



Transport Accident  
Investigation  
Commission

# **Final report**

## **Tuhinga whakamutunga**

***Rail inquiry RO-2021-101***  
***Serious injury during shunting operations on***  
***board the Aratere, Interislander ferry terminal,***  
***Wellington***  
***9 April 2021***

**September 2022**





# The Transport Accident Investigation Commission

## Te Kōmihana Tirotiro Aituā Waka

### ***No repeat accidents – ever!***

“The principal purpose of the Transport Accident Investigation Commission (TAIC) 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 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 insights to influence others in the transport sector to improve safety, nationally and internationally.

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Deputy Chief Commissioner	Stephen Davies Howard
Commissioner	Richard Marchant
Commissioner	Paula Rose, QSO

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Investigator-in-Charge for this inquiry	David Manuel
Commission General Counsel	Cathryn Bridge

# Notes about Commission reports

## Kōrero tāpiri ki ngā pūrongo o te Kōmihana

### ***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***

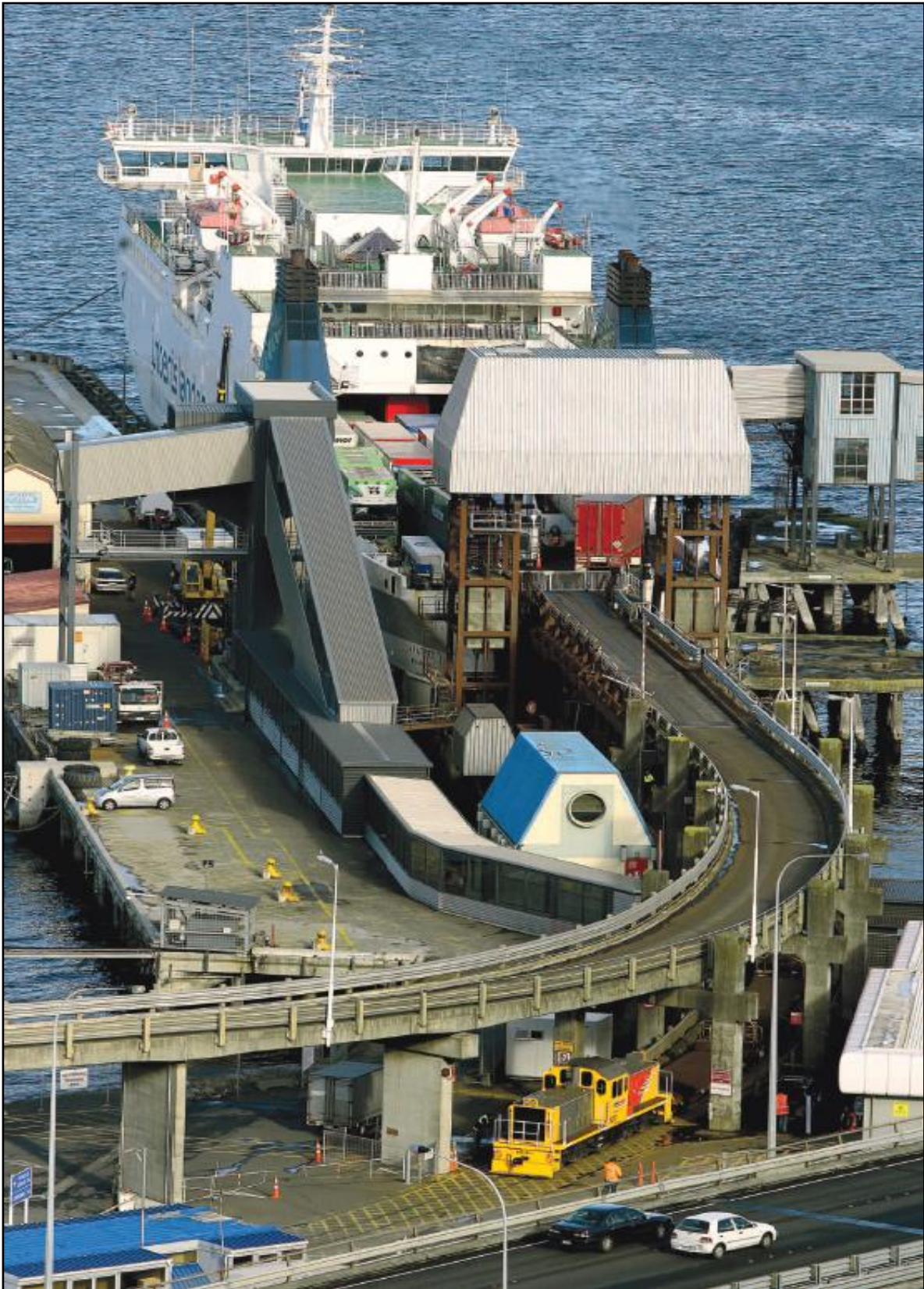
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### ***Verbal probability expressions***

