

Transportation Safety Board
of Canada



Bureau de la sécurité des transports
du Canada

**RAILWAY INVESTIGATION REPORT
R13W0260**



EMPLOYEE FATALITY

**CANADIAN NATIONAL RAILWAY
TRAIN L586 41-18
MILE 61.0, TISDALE SUBDIVISION
TISDALE, SASKATCHEWAN
18 NOVEMBER 2013**

Canada

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

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Summary

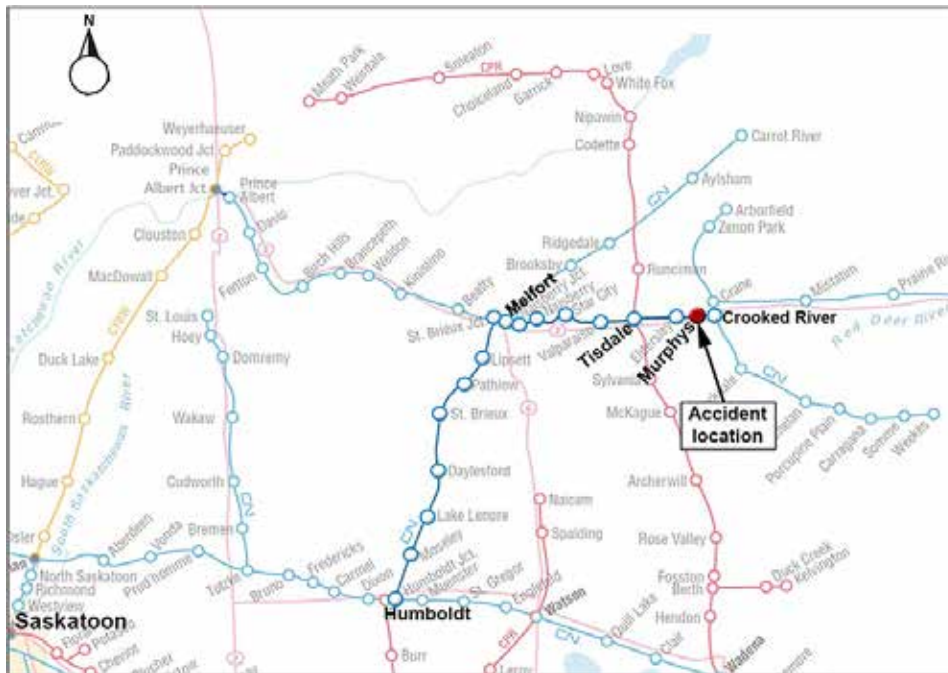
On 18 November 2013, Canadian National Railway freight train L586 41-18 was switching into the Murphys interchange track at Mile 61.0 of Canadian National Railway's Tisdale Subdivision, near Tisdale, Saskatchewan. At about 1818 Central Standard Time, during the hours of darkness, while reversing westward at approximately 12 miles per hour, the train struck and seriously injured a conductor trainee. The employee was transported by ambulance to hospital, but succumbed to his injuries during transport.

Le présent rapport est également disponible en français.

Factual information

On 18 November 2013, Canadian National Railway (CN) freight train L586 41-18 (the train) was en route from Humboldt, Saskatchewan, to switch cars at Murphys, Saskatchewan, just east of Tisdale, Saskatchewan, on the main track of the Tisdale Subdivision (Figure 1).

Figure 1. The accident location (Source: Railway Association of Canada)



The train crew comprised

- a locomotive engineer, who was new to the territory;
- a pilot locomotive engineer,¹ who was familiar with the territory and was to work alongside and provide guidance to the locomotive engineer;
- a conductor trainee (trainee), who was new to the territory, had limited yard experience and had yet to fully qualify as a conductor (which would allow him to work independently without a trainer); and
- a conductor, who was familiar with the territory and was providing on-the-job training to the trainee.

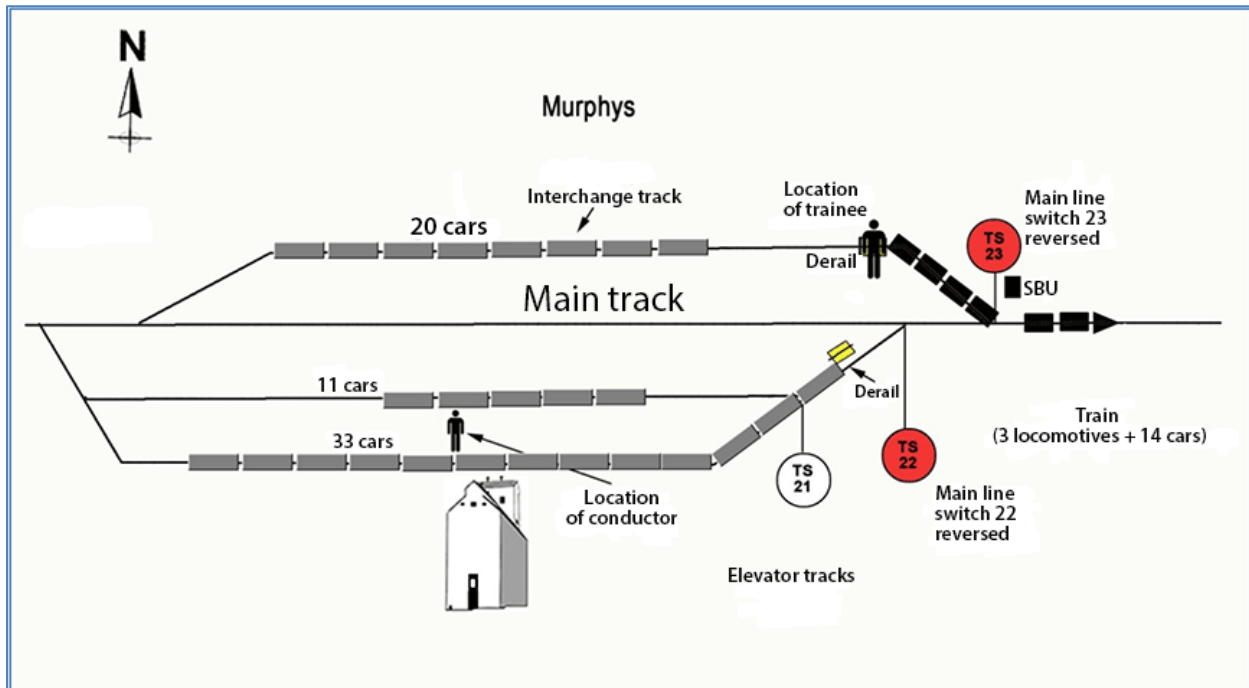
¹ A pilot locomotive engineer is a fully qualified locomotive engineer who is familiar with the territory and who provides familiarization training to another fully qualified locomotive engineer who is new to the territory.

