Transport Accident Investigation Commission

Final report
Tuhinga whakamutunga

Rail inquiry RO-2023-101
Hi-Rail vehicle collision near Te Puna
86.43 km East Coast Main Trunk line
10 January 2023

April 2024

The Transport Accident Investigation Commission
Te Kōmihana Tirotiro Aituā Waka

No repeat accidents – ever!

"The principal purpose of the Commission shall be to determine the circumstances and causes of accidents and incidents with a view to avoiding similar occurrences in the future, rather than to ascribe blame to any person."

Transport Accident Investigation Commission Act 1990, s4 Purpose

The Transport Accident Investigation Commission is an independent Crown entity and standing commission of inquiry. We investigate selected maritime, aviation and rail accidents and incidents that occur in New Zealand or involve New Zealand-registered aircraft or vessels.

Our investigations are for the purpose of avoiding similar accidents and incidents in the future. We determine and analyse contributing factors, explain circumstances and causes, identify safety issues, and make recommendations to improve safety. Our findings cannot be used to pursue criminal, civil, or regulatory action.

At the end of every inquiry, we share all relevant knowledge in a final report. We use our information and insight to influence others in the transport sector to improve safety, nationally and internationally.

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Citations and referencing

The citations section of this report lists public documents. Documents unavailable to the public (that is, not discoverable under the Official Information Act 1982) are referenced in footnotes. Information derived from interviews during the Commission's inquiry into the occurrence is used without attribution.

Photographs, diagrams, pictures

The Commission owns the photographs, diagrams and pictures in this report unless otherwise specified.

Verbal probability expressions

For clarity, the Commission uses standardised terminology where possible.

One example of this standardisation is the terminology used to describe the degree of probability (or likelihood) that an event happened, or a condition existed in support of a hypothesis. The Commission has adopted this terminology from the Intergovernmental Panel on Climate Change and Australian Transport Safety Bureau models. The Commission chose these models because of their simplicity, usability, and international use. The Commission considers these models reflect its functions. These functions include making findings and issuing recommendations based on a wide range of evidence, whether or not that evidence would be admissible in a court of law.

Terminology	Likelihood	Equivalent terms
Virtually certain	> 99% probability of occurrence	Almost certain
Very likely	> 90% probability	Highly likely, very probable
Likely	> 66% probability	Probable
About as likely as not	33% to 66% probability	More or less likely
Unlikely	< 33% probability	Improbable
Very unlikely	< 10% probability	Highly unlikely
Exceptionally unlikely	< 1% probability	

Figure 1: Hi-Rail vehicle 2 (HRV2) before the accident

Figure 2: Hi-Rail vehicle 2 (HRV2) showing collision damage

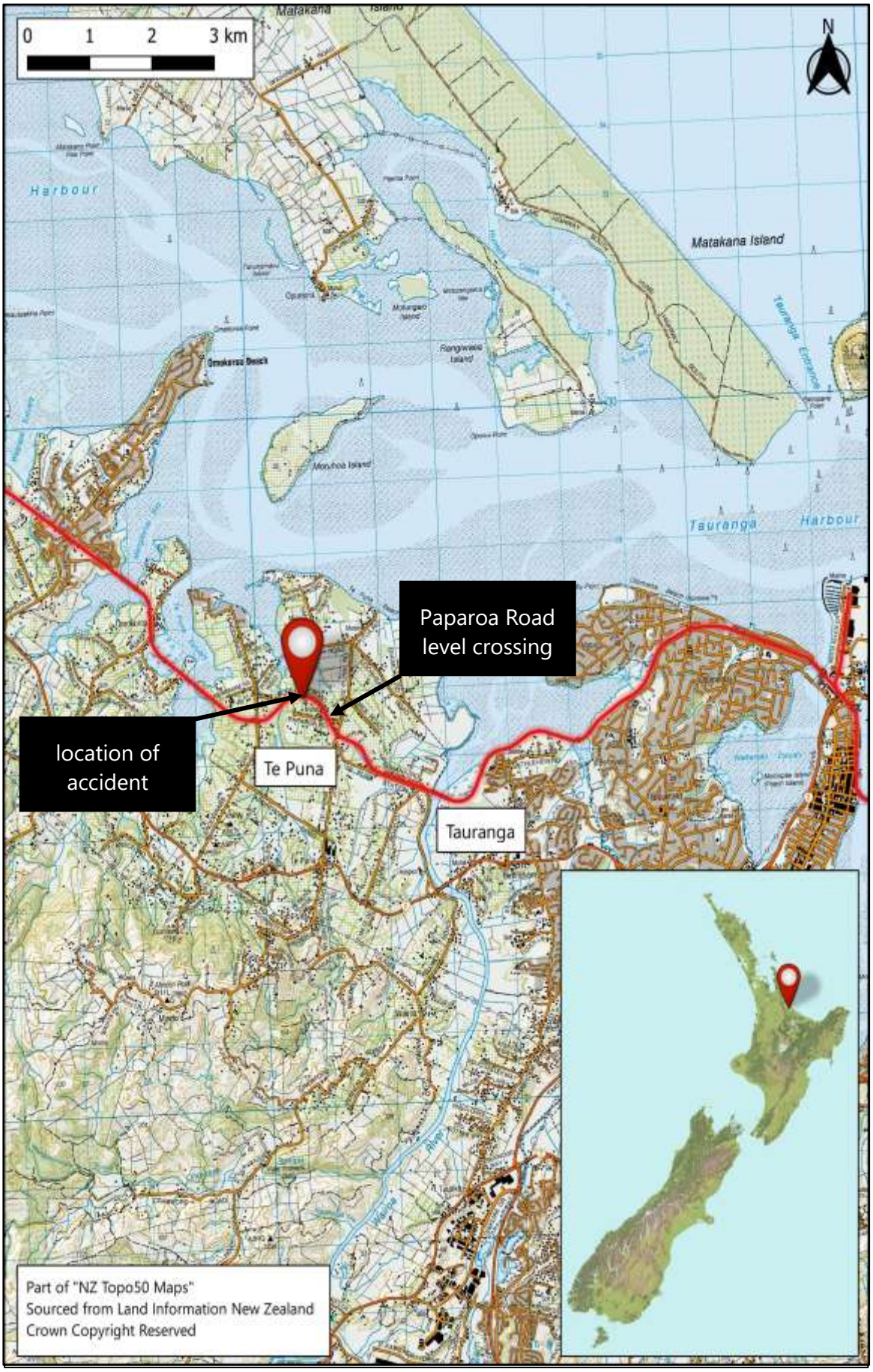

Figure 3: Location of accident

(Credit: Land Information New Zealand Toitū Te Whenua)

Contents
Rārangi take

Figures

1 Executive summary
Tuhinga whakarāpopoto

What happened

1.1. At about 0707[1] on 10 January 2023, a Hi-Rail vehicle[2] (HRV1) on-tracked[3] at the Paparoa Road level crossing near Te Puna, approximately eight kilometres (km) west of Tauranga and near the 87-kilometre mark on the East Coast Main Trunk line (*see* Figure 3). It then began travelling northwest towards a planned worksite near Apata for an infrastructure team to carry out maintenance work.

1.2. HRV1 was being driven by the infrastructure team's supervisor (the Ganger[4]) and there was one passenger, a track worker[5] (TW1).

1.3. A second Hi-Rail vehicle (HRV2), driven by another track worker (TW2), on-tracked at the same location two minutes after HRV1 and started travelling in the same direction towards Apata, following HRV1 to the worksite.

1.4. The Ganger driving HRV1 stopped the truck in the middle of a left-hand curve, approximately 500 metres (m) from the on-tracking location, to mark a section of track that indicated the start of the worksite.

1.5. Once stopped, the Ganger and TW1 both exited HRV1 and walked to the track in front of the vehicle. The Ganger then spray-painted markings onto the track while TW1 watched what the Ganger was doing.

1.6. A short time later HRV2, driven by TW2, rounded the left-hand curve behind HRV1 travelling at approximately 38 kilometres per hour (km/h).

1.7. When TW2 realised that HRV1 was stopped on the track, they attempted to stop by braking heavily. However, HRV2 collided with the rear of HRV1 while travelling at 38 km/h at the same time as TW1 was climbing back into the cab of HRV1.

1.8. Upon impact TW1 was thrown off HRV1 onto the stone ballast at the side of the track. TW1 suffered bruising to their body and a lacerated finger. Metal cabinets on the rear deck of HRV1 were also shorn off their mountings and became unsecured.

Why it happened

1.9. A radio call made by the Ganger to HRV2 stating that HRV1 was stopped on the track ahead was not received or acknowledged.

1.10. HRV2 was travelling at a speed that did not reflect the conditions and was contrary to the requirements of KiwiRail's Rail Operations Rules and Procedures.

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[1] Times used in this report are expressed in the 24-hour format based on New Zealand Daylight Time.

[2] A vehicle fitted with retractable rail wheels that can travel on both road and rail. When travelling in rail mode the front road wheels are not in contact with the ground and the vehicle is unable to be steered in the manner of a road vehicle (*see* Figure 4).

