

Transportation Safety Board
of Canada



Bureau de la sécurité des transports
du Canada

**RAILWAY INVESTIGATION REPORT
R11T0161**



EMPLOYEE FATALITY

**VIA RAIL INC.
TRAIN VIA 051
MILE 314.4 KINGSTON SUBDIVISION
DURHAM JUNCTION, ONTARIO
14 JULY 2011**

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

Employee Fatality

VIA Rail Inc.

Train VIA 051

Mile 314.4 Kingston Subdivision

Durham Junction, Ontario

14 July 2011

Report Number R11T0161

Summary

At approximately 1306 Eastern Daylight Time on 14 July 2011, VIA Rail Canada Inc. passenger train VIA 051 was proceeding westward from Montreal, Quebec, to Toronto, Ontario, when it struck and fatally injured a CN Engineering Services employee at Mile 314.4 of the Metrolinx owned portion of the Kingston Subdivision. Canadian National (CN) maintained the track in the area.

Ce rapport est également disponible en français.

Other Factual Information

At approximately 0630¹ on 14 July 2011, westward VIA Rail Canada Incorporated (VIA) passenger train VIA 051 (VIA 51) departed from Montreal, Quebec, destined for Toronto, Ontario. The train comprised 1 locomotive and 8 coaches. VIA 51, a regularly scheduled passenger train, carried 180 passengers and 7 crew members, including 4 on-board service personnel and 3 locomotive engineers. Two locomotive engineers were the regular assigned crew. They were qualified for their respective positions and familiar with the territory. The third locomotive engineer was on board to gain familiarity with the territory and was under the supervision of the regular crew.

Between Mile 311.4 and Mile 313.5, VIA 51 encountered planned track protection, Canadian Rail Operating Rule (CROR) Rule 842.² The crew contacted the foreman involved and were instructed to activate the locomotive bell and sound the locomotive horn while travelling through the limits. VIA 51's bell and horn were sounded through the Rule 842 limits between Mile 311 and Mile 313.5, ending at 1305:31. VIA 51 was also in possession of a general bulletin order (GBO) which warned of potential trespassers on the right-of-way. The GBO required that the bell be rung continuously and the locomotive horn be sounded as required between Mile 314 and Mile 315.

At approximately 1306, while travelling at 96 mph on the south track of the Kingston Subdivision near Durham Junction, VIA 51 rounded a 6000-foot long 1° left-hand curve. About 800 feet ahead (Mile 314.4), the crew noticed 2 CN Engineering Services (ES) employees, a senior track foreman and a trackman, working on the north track³. At 1306:20, VIA 51's bell and horn were sounded approaching the work location. Just before arriving at the work location, the crew made an emergency train brake application. The trackman, who was facing north east, reacted to the approach of the train as it came into sight, approximately 6 seconds before it reached the work site. He moved north, cleared the track and shouted at his co-worker to clear the track. The senior track foreman attempted to exit over the south track, moving into the path of the oncoming train. The senior track foreman was struck by VIA 51 and was fatally injured. The train crew made an emergency radio call to advise the rail traffic controller (RTC) of the accident and to request emergency medical assistance. VIA 51 came to a stop approximately 3440 feet west of the accident location (Figure 1).

¹ All times are Eastern Daylight Time.

² CROR 842 is the Engineering service employee rule equivalent to CROR 42 for operations employees. It is a form of positive track protection that ensures a foreman is in possession of written authority issued and protected by the RTC. The foreman has control of all movements within the working limits.

³ A different foreman was in charge of the maintenance work being conducted at Mile 314.4 (as compared to the maintenance work being conducted using planned track protection between Mile 311.4 and Mile 313.5).

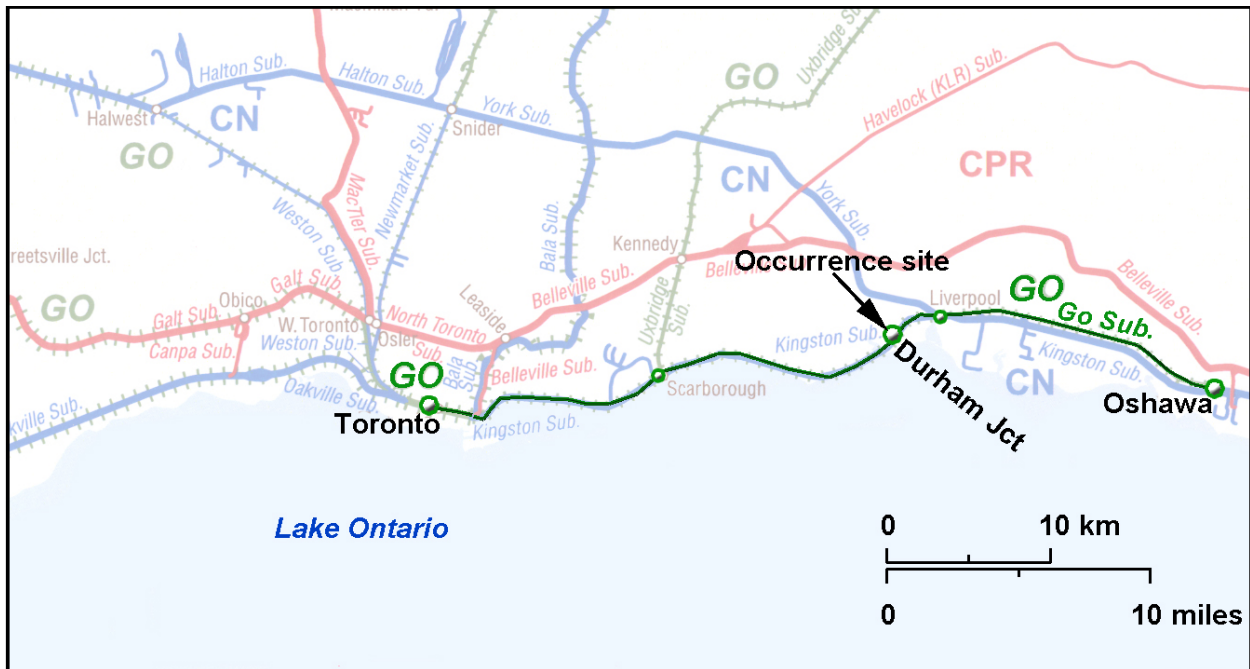


Figure 1. Occurrence site (Source: Railway Association of Canada, *Canadian Railway Atlas*)

Prior to the start of the track work that morning, a job briefing was conducted by a supervisor in the Oshawa Engineering Office. At that time, 3 Engineering Services (ES) employees were assigned to work on a number of near-urgent track defects located between Mile 299 and Mile 300. At the work site, no additional job briefings were conducted.

