

Transportation Safety Board
of Canada



Bureau de la sécurité des transports
du Canada

**RAILWAY INVESTIGATION REPORT
R10E0080**



**NON MAIN TRACK TRAIN COLLISION
CANADIAN NATIONAL RAILWAY AND VIA RAIL**

**CN Q101 31 04 AND VIA NO. 1
MILE 0.16, ALBREDA SUBDIVISION
JASPER, ALBERTA
06 JULY 2010**

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.

Railway Investigation Report

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Summary

On 06 July 2010, at 1320, Mountain Daylight Time, Canadian National Railway freight train Q101 31 04, proceeding westward through Track YC01 of Jasper Yard (Mile 0.16, Albreda Subdivision) in Jasper, Alberta, side collided with VIA No. 1 while the train was disembarking passengers on the station track. VIA passenger car 8328 was struck on the south side and was pushed to a 45° angle. VIA passenger car 8328 and CN locomotive 8904 sustained damage. There were no injuries.

Ce rapport est également disponible en français.

Other Factual Information

On 06 July 2010, upon arrival at Jasper at approximately 1306, ¹ VIA Rail Canada (VIA) passenger train No. 1 (VIA No. 1), comprised of 2 locomotives and 20 passenger coaches, was lined through the connecting track from track YC01 onto the station track YC58 (see Figure 1). To facilitate the move, the east and west connecting track switches were reversed ² by the VIA equipment supervisor (VIA supervisor). Both connecting track switches were equipped with locks. Once VIA No. 1 was completely crossed over, 1 of the locomotive engineers from VIA No. 1, who had detrained at the crossovers, restored the west connecting track switch (XO58 West) to the normal position. The VIA supervisor entrained and rode the train as it was guided eastward in the station track by the locomotive engineer who was on the ground. The east connecting track switch (XO58 East) was left in the reverse position (see Photo 1).



Photo 1. View of east connecting track switch in track YC-01 looking west

¹ All times are Mountain Daylight Time.

² Track switches can be set in either the normal or reverse position. When set in the normal position, movements are lined for the through route; when set in the reverse position, movements are lined to diverge.

The inbound crew on VIA No. 1 then moved eastward approximately 3 car lengths where it was brought to a stop just short of VIA train No. 5 (Skeena), which was standing on the station track between the YC58 switch and the XO58 West switch. VIA No. 1 was now in position to accommodate the scheduled servicing and the rearrangement of the motive power. The VIA supervisor then turned his attention to assisting his staff in servicing VIA No. 1.

Westward Canadian National (CN) freight train 101 (CN 101), proceeding into Jasper Yard, comprised 2 locomotives, 50 loaded and 18 empty cars. CN 101 weighed 4301 tons and was 9974 feet long. Approaching Jasper, CN 101 was instructed by the rail traffic controller (RTC) to follow VIA No. 1 through track YC01 and to contact VIA No. 1 for further instructions. Reportedly, CN 101 then had at least 2 follow-up radio conversations with VIA personnel. The CN crew believed that it was communicating with either the inbound or outbound crew of VIA No. 1. However, no VIA personnel recalled having had these conversations. Positive identification between the communicating parties had not been established. Through these radio conversations, CN 101 was initially advised that VIA No. 1 was not yet in the clear on the station track. Approximately 10 minutes later, CN 101 was reportedly advised that VIA No. 1 was in the clear on the station track and that the connecting track switches had been restored to the normal position.³

Proceeding westward at 10 mph, CN 101 arrived at connecting track switch XO58 East, which had not been returned to normal position. Upon realizing that they were diverging, the locomotive engineer of CN 101 put the train into emergency, but could not stop in time and collided into the side of VIA No. 1 at approximately 6 mph (see Photo 2). Two passengers were inside the impacted passenger coach at the time of the collision. They disembarked the train unaided. All passengers and VIA employees were accounted for. There were no injuries.

³ The follow-up radio communications between CN101 and VIA Rail personnel were not recorded and the contents could not be validated.



Photo 2. Side Collision between CN101 and VIA No. 1

Site Examination

The station track at Jasper is designated as track YC58 and can be accessed from track YC01 through the east and west end YC58 switches or through the connecting track switch XO58 East.

Post-accident examination of the site revealed that the CN 101 lead locomotive (CN 8904) had collided into the side of VIA No. 1's 20th passenger car (VIA 8328). The force of the impact knocked VIA 8328 to an approximate 30° angle damaging the exterior and interior structure of the coach. CN 8904 sustained damage to the front right of the locomotive.