[3] The activity whereby the HRV transitions from the road onto the railway track by lowering the rail wheels. Off-tracking is the opposite action, from the railway track onto the road.

[4] Traditional railway terminology for the supervisor of an infrastructure team (work gang) of track workers.

[5] A person who is part of an infrastructure team carrying out maintenance and repair of the railway track.

1.11. As well as carrying out the work task, the Ganger was conducting multiple roles including worksite supervisor, team trainer/instructor and rail protection officer. The Ganger was not adequately supported to carry out these roles while simultaneously supervising the safety of a relatively inexperienced team.

What we can learn

1.12. Safety-critical tasks, such as operating HRVs on track, require a high level of focus, behaviour and communication.

1.13. All rail staff should be aware of the possibility of conflicting rail traffic while working near vehicles stopped on track.

1.14. Personnel involved with the loading of rail vehicles, including HRVs, should ensure the security of loads before travel to mitigate the consequences of a collision.

Who may benefit

1.15. Rail operators, worksite supervisors, rail protection officers (RPOs) [6], HRV operators, track maintenance personnel and people working around vehicles may all benefit from the findings in this report.

[6] An RPO is a person qualified to establish track protection for a protected work area.

2 Factual information
Pārongo pono

Narrative

Background

2.1. The work gang operating on the day of the accident consisted of six people: the Ganger (worksite supervisor), who was also the RPO, and five track workers. The work gang was operating three Hi-Rail vehicles (HRVs): a heavy destress[7] unit (HRV1), a tamper[8] unit (HRV2) and a third unit (HRV3) (*see* Figure 4).

Figure 4: A Hi-Rail vehicle travelling in rail mode

2.2. The work gang was to travel from the on-tracking location to the worksite to conduct destressing operations.

2.3. On arrival at the on-tracking location, the work gang carried out a pre-start meeting. This included completion of a Job Plan using KiwiRail's Job Plan Book (referred to as a TS90 book) and a safety-briefing on the work location, work tasks, protection arrangements, health and safety details, communications plan and specific site hazards (*see* Appendix 1).

2.4. The specific site hazards for this day included rail vehicle separation, weather and driving/Hi-Railing. The safety-briefing did not include a diagram of the proposed

[7] Destressing is the process of adjusting the rails to a stress-free state at a certain rail temperature. Destressing helps the rails cope better with temperature extremes and prevents buckling or contraction.

[8] A machine used to pack (tamp) the track ballast under railway tracks to make the tracks more level.

worksite or how the activity was to be carried out, although there was a specific form in the TS90 book for this information that was not filled out.

2.5. TW1 completed the Job Plan form and the Ganger conducted the safety-briefing. There was heavy rain on the morning of the accident and the safety-briefing was held in a group outside the vehicles.

The event

2.6. At about 0707 on 10 January 2023, after receiving permission from train control[9] and the necessary protections[10] having been established, HRV1 on-tracked at the Paparoa Road level crossing, near the 87-kilometre mark on the East Coast Main Trunk line. It then began travelling towards a planned worksite near Apata.

2.7. The Ganger was driving HRV1 and there was one passenger, TW1.

2.8. The plan was for all three HRVs to on-track and travel to the worksite in the order of HRV1, HRV2 and HRV3. However, HRV3 did not have time to on-track before the accident occurred and it remained off track at the Paparoa Road crossing.

2.9. HRV2 on-tracked two minutes behind HRV1, with a driver (TW2) and one passenger and began travelling in the same direction as HRV1 towards the planned worksite (*see* Figure 5).

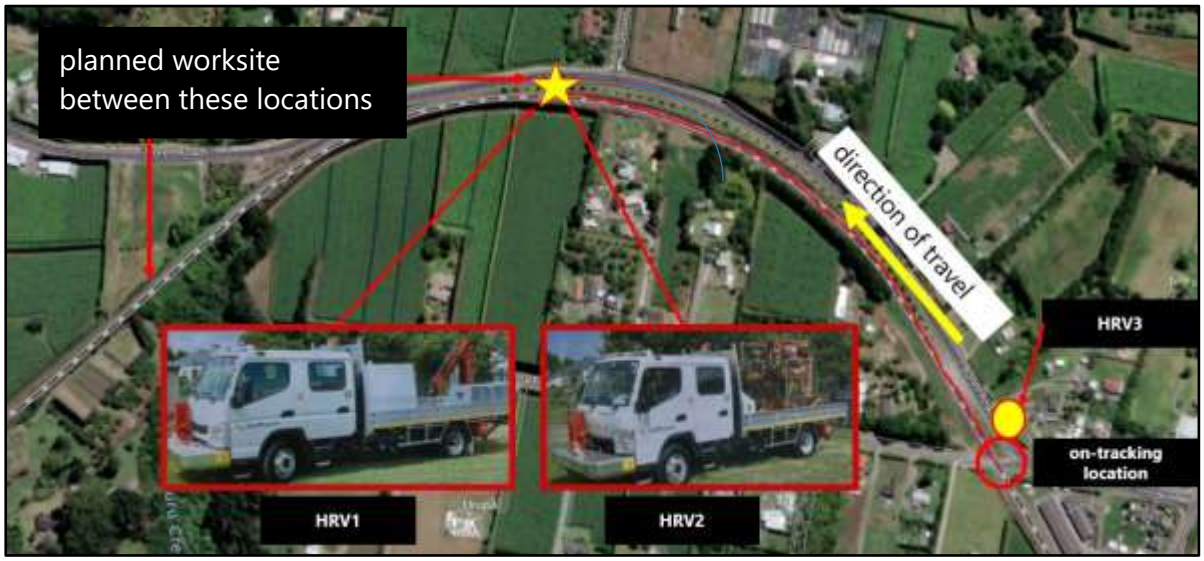


Figure 5: Map of accident site

2.10. Because of the wet weather conditions at the time and of also travelling in convoy, the HRVs should have been travelling at no more than 30 kilometres per hour (km/h), and at such a speed that they would have been able to stop within half the clear distance that could be seen ahead.[11]

[9] Train control is responsible for track authorisations and the safe movement of rail traffic. At the time of the accident the national train control centre was situated in Wellington Railway Station.

[10] Train control established protection by holding signals providing entry into the area at red (stop). This prevented rail traffic from entering the same area as the HRVs.

[11] KiwiRail Rail Operating Rules – Track Safety Rule 916(c)-(d) – HRV and Trolley – Driver's responsibilities (*also see* Appendix 3).

2.11. At about 0711 the Ganger stopped HRV1 to mark a section of the track with spray paint. The Ganger and TW1 left the cab of HRV1 and were standing on the ballast[12] in front of the vehicle.

2.12. The Ganger stated that on stopping they made a call on the radio to inform HRV2 that HRV1 had stopped. No response or acknowledgement was received for this radio call from HRV2 and the occupants of HRV2 both stated that they did not hear a call on the radio.

2.13. At 0712 TW2, the driver of HRV2, which was travelling at approximately 38 km/h, was not aware that HRV1 had stopped. On seeing the vehicle after rounding a bend and realising that HRV1 was not moving, TW2 attempted to stop HRV2 but was unable to do so before it collided with the rear of HRV1 (*see* Figures 6 and 7).

[12] Crushed stone or rocks placed under rail to support and hold the track in place as trains roll over it.

Figure 6: First clear sight line between HRV1 and HRV2 (re-enactment)

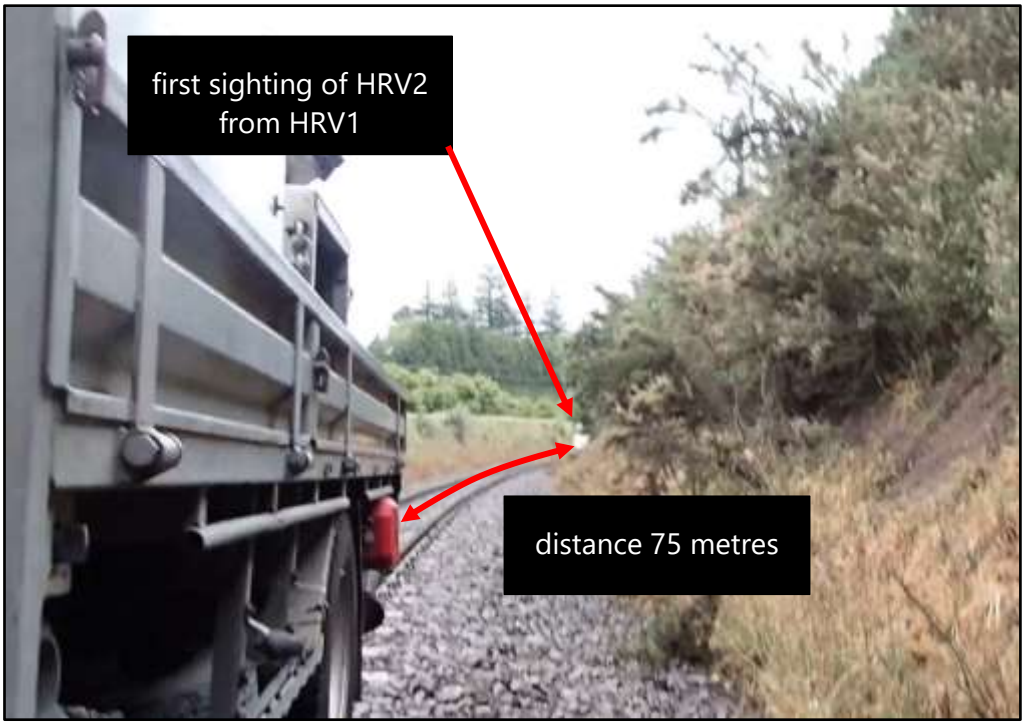


Figure 7: Reverse view from HRV1 (re-enactment)

2.14. The Ganger stated that on sighting the incoming vehicle, and realising HRV2 would not be able to stop in time, they shouted a warning to TW1. However, TW1 had neither seen the approaching HRV2 nor heard the warning and was in the process of climbing back into the cab when the collision happened.