On the morning of the accident, 6 different low spots were lifted by the 3 employees. In each case, 2 employees performed the track repair, while the third employee provided a safety watch. ⁴ For each of these 6 locations, the sightlines were more than 2,200 feet in each direction. After lunch, the workers had one extra low spot at Mile 314.4 that was situated just outside the CROR Rule 842 work limits that had not been discussed during the job briefing. A missing bolt had been discovered ⁵ at the insulated joint at Mile 314.4. ⁶ Two of the 3 ES employees were requested by the supervisor to replace the bolt and to lift the low insulated joint. ⁷ The third ES employee was assigned to other work ⁸ and did not accompany his workmates to Mile 314.4

⁴ A safety watch is a lesser form of protection for on-track activities (i.e., inspection, minor repairs) that do not require positive protection from the Rail Traffic Controller.

⁵ A signal maintainer detected the missing bolt on the day of the accident. This location could not be included in the work limits of the CROR Rule 842 because such protection must be requested the day before.

⁶ Joint bolts in low track joints are often loosened due to impact under traffic. Lifting a joint after replacing a bolt would be a normal sequence of related tasks.

⁷ A low joint defect is a low point in the track. It requires the track be jacked under the ties at the low point, the slag tamped underneath the ties using a lining bar or shovel, so that the top of the rail is raised flush with the rail on either side of the low spot when the jacks are removed.

⁸ The third ES employee was performing administrative work (i.e., inputting work hours for the work crew to facilitate payment). This task is normally performed near the end of the work day on the final day of the work cycle.

At about 1250, the senior track foreman requested a track occupancy permit (TOP) ⁹ for the north track. He was advised by the RTC, who was training with the regular RTC, to call back after a westward GO train cleared. The regular RTC was supervising the RTC in training, and took no exception to the information given. After waiting for the GO train to pass and without re-contacting the RTC to obtain a TOP, the 2 ES employees proceeded onto the track to perform the maintenance work using the safety watch procedure. In the earlier communication, the RTC had not advised the workers about VIA 51 approaching the area on the south track, nor was there a requirement to do so.

At Mile 314.4, the trackman, who was providing the safety watch, was also actively engaged in the work. To help lift the insulated joint, the trackman jacked the track and placed his weight on the lining bar, allowing the senior track foreman to tamp slag under the ties at the low joint. During this work, neither track worker was dedicated to watching for trains. The sightline to the east of the accident location was 769 feet and the sightline to the west was 911 feet.

The accident occurred just east of the White Road overpass (Mile 314.76). Highway 401 is situated to the north and Bayly Road is situated to the south (Figure 2).

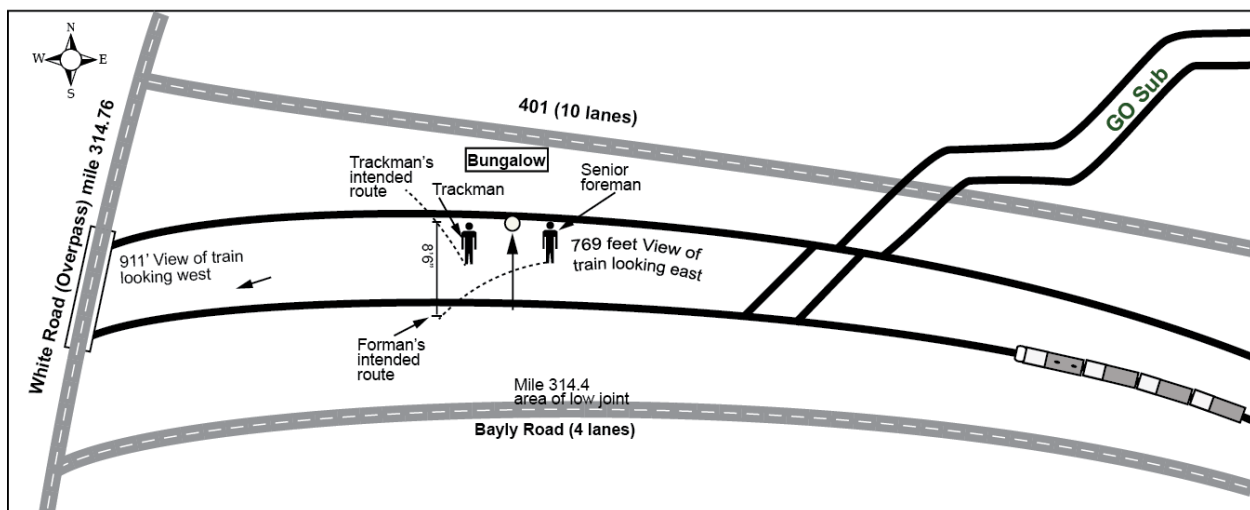


Figure 2. Accident Site Diagram (diagram not to scale)

At the time of the occurrence, the weather was 28°C, with moderate winds of approximately 8 to 15 km/h. Visibility was clear and the sun was shining.

Track Personnel

The 2 CN ES employees were qualified for their respective positions and were familiar with the territory.

⁹ Track Occupancy Permit, CN Canadian Rail Operating Rule (CROR) 849: Written authority provided to a track foreman by a rail traffic controller for the positive protection of track units or track work.

The senior track foreman had a knee injury about a year before the accident, and was required to wear a leg brace, which the senior track foreman wore at the time of the accident. The brace compromised agility, and pain was common.

Subdivision Information

The Kingston Subdivision consists of double track and multi track extending from Mile 10.3 (Dorval, Quebec) to Mile 333.8 (Toronto, Ontario). These tracks connect with the GO Subdivision at Mile 313.9 (Durham Junction). The Kingston Subdivision is CN's main east/west corridor for passenger and freight traffic through Southern Ontario. In the accident area, the maximum permissible speed is 65 mph for freight trains and 100 mph for passenger trains. Train movements on both the Kingston and GO Subdivisions are controlled by the Centralized Traffic Control System (CTC), as authorized by the *Canadian Rail Operating Rules* (CROR) and supervised by an RTC located in Toronto.

The track at the accident location consisted of 136-pound rail, laid on 14-inch double shoulder tie plates, fastened onto hardwood ties with spikes and anchored every second tie. The cribs were full and the ties and ballast were in good condition.

Track Geometry Test Car Inspection and Resulting Track Repairs

During the track geometry test car inspection of 09 April 2011, a near-urgent defect was identified at the insulated joint (Mile 314.4) on the south rail of the north track.

According to CN's Engineering Track Standards dated March 2007, TS 7.1 (Track Geometry Maintenance Standards):

Deviations approaching Transport Canada Track Safety Rules or F.R.A. Track safety Standards minimum safety requirements for track geometry are defined as NEAR URGENT defects.

- i. NEAR URGENT defects will be identified by the Geometry Car and must be inspected within 72 hours and remedial action must be taken within 30 days.

The "Near Urgent" defect designation provides a warning that a defect is present but has not yet progressed to "Urgent" status. In this case, the near-urgent defect was a low point in the track (i.e., a low joint).

Typically, after addressing a near-urgent defect such as lifting or surfacing a low joint, the foreman in charge will indicate in writing the date action was taken along with his name beside the defect. This report is then returned to the supervisor. There were no specific records, indicating that the defect had been repaired within the required 30 days from the date of inspection. However, given that the accident area was susceptible to low joint conditions, the track had been lifted at least twice in the month preceding the accident.