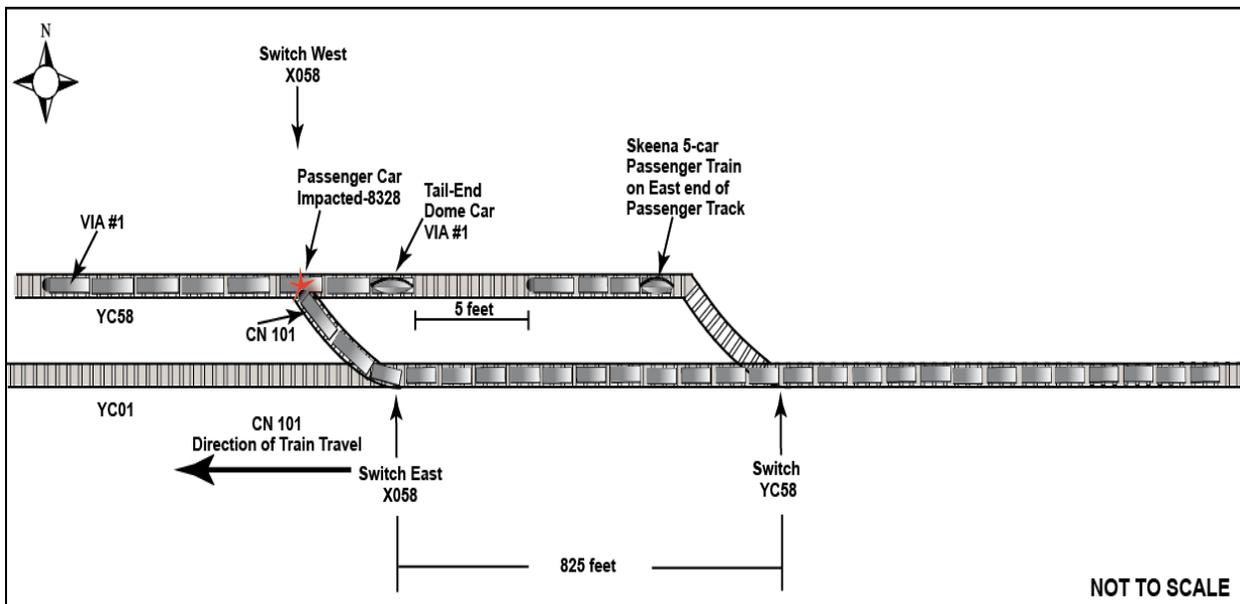


Figure 1. Accident Site Diagram

Crew Information

The crew of CN 101, a locomotive engineer and a conductor took control of the train in Edmonton, Alberta. The crew had worked a trip from Jasper to Edmonton on the previous day (05 July 2010) and was off duty at 1325. They were called for work at 0230 on 06 July 2010. They met fitness and rest standards and were familiar with the Edson and Albreda Subdivisions.

The inbound train crew of VIA No. 1, which included 2 locomotive engineers, operated from Edmonton to Jasper and were familiar with the Edson and Albreda Subdivisions and met fitness and rest standards.

The outbound train crew of VIA No. 1, which included 2 locomotive engineers, were commencing their shift in Jasper and were taking the train to Kamloops, British Columbia; they had arrived in Jasper the previous day and met fitness and rest standards.

Track Information

The CN Edson Subdivision extends between Mile 2.5 (Procyk), just west of Edmonton and Mile 235.7 (Jasper). The Albreda Subdivision starts at Jasper (Mile 0.0) and extends westward to Blue River, British Columbia. Both subdivisions are Centralized Traffic Control (CTC) territory and are supervised by an RTC in Edmonton, Alberta.

Subdivision Track is designated in Jasper both on the Edson and Albreda Subdivisions as follows:

- Edson Subdivision - Mile 234.2 to Mile 235.7
- Albreda Subdivision - Mile 0.0 to Mile 0.4

Subdivision Track is defined in the CN 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.

Track YC-01 is the designated Subdivision Track at Jasper. Jasper yard is governed by rule 105⁴ of the CROR.