2.15. As a result of the collision HRV1 was shunted 13 metres (m) forward from its stationary position. Global Positioning System (GPS) data shows HRV1 accelerating from 0 km/h to 10.2 km/h one second after the collision, then moving at 15.9 km/h two seconds after the collision, 12.7 km/h three seconds after the collision, 9.5 km/h four seconds after the collision and 3.2 km/h five seconds after the collision before coming to a stop six seconds after the collision.

2.16. TW1 was in the process of climbing from the trackside into the cab when the collision occurred and as a result was thrown from the vehicle onto the ballast, suffering bruising and a lacerated finger requiring stitches.

2.17. Immediately after the collision the Ganger went to the assistance of TW1. On assessing that TW1 required medical treatment the Ganger also checked the occupants of HRV2 before instructing the work gang to reverse the HRVs to the original on-tracking location to clear the track. TW2 and their passenger reversed to the off-tracking location in HRV2, followed by the Ganger driving HRV1 with TW1 as passenger.

2.18. At 0813, one hour after the accident, the Ganger advised train control that an accident had occurred, and that all vehicles and personnel were now clear of the track.

2.19. On being advised that an accident had occurred train control escalated the situation to the Network Control Manager[13] and an investigation was initiated by KiwiRail.

2.20. TW1 was taken to hospital in HRV3 for medical attention. The HRVs and the work gang returned to Tauranga depot where the Ganger and TW2, as drivers of the HRVs, underwent drug and alcohol testing.

Personnel information

2.21. The Ganger had been employed by KiwiRail since August 2016. On 28 September 2020 they completed the Ganger's Skills course (KiwiRail's leadership course for worksite supervisors). Post-accident drug and alcohol testing was conducted and indicated a negative (passed) result.

2.22. TW2 had been employed by KiwiRail as a track worker since October 2021. On 14 June 2022 they completed the Track Protection Basic Machines course (full and final certification to operate a Hi-Rail vehicle within a protected work area). Post-accident drug and alcohol testing was conducted and indicated a negative (passed) result.

Vehicle information

2.23. Both HRVs were Mitsubishi Fuso Canter trucks that had been fitted with retractable rail wheel equipment allowing them to travel on both road and rail. Both trucks held current certificates of fitness and had been recently serviced.

Meteorological information

2.24. Between 1 January 2023 and 11 January 2023, 119 millimetres (mm) of rain was recorded in Tauranga as a result of ex-tropical cyclone Hale, compared to 22.2 mm for the same period the year before. Although there was heavy rainfall in the area on the morning of the accident, visibility was not affected. However, compared to dry conditions, the wet rails would have reduced the braking efficiency of the HRVs.

[13] The shift-manager at train control.

Recorded data

2.25. The Commission obtained recordings of radio communications between the Ganger and train control. Radio communications between HRVs are not recorded.

Other data sources

2.26. HRV1 and HRV2 were both fitted with 'Navman' GPS equipment. The Commission obtained data from the GPS equipment for use in its investigation.

Site and wreckage information

2.27. HRV1 received superficial damage to the rear of the vehicle.

2.28. HRV2 received substantial damage to the front of the vehicle and to the retractable Hi-Rail equipment.

2.29. The Commission issued a Protection Order on both vehicles to conduct testing and evidence gathering.

Medical and pathological information

2.30. TW1 was treated for bruising and required stitches to a lacerated finger.

Tests and research

2.31. During interview, TW2 stated that they thought HRV2 had 'lost power' when they applied the brakes on seeing HRV1. The Commission engaged a Mitsubishi agent to conduct fault data analysis testing on HRV2. The fault data analysis found no evidence of power loss leading up to the accident. GPS data indicated HRV2 was travelling at an almost steady speed without significant deceleration until the time of impact (*see* Figure 8).

TIME	SPEED (km/h)
07:11:56	35.8
07:11:57	38.9
07:11:58	38.9
07:11:59	38.9
07:12:00	38.3
07:12:01	35.8
Time of impact 07:12:02	38.3
07:12:03	32
07:12:04	16.4
07:12:05	13.3
07:12:06	0

Figure 8: Speeds of HRV2 during the incident, based on GPS data

2.32. Commission investigators also conducted a re-enactment of the accident using two HRVs of the same type as those involved in the collision and in similar weather conditions to determine sighting and braking distances.

Previous occurrences

2.33. On 24 April 2020, a Mitsubishi Fuso Canter HRV was struck by a freight train at Limeworks Road level crossing between Milton and Henley.[14] The investigation found that the accident occurred in track warrant territory[15] as a result of the HRV driver on-tracking before a train travelling towards their location had cleared, contrary to the track warrant requirements.

2.34. On 2 May 1996, two HRVs collided near Kotemaori.[16] The two vehicles were working in the same area independent of each other when one vehicle rounded a bend and encountered the other vehicle ahead of it travelling in the same direction but at a

[14] TAIC report RO-2020-102 https://www.taic.org.nz/inquiry/ro-2020-102
[15] An area operating on verbal and written instructions from train control indicating limits of authority, as opposed to following red or green trackside signals.
[16] TAIC report RO-1996-104 https://www.taic.org.nz/inquiry/ro-1996-104

much lower speed. The investigation found that "the cause of the collision was insufficient information available to the employee in charge of one of the Hi-Rail vehicles."

Organisational information

2.35. KiwiRail Holdings Limited (trading as KiwiRail) was the operator of the railway, owner of the HRVs and employer of all the workers involved.

3 Analysis
Tātaritanga

Introduction

3.1. The safety of multiple vehicles working together within a protected work area[17] relies on all operators following established rules and procedures to maintain safe vehicle separation.

3.2. The following section analyses the circumstances surrounding the event to identify those factors that increased the likelihood of the event occurring or increased the severity of its outcome. It also examines any safety issues that have the potential to adversely affect future operations.

Training

Safety issue 1: Training of staff covered operating a HRV within a protected work area but assumed it occurred under direct supervision of a rail protection officer or qualified safety protector. The training did not adequately address independently travelling longer distances to get to the work area. Had the track workers understood the risks involved with travelling, the accident would likely not have occurred.

3.3. TW2 (the driver of HRV2) completed a two-day Track Protection Basic – Machines (TPBM) course and received full and final certification to operate a HRV within a protected work area on 14 June 2022 – six months before the accident.

3.4. The TPBM workbook contained information for operators of HRVs that aligned with KiwiRail's Rail Operating Rule 916 – Hi Rail Vehicle and Trolley – Drivers responsibilities (*see* Appendices 2 and 3)

3.5. Content of the TPBM course included:

- Introduction to TPBM
- Protected Work Areas
- Radio communication
- HRVs in Protected Work Areas
- Emergency situations
- Operating a HRV
- Theory assessment
- On job training assessment

3.6. Rather than being a comprehensive HRV training programme, the TPBM course was designed to give personnel operating HRVs (such as Hi-Rail diggers and other maintenance vehicles) a basic understanding of the requirements of arriving on site, on-tracking and working on-track in a protected work area under the supervision of a

[17] A worksite within the railway corridor protected from entry by unauthorised rail traffic through a variety of means. Protection may include; blocking of signals, compulsory stop boards, signage and detonators.

RPO. This basic course was considered necessary as some operators, such as non-KiwiRail contractors, may not have been familiar with KiwiRail's HRV safety requirements. The TPBM workbook stated in part:

> Once you have completed the theory course and on job training, you will have KiwiRail's Licence to Operate: **TPBM**. This means you will be able to safely use a hi rail vehicle in a protected work area – *where a qualified safety protector is present at all times.* [Emphasis KiwiRail's]

3.7. TW2 did not drive a HRV on a daily basis, as this task was shared between those members of the work gang with the necessary qualification. At the time of the accident, TW2 had been TPBM certified for six months and had not received any safety observations to confirm competency during that time.

3.8. TW2 stated that they had not worked at the Apata worksite before and were not "100 per cent sure where they were going" but had simply intended following the lead HRV.