On 03 July 2011, the track geometry test car inspection identified 30 near-urgent defects, between Mile 299 and 314.

Protection of Track Units and Track Work

In CROR, "Track Work" is defined as follows:

Any work on or near the track that may render the track unsafe for movements at normal speeds or where protection against movements may be required for employees and machines involved in track construction and repairs.

Rule 804, Track Work Authorization, of the *Rules for the Protection of Track Units and Track Work* states, in part:

Track work is permitted in CTC as follows:

Rule 842, Planned Protection, or Rule 849, Track Occupancy Permits.

Both Rule 842 and Rule 849 are considered to provide positive protection for track work:

- **Rule 842, Planned Protection**, requires advance notification, (i.e., 24 hours), to the RTC by the foreman specifying the proposed working limits and the duration of the required protection. The RTC must ensure that a General Bulletin Order (GBO) is issued to all trains specifying the exact working limits, the track or tracks involved and the times between which the planned protection is effective. The foreman must receive confirmation from the RTC that proposed working limits will be protected. This rule also requires the placement of warning flags both at the working limits and a sufficient distance in advance of the working limits to warn approaching trains. Trains are not permitted to enter or move within the working limits without the permission of the foreman named on the GBO.
- **Rule 849, Track Occupancy Permits**, requires that the proposed limits be requested of the RTC by the foreman. In CTC, the RTC protects the proposed limits by "blocking at Stop", all signals governing movements into the limits and issues the TOP to the foreman. Trains are either stopped at the governing signal or instructed to protect against the foreman by obtaining permission to enter or operate through the limits. There are no warning flags with a TOP.

Track Worker Protection at CN

In the 1990s, lone worker and safety watch protection began to emerge as forms of track worker protection on North American railways. These procedures were designed to improve track worker productivity, especially at locations with increased traffic and reduced track time. Use of lone worker and safety watch were introduced in single-track territory. These practises eventually spread to multi-track territory.

CN adopted the use of such track worker protection. Written guidelines to accompany their application were established in 2006 within CN's General Engineering Instructions (GEI):

Section 3.0 (Forms of Protection) states:

- 3.1 All Engineering employees required to foul or occupy tracks must be protected by one of the following means:
- Positive protection as per the CROR
 - Safety Watch
 - Lone Worker

Section 4.0 (Lone Worker Protection) states:

- 4.1 A lone worker may perform routine inspection or work of a very minor nature by use of individual protection when:
- The work will not affect the movement of trains;
 - The lone worker is able to visually detect the approach of a train at maximum timetable speed and be in a place of safety 15 seconds before the arrival of the train;
 - Power operated tools and track units are not in use within hearing range;
 - The ability to hear and see approaching trains and track units is not impaired by background noise, lights, precipitation, fog passing trains or physical conditions;
 - The employee has identified a place of safety prior to occupying or fouling the track.

Section 5.0 (Safety Watch) established the following requirements:

- 5.1 Work that is performed on or about the track that does not require positive protection as provided by the Canadian Rail Operating Rules (CROR) may be performed with a Safety Watch. The sole duty of the working personnel through the observance of Safety Watch is to protect all train and track unit movements and hazards from all directions. The Safety Watch must dedicate their entire attention to this task and never engage in other activities, which could detract them from this primary responsibility to protect others.
- 5.2 Prior to implementing a Safety Watch, the person in charge, the Safety Watch and the employee(s) being protected must ensure that there is a clear understanding of the following:
- What work is being performed,
 - How the work is to be performed,
 - Where the Safety Watch is to be positioned,
 - How the warning is to be given,
 - Where the workers will clear on the approach of rail traffic,
 - Where any tools are to be placed when clearing, and
 - Who will clear the tools.

- 5.3 The Safety Watch must always remain in a position to immediately warn by physical means those employees they are protecting of any approaching rail traffic.
- 5.4 Safety Watch will NOT be considered as adequate protection when sightlines, train speeds, weather conditions, restricted clearing ability, etc., do not allow sufficient time for each worker being protected to move to and occupy a previously arranged place of safety not less than 15 seconds before a train moving at maximum speed on that track, reaches that point.
- 5.5 Safety Watch will NOT be considered as adequate protection when the Safety Watch cannot physically warn all members of the work group of the approach of a train or track unit.
- 5.6 The following table indicates the required distance by which time employees and their tools must be completely in the clear and in a safe location, for trains traveling at various speeds.

Train Speed (mph)	Distance travelled in 15 seconds in feet
10	220
15	330
20	440
25	550
30	660
35	770
40	880
45	990
50	1100
55	1210
60	1320
65	1540
70	1650
75	1760
80	1760
85	1870
90	1980
95	2090
100	2200

CN Training on Safety Watch

Currently, as part of CN's CROR refresher training, safety watch protection is presented in the training for the Engineering workbook.¹⁰ Within the Engineering workbook, the following question concerning safety watch is asked:

May ALL track work be performed solely under the protection of a safety watch?

The correct answer from the facilitator's training guide is:

No. Positive protection is available for any track work requirement and Safety Watch on its own should only be used when the work to be performed does not render the track unsafe and employees and equipment can be immediately advised of and clear approaching trains.

There is no other mention of safety watch within this training material.

CROR recertification is required every 3 years. A 2-day refresher training session is provided and the exam is performed on-line.

Through general discussion with CN ES employees, it was observed that:

- Knowledge of safety watch procedures for CN ES employees is normally acquired on the job.
- There were different interpretations among ES employees on how long they must be in the clear prior to the arrival of an approaching train at the work site.
- Some ES employees were not completely aware of the type of work activities and situations when safety watch protection can be used.

Safety Watch – Type Protection on U.S. Railroads

In the United States, track worker protection procedures are included in Section 214.349 of the Code of Federal Regulations (Title 49, Volume 4, revised 01 October 2003), which states (in part):

- (a) The training and qualification for roadway workers assigned the duties of watchmen/lookout shall include, as a minimum, consideration of the following factors:
 - (1) Detection and recognition of approaching trains.
 - (2) Effective warning of roadway workers of the approach of trains.
 - (3) Determination of the distance along the track at which trains must be visible in order to provide the prescribed warning time.
 - (4) Rules and procedures of the railroad to be used for train approach warning.

¹⁰ The Engineering workbook (June 2008) refers to CROR refresher material (presented by a facilitator), that provides review and practice questions concerning rules that are predominantly used by engineering employees.

The Union Pacific Railroad uses an electronic system to provide advance warning of approaching trains to employees working on the track. The Track Watch system (Figure 3) uses a track-mounted proximity detector to identify an approaching train. The proximity detector interacts with a portable signal repeater worn by the track worker. When a train approaches to within one mile of the proximity detector, a warning signal is transmitted to the device worn by each track worker. The device emits a loud audible alarm, a vibration alert and flashing LEDs. With this technology, there is also the option of having a track side warning system with warning sirens and a strobe light. Repeaters can be used to increase the range of the system in difficult terrain or environments.