⁴ Canadian Railway Operating Rules Rule 105 state that " Unless otherwise provided by signal indication, a movement using non-main track must operate at REDUCED speed and be prepared to stop short of the end of track or the red signal prescribed by Rule 40.1.
a) In CTC, movements may only enter a siding by signal indication or with permission from the RTC
b) Unless otherwise provided by signal indication or special instructions, movements operating on non-main tracks must not exceed 15 mph.
c) In addition to moving at REDUCED speed, a movement using a non-signalled siding or using other non-main tracks so designated in special instructions, must operate at a speed that will allow it to stop within one-half of the range of vision of a track unit.

Servicing of VIA Equipment in Jasper

VIA Mechanical Department employees service and maintain locomotives and passenger coaches for the scheduled passenger trains arriving in Jasper. Their duties include watering and cleaning the inside and outside of the coaches as well as minor troubleshooting and repair of locomotives and coaches. The Mechanical Department had a scheduled 90-minute interval to accomplish its duties on train No. 1. This is the normal scheduled lay-over for this train, provided that it arrives on time. The 90-minute interval includes the time required for entraining and detraining passengers.

VIA Supervisor

In Jasper, the VIA supervisor is responsible for a crew of 8 part-time employees who perform servicing, cleaning and minor repairs of VIA coaches and locomotives. At times, the VIA supervisor must fill in as a worker when the work load is high or when employees are not available (e.g., sickness, vacation).

It was not uncommon for the VIA supervisor to handle the connecting track switches for VIA No. 1. When VIA No. 1 was clear of the XO58 West switch, the switch was restored to its normal position by 1 of the locomotive engineers. The VIA supervisor then entrained on the side of VIA No. 1 as it was guided eastward on the station track and spotted close to the stationary Skeena train.

On the day of the occurrence, the Mechanical Department was short staffed, as 2 employees were off on long term disability and 2 others were on their scheduled vacation. It was not common to have this many employees unavailable at one time. The VIA supervisor had to assume some of the required servicing duties. Once VIA No. 1 was spotted on the station track, the VIA supervisor began to coordinate the servicing of the coaches.

During servicing of VIA No. 1, the VIA supervisor had to leave the station track to obtain the wheel impact detector readings to ensure that there had been no wheel impacts on the train.⁵ He returned approximately 10 minutes later, about the same time the collision occurred.

Crew Actions for CN Train 101

As CN 101 approached the east station track switch, the locomotive engineer, who was aware that VIA Mechanical Department staff would be servicing the passenger train, became more watchful for VIA employees working on the VIA train on the adjacent track. The locomotive engineer was concerned that the VIA servicing staff may not be able to hear the locomotive bell due to the noise of the servicing equipment. The locomotive engineer also began to watch out the side window of the locomotive, as he was concerned that someone may step back into the train's path. There was one servicing employee working on the south side of the VIA train.

⁵ Wheel impacts are recorded through wayside detectors to identify wheels that exceed the impact threshold set by the railway.

The east connecting track switch was displaying a yellow target, indicating that it was lined for the diverging route. There was some visual clutter in the vicinity of the switch in the form of servicing equipment.⁶ The switch target could be seen from an approaching locomotive's cab at least 300 meters away.

As CN 101 approached, the conductor was filling out paperwork in preparation for the trip's end and was communicating by radio with the train's outbound crew in preparation for the crew change. The conductor did not observe the switch target and was not aware that the switch was lined against the train.

Train CN 101's crew did not identify the reversed connecting track switch prior to arriving at that location.

Canadian Railway Operating Rules

Within the CROR, the handling of switches is governed by Rule 104, which states (in part):

Unless otherwise specified by special instructions, non-main track switches, when equipped with a lock, must be lined in normal position and locked after having been used.

Non-main track switches are not required to be restored to normal after use, unless they are equipped with a lock. This provision can protect against yard movements being lined toward other locations within yards that may require protection, such as station tracks and repair tracks. In yard operations, railway employees learn to be on the lookout for switches lined against them and to expect that yard switches equipped with locks must be restored to the normal position when not in use.

Movements on non-main track are governed by Rule 105 - Speed on Non-Main Track, which states (in part):

Unless otherwise provided by signal indication, a movement using non-main track must operate at REDUCED speed [...] (a speed that will [permit stopping] within one-half the range of vision of [equipment]).

a) In CTC, movements may only enter a siding by signal indication or with permission from the RTC. (CN Time Table 12, Effective 15 December 2007, Edson Subdivision, notes for Jasper indicates that Rule 105(a) is applicable on yard tracks.)

b) Unless otherwise provided by signal indication or special instruction, movements operating on non-main must not exceed fifteen (15) mph.

