Transportation
Safety Board
of Canada

Bureau de la sécurité
des transports
du Canada

RAILWAY INVESTIGATION REPORT
R15H0092

Main-track derailment

Huron Central Railway
Freight train SUSM-01
Mile 72.08, Webbwood Subdivision
Spanish, Ontario
01 November 2015

Canada

Transportation Safety Board of Canada
Place du Centre
200 Promenade du Portage, 4th floor
Gatineau QC K1A 1K8
819-994-3741
1-800-387-3557
www.tsb.gc.ca
communications@bst-tsb.gc.ca

Railway Investigation Report R15H0092

Cat. No. TU3-6/15-0092E-PDF
ISBN 978-0-660-07710-9

Railway Investigation Report R15H0092

Main-track derailment
Huron Central Railway
Freight train SUSM-01
Mile 72.08, Webbwood Subdivision
Spanish, Ontario
01 November 2015

Summary

On 01 November 2015, at approximately 2250 Eastern Standard Time, Huron Central Railway freight train SUSM-01 was proceeding westward on the Webbwood Subdivision at 25 mph when a train-initiated emergency brake application occurred at Mile 72.08, near Spanish, Ontario. Two separate groups of equipment derailed: 3 locomotives and 8 cars on the head end and 5 cars near the middle of the train. Approximately 225 feet of roadbed was destroyed. No dangerous goods were involved and there were no injuries.

Le présent rapport est également disponible en français.

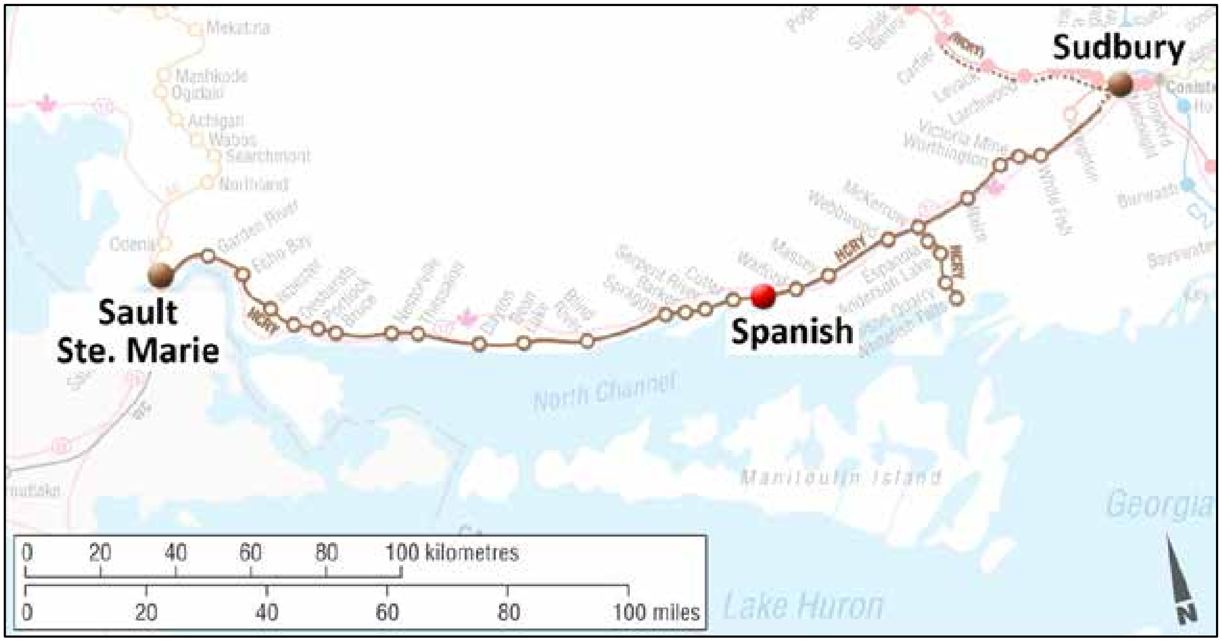
Table of contents

1.0 Factual information

On 01 November 2015, a Huron Central Railway (HCRY) train crew (the crew) was ordered at 1330[1] in Sault Ste. Marie, Ontario (Mile 179.0) to operate freight train SMSU-01[2] eastward to McKerrow, Ontario (Mile 41.6) (Figure 1). Train SMSU-01 weighed 4175 tons and was 2045 feet long. During the trip eastward on the Webbwood Subdivision, no track anomalies were noted.

After arriving at McKerrow, the crew switched trains to operate freight train SUSM-01 (the train), which was destined for Sault Ste. Marie. At about 2130, after coupling 2 separate portions of the train together and performing the necessary inspections, the train departed westward. The train consisted of 3 head-end locomotives, 19 loaded cars, and 58 empty cars. It was 4329 feet long and weighed 4503 tons. The train crew consisted of a locomotive engineer and a conductor, both of whom were qualified for their positions, met fitness and rest standards, and were familiar with the territory.

Figure 1. Derailment site (Source: Railway Association of Canada, *Canadian Railway Atlas*, with TSB annotations)



1.1 The accident

At 2234, the train operated over a hot box detector located at Mile 65.0 with no defects noted. At approximately 2245, while proceeding westward at about 25 mph, the crew felt the locomotive dip at Mile 72.08, followed by a sudden tug. Looking back towards the rear of the

---

[1] All times are Eastern Standard Time.

[2] Eastward trains operating from Sault Ste. Marie to Sudbury are called SMSU and westward trains operating from Sudbury to Sault Ste. Marie are called SUSM.

train, sparks were observed from the second locomotive. Shortly thereafter, a train-initiated emergency brake application occurred. Upon coming to a stop, the train crew made an emergency call to the rail traffic controller (RTC) and then inspected the train.

The 3 head-end locomotives had derailed, had separated from the train, and had come to rest approximately 115 feet west of a group of derailed cars. The first 8 cars, all tank cars, were derailed and located within a gap where the roadbed had collapsed. Another 5 covered gondola cars, positioned 24th to 28th from the head end, were also derailed. No dangerous goods were involved and there were no injuries.

1.2 Weather

At the time of the derailment, the temperature was about 8 °C, and there had been about 0.8 mm of rain that day.

As recorded by Environment Canada at the weather station in Massey, Ontario, about 15 miles from the derailment location, the total precipitation in October 2015 (the month before the accident) was 134.4 mm. In comparison, this was the highest total monthly precipitation in the past year (since November 2014), with a monthly average of approximately 72 mm. Table 1 provides the precipitation for the 5 days preceding the derailment.

Table 1. Daily precipitation for the 5 days preceding the derailment

Date	Precipitation (mm)
27 October 2015	3.2
28 October 2015	36.4
29 October 2015	2.2
30 October 2015	0.0
31 October 2015	20.6

1.3 *Site examination*

Photo 1. Adjacent joints near the derailment site

In the direction of travel, the first marks on the rails were located at Mile 72.08 at 2 adjacent rail joints on the north rail and the south rail, which were staggered by less than 5 feet (Photo 1). The north rail joint was broken in half with the east-end rail in place and the broken joint bars still attached while the west-end rail was located under the derailed cars with the broken joint bars attached. The south rail joint remained intact and rolled to the field side. Both joints were recovered and forwarded to the TSB Engineering Laboratory for a detailed examination.

Photo 2. Mud on the underside of the lead locomotive

All 3 locomotives derailed upright. Two wheels (R3 and R4) from the lead locomotive (HCRY 2008) derailed and 6 wheels (R1, R2, R3, R4, L3 and L4) from the second locomotive (HCRY 800) derailed. The second locomotive also sustained minor damage to the rear ladder and pilot from rubbing along the rail. All wheels from the third locomotive (HCRY 3800) derailed, and that locomotive sustained damage to its fuel tank, which rubbed along the head of the rail. There was mud on the rail head between the derailed cars and the lead wheel of the lead locomotive. There was also mud on the underside of the lead locomotive at the leading truck and fuel tank on the south side (Photo 2).

The 1st to 8th derailed cars, all loaded with sodium carbonate,[3] came to rest in various positions (Figure 2). The 1st derailed car was overturned and laying north of the roadbed. The 2nd to 6th cars were jackknifed in a pile-up, resting where the roadbed had collapsed. The 7th car was upright just west of the broken rail joint with its A-end angled on the south-side embankment, resting against the 6th derailed car. The 8th car was standing just east of

---

[3] Sodium carbonate has a low toxicity and is not considered a dangerous good.

the joint with only its B-end derailed. A small amount of sodium carbonate had been released in the area around the cars.

Figure 2. Tank cars derailed in various positions

The roadbed was destroyed for a distance of approximately 225 feet beginning immediately west of the broken joint. At the bottom of the roadbed collapse, where the derailed cars came to rest, some of the cars and their appliances were partially submerged in about 2 feet of water and clay soil material (Photo 3). Directly north of the roadbed, water was running rapidly and was of considerable depth. To the south of the roadbed, standing water was observed in a treed area.

Photo 3. Derailed cars and appliances partially submerged

An additional 5 cars, empty covered gondola cars (cars 24 to 28), also derailed (Photo 4). The 24th car derailed upright and angled north of the roadbed. The 25th car was lying perpendicular to the track on the north embankment. The other 3 cars derailed in an upright position along the track. At this location, the north rail was rolled to the north and was damaged for approximately 150 feet. There was only minor damage to the south rail.

Photo 4. Additional derailed empty covered gondola cars

An on-foot examination of the track between Mile 71.0 and Mile 72.5 identified a total of 39 joint defects. These defects included 10 cracked or broken joint bars (Photo 5). One cracked joint bar was located at a rail joint that had been marked during a rail flaw test due to the presence of an internal rail defect. The remaining joint defects included loose, bent or missing bolts (Photo 6) and broken or missing tie plates (Photo 7). At the time of the occurrence, no slow orders were in effect at that location.

Photo 5. Broken joint bar

Photo 6. Missing bolts

Photo 7. Missing tie plate

1.4 *Huron Central Railway*

Huron Central Railway (HCRY) is a provincially regulated shortline freight railway that was acquired by Genesee & Wyoming Inc. (GWI). Since 1997, the Webbwood Subdivision was being leased from Canadian Pacific Railway (CP).

1.5 *Subdivision and track information*

HCRY operates on the Webbwood Subdivision, which extends westward from Sudbury, Ontario (Mile 4.8) to Sault Ste. Marie (Mile 180.7). Train movements are governed by the occupancy control system (OCS), as authorized by the *Canadian Rail Operating Rules* and supervised by an RTC located in Montréal, Quebec. Track on this subdivision is classified as Class 2, with an authorized speed of 25 mph according to the Transport Canada (TC)-approved *Rules Respecting Track Safety*, also known as the Track Safety Rules (TSR).

