5 cm (8 inches) eastward. The marks also indicated that the rail had moved in both directions indicating that the box-anchoring was ineffective.

CN employees stated that there was a chronic problem with broken and missing bolts and rail creep between Mile 105 and Mile 108.

The subgrade was constructed with local fill materials. Culverts located at Mile 105.36 and Mile 106.61 were free of obstructions. The ditches on both sides of the roadbed were filled with water, snow, and ice to within 0.6 m (2 feet) below the base of the rail.

---

[2] Tracks are classified from Class 1, with speed restricted to a maximum of 10 mph for freight trains, to Class 6 with a maximum speed of 110 mph for freight trains. Most heavily used main tracks are Class 4 with a maximum designated speed of 60 mph for freight trains.

[3] *Railway Track Safety Rules*, approved by the Minister of Transport on 27 March 1992 under the authority of the *Railway Safety Act* of 1985.

About 15 cm (6 inches) of snow covered the terrain on both sides of the track. The subgrade shoulders were soft. Ballast was crushed gravel, about 25.5 cm (10 inches) deep, with a shoulder varying from 25.5 cm to 40.5 cm (10 to 16 inches) in width. In the immediate area of the derailment, the ballast was fouled with fine-grained materials. The subgrade and ballast materials were saturated with moisture.

Cross-level variation beneath the first car that remained on the track (50th car) was measured to be 5 cm (2 inches). The maximum allowable cross-level variation according to CN's SPC 3101 for Class 3 track is 4.4 cm (1 3/4 inches). CN's SPC 3101, Appendix C, calls for a maximum speed of 25 mph for a track condition of 5 cm (2 inches) of difference in cross-level.

Cross-level and gauge were measured at each joint under the load of a locomotive for a distance of 1 000 feet west of the derailment location. All measurements met the 4.4 cm tolerance set for Class 3 track.

In October 1998, passenger service had been terminated on this portion of the subdivision. In February 1999, due to the deteriorated condition of the track, the classification was downgraded from Class 4 to Class 3. This reclassification resulted in the maximum track speed being reduced from 60 mph to 40 mph for freight trains.

The traffic density on this portion of the Montmagny Subdivision was four freight trains per day (predominantly Ultratrain). Following the inauguration of the Ultratrain in 1996, tonnage hauled on this line increased from 0.85 million gross tons per mile (MGTM) to 5.20 MGTM in 1998.

1.7 Occurrence Site Information

The derailment site was approximately four miles from the nearest urban area. The track on this portion of the subdivision was built in 1884. The terrain was flat and marshy. The track passed through a marsh area known locally as the "Grande Plée Bleue" or "Les Quarante Lacs" (Forty Lakes). Drainage of the subgrade was provided by ditches on both sides of the track. The marsh was also a harvest area for peat moss, and there were drainage canals on both sides of the track beyond the right-of-way. Due to the nature of the terrain, there were no inhabited buildings within 1.6 km (1 mile) of the site.

All of the derailed cars were on the north side of the track. The first car had rolled completely over onto its top. The second and third cars were lying on their sides in the ditch parallel to the track. The fourth to seventh cars were lying on their sides, clear of the grade and off the right-of-way. The eighth and ninth cars were on the grade, leaning towards the north-side ditch. The tenth car had the A-end (front) truck derailed, and was upright.

Two rails were twisted, broken, and scattered in the derailment area. A piece of broken rail with a bent splice bar attached to one side and a broken splice bar fastened to the other was recovered from between the seventh and eighth cars and sent to the TSB Engineering Laboratory for testing. The marks on the rails and the ties indicated that the cars derailed abruptly to the north of the track at the broken rail joint.

1.8 *TSB Engineering Laboratory Analysis*

The TSB Engineering Laboratory examination of the piece of broken rail and attached splice bars (report LP 047/99) concluded the following:

- The splice bar failed from the overstress extension of a fatigue pre-crack located at the bottom of the splice bar.

- The pre-crack was coincident with the wear line from contact with the rail, suggesting that the track was subject to cyclic vertical movements in the area although the absence of pre-cracking at the rail bolt hole locations and the absence of bolt hole elongation suggest that the movement was not significant.