The crew members were qualified for their respective positions and met established rest and fitness requirements. Each crew member had had sufficient rest on the day before the accident. On the day of the accident, the crew came on duty at 0900. The crew members had planned to complete the switching at Murphys by about 1830. They would then turn the train around (wye) at Crooked River, Saskatchewan, and return to Melfort, Saskatchewan, by about 2030. While en route, the crew was instructed to lift an additional 14 high-priority, empty, covered hopper cars at Melfort. These cars were to be transported to Tisdale for set-off.

Upon arrival at Tisdale, the crew members noted that the cars they had picked up in Melfort consisted of 1 empty and 13 loaded cars, rather than all empty cars as originally instructed. After completing other switching activities at Tisdale, the crew was instructed to hold on to the 14 cars and to bring them back to Melfort on the return trip. The 14 cars remained positioned at the head end of the train as it continued its trip to Murphys. Departing Tisdale, the train comprised 3 locomotives and 78 cars (now 13 loaded cars and 65 empty cars). It weighed approximately 4500 tons and was about 4300 feet long.

The accident

Figure 2. Diagram of the accident site, showing locations of the conductor, the trainee, and the train components and derrails.



Upon arrival at Murphys (Mile 61.0), the following events occurred² (Figure 2):

1730: Just prior to arriving there, a job briefing was conducted between the conductor and trainee regarding the work to be performed at Murphys. The conductor agreed to look after the elevator tracks, while the trainee would attend to the interchange track.

² All times are Central Standard Time and are approximate.

- 1735: The train arrived at the east end of Murphys. The conductor detrained in the vicinity of the elevator in order to spot the empty grain cars, while the trainee detrained at the east end mainline track switch TS 23 (switch TS 23). The conductor's tasks in spotting the cars included operating a derail, operating a switch, walking 3600 feet of train, spotting the cars set off, applying hand brakes and, since the trainee was out of visual range, monitoring the trainee by radio.
- 1740: The trainee removed the sense-and-braking unit (SBU) from the tail end of the train and placed it on the north side of the interchange track, near switch TS 23. The SBU was to be placed on the tail end of the train after setting off the required empty cars.
- 1742: The trainee reversed³ switch TS 23 and removed the derail on the interchange track, located just north of the main track, in preparation for setting off 20 empty cars.
- 1747: The 20 empty cars were set off, and the trainee secured the cars with the required number of hand brakes. The hand brakes were then tested for effectiveness in accordance with *Canadian Rail Operating Rules* (CROR) 112. After the train left the interchange track, the trainee placed switch TS 23 in the normal⁴ position for main track movement.
- 1757: The conductor reversed mainline track switch TS 22⁵ (switch TS 22) and removed the derail for the elevator tracks (i.e., track TS 21 and track TS 22 [Photo 1], located south of the main track) in preparation for spotting 44 empty grain cars onto the elevator tracks. The conductor was positioned at the east end of track TS 21 to make the cut after the first 11 cars were set off in track TS 21, and in preparation for setting off the remaining 33 cars in track 22.

All cars set off in the elevator tracks were spotted and secured by the conductor, while the trainee returned to the main track with the 14 remaining cars.

The trainee had planned to place the SBU on the tail-end car of the 14 cars, which were now on the main track adjacent to switch TS 23, and to then place switch TS 22 in the normal position and apply both derails to protect against unintended movement of the cars they had just spotted.

³ A railway term used to describe the act of turning a switch to its "reverse" position, whereby the switch is aligned against the main or lead track in order to access a siding or secondary track.

⁴ A railway term used to describe the act of turning a switch to its "normal" position, whereby the switch is aligned for the main or lead track.

⁵ Mainline track switch TS 22 is located approximately 282 feet west of mainline track switch TS 23.

Photo 1. Mainline track switch TS 22 in the normal position



1816: The trainee informed the rest of the crew (by radio) that he was about to place the SBU on the tail-end car. Before continuing with the task, the trainee was instructed by the conductor via radio to place the main track switch (TS 22) in the normal position in preparation for a reverse movement of 20 car lengths to pick up the conductor.

The trainee was also instructed to place the SBU into the locomotive, rather than attaching it to the tail-end car. The crew had planned to take the remaining 14 cars further east to Crooked River, where the locomotives would be turned and placed on the opposite end of the train, and the SBU would be placed on the new tail-end car, prior to returning the 14 cars to Melfort.

To complete this task, the trainee needed to line switch TS 22 to the normal position in order for the train to reverse on the main track and pick up the conductor.

1817: Instead of lining TS 22, the trainee inadvertently reversed switch TS 23, which lined it for the interchange track, and then reported (on the radio) that the mainline switch had been lined and locked in the normal position for the main track. The crew acknowledged the radio transmission as required. However, the entire crew was unaware that the train was being routed into the wrong track.

