TSB Recommendation R22-05

Crew resource management training

The Transportation Safety Board of Canada recommends that the Department of Transport require, under the *Railway Employee Qualification Standards Regulations*, Canadian railways to develop and implement modern initial and recurrent crew resource management training as part of qualification training for railway operating employees.

Rail transportation safety investigation report	R19W0002
Date the recommendation was issued	24 August 2022
Date of the latest response	March 2025
Date of the latest assessment	March 2025
Rating of the latest response	Satisfactory Intent
File status	Active

Summary of the occurrence

On 03 January 2019, about 0610 Central Standard Time, Canadian National Railway Company (CN) eastbound freight train M31851-01 (train 318) began following eastbound CN train Q11651-30 (train 116) near Rivers, Manitoba, on the CN Rivers Subdivision. Both trains were destined for Winnipeg, Manitoba. Train 318 was a key train[1] operating on a key route,[2] as defined by the Transport Canada (TC)–approved *Rules Respecting Key Trains and Key Routes*. At 0906:54, train 318 was travelling at 42 mph, with Trip Optimizer (TO) engaged and the throttle in position 7, as it passed a Clear to Stop signal indication at Mile 52.2. The conductor had called

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1   "'Key Train' means an engine with cars:

[...]

b)   that includes 20 or more loaded tank cars or loaded intermodal portable tanks containing dangerous goods, as defined in the *Transportation of Dangerous Goods Act, 1992* or any combination thereof that includes 20 or more loaded tank cars and loaded intermodal portable tanks." (Transport Canada, *Rules Respecting Key Trains and Key Routes* (12 February 2016), Section 3.4)

2   "'Key Route' means any track on which, over a period of one year, is carried 10,000 or more loaded tank cars or loaded intermodal portable tanks containing dangerous goods, as defined in the *Transportation of Dangerous Goods Act, 1992* or any combination thereof that includes 10,000 or more loaded tank cars and loaded intermodal portable tanks." (Transport Canada, *Rules Respecting Key Trains and Key Routes* (12 February 2016), Section 3.3)

out the signal in the locomotive cab and identified the Clear to Stop indication. However, the conductor did not hear the locomotive engineer (LE) verbally respond to acknowledge the signal, and the LE appeared to be staring straight ahead. At this point, conversation in the cab ceased. TO remained engaged, and the train continued at track speed.

As CN train 318 was proceeding on the south track, a westbound CN freight train M31541-03 (train 315) was transitioning from single track to the north track while exiting the equilateral turnout (Mile 50.37) at Nattress near Portage la Prairie, Manitoba. At Mile 51.13, while travelling at 46 mph, train 318 passed the head end of train 315. The train 318 conductor then reminded the LE that they were operating under a Clear to Stop indication. Once reminded, the LE disengaged TO and made a full service brake application at 0908:34; 24 seconds later, he inadvertently placed the brake handle into the suppression position (rather than the emergency position), and then applied the locomotive independent brake.

Ten seconds later, as Stop Signal 504S came into view, the LE placed the train in emergency and the crew evacuated the locomotive cab. Train 318 side-collided with train 315 while travelling at 23 mph. Shortly thereafter, the train 318 crew members jumped from the locomotive to the south side of the track and sustained minor injuries. As a result of the collision, the 2 head-end locomotives on train 318 and 8 cars on train 315 derailed. Although no cars loaded with dangerous goods were involved, the head-end locomotives on train 318 lost a combined total of about 3500 imperial gallons of diesel fuel. The released diesel fuel was contained locally and cleaned up with no waterways affected.

Rationale for the recommendation

Railway operations are governed by rules and instructions that place equal responsibility for safe train operations on all crew members. Safe railway operations are predicated on all crew members following all of the rules, all of the time. In the rail industry, operating rules require that crew members verbally acknowledge signal indications displayed in the field to each other. When a train encounters a signal indication displayed in the field, 1 crew member must communicate the signal indication aloud within the locomotive cab to the other crew member. While the other crew member is required to repeat the message back, there is no requirement for the original sender to confirm that the message was received accurately or understood by the other crew member. As a result, this communication can fail.

The railway rules do not specify a closed-loop communication method, meaning there is no requirement for the original sender of the message to acknowledge, and therefore confirm, that it was received accurately. Moreover, when there is a significant difference in level of experience between operating crew members, an authority gradient may develop in which the less experienced crew member may not always intervene to ensure compliance with all of the rules. In these situations, there is a danger that safety-compromising behaviour will be overlooked because a less experienced employee may be reluctant to question the actions of a more senior employee or intervene in the operation of the train even when it may be critical to do so.