3.9. When HRV1 on-tracked and began travelling to the worksite in front of HRV2, TW2 was left unsupervised, as the passenger in HRV2 was not TPBM qualified and was also unfamiliar with the area.

3.10. This was contrary to instructions given in the TPBM workbook, and also KiwiRail Rule 916(b) which stated:

> **Driver without local knowledge**
>
> Where for some reason the driver is not a person with adequate local knowledge, the driver must be accompanied by a second person with such knowledge, who holds the appropriate licence to operate.

3.11. The effects of the lack of direct supervision may have been mitigated if the Ganger had remained in constant radio communication with TW2 to monitor their progress during the trip from Paparoa Road to the work site. However, this communication did not occur. No pre-start radio checks had been conducted that morning to ensure the HRV radios were working correctly. TW2 stated they did not check the state of the radio when they entered HRV2; they recalled that it was turned on but were unaware if the volume was up or if it was on the correct working channel.

3.12. The radio call the Ganger stated they made to the following HRVs to advise that HRV1 was stopped, was not received by TW2 and there was no acknowledgement of the message. The TPBM workbook stated in part:

> **Acknowledgements**
>
> All radio messages must be acknowledged. The person sending the message must not assume it has been received until it is acknowledged.

And further stated in part regarding radio testing:

> **Testing the radio**
>
> To be confident that people can hear and understand your message, you need to know that your radio is working properly and if you can communicate with another radio.
>
> You need to check the channel is clear and carry out a call to test how well you can be heard.

3.13. Had the procedures been followed to test that the radios were working correctly, and the message that HRV1 was stopped been acknowledged, the accident would **likely** not have occurred.

3.14. The Ganger, also acting as RPO, was required to travel in the lead vehicle of the convoy to comply with KiwiRail Rule 916(c), which stated in part:

> Where two or more HiRail vehicles/trolleys are travelling together the addressee of the occupancy authority must travel in the leading vehicle…

And also to comply with the TPBM workbook, which stated in part:

> If HRVs are travelling in a convoy then the RPO will be in the leading vehicle. They will inform all other drivers about information they receive from train control and will provide permission to travel.

3.15. The requirement for the Ganger to travel in the lead vehicle effectively left TW2, who had minimal training and was unsupervised, on their own to drive the HRV through an area they were not familiar with, and with only a basic understanding of the worksite location.

3.16. When HRV2 rounded the bend at over 38 km/h and TW2 saw HRV1 ahead, it took TW2 a moment to realise that HRV1 was stopped on the track and that immediate action needed to be taken.

3.17. Upon realising HRV1 was not moving, TW2 estimated they were about 12 m from the vehicle when they started braking. This estimation is broadly supported by the GPS speed data obtained by the Commission.

3.18. To comply with KiwiRail's Rule 916(d) and the guidelines stated in the TPBM workbook, TW2 should have been travelling at no more than 30 km/h and at such a speed that they were able to stop in half the clear distance ahead.

3.19. It was **very likely** that as a result of a combination of the above conditions, the application of HRV2's brakes occurred too late to avoid a collision with HRV1.

3.20. No action has been taken to address these safety issues. Therefore the Commission has made a recommendation in Section 6.

Safety issue 2: KiwiRail had not identified HRV cabs as being a safety-critical area so there was no enhanced training on the need for a high level of focus, behaviour and communication. Had track workers received such enhanced training, the accident would likely not have occurred.

3.21. There was scant information in the TPBM workbook about safe working within the cab of a HRV. However, it did state in part:

> The HRV driver is responsible for the safe operation of the HRV. They need to comply with the relevant KiwiRail rules and procedures as outlined in this course, and follow any specific instructions from the RPO.

3.22. The RPO on this occasion was also the Ganger, travelling in a separate vehicle, who had not issued any specific instructions to TW2 other than the unacknowledged radio call that HRV1 had stopped.

3.23. During their interview, TW2 stated they had not been advised that a HRV cab was a safety-critical area[18], and therefore they had not considered that it was.

3.24. TW2 also stated that just before the accident they had been engaged in conversation with the passenger and they were not fully focused on the track ahead.

3.25. Nevertheless, a track worker in charge of a HRV not being aware through training of the safety-critical nature of the task and of the need for a greater level of attention is of concern to the Commission.

3.26. No action has been taken to address these safety issues. Therefore the Commission has made a recommendation in Section 6.

Support for the Ganger

Safety issue 3: The Ganger did not have adequate support to conduct multiple roles, including worksite supervisor, team trainer/instructor and rail protection officer, as well as carrying out the work task. Had the Ganger been able to delegate some of the workload it is likely the safety-critical tasks would have been more effectively supervised and the accident would likely not have occurred.

3.27. The Ganger was first employed by KiwiRail as a track worker in 2016. In 2020, they completed the 'Ganger's skills' course, a leadership-focused course provided by KiwiRail with the stated intention to "create a pathway for future leaders to successfully lead teams".

3.28. This course should have been followed by further training on business management and leadership. However, this further training was postponed because of the COVID-19 pandemic and had not restarted before the accident.

3.29. The Ganger was assigned the members of the work gang as each of them completed initial KiwiRail induction training. Of the five members of the work gang, only one track worker in HRV3 had more than 18 months' experience, and they were still at the on-tracking location when the accident occurred.

3.30. In addition to carrying out any assigned work tasks, the Ganger bore the responsibility for the instruction of new staff in all aspects of track work, including health and safety.

3.31. The Ganger also acted as the RPO at worksites, communicating with train control to establish protection for all personnel within the protected work area and ensuring those personnel were adhering to safety requirements.

3.32. The responsibilities that came with being a Ganger and a RPO were substantial and would have been mitigated by the availability of adequately experienced staff to oversee less experienced staff during routine tasks.

3.33. While the Ganger tried to allow less experienced staff to conduct tasks, such as recording the day's safety plan, the Ganger was then responsible for checking that all of these tasks had been completed correctly.

[18] An environment of potential high risk in which unsafe behaviors will inevitably result in a mishap with severe consequences.

3.34. During their interview the Ganger stated that they faced a considerable amount of pressure to complete the work gang's planned work to the required standard while simultaneously training the work gang to do that work.

3.35. During the investigation the Commission asked KiwiRail to provide its policies on the acceptable ratio of trainees/inexperienced staff assigned to a single direct supervisor. On 12 June 2023 KiwiRail replied:

> There is no policy that states the acceptable ratio of trainees/inexperienced staff vs a supervisor. We very rarely get in the position where we have more than 1 trainee at one time with 1 gang so can manage internally.
>
> We do have a buddy system that is part of the new employee induction process where an experienced employee is assigned as a Buddy to a new employee, this doesn't necessarily need to be the Ganger/Supervisor, but someone to ensure the Safety of the new employee and to answer any queries [*sic*].

3.36. However, this was not the situation the Ganger was operating in at the time of the accident; they were the only experienced person on site and acting as 'Buddy' to every other person on site out of necessity. KiwiRail's 'Buddy' system was ad hoc and was not in place for the work group at the time of the accident. There remains a gap in KiwiRail's policies for when there is more than one trainee at one time with one gang.

3.37. Had there been more experienced staff available to assist the less experienced staff, adequate supervision of safety-critical tasks, such as operating HRVs, would **likely** have occurred and the accident would **likely** not have happened.

3.38. No action has been taken to address this safety issue. Therefore the Commission has made a recommendation in Section 6.

Non-contributory factors

Post-incident procedures

3.39. Immediately following the accident, the Ganger's primary concern was for the wellbeing of their staff. The Ganger assessed if anyone was injured and provided first aid to TW1.

3.40. The Ganger made the decision to reverse both HRVs back to the Paparoa Road crossing, off-track and transport TW1 to hospital.

3.41. The Ganger contacted the driver of HRV3 and instructed them to remain off-track while HRV2 and HRV1 reversed towards the crossing.

3.42. On arrival at the crossing, both HRV2 and HRV1 off-tracked. TW1 transferred to HRV3 and was taken to hospital for assessment.

3.43. Once the situation had stabilised, the Ganger attempted to contact their line manager for direction and advice, but their phone was turned off as they were on leave. The Ganger then called the Production Manager but was again unsuccessful. The Ganger then called the Regional Manager and also received no answer. Eventually the Ganger was able to contact the Production Manager who enquired about the wellbeing of the

work gang, asked the Ganger if they had marked up[19] the site and advised the Ganger that they would start the investigation process.

3.44. During their interview the Ganger could not recall being trained to freeze[20] an accident site and was unable to describe the process or where to find the procedure.

3.45. The procedure for what actions to take following an incident are provided in the back pages of KiwiRail's 'TS90' book – the Job Plan book that the Ganger had briefed the work gang from about 10 minutes before the accident (*see* Figure 9).

[19] To spray-paint the position of equipment or vehicles on the railway so that measurements can be taken once the equipment has been moved

[20] Where an investigation is required, the act of retaining all evidence by ensuring nothing is moved or removed from the scene.