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: Shunt locomotive with the Aratere in the background**



**Figure 2: Location of the accident**

(Credit: Toitū te Whenua Land Information New Zealand)

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# 1 Executive summary

## Tuhinga whakarāpopoto

### **What happened**

- 1.1 On the evening of 9 April 2021, a remote-control operator operating a remotely controlled shunt locomotive was injured during discharging operations on board the rail ferry *Aratere*. The remote-control operator was caught between the foot step of the head wagon and the runner wagon while attempting to couple to the wagons. The head wagon was the first of a set of coupled wagons (a rake) located on the starboard outer track of the *Aratere*'s rail deck.
- 1.2 The remote-control operator had made multiple unsuccessful attempts to couple the two wagons. The position of the two wagons on a curved section of the outer starboard track had caused a misalignment of the two couplers. During the final attempt the remote-control operator moved between the two wagons to physically open the knuckle of the couplers, but did not relocate to a safe area before operating the shunt locomotive remotely.

### **Why it happened**

- 1.3 The Transport Accident Investigation Commission (the Commission) found that the remote-control operator entered the danger zone (an area in which individuals are exposed to physical risk) to realign an off-centre coupler, but did not reposition clear of the danger zone before they operated the shunt locomotive remotely.
- 1.4 The Commission found that the degree of track curvature on the starboard outer track on the *Aratere* made it difficult to couple wagons positioned on parts of the curve.
- 1.5 The Commission found that the risk assessment undertaken to determine the maximum rake length on the outer rails had not adequately mitigated the difficulty involved with coupling wagons positioned on the curved part of a track.

### **What we can learn**

- 1.6 Shunting rail vehicles is a safety-critical task. Safety-critical tasks should be designed in such a way so as not to cause additional or unnecessary risks for employees.
- 1.7 Experiencing difficulties with a procedure can lead to task fixation. This can create an environment conducive to risk-taking activity and error-producing conditions.

### **Who may benefit**

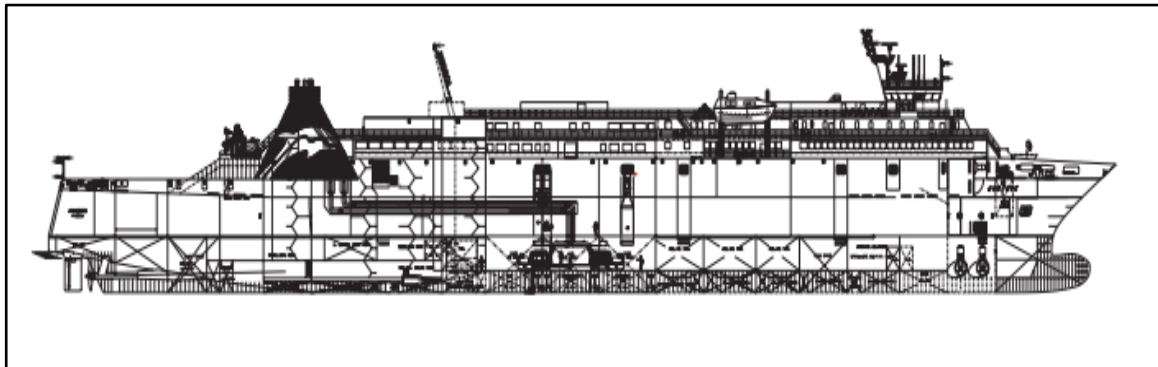
- 1.8 Rail operators and operational staff involved in shunting activities may benefit from this report.

