Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada

RAILWAY INVESTIGATION REPORT
R11W0247

MOVEMENT EXCEEDS LIMITS OF AUTHORITY

VIA RAIL CANADA INC.
PASSENGER TRAIN 692
MILE 32.73, TOGO SUBDIVISION
MEHARRY, MANITOBA
29 OCTOBER 2011

Canada

Railway Investigation Report

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Summary

On 29 October 2011, at approximately 1205 Central Daylight Time, VIA Rail Canada Inc. passenger train 692, en route to Winnipeg, Manitoba, from Canora, Saskatchewan, was proceeding eastward on the single main track of Canadian National's Togo Subdivision when it exceeded its limits of authority by approximately 4.3 miles. Upon seeing an approaching westbound Canadian National freight train, the crew stopped train 692 at approximately Mile 32.73 and then made a reverse movement on the main track back to the siding at Meharry. There were no injuries.

Ce rapport est également disponible en français.

Other Factual Information

On 29 October 2011 at 0932, [1] VIA Rail Canada Inc. (VIA) passenger train 692 (VIA 692) departed Canora, Saskatchewan, travelling eastward on Canadian National's (CN) Togo Subdivision on a proceed clearance. [2] The train consisted of 2 locomotives and 7 coaches. The crew consisted of 2 locomotive engineers [3] and 6 service personnel. There were 55 passengers on board.

The VIA engineers were both based out of Winnipeg, Manitoba. The crew had been called for the assignment during mid-morning on 28 October 2011. That afternoon, the crew members travelled together in the same taxi to Canora, Saskatchewan, which is located approximately 500 km northwest of Winnipeg. They spent the night in the railway's rest facility in Canora. At about 0730 the next morning, the crew was called by phone to report for duty at 0853. Both VIA crew members had over 35 years of experience and were fully qualified for their respective positions. They met fitness and rest standards and were familiar with the territory they were operating on.

CN freight train G85341-28 (CN 853, also referred to as 5541 West [4] for Occupancy Control System [OCS] clearances) was proceeding westward on the Togo Subdivision. The train consisted of 2 locomotives and 68 cars (30 loaded and 38 empties). It weighed 5565 tons and was 4158 feet long. CN 853 was manned from a pool of operating employees based out of Dauphin, Manitoba. The crew consisted of a locomotive engineer and a conductor. Both crew members were fully qualified for their respective positions, met fitness and rest standards and were familiar with the territory they were operating on.

The Incident

At 1048, the CN rail traffic controller (RTC), located in Edmonton, Alberta, issued clearance 1234 to CN 853, allowing it to proceed westward from Harrington (Mile 4.5) to the west switch at Meharry Siding (Mile 37.0).

At 1051, VIA 692 was issued clearance 1235 by the RTC, allowing it to proceed from Togo (Mile 79.5) to Meharry. One locomotive engineer copied the clearance and gave a copy to the second locomotive engineer. Clearance 1235 included the instruction to take the siding at Meharry. At 1054, VIA 692 was issued clearance 1236, allowing it to proceed eastward from Meharry to Harrington with the instruction "do not leave Meharry until 853, 5541 West arrives at Meharry."

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1 All times are Central Daylight Time (Coordinated Universal Time minus 5 hours).

2 A proceed clearance allows a train to proceed in only the direction specified.

3 VIA trains are crewed using 2 locomotive engineers in the lead locomotive. The operating locomotive engineer (OLE) is at the controls while the in–charge locomotive engineer (ICLE) sits at the opposite side of the cab and performs the role of the conductor.

4 Occupancy Control System clearances are issued according to the lead locomotive number. CN 5541 was the lead locomotive of the train.

The 2 clearances for VIA 692 were issued by the RTC by radio. The clearances were repeated [5] by the in–charge locomotive engineer (ICLE) to the RTC. The purpose of the clearances was to facilitate the train meet at the Meharry Siding between eastbound VIA 692 and westbound CN freight train 853.