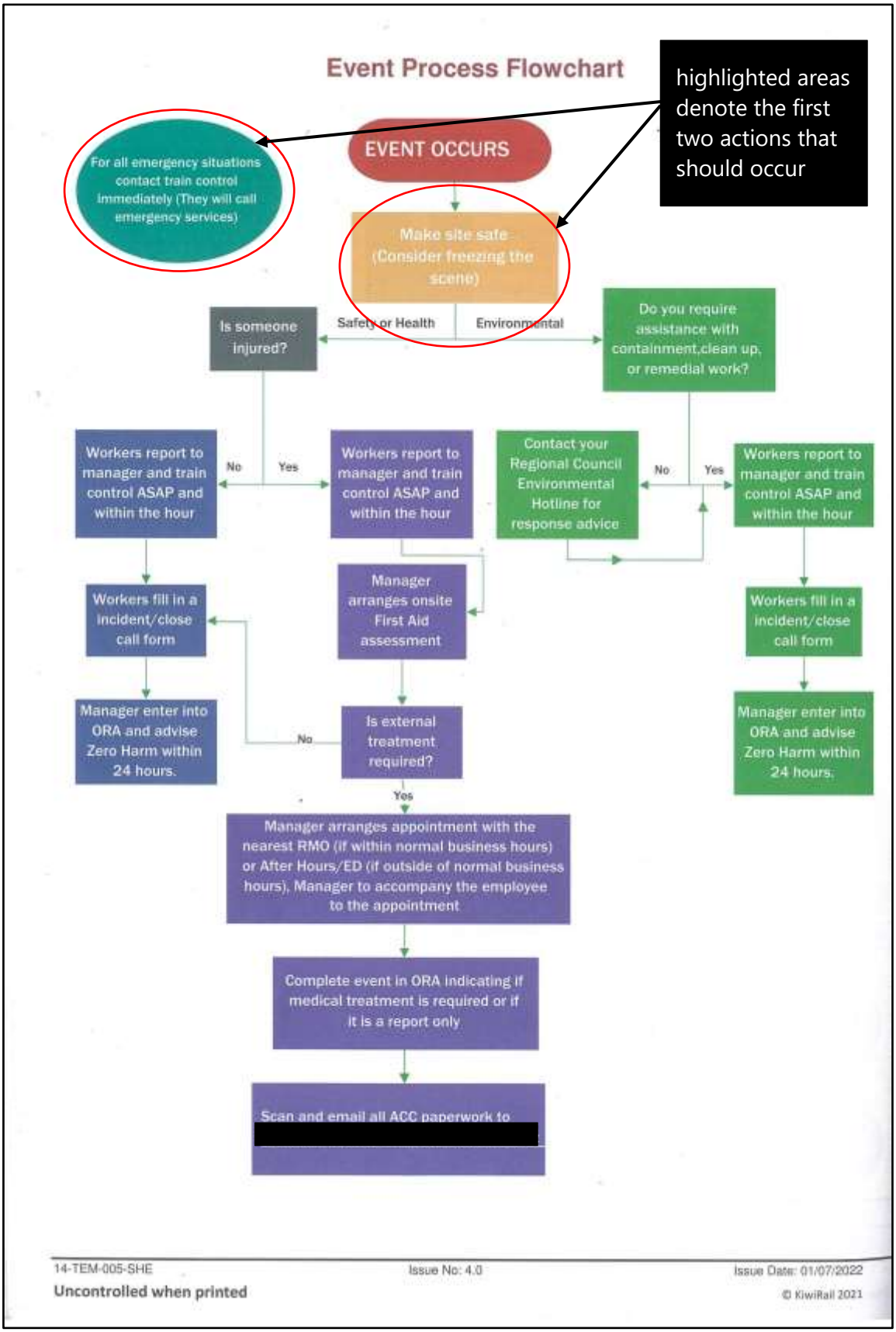


Figure 9: Event process flowchart included in KiwiRail TS90 Job Plan Book

(Credit: KiwiRail)

3.46. The Ganger was under pressure during the aftermath of the incident and was acting as they felt necessary to seek urgent medical treatment for TW1. However, one of the first actions they should have taken was to contact train control and advise of the situation.

3.47. Advising train control would have afforded the Ganger the opportunity to deal with the situation at hand while train control made the necessary arrangements for medical attendance, halting rail traffic in the area, directing assistance to the scene and a multitude of other actions that could have assisted the Ganger who was working in isolation.

3.48. The Ganger did not advise train control that there had been an accident until just over one hour after the collision, when at 0813 the Ganger notified train control that all personnel and machinery were clear, and the protection established for the work area could be rescinded. When train control acknowledged this the Ganger informed them that there had been an 'incident' and they would not be requiring further track time that day.

3.49. It was on receipt of this information that train control informed the Network Control Manager, who began making enquiries into what had occurred and initiated the investigation process.

3.50. By not immediately informing train control of the accident, an opportunity was lost for support to be provided earlier to the Ganger and for the scene to be frozen to preserve evidence that could have been crucial to an investigation had the circumstances been more serious.

Working near vehicles on track

3.51. Moments before the accident, the Ganger and TW1 were standing directly in front of HRV1 while the Ganger marked the track with spray paint.

3.52. KiwiRail rules are silent on working around vehicles on track while there is following traffic in the area.

3.53. Had the Ganger and TW1 still been in front of HRV1 when it was struck from the rear by HRV2 they would have **likely** sustained serious injuries based on the rate HRV1 accelerated on impact.

3.54. Although not contributory to this accident there is a **key lesson** that all rail staff should be aware of the possibility of conflicting rail traffic while working near vehicles stopped on track.

Crashworthiness

3.55. The Commission found that on impact the four 8mm steel bolts that secured two metal cabinets containing heavy equipment were shorn from their mountings on the deck of HRV1.

3.56. The Commission also found that tanks containing flammable welding gas were not secured sufficiently on the deck of HRV1 and were attached to the metal cabinets that became unsecured when the bolts were shorn off during the collision (*see* Figure 10).

Figure 10: Gas bottles secured to metal cabinets on deck of HRV1

3.57. This collision between the two HRVs occurred at a relatively low speed, and with little resistance when HRV1 began moving on impact.

3.58. The Commission is concerned that had one of the HRVs, which can travel on both rail and road, been involved in a rail incident at a higher impact speed the consequences of the load being unsecured could have been serious.

3.59. Although the unsecured load was not contributory to this accident, there is a **key lesson** for personnel involved with the loading of rail vehicles, including HRVs, that they should ensure the security of loads before travel to mitigate the consequences of a collision.

4 Findings
Ngā kitenga

4.1. KiwiRail rules are silent on the acceptability of standing in front of a stationary track vehicle while there is following traffic in the area.

4.2. Had the Ganger and TW1 still been in front of HRV1 when it was struck from the rear by HRV2 they would have **likely** sustained serious injuries based on the rate HRV1 accelerated on impact.

4.3. Had the track workers received adequate training to understand the risks involved with travelling in HRVs, the accident would **likely** not have occurred.

4.4. Had the procedures been followed to test that the radios were working correctly, and the message that HRV1 was stopped been acknowledged, the accident would **likely** not have occurred.

4.5. The application of HRV2's brakes **very likely** occurred too late to avoid a collision with HRV1.

4.6. Had there been more experienced staff available to assist the less experienced staff, adequate supervision of safety-critical tasks, such as operating HRVs, would **likely** have occurred and the accident would **likely** not have happened.

4.7. Had one of the HRVs, which can travel on both rail and road, been involved in a rail incident at a higher impact speed, the consequences of the load being unsecured could have been serious.

4.8. By not immediately informing train control of the accident, an opportunity was lost for support to be provided earlier to the Ganger and for the scene to be frozen to preserve evidence that could have been crucial to an investigation had the circumstances been more serious.

5 Safety issues and remedial action
Ngā take haumanu me ngā mahi whakatika

General

5.1. Safety issues are an output from the Commission's analysis. They may not always relate to factors directly contributing to the accident or incident. They typically describe a system problem that has the potential to adversely affect future transport safety.

5.2. Safety issues may be addressed by safety actions taken by a participant, otherwise the Commission may issue a recommendation to address the issue.

5.3. The Commission identified three safety issues during the investigation.

Safety issue 1: Training of staff covered operating a HRV within a protected work area but assumed it occurred under direct supervision of a rail protection officer or qualified safety protector. The training did not adequately address independently travelling longer distances to get to the work area. Had the track workers understood the risks involved with travelling, the accident would likely not have occurred.

5.4. No action has been taken to address this safety issue. Therefore, the Commission has made a recommendation in Section 6 to address this issue.

Safety issue 2: KiwiRail had not identified HRV cabs as being a safety-critical area so there was no enhanced training on the need for a high level of focus, behaviour and communication. Had track workers received such enhanced training, the accident would likely not have occurred.

5.5. No action has been taken to address this safety issue. Therefore, the Commission has made a recommendation in Section 6 to address this issue.