MICRO TPASS Repeater -
A Small, Light Weight, Portable, Signal Repeating Device That Operates Interactively With Train Detector Extending the Range of the Track-Watch System.

Track-Side Warning Alarm -
Receives Warning Signals from the Train Detector and Activates Loud Sirens, a Bright Flashing Strobe Light, and Notifies Personnel of an Emergency Situation

MAINTENANCE-OF-WAY SAFETY SYSTEM
Track-Watch Providing Advanced Warning Of Oncoming Rail Traffic

Features:

- Enhances Two-Way Signaling Effectiveness with Track-Watch Train Detector
- Visual / Audio Activity Indicators Show Unit is **ON** and Operational
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- Meets FCC part 15 and Industry Canada requirements

Features:

- Advanced Warning of Oncoming Rail Traffic
- Invaluable to All Personnel Working On Railways
- Extremely Loud Dual Warning Siren and Bright Strobe Light
- Smart-Signal Intelligent Repeating Action
- Self-Contained in a Weather Resistant Enclosure
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Figure 3. Track Watch System

Track Worker Protection on Other Canadian Railways

CP Rail's Lookout Warning Policy (Appendix A) is a similar form of track worker protection to that of CN's safety watch. Before using the Lookout Warning Policy, the employee in charge must (in part) ensure that:

- i. Lookout Warning is only used for providing warning when protection required by rule is not required;

- ii. They can visually detect the approach of movements or equipment at maximum authorized speed and can occupy the designated place of safety 15 seconds before its arrival; and
- iii. The ability to hear and see approaching movements and other on-track equipment is not impaired by background noise, lights, inclement weather, passing movements, or other physical conditions.

On VIA Rail track, including the Alexandria Subdivision (Mile 0 to Mile 76.43), the Beachburg Subdivision (MP 0 to MP 6), the Smiths Falls Subdivision (Mile 0 to Mile 34.4) and the Chatham Subdivision (Mile 63.9 to Mile 99.2), the safety watch procedure is not permitted on main-track territory where authorized train speed is above 15 mph.

Railway and Regulatory Oversight of Safety Watch Procedures

CN conducts performance measurement of rules compliance (PMRC) to evaluate the extent to which employees comply with rules, regulations, standards, and other procedures, as part of its Safety Management System (SMS). These tests are documented and any misapplications of rules/procedures are addressed. Job briefings and Safety Watch procedures are within the scope of CN's PMRC tests. Company records indicate that, generally, these procedures have been followed correctly.

Transport Canada (TC) monitors and audits railway employees with respect to compliance with rules, regulations and standards. However, as Safety Watch is a company-initiated procedure, TC has not specifically audited this type of track worker protection. TC considers it is the company's responsibility to ensure that employees comply with this procedure.

Sustained Attention

Vigilance is about sustaining attention for the occurrence of rare critical events (e.g., when an operator has to look or listen over long periods of time for an infrequent signal or target). Judged by an individual's ability to detect critical, rare events and by the speed of reacting when it occurs, vigilance on sustained attention tasks is usually low and declines with time on the task.¹¹ Almost without exception, detections are lower and response times are longer when signals can occur from more than one source. The reasons for the longer detection and response times include:

- the critical event will take longer to detect when it arrives at a location not currently fixated than when it arrives at its singular, fixated location; and
- when the signal is transient, it may well be missed.¹²

¹¹ *Multiple Task Performance*, Taylor & Francis Inc., Bristol PA., 1991, pg. 153.

¹² *Multiple Task Performance*, Taylor & Francis Inc., Bristol PA., 1991, pg. 160.

Survey Concerning Working in Multi-track Territory

In November 2010, a union member of CN's Great Lakes Region Level II Health and Safety Committee conducted an employee survey involving 200 Engineering employees related to safety concerns when working in multi-track territory.

The survey results included (in part):

- During job briefings, 51% of the participants did not specifically indicate the location of the safe area to clear when allowing trains to pass.
- 70% of the participants responded that they had never received formal training as to how to work and clear safely in multi-track territory.

Job Briefing

CN GEI section 2.1 states (in part) that:

[...]prior to commencing any work, and as conditions or circumstances or the method of protection is changed, extended or about to be released, the person in charge of a work group will hold a job briefing session for all persons engaged in the activity.

Section 2.2 states (in part) that:

[...] the job briefing session shall cover all relevant issues with respect to the task being performed and necessary safety precautions that must be taken, including but not limited to the following:

- Designation of the employee in charge
- Method of on-track protection being used and the limits of authority
- Track(s) that may be fouled
- Operational control of movements on adjacent tracks if necessary
- Means of providing a warning when Safety Watch is used
- Designated place of safety where workers will clear for trains or track units
- Designated work zones around track units
- Safe working and travelling distances between track units.

In addition, job briefings are to be written down for ready reference by each employee.

Near-miss Reporting

Paragraph 125(1)(z.03) of the *Canada Labour Code* Part II requires the employer to:

Develop, implement and monitor, in consultation with the policy committee or, if there is no policy committee, with the work place committee or the health and safety representative, a prescribed program for the prevention of hazards in the work place

appropriate to its size and the nature of the hazards in it that also provides for the education of employees in health and safety matters.

Paragraph 126 (1)(g) of the *Canada Labour Code II* states:

While at work, every employee shall report to the employer any thing or circumstance in a work place that is likely to be hazardous to the health or safety of the employee, or that of the other employees or other persons granted access to the work place by the employers.

In a healthy safety culture, the employer encourages accident, incident and near-miss reporting and ensures that the reporting system is non-punitive both in practice and reputation. The employer motivates employees to submit reports by taking corrective actions and making it clear that managers value the input and respect the contribution of employees. In this way, reporting systems allow the managers and employees to work together toward the common goals of safety and efficiency. In such an environment, employees would want to report near-misses, which would prompt further company review of the root cause, potential risk, safety hazard or deficiency. Risks can be mitigated, and other employees can learn from mistakes made.

The minutes from CN's local Health and Safety Committee (Oshawa) from July 2010 to June 2011 were reviewed. During this period, no near-miss events were recorded in the minutes, despite the requirement to report these incidents. Near-miss Events was a subject heading in the committee minutes. In addition, there is no mechanism whereby near-miss data reported to the various Health and Safety committees are collected and analysed.

Through interviews with CN ES employees, it was learned that near-misses have occurred while working under lone worker or safety watch protection. The dates of the near-miss events were not available.

Between 2007 and 2011, there were at least 9 near-miss incidents involving track workers and a VIA Rail or GO/Metrolinx train. In each of these situations, positive protection had not been obtained before the track work was started. Instead, the safety watch or lone worker procedure had been used (Appendix B).

Other Related Occurrences

On 19 April 2007, a railway signal maintainer working under lone worker protection at Mile 52.8 of the CN Kingston Subdivision near Regis, Ontario, was struck and fatally injured by a passing freight train. Subsequent to this accident, Labour Canada conducted a risk assessment concerning spray painting of a switch machine under lone worker protection (i.e., the activity that was being performed when the employee was fatally injured). The risk assessment concluded in part, that:

the hazard of trains moving at high speeds at close proximity [to workers] creates a potential consequence of being struck by a train. This activity presents a high risk level, which identifies potentially serious problems requiring change.