The trainee then directed the train to back up 20 cars and notified the conductor, who was located west of the trainee at the elevator tracks, that the cars were coming toward the conductor. The conductor acknowledged this radio transmission.

1818: With switch TS 23 set in the reverse position, the train reversed into the interchange track instead of reversing westward on the main track.

The trainee was positioned between the rails of the interchange track (i.e., track TS 23) with his back to the train as he worked to secure the derail, which was located between

the rails. Unaware of the train's approach, the trainee was struck by the train and sustained serious injuries. After striking the trainee, the train coupled heavily to the cars that had been set off on track TS 23. The loud noise alerted the crew in the area that something may be wrong. At about the same time, the trainee broadcasted over the radio that he was hurt. The pilot locomotive engineer detrained and located the trainee. While providing comfort and emergency first aid, the pilot locomotive engineer notified the rest of the crew to stay clear and to initiate an emergency call for immediate medical assistance. Subsequently, the trainee was transported by ambulance to a hospital in Tisdale, but succumbed to his injuries while en route.

At the time of the accident, the temperature was $-9.6\text{ }^{\circ}\text{C}$ ($-15\text{ }^{\circ}\text{C}$ with wind chill), and the wind was from the west at 11 km/h. Sunset occurred at 1710 that day.

Subdivision and track information

The Tisdale Subdivision consists of a single main track that extends from Hudson Bay, Saskatchewan (Mile 0.0), to Letain, Saskatchewan (Mile 101.0). Train movements on the subdivision are operated under the Occupancy Control System, as authorized by the CROR and supervised by a rail traffic controller (RTC) located in Edmonton, Alberta. Some sections of track, including Murphys, were being operated as subdivision track. Subdivision track is a non-main track that is operated as a main track in accordance with the instructions contained in the railway timetable.⁶ Rail traffic consisted of about 1 freight train per day.

In the vicinity of the accident, the track is Class 2. The track is oriented in an east-west direction, with a maximum allowable speed of 25 mph. The Murphys elevator tracks (i.e., tracks TS 21 and TS 22) run parallel to the main track on the south side. The interchange track (i.e., track TS 23) runs parallel to the main track on the north side. At Murphys, empty cars were spotted and loaded cars were lifted about once per week.

The rail on the interchange track is a mixture of 80-pound and 85-pound rail, manufactured between 1905 and 1950. The ties are a mix of no. 1 and no. 2 softwood ties, with 11-inch single and double shoulder tie plates secured with 2 spikes per plate. The ballast was pit run gravel. The derail on the interchange track was a model EB no. 5, manufactured by Hayes. As per CN's standard practice circular (SPC) and the manufacturer's specifications, the derail was installed between the rails with no tie plates, and secured to the ties with lag screws.

The track had been inspected in accordance with company and regulatory requirements, and no track defects had been noted in the vicinity of the derail.

⁶ Subdivision track is defined by the *Canadian Rail Operating Rules* (CROR) as a "Non-Main Track so indicated in the time table method of control column that is an extension of the main track, and the through track at that location, defined with subdivision mileage signs. REDUCED speed is applicable to a maximum speed as indicated in the time table." (Transport Canada, TC O-0-167, *Canadian Rail Operating Rules* [CROR], Definitions.)

Canadian Rail Operating Rules and Canadian National Railway general operating instructions for switching operations

The following CROR rules and CN general operating instructions (GOIs) outline the procedures to be used in order to safely perform switching operations. CROR 104(b) states the following, in part:

[...] When a switch has been turned, the points must be examined and the target, reflector or light, if any, observed to ensure that the switch is properly lined for the route to be used.⁷

CN's special instructions regarding CROR 106 state the following:

PEER-TO-PEER COMMUNICATIONS BETWEEN CREW MEMBERS

[...]

SWITCHES Plan the Movement:

1. Ensure the intended route is clear.
2. Visually check the switch target(s) to confirm the switch(es) are lined for the intended route. If in doubt also confirm the position of the switch points.
3. When a switch is lined by hand, confirm both the position of the points and the target.

Communicate During Movement:

1. Communicate with other crew members the switch position and track designation, prior to the movement. eg... "CN 5226, the switch is lined into Track CF 45, bring them ahead 10 cars."
2. Another crew member must repeat this information and any other instructions. Employee initiating will confirm with "5226, that is correct," before movement begins.

DERAILS

Plan the Movement:

1. Always confirm the derail is in the non-derailing position (off) prior to the intended movement and restored to derailing position and locked when no longer in use.

Communicate During Movement:

1. Communicate the position of the derail: "CN 5226 derail is off, bring them ahead 10 cars".
2. Another crew member must repeat this information and any other instructions. Employee initiating will confirm with "5226, that is correct," before movement begins.⁸

⁷ Transport Canada, TC O-0-167, *Canadian Rail Operating Rules (CROR)*, 104 – Hand Operated Switches: General, (b).

Item 4.5.2 of Section 8 – Safe Work Procedures in CN’s GOIs states the following:

4.5.2: Walk clear of tracks when duties permit. Employees, contractors and others who must walk on or near the track must be constantly alert and use good judgment. Expect the movement of a train, engine, car or track unit at any time, on any track, and in either direction.⁹

Item 12.8 (Hand-Operated Derails), states, in part:

PURPOSE:

Derails are installed to protect against unintended movement of equipment. They must be secured in the derailing position whenever the track on which they are installed is not in use. This procedure identifies steps to follow to ensure derails are handled safely.