Safety issue 3: The Ganger was not given adequate support to conduct multiple roles, including worksite supervisor, team trainer/instructor and rail protection officer, as well as carrying out the work task. Had the Ganger been able to delegate some of the workload it is likely the safety-critical tasks would have been more effectively supervised and the accident would likely not have occurred.

5.6. No action has been taken to address this safety issue. Therefore, the Commission has made a recommendation in Section 6 to address this issue.

6 Recommendations
Ngā tūtohutanga

General

6.1. The Commission issues recommendations to address safety issues found in its investigations. Recommendations may be addressed to organisations or people and can relate to safety issues found within an organisation or within the wider transport system that have the potential to contribute to future transport accidents and incidents.

6.2. In the interests of transport safety, it is important that recommendations are implemented without delay to help prevent similar accidents or incidents occurring in the future.

New recommendations

6.3. On 27 March 2024 the Commission recommended that KiwiRail review and improve the training given to track workers, to include identification of the risks associated with:

1. operating a HRV unsupervised when travelling to worksites

2. a HRV cab being a safety-critical area,

to enable them to operate a HRV safely **(010/24)**.

6.4. On 8 April 2024, KiwiRail replied:

> This recommendation is accepted. We are engaging with our Learning and Development team regarding course content for HRV operators, with a focus on the safety critical environment of the HRV cab when ontrack and understanding of risks (safe travel distance/speed/emergency braking/radio calling) when travelling under TPBM to a worksite.

6.5. On 27 March 2024 the Commission recommended that KiwiRail provide Gangers with the necessary resources to enable them to supervise and train track workers safely and effectively while also completing work tasks **(011/24)**.

6.6. On 8 April 2024, KiwiRail replied:

> This recommendation is accepted. We are working on determining the best way to manage the trainee worker/ganger ratio.

7 Key lessons
Ngā akoranga matua

7.1. Safety-critical tasks, such as operating HRVs on track, require a high level of focus, behaviour and communication.

7.2. All rail staff should be aware of the possibility of conflicting rail traffic while working near vehicles stopped on track.

7.3. Personnel involved with the loading of rail vehicles, including HRVs, should ensure the security of loads before travel, to mitigate the consequences of a collision.

8 Data summary
Whakarāpopoto raraunga

Vehicle particulars

Vehicle type and number:	Two Mitsubishi Fuso Canter Hi-Rail trucks
Classification:	Hi-Rail vehicles
Year of Manufacture:	HRV1 – 2014, HRV2 – 2017
Operator:	KiwiRail

Date and time	10 January 2023, 0712hrs
Location	Te Puna, Bay of Plenty
Operating crew	one Ganger, three track workers
Injuries	minor injuries to one track worker
Damage	substantial but repairable damage to HRV2

9 Conduct of the Inquiry
He tikanga rapunga

9.1. On 10 January 2023 the NZ Transport Agency Waka Kotahi notified the Commission of the occurrence. The Commission subsequently opened an inquiry under section 13(1) of the Transport Accident Investigation Commission Act 1990 and appointed an Investigator-in-Charge.

9.2. The Commission seized the two HRVs for testing and examination including fault analysis and obtained documents and records for analysis, including:

- interviews conducted with the Ganger, five track workers and the Production Manager
- statements made by involved parties to KiwiRail
- GPS download data
- train control radio and telephone recordings
- train control diagram
- Job Plan book (TS90)
- operating manuals for the HRVs.

9.3. On 13 December 2023, the Commission approved a draft report for circulation to five interested parties for their comment.

9.4. Four interested parties replied that they had no comment. One interested party did not respond despite efforts to contact them.

9.5. On 27 March 2024, the Commission approved the final report for publication.

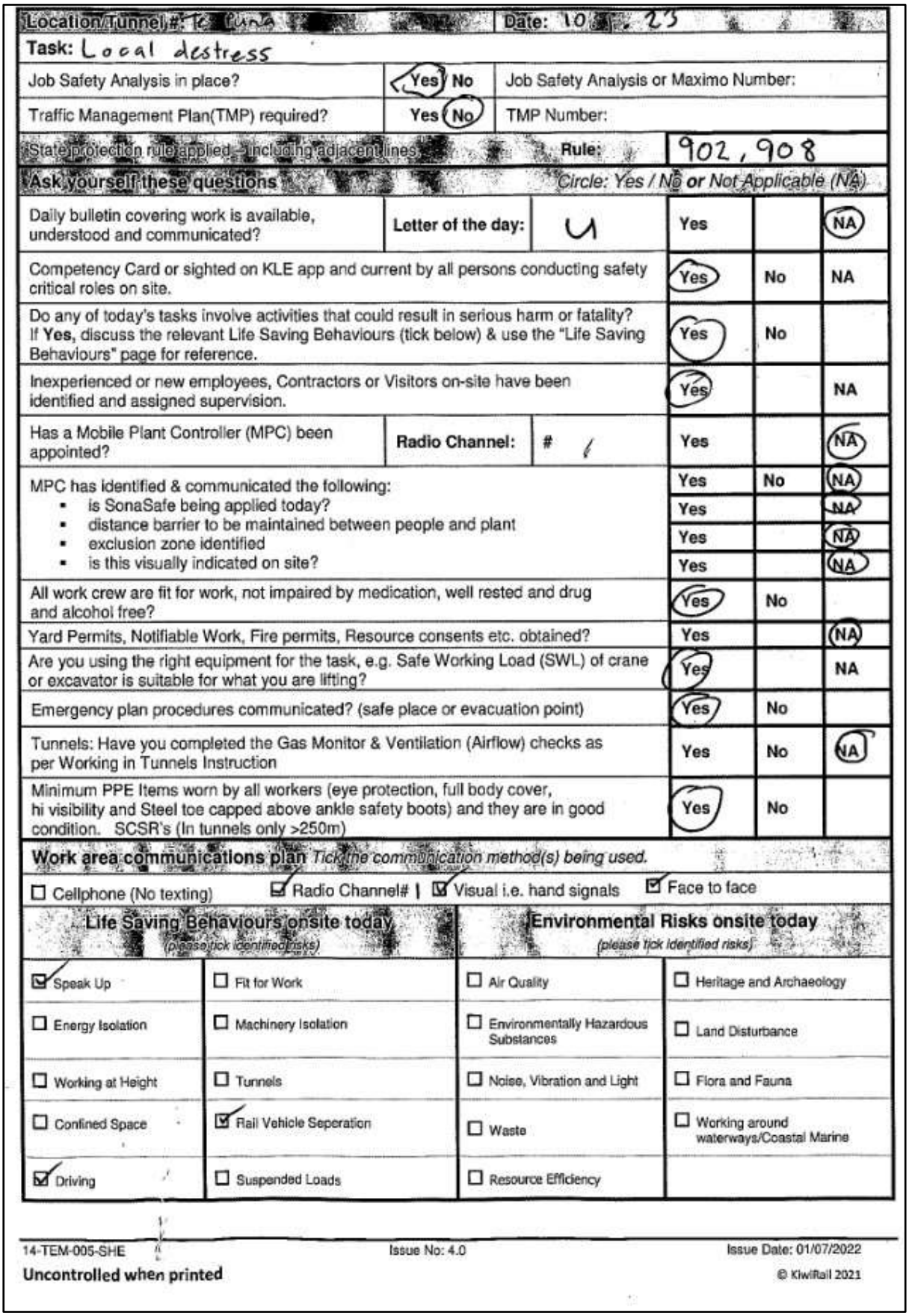
Abbreviations
Whakapotonga

GPS	Global Positioning System
HRV	Hi-Rail vehicle
km	kilometres
km/h	kilometres per hour
m	metres
mm	millimetres
RPO	rail protection officer
TPBM	Track Protection Basic – Machines
TW1	track worker one
TW2	track worker two

Glossary
Kuputaka

Freeze	Where an investigation is required, the act of retaining all evidence by ensuring nothing is moved or removed from the scene
Ganger	The supervisor of a railway infrastructure team
Hi-Rail vehicle	A vehicle fitted with equipment that enables it to travel on both road and rail
Mark up	To spray-paint the position of equipment or vehicles on the railway so that measurements can be taken once the equipment has been moved
Network Control Manager	The supervising manager of a train control centre
On-track	The activity whereby a HRV transitions from the road onto the railway track by lowering the rail wheels. Off-tracking is the opposite action, from the railway track onto the road
Train control	The centre responsible for track authorisations and the safe movement of rail traffic
TS90	KiwiRail Job Plan Book