In accordance with the *Canadian Rail Operating Rules* (CROR), upon approaching Meharry, the VIA crew was required to confirm the location with each other in the cab and to initiate a radio broadcast on the designated standby channel that included identifying the restriction on their clearance to take the siding at Meharry and the restriction at the east switch. [6] Neither of the required broadcasts was heard by the crew of CN 853.

At approximately 1205, VIA 692 passed through Meharry while travelling at 27 mph. The train crew activated the train whistle (as required) at the 2 Meharry public crossings situated at the west end and at the east end.

At approximately 1215, the crew of CN freight train 853 saw the headlight of the oncoming VIA train. The CN crew members contacted VIA 692 by radio and began to stop their train, which was travelling westward at 25 mph. Upon hearing the radio call from CN 853, the crew members of VIA 692 realized that they had travelled beyond the limits of their authority and immediately brought the train to a stop. VIA 692 stopped with the head-end locomotive at Mile 32.7, approximately 4.3 miles past its authorized limit.

The 2 opposing trains came to a stop approximately 1500 feet apart. Without requesting authority from the RTC, VIA 692 then began a reverse movement on the main track and backed into the siding at Meharry. CN 853 proceeded westward to Meharry and came to a stop at the east switch (Figure 1).

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5 Requirement to repeat RTC clearances : CROR Rule 136

6 CROR Rule 142(b) and Rule 315

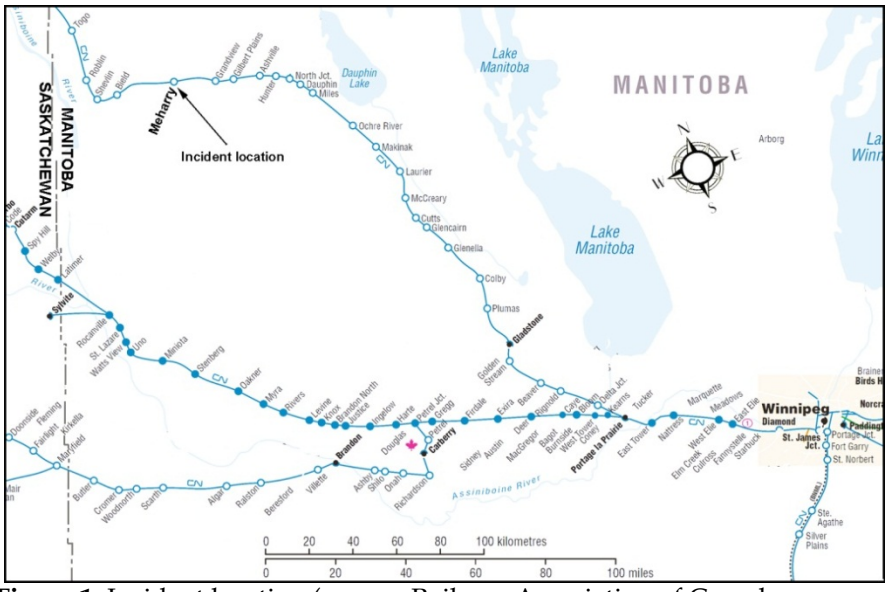


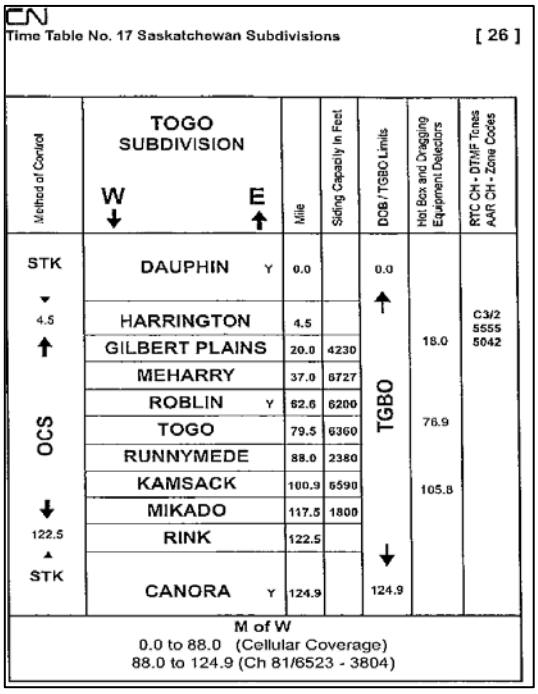
Figure 1. Incident location (source: Railway Association of Canada, *Canadian Railway Atlas*)