Following the accident, a lone worker job aid was developed and distributed to Engineering Services employees at CN. The job aid included a form, namely Statement of On Track Safety (Appendix C), which must be completed by each employee prior to using lone worker protection. The form must be in the employee's possession while work is being performed (TSB Occurrence No. R07D0033).

On July 27 2011, at approximately 1135, Capital Railway (CR) O-train (WKCI), equipped with 3 passenger cars was proceeding northward at 34 mph on the main track of the Elwood Subdivision. As WKCI approached the Rideau River bridge (KM 3.82), the crew observed track maintenance employees and a flagman on the bridge. The train reduced speed while the track maintenance employees, startled by the sudden appearance of WKCI, quickly evacuated the bridge. The workers had been conducting track and bridge inspections and were being protected by a safety watch. Trains in the vicinity had been advised to contact the foreman by radio prior to arriving at km 2.88. However, in this situation, after a radio contact attempt was made and was not heard or acknowledged, the train proceeded at track speed towards the bridge (TSB Occurrence – Voluntary).

On 14 August, 2011, at approximately 1350, VIA Rail passenger train 643 (VIA 643) was proceeding westward at 93 mph on the south track of the GO transit/Metrolinx portion of the Kingston Subdivision. Near Mile 315.95, as VIA 643 rounded a curve, the crew observed a Pacific Northern Rail (PNR) foreman working on a crossing on the south track. The VIA crew activated the horn. The foreman, startled by the sudden appearance of VIA 643, exited the track to the south. Shortly before the incident, the foreman and his track workers had decided to work under a safety watch to perform track maintenance at the crossing. While working, the crossing became activated by an eastbound GO train on the north track, and all but the foreman cleared both tracks. The foreman continued working. As the GO train cleared, VIA 643 rounded the curve approaching from the east on the south track and the worker was almost struck (TSB Occurrence No. R11T0241).

Analysis

The analysis will focus on the actions of the train crew, the actions of the two track workers, job briefing, near-miss reporting, and safety watch procedures, training and regulatory oversight.

The Accident

As westbound VIA 51 traversed a long, sweeping 1° left-hand curve on the south track approaching Mile 314.4, the train crew observed 2 track workers performing maintenance on the south rail of the north track immediately ahead. The accident occurred when the track foreman attempted to clear to the south and inadvertently moved into the path of VIA 51.

The train was placed into emergency braking just before the track worker was struck and injured fatally.

Train Crew Actions

The maximum sight line from the train to the location where the 2 ES employees were working was about 800 feet. The train was travelling at 96 mph or about 141 feet per second so it was about 5.7 seconds away from the accident location when the employees first came into view. As it is not uncommon for train crews to encounter track workers, pedestrians and/or trespassers on the track, the normal course of action is to sound the locomotive horn as was done in this case. The train crew anticipated that the track workers would react and clear the track. In these situations, train crews are not expected to apply the emergency brakes unless it becomes apparent that the person or group of people on the track are not reacting to reach a safe location. The train crew's actions were not contributory to the accident.

Safety Watch Protection

Using the safety watch procedure as the form of track worker protection, the crew of 3 ES employees had spent the morning prior to the accident lifting track joints. With a team of 3 track workers, 1 employee was assigned the sole duty of observing train and track unit movements and hazards while the other 2 employees performed the work.

In the afternoon just prior to being assigned the task of lifting the low joint at Mile 314.4, the work crew was reduced to 2 employees. After initially checking with the RTC regarding a track occupancy permit (TOP), the 2 remaining track workers decided to conduct the track maintenance work under the safety watch procedure rather than wait for the positive protection of a TOP. The competing pressures of time and productivity were likely the primary considerations for proceeding with the work under a safety watch. The work crew did not conduct a separate job briefing for the additional work task at Mile 314.4, missing an opportunity to discuss the potential risks and to reconsider the chosen work plan. While performing the maintenance, both track workers were engaged in the work and no one was performing the duties of the safety watch. At Mile 314.4, the sight line to the east was just under 800 feet, which was much less than the minimum required sight line of 2200 feet for 100 mph track. Despite not having the required minimum sight line to safely apply the safety watch procedure, the work crew elected to proceed with the work.

The work crew had been in contact with the RTC and believed that there were no other trains approaching on the north track after the passing of the GO train. The work crew's mental model was that it was safe to perform work on the north track. Without a dedicated safety watch, the work crew were focused on their work and consequently they were unaware of the approach of VIA 51, a regularly-scheduled westbound passenger train.

Risks Inherent in the use of Safety Watch

The successful application of safety watch is based on the assumption that the employee performing the safety watch dedicates his/her full attention to this task and does not engage in other activities that can distract from this primary responsibility. Research indicates that vigilance on sustained attention tasks is usually low and declines with time on task. Further, almost without exception, detections are lower and response times are longer when signals can occur at more than one location. On high-speed main lines in multi-track territory, distraction of any kind, even for a few seconds, can result in tragic consequences. Given that individuals cannot reliably devote their full attention to any one task for an extended period, particularly when the expected stimulus can come from more than one direction, there is an increased risk under safety watch that trains will not always be observed in time for adequate warning to be provided.

While working under safety watch protection, railway instructions require employees to be in the clear at least 15 seconds prior to the arrival of a train at the work location. A train travelling at 100 mph (147 feet/second) would travel 2200 feet in 15 seconds. Employees would have to be in the clear by the time the train is no closer than 2200 feet from their location. To calculate the total sightline distance required, the following additional elements must be considered;

- the time required to positively identify an approaching train (perception),
- the time required to signal the other workers (reaction),
- the time required for the other workers to perceive and react to the signal, and
- the time required for the workers to move to a safe location.¹³

If it takes an additional 9 seconds to complete the above 4 elements, in territories where passenger trains travel 100 mph, an additional 1323 feet of sight line distance for a total of 3523 feet is required (Appendix D). Due to the number and complexity of calculations that must be undertaken, safety watch presents numerous opportunities for human error, and therefore cannot be relied upon to protect track workers on busy mainline track.

Railway instructions indicate that safety watch protection can be used for minor work tasks such as inspections and repairs on the track with hand tools that do not render the track unsafe for the passage of trains. However, for some CN employees, there was confusion over which tasks were permissible under safety watch protection. No comprehensive list was available identifying the tasks that could be safely conducted using safety watch protection. In the absence of clear direction on when safety watch can be utilized and a definitive list of tasks that can be performed under the safety watch procedure, more complex tasks which may not be suitable may be undertaken, increasing the risk to track workers.

¹³ In this occurrence, the senior track foreman was wearing a leg brace which would reduce agility and possibly increase reaction time.