Appendix 1 Job Plan for 10 January 2023



Location/Tunnel#: Te Kuiti			Date: 10 . 23		
Task: Local destress					
Job Safety Analysis in place?	Yes / No	Job Safety Analysis or Maximo Number:			
Traffic Management Plan(TMP) required?	Yes / No	TMP Number:			
State protection rule applied - including adjacent lines		Rule:	902, 908		
Ask yourself these questions			*Circle: Yes / No or Not Applicable (NA)*		
Daily bulletin covering work is available, understood and communicated?	Letter of the day:	U	Yes		NA
Competency Card or sighted on KLE app and current by all persons conducting safety critical roles on site.			Yes	No	NA
Do any of today's tasks involve activities that could result in serious harm or fatality? If **Yes**, discuss the relevant Life Saving Behaviours (tick below) & use the "Life Saving Behaviours" page for reference.			Yes	No	
Inexperienced or new employees, Contractors or Visitors on-site have been identified and assigned supervision.			Yes		NA
Has a Mobile Plant Controller (MPC) been appointed?	Radio Channel:	# 1	Yes		NA
MPC has identified & communicated the following: ▪ is SonaSafe being applied today? ▪ distance barrier to be maintained between people and plant ▪ exclusion zone identified ▪ is this visually indicated on site?			Yes Yes Yes Yes	No	NA NA NA NA
All work crew are fit for work, not impaired by medication, well rested and drug and alcohol free?			Yes	No	
Yard Permits, Notifiable Work, Fire permits, Resource consents etc. obtained?			Yes		NA
Are you using the right equipment for the task, e.g. Safe Working Load (SWL) of crane or excavator is suitable for what you are lifting?			Yes		NA
Emergency plan procedures communicated? (safe place or evacuation point)			Yes	No	
Tunnels: Have you completed the Gas Monitor & Ventilation (Airflow) checks as per Working in Tunnels Instruction			Yes	No	NA
Minimum PPE Items worn by all workers (eye protection, full body cover, hi visibility and Steel toe capped above ankle safety boots) and they are in good condition. SCSR's (In tunnels only >250m)			Yes	No	

Work area communications plan *Tick the communication method(s) being used.*

☐ Cellphone (No texting) ☑ Radio Channel# 1 ☑ Visual i.e. hand signals ☑ Face to face

Life Saving Behaviours onsite today *(please tick identified risks)*		Environmental Risks onsite today *(please tick identified risks)*	
☑ Speak Up	☐ Fit for Work	☐ Air Quality	☐ Heritage and Archaeology
☐ Energy Isolation	☐ Machinery Isolation	☐ Environmentally Hazardous Substances	☐ Land Disturbance
☐ Working at Height	☐ Tunnels	☐ Noise, Vibration and Light	☐ Flora and Fauna
☐ Confined Space	☑ Rail Vehicle Seperation	☐ Waste	☐ Working around waterways/Coastal Marine
☑ Driving	☐ Suspended Loads	☐ Resource Efficiency	

14-TEM-005-SHE Issue No: 4.0 Issue Date: 01/07/2022

Uncontrolled when printed

Job Safety & Environment Analysis

Job start date:	10.01.23	Job finish date:	10.01.23
Description of task:	Local Destress.	Related task instruction doc:	T-TI-WO-5912

Site Specific Hazard What is **source** of harm to persons or the environment, **within the defined context and circumstances?** Consider the critical risks that you have identified	Potential Risk of What is the **unwanted or unplanned** event related to the hazard?	Controls What are you going to do to make the job **as safe as possible?**
Step 1: please list out all site specific hazards	**Step 2**: after all specific hazards are listed, start to discuss potential risks and controls against each hazard	
Rail Vehicle Seperation.	Being hit / crash.	Use communication via radio, face to face, hand signals. Be aware of surroundings.
Weather / Raining.	Slips, trips, falls.	Correct PPE Pace ourselves. Be aware of surroundings.
Driving / Hi-railing.	Crashing, slower to stop on track in wet weather.	Give enough time to stop. Be cautious. obey speed limits on and off track.

Appendix 2 Excerpts from TPBM workbook

4. HRVs in Protected Work Areas

Hi rail vehicles (HRVs) are road vehicles or equipment such as a cherry picker, which are fitted with retractable rail wheels so they can also be driven along rail tracks.

To move between road and rail an HRV must be on / off tracked at level crossings or other suitable sites.

To operate on track all HRVs must be certified and display a current '155B' sticker. As part of that certification, the HRV must carry the following equipment:

- Train Control radio
- Detonators
- Red & green flags
- Torch

The HRV driver is responsible for the safe operation of the HRV. They need to comply with the relevant KiwiRail rules and procedures as outlined in this course, and follow any specific instructions from the RPO.

Arriving on site

When you arrive at a protected work area, contact the RPO before entering and getting on track. They will brief you on all relevant information. Make sure you know where the off tracking points and worksite limits are.

Drivers without adequate local knowledge must be accompanied by someone who is familiar with the area and is licensed to operate a HRV.

When you start work in a new location ask:

- Where are the on / off tracking points?
- Are there any level crossings? Tunnels?
- What is the gradient?
- Does the work area include any stations?
- Are there any temporary or permanent speed restrictions?

Trains

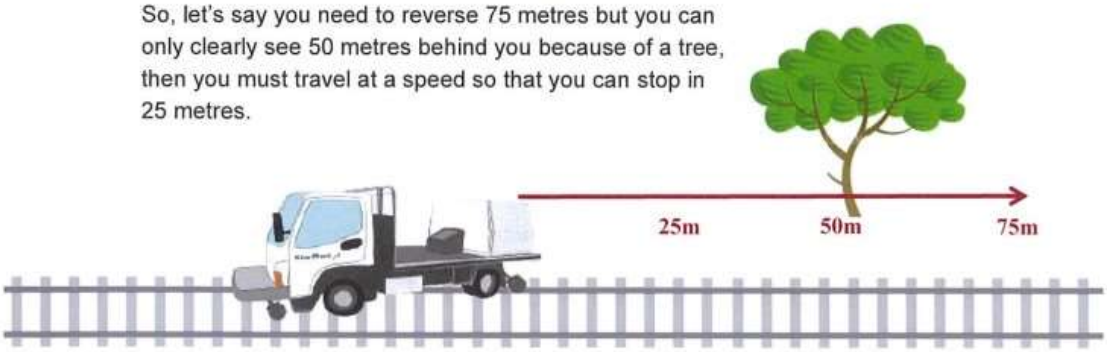
If a train needs to travel through a protected work area, it will need permission first. Before allowing the train to pass, the RPO needs to confirm that you and your HRV are off and clear of the track – and therefore separate from trains. You cannot start work again until the RPO tells you it is safe to do so.

What you need to do when a train passes on an adjacent line will depend on the particular conditions of your work area, such as whether there is authorised fencing in place. The RPO will brief you on these steps before starting work.

Permission to proceed

You must work in the direction you've been told. You can reverse ('setting back' in railway terms) up to 100 metres within the area you've been told to travel but you have to be able to stop within half the clear distance.

So, let's say you need to reverse 75 metres but you can only clearly see 50 metres behind you because of a tree, then you must travel at a speed so that you can stop in 25 metres.



In some situations you will be able to work in either direction between locations specified by the RPO. This is called 'working between'.

If you off track within the protected work area, you must get permission from the RPO before on tracking again.

Speed

HRVs must keep to the following speed limits:

Speed	Conditions
50km/h	Dry, normal conditions
30km/h	Wet conditions
25km/h	Yards, turnouts and other areas where the ballast comes to the head of the rail
10km/h	Level crossings

Always drive to the conditions and think about weather, gradient and view lines.

Stopping distances

You must travel at a speed where you are able to stop within half the clear distance you see ahead. So, if you can only see 100 metres ahead, you must travel at a speed where you can stop within 50 metres.

Curve speeds

At the entrance to every curve there is a curve board which indicates the speed limit for trains going around that curve. HRVs must travel at least 10km/h less than the curve speed.

Permanent speed restrictions

Permanent speed restrictions can be set for some areas. You must not exceed these speed limits. Permanent speed boards are put up trackside to indicate where speed limits begin.

Temporary speed restrictions

Temporary speed restrictions can be set for certain sections of track, for example if there has recently been some work done on the track. You must ask the RPO if there are any temporary speed restrictions within the protected work area.

Speed restrictions are shown by three track side signs:

	Caution Board	Indicates that a speed restriction is coming up
	C Board	Indicates where the speed restriction starts
	T Board	Indicates where the speed restriction ends

HRVs operating together

When there are two or more HRVs operating within a work area, always make sure you tell all other groups in the work area what your intended movements are. Are you about to stop? About to move off? About to reverse?

If HRVs are travelling in a convoy then the RPO will be in the leading vehicle. They will inform all other drivers about information they receive from Train Control and will provide permission to travel.

You must keep a following distance of 300 metres behind another HRV or train travelling in the same direction.

If the train is not moving the HRV must be at least 50m behind it, provided you are ready to reverse if the train begins to move towards you.

Appendix 3 KiwiRail Rail Operating Rule 916 Hi Rail Vehicle and Trolley – Drivers responsibilities

916 Hi Rail Vehicle and Trolley – Drivers responsibilities

(a) Safe Operation

The driver is responsible for the safe operation of the HRV / trolley, and must operate it in accordance with these rules, and any other current instructions. Personnel must take all reasonable care to protect themselves and the vehicle from injury or damage.

Drivers and passengers travelling in Hi Rail vehicles must wear seat belts, except when:

- travelling at low speed (less than 25 km/h) and it is necessary to stop frequently.