In this occurrence, the investigation determined that communications between the 2 crew members were not always closed-loop. The callouts of signal indications by the conductor were not always acknowledged or repeated back by the LE. The conductor did not confirm that the LE had understood the communication nor was he required to do so. The inexperience of the conductor on the subdivision, and with locomotive operations, also deterred him from trying to intervene and stop the train.

Crew resource management (CRM) is a concept introduced in the aviation and marine industries to limit or eliminate human errors by recognizing the importance of cognitive and interpersonal skills, thereby improving safety. CRM targets a crew's skills, abilities, attitudes, communication, situational awareness, problem solving, and teamwork. Crew members must successfully interact with each other, their equipment, and their environment to effectively manage threats, errors, and unexpected conditions that may be encountered.

In order to perform in a coordinated, efficient, and safe manner, crew actions need to be based on a common understanding of the current state of the equipment, the intended route to be taken, and any other potential threats. When this understanding is consistent, crews are better able to effectively anticipate and coordinate their actions to achieve their common goal. This common understanding between crew members is referred to as team or shared situational awareness.

Shared situational awareness is developed and maintained by a crew through a number of discrete and continuous behaviours. These behaviours include in-trip briefings, the identification of key points throughout the trip, threat and error management (TEM), callouts to any change in the state of the equipment, the instrument setting or mode, and the communication of any change in plans to ensure that all crew members have a common understanding of activities.

TEM stresses the principles of anticipation, recognition, and recovery when addressing threats, errors, and undesirable equipment states, and is based on the proactive detection of threats that could reduce safety margins. Effective error management is associated with specific behaviours by the crew, the most common being vigilance, a propensity to ask questions or provide feedback, and assertiveness.

A 2015 study entitled *Human Factors Analysis of "Missed Signals" in Railway Operations*,[3] when addressing team training, indicated that CRM training

> emphasizes non-technical skills such as communication, briefing, backing-up behaviour,[4] mutual performance monitoring, team leadership, decision making,

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3   S. Banbury and K. Baker Peng, *Human Factors Analysis of "Missed Signals" in Railway Operations*, C3 Human Factors Consulting Inc. (2015).

4   Backing-up behaviour is defined as "the ability of team members to anticipate the needs of others through accurate knowledge about each other's responsibilities, including the ability to shift workload between members to create balance during periods of high workload or pressure."

task-related assertiveness (e.g., a junior operator speaking up to a dominant colleague), and team adaptability.

The report went on to state that CRM training includes aspects of team situational awareness such as "perception" and "information sharing, coordination and crosschecking information" and instructed crews to "become vigilant for losses of [situational awareness]; both one's own and by others."

CRM focuses on providing crews with the interpersonal skills required to carry out their tasks safely: "CRM training typically consists of an ongoing training and monitoring process through which personnel are trained to approach their activities from a team perspective rather than from an individual perspective."[5]

Significant safety benefits were experienced in the aviation and marine industries with the introduction of CRM. Given the prevalence of human factors issues in rail accident statistics, this type of training could yield significant safety benefits in the rail industry.[6]

Since 2017, CN has delivered a course called "Looking out for each other" as part of its operating crew requalification programs delivered every 3 years. While the CN training is insightful, it is broadly focused and does not specifically deal with train crew interaction within a locomotive cab or the authority gradients that may exist in that environment. While Canadian Pacific Railway Company (CP) provides CRM training to its new operating employees, it does not provide formal dedicated recurrent CRM training.

The *Railway Employee Qualification Standards Regulations* have no requirement for operating crews to complete a separate module on CRM when they qualify or re-qualify. Consequently, the adoption of CRM training in the rail industry has been sporadic and the approach differs between railways. Although railway training touches on CRM principles, neither CP nor CN provide dedicated, recurrent CRM training that explores all aspects of CRM. Recurrent CRM training would seek to improve non-technical skills that deal with in-cab communication, job briefings, backing up behaviour, mutual performance monitoring, team leadership, decision making, task-related assertiveness (e.g., a junior operator speaking up to a dominant colleague), team adaptability, as well as concepts of TEM and team situational awareness.