PROCEDURE:

1. Determine whether track to be used has a derail. In Canada, this can be ascertained by:
 - derail sign adjacent to the derail;
 - special instructions (e.g. bulletin, Timetable footnote, yard manual).
2. Ensure derail is clear of debris.
3. Look in both directions to ensure no rolling stock is approaching on adjacent tracks prior to operating a derail.
4. Set the derail in non-derailing position: unlock and remove switch lock; when operating flop type derails,
 - bend knees, keep back straight;
 - use leg muscles to lift derail;
 - keep feet clear;
 - carefully drop derail between the rails.

When operating switch stand derails (split point, slide type):

- firmly grip the end of the derail switch handle with both hands;
 - throw derail exerting a steady pull until derail is in place.
5. Place derail back in derailing position by:
 - Ensuring rail (on which derail will rest) is clear of debris or obstructions.
 - Ensuring your hands, feet, and body are clear of derail rotation path.
 - Looking in both directions to ensure that no equipment will interfere.

⁸ Canadian National Railway (CN), CN CROR (15 February 2013), CROR Rule 106 Special Instructions, pp. 50–51.

⁹ Canadian National Railway (CN), CN General Operating Instructions (GOI), CN Safety Rules (December 2009), Section 8 – Safe Work Procedures, 4.5.2.

- Placing the derail in the derailing position using the leg muscles to do the lifting, while ensuring knees are bent and back is straight.¹⁰

Railway Employee Qualification Standards Regulations

The *Canada Transportation Act* details the *Railway Employee Qualification Standards Regulations* (the Regulations) (SOR/87-150), which state the following, in part:

GENERAL

[...]

5. (1) No railway company shall permit any employee to work as a locomotive engineer, transfer hostler, conductor, or yard foreman unless the employee
 - (a) has qualified for that occupational category in accordance with section 14; and
 - (b) in the case of a locomotive engineer or transfer hostler, has received a passing mark for on-job training in that occupational category.
6. A railway company shall provide to its locomotive engineer candidates and transfer hostler candidates sufficient on-job training in respect of the required subjects to enable them to demonstrate to instructors and examiners that they are competent to perform their required duties.
7. No examiner shall issue a passing mark for on-job training to a locomotive engineer candidate or transfer hostler candidate unless the examiner
 - (a) is satisfied that the candidate is competent to perform his required duties by
 - (i) obtaining an evaluation of the candidate's competency from the locomotive engineer or transfer hostler with whom the candidate has made student on-job training trips, and
 - (ii) assessing the candidate's competency in actual locomotive or train operation, or both, depending on the requirements of the occupational category for which the candidate is being examined; and
 - (b) has completed, signed and placed on the candidate's personnel file a document indicating that the candidate has passed the on-job training.
8. An examiner shall determine the overall mark for a candidate based on written or oral classroom examinations, or both, dealing with the required subjects.
9. An employee undergoing on-job training in order to qualify as a locomotive engineer or transfer hostler may perform the duties of the occupational category for which he is a candidate under the direction of an on-job training instructor for the duration of the employee's training period.

[...]

TRAINING PROGRAMS AND CONSULTATION

¹⁰ Ibid., 12.8 – Hand-Operated Derails, pp. 35–36.

19. (1) A railway company shall establish employee training programs for each occupational category.

(2) A railway company shall establish and modify its employee training programs in consultation with the trade unions representing its employees in the occupational categories.

(3) Within 90 days after the coming into force of these Regulations, a railway company shall file with the Committee¹¹ a description of all employee training programs relating to each occupational category.

(4) Within 90 days after any change is made to an employee training program required by subsection (1), a railway company shall file with the Committee a description of the change.

REPORTING

20. (1) For each calendar year a railway company shall submit to the Committee, not later than March 31 of the following year, a comprehensive report on its employee training programs.

(2) A report referred to in subsection (1) shall specify:

- (a) the total number of employees in each occupational category;
- (b) the total number of employees who received training in each occupational category;
- (c) the number of employees who received training and met the training requirements for each category and the number who failed to meet the training requirements; and
- (d) any new or improved techniques or devices adopted in the company's employee training programs.¹²

Once railway companies have satisfied the training, consultation and reporting requirements of the Regulations, Transport Canada (TC) provides no further review of the material or programs in place for the training of railway operating employees. In addition, in contrast to the requirement for operating employees undergoing training to become locomotive engineers or transfer hostlers, the Regulations contain no requirement for a conductor trainee to work under the direction of, or remain in close proximity to, an on-the-job training instructor for the duration of the employee's training period.

¹¹ Canadian Transport Commission

¹² *Canada Transportation Act, SOR/87-150, Railway Employee Qualification Standards Regulations* (current to 26 November 2013).

Proposed minimum qualification standards for railway employees

On 23 June 2009, TC approved *Rules Respecting Minimum Qualification Standards for Railway Employees* (the Rules) which were to come into force once the *Railway Employee Qualification Standards Regulations* were repealed. The Rules specify (in part) that:

- 4.7 No railway company shall permit any employee to work in an occupational category unless the employee has qualified for that occupational category.
- 4.8 Notwithstanding the requirements of section 4.7, an employee undergoing on-job training may perform the duties of the occupational category for which they are a trainee under the direction of an on-job training instructor.¹³

Under the new Rules, conductor trainees would also receive on-the-job training under the direction of a training instructor for the duration of the training period. To date, the Regulations remain in force, and the new Rules do not yet apply.

Canadian National Railway conductor trainee program

Before 1995, it took over 2 years to become a fully qualified conductor at CN. The training program began with classroom training on rules and instructions to qualify as a brakeman/assistant yard conductor. This component typically took about 3 months to complete. It was followed by 2 years of practical training, during which a brakeman/assistant yard conductor would work as a member of a 3-person crew, under the guidance of a qualified conductor and locomotive engineer. During this practical component, the brakeman/assistant yard conductor would normally experience numerous situations that would serve to reinforce safe work practices and the practical application of the CROR. On completion of the training, a brakeman/assistant yard conductor was required to pass a rules examination to qualify as a conductor.