- The size of the fatigue pre-crack on the broken splice bar was considered smaller than a critical flaw size and therefore served only to locate the fracture initiation.

- The rail fractured in overstress, and revealed no evidence of pre-cracking.

1.9 *Track Inspection*

The track and related infrastructure on the Montmagny Subdivision was under the care and overview of a track supervisor working out of Joffre, Quebec. Track geometry was last surveyed by a track geometry car on 18 June 1998. No deficiencies were found in the area of the derailment. The test results were based on Class 4 track standards and tolerances.

A rail flaw detection car tested the rail on 31 March 1999 and did not detect any metallurgical defects in the derailment area.

The track had been inspected from a Hi-rail vehicle on 12 April 1999, the day before the derailment, and no exceptions were noted at the derailment location. Routine inspections for Class 3 track carrying more than 3 million gross tons of traffic annually are carried out twice per week with not less than two days between inspections.

Track inspectors were required to take appropriate corrective action when reportable track defects were noted, including protection by temporary slow order when necessary.

CN's SPCs specify that walking inspections on Class 3 to Class 6 main tracks are required annually. Ties to be replaced are identified and marked during the annual walking inspection. The last walking inspection had been conducted in May 1998. The 1999 annual walking inspection had not been completed on this portion of the subdivision at the time of the derailment.

Based on 1998 track geometry car results and field inspection reports, CN believed that this stretch of track was in a safe condition for the authorized operating speed of 40 mph. This portion of the subdivision had no previous known problems related to track geometry caused by subgrade degradation.

1.10 Transport Canada's (TC) Railway Track Safety Rules and Reporting Requirements

TC's *Railway Track Safety Rules* contain rules pertaining to drainage and vegetation and procedures for special inspections following floods, storms, or other major phenomena. The *Railway Track Safety Rules* contain no rules relating specifically to subgrade stability.

TC requires railways to keep records of inspections, noting defects prescribed in the *Railway Track Safety Rules* and corrective action taken. CN documents additional corrections for its own internal records. The derailment area had no recent record of defects.

1.11 Maintenance Programs

On the portion of the subdivision between Saint-Charles (Mile 101.3) and Harlaka (Mile 110.2), no preventive maintenance or upgrading had been carried out since the inauguration of the Ultratrain and the resulting increase in traffic. However, normal maintenance, such as surfacing, was done annually. A request for new ties was made in 1997 for the 1998 program. This was not completed as other district requirements took precedence. Tie replacement had, however, been approved and was scheduled for the summer of 1999.

CN makes extensive use of track geometry car inspection reports to assist in identifying areas which may affect operating safety. The information is also used to plan future maintenance programs. The frequency of track geometry inspections is based on *Railway Track Safety Rules* requirements, annual tonnage, condition, and class of track. The pertinent portion of the subdivision was inspected annually during summer months by a track geometry car.

1.12 Track Inspection and Supervision

As a result of a reorganization of personnel, the Montmagny Subdivision came under the responsibility of the Joffre track supervisor on 01 March 1999. This reorganization expanded the area of responsibility of that position and, during a six-week transition period, responsibility for a portion of the Drummondville Subdivision (a responsibility before the reorganization) was retained. The track supervisor was immediately sent on a management training course and these expanded responsibilities were assumed, in an acting capacity, by the assistant track supervisor (ATS). The ATS duties (track inspections) were in turn assumed by another person who became ill. The acting track supervisor then assigned another person familiar with the territory to perform the track inspection as a temporary assignment.

1.13 Training and Communication

The CN training program for Engineering personnel teaches track inspection and maintenance. The training program covers the application of all CN SPCs, including those governing roadbed, track geometry, ties, and track inspection. Track inspectors are also taught how to identify tie defects, and how to detect weak subgrade based on visual identification of surface or roadbed defects. Track inspectors are instructed that one of their responsibilities is to identify, report, and monitor high-risk sections of track.

In October 1998 and March 1999, District Engineering staff, including the supervisors from this territory, attended geotechnical training seminars (*Geotechnology for Railroaders)* developed jointly by CN and Canadian Pacific Railway (CPR). The seminar content was oriented towards potential natural hazards, roadbed instability, and landslide problems in known high-risk areas.