The CN crew immediately contacted the CN RTC, while the VIA crew first contacted the VIA Operations Control Centre (OCC) in Montreal, Quebec, and then the CN RTC for instructions. The VIA crew was subsequently removed from service. The CN crew was relieved from duty for critical incident stress. There were no injuries sustained by crew members or passengers. After approximately 4 hours, the VIA passenger train was re-crewed and then continued on to its destination.

Weather at the time of the incident was overcast skies and light winds, and the temperature was 6°C.

Togo Subdivision

CN's Togo Subdivision runs east to west from Dauphin, Manitoba (Mile 0.0), to Canora, Saskatchewan (Mile 124.9). The subdivision is controlled by an RTC in Edmonton, Alberta. Between Harrington (Mile 4.5) and Mile 122.5, train operations are controlled using the OCS. The timetable for CN's Togo Subdivision is presented in Figure 2.



CN
Time Table No. 17 Saskatchewan Subdivisions [26]

Method of Control	TOGO SUBDIVISION W ↓ E ↑	Mile	Siding Capacity in Feet	DCB / TGBO Limits	Hot Box and Dragging Equipment Detectors	RTC CH - DTMF Tones AAR CH - Zone Codes
STK	DAUPHIN Y	0.0		0.0		
▼ 4.5 ↑	HARRINGTON	4.5		↑		C3/2 5555 5042
	GILBERT PLAINS	20.0	4230		18.0	
	MEHARRY	37.0	6727			
	ROBLIN Y	62.6	6200	TGBO		
OCS	TOGO	79.5	6360		76.9	
	RUNNYMEDE	88.0	2380			
	KAMSACK	100.9	6590		105.8	
↓ 122.5 ▲ STK	MIKADO	117.5	1800			
	RINK	122.5		↓		
	CANORA Y	124.9		124.9		

M of W
0.0 to 88.0 (Cellular Coverage)
88.0 to 124.9 (Ch 81/6523 - 3804)

Figure 2. Timetable for CN's Togo Subdivision

The authorized speed in the vicinity of the incident was 25 mph for freight trains and 40 mph for passenger trains. At the time of the incident, a General Bulletin Order (GBO) was in effect from Mile 22 to Mile 45 that restricted speeds for both freight trains and passenger trains to 25 mph.

Meharry Siding

In this incident, Meharry was the seventh station encountered by VIA 692 on the Togo Subdivision. Approaching the west switch at Meharry Siding (Photo 1), there were several visual cues indicating the siding, including:

- the 1 mile to station sign;
- the west siding switch and the switch target located north of the main track;
- the whistle post sign located south of the main track;
- a back track that contained a gondola car situated south of the main track;
- the Meharry station sign located north of the main track;
- the mile post 37 sign located north of the main track;
- the 6727-foot siding track situated north of and adjacent to the main track;
- 2 public road crossings (at each end of Meharry crossing); and
- the east siding switch and the switch target.