Traffic on the Webbwood Subdivision consisted of 1 road switcher per day between Sudbury and McKerrow. There was also 1 freight train in each direction (SMSU and SUSM) over the entire subdivision 6 days per week. The rail traffic volume was about 2.2 million gross tons (MGT) per year.

Train operations on this subdivision typically were as follows:

- Freight train SMSU departed Sault Ste. Marie and freight train SUSM departed Sudbury.
- The trains met at McKerrow where the crews exchanged trains for their return trip. The crew members on freight train SUSM usually arrived in advance of train SMSU and performed any required switching.

In the vicinity of the derailment, the rail consisted of 100-pound head-free Dominion rail and Algoma rail, manufactured between 1945 and 1952. The rail consisted of 39-foot lengths and cropped and welded 72-foot lengths. The rails were joined together with 6-bolt joint bars and were laid on 14-inch double-shouldered tie plates and some single-shouldered plates. Some of the rail joints were staggered by less than 5 feet. The rail was fastened to the ties with 2 spikes per plate and was box-anchored every third or fourth tie.

In 2012, a tie program had gone through the area. At the time of the derailment, approximately 15% defective ties remained. On 16 July 2015, the track in this area was resurfaced.

1.6 *Huron Central Railway's organizational structure for track maintenance*

As the Webbwood Subdivision was leased from CP, HCRY chose to use CP's *Red Book of Track and Structures Requirements* (Red Book) as guidance for track maintenance in addition to the TSR.

At the time of the occurrence, track maintenance on the Webbwood Subdivision was managed by a road foreman and an assistant track supervisor. The subdivision was separated into the following 3 sections for track maintenance activities:

- McKerrow: Mile 4.8 to Mile 58.6
- Blind River: Mile 58.6 to Mile 125.5
- Sault Ste. Marie: Mile 125.5 to Mile 180.7

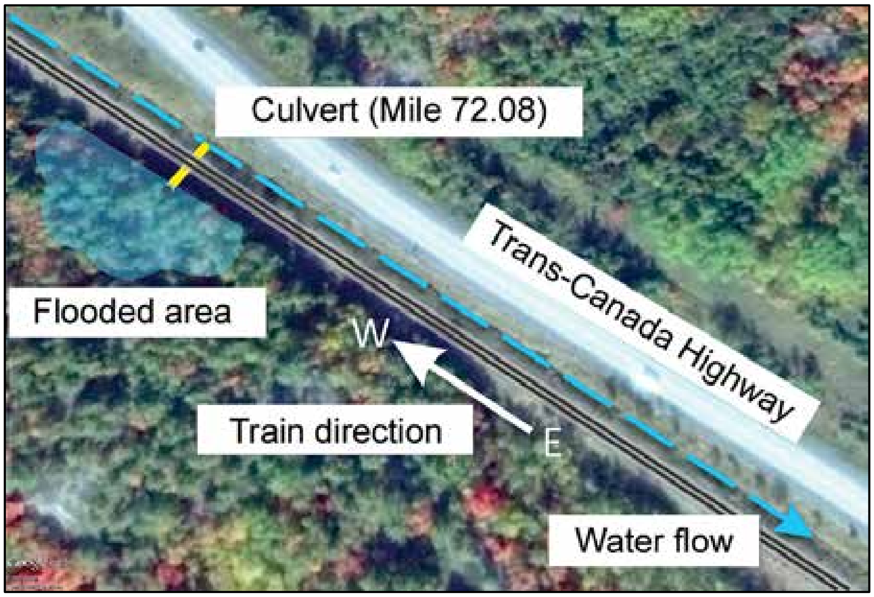
Each section was crewed by a foreman, a truck driver and a track employee. These maintenance crews performed regular inspections and general track maintenance. In addition, HCRY had a machine operator and a welder foreman based in Sudbury, a patrolman in Blind River, 2 machine operators in Sault Ste. Marie, and a temporary employee. Two additional employees were on leave at the time of the occurrence. For larger track maintenance projects, third-party contractors were also employed.

In November and December of each year, maintenance employees at HCRY normally receive a 1-day training class, which covers any rule or safety update. In January 2015, CP issued an update to its Red Book. HCRY had planned to provide information on the Red Book updates to its employees during the next scheduled training that was to be held in November and December 2015.

1.7 Drainage mitigation strategies

Much of the track on the Webbwood Subdivision was located in swampy, low-lying areas. In the vicinity of the occurrence, on the north side of the track, there was an eastward water flow year round at varying depths, depending on the amount of precipitation, snow melt and any obstructions such as beaver dams (Figure 3).

Figure 3. Water flow in the occurrence area (Source: Google Maps, with TSB annotations)



The water running along the right-of-way connected several small pools of water, which eventually flowed into Lake Huron.

At Mile 72.08, a 30-inch concrete culvert with corrugated steel pipe extensions at both ends was in place to help relieve water buildup south of the track, which typically occurred during heavy rain or post-winter thawing. The steel pipe extensions had been added to the concrete culvert after its initial installation when the track was lifted and the roadbed was widened.

After this occurrence, the following was noted:

- Drainage, which normally occurred from the south side to the north side of the track, had been restricted or completely blocked, despite having a culvert at Mile 72.08.
- The culvert had either collapsed, sunk, and/or had become plugged.
- The corrugated steel pipe extensions contained large areas of rust-through corrosion (Photo 8) and had separated from the concrete box culvert, which had allowed subgrade material to fall into the gaps.

Photo 8. Section of culvert containing rust-through corrosion

Aerial inspections evaluating the drainage system in proximity to the track structure had been conducted over the subdivision. To control the buildup of beaver dams, some track personnel had been trained to trap problem animals. However, before the derailment, HCRY had stopped actively trapping problem animals.

1.8 Ground hazard training

Other railways have developed ground hazard training programs for maintenance-of-way employees and operating personnel to identify warning signs for natural ground hazards and geotechnical issues, such as drainage conditions, stability of shoulders and embankments, and roadbed subsidence.

HCRY's maintenance-of-way-employees had not received any specific training in ground hazards and geotechnical issues. However, its annual training did address culvert inspections and drainage issues.

1.9 Rehabilitation project for the Webbwood Subdivision

On 15 June 2009, citing a substantial operating loss in 2008, GWI announced that it would be ceasing operations on the Webbwood Subdivision by October 2009. The previous year, HCRY had determined that it would need 33 million dollars to upgrade the degrading track infrastructure on the Webbwood Subdivision. Shortly after the June 2009 announcement, following negotiations with a delegation of municipal and business representatives affected by the possible closure of the line, a 1-year reprieve was announced by GWI.

To secure funding from federal, provincial and private interests, HCRY proposed to complete a rehabilitation project over 5 years of its 174-mile main track between Sudbury and Sault Ste. Marie. On 22 February 2010, a business plan was submitted to the governments of Ontario and Canada. The rehabilitation project was to include

- replacement of rail, cross ties, switch ties and ballast;
- removal and replacement of existing turnouts;
- resurfacing of track;
- rehabilitation of signals and communication devices; and
- repair of bridges, culverts and drainage ditches.

On 24 September 2010, GWI announced that it would be receiving funding of 15 million dollars each from the federal government and the provincial government. That funding (totalling 30 million dollars), along with an additional 3.3 million dollars provided by GWI, was the amount required for the HCRY rehabilitation project. Following the signing of the contribution agreement with the Ontario government on 22 March 2011 and with the federal government on 30 June 2011, the rehabilitation project started in August 2011.

The general goals of the rehabilitation project were to

- maintain the railway operation on a commercially viable basis, in the interests of the region's economic development;
- ensure the completeness of the region's transportation network; and
- improve operating performance on the entire line.

The project deliverable was to improve the track on the Webbwood Subdivision from Class 1 to Class 2, with the exception of a limited number of locations with speed restrictions as required by localized and temporary conditions in effect from time to time. Before the rehabilitation, approximately 82.2 miles of the 174 miles of main track was rated as Class 1 with a maximum speed of 10 mph. Contracts were awarded for the different elements of the rehabilitation project, including surfacing, work on culverts, acquisition and installation of rail components, and ballast replacement.

By 31 December 2014, the track on the Webbwood Subdivision had mostly been upgraded to Class 2 with a maximum speed of 25 mph. By late 2015, only about 1.4 miles of the track was still rated as Class 1 track with a maximum operating speed of 10 mph. With the track improvement, travel time over the Webbwood Subdivision was reduced significantly from 14 hours to 7.5 hours. The track improvements would have allowed HCRY to more than double its annual car loads and operate trains up to 4 times heavier. However, traffic on the Webbwood Subdivision had not increased since the beginning of the project.

1.10 Track inspections at Huron Central Railway

In Canada, TC's TSR outline the minimum maintenance standards and related track inspection requirements. In addition to the TSR, HCRY used CP's Red Book, which met or exceeded the TSR requirements, as its guideline. The following types of track inspections were required to be conducted by HCRY:

- visual track inspections;
- walking and rail joint inspections;
- ultrasonic rail flaw inspections;
- track geometry inspections; and
- special inspections.

1.10.1 Visual track inspections

The TSR stipulate the person responsible for performing inspections, the frequency of inspections, the methods of inspections, and the requirements for recording the inspections.

When conducting visual inspections, qualified rail employees are either on foot or in a hi-rail vehicle at a speed that allows the visual inspection and evaluation of track infrastructure elements including

- rail;
- rail joints;
- anchors, ties, tie plates, spikes and ballast;
- crossing protection; and
- high water and drainage.

At HCRY, visual track inspections were performed twice per week in accordance with the Red Book. The assistant track supervisor (ATS) or another qualified employee would normally commence the track inspection in Sudbury and proceed westward for a portion of the subdivision. The same day (or the following day), another qualified employee would complete the track inspection for the remainder of the subdivision up to Sault Ste. Marie.

The ATS would normally begin work at 0700 in Sudbury, with the inspection commencing shortly thereafter. The inspection was performed by hi-rail, travelling at a speed not exceeding 25 mph and being prepared to stop at all railway crossings. During the inspection, if defects were noted, the local section crew would be notified to take remedial action. For some minor repairs, the ATS performed the work. These track inspections normally covered between 80 and 90 miles, and took at least 8 hours to complete. Following the inspection, the ATS would travel back to Sudbury by road, requiring an additional 2 hours.