Since 1995, the conductor trainee program at CN has been progressively shortened to the present 17- to 20-week program. However, some trainees receive incentives to train for 6 or 7 days straight during the 45-day trial trip portion of the training, and may qualify in less than 17 weeks.

Since 2012, the Teamsters Canada Rail Conference (TCRC) union has been involved in making recent changes to the Conductor Intensified Field Training program (“Boot Camp”) and the trainer/trainee evaluation process.

CN’s present accelerated conductor training program is structured as follows:

- An employee must first attend a 3-week classroom course, where instruction is provided on portions of the CROR, Qualification Standards for Operating Crews (QSOC), and CN GOIs.

¹³ Transport Canada, TC O 0-102, *Rules Respecting Minimum Qualification Standards for Railway Employees* (23 June 2009), 4.7 and 4.8.

- After completing the initial 3 weeks, conductor trainees attend Conductor Intensified Field Training (Boot Camp) for an additional 2 weeks. This training is held in a train yard, where a trainee is accompanied by an instructor who is either an on-the-job trainer,¹⁴ a manager, or an operating practices officer.
- During this practical training, a conductor trainee learns how to apply the CROR and GOIs that were learned in class. The practical training typically covers pre-departure requirements, radio rules, and en-route rules, involving communications, switching activities, securing equipment, riding equipment, entraining, detraining, coupling air hoses, shoving equipment, and lining switches.
- To successfully pass this part of the training, each trainee's performance is evaluated by the instructor who fills out a checklist detailing levels of success. Instructor notes are also taken to address any shortcomings the trainee may have. There is no specific pass mark for this part of the course. The information is not required to be communicated to the instructor who delivers the next round of training to facilitate future improvement.
- Upon successful completion of boot camp, the trainees return to the classroom for an additional 2 weeks of CROR and QSOC instruction. The course concludes with a final written exam that requires a mark of at least 90% to pass.
- Once the final exam is passed, conductor trainees attend 1 week of beltpack training.
- Following beltpack training, conductor trainees must accompany qualified conductors on a minimum of 45 trips (30 road and 15 yard).

For the qualifying trips, CN has no written policies or guidelines in place that specify proximity requirements between the conductor and the trainee while they perform switching operations. Conductor trainees are sometimes permitted to perform the duties of a regular crew member without direct supervision. This performance can be challenging for a trainee who, in many cases, is still learning the proper application of operating rules and instructions while becoming familiar with a new territory.

The conductor who provides the supervision must complete evaluation review sheets for each trip, documenting the trainee's performance on up to 65 different operational tasks. At the end of the trip, the evaluation is captured electronically. Once a conductor trainee completes the required number of qualifying trips, the evaluations are reviewed by the on-the-job-trainer, who then decides whether the trainee is qualified to work as a fully qualified conductor. A Transportation Safety Board (TSB) review of CN's present accelerated conductor training program revealed the following:

- The initial 2 weeks of observation trips with a qualified conductor have been cut.
- Recently qualified (i.e., less experienced) conductors are permitted to train new hires.
- Some conductors, who are providing on-the-job supervision, are not completing the evaluation review sheets for trainees. In this occurrence, the trainee had received evaluations on 44 of the 57 trips he had completed.
- Instead of having 1 dedicated trainer for a conductor trainee for the duration of the training, a number of conductors act as trainers.

¹⁴ An on-the-job trainer is an experienced employee who is designated by the company to provide assignments and trainers for a trainee.

- There is no requirement that a trainer be briefed on any potential shortcomings that may have been identified previously regarding a newly assigned trainee.
- Conductors (unlike locomotive engineers) are not required to become familiar with the territory before working unsupervised.
- The on-the-job-trainer or trainmaster does not ride along on trips to evaluate actual trainee performance.

The trainee

The trainee was reportedly a good employee with a good work record, who had recently joined CN and had moved to Saskatchewan from Nova Scotia. He had successfully passed a 7-week conductor trainee course and had completed 57 road trips with 6 different trainers, but had not yet completed the yard-training practical component. Three of the trainee's road trips in September 2013 had been to Murphys. The trainee was evaluated on 44 of the 57 trips. While the evaluations were generally favourable, there were 5 comments, provided by 2 different trainers, that identified that the trainee had difficulty with switching activities and working on his own, and that he required more work to learn the territory. While some trainers discuss observations and comments with trainees, others do not.

While the CN Student Conductor Trip Structure Job Aid (published in April 2013) encourages trainers to complete the comments/suggestion section of the evaluation, there is no requirement for the next trainer to review them. Trainees are required to provide a copy of their evaluations to new trainers, but this was not a common practice and did not occur in this instance.

Mental model and situational awareness among operating crews

Situational awareness (SA) in relation to operational matters refers to the operator's perception of what is happening in the immediate environment. There are 3 levels of SA:¹⁵

- Perception is the ability to recognize that new cues exist. Some cues are clear; others are ambiguous.
- Comprehension is the ability to understand the order of importance of new cues.
- Projection is the ability to forecast future events based on current information.

A train crew's SA while performing switching activities comes from various information sources. These sources can include radio transmissions, on-site crew-to-crew conversations, observations of the track, the switch and target position, and the equipment. The crew's decisions and actions depend on its members' assessment and understanding of what is required, and their ability to select the appropriate course of action based on their SA.

The overall understanding of a situation is based on experience and knowledge of how something works, resulting in a mental model. Mental models are partial representations of complex situations and are created to achieve specific goals by filtering inputs and using what is perceived to be the most critical information. It is difficult to alter a mental model once it has been developed, particularly in a short period of time. For one's thinking to change, the existing

¹⁵ M.R. Endsley and D.J. Garland, *Situation Awareness Analysis and Measurement* (Mahwah, NJ: Lawrence Erlbaum Associates, Inc., 2000).

model must be superseded by another mental model; this change occurs when new information is sufficiently compelling to update the existing model.