Near-miss Reporting

It was observed that CN employees involved in near-misses were not always using the established channels (i.e., Supervisor and/or the Health and Safety Committee) to report these events. The absence of a formal data collection system to capture near-miss reports means incident frequency and training effectiveness cannot be measured to prompt further coaching and/or training, or review policies and procedures if required. When employees are reluctant to report near-miss events, there is an increased risk that others will not have the opportunity to learn and avoid a similar incident.

Training and Regulatory Oversight of Safety Watch

At CN, at the time of this occurrence, there was no job aid ¹⁴ for the safety watch procedure. In addition, many employees were unsure of where the instructions could be found in their training materials. Although the GEI sets out guidelines for how to apply the safety watch procedure, many track workers had primarily learned this procedure while working on the job.

This form of track worker protection is conducted without written authority from the RTC. Written authorities such as track occupancy permits are captured and retrievable from the RTC data base. Given that safety watch protection is self-administered and therefore not captured, it is difficult for the railway to oversee this practice. Without consistent training on the use of the safety watch procedure, there is an increased risk that track workers may not understand the procedure, including how to determine the critical time and sight line distance required to clear the track.

In Canada, the safety watch procedure was not mandated by regulation. Other jurisdictions (i.e., the US) have taken the initiative to regulate similar methods of track protection.

Transport Canada does not specifically oversee employee compliance with procedures in the railway General Engineering Instructions and therefore did not monitor the safety watch procedure.

Railway Protocol for Tracking Near-urgent Defects

The near-urgent defect at Mile 314.4 had been detected on 09 April 2011 by the track geometry test car. This defect was not repaired within the 30-day limit specified in CN's engineering standards and there was no record indicating what remedial action had been taken. This location was susceptible to a reoccurring surface condition, as track maintenance had been performed at least twice within the month prior to the accident.

Typically, track workers will be provided with a computer-generated defect report listing the locations requiring attention. After completion of each repair, the foreman in charge will indicate in writing the date that action was taken and write his name beside the defect. This report is then returned to the supervisor for data entry. In this occurrence, the specific maintenance records for previous repairs to the track joint at Mile 314.4 were not available.

¹⁴ A job aid is a document developed for training and reference purposes to describe the recommended application of a rule or procedure.

Without accurate track repair records, there is a risk that the maintenance of recurring near-urgent track defects may not be performed in a timely and optimal manner.

Findings as to Cause and Contributing Factors

1. The accident occurred when the track foreman attempted to clear to the south and inadvertently moved into the path of VIA 51.
2. The work crew did not conduct a separate job briefing for the additional work task at Mile 314.4, missing an opportunity to discuss the potential risks and to reconsider the chosen work plan.
3. No TOP was issued and, despite not having the required minimum sight line to safely apply the safety watch procedure, the work crew elected to proceed with the work.
4. While performing the maintenance, both track workers were engaged in the work and no one was performing the duties of the safety watch.
5. Without a dedicated safety watch, the work crew were focused on their work and consequently were unaware of the imminent approach of VIA 51.

Findings as to Risk

1. Safety watch does not reliably protect track workers on busy mainline track.
2. In the absence of clear direction on when safety watch can be used and a definitive list of tasks that can be performed under the safety watch procedure, more complex tasks which may not be suitable may be undertaken, increasing the risk to track workers.
3. Without consistent training on the use of the safety watch procedure, there is an increased risk that track workers may not understand the procedure, including how to determine the critical time and sight line distance required to clear the track.
4. When employees are reluctant to report near-miss events, there is an increased risk that others will not have the opportunity to learn and avoid a similar incident.
5. Without accurate track repair records, there is a risk that maintenance of recurring near-urgent track defects may not be performed in a timely and optimal manner.

Other Finding

1. The train crew's actions were not contributory to the accident.

Safety Action

Transportation Safety Board of Canada

On 30 August 2011, the TSB sent a Rail Safety Advisory Letter (RSA 09/11 Use of Lone Worker and Safety Watch Protection on High Speed Railway Corridors) to Transport Canada. The advisory explained how CN's GEI regarding track worker protection can be misinterpreted. In particular, the letter indicates that, as the instructions are not incorporated in the CROR, there is no formal requirement to conduct initial training or recurrent training for these forms of track protection, nor was there any regulatory overview. Furthermore, efficiency testing surrounding these procedures is not performed consistently enough to ensure that the procedures are properly understood and applied in the field. The letter also states that given the importance of workplace safety for track maintenance personnel on high speed railway corridors, Transport Canada may wish to review the manner in which federally regulated railways implement, monitor and conduct training for Lone Worker and Safety Watch protection to ensure that the criteria are properly applied and that adequate protection is provided to track maintenance personnel.

Transport Canada

On 26 October 2011, Transport Canada responded to RSA 09/11, indicating that CN had temporarily suspended its "Safety Watch" and "Lone Worker Protection" on double track Class 5 territory in Eastern Canada.

In addition, TC Ontario Region conducted a series of inspections and interviews on the CN Kingston and Oakville subdivisions to ensure that employees were complying with company instructions regarding the suspension of safety watch and lone worker protection.

In August 2011, TC contacted other railways within the Ontario Region to obtain copies of their "Safety Watch" and "Lone Worker Protection" process for review. Processes submitted by the railways were reviewed, and subsequent inspections and interviews were conducted with railway employees to determine the level of knowledge and compliance to their internal instructions.

Transport Canada is reviewing the manner in which federally-regulated railways implement, monitor and conduct training for safety watch protection.

In the longer term, TC is considering the possibility of encouraging the railway to develop new rules and/or amend older ones to incorporate these company instructions into a more formal regulatory framework.

On 25 May 2012, the revised *Rules Respecting Track Safety* came into effect. Section 10.3 of Part F of the revised rules indicates that:

Each record of an Inspection under Part II, Subpart F sections 4, 5, 8 and 9 must specify the date of inspection, the location and nature of any defects found, the remedial action taken and the date thereof, and the location of any segments of track not tested per Part II, Subpart F sections 4 and 5. The railway company must retain a rail inspection record for at least two years after the inspection and for one year after the defect is removed.

HRSDC

On 21 November 2011, Human Resources and Skills Development Canada (HRSDC) issued a *Canada Labour Code* (CLC) direction to CN, noting that the employer has failed to ensure that:

- crews working under Safety Watch are properly protected
- work crews have a designated Safety Watch as set out in CN's GEI 5.0.
- employees are provided with the necessary tools to properly assess distances when considering using Safety Watch.

CN was directed, pursuant to paragraph 145(2)(a) of the *Canada Labour Code*, Part II, to alter the activity that constitutes the danger immediately.

On 28 November 2011, HRSDC issued 3 additional directions:

- The Preventative Measure Direction stated in part: To the extent that the employer controls the activity, develop, implement and monitor, in consultation with the appropriate committee or, health and safety representative;
 - a prescribed program for the prevention of hazards in the work place,
 - provide for the education of employees in health and safety matters,
 - take preventive measures to address hazard of moving trains within areas of track that the employer knows would be unsafe to use Safety Watch i.e. sharp bends in the track, and
 - first try to eliminate the hazard.
- The Hazard Elimination Direction requested the identification of areas where safety watch would be prohibited as a method of track protection.
- The Lack of Supervision Direction stated in part that: The employer has failed to:
 - take preventative measures to address assessed hazards,
 - manage/supervise their employees' work methods, to ensure that work being completed is done so in accordance with CN's safety protocol.