Photo 1. West switch at Meharry Siding looking eastward

Prospective Memory

Remembering to take the siding and await CN 853 at Meharry required the crew of VIA 692 to use event-based prospective memory. The event was the arrival at Meharry Siding, and the task was entering the siding and awaiting the oncoming train. Prospective memory is used when an individual remembers to perform an action in the future; it requires that individual to first form an intention to perform a task and then to retain that intention while performing other tasks. Because these other tasks can occupy one's limited short-term attention capacity, the intention to perform the task is stored in long-term memory. The mechanisms by which these intentions are retrieved are subject to ongoing research, but are known to be fragile. [7]

Steps can be taken to influence the probability of remembering the deferred task at the appropriate time. Identifying unique environmental cues that do not trigger more familiar or routine tasks and forming explicit mental notes that identify actions that an individual is likely to be performing at the time increases the probability of the memory being triggered and acted upon according to the pre-rehearsed plan. Effective event-based cues are "conspicuous, strongly associated with the deferred task, and positioned in a way that an individual is likely to notice them at the appropriate time (Brandimonte, and Passolunghi, 1994)." [8] Also, uncommon cues have fewer related memories, and therefore are more effective in triggering the related deferred memory.

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7 L.D. Loukopoulos, R.K. Dismukes, I Barshi, *The Multitasking Myth: Handling Complexity in Real-World Operations* (England: Ashgate Publishing Limited, 2009).

8 Brandimonte and Passolunghi, 1994, quoted in L.D. Loukopoulos, R.K. Dismukes, I Barshi, *The Multitasking Myth: Handling Complexity in Real-World Operations* (England: Ashgate Publishing Limited, 2009).

Railway environmental cues can include mile posts, crossings, station mile signs, station name signs, main track switches, familiar structures along the right-of-way or possession of the written clearance. To be effective as event-based prospective memory cues, they must unambiguously trigger the correct task. If they are not the focus of cognitive attention, their characteristics must be manipulated to attract attention. [9]

CROR-Related OCS Rules

For train operations in OCS territory, RTCs monitor the location of trains using the reported information they receive from train crews from the field. In OCS territory, train separation and train safety rely on the correct interpretation and application of a series of CROR rules by train crews when carrying out RTC instructions. There are no physical defences associated with OCS. All of the safety defences are administrative in nature and rely solely on the operating crew correctly applying the operating rules in each situation.

CROR Rule 142, which is related to the understanding between crew members, states (in part):

> (a) Every conductor, locomotive engineer, remote control operator, pilot and snow plow foreman must read and have a proper understanding of all GBO and clearances as soon as possible after they have been received. Each must be made available to other crew members, as soon as practicable, ensuring that each crew member has read and understands them and, when required, the arrangements for protection between crews and between foremen and crews.
>
> (b) Crew members within physical hearing range are required to remind one another of the restrictions contained in GBO and clearances in sufficient time to ensure compliance.

CROR Rule 308.1, which is related to changing direction while operating under a proceed clearance, states (in part):

> Unless otherwise provided by rules or special instructions, when authorized to proceed by clearance, a train or transfer must move only in the specified direction.
>
> Provided that the trailing end has stopped within 300 feet of the switch or signal, a proceed train or transfer may:
>
> 1. reverse into interlocking limits on signal indication or permission of the signalman;
> 2. reverse into CTC on signal indication or written permission of the RTC; or
> 3. reverse to enter non-main track at a hand operated switch.

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[9] J.L.Hicks, I. Cook and R.L. Marsh, "Detecting event-based prospective memory cues occurring within and outside the focus of attention," *The American Journal of Psychology*, 118(1), 1-11 (2005).

> **Note**:
> 1. A train or transfer operating under the above provisions must not have released the track to be operated over.
> 2. Item (iii) is not applicable to a train or transfer operating in ABS that has to re-enter a block it has cleared.

Other CROR rules associated with OCS (Appendix A) include:

> Rule 34 - Fixed Signal Recognition and Compliance
> Rule 35 - Emergency Protection
> Rule 80 - Main Track Authorization
> Rule 125 - Emergency Communication Procedures
> Rule 304 - Restriction before Leaving
> Rule 304.1 - Stopping Clear of Fouling Point
> Rule 312 - Fouling OCS without Authority
> Rule 315 - Radio Broadcast Requirements

Adaptations to Rules

Operating rules and procedures in the workplace define the envelope of safe work practices in standard and non-standard situations. Normally, the rules and procedures have a built-in safety margin. However, adaptations [10] to the rules and procedures can develop within rule-based work for various reasons. Over time, strict application of rules or procedures may be relaxed if there are no adverse outcomes or consequences. Sometimes, adaptations develop when experienced employees complete work and use their professional judgement to maintain what they believe is adequate safety. Because of the safety margin built into the rules and procedures, there are often no adverse consequences to these adaptations.