The driver and passengers must wear hi-visibility clothing on a trolley.

(b) Driver without local knowledge

Where for some reason the driver is not a person with adequate local knowledge, the driver must be accompanied by a second person with such knowledge, who holds the appropriate licence to operate.

(c) Two or more Rail Vehicles operating together

Where two or more HRVs / trolleys are travelling together, the addressee of the occupancy authority must travel in the leading vehicle. They must give clear information to Train Control/Signaller regarding the number of HRVs and trolleys, and give the full information they received to all other drivers involved, and advise them of the authority to move.

HRVs or trolleys must not approach closer than:

- 300 metres from another HRV / trolley or train moving in the same direction always being able to stop short of an obstruction, within half the distance of clear line that is visible ahead, taking into consideration the physical characteristics of the track being traversed and the environmental conditions.
- 50 metres from a stationary train, with the HRV or trolley driver being prepared to remove or reverse should the train begin to set back.

916 HRV and Trolley – Drivers responsibilities – continued

(d) Speed of Hi Rail Vehicles and Trolleys

Drivers of HRVs / trolleys must limit speeds to those authorised but in any situation must drive at speeds that consider local conditions, i.e. weather, grade, view lines for stopping within and so on.

Maximum speeds: HRV / trolley 50km/h

EXCEPTIONS:
30 km/h maximum when:
- approaching level crossings
- approaching turnouts
- travelling with other HRV / trolleys, and
- travelling within a PWA worksite(s)

10 km/h maximum when:
- travelling over level crossings

When travelling on curves, speed must be 10 km/h less than the speed value of any curve, such that the maximum speed is 50 km/h at any time.

All line speeds, and other permanent or temporary speed restrictions must be observed.

In yards and through all turnouts must not exceed 25 km/h, also in areas where the track is ballasted up to the head of the rails or where any materials or equipment extend up to the underside of the rail head.

Other HRV with lower maximum speeds imposed as shown on Loco 155 or Loco 442 (Non Conforming Vehicle form)

When towing a material trolley, the speed of the HRV must not exceed the maximum speed for the trolley or 25 km/h whatever is the lesser.

916 HRV and Trolley – Drivers responsibilities – continued

(e) Main Line Points Reversed

When approaching main line points drivers must ensure that they are correctly set for the intended movement. Where main line points are found reversed Train Control or the Signaller concerned must be advised. On Train Control authority hand points can be restored to normal, and the points lever locked.

(f) Movement over Level Crossings

When approaching a level crossing the driver must sound the horn to give ample warning of approach.

The driver must be prepared to stop at level crossings, unless it can be clearly seen that there is no traffic in the vicinity of the crossing.

For crossings fitted with the remote control function, the driver must ascertain that the warning devices are operating and that any approaching traffic is acting on the warning devices before proceeding onto the crossing.

(g) Parking of HRVs and trolleys

When not on track, HRVs and trolleys must be parked well clear of the line so that they cannot become an obstruction. When not under supervision, trolleys must either be secured with a chain and padlock, or parked in a locked shed. Vehicles must either have all their lights extinguished, or be parked in such a way that the lights and reflectors cannot be misinterpreted by the Operators of passing trains.

(h) Use of Lights

HRVs when on track must have headlights, hazard lights and tail lights switched on. When fitted, the flashing roof light must also be switched on.

HRVs stopped on track with the vehicle motor switched off, must have hazard lights and roof mounted flashing light switched on.

916(h) HRV and Trolley – Drivers responsibilities / Use of Lights – continued

Trolleys in use at night, i.e. from half an hour after sunset until half an hour before sunrise, during fog or falling snow, in tunnels or when, for any reason, visibility is poor, they must have front and rear lights switched on.

Lightweight inspection trolleys not fitted with front and rear lights, in poor visibility or in tunnels must dsisplay an orange flashing light.

(i) Equipment

Hi Rail vehicles and the trolley user must be equipped with:

- Train Control radio with selcall ability.
- Handheld radio (Hi-Rail vehicles only)
- Adequate supply of detonators.
- Two red and green flags.

(j) Mandatory calling of Limits

Drivers of HRVs and trolleys approaching station limits, must call on radio channel 1 advising:

- Designation and name.
- Location being approached.
- Terminating limit of the authorised track occupancy.

When calling on the radio make sure that there are no other transmissions on channel 1 otherwise the transmission will not be heard correctly.

(k) HRV or Trolley off tracking within occupancy limits

Should a Rail Vehicle 'off track' within the authorised occupation limits or before the authorised time has expired, the driver must **not** again occupy the line within the authorised limits until further authority has been obtained from Train Control.

Kōwhaiwhai - Māori scroll designs

TAIC commissioned its four kōwhaiwhai, Māori scroll designs, from artist Sandy Rodgers (Ngāti Raukawa, Tūwharetoa, MacDougal). Sandy began from thinking of the Commission as a vehicle or vessel for seeking knowledge to understand transport accident tragedies and how to avoid them. A 'waka whai mārama' (i te ara haumaru) is 'a vessel/vehicle in pursuit of understanding'. Waka is a metaphor for the Commission. Mārama (from 'te ao mārama' – the world of light) is for the separation of Rangitāne (Sky Father) and Papatūānuku (Earth Mother) by their son Tāne Māhuta (god of man, forests and everything dwelling within), which brought light and thus awareness to the world. 'Te ara' is 'the path' and 'haumaru' is 'safe' or 'risk free'.

Corporate: Te Ara Haumaru - the safe and risk free path

The eye motif looks to the future, watching the path for obstructions. The encased double koru is the mother and child, symbolising protection, safety and guidance. The triple koru represents the three kete of knowledge that Tāne Māhuta collected from the highest of the heavens to pass their wisdom to humanity. The continual wave is the perpetual line of influence. The succession of humps represents the individual inquiries.

Sandy acknowledges Tāne Māhuta in the creation of this Kōwhaiwhai.

Aviation: Ngā hau e whā - the four winds

To Sandy, 'Ngā hau e whā' (the four winds), commonly used in Te Reo Māori to refer to people coming together from across Aotearoa, was also redolent of the aviation environment. The design represents the sky, cloud, and wind. There is a manu (bird) form representing the aircraft that move through Aotearoa's 'long white cloud'. The letter 'A' is present, standing for a 'Aviation'.

Sandy acknowledges Ranginui (Sky father) and Tāwhirimātea (God of wind) in the creation of this Kōwhaiwhai.

Maritime: Ara wai - waterways

The sections of waves flowing across the design represent the many different 'ara wai' (waterways) that ships sail across. The 'V' shape is a ship's prow and its wake. The letter 'M' is present, standing for 'Maritime.

Sandy acknowledges Tangaroa (God of the sea) in the creation of this Kōwhaiwhai.

Rail: rerewhenua - flowing across the land

The design represents the fluid movement of trains across Aotearoa. 'Rere' is to flow or fly. 'Whenua' is the land. The koru forms represent the earth, land and flora that trains pass over and through. The letter 'R' is present, standing for 'Rail'.

Sandy acknowledges Papatūānuku (Earth Mother) and Tāne Mahuta (God of man and forests and everything that dwells within) in the creation of this Kōwhaiwhai.

Transport Accident Investigation Commission

Recent Rail Occurrence reports published by the Transport Accident Investigation Commission (most recent at top of list)

RO-2023-103	Safe working irregularity, 3.85km, Johnsonville line, tunnel 5, 4 May 2023
RO-2022-104	Shunt train L51 and heavy goods vehicle, level crossing collision and derailment, Whangārei, 7 December 2022
RO-2022-102	L71 Mainline Shunt, derailment and subsequent rollover, Tamaki, 1 June 2022
RO-2022-101	Passenger train, fire in auxiliary generator wagon, Palmerston North, 11 May 2022
RO-2022-103	KiwiRail W6 shunt and Metro (Go Bus) Route 60 bus, near miss at Selwyn Street level crossing, Christchurch, 8 August 2022
RO-2021-105	Unintended movement resulting in locomotive and wagon entering Picton Harbour, Picton, 1 September 2021
RO-2021-106	Derailment of Train 220, South of Hunterville, 13 December 2021
RO-2021-103	Te Huia passenger service, train parting, North Island main trunk line, Paerata, 19 July 2021
RO-2021-102	Freight Train 391, collision with light truck, Saunders Road, Marton, 13 May 2021
RO-2021-101	Serious injury during shunting operations on board the Aratere, Interislander ferry terminal, Wellington, 9 April 2021
RO-2020-101	Level crossing collision, Mulcocks Road, Flaxton, 10 February 2020
RO-2020-104	Safe working irregularity, East Coast Main Trunk Line, Hamilton – Eureka, 21 September 2020
RO-2020-103	Collision between bus and locomotive, Clevely Line level crossing, Bunnythorpe, 16 September 2020
RO-2019-108	Level crossing collision, Piako Road, Morrinsville, 7 December 2019
RO-2020-102	Express freight Train 932, strikes hi-rail vehicle, Limeworks Road, 24 April 2020

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