CN was directed to address the above 3 contraventions no later than 5 January 2012.

CN

On 19 July 2011, CN supervisors and Health and Safety representatives were advised of the rescinded use of safety watch and lone worker protection on the Kingston Subdivision.

On 3 August 2011, CN issued a Safety Flash to ES employees reiterating the requirements to apply safety watch properly.

CN's ES reviewed the safety watch procedure and implemented the following improvements:

- enhanced the sight line distance / time chart to include the time employees need to clear the track,
- developed a list of activities that could be performed under safety watch protection, and
- developed a safety watch job aid and training course for all engineering employees.

On 21 December 2011 CN responded to HRSDC's Preventative Measures Direction indicating that a rigorous "Safety Watch" training initiative had been implemented. More than 3000 CN's ES employees had been re-trained for safety watch protection. Re-training included identifying changes and the parameters in which safety watch can be used.

CN's response to HRSDC's Hazard Elimination Direction indicated that safety watch protection, as a method of protection on all class 5 double-track territory including the Kingston, Oakville and portions of the St-Hyacinthe subdivisions remains suspended. Safety watch on all other tracks is governed by the more stringent general operating instructions.

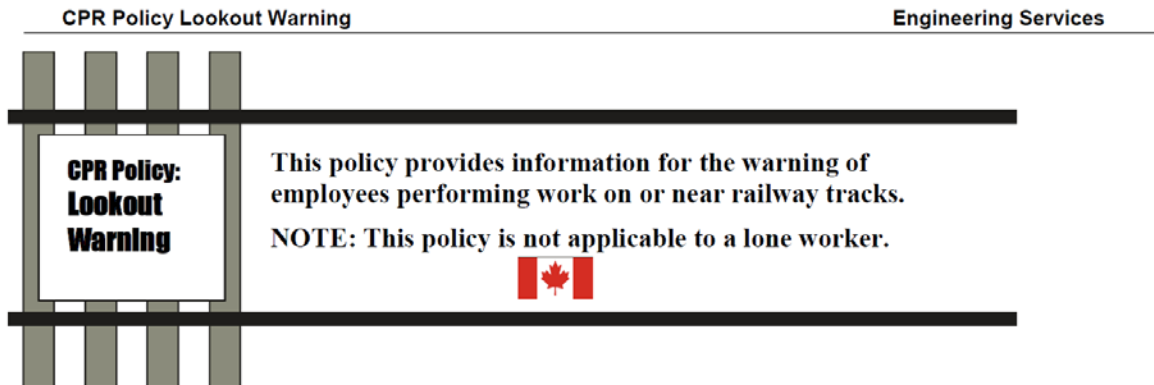
CN's response to HRSDC's Lack of Supervision Direction indicated that CN's System Management Safety Plan includes the Performance Management Rules Compliance program that involves supervisors monitoring employees and contractors while they work, assessing their performance with regard to process, procedures, method of protection, PPE, etc. Safety watch protection processes across the system underwent 2504 observations, with a compliance rate of 98%. Of the failures, 17% of the employees were investigated formally and received between 10 and 30 demerit points through the disciplinary system. The balance of the employees that were non-compliant was addressed at the time of the observance by the supervisor who reviewed the intent of the safety watch process and the application of the parameters. Once the process is confirmed to be understood by the employee or contractor, the supervisor authorizes resumption of work and records this action in the PMRC database.

The actions taken by CN met the requirements of HRSDC directions.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 05 September 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 – CP's Lookout Warning Policy



1.0 Lookout Procedures

1.1. General Information

This information is intended for the warning of employees on or near the track who do not have and do not require protection according to the rules.

1.2. Definitions

Lookouts - employees assigned to warn other employees of the approach of a movement or equipment

Lookout Warning - a means of affording a warning to workers in order to permit the employees to safely clear the track

Movement(s) – the term used in this policy to indicate trains, engines or transfers

1.3. Permissible Use

Lookout Warning must only be used when track protection according to applicable rules is not required. It must only be used at locations and under conditions that will permit all employees using such to receive the required warning signals in time to:

- i. suspend work activities; and
- ii. reach the designated place of safety no less than **15** seconds before the arrival of a movement or equipment.
- iii. Lookout Warning must not be used for work that will affect operation of movements.

1.4. Prior to Lookout Warning use

Before using Lookout Warning, the employee in charge must ensure that:

- i. Lookout Warning is only used for providing warning when protection required by rule is not required;
- ii. they can visually detect the approach of movements or equipment at maximum authorized speed and can occupy the designated place of safety 15 seconds before its arrival.

- iii. the ability to hear and see approaching movements and other on-track equipment is not impaired by background noise, lights, inclement weather, passing movements, or other physical conditions.

EXCEPTION: If a Lookout is providing warning signals to a single employee who remains within 25' of the Lookout, the noise level is allowed to be higher.

IMPORTANT: Lookout Warning must not be used if the sight distance does not provide enough warning for employees to reach the designated place of safety **15** seconds before a movement or equipment arrives.

- iv. Prior to assigning the duties of a Lookout, ensure the employee is able to:
 - detect and recognize approaching movements and equipment;
 - identify a place of safety where they and the employees can go when a movement or equipment approaches and record same on the prescribed form;
 - provide the required warning signals according to item 1.6
 - devote full attention to detecting approaching movements or equipment; and
 - determine how far down the track a movement or equipment must be before the warning signals to employees is given.
- v. All affected employees are provided, through a job briefing, with sufficient information to ensure that:
 - each employee is aware of the role and identity of the Lookout, including the warning signals to be provided and the designated place of safety, and when the Lookout must be given a break; and
 - each employee is aware of the method to be used for clearing the track when the command to do so is given by the Lookout.

1.5. Lookouts

- i. A Lookout's sole duty is to watch out for approaching movements or equipment and to provide warning signals to employees to cease activities and be in the designated place of safety at least **15** seconds before the arrival of the movement or equipment.
- ii. Lookouts must:
 - have a valid certificate of Rules Qualification at the "D" level as a minimum;
 - have the appropriate equipment to perform their duties, such as a warning whistle or horn and white disc;
EXCEPTION: The use of the white disc is not necessary when warning is being provided to a single employee who remains within 25 feet of the Lookout;
 - be on the ground close to the work area, in a location that provides a clear view of the area;

- not engage in any activities, including any unnecessary conversation, which may affect his or her ability to provide uninterrupted observation; and
- be able to evaluate his or her ability to act as a Lookout for extended periods of time.

IMPORTANT: It is the responsibility of the Lookout to arrange for relief or for a break if required. This will ensure that he or she continues to be alert and able to perform the duties of the Lookout conscientiously for the required period of time.