In-Cab Voice Recorder

There was no on-board voice recorder in the head-end locomotive of VIA 692, nor was there a requirement to have one installed. The Board has previously made recommendations on the topic of on–board voice recordings. In TSB investigation R99T0017, the Board recommended that:

> The Department of Transport, in conjunction with the railway industry, establish comprehensive national standards for locomotive data recorders that include a requirement for an on–board cab voice recording interfaced with on–board communications systems.
>
> (R03–02, issued July 2003)

In February 2012, considering that Transport Canada (TC) had implemented partial performance specifications for data collection, the Board assessed TC's response as Satisfactory

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[10] An adaptation is an intentional deviation from a rule or procedure usually to gain an operational advantage to get the job done.

in Part. However, the Board remained concerned that the principle of voice recordings as a valuable safety tool had not been implemented.

Last June, the TSB went further in its 2012 Watchlist, calling for the rail industry to install in-cab voice and video recorders in locomotives.

Analysis

There were no equipment defects or track defects present that were considered contributory to this incident. The analysis will focus on train operations, including OCS clearances, CROR rules and human factors associated with operating procedures.

The Incident

At 1050 on the morning of the incident, the RTC issued a clearance to VIA 692 to proceed from Togo to Meharry. About 4 minutes later, another clearance was issued, allowing VIA 692 to proceed eastward from Meharry to Harrington with the following instruction : "do not leave Meharry until 853, 5541 West arrives at Meharry." There was no miscommunication between the RTC and the crew related to the clearances. The VIA crew members correctly understood and wrote down that they were to stop the train in the siding at Meharry to meet CN 853. However, when VIA 692 reached the west switch at Meharry, it did not enter the siding. Instead, VIA 692 continued down the main track for another 4.3 miles, until the crew was made aware of the approaching freight train. The incident happened when VIA 692 did not take the siding at Meharry as instructed by the RTC on OCS clearance 1235.

The 2 clearances related to Meharry were issued approximately 1 hour before VIA 692 reached the station. The RTC instruction was given over the radio and repeated by the ICLE. The ICLE completed the paperwork and gave a copy to the operating locomotive engineer (OLE). The importance of the clearance is strengthened by the fact that the crew must indicate on the clearance why the train is being directed into the siding (that is, to facilitate the meet with CN 853).

To maximize the effectiveness of prospective memory cues, the cues must be unique, related to the intended task and not trigger memories of more routine, habitual tasks. The track-side markers are not uniquely associated with instructions to enter a siding. In addition, the crew members were familiar with this route and used landmark cues (in addition to track-side indicators) to establish their location in space. It is likely that the usual track-side markers were not effective prospective memory cues.

Once instructions are stored in memory, they need to be recalled to be acted upon. For train operations in OCS territory, memory retention is reinforced by the requirement to call the restriction on the clearance when the train encounters the 1 mile to a station sign. This task helps facilitate a recall from memory of any instruction relevant to a station. In addition, as required by CROR Rule 142(b), at 1 to 3 miles before a station, the crew must broadcast the restriction over the radio. One objective of making these calls is to help maintain a sufficient level of attentiveness and situational awareness and to advise any other trains in the vicinity of an approaching train. However, in this incident, the CN crew in the opposing train did not hear

any VIA crew broadcasts over the radio. The investigation determined that the VIA crew did not broadcast the 1 mile to Meharry station sign or broadcast the restriction at Meharry and lost an opportunity to remember to bring the train into the siding.