Effective SA is highly dependent on switching attention between different information sources. People can get trapped in a phenomenon called attention narrowing or tunnelling, whereby they lock onto certain aspects of information, and may then either intentionally or inadvertently stop their scanning behaviour. When this occurs, their SA may be very good with respect to what they are concentrating on, but will quickly become outdated with respect to the aspects they have stopped attending to. Focusing on certain information and not reinstating information-scanning activity can result in inaccurate SA. Therefore, keeping a high-level understanding of what is happening is a prerequisite to being able to know what factors are more important than others. Otherwise, neglected information will result in an inaccurate SA.¹⁶

Manual derails

A derail is a device that is designed to intentionally derail rolling stock in order to

- protect against an uncontrolled movement rolling out onto, or becoming foul, of another track;
- limit the movement of railway equipment in order to prevent injury of employees working on a track; or
- prevent damage to other equipment and structures.

While in position, a derail lifts the flange of a wheel up, deflecting the wheel laterally to drop clear of the rail head on the field side of the track. An unintended movement is stopped when the wheels become imbedded in the track ballast. There are 3 primary types of derails:

- Hinged derails are located between the rails (Figure 3). To operate them, particularly in situations that require the clearing of ice or snow, an employee usually works by standing between the rails and lifting the derail by hand in a semi-circular motion on and off the rail head.
- Sliding derails are also located between the rails, but are operated from an operating lever and stand that is mounted outside of the rails (Figure 4). For this derail design, employees operate the derail while standing clear of the track.
- A switch point derail (Photo 2), sometimes referred to as a split switch derail, is a track switch installed at the derail location. The switch point derail can be operated as a power derail or as a conventional hand-operated derail. In both cases, the switch is activated from outside the track just as a regular track switch would be. However, there is no track extending from the diverging route. When the switch point derail is in the derailing position, rail cars are diverted directly to the roadbed.

¹⁶ Mica R. Endsley, Betty Bolté and Debra G. Jones, *Designing for Situation Awareness: An Approach to User-Centered Design* (Taylor and Francis: London, UK, 2003).

Figure 3. A model EB hinged derail, mounted between the rails, in derailing position

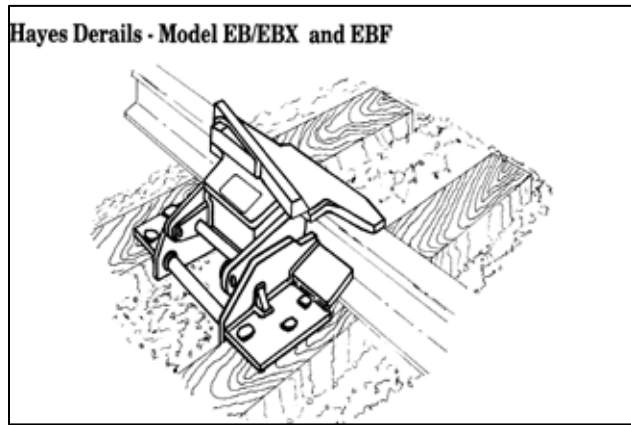


Figure 4. A model HB sliding derail, with the operating stand mounted on 2 ties outside the rails, in the derailing position

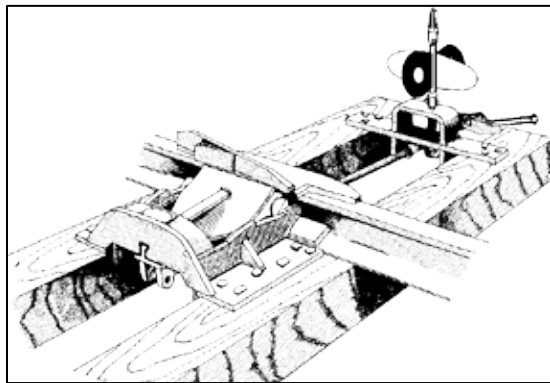


Photo 2. A switch point derail operated by a power switch



CN's June 2011 Track Standard document (Section 3.2 – Derails) provides a list of approved derails to be installed on CN territory. This list includes the following:

- Hinge type derail, Hayes Model EB, drawing TS 2208
- Sliding type derail, Hayes Model HB, drawing TS 2209
- Switch point derail, drawing TS 2210.

At Murphys, hinged derails were installed on both the interchange track and the elevator tracks.

Analysis

No track or equipment deficiencies were found to have contributed to the accident. The analysis will focus on situational awareness, the application of operating rules/instructions without adequate supervision, conductor training, the manual operation of derails, and regulatory overview.

The accident

The accident occurred while the trainee was securing a derail mounted between the rails on track TS 23, with his back to the train. Unaware of its approach, the trainee was struck by the train. The crew reacted quickly and took care to provide comfort and emergency response under difficult circumstances. However, the trainee succumbed to his injuries while being transported to hospital.

The trainee had returned to the north side of the interchange track to pick up the sense-and-braking unit (SBU), which he had left near switch TS 23. The trainee had intended to place the SBU on the tail-end car, which was now on the main track adjacent to switch TS 23, and then place switch TS 22 in the normal position and apply both derails to protect against unintended movement of the cars that had just been spotted at Murphys. While this work plan was reasonable considering the original consist, the plan had changed due to the addition of the 14 cars that had to be returned to Melfort. As a result, after communicating his intention to the rest of the crew, the trainee was instead instructed to leave the SBU and place the main track switch (TS 22) to the normal position, allowing the train to reverse westward and pick up the conductor at the elevator. To complete this task, the trainee would need to line main track switch TS 22 to the normal position.