CN's Champlain District Spring Preparedness Plan and System Engineering Spring Preparedness Plan identify the risks of spring thaw, and describe the visual symptoms of potential defects. The spring preparedness plans also identify known historical problem areas, the locations of maintenance resources available to supervisors, and measures required to ensure safe operations. Planning documents contain specific information on drainage and water management, and the location of known problem areas. The derailment area was not identified as a problem area in the district plan.

The training material and spring preparedness plans describe the impact of water saturation on tie condition, the potential effects of water saturation on the roadbed and subgrade, and criteria for visually identifying high-risk spring conditions. Track supervisors and the ATS's attended a preparedness briefing before plan implementation.

The *CN Natural Hazard Report for Engineering Personnel* contained in the spring preparedness plans provides for reporting only some potential hazard indicators (e.g., potential rockfall indicators), while other hazards are reported only after they have occurred (such as grade failure, misalignment and subsidence).

1.14 *Canadian National (CN) Standard Practice Circulars (SPCs) and Inspection Reports*

CN's SPC 3100, outlining track inspection items for walking and Hi-rail inspections, did not list roadbed conditions specifically, although it required the inspector to observe geometry defects such as cross level, and surface and tie conditions. The TC-approved report form was used by CN track inspectors to record reportable *Railway Track Safety Rules* track defects identified during routine inspections. The Hi-rail inspection criteria for tie condition required only that inspectors note those ties which are damaged or broken by equipment. A more detailed inspection of tie condition required that a walking inspection be made.

1.15 *Weather*

The temperature was six degrees Celsius, the winds were moderate from the east at 25 km/h, and the sky was clear.

Between 01 April and 13 April 1999, the daily high temperatures reached an average of nearly 10 degrees Celsius, and fell to an average of minus 6 degrees Celsius during the night. During this period, the snow cover decreased by about 36 cm (14 inches). The snow cover had decreased 15 cm (6 inches) in the 48 hours before the derailment.

1.16 *Other Information*

As a result of other accidents due to subgrade failures at Conrad, British Columbia (TSB report No. R97V0063), and Pointe au Baril, Ontario (TSB report No. R97T0097), the Board recommended that:

> The Department of Transport, in collaboration with Canadian National, Canadian Pacific Limited, and the British Columbia highway authority:
>
> [. . .]
>
> c) where applicable, implement a monitoring program to detect roadbed subgrade instability as a result of water saturation.
>
> (R97-01, issued April 1997)

> The Department of Transport, in collaboration with the Railway Association of Canada:
>
> [. . .]
>
> b) evaluate alternative methods for confirming the integrity of the roadbed during high risk periods.
>
> [. . .]
>
> (R97-02, issued April 1997)

TC met with the industry in May 1997 to assess and evaluate possible improvements, including study of new technologies, and to evaluate methods for confirming roadbed integrity. The *Geotechnology for Railroaders* training seminars and the various railway contingency plans for spring preparedness were a part of the response to this meeting, and the various TC regional offices continued to monitor industry action.

2.0 Analysis

2.1 Introduction

As no defective equipment was identified and the operation of the train before the derailment met company and regulatory requirements with no train handling irregularities evident, it is concluded that neither equipment defect nor manner of train operation played a role in the derailment. The analysis will therefore explore other areas of railway operations to make determinations as to the causes and contributing factors.

2.2 The Derailment

The destruction of the track structure and a lack of physical indicators prevented a determination of the location of the initial point of derailment or the identification of the first car to derail. It is probable, however, that the derailment sequence began in the area of the cluster of defective ties. In this location, the subgrade was soft, moisture laden and contaminated with fine-grained materials indicative of pumping ties. A significant cross-level variation was noted on the track near the derailment location. Furthermore, rail creep and joint fastening problems were observed. These factors indicate that vertical rail movement and cross-level variations probably existed in the area of track destruction. In this situation, car oscillation is amplified and the horizontal and vertical forces generated on the track are increased. It is most probable, therefore, that either a car experienced a wheel lift and derailed due to the oscillation, or the lateral forces displaced the rail in the area of the cluster of poor ties leading to a loss of gauge and a wheel dropping onto the roadbed. In either case, the initial derailment led to rail displacement, breaking the splice bar at the pre-existing crack which then led to the derailment of nine other cars.