The Meharry signs on the railway right-of-way provide visual indications of the station. In addition, there were other visual cues present, including the siding track, a gondola car stored on the side-track, the manual switches at each end of Meharry Siding, the mile post markers, and the whistle post. However, neither these visual cues nor the written clearance triggered a recall of the RTC instructions or alerted the train crew members that they were proceeding down the main track rather than entering the siding to stop and wait for CN 853.

Once the VIA crew members realized that they had exceeded their authorized limits, they brought the train to a stop. They were then anxious to clear the main track. Having just passed Meharry, the VIA crew assumed that it was safe to make a reverse movement back to the siding. However, as per CROR Rule 308.1, trains are not allowed to make a reverse movement without authority from the RTC. In the crew members' effort to clear the main track, VIA 692 backed up the main track to Meharry Siding without proper clearance from the RTC, which in itself was hazardous.

Understanding the sequence of events leading up to the incident and identifying operational issues and human factors, including crew performance and interaction, would have been enhanced had the locomotive on VIA 692 been equipped with an on-board voice or video recorder. When cab recordings are not available to an investigation, this may preclude the identification and communication of safety deficiencies to advance transportation safety.

Adaptations to Operating Rules

In OCS territory, train operations and train safety are maintained using administrative defences that rely on train crews correctly interpreting and applying operating rules. Over time, adaptations can occur and become routine. Adaptations to rules and operating procedures (that is, not calling all station name signs or not performing required radio broadcasts) are adaptations of railway standard operating procedures.

By making these adaptations, the routine task can normally be completed in less time and with reduced effort. This choice reflects the natural tendency to accept low-probability risks with potentially severe outcomes. When adaptations are made to operating rules and procedures, the safety margins built into the rules are often reduced, increasing the risk of unsafe operations and accidents.

Findings as to Causes and Contributing Factors

1. The incident occurred when VIA Rail Canada Inc. (VIA) passenger train 692 did not take the siding at Meharry as instructed by the rail traffic controller on Occupancy Control System clearance 1235, issued 1 hour earlier.

2. The VIA crew did not broadcast the 1 mile to Meharry station sign or the restriction at Meharry and lost an opportunity to remember to bring the train into the siding.

3. Neither the track-side visual cues nor the written clearance triggered a recall of the RTC instruction or alerted the train crew members that they were proceeding down the main track rather than entering the siding to stop.

4. In the VIA crew members' efforts to clear the main track, VIA passenger train 692 backed up the main track to Meharry Siding without proper clearance from the RTC.

Finding as to Risk

1. When adaptations are made to operating rules and procedures, the safety margins built into the rules are often reduced, increasing the risk of unsafe operations and accidents.

2. When cab recordings are not available to an investigation, this may preclude the identification and communication of safety deficiencies to advance transportation safety.

Safety Action

VIA Rail Canada Inc. management met with all operating employees within the Winnipeg terminal and provided them with briefings and mentoring to reinforce the *Canadian Rail Operating Rules* associated with the Occupancy Control System.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 26 September 2012. It was officially released on 17 October 2012.

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.

Appendix A – Canadian Rail Operating Rules Associated with Occupancy Control System

Canadian Rail Operating Rules (CROR) Rule 34 - Fixed Signal Recognition and Compliance

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

(b) Crew members within physical hearing range must communicate to each other, in a clear and audible manner, the indication by name, of each fixed signal they are required to identify. Each signal affecting their movement must be called out as soon as it is positively identified, but crew members must watch for and promptly communicate and act on any change of indication which may occur.

The following signals/operating signs must be communicated:

1. Block and interlocking signals;
2. Rule 42 and 43 signals;
3. One mile sign to interlocking;
4. One mile sign to hot box detector;
5. Stop sign;
6. OCS begins sign;
7. Red signal between the rails;
8. Stop signal displayed by a flagman;
9. A switch not properly lined for the movement affected;
10. One mile to Cautionary Limit Sign; and
11. Cautionary Limit Sign.