On 30 October 2015 (2 days before the occurrence), the last visual track inspection was conducted by the ATS by hi-rail vehicle between Mile 4.8 and Mile 88. During that inspection, high water was identified at Mile 71.0 and at 7 other locations. In addition, a broken rail joint bar and some missing bolts at a rail joint were identified. For the noted exceptions, remedial action, which included breaking more than 11 beaver dams, was taken.

1.10.2 Walking and rail joint inspections

The purpose of a walking inspection is to evaluate the track components, including the rail, ties, fasteners, and ballast.

As per the Red Book, rail joint inspections were to be performed annually[4] from the ground to ensure a close visual evaluation of rail joint components. Walking inspections could be used as an opportunity to meet the requirements to conduct one of the rail joint inspections. When conducting rail joint inspections, special attention was to be paid to conditions such as

- poor surface at joints;
- cracked or broken joint bars; and
- loose, broken, bent or missing bolts.[5]

A review of HCRY's joint bar inspection forms from 2015 indicated that some foremen would fill out the form if joint defects were identified during their regular visual track inspections by hi-rail. However, none of these inspection forms included any joint defects west of Mile 59. There was no record to indicate that HCRY had performed any walking or joint bar inspections on the subdivision.

1.10.3 Ultrasonic rail flaw inspections

Ultrasonic rail flaw inspection was the primary method used by HCRY to detect internal rail defects and to control the risk of rail failures. However, ultrasonic testing does not identify defects such as cracks and breaks in joint bars. On the Webbwood Subdivision, these inspections were conducted twice per year, exceeding the TSR requirement of an annual rail flaw inspection for Class 2 track.

---

[4] As per the TSR, on Class 2 jointed track, walking inspections were to be performed at least once every 3 years where track curvature was 4 degrees or greater.

[5] Loose bolts were to be tightened. Missing, bent or frozen bolts were to be replaced. In jointed track, if repairs had not been made, a 10 mph slow order was to be placed on the track until such time as remedial action was completed.

Table 2 outlines the remedial action required for bolt hole cracks as prescribed in the TSR.

Table 2. Remedial action prescribed in the Track Safety Rules for bolt hole crack defects

Defect length (inches)	Remedial action
0 to ½	F. Inspect rail 90 days after it is determined to continue the track in use. H. Limit operating speed over defective rail to 60 mph or the maximum allowable speed under Subpart A, Classes of Track: Operating Speed Limits for the class of track concerned, whichever is lower.
½ to 1½	G. Inspect rail 30 days after it is determined to continue the track in use.
1½ and over	B. Limit operating speed over defective rail to that as authorized by the Track Supervisor or other supervisory personnel.

In comparison, the Red Book does not allow for any detected rail flaw to remain in service beyond 30 days unless a 10 mph speed restriction is applied, as stated in paragraph 16.2.5(g):

> All rail defects detected visually or by using rail flaw detector cars, including defects temporarily repaired by the application of joint bars, must be repaired by welding, wide-gap welding, approved head repair weld or by change-out of the defective rail within 30 calendar days of their detection, or a 10 MPH speed restriction must be applied.

At HCRY, when rail flaws were identified and recorded during ultrasonic inspections, only a small number of the flaws were immediately repaired. Instead, most of the defects (including bolt hole cracks in rail joints) remained in service and were to be monitored every 30 days using an ultrasonic hand tester. If the defects remained unchanged (i.e., did not increase in size), no action would be taken and no speed restriction would be issued. Only if the condition of the flaw worsened would it be repaired. Once the hand test was conducted, if no change had occurred for bolt hole cracks that were over 1½ inches in length, the track supervisor or other supervisory personnel would normally give authority for trains to proceed at track speed (25 mph).

The most recent ultrasonic test for the entire Webbwood Subdivision had been conducted between 14 October 2015 and 27 October 2015. This ultrasonic test identified 757 rail defects, which included 505 bolt hole cracks. However, no defects were noted in the immediate vicinity of the derailment. Table 3 summarizes the results of the 4 rail flaw inspections conducted since 2014.

Table 3. Results of rail flaw inspections conducted since 2014

Date	Total number of rail defects	Number of joint bolt hole cracks
May – July 2014 (entire subdivision)	1129	755
September 2014 (Mile 4.8 to Mile 40.0)	239	125
July 2015 (entire subdivision)	843	623
October 2015 (entire subdivision)	757	505

There was no indication that any ultrasonic hand tests had been performed on the subdivision before the occurrence.

Shortly after the occurrence, from 17 November 2015 to 20 November 2015, ultrasonic hand testing was conducted between Mile 62.0 and Mile 179.0 for the rail defects identified during the October 2015 test. Of the 400 joint defects that had been identified between these limits, 381 were still present, of which 272 were bolt hole cracks. These bolt hole cracks included

- 121 bolt hole cracks that were between 2 inches and 5 inches in length; and
- 8 bolt hole cracks that had increased in size.

1.10.4 Track geometry inspections

The TSR require that track geometry for Class 2 track be tested at a minimum frequency of once annually if a heavy geometry inspection vehicle is used or 3 times annually if a light geometry inspection vehicle is used. The most recent track geometry inspection had been conducted on 16 June 2015 using a track evaluation car. During that inspection, no track defects were noted in the vicinity of the derailment.

1.10.5 Special inspections

The TSR and the CP Red Book indicated the need for additional inspections to be performed when required to ensure safe railway operations. For example, severe weather conditions could prompt additional inspections in order to evaluate drainage and other weather-related issues.

To help determine the need for a special inspection relating to weather, HCRY subscribed to a weather alert service that would notify HCRY when pre-determined conditions were forecast, including

- flash flooding (100 mm of rain within 3 hours); and
- heavy rain (at least 15 mm of rain at a rate of 10 mm per hour or greater).

The month of October 2015 had a higher-than-normal amount of precipitation. However, no one day that month exceeded the pre-determined conditions for a weather alert. As no weather alerts had been issued, no special inspections were conducted on the Webbwood Subdivision during October 2015.

1.11 Track Safety Rules Class 2 standards

With the upgrade of track from Class 1 to Class 2, HCRY was required to comply with the increased track standards as specified in the TSR. At the time of the occurrence, HCRY was meeting or exceeding requirements for Class 2 track with an annual tonnage of between 5 and 15 MGT.[6] Table 4 summarizes the track standards for Class 1 and Class 2 tracks.

---

[6] HCRY had opted to maintain its track to standards for an annual tonnage of between 5 and 15 MGT even though its annual tonnage was about 2.2 MGT.

Table 4. Track standards for Class 1 and Class 2 tracks

Item	Class 1 track	Class 2 track
Speed (for freight trains)	10 mph	25 mph
Gauge	Between 55¾ inches and 58 inches	Between 55¾ inches and 57¾ inches
Track alignment – tangent* and curved** track	Not more than 5 inches	Not more than 3 inches
Difference in cross-level between any two points less than 62 feet apart	Not more than 3 inches	Not more than 2¼ inches
Number of good crossties (each 39-foot segment)	5	8
Mismatch on the top of the rail ends	¼ inch	¼ inch
Mismatch on the gauge side of the rail ends	¼ inch	3/16 inch
Number of bolts at rail joints per rail (conventional jointed track)	At least 1	At least 2
Visual track inspections	Twice monthly	Twice weekly
Walking track inspections on jointed rail	N/A	Every 3rd year
Track geometry inspections	Twice annually with a light vehicle or once annually with a heavy vehicle	Three times annually with a light vehicle or once annually with a heavy vehicle
Rail flaw inspections	N/A	Annually

* Deviation of the mid-offset from a 62-foot line

** Deviation of the mid-ordinate from a 62-foot line

1.12 Track maintenance in the vicinity of the derailment

The derailment location had a history of track and roadbed instability. Frequent track maintenance had been required, including track surfacing, shimming, rail pull-aparts and low joints. Table 5 summarizes the track maintenance work performed in 2014 and 2015 in the vicinity of the derailment (i.e., within 1500 feet of Mile 72.08).

Table 5. Defects and track maintenance performed in the vicinity of the derailment

Date	Track defect	Work performed
14 March 2014	Daily inspection identified a broken rail at Mile 72.3.	The rail section was repaired.
20 March 2014	Daily inspection identified a broken rail at Mile 72.3.	The rail section was repaired.
10 April 2014	Daily inspection identified poor surface conditions at Mile 72.08.	The track section was shimmed.
22 April 2014	Daily inspection identified a rail pull-apart and broken joint bars at Mile 72.2.	The joint bars were replaced.
14 May 2014	Daily inspection identified a problem with the shims at Mile 72.1.	The shims were removed and the track was surfaced.
21 May 2014	Daily inspection identified a problem with the shims at Mile 72.1.	The shims were removed and the track was surfaced.
28 August 2014	Daily inspection identified a rail pull-apart at Mile 71.95.	The rail was repaired.
06 October 2014	Track geometry inspection identified a cross-level (priority) defect at Mile 72.08.	The cross-level defect was flagged for follow-up.
29 December 2014	Daily inspection identified poor surface conditions at Mile 71.8.	The track section was repaired.
09 February 2015	Daily inspection identified a broken joint bar at Mile 72.03.	The joint bar was replaced.
09 March 2015	Daily inspection identified a low joint and a broken joint bar at Mile 72.05.	The track section was shimmed and the joint bar was replaced.
24 April 2015	Daily inspection identified poor surface conditions at Mile 72.1.	The track section was repaired.
25 May 2015	Daily inspection identified high water near the track at Mile 71.0 and poor surface conditions at Mile 71.8.	The track section was repaired.
16 July 2015	Poor surface conditions were identified between Mile 71.3 and Mile 72.6.	The surface program was completed.
09 October 2015	Daily inspection identified a rail pull-apart at Mile 72.3.	The bolts at the rail joint were replaced.

1.13 *Technology for joint bar inspections*

The Federal Railroad Administration (FRA) Office of Research and Development and ENSCO, Inc. developed a machine vision-based system for joint bar inspections using high-speed cameras at speeds up to 70 mph. This system is based on the use of 4 line-scan cameras mounted on a hi-rail or rail-bound vehicle that continuously capture high-resolution images from both sides of each rail. An on-board computer system analyzes the images in real time to initially detect the joint bars. Each joint bar image is then automatically saved and analyzed for visible fatigue cracks. The images are also analyzed for missing bolts and other defects. However, only cracks on the outside of the joint bars are visible to the cameras.