- iii. Provide warning signals in such a way that the warned employee can take action:
 - without having to look in any particular direction at the time of the warning signals; and
 - regardless of the noise levels or distractions at the work location.
- iv. The following chart as contained in the job briefing booklet must be used by Lookouts to determine the distance (in feet) that movements or equipment travel relative to their speed (in MPH).

DISTANCE TRAVELLED IN FEET, IN 15 SECONDS OF TIME, FOR VARIOUS SPEEDS			
MPH	Distance	MPH	Distance
5	110'	40	880'
10	220'	45	990'
15	330'	50	1110'
20	440'	55	1210'
25	550'	60	1320'
30	660'	65	1430'
35	770'	70	1540'

Figure 1

1.6. Warning Signals

On the approach of a movement or equipment the following warning signals must be given in sufficient time to permit employees to cease work activity and reach the designated place of safety at least **15** seconds prior to arrival of the movement or equipment moving at track speed.

- a. Sound a warning whistle or horn; and
- b. Hold the white disc at arm's length above head and then horizontally at arm's length towards the designated place of safety

When it is safe to resume work, the Lookout must hold the white disc horizontally at arm's length towards the work site.

EXCEPTION: The use of the white disc is not necessary when warning signals are being provided to a single employee who remains within 25 feet of the Lookout.

1.7. Employees Working Under A Lookout

- a. All employees using Lookout Warning must know the role and identity of the Lookout;
- b. be familiar with the warning signals that will be provided by the Lookout;
- c. remain alert for warning signals given by the Lookout;
- d. clear the track to the designated safe place as identified in the job briefing immediately when the warning signals are given; and
- e. stay until the signal is given to return.

1.8. Equipment For Lookout

- a. SAP part # 771200976 Paddle, 16" dia, white reflect, lookout kit
- b. SAP part # 771200974 Kit, lookout warning, PPE Equipment **which will contain:**
 - BAG - CP PART # 771200975
 - 16 INCH DIAMETER PADDLE, - CP PART #771200976
 - 20 INCH HANDLE - CP PART #771200977
 - FLASHLIGHT, TAKES 2 BATTERIES - CP PART #771200978
 - BATTERIES CP PART #736013458
 - WHISTLE - CP PART # 771200985
 - AIR HORN - CP PART # 771200983
 - AIR HORN REFILL - CP PART #771200984

Appendix B – Summary of Near-miss Reports

VIA Rail (2007 – 2011) – Near-miss Reports Involving Track Workers and Passenger Trains
(when Safety Watch or Lone Worker Protection was used)

Date	Near-miss Event
2 June 2010	VIA train involved in a near miss with a track worker at Turcot
6 February 2010	VIA train involved in a near miss with two CN employees near Turcot
10 July 2008	VIA 39 involved in a near miss with track workers near Mile 26.7 (Kingston Subdivision)
6 July 2007	VIA train involved in a near miss with a track worker
3 July 2007	VIA 30 involved in a near miss with track workers in Central Station (Montreal)
3 July 2007	VIA 32 involved in a near miss with a track welder near Ballantyne

Go Transit/Metrolinx (2007 - 2011) - Near Miss Reports Involving Track Workers and Passenger Trains (when Safety Watch or Lone Worker Protection was used)

Date	Near-miss Event
2 February 2011	Train 252 involved in near miss when a track worker was unaware of the approaching train at Mile 3 (Weston Subdivision)
1 April 2010	GO Train 837 involved in a near miss when the train was lined into a track where train workers were present.
22 June 2008	Train 909 involved in a near miss at Union Station (Toronto) when a track worker was performing repairs to the track.

Appendix C – Statement of On Track Safety for Lone Worker Protection



Statement of On Track Safety / Déclaration sur la sécurité en voie

A lone worker using Individual Train Detection must complete this form prior to fouling a track.

Tout travailleur isolé ayant recours à la Détection individuelle des trains doit remplir le présent formulaire avant de s'engager sur la voie.

To complete this form / Instructions à suivre :

1. Provide the following information / Veuillez d'abord fournir les renseignements suivants :

Name / Nom _____ Date / Date _____

Subdivision / Subdivision _____

Working Limits / Zone de travail _____

Time Limits / Heures de début et fin _____

2. In the table below, place an X in the box adjacent to the maximum authorized timetable speed of trains within the working time specified above and observe the minimum required sight distance associated with that speed.

Dans le tableau ci-dessous, tracez un x dans la case adjacente à la vitesse maximale autorisée par l'indicateur pour la zone de travail susmentionnée, et prenez note de la distance de visibilité minimale correspondant à cette vitesse.

Maximum Authorized Speed in MPH <i>Vitesse maximale autorisée, en mi/h</i>	Minimum Required Sight Distance <i>Distance de visibilité minimale</i>		Maximum Authorized Speed in MPH <i>Vitesse maximale autorisée, en mi/h</i>	Minimum Required Sight Distance <i>Distance de visibilité minimale</i>	
	X	feet / pieds		X	feet / pieds
5		110	55		1 210
10		220	60		1 320
15		330	65		1 430
20		440	70		1 540
25		550	75		1 650
30		660	80		1 760
35		770	85		1 870
40		880	90		1 980
45		990	95		2 090
50		1 100	100		2 200

100 feet / pieds = 30.5 metres / mètres

Note: When the maximum authorized timetable speed is not shown on the form, use the next higher speed.

This form must be in the employee's possession while work is being performed.

Nota : Si la vitesse maximale autorisée par l'indicateur ne figure pas sur le formulaire, utilisez la vitesse maximale suivante.

Le travailleur doit être en possession du présent formulaire pendant le déroulement des travaux.

Appendix D – Safety Watch Calculation for Time and Sightline Distance

To calculate the time and sightline distance for a Safety Watch, the following elements must be considered:

- The standard detection and reaction time of a person to a simple visual cue is about 2.5 seconds ¹⁵ assuming the person has focussed their attention on that location first and that they are expecting to see something.
- The time for a person to notice and react to an unexpected or ambiguous cue is longer, as high as 4.5 seconds.
- The job briefing form requires that in multi-track, employees must be clear of a train or track unit by 19 feet.
- Therefore, when the person performing the Safety Watch is looking in the direction of the target at the moment it becomes visible, they should react to it within 2.5 seconds. The worker(s) being protected needs an additional 2.5 seconds to react to the Safety Watch command. Considering that it would take the average person at least 4 seconds to walk 19 feet, the total time required to detect the train and clear the tracks would be at least 9 seconds.
- For trains travelling 100 mph (147 feet/second), this requires approximately 1320 feet in addition to the 2200 feet requirement listed in the GEI.
- Therefore, in the best case scenario, the Safety Watch needs a total of 3520 feet of sightline in order for the track workers to be clear 15 seconds prior to the arrival of the 100 mph train.

¹⁵ This is the standard perception and reaction time used for transportation safety design in North America. For example, table 1.2.2.1 of the Transportation Association of Canada's Geometric Design Guide for Canadian Roads.