(c) If prompt action is not taken to comply with the requirements of each signal indication affecting their movement, crew members must remind one another of such requirements. If no action is then taken, or if the employee controlling the engine is observed to be incapacitated, other crew members must take immediate action to ensure the safety of the movement, including stopping it in emergency if required.

CROR Rule 35 - Emergency Protection

This rule does not authorize main track occupancy or track work.

(a) Any employee discovering a hazardous condition, which may affect the safe passage of a movement, must by the use of flags, lights, fusees, radio, telephone, or other means, make every possible effort to stop and/or provide necessary instructions to any movement that may be affected. Flag protection must be provided on main track unless or until otherwise relieved of the requirement.

(b) A flagman must go the required distance from the condition, and in each direction when possible, to ensure that an approaching movement will have sufficient time and distance to be able to stop before the condition. Unless otherwise provided, a flagman must go at least two miles from the condition to a location where there will be an unobstructed view of the flagman from an approaching movement.

When a movement is observed approaching, the flagman must display a stop signal using a red flag by day or a lighted red fusee by night or when day signals cannot be plainly seen. The flagman must continue to display a stop signal until the movement being flagged has:

1. acknowledged the stop signal with engine whistle signal 14 (b) (two short);
2. come to a stop; or
3. reached the location of the flagman.

(c) A movement stopped by a flagman must not proceed until so instructed by the flagman.

(d) A flagman must be equipped with a red flag and eight red fusees. The presence of an unbroken seal verifies that the flagging equipment kit is properly supplied.

CROR Rule 80 - Main Track Authorization

A movement must not foul or enter a main track without authority. Authority is conveyed in:

CTC: By signal indication, RTC permission or written authority.
OCS: Clearance
Cautionary Limits: Rule 94
SCS: Special Instructions

CROR Rule 125 - Emergency Communication Procedures

(a) An employee will transmit the word "EMERGENCY" three times at the beginning of the transmission to indicate the report of;

(i) an accident involving injury to employees or others;
(ii) a condition which may constitute a hazard to employees or others;
(iii) a condition which may endanger the passage of movements; or
(iv) a derailment which has occurred on, or is fouling, a main track.

(b) When an emergency communication, which is directed to a specific person or movement, has not been acknowledged, any other employee hearing it will, if practicable, relay the communication by any means available. Other employees must not interfere with such communication.

(c) An emergency communication has absolute priority over other transmissions.

CROR Rule 304 - Restriction before Leaving

When a train or transfer has been restricted by clearance, such train or transfer must not leave the point named until it is positively known that the opposing trains or transfers named on the clearance have arrived.

A train has not arrived until its designated engine and TIBS or tail end remote locomotive has arrived.

Trains or transfers operating without TIBS or a tail end remote locomotive have not arrived until confirmed by direct communication with a member of the crew of such movement.

Note: If unable to observe the arrival of a train or transfer, or unable to communicate with a member of the crew, the RTC must be contacted.

CROR Rule 304.1 Stopping Clear of Fouling Point

A train or transfer required to stop at a meeting, clearing or waiting point, or at the end of authority, must be stopped clear of the route to be used by another train or transfer.

CROR Rule 312 - Fouling OCS without Authority

If a movement fouls OCS without authority, it must be stopped and an emergency radio broadcast initiated on the standby channel and then on the standby channel for the RTC and protection as required by Rule 35 initiated.

CROR Rule 315 - Radio Broadcast Requirements

(a) A member of the crew on all trains and transfers must initiate a radio broadcast to the airwaves on the designated standby channel 1 to 3 miles from the next station or interlocking. This broadcast must include the next requirement to protect against another train, transfer or foreman if the restriction is between the upcoming station and the next station or interlocking.

(b) A member of the crew located on other than the engine must confirm that the radio broadcast has been made in accordance with (a). If unable to contact the engine crew to ascertain this information, immediate action must be taken to stop the movement before it will reach the next point of restriction.