⁶ Servicing equipment located between the station track and YC-01 included a water pumping station and rack with spare hoses for use by VIA servicing personnel.

Rule 34a

The crew on the controlling engine of any movement and snow plow foreman must know the indication of each fixed signal (including switches where practicable) before passing it.

Rule 107

Unless otherwise directed by special instructions, a movement must operate with extreme care when passing along side a train carrying passengers that is discharging or receiving traffic.

Routine and Cognitive Workload

Routine is an important component of any operational activity. It reinforces the sequential nature of tasks, as each task acts as a trigger for the next. As each sub-task becomes more familiar, less and less mental processing is needed to remind the individual to perform the next sub-task in the operation. Routine allows people to become efficient to the point where the sub-tasks become automatic and do not require conscious thought. People are therefore able to monitor and conduct a variety of operations simultaneously, as they no longer need to monitor the detailed actions associated with individual tasks. They become focused on the outcomes of the individual operations and attention can therefore be divided between several operations. At this point, expectation plays a critical role in guiding decision making. If the outcomes observed do not contradict the expectations associated with the operations under consideration, then no change is required at the task level. This is referred to as recognition-primed decision making.

Before tasks become routine, the order of each sub-task must be remembered, which increases cognitive workload. If the tasks must be performed quickly and accurately, cognitive workload increases even more. When a routine is interrupted, more mental energy must be applied to remember to return to the original task, causing cognitive workload to again increase. When cognitive work load increases, people tend to focus attention on the primary task, leaving reduced cognitive capacity to monitor other concurrent operations.

Situational Awareness and Mental Models During Train Operations

Situational awareness (SA), as it related to operational matters, refers to an operator's perception of what is going on around him or her. There are 3 levels of SA: ⁷

1. Perception is the recognition that new cues exist. Some cues are clear, while others are ambiguous.
2. Comprehension is the understanding of the order of importance of the new cues.
3. Projection is the ability to forecast future events based on information provided.

⁷ Mica R. Endsley & Daniel J. Garland, *Situation Awareness Analysis and Measurement*, Lawrence Erlbaum Associates, Inc., Mahwah, NJ, 2000.

A train crew's SA may come from various information sources, which can include radio transmissions (e.g., crew-to-crew conversations, messages received from wayside inspection systems). Other information sources include:

- signal indications;
- switch targets;
- RTC radio transmitted instruction;
- in-cab displays;
- track observations;
- environmental conditions;
- environment sounds (e.g., noise from other trains and traffic); and
- written information (e.g., operating authorities, timetables and operating bulletins).

Railway rules and operating instructions also affect SA. The CROR and General Operating Instructions (GOI) provide information according to which operating crews are either permitted or required to use.

When operating a train, decisions and actions greatly depend upon the crew's assessment and understanding of train operations and its ability to select the appropriate course of action based on SA. The overall understanding of a situation is based on experience and knowledge of how something works, resulting in a mental model. If cues are not clear, more effort is required to accurately assess a situation. It is difficult to alter a mental model once developed, particularly in a short period of time. To change one's thinking, the existing model must be superseded by another, with new information being sufficiently compelling to result in an update of the mental model.

Analysis

There were no track or equipment factors that were considered to be contributory in this occurrence. The collision occurred when CN 101 inadvertently changed tracks at the east connecting track switch and was not able to stop before colliding into the side of VIA No. 1. The analysis will focus on the operation of CN 101 and the actions of the VIA supervisor.

The Accident

While approaching Jasper, CN 101 contacted the RTC for instructions. The crew was advised that VIA No. 1 was working on track YC01 and that it was required to obtain further instructions from the VIA crew. While at least 2 radio communications were reported to have taken place between CN 101 and VIA personnel, during which CN 101 was advised that the passenger train was in the clear and that the connecting track switches had been restored, these communications could not be validated. Given the instruction from the RTC for CN 101 to communicate with the passenger train and that 2 separate communications were reported to have occurred, it is possible that there was some communication between CN 101 and VIA personnel. In the absence of positive identification between the communicating parties, it was not possible to determine with certainty with whom CN 101's crew was communicating.