When a potential defect is identified, the system provides an audio warning and then tags the image with the GPS (global positioning system) position. The joint bar image containing any defects is displayed and its defects are highlighted on the screen. The operator can confirm or reject defects, and can generate a survey report containing the joint bar GPS location and types of all defects.

This system improves productivity and worker safety by allowing for the inspection of rail joint bars from a moving vehicle instead of having to walk the tracks. It also allows railways to reduce the time between inspections, preventing defects from developing into hazards. Sperry Rail Service and Herzog Railroad Services, Inc. (Herzog) have equipped some of their ultrasonic/induction testing vehicles with this system.

In addition, the Transportation Technology Center, Inc. (TTCI) and Herzog developed a non-destructive inspection (NDI) ultrasonic system to detect flaws in the area of a joint bar that are masked by the rail head-to-web radius and are not detectable by visual or optically aided inspection techniques.[7] This system uses ultrasonic transducers that are mounted into a sliding (skid-style) fixture or roller search unit that scans along the outside of the joint bar while introducing pulsed sound waves across the bar in order to detect flaws and cracks located at the top inside surface of the middle portion of the joint bar (i.e., where 95% of fatigue cracks initiate[8]).

Automated joint bar inspection systems were not in use at HCRY.

1.14 Engineering Laboratory examination of rail joints (LP 274/2015)

The TSB Engineering Laboratory conducted a detailed examination of the broken north rail joint, the associated rail and the non-broken, adjacent south rail and joint.

For the broken north rail joint, the following was determined:

- The north rail joint bar materials met the specified strength requirements.
- The north rail joint bars failed due to overstress extension of fatigue cracking (Photo 9).
- Fatigue cracking of the north rail field side joint bar initiated along the lower outside edge.
- Fatigue cracking of the north rail gauge side joint bar initiated along the lower outside edge as well as at fretted areas at the upper fishing surface.
- Fretting between the north rail gauge side joint bar and the parent rail occurred due to relative movement between the joint bar and the parent rail.

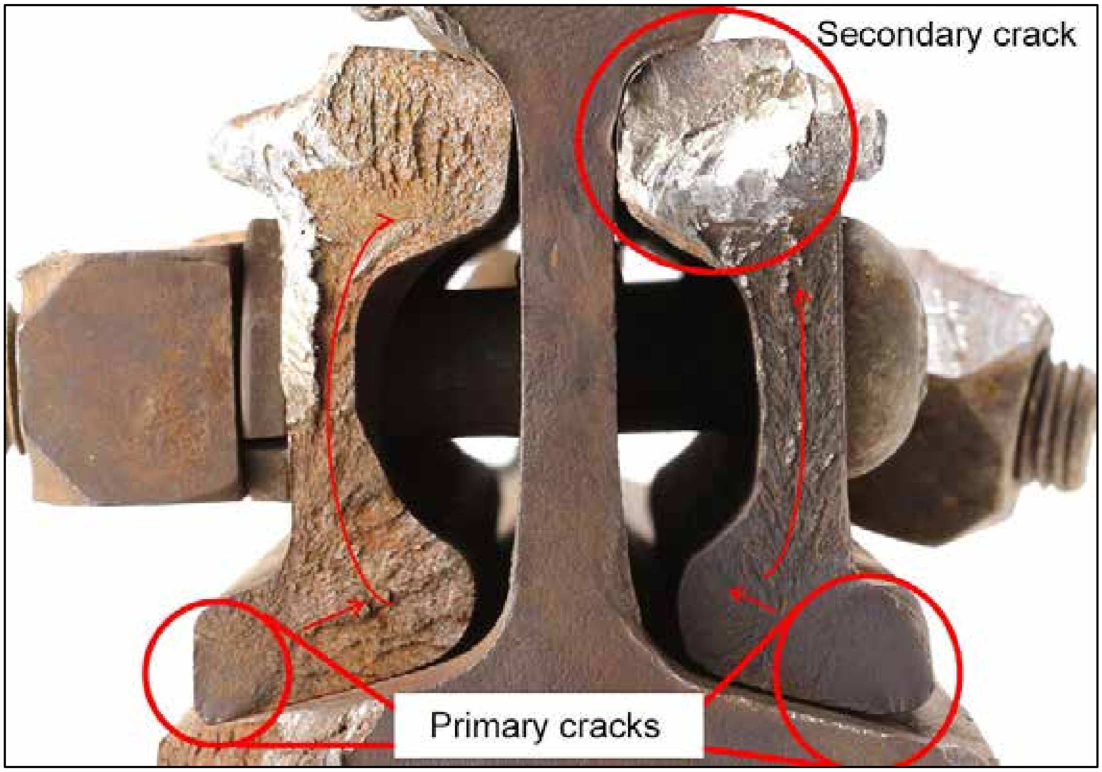
---

[7] G. Garcia, "Automated ultrasonic inspection detects cracks in joint bars: TTCI and Herzog study nondestructive inspection methods for joint bars in service utilizing ultrasonic technology," *Railway Track and Structures*, Volume 107, Issue 4, 01 April 2011.

[8] D.D. Davis, M. Akhtar and G. Garcia, "Evaluation of the feasibility of automated joint bar inspection," *Technology Digest* TD 08-040, Transportation Technology Center, Inc., October 2008.

- For the non-broken, adjacent south rail joint, crack indications were observed along the lower outside edge of both the gauge and field side south rail joint bars.

Photo 9. Pre-existing primary and secondary cracks in rail joint bars (arrows showing extension of fatigue cracking)



1.15 *Culvert inspections*

1.15.1 *Regulatory requirements*

Minimum requirements for culvert inspections are outlined in the TSR and TC's *Guideline for Culvert Safety Management*.

Part II, Subpart B, Roadbed, of the TSR states (in part):

> I. Drainage
>
> Each drainage or other water carrying facility under or immediately adjacent to the roadbed must be maintained and kept free of obstruction, to accommodate expected water flow for the area concerned.

TC's *Guideline for Culvert Safety Management* indicates that a Culvert Safety Management Program (CSMP) must be developed in accordance with the *Railway Safety Management System Regulations*, the *Railway Safety Act* and the TSR.

This guideline also indicates that culvert inspections should be performed by "a person who is designated by a railway authority, and deemed to be technically competent to view, measure, report, and record the condition of a culvert along with its surroundings under the direction of the Railway Engineer." The guideline states (in part):

> […] CSMP should include an inventory of all culverts over which trains operate and at a minimum, including the following information:
>
> a. Location (i.e. subdivision and mileage);
>
> b. Number of tracks;
>
> c. Culvert type;
>
> d. Culvert Dimensions (i.e. span, rise, and number of cells);
>
> e. Total length;
>
> f. Height of Cover (measured from the top of the culvert to the bottom of tie);
>
> g. Year installed, if available;
>
> h. Geo-referenced coordinates (i.e. longitude, latitude); and
>
> i. Type of crossing (i.e. stream, pedestrian walkway, cattle pass etc.).
>
> **4.3 – Scheduling of Culvert Inspections**
>
> In addition to visual inspection requirements of culverts contained in the Track Safety Rules, a railway authority shall have a CSMP that:
>
> a. Should include a documented structural inspection at a minimum of once every five years. Should any culvert inspection indicate that the culvert is at a minimum acceptable condition (advance deterioration evident but still functioning as intended), the culvert should be scheduled for a more frequent visual documented inspection, as determined by a Railway Engineer.
>
> […]
>
> **4.10 – Culvert Hazard Identification and Risk Assessment**
>
> Railway companies are required to implement and maintain processes for the identification of safety issues or concerns, evaluating and classifying risks by means of a risk assessment, and implement necessary risk control strategies.

TC's *Appendix - Guideline for Culvert Safety Management with Clarification Comments on Grey Background* provides further guidance for the maintenance and inspection of culverts. It states (in part):

> d. Debris and sediment blocking culverts:
>
> It is essential that the culvert be able to handle the design flow. If the culvert is blocked with deposits of debris, driftwood, organic growth (including beaver dams) or sediment, the culvert may be inadequate to handle design flows. This may result in excessive ponding, flooding of nearby properties, and washouts of track and embankment. Accumulations of debris sediment in the stream may cause scour of the stream banks and embankments, or could cause changes in the channel alignment. Thus it is imperative that railway authorities remove deposits of debris and sediment blockings if it poses a threat to safe railway operations and property.
>
> […]

> g. Severe weather conditions:
>
> Railway authorities should monitor weather conditions and weather warnings and follow-up with special patrols for culvert inspections, including drainage assessments for the specific warning areas. Weather monitoring is an effective way to plan for any adverse situation.
>
> Railway authorities should remain vigilant of events, including but not limited to heavy precipitation, spring runoff, high river levels and/or higher than normal flow conditions, etc. When such conditions exist, inspections should be performed and appropriate measures taken before and after the event to protect safe railway operations. Culverts should be re-evaluated to confirm both structural integrity and the ability to effectively accommodate water flow under the track.

HCRY used TC's *Guideline for Culvert Safety Management* as its CSMP.

1.15.2 Canadian Pacific Railway's Red Book – 2015 update

CP's Red Book was updated and came into effect on 31 January 2015. The updated version contained enhanced requirements regarding the inspection of structures, including culverts.

Section 17.3.0, Railroad Culvert Inspection, subsection 17.3.1, General Requirements, states (in part):

> […]
>
> b. Culvert Inspections are for the purpose of ensuring;
>
>   i. Hydraulic flow can be observed without obstruction upstream and downstream of the inlet and outlet;
>
>   ii. Site conditions have not changed in a manner that impacts drainage through assessment of land use and ditch conditions;
>
>   iii. The structural integrity of the culvert is sufficient to support track, ballast and embankment material and no voids are observed in the ballast or embankment; and
>
>   iv. Identification of maintenance that may be required prior to the next inspection.

Subsection 17.3.2, Inspection of Railroad Culverts Less Than or Equal to 36" in Diameter, states (in part):

> a. All culverts 36" in diameter or less must be inspected annually with no more than 540 days between successive inspections by Track Inspectors in accordance with Section 14.12.0 (Culverts and Drainage) of the Red Book of Track Requirements (RBTR). These inspections are to be recorded in DTN [Digital Track Notebook].
>
> b. All culverts 36" in diameter or less must be inspected every 5 years with no more than 1250 days between successive inspections by Bridge Inspectors. These inspections are to be recorded in DTN.

Although HCRY had adopted CP's Red Book as a supplement to the TSR, at the time of the occurrence, HCRY had not yet implemented the new guidelines that were established in the updated Red Book.