The TSB has investigated 8 other rail occurrences, dating back as far as 1996, in which ineffective CRM practices were identified as a factor that contributed to the accidents.[7]

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5   S. S. Roop, C. A. Morgan, T. B. Kyte, et al., DOT/FRA/ORD-07/21, *Rail Crew Resource Management (CRM): The Business Case for CRM Training in the Railroad Industry* (Washington, DC: United States Department of Transportation, September 2007), p. 3.

6   Ibid., pp. 4–8.

7   TSB rail transportation safety investigation reports R18H0039, R17W0267, R16E0051, R08W0058, R07E0129, R07C0040, R98V0148, and R96Q0050.

If operating crew members do not receive enhanced initial and recurrent CRM training to develop skills in crew communication, the coordination of decision making and activities, and dealing with authority gradients that may exist within a locomotive cab environment, there is an increased risk that inadequate crew communication will lead to unsafe operations.

Therefore, the Board recommended that

> the Department of Transport require, under the *Railway Employee Qualification Standards Regulations*, Canadian railways to develop and implement modern initial and recurrent crew resource management training as part of qualification training for railway operating employees.
>
> **TSB Recommendation R22-05**

Previous responses and assessments

November 2022: response from Transport Canada

Transport Canada (TC) agrees with recommendation R22-05 and recognizes the importance of initial and recurrent Crew Resource Management (CRM) training. This aligns with proposed regulatory changes to the *Railway Employee Qualification Standards Regulations* (REQSR) that were put forward for consultation in November 2021. TC is working on a regulatory package currently targeting pre-publication in 2023.

The proposed revisions will address this gap by requiring railway companies to ensure that CRM training be incorporated during all stages of training in an employee's career (e.g., from those initially training to those returning to duty), ensuring that it is thoroughly integrated into industry practices.

In order to mitigate the risks identified by the TSB prior to publication of revised regulations, TC will take immediate action to develop and publish on its website, by May 2023, a Best Practices for CRM in the Railway Industry.

- The document will be informed by a review of CRM best practices in aviation, as well as work in the UK and the USA, to incorporate CRM in rail.
- The review of best practices will be presented to industry and labour at an Advisory Council on Rail Safety meeting in early 2023 for input and feedback.

January 2023: TSB assessment of the response (Satisfactory Intent)

TC agrees with this recommendation and notes that the proposed revisions to the *Railway Employee Qualification Standards Regulations* (REQSR) will address the gap in crew resource management (CRM) training by requiring railway companies to ensure that such training be incorporated during all stages of training in an employee's career. The regulatory changes to the REQSR were put forward for consultation in November 2021 and TC is working on a regulatory package currently targeting pre-publication in 2023.

TC also notes that, in the interim, to mitigate the risks identified by the TSB, it will develop and publish on its website, by May 2023, a Best Practices for CRM in the Railway Industry.

The Board is encouraged that TC is proposing to revise the REQSR to address the gaps in CRM training, and the Board looks forward to the publication of a Best Practices for CRM in the Railway Industry. However, the Board will review the proposed revised REQSR when they are pre-published and the planned Best Practices for CRM in the Railway Industry when they are issued. Until then, the Board considers the response to Recommendation R22-05 to show **Satisfactory Intent**.

December 2023: response from Transport Canada

Over the course of 2023, Transport Canada (TC) has made substantial progress on the proposed regulatory changes concerning the *Railway Employee Qualification [Standards] Regulations*. Specifically, targeted consultations with the railway industry and unions have occurred where specific elements were discussed to ensure feasibility of the proposed new requirements. In parallel, the regulatory development process follows its course with a view of publishing in the *Canada Gazette*, Part I in 2024.[8]

The proposed Regulations would include provisions addressing crew resource management, and oversight of less experienced employees.

In anticipation of the finalized Regulations, the department has taken a proactive approach by developing and publishing a Crew Resources Management (CRM) training best practice document, which was posted on its website[9] in June 2023. This guidance sets the stage for best practices that would be considered in the context of rail operations.

The foundation of the CRM training best practice document lies in a thorough review conducted by TC. This detailed review included literature on CRM in transportation industries, with a notable emphasis on aviation. The resultant summaries on training topics, training methods, and other best practices addressed in these resources were then compared to identify commonalities across different transportation industries. These commonalities, as well as other valuable practices, were subsequently incorporated into the guidance document. The approach for the development of the CRM training best practice document ensures a comprehensive resource for railway employees until updated Regulations are in place.

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[8]   All responses are those of the stakeholders to the TSB in written communications and are reproduced in full. The TSB corrects typographical errors and accessibility issues in the material it reproduces without indication but uses brackets [ ] to show other changes or to show that part of the response was omitted because it was not pertinent.