The weather conditions experienced in the Bégin area in the 13 days before the derailment had both created high water levels on both sides of the roadbed, a situation conducive to water infiltration, and freeze/thaw cycles that had an adverse impact on roadbed stability.

2.3 Track Condition

2.3.1 Human Behaviour

The track failure occurred notwithstanding;

- adherence to visual inspection intervals and planned maintenance (tie renewal), and attention to subgrade issues in the spring preparedness plans;
- roadbed and track overview by personnel trained in and sensitive to geotechnical issues; and

- obvious manifestations of track movement as evidenced by the rail creep, tie plate movement and missing splice bar bolts.

Three different acting track inspectors had been responsible for inspecting the subject section of track within a short period of time. Each successive inspector knew that prior inspectors had not reported the physical signs of a potential "grade subsidence/collapse" location.

While the adverse track condition was evident and warranted corrective action, such as a slow order, this did not raise an alarm to the inspectors. It is likely that the lack of action by any of the three inspectors resulted in a diffusion of responsibility wherein, cumulatively over time, each inspector was influenced by the behaviour of his colleagues. Also, social pressures have been identified as contributing to the quality of inspections[4] because pressure from peers or supervisors for "acceptance" or "rejection" of components can influence the decision-making aspect of inspection processes. The diffusion of responsibility and social pressures may have led to a situation that was not conducive to the identification of the adverse track conditions by the three acting inspectors.

2.3.2 *Track Inspection*

Subgrade inspection criteria for Hi-rail and walking inspections conditions were not specifically mentioned in either CN's SPCs or the *Railway Track Safety Rules*; furthermore, it was not explicit that there was a relationship between the geometry defects identified and the subgrade condition.

While the supervisors and track inspectors were trained in geotechnical issues and spring preparedness plans were in place, there was no written link between the training given on soft subgrade and natural hazard identification and the track inspection procedures. The absence of such a link reduced the effectiveness of the track hazard identification process.

2.3.3 *Track Geometry Evaluation*

The most recent track inspections by Hi-rail failed to identify the impact of transient spring thaw conditions on track geometry. Routine inspections by low axle load Hi-rail vehicles would not normally lead to the identification of such a defect as they may be at or within acceptable limits when not under load. Certain characteristics can be properly assessed, such as gauge where the lateral movement marks beside the tie plate can be observed. However, in cases of soil subsidence or soft track, inspectors do not have an equivalent indication of softness of track; therefore, they cannot quantify or estimate the movement under load. A Hi-rail vehicle in motion will not cause enough track displacement due to subgrade softness to attract a track

---

[4] B. Kantowitz and R. Sorkin, *Human Factors: Understanding People-System Relationships*, 1983.

inspector's attention if all of the other visual signs of potential track geometry defects are ignored. The visual signs present in this case required that the track inspector make the required measurements manually, evaluate the potential impact of track movement under load, and take appropriate corrective action to ensure safe operation.

A track geometry inspection performed by a track geometry car, which tests the track under load, would have given a clear indication of the condition had it been performed during the spring runoff. Since track geometry tests are performed in the summer when the subgrade is dry and stable and would not lead to the detection of this transient weakness, additional care should be taken during normal high water periods to ensure that roadbed softness does not adversely affect track geometry. It is evident, therefore, that the usual methodologies used to identify track geometry defects associated with transient subgrade weakness may not lead to identification and remedial action.

2.4 *Training and Preparedness*

Much of the geotechnical training program and the spring preparedness plans were specifically designed to prevent derailments attributable to roadbed failure during the spring thaw period. The detection of weak subgrade is also an important component of the weekly track inspection regimen. Many of the physical manifestations of degraded subgrade were evident at the accident location (e.g., rail creep, contaminated ballast, poor ties, missing joint bar bolts), while the presence of the marsh, elevated water levels and the probability of local fills forming the roadbed foundation should have heightened awareness of the track weaknesses in this area. This accident indicated that the need to identify, report and monitor high-risk areas has not been sufficiently understood by the employees who must make such determinations and take the necessary action.