1.15.3 Huron Central Railway culvert inspections

At HCRY, detailed inspections for culverts were conducted every 3 years by a contractor accompanied by the ATS. Culvert inspection forms were used to report on the culvert condition. A 5-point rating system for culvert condition had been developed by HCRY. The culvert condition rating was based on the following:

- For each culvert component or feature, such as headwall, alignment, obstruction, deformation and erosion, a rating between 1 and 5 (with 5 being the best condition) was assigned.
- The culvert type, dimensions and length were recorded on the form.
- In addition, an overall average rating (based on the average of the individual ratings) was assigned to the culvert as follows:
    - 5 = Excellent
    - 4 = Good
    - 3 = Poor
    - 2 = Very Poor
    - 1 = Urgent

At HCRY, an average overall rating below 2 would require immediate work to be performed to improve the condition of the culvert. When any one component received a rating below 2, but the overall rating was above 2, HCRY would further evaluate the culvert to determine if work should be performed to improve its condition. There was no specific rating or condition that would flag a culvert as needing more frequent inspections.

In June 2013, during the most recent culvert inspection, the culvert at Mile 72.08 was assigned a rating of 3 (poor), as all structural and hydraulic components, including the seams and material, were assessed as being in poor condition (Figure 4). With a rating above 2, repair work was not required nor performed to improve any of the culvert components.

Figure 4. Culvert at Mile 72.08 during June 2013 inspection. Note: brightness adjusted for easier identification of defects. (Source: Huron Central Railway inspection report, with TSB annotations)

During the June 2013 inspection, 36 culverts were inspected between Mile 65.0 and Mile 80.0. Of these culverts, 10 received a rating of 3 (poor) for most of their components. No culvert received an overall rating below 2 and no individual culvert component received a rating below 2. With condition ratings of 2 or more, repair work was not required nor performed on any of these 36 culverts.

Between the June 2013 culvert inspection and the date of the occurrence, there was no indication that visual inspections had been conducted at any of the culverts in the vicinity of the derailment.

Shortly after the occurrence, HCRY conducted a detailed inspection of all culverts on the Webbwood Subdivision. For the 36 culverts located between Mile 65.0 and Mile 80.0, the following was noted:

- 4 culverts were 50% to 100% flooded due to high water (1 inspection record identified a nearby beaver dam as the cause of the high water). These conditions were present during both the 2013 and 2015 inspections;
- 3 culverts were completely blocked with beaver dams within the culverts;
- 3 culverts were heavily corroded;

- 2 culverts had bad seams between culvert materials;
- 2 culverts contained small amount of debris;
- 1 culvert was deformed; and
- 1 culvert had a broken headwall with bank erosion.

As a result of the post-accident culvert inspection,

- 3 culverts received an overall rating of 0;
- 1 culvert received an overall rating of 2.775, but was highlighted in yellow, indicating that work would have to be performed; and
- 2 culverts received an overall rating of 4 (good), even though one of their components had a rating of 1 (urgent).

1.16 Previous washout derailments on Huron Central Railway

Since 2013, 2 other derailments involving track washouts occurred on the Webbwood Subdivision.

- On 10 September 2013, while travelling westward on the Webbwood Subdivision, HCRY train 802 came upon a washout at Mile 127.5, derailing the trailing locomotive. There were no injuries, and no dangerous goods were involved (TSB occurrence R13T0301).
- On 14 April 2014, the HCRY crew on assignment SUSM reported having derailed due to a washout at Mile 30.2 of the Webbwood Subdivision. All 3 locomotives and 1 flat car derailed on the main track; one of the locomotives leaked diesel fuel. A small fire was extinguished by the crew (TSB occurrence R14T0110).

1.17 Other TSB-reportable occurrences at Huron Central Railway

In 1996, as part of a Memorandum of Understanding (MOU) with the TSB, the Ministry of Transportation of Ontario (MTO) required all provincially regulated railways in Ontario to notify the TSB as soon as possible following a TSB-reportable occurrence. Following this occurrence, HCRY was requested to provide information on all TSB-reportable occurrences since 2009 (Appendix A). The provided information was compared to the occurrences that had been previously reported. It was noted that, of the 63 reportable occurrences since 2009, only 31 had been reported to the TSB at the time of this occurrence.

Occurrences that had not been immediately reported[9] included

- 5 crossing accidents;
- 2 uncontrolled movements;
- 2 fires on rolling stock; and

---

[9] The TSB provided clarification to Huron Central Railway on the criteria for a TSB-reportable occurrence. The 32 occurrences that were reported late to the TSB were entered into TSB's Rail Occurrence Database System (RODS).

- 1 main-track derailment of 9 cars and 2 locomotives.

1.18 Regulatory oversight

1.18.1 Ministry of Transportation of Ontario

In the province of Ontario, there are 9 provincially regulated railways. With the exception of HCRY, these shortline railways typically operate over short distances with low traffic volumes. The MTO issues railway licences to Ontario shortline railways. However, the MTO did not have the organizational structure, including railway expertise, to provide full regulatory oversight of these railways. Therefore, through an agreement between the Province of Ontario and TC, rail safety inspections and the related regulatory functions for the 9 provincial railways were performed by TC. TC enforces the applicable federal laws respecting railway safety in the same manner and to the same extent as they apply to federally regulated railways, with the exception of being able to fine or prosecute under the *Railway Safety Act*. The MTO, as the registrar for shortline railway licences, could revoke a railway's licence, but did not have the mechanism to fine or prosecute a railway. With respect to the frequency and content of the rail safety inspections, the agreement did not contain specific timelines and details.

Each year, TC provided the MTO with the annual inspection schedule for each provincial shortline railway. When the inspections were performed, TC provided the MTO with the inspection reports and with any communications sent to the railway for corrective action. As the staff at the MTO did not have extensive railway knowledge to interpret the inspection reports, the MTO relied on TC for all railway regulatory oversight expertise.

1.18.2 Rail safety inspections at Transport Canada

To evaluate risk and to appropriately monitor railway operations, TC planned and carried out oversight using its risk-based business planning (RBBP) methodology. This methodology was designed to identify issues for which a possible intervention was required, as well as to help in the prioritization of TC's inspection regime. Oversight activities conducted by TC included on-site inspections, audits, reviews, and data collection and analysis.

TC's RBBP included the following 3 components:

- For the A-component inspections, TC Headquarters developed a national inspection plan for the following year using a statistical model. This plan identified the number of inspections, and targeted railway companies that were to receive these inspections in order to verify regulatory compliance and to possibly detect emerging safety issues and immediate safety threats.
- For the B-component inspections, TC regions focused on specific recurring issues that required closer monitoring. Using the RBBP process, railway companies were identified to receive these inspections.
- For the C-component inspections, which were unplanned, TC responded to issues that emerged through the year.

Using the national inspection plan, each TC region develops an operational plan to provide guidance to its rail safety inspectors on which railway companies, infrastructure locations, subdivision portions, operations, and maintenance employees to inspect.

In TC's Ontario Region, each functional group performs a risk assessment to rank the relevant subdivisions, yards, and maintenance facilities according to level of risk. The factors considered in this risk assessment include accident history, level of compliance with standards and regulations, recent changes in operations, amount and type of rail traffic, hours of work, and type of work performed. Based on the risk assessment, the inspection locations are identified and prioritized, ensuring that the higher risk locations and activities are inspected in a timely manner.

1.18.3 Track inspections conducted by Transport Canada's Ontario Region

Once the A-component inspections were determined by TC Headquarters, TC's Ontario Region Engineering Group divided the remainder of the track (including both federally and provincially regulated track) into segments and rated each segment according to risk (B-component inspections). In comparison to federal railways, the provincial railways in Ontario typically operate on a lower class of track with reduced speeds and traffic. As such, the provincial railways would not normally have a risk profile that would require frequent track inspections. Therefore, the provincial railways in Ontario were typically placed on a 3-year to 5-year inspection schedule.

The federally regulated railways would typically have track geometry data and rail ultrasonic inspection results available, allowing TC to consider this information when determining the level of risk for the B-component inspections. In comparison, the MTO would have had to request the information from the provincially regulated railways in order to provide it to TC. However, no process was in place to obtain this information. Therefore, track geometry data and rail ultrasonic inspection results were not provided to TC and were not taken into consideration.

Table 6 summarizes the inspections conducted by TC on the Webbwood Subdivision since 2005.

Table 6. Track inspections conducted by Transport Canada on the Webbwood Subdivision since 2005

Date	Location	Results
08 April 2009	Mile 4.8 to Mile 87.41	4 defects, including 1 joint defect
18-19 November 2009	Mile 7.2 to Mile 98.3	2 gauge dimension defects (Code: T.C.2.3)
27-28 October 2010	Mile 4.8 to Mile 102.30	6 defects, including elevation of curves and spiral from Mile 4.8 to Mile 102.30
25-27 September 2012	Mile 4.8 to Mile 177.0	67 track geometry "urgent" warnings

Shortly after the occurrence, in early November 2015, TC performed a previously planned track inspection on the Webbwood Subdivision between Mile 77.03 and Mile 175.0. This inspection identified 244 non-compliant conditions, which included 221 joints with missing bolts and 21 other concerns and observations.

Following this inspection, TC issued a letter of non-compliance and notice to HCRY. On 23 November 2015, following HCRY's response to the letter of non-compliance, TC issued a letter of insufficient action taken, indicating that HCRY's corrective actions did not adequately address the issues of non-compliance. For example, TC highlighted HCRY's inability to provide 30-day rail flaw inspection reports to monitor previously identified rail flaws that were allowed to remain in track. HCRY then responded with detailed information on actions initiated, including recent full hand test results of all rail flaws still in service.

1.19 Safety management system

A safety management system (SMS) is "a systematic, explicit and comprehensive process for managing safety risks."[10] It is a means to ensure that a railway has the processes in place to identify the hazards in its operation and mitigate identified risks. SMS was designed around evolving concepts about safety that are believed to offer great potential for more effective risk management. SMS was progressively introduced in the Canadian transportation industry because this approach to regulatory oversight, which seeks to ensure that organizations have processes in place to systematically manage risks, when combined with inspections and enforcement, is believed to be more effective in reducing accident rates.