[9]   Transport Canada, "Best practices for crew resource management training," at https://tc.canada.ca/en/rail-transportation/publications/best-practices-crew-resource-management-training

January 2024: response from the Railway Association of Canada

In addition to the actions described in the comments to R18-02, the industry participated in consultations with TC in early 2023 regarding proposed CRM Guidelines. These guidelines were finalized and published in May 2023.

Classroom and/or practical hands-on CRM training has been a part of Canadian railway industry training programs since as far back as 1999, though in some cases, is delivered as part of other training or referred to by different terminology than the recently published CRM guidance suggests.

February 2024: TSB assessment of the response (Satisfactory Intent)

In 2023, Transport Canada (TC) reported making substantial progress on the proposed revisions to the *Railway Employee Qualification Standards Regulations* (REQSR). Specifically, it held targeted consultations with the railway industry and unions to ensure the feasibility of the proposed new requirements.

TC intends to publish the proposed revisions to the REQSR in the *Canada Gazette*, Part I, in 2024. The revised REQSR will include provisions addressing crew resource management (CRM) and oversight of less experienced employees.

In anticipation of the finalized REQSR, TC developed and published a CRM training best practices document, which was posted on its website in June 2023. In the development of the best practices document, TC reviewed the literature on CRM in the transportation industries and then compared the training topics, methods, and other best practices to identify commonalities across the different transportation industries.

The Board is encouraged that TC has published its CRM training best practices document, which will ensure that railway employees have a comprehensive resource until the updated REQSR are in effect. The Board looks forward to reviewing the proposed revised REQSR when they are pre-published in the *Canada Gazette*, Part I. Until then, the Board considers the response to Recommendation R22-05 to show **Satisfactory Intent**.

Latest response and assessment

December 2024: response from Transport Canada

On 14 December 2024, Transport Canada pre-published a proposal in the *Canada Gazette*, Part I to repeal and replace the *Railway Employee Qualification Standards Regulations*. The new *Railway Personnel Training and Qualifications Regulations* aim to establish a more comprehensive and robust framework for training and qualifications. The revised regulations will expand to include two additional safety-critical positions—remote control locomotive operators (RCLOs) and rail traffic controllers (RTCs)—and introduce new provisions for crew resource management, along with requirements for pairing less experienced employees with more experienced colleagues.

The training types required under the new regulations will include:
- On-the-job training
- Knowledge training
- Familiarization training
- Continuing training
- Certificate renewal training
- Crew resource management (CRM)

Continuing training will address elements not covered in the initial knowledge-based training, such as new equipment, procedural changes, regulatory requirements, exemptions, and inspection findings.

The proposed regulations also require companies to provide on-the-job training and familiarization training to certificate holders that have not carried out their duties in the previous 12 months for a variety of different reasons, such as illness or leave.

Throughout 2025, Transport Canada will review the feedback gathered during the pre-publication consultation period and work toward finalizing the regulations for publication in the *Canada Gazette*, Part II.

March 2025: response from the Railway Association of Canada

On 14 December 2024, TC published the proposed *Railway Personnel Training and Qualifications Regulations* (RPTQR) in the *Canada Gazette*, Part I and a proposed Order to repeal the current *Railway Employee Qualification Standards Regulations*. Industry has provided feedback on the proposed RPTQR and intends to continue engaging with TC to discuss proposed language and TC expectations prior to publication of the final regulations in the *Canada Gazette*, Part II.

March 2025: TSB assessment of the response (Satisfactory Intent)

In its response, Transport Canada (TC) indicated that, on 14 December 2024, it had pre-published the proposed *Railway Personnel Training and Qualifications Regulations* in the *Canada Gazette*, Part I to repeal and replace the *Railway Employee Qualification Standards Regulations*. The proposed regulations aim to establish a more comprehensive and robust framework for training and qualifications and will include new provisions for crew resource management and related training.

TC also indicated that, throughout 2025, it will review the feedback gathered during the pre-publication consultation period and work toward finalizing the regulations for publication in the *Canada Gazette*, Part II.

The Board is encouraged by TC's actions and is looking forward to reviewing the final regulations in the *Canada Gazette*, Part II. Until then, the Board considers the response to Recommendation R22-05 to show **Satisfactory Intent**.

File status

The TSB will monitor TC's progress on its planned actions.

This deficiency file is **Active**.