2.5 *Ultratrain Tank Cars*

Under the circumstances of this derailment, in an area of soft ground, the tank shells, although damaged in some cases, remained intact. The isolation valves, roll-over and skid protection systems built into the Ultratrain tank cars functioned as designed, and no major flammable liquid release or environmental contamination occurred.

3.0 Conclusions

3.1 Findings as to Causes and Contributing Factors

1. High cross-level variation and vertical rail movement attributable to soft subgrade either created lateral forces that could not be contained by the rail fastenings in a cluster of defective ties or a wheel lift derailment.

2. Weather conditions created an environment of high track-side water levels and freeze/thaw cycles that degraded roadbed stability.

3. The need to identify, report and monitor areas of subgrade at high risk to degradation was not sufficiently understood by the employees who must make such determinations and take the necessary action.

3.2 Findings as to Risk

1. The absence of a link between track geometry defects and soft subgrade conditions in the *Railway Track Safety Rules* and Canadian National's Standard Practice Circulars reduced the effectiveness of the track hazard identification process.

3.3 Other Findings

1. The diffusion of responsibility and social pressures may have led to a situation that was not conducive to the identification of the adverse track conditions by the three acting inspectors.

2. The roll-over protection and isolation valve system of the Ultratrain tank cars functioned as designed.

4.0 Safety Action

4.1 Action Taken

On 14 April 1999, Canadian National (CN) increased the number of routine inspections on this portion of the subdivision to three times weekly from twice weekly until the spring runoff was completed.

On 20 April 1999, Transport Canada advised CN of its intention to perform a special inspection of all tracks used by the Ultratrain service, and requested CN's comments concerning the maximum permissible speed between Harlaka, Mile 110.2, and Mile 102.3, given the particular conditions of the track and the nature of the traffic.

Subsequent to the derailment, CN further lowered the maximum allowable speed to a maximum of 25 mph, and lowered the class of track to Class 2, until such time as corrective actions were completed.

Remedial work was performed to renew rail anchors and ties and to re-surface and install continuous welded rail on this stretch of track. The maximum speed limit was raised to 30 mph temporarily in the zone where the accident occurred. It became permanent with the introduction of Time Table 77, 01 May 2000.

Standard Practice Circular (SPC) 3100 was revised to include roadbed/slope stability and drainage evaluations in the annual walking inspection, and the three SPCs (4400, 4401, and 4402) governing inspection, maintenance, and drainage of small pipe culverts were revised and combined into a single new SPC, consolidating and clarifying the culvert inspection criteria.