However, the trainee's actions suggest that his mental model of the work plan had already been formed and was fixated at his location, north of the main track, which affected his situational awareness. Consequently, he did not recognize that main track switch TS 22 was 282 feet west of his location, did not pay full attention to the switch he was lining, and did not ensure that the switch points and target were properly lined for the main track. The required switching tasks likely conflicted with the trainee's mental model and, instead of lining main track switch TS 22 to the normal position, the trainee inadvertently reversed the nearest main track switch (TS 23) and lined it into the interchange track where he was working.

In accordance with operating procedures, the trainee had reported that the main track switch was lined and locked in the normal position for the main track, and the radio transmission was properly acknowledged by the crew in the locomotive. The trainee then requested that the train reverse 20 cars and instructed the conductor, located at the elevator, to protect the tail end of the movement. The conductor properly acknowledged this request, and the movement commenced. Because the trainee had inadvertently reversed switch TS 23 and mistakenly reported the mainline switch as lined and locked in the normal position for the main track, the entire crew was unaware that the train was not following its intended route. This situation demonstrates that, if a loss of situational awareness occurs, administrative defences such as rules and procedures may not always protect against switching errors, which increases the risk of an accident.

With the conductor positioned in the vicinity of the elevator and the 2 locomotive engineers on the locomotive, there was no crew member in close enough proximity to observe the trainee's actions and ensure that switches TS 22 and TS 23 were properly lined for the main track. Subsequently, the trainee:

- did not confirm that the proper switch points and target were lined for the intended movement;
- did not ensure that rolling stock was not approaching prior to operating a derail; and
- was unprepared for movement on any track in any direction.

As a result, the conductor trainee, who had worked at this location on 3 earlier trips in September 2013, who was still unfamiliar with the territory, and who was working without direct supervision, misapplied a number of safety-critical operational procedures.

Supervision of Canadian National Railway conductor trainees

While the current Regulations require that a railway establish employee training programs for each occupational category, they require only on-the-job training for the duration of the training period for locomotive engineers and transfer hostlers. During the training period, locomotive engineer and transfer hostler trainees are directly supervised by, and work in close proximity to, a qualified on-the-job trainer. Unlike in the case of locomotive engineers and transfer hostlers, there is no regulatory requirement for a conductor trainee to work under the direction of, or remain in close proximity to, an on-the-job training instructor for the duration of the training period. Consequently, conductor trainees will sometimes perform the duties of a regular crew member, without direct supervision. Such performance can be challenging for a trainee who, in many cases, is still learning the proper application of operating rules and instructions while becoming familiar with a new territory.

While the present conductor training program of Canadian National Railway (CN) has an on-the-job training component under the guidance of a trainer, there is no regulatory requirement, and no company guidance or instructions provided, requiring a trainer to remain in close proximity to a trainee. When the conductor works in close proximity to the trainee, there are additional opportunities to observe and correct any switching errors. In this occurrence, the inadvertent reversal of switch TS 23 was not identified. If conductor trainees work independently, without direct supervision in close proximity, there is an increased risk of error, which can result in an accident.

The trainee had completed 57 road trips, but he did not yet have enough yard trips to complete the training. The trainee had received evaluations from a number of different trainers on 44 of the 57 trips. The evaluations were generally favourable, but there were 5 comments, provided by 2 different trainers, that identified that the trainee had difficulty with switching activities and working on his own, and that the trainee required more work to learn the territory. The comments were not reviewed or shared among the trainee's 6 different trainers, nor were they required to be. While some trainers discussed comments with the trainee, others did not.

Because the conductor who was on duty on the day of the accident was not provided with or required to review previous evaluations, the conductor was not aware that the trainee had previously had difficulty with a number of essential aspects of the job. If evaluations conducted by other trainers are not reviewed, there is increased risk that trainees will not be provided with

adequate reinforcement of proper procedures and work practices to correct weaknesses identified during on-the-job training.

Canadian National Railway accelerated conductor training program

Until 1995, all CN conductors were first qualified as brakemen/assistant yard conductors on a 3-person switching crew. After completing a minimum number of shifts as set out in their contract over the course of 2 years, they would then be qualified as conductors. Commencing in 1995, the training program and the time required to qualify as a conductor were incrementally reduced. The course evolved into an accelerated conductor training program that now can qualify a conductor in about 17 weeks.

The Transportation Safety Board (TSB) reviewed CN's conductor training program and identified the following issues relevant to this occurrence:

- In some cases, newly qualified conductors are permitted to train new hires. Without significant experience working with the *Canadian Rail Operating Rules* (CROR) in the field, a trainer may not readily identify an unsafe work practice or error.
- On-the-job training is administered by a number of different trainers without requirement for review of a trainee's previous evaluations. Consequently, any potential shortcomings of a newly assigned trainee may be overlooked and may remain uncorrected.
- The company guidance or instruction provided does not require a trainer to remain in close proximity to a trainee. This situation can reduce opportunities to observe and correct any unsafe practices or errors, or misinterpretations of rules or instructions, before an accident occurs.
- Conductor trainees do not have to be familiar with the territory before working without direct supervision.

If there is a reduced training period, an absence of direct supervision, and a lack of continuity and assessment among trainers, conductor trainees may not apply rules and instructions correctly in the field, which increases the risk of an accident.

Potential hazards when manually operating hinged derails

Item 12.8, Hand-Operated Derails, of CN's general operating instructions (GOIs) specifies a number of procedures that are required to place a hinged derail back in derailing position. These administrative defences imply that employees work from outside the rails. However, due to the weight of a hinged derail, its location between the rails, and its configuration, employees must frequently stand between the rails to clean debris (snow, etc.) and operate a hinged derail. Consequently, employees can be placed in a vulnerable position. Such was the case with the trainee who was operating the hinged derail that was located on the interchange track just west of the mainline switch stand at Murphys.