Part 1, section 5 of TC's *Railway Safety Management System Regulations, 2015* (SMS Regulations) outlines the processes that a railway must develop and implement including

> (a) a process for accountability;
>
> (b) a process with respect to a safety policy;
>
> (c) a process for ensuring compliance with regulations, rules and other instruments;
>
> (d) a process for managing railway occurrences;
>
> (e) a process for identifying safety concerns;
>
> (f) a risk assessment process;
>
> (g) a process for implementing and evaluating remedial action;
>
> (h) a process for establishing targets and developing initiatives;
>
> (i) a process for reporting contraventions and safety hazards;
>
> (j) a process for managing knowledge;
>
> (k) a process with respect to scheduling; and
>
> (l) a process for continual improvement of the safety management system.

---

[10] Transport Canada, TP 15058E, *Railway Safety Management Systems Guide: A Guide for Developing, Implementing and Enhancing Railway Safety Management Systems* (November 2010), p. 3, available at http://publications.gc.ca/site/eng/9.694086/publication.html (last accessed on 27 February 2017).

1.19.1 Huron Central Railway's safety management system

In accordance with TC's SMS Regulations, HCRY had developed and implemented an SMS. It described company initiatives relating to the requirements of the SMS Regulations. HCRY had developed and implemented processes for each of the items listed in Part 1, section 5. In October 2015, HCRY's SMS had been recently updated.

Section 6, Risk Assessment Process, of HCRY's SMS states (in part):

> The objective of Risk Assessment is to ensure that significant risks are identified and that appropriate action is taken to mitigate these risks. Risk Assessment comprises the logical sequence of:
>
> - Identifying and analyzing risks or hazards.
> - Perform Risk Assessment using appropriate risk matrix.
> - Determine methods of mitigating risks and understating of residual risks
> - Implementing the appropriate risk control strategies
> - Monitoring the results to verify that the implemented strategies are adequate, and demonstrate result.

Section 6.1.3 of HCRY's SMS identifies the risk control strategies for general risks within certain areas, such as operations, equipment and infrastructure. For example, the strategies developed for infrastructure risks, including flooding, slope failures, track condition and washouts, were as follows:

- Design and construction standards and procedures
- Modification review and approval process
- Procedures to document changes to equipment and systems, including on as-built drawings
- Inspection and maintenance standards & procedures, including cycles, record-keeping procedures, and corrective action and implementation monitoring procedures
- Facility inspection
- Safety technology
- Devices on railway equipment (locomotive event recorders, reset control devices)
- Relevant safety policies
- Procurement procedures to prevent the introduction of defective or deficient materials and supplies or unauthorized hazardous materials

With respect to allowing track defects to remain in service, HCRY had not specifically performed a risk assessment. Instead, HCRY relied on its risk control strategies to deal with all infrastructure risks.

1.20 *Safety culture*

Section 5, Achieving an Effective Safety Culture, of TC's *Rail Safety Management Systems Guide: A Guide for Developing, Implementing and Enhancing Railway Safety Management Systems* (TP 15058E, November 2010) states (in part):

> […] An effective safety culture in a railway company can reduce public and employee fatalities and injuries, property damage resulting from railway accidents, and the impact of accidents on the environment.
>
> […] In simple terms, an organization's safety culture is demonstrated by the way people do their jobs – their decisions, actions and behaviours define the culture of an organization.
>
> […]
>
> The safety culture of an organization is the result of individual and group values, attitudes, perceptions, competencies and patterns of behaviour that determine the commitment to, and the style and proficiency of, an organization's health and safety management system.
>
> Organizations with a positive safety culture are characterized by communications from various stakeholders founded on mutual trust, by shared perceptions of the importance of safety and by confidence in the efficacy of preventive measures.

An effective safety culture includes proactive actions to identify and manage operational risk. Organizations must strike a balance between safety and production by managing risks present in their operation. The challenge for an organization is to operate efficiently while identifying and overcoming threats to safety, thereby minimizing safety risks. The reality within many organizations is that production and operational concerns may at times seem more pressing since they are more measurable and provide immediate feedback in terms of results. Therefore, in the minds of decision makers, operational concerns may be more salient than concerns dealing with safety. In this context, organizations may unwittingly introduce risk into their operations.

Organizations differ considerably in the level of risk they tolerate within their operations. Organizations that take proactive steps to identify and mitigate risks are considered to have positive safety cultures, while other organizations with poor safety cultures knowingly or unknowingly operate with higher levels of risk. An organization that operates with significant risk faces a greater potential for an accident.

2.0 Analysis

The train was operated in accordance with company and regulatory requirements. There was no indication that the mechanical condition of the rolling stock contributed to the occurrence. The analysis will focus on the track conditions, including geotechnical and subgrade instability in the vicinity of the accident, the inspection of culverts and rail joints, the failure mode of rail joint bars, regulatory oversight of provincial shortline railways, and the company's safety culture.

2.1 The accident

The 3 locomotives and first 8 cars of freight train SUSM-01 derailed at Mile 72.08 when the roadbed collapsed and the north rail joint broke apart under the train.

During a derailment, rapid deceleration can lead to high compressive buff forces that can result in a secondary derailment, especially on empty cars followed by heavy loaded cars. In this occurrence, an additional 5 empty cars near the middle of the train derailed. The derailed position of 2 of these cars, sitting angled and perpendicular to the track, indicates that the train had experienced extremely high in-train longitudinal buff forces. The second group of cars derailed due to the rapid buildup of longitudinal buff forces on the 5 empty cars near the middle of the train during the derailment sequence.

Prior to the derailment, water had been present on both sides of the railway right-of-way. Drainage at the derailment location, which normally occurred from the south side to the north side of the track, had been restricted or completely blocked due to debris buildup within the culvert and/or culvert deformation. This allowed water to infiltrate and migrate through the railway embankment. The mud on the underside of the first locomotive and the formation of the gully during the derailment were indicators that the subgrade was saturated when the train arrived. The blocked culvert resulted in inadequate drainage during several days of rain, allowing water to pool and migrate through the railway embankment and to saturate the subgrade.

Water saturation within the embankment resulted in reduced cohesion and stability of the subgrade material, reducing the capacity of the track to support trains. Over time, the unstable roadbed, in conjunction with the impact loading of car wheels that was magnified by the non-staggered joints, had produced increased deflections at the rail joints, initiating fatigue cracks within the joint bars. The fatigue cracks were located along the lower outside edge of the joint bar. This area of the joint bar was subjected to the greatest tensile loads in service. The joints were not loose, but relative movement between the bolted components still occurred. This was a typical joint bar fatigue mechanism where poor roadbed conditions existed. With continued train operation on the unstable roadbed, the joint bar fatigue cracks on the north rail joint increased in size. When the freight train traversed over the track, the pre-cracked north rail joint failed due to an overstress fracture as the subgrade collapsed.

2.2 *Identification of poor drainage conditions*

The detection of a weak track subgrade is an important component of track inspection and track maintenance.

The derailment location had a history of track and roadbed instability. Specifically, frequent track maintenance had been required, including track surfacing, shimming, rail pull-aparts and low joints. These maintenance activities were generally required as a result of poor drainage. Despite the fact that Huron Central Railway (HCRY) had adopted the Transport Canada (TC) *Guideline for Culvert Safety Management* and had a history of track instability and frequent track maintenance, there was no indication that the problem was fully understood nor was a more permanent mitigation established. If poor drainage conditions that affect track stability are not identified and mitigated in a timely manner, accelerated track structure degradation can occur, increasing the risk of derailments.

2.3 *Training for track inspectors on ground hazards*

At HCRY, track inspectors had not received any significant training in identifying precursor ground conditions. Training on geotechnical issues, including drainage and maintenance requirements relating to drainage, had not been specifically given to employees tasked with carrying out inspections.

In this occurrence, the blocked culvert had resulted in inadequate water drainage. The prolonged weather conditions that affected track stability and the pooling of water did not generate any alerts during the regular visual track inspections. Another precursor indication of ground hazards relating to drainage includes a history of track and roadbed instability and track maintenance (i.e., maintenance relating to drainage, including track surfacing, shimming, rail pull-aparts and low joints). If track inspectors are not provided with appropriate training on precursor ground hazards, such as inadequate drainage, unstable ground conditions may not be detected in a timely manner, increasing the risk of derailment due to track conditions.

2.4 *Frequency of culvert inspections*

At HCRY, detailed inspections were conducted on culverts every 3 years. During the most recent culvert inspection (June 2013), each component of the culvert at Mile 72.08 had received a condition rating of 3 (poor). HCRY's culvert inspection protocol stated that, with a rating for each component above 2, repair work at the culvert was not required. As a result, no repairs were required in the foreseeable future. In addition, there was no specific rating or condition that would flag a culvert as needing more frequent inspections. At HCRY, culvert condition ratings of 3 (poor) did not trigger more frequent detailed inspections to monitor the degrading condition of the culverts.

However, during the derailment site examination (i.e., over 6 months before the next scheduled inspection), the culvert at Mile 72.08 was found to have been rusted through. This condition had compromised its structural integrity and affected its ability to provide adequate drainage capacity. As the corrugated steel pipe extensions were heavily corroded, they had separated from the concrete box culvert and/or deformed, allowing subgrade material to fall into the gaps, blocking the flow of water.

While the observance of high water was part of HCRY's regular inspection program, there was no specific requirement for an on-ground visual culvert inspection between detailed culvert inspections. While the Canadian Pacific Railway (CP) *Red Book of Track and Structures Requirements* (Red Book) had been updated in January 2015 to require such inspections, HCRY's maintenance employees were not scheduled for training that would have included such updates until after the derailment. Such an inspection during a rainy period could provide a general indicator of the culvert's ability to effectively move water. If culverts are not visually inspected on a periodic basis, conditions that impede water flow through the culvert can remain undetected, increasing the risk of roadbed saturation during periods of high water flow.

2.5 *Monitoring of rail joint bar defects*

The identification and remediation of rail joint defects are imperative to maintaining track integrity. When rail joints are not properly maintained, the resulting wheel impact forces can lead to increased vertical deflections in the rail, the development of fatigue cracks in the joint bars, and the loosening and deterioration of the rail joint assembly. Rail head batter and degradation of the ties, ballast, and subgrade also occur under the joint.

While ultrasonic testing is effective at identifying rail defects within rail joints, it cannot detect other joint defects such as cracked joint bars, loose bolts, and poor support. For effective detection of rail joint defects, walking inspections to ensure proper support at all rail joints must be conducted in conjunction with ultrasonic testing. Despite Track Safety Rules (TSR) requirements to perform a walking inspection every 3 years and the Red Book guidelines suggesting that rail joint bar inspections be performed every year, such inspections were not conducted by HCRY after the track had been upgraded to Class 2.