The VIA supervisor was preoccupied with various operational tasks and did not restore the east connecting track switch to normal after VIA No. 1 arrived. The VIA No. 1 locomotive engineer, who detrained at the connecting track, did not restore the east connecting track switch to normal. The east connecting track switch displayed a yellow target for the diverging route, but CN 101's crew did not identify the reversed switch as it approached. The conductor was communicating with CN 101's outbound crew, as well as completing his paper work and the locomotive engineer was watching out for VIA servicing employees on the adjacent track. At the connecting track, once CN 101's crew realized that it was diverging, the locomotive engineer put the train into emergency, but could not stop before colliding into the side of the VIA train. Train 101's crew did not observe the reversed connecting track switch in time to avoid the collision.

Distractions and Increased Workload

At the time of the occurrence, the VIA supervisor had an elevated workload, as several VIA servicing employees were not available. When VIA No. 1 arrived at Jasper, the other VIA train (Skeena) was at rest on the standing on the station track, reducing the amount of room for the arriving train. Given the VIA supervisor's additional workload, it is likely that his intention to restore the east connecting track switch was interrupted by the numerous tasks he was preparing to perform.

With no secondary cueing to remind the VIA supervisor that the east connecting track switch had to be returned to the normal position, the final reset task was overlooked. The VIA supervisor's additional tasks (i.e., handling the switches for the inbound VIA train and performing the duties of the absent employees) added to his cognitive workload. When cognitive overload takes place, it often results in crucial tasks being neglected, such as a switch not being returned to the normal position.

Despite the existence of administrative defenses (i.e., CROR Rules for the handling of switches), distraction and increased workload led to reduced cognitive capacity resulting in the VIA supervisor inadvertently leaving the east connecting track switch in the reversed position. Distractions and increased workloads can lead to reduced cognitive capacity for operating employees when monitoring concurrent operations, increasing the risk of unsafe train operations.

Situational Awareness During Train Operations

CN 101's crew believed that both connecting track switches had been restored to normal position. The connecting track switch, which was equipped with a lock, was required to be restored to its normal position and locked when not in use.

While the train approached the connecting track, the conductor was filling out paperwork and was not actively observing the route ahead. The locomotive engineer's attention was split between ensuring the safety of the employees performing the mechanical servicing activities on the adjacent track and other operational tasks. He was not expecting the east connecting track switch to be reversed and, consequently, the switch target was not part of his scanning activity.

CN 101 was being operated at reduced speed on a subdivision track prepared to stop short of equipment (rolling stock).

Situational awareness in relation to operational matters refers to the operator knowing what is happening around him. A train crew's situational awareness may come from various information sources. For CN 101's crew members, their mental model was formed by the information reportedly provided to them through communication with an unidentified VIA employee and from previous experience. Once this mental model was formed, the CN crew did not actively seek to verify the position of the connecting track switches and there were no new cues sufficiently compelling to alter this model until their train began to diverge.

Findings as to Causes and Contributing Factors

1. The collision occurred when CN 101 inadvertently changed tracks at the east connecting track switch and was not able to stop before colliding with the side of VIA No. 1.
2. Given the additional workload for the VIA supervisor, it is likely that his intention to restore the east connecting track switch was superseded by the numerous tasks he was in anticipation of performing.
3. Despite the existence of administrative defenses (i.e., the Canadian Rail Operating Rules (CROR) for the handling of switches), distraction and increased workload led to reduced cognitive capacity resulting in the VIA supervisor inadvertently leaving the east connecting track switch in the reversed position.
4. CN train 101's crew did not observe the reversed connecting track switch in time to avoid the collision. They were not expecting the switch to be reversed and, consequently, did not actively seek to verify the position of the switch.

Finding as to Risk

1. Distractions and increased workload can lead to reduced cognitive capacity for operating employees when monitoring concurrent operations, increasing the risk of unsafe train operations.

Other Finding

1. In the absence of positive identification between the communicating parties, it was not possible to determine with certainty with whom CN 101's crew was reportedly communicating.

Safety Action Taken

Following this occurrence, the following safety action was taken:

On 12 July 2010, VIA issued a notice to operating employees indicating that:

Effective immediately and until further notice, locomotive engineers will be responsible for the handling of all switches in Jasper yard.

For the departure of Train 001 at Jasper, the inbound locomotive engineers will be responsible for restoring the switch after the departure of 001 and the engineer responsible for handling the switch must be located at the switch to immediately restore the switch to normal upon train departure.

If time is available, the mechanical staff in Jasper will continue to assist the locomotive engineers by transporting them by vehicle.

VIA conducted a number of audits to ensure that the new procedures were being followed.

VIA provided CROR Rules mentoring in Jasper.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 17 October 2011.

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