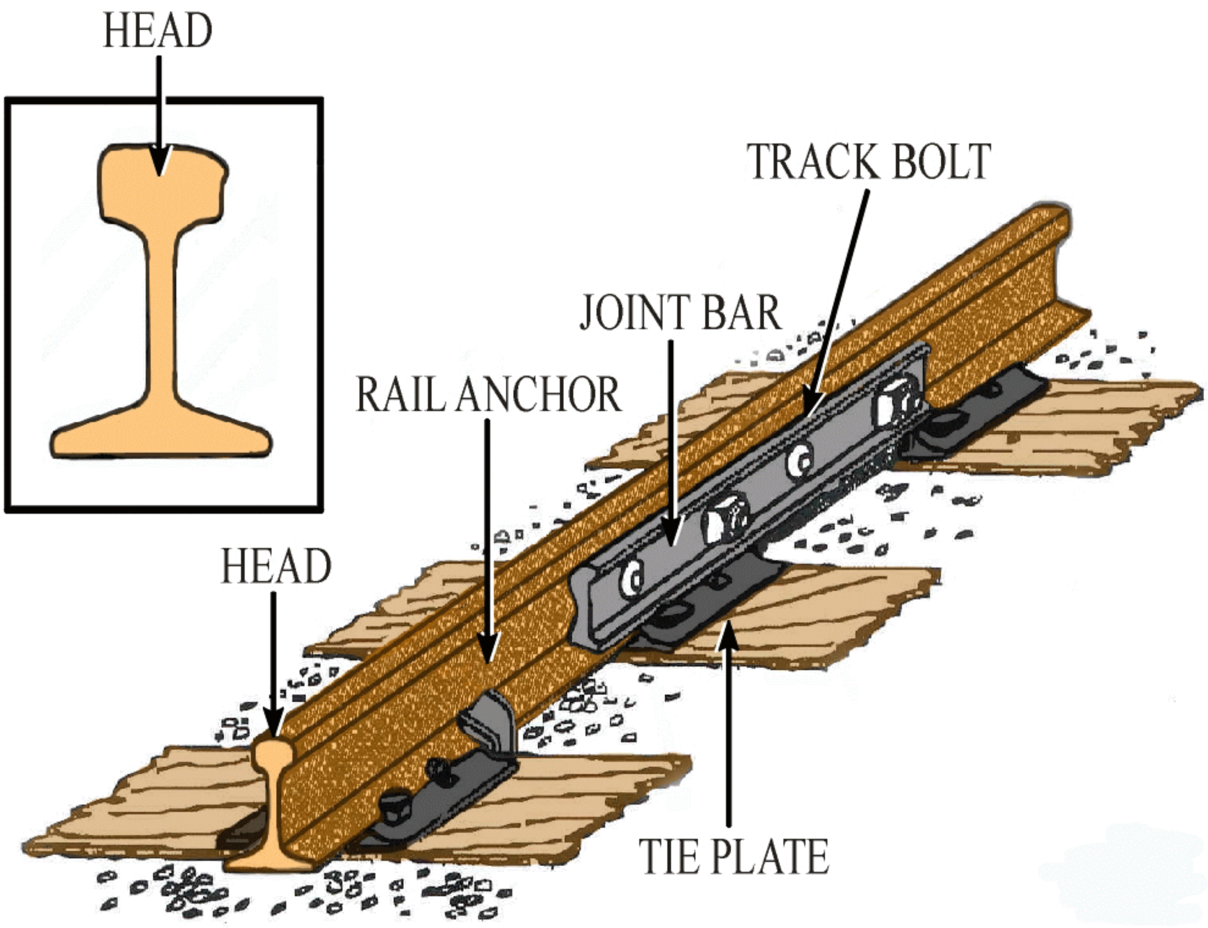
As a result of the operating experience gained with the Ultratrain tank cars since the inception of operations, and the requirement to replace the Ultratrain tank cars destroyed in the accident at Mont-Saint-Hilaire, Quebec, on 30 December 1999 (R99H0010 - under TSB investigation), the new replacement cars were constructed to an improved standard. Changes were made to strengthen the loading/unloading accessories on the cars, and full roll-over protection for the top valve fittings was introduced.

4.2 *Safety Concern*

As a result of the TSB Recommendation R97-01, CN has incorporated a geotechnical training program into the spring preparedness plan. The Board recognizes that this action taken by the industry was a positive step to reduce issues related to track stability. The Board also acknowledges that the measures taken after this derailment, with regard to the revision to SPC 3100, have made the track inspection process clearer. However, the tools available to the track inspectors, and more specifically the absence of a specific linkage between track geometry defects and soft subgrade conditions in the *Railway Track Safety Rules* and CN's SPCs render the track hazard identification process sub-optimal.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 07 March 2002.

Appendix A—Infrastructure Components



Appendix B—Glossary

ATS	assistant track supervisor
CGTX	Canadian General Transportation Company
cm	centimetre
CN	Canadian National
CPR	Canadian Pacific Railway
CROR	Canadian Rail Operating Rules
CTC	Centralized Traffic Control System
EDT	eastern daylight time
GATX	General American Transportation Corporation
km	kilometre
km/h	kilometre per hour
m	metre
MGTM	million gross tons per mile
mph	mile per hour
RTC	rail traffic controller
SPC	Standard Practice Circular
TC	Transport Canada
TSB	Transportation Safety Board of Canada
Ultramar	Ultramar Canada Inc.
U.S.	United States
UTC	Coordinated Universal Time