At HCRY, only a very small number of rail joint defects identified through ultrasonic testing were immediately repaired. Instead, most of these defects remained in service and were to be monitored by ultrasonic hand test every 30 days. Repairs at these defect locations would only be performed if the condition was found to have worsened. In this occurrence, there was no indication that ultrasonic hand tests had been performed at the rail joint bolt hole crack locations following the July 2015 ultrasonic rail test. Between Mile 62.0 and Mile 179.0 of the subdivision, at least 272 bolt hole cracks (some up to 5 inches long) had remained in service and were unmonitored. If rail joints containing bolt hole cracks remain in service and are not monitored on a regular basis, the defect can increase in size undetected and result in cracks or breaks, increasing the risk of derailment.

2.6 *Automated joint bar inspection systems*

Automated joint bar inspection systems have been developed to help detect flaws at rail joints such as cracked or broken joint bars, missing bolts and other defects. These systems include

- a machine vision-based system for joint bar inspections; and
- a non-destructive inspection (NDI) ultrasonic system to detect flaws in the area of the joint bar.

At HCRY, while improvements were made to the track on the Webbwood Subdivision, joint maintenance continued to be a significant track issue. Automated joint bar inspection systems were not in use at HCRY. Instead, visual track inspections and ultrasonic rail testing (with its limitations to fully inspect rail joints) were normally conducted to identify joint defects. The use of automated joint bar inspection systems, in conjunction with walking visual inspections, improves joint inspection effectiveness and allows the railway to reduce the time between inspections, preventing defects from developing into hazards.

2.7 *Huron Central Railway track inspection and maintenance program*

Despite the extensive track restoration activities completed on the Webbwood Subdivision in 2014, there remained a number of issues relating to HCRY's track inspection and maintenance program, including the following:

- HCRY track inspectors had not received training on geotechnical issues, including drainage and maintenance requirements relating to drainage.
- Although there had been a history of track instability and frequent track maintenance in the derailment area, no attempt was made to understand the problem and to take more effective remedial action.
- The HCRY culvert inspection process was not effective. The effectiveness of this inspection process was compromised by the infrequent inspections, insufficient training and insufficient monitoring. In this occurrence, a culvert, which had been left in service in a degraded condition, failed prior to the next inspection.
- Slow orders were not being used at locations where there were multiple track or rail defects. For example, shortly after the occurrence, between Mile 71.0 and Mile 72.5, a walking inspection identified a total of 39 joint defects, including 10 cracked or broken joint bars, missing, loose or bent joint bolts, and broken or missing tie plates.
- HCRY was not performing walking joint inspections as outlined in CP's Red Book.
- Most of the rail joints with bolt hole cracks remained in service and were not being monitored. For example, between Mile 62.0 and Mile 179.0, there were at least 272 bolt hole cracks, with some up to 5 inches long.
- Most of the rail joints with missing bolts remained in service with no slow orders being imposed. For example, between Mile 77.03 and Mile 175.0, there were at least 221 joints with missing bolts. The bolts had likely been missing for some time before the derailment and had not been specifically noted during HCRY's track inspections.

HCRY's track inspection and maintenance program was not effective in dealing with various track infrastructure issues such as drainage, track instability, and rail joint defects.

2.8 Regulatory oversight

2.8.1 Ministry of Transportation of Ontario

As the Ministry of Transportation of Ontario (MTO) did not have the organizational structure or railway expertise to provide full regulatory oversight of its provincial railways, through an agreement with TC, rail safety inspections and the related regulatory functions were performed by TC. TC enforced the applicable federal laws and rules (including the TSR) in the same manner as they would apply to federally regulated railways, with the exception of being able to fine or prosecute under the *Railway Safety Act*. Similarly, the MTO, as the registrar for shortline railway licences, could revoke a railway's licence, but did not have the mechanism to fine or prosecute the railway.

Following inspections of the provincially regulated railways by TC through its Ontario Region office, the MTO was provided with the inspection reports and other communications sent to railways for corrective action. While this information was important in ensuring that the provincial shortline railways were operating within the regulations, the information was generally technical in nature and difficult to fully understand without having the requisite railway technical knowledge. Without internal technical railway expertise, the MTO had to rely solely on external resources to assess the fitness of provincial railways under its jurisdiction.

2.8.2 Transport Canada

To evaluate risk and to appropriately monitor railway operations, TC assigned risk profiles to the railways and each railway subdivision based on a number of factors, including track speed, the volume of dangerous goods transported, the volume of train traffic, accident history, track infrastructure/geometry information, and the results of various types of track inspections.

Due to the normally low risk profile of provincial shortline railways, TC Ontario Region had placed these railways on a 3- to 5-year inspection schedule. However, if it was determined that the risk profile of any provincial shortline was sufficiently elevated, that shortline railway would be included in TC's B-Component inspection and would be subject to more frequent regulatory inspections.

As per agreements with both TC and the TSB, the MTO advised its provincial railways to report all occurrences that meet TSB-reportable criteria to the TSB. However, at the time of this occurrence, of the 63 HCRY occurrences that met the TSB-reportable criteria since 2009, only 31 had been reported to the TSB. When TC conducted the risk assessment for HCRY, only the 31 reported occurrences would have been available and considered as part of the risks relating to previous accident history. In addition, TC did not have HCRY's track geometry and ultrasonic rail test results for consideration. Although track geometry and ultrasonic rail tests had been performed on the Webbwood Subdivision, the MTO did not request the information from HCRY. As this information was not made available to TC, it was not considered during TC's annual risk–based review to determine which subdivisions to inspect the following year.

With this additional information, HCRY's risk profile may have been sufficiently elevated to trigger more frequent TC inspections. If the information required for TC railway risk assessments is not accurate or available, a railway's risk profile may not be accurately depicted, increasing the risk that the type and frequency of regulatory inspections will not be sufficient to assess rail safety.

2.9 *Identifying emerging safety problems*

A good safety culture in a railway is part of an effective safety program and can help identify emerging safety problems and significantly reduce the number of accidents. The strength of an organization's safety culture starts at the top, and is characterized by proactive measures to eliminate or mitigate operational risks.

At HCRY, a track rehabilitation project completed in 2014 was an example where the railway was able to mitigate its operational risks. HCRY had received funding from the federal and provincial governments in 2010, allowing it to make track improvements. HCRY successfully completed this 5-year rehabilitation project to raise the track standards on the Webbwood Subdivision from Class 1 to Class 2.

Another operational decision relating to its track standards also characterized the safety culture at HRCY. As a provincial shortline in Ontario, the track on the Webbwood Subdivision had to meet the TSR standards. Moreover, HCRY also adopted CP's Red Book (which exceeded the requirements of the TSR in many areas) as an additional guidance document. This was a proactive decision that helped mitigate risks in a number of operational areas.

However, there were also indicators within HCRY operations and its safety culture where the implications for rail safety may not have been fully considered, including the following:

- In some situations where the Red Book guidance was deemed too costly or restrictive, HCRY would revert back to the requirements of the TSR. For example, the guidance in the Red Book indicated that all rail defects detected visually or by using rail flaw detector cars must be repaired within 30 calendar days, or a 10 mph speed restriction must be applied. For these defects, as permitted by the TSR, HCRY had intended, but failed, to monitor the defects every 30 days and repair them only if the condition worsened.
- HCRY's culvert inspection process had not been adequately implemented, particularly with respect to risk assessments. For example, the culvert inspection process was compromised by infrequent inspections, insufficient training and insufficient monitoring.
- HCRY had a safety management system (SMS) that was based on TC's *Railway Safety Management System Regulations, 2015* (SMS Regulations), including a process for managing railway occurrences. However, HCRY's approach to managing railway

> occurrences had not been effectively implemented, resulting in gaps for occurrence notification to external organizations. For example, of the 63 HCRY occurrences that met the TSB-reportable criteria since 2009, only 31 had been reported to the TSB at the time of this occurrence.

In today's rail environment, modern safety management practices must be embedded within an organization's management system so that the management of safety is integrated into day-to-day operations. If unsafe conditions are allowed to persist or are not effectively prioritized by the railway, an increased acceptance of such risks can result in all levels of the organization, reducing the effectiveness of the railway's SMS. Organizations that comply only with the minimum standards or do not fully collect and examine rail safety information, including rail occurrence data, are not well situated to identify emerging safety problems.

3.0 Findings

3.1 Findings as to causes and contributing factors

1. The 3 locomotives and first 8 cars of freight train SUSM-01 derailed at Mile 72.08 when the roadbed collapsed and the north rail joint broke apart under the train.
2. The second group of cars derailed due to the rapid buildup of longitudinal buff forces on the 5 empty cars near the middle of the train during the derailment sequence.
3. Drainage at the derailment location, which normally occurred from the south side to the north side of the track, had been restricted or completely blocked due to debris buildup within the culvert and/or culvert deformation.
4. The blocked culvert resulted in inadequate drainage during several days of rain, allowing water to pool and migrate through the railway embankment and to saturate the subgrade.
5. Water saturation within the embankment resulted in reduced cohesion and stability of the subgrade material, reducing the capacity of the track to support trains.
6. The unstable roadbed, in conjunction with the impact loading of car wheels that was magnified by the non-staggered joints, had produced increased deflections at the rail joints, initiating fatigue cracks within the joint bars.
7. With continued train operation on the unstable roadbed, joint bar fatigue cracks on the north rail joint increased in size.
8. When the freight train traversed over the track, the pre-cracked north rail joint failed due to an overstress fracture as the subgrade collapsed.
9. Huron Central Railway’s track inspection and maintenance program was not effective in dealing with various track infrastructure issues such as drainage, track instability, and rail joint defects.

3.2 Findings as to risk

1. If poor drainage conditions that affect track stability are not identified and mitigated in a timely manner, accelerated track structure degradation can occur, increasing the risk of derailments.
2. If track inspectors are not provided with appropriate training on precursor ground hazards, such as inadequate drainage, unstable ground conditions may not be detected in a timely manner, increasing the risk of derailment due to track conditions.

3. If culverts are not visually inspected on a periodic basis, conditions that impede water flow through the culvert can remain undetected, increasing the risk of roadbed saturation during periods of high water flow.

4. If rail joints containing bolt hole cracks remain in service and are not monitored on a regular basis, the defect can increase in size undetected and result in cracks or breaks, increasing the risk of derailment.

5. If the information required for Transport Canada railway risk assessments is not accurate or available, a railway's risk profile may not be accurately depicted, increasing the risk that the type and frequency of regulatory inspections will not be sufficient to assess rail safety.