In comparison, a sliding derail is operated with a switch stand. This arrangement keeps the employee clear of the track while the derail is either put in place or removed, and reduces the risk of an employee being struck by moving equipment. If an employee is required to be

positioned between the rails to operate hinged derails, there is increased risk that a serious injury will occur.

Regulatory oversight

The *Railway Employee Qualification Standards Regulations* (the Regulations) require railways to file with TC a description of all employee training programs and subsequent changes related to each occupational category. Railways are also required to submit an update report to TC on their employee training programs each year, outlining

- the total number of employees in each occupational category;
- the total number of employees who received training in each occupational category;
- the number of employees who met the training requirements for each category and the number who failed; and
- any new or improved techniques or devices adopted in the company's employee training programs.

Although TC is provided with the information, the adequacy of the training program for each respective railway is not assessed. There is no requirement for TC to review the course material or evaluate the program. Consequently, once railway companies have satisfied the training, consultation and reporting requirements of the Regulations, TC provides no further overview with regard to the training of railway operating employees. If there is no regulatory oversight of the effectiveness of training programs for railway operating employees, there is increased risk that these programs may not be sufficiently robust to ensure that trainees have adequate practical experience to work independently and safely.

On 23 June 2009, TC approved *Rules Respecting Minimum Qualification Standards for Railway Employees* (TC O 0-102) (the Rules), which were to come into force once the Regulations were repealed. However, despite attempts over the past 5 years to repeal the Regulations, the Rules do not yet apply. Under the new Rules, conductor trainees would receive on-the-job training under the direction of a training instructor for the duration of the training period.

Findings

Findings as to causes and contributing factors

1. The accident occurred while the trainee was securing a derail mounted between the rails on track TS 23, with his back to the train. Unaware of its approach, the trainee was struck by the train.
2. The required switching tasks likely conflicted with the trainee's mental model and, instead of lining main track switch TS 22 to the normal position, the trainee inadvertently reversed the nearest main track switch (TS 23) and lined it into the interchange track where he was working.
3. Because the trainee had inadvertently reversed switch TS 23 and mistakenly reported the mainline switch as lined and locked in the normal position for the main track, the entire crew was unaware that the train was not following its intended route.
4. The conductor trainee, who was unfamiliar with the territory and working without direct supervision, misapplied a number of safety-critical operational procedures.

Findings as to risk

1. If a loss of situational awareness occurs, administrative defences, such as rules and procedures, may not always protect against switching errors, which increases the risk of an accident.
2. If conductor trainees work independently, without direct supervision in close proximity, there is an increased risk of error, which can result in an accident.
3. If evaluations conducted by other trainers are not reviewed, there is an increased risk that trainees will not be provided with adequate reinforcement of proper procedures and work practices to correct weaknesses identified during on-the-job training.
4. If there is a reduced training period, an absence of direct supervision, and a lack of continuity and assessment among trainers, conductor trainees may not apply rules and instructions correctly in the field, which increases the risk of an accident.
5. If an employee is required to be positioned between the rails to operate hinged derails, there is increased risk that a serious injury will occur.
6. If there is no regulatory oversight of the effectiveness of training programs for railway operating employees, there is increased risk that these programs may not be sufficiently robust to ensure that trainees have adequate practical experience to work independently and safely.

Other findings

1. The crew reacted quickly and took care to provide comfort and emergency response under difficult circumstances.

Safety action

Safety action taken

Transportation Safety Board Rail Safety Advisory Letter

On 19 December 2013, the Transportation Safety Board (TSB) issued Rail Safety Advisory Letter 16/13 to Transport Canada (TC), identifying the potential risks associated with switching operations, specifically concerning the proximity of the conductor to the trainee while supervising task performance.

Transport Canada

On 04 February 2014, TC responded that this accident is being investigated by TC's Prairie and Northern Surface Regional Office under the authority of the Canada Labour Code (CLC) Part II. An investigation report will be completed by its investigators. Once complete, the report will be provided to the employer and to the local health and safety committee for review and action as required.

In addition, TC indicated that it has identified the issue of trainee supervision in its risk-based business plan for the upcoming program year, and is developing risk-control actions to address it.

Canadian National Railway

On 21 November 2013, Canadian National Railway (CN) issued a safety flash to its Western Region employees, explaining the details of the accident and reminding employees to comply with all rules and regulations, including the following:

- General Operating Instructions (GOIs), Section 8, item 4.5.2., regarding expecting the movement of trains;
- *Canadian Rail Operating Rules* (CROR) 104(b), regarding hand-operated switches;
- Special instructions regarding CROR 106 (Peer-to-Peer Communications Between Crew Members);
- CROR 123.2 (Switching By Radio); and
- CROR General Rule C, which regards expecting a movement, track unit, or equipment to move at any time.

On 02 December 2013, CN issued a notice within the Western Region with the information contained in the November flash, and added a reminder to employees of item 12.3 of the GOIs (Pushing Equipment: Observing from the Ground).

Both the flash and the notice reminded employees of the importance of maintaining situational awareness and safety-related focus.

In January 2014, CN issued a system-wide general notice to monitor and record trainee performance, and an e-test was established to monitor and record compliance.

On 05 August 2014, CN issued Operating Bulletin BCN-065, which provided a reminder that employees who are assigned a trainee must be in a position that provides continuous monitoring of the trainee, and that allows for immediate intervention and corrective action of any non-compliant or unsafe activities observed.

This report concludes the Transportation Safety Board's investigation into this occurrence. The Board authorized the release of this report on 24 September 2014. It was officially released on 22 October 2014.

Visit the Transportation Safety Board's website (www.bst-tsb.gc.ca) for information about the Transportation Safety Board 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.