6. If unsafe conditions are allowed to persist or are not effectively prioritized by the railway, an increased acceptance of such risks can result in all levels of the organization, reducing the effectiveness of the railway's safety management system.

3.3 *Other findings*

1. At Huron Central Railway, culvert condition ratings of 3 (poor) did not trigger more frequent detailed inspections to monitor the degrading condition of the culverts.

2. The use of automated joint bar inspection systems, in conjunction with walking visual inspections, improves joint inspection effectiveness and allows the railway to reduce the time between inspections, preventing defects from developing into hazards.

3. Without internal technical railway expertise, the Ministry of Transportation of Ontario had to rely solely on external resources to assess the fitness of provincial railways under its jurisdiction.

4. Although track geometry and ultrasonic rail tests had been performed on the Webbwood Subdivision, the Ministry of Transportation of Ontario did not request the information from Huron Central Railway. As this information was not made available to Transport Canada, it was not considered during Transport Canada's annual risk–based review to determine which subdivisions to inspect the following year.

5. Organizations that comply only with the minimum standards or do not fully collect and examine rail safety information, including rail occurrence data, are not well situated to identify emerging safety problems.

4.0 Safety action

4.1 Safety action taken

4.1.1 Huron Central Railway

Following the occurrence and subsequent inspection, slow orders were issued for any identified defects on the Webbwood Subdivision. Soon thereafter, the defects were repaired by Huron Central Railway (HCRY) and contractors. The slow orders were removed only after repairs were completed and inspected by a supervisor.

HCRY reinforced the joint bar and track bolt inspection and documentation process and added an auditing process to ensure that requirements will be met.

HCRY trained all of its maintenance-of-way (MOW) employees with regards to the changes in the Canadian Pacific Railway (CP) *Red Book of Track and Structures Requirements* (Red Book) and will ensure that future changes to the Red Book are implemented in a timely fashion.

HCRY made changes to its culvert maintenance program, including annual culvert inspections to more effectively manage risk. The track inspector training was adjusted to reinforce the need for culvert inspection and geotechnical hazard mitigation.

HCRY initiated a review of its occurrence reporting policies and requirements to ensure that proper reporting requirements are met.

HCRY added an additional assistant track supervisor to shorten inspection distances to facilitate more detailed inspections. HCRY management met with MOW employees to help ensure clear understanding of expectations, rule applications, policies and documentation.

4.1.2 Ministry of Transportation of Ontario

The Ministry of Transportation of Ontario (MTO) conducted a review of shortline railway safety oversight. The scope of this review included the program responsible for oversight of shortline railways and the *Shortline Railways Act* and related regulations, including

- improvements to the licensing regime for shortline railway operators, including reporting requirements; and
- better communications and data sharing between regulated railways, Transport Canada (TC) and the MTO.

In addition, the MTO took steps to build in-house capacity to coordinate external rail expertise, which should provide the Ontario Registrar of Shortline Railways with access to required technical knowledge and support.

This report concludes the Transportation Safety Board's investigation into this occurrence. The Board authorized the release of this report on 15 February 2017. It was officially released on 08 March 2017.

Visit the Transportation Safety Board's website (www.tsb.gc.ca) for information about the TSB and its products and services. You will also find the Watchlist, which identifies the transportation safety issues that pose the greatest risk to Canadians. In each case, the TSB has found that actions taken to date are inadequate, and that industry and regulators need to take additional concrete measures to eliminate the risks.

Appendices

Appendix A – Huron Central Railway reportable occurrences from 2009 to 2015

Date	Location	Summary	Reported to the TSB at time of occurrence
21 May 2009	Domtar spur	A locomotive derailed in passing track.	No
30 August 2009	Sault Ste. Marie Yard	Yard derailment.	No
07 November 2009	Mile 41.8	2 cars derailed at McKerrow.	No
12 December 2009	Mile 173.22	A vehicle struck the front of a locomotive; no damage to track or locomotive.	No
31 January 2010	Mile 180.41	A train struck a vehicle that did not clear the track; no injuries or damage.	No
20 February 2010	Shell plant	The B-end of a car derailed while shoving into the Shell plant.	Yes
20 June 2010	West leg of wye in Sault Ste. Marie Yard	The R1 wheel of locomotive 3010 derailed and continued for 30 feet.	No
07 July 2010	Mile 21	The Espanola switcher derailed 6 cars due to wide gauge and heat.	Yes
09 September 2010	Sault Ste. Marie Yard	2 cars derailed in Sault Ste. Marie Yard.	Yes
10 September 2010	Mile 131.80	11 cars derailed at the west siding switch at Thessalon.	Yes
11 September 2010	Espanola Domtar	While shoving into facility at Espanola, a car derailed and then re-railed itself.	Yes
27 September 2010	Wye at McKerrow	2 locomotives derailed in the west leg of the wye track.	Yes
17 October 2010	Sault Ste. Marie Yard	4 yard locomotives derailed while coupling in Sault Ste. Marie Yard.	Yes
22 October 2010	Sault Ste. Marie Yard	2 yard locomotives derailed while coupling in Sault Ste. Marie Yard.	Yes
03 March 2011	Shell spur	A car derailed because the derail had not been set in the non-derailing position.	No
11 April 2011	McKerrow	2 locomotives and 1 car derailed while operating in the east leg of the wye at McKerrow.	Yes
09 May 2011	Espanola	A locomotive derailed at Domtar.	No
03 June 2011	Sault Ste. Marie Yard	A car loaded with logs caught fire due to vandalism.	No
05 July 2011	Sault Ste. Marie Yard	A car derailed over a broken rail near the Canadian National interchange.	No
25 July 2011	Sault Ste. Marie Yard	2 cars derailed due to a run-through switch.	No
07 August 2011	Sault Ste. Marie Yard	A locomotive derailed due to worn flange.	No

Date	Location	Summary	Reported to the TSB at time of occurrence
22 September 2011	Sault Ste. Marie Yard	3 cars derailed in Sault Ste. Marie Yard.	No
23 November 2011	Espanola	3 cars derailed on the River track on the Domtar spur.	No
23 January 2012	Sault Ste. Marie Yard	A car derailed when the air brake hose got caught in the flangeway.	No
31 January 2012	Sault Ste. Marie Yard	A car derailed on the shop lead due to wide gauge.	No
06 March 2012	Massey	A train encountered the east siding switch Massey in the reverse position.	Yes
22 April 2012	Sault Ste. Marie	A yard switcher struck a vehicle at the Bruce Street crossing; no injuries.	Yes
24 April 2012	Sault Ste. Marie	A locomotive derailed due to a wheel flange problem; fuel spilled due to a punctured fuel tank.	Yes
28 May 2012	Mile 62.54	A work train struck a vehicle while reversing over the crossing; no injuries.	Yes
24 June 2012	Sault Ste. Marie Yard	2 locomotives derailed in the rip track due to wide gauge.	No
26 June 2012	Sault Ste. Marie Yard	A car loaded with logs caught fire; suspected arson.	No
30 November 2012	Espanola	2 cars loaded with logs derailed at the Domtar mill due to wide gauge.	No
10 December 2012	Sault Ste. Marie	A vehicle slid onto the track and was struck by a train reversing over the Huron Street crossing; no injuries.	No
24 December 2012	Mile 99.9	A track unit struck a vehicle at the Beach Street crossing in Blind River.	No
11 February 2013	Sault Ste. Marie Yard	A locomotive derailed due to vandalism.	No
19 February 2013	Mile 143.7	The SMSU train derailed 1 locomotive over the crossing while proceeding.	Yes
17 March 2013	Sault Ste. Marie	The SMSU train struck a pickup truck at the Simpson Street crossing; no injuries.	Yes
23 March 2013	Sault Ste. Marie Yard	A cut of cars rolled uncontrolled and derailed over a derail due to improper securement.	No
08 April 2013	Sault Ste. Marie Yard	A vehicle struck a rail car on a train shoving into the Shell spur.	No
05 May 2013	Mile 156.7	2 locomotives and 9 cars derailed due to a broken rail on the main track.	No
10 September 2013	Mile 127.5	A locomotive derailed while operating over a washout.	Yes
28 November 2013	Mile 60.05	An all-terrain vehicle struck a train along the right-of-way.	Yes

Date	Location	Summary	Reported to the TSB at time of occurrence
01 February 2014	Domtar spur	A locomotive derailed on the Domtar spur passing track.	No
11 March 2014	Mile 143.97	The SMSU train struck a tractor-trailer at the Bruce Mines crossing; no injuries.	Yes
14 April 2014	Mile 30.20	3 locomotives and 1 car derailed at a track washout.	Yes
17 June 2014	Sault Ste. Marie Yard	A locomotive derailed over a switch that had been vandalized.	No
07 November 2014	Domtar spur	3 cars derailed in a customer facility due to wide gauge.	Yes
10 December 2014	Sault Ste. Marie	A train struck a vehicle at the John Street crossing; no injuries.	Yes
17 December 2014	Sault Ste. Marie	The SUSM train struck a vehicle at the Moccasin Road crossing; no injuries.	Yes
20 December 2014	Domtar spur	2 cars derailed while spotting at the Domtar plant.	Yes
21 January 2015	Webbwood	An improperly secured car in the siding at Webbwood ran uncontrolled and collided with a train on the main track; 1 car derailed.	Yes
20 February 2015	Mile 38.81	A train struck a pickup truck at the crossing; no injuries.	Yes
06 March 2015	Sault Ste. Marie Yard	A car derailed on the track 13 lead.	No
11 April 2015	Sault Ste. Marie Yard	A car derailed near the Canadian National interchange.	No
23 May 2015	Domtar spur	A locomotive derailed due to wide gauge.	No
13 June 2015	Mile 21	14 cars derailed on the main track.	Yes
13 June 2015	Sault Ste. Marie Yard	2 locomotives derailed in the yard.	No
20 June 2015	Mile 164.13	A work train struck a pedestrian at the Highway 638 crossing; serious injuries.	Yes
18 August 2015	Sault Ste. Marie Yard	A yard crew derailed 3 cars while pulling into siding.	Yes
01 November 2015	Mile 72	The SUSM train derailed 13 cars and 3 locomotives at Spanish.	Yes
04 November 2015	Domtar spur	2 locomotives derailed on the River track at Espanola.	No
17 November 2015	Sault Ste. Marie	The SMSU train struck a vehicle at the South Market Street crossing; no injuries.	Yes
24 December 2015	Sault Ste. Marie	A light engine movement was struck by a vehicle at the Bruce Street crossing; no injuries.	Yes