## 2 Factual information

### Pārongo pono

#### Background

- 2.1 The *Aratere* is a rail ferry that can carry up to 32 rail wagons on its lower cargo deck (the rail deck). The rail deck has four rail tracks; the two inner tracks are straight and the two outer tracks are curved at the stern (back) end of the vessel.
- 2.2 At the time of the accident, the *Aratere* had just berthed in Wellington after completing a scheduled voyage from Picton to Wellington.



**Figure 3: Cross-sectional view of the *Aratere* showing the location of the rail deck**

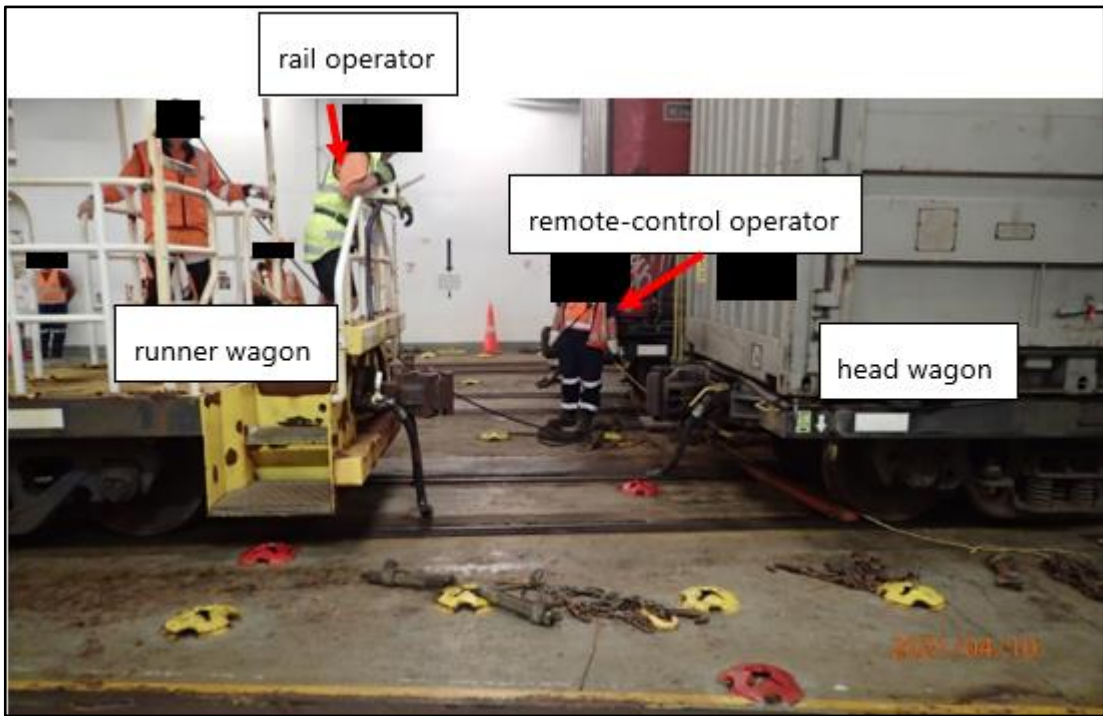
#### Narrative

- 2.3 At 2013 on 9 April 2021, the *Aratere* departed Picton with four rakes<sup>1</sup> of freight wagons, consisting of two long rakes on the outer tracks and two shorter rakes on the inner tracks.
- 2.4 A two-person KiwiRail shunting team consisting of a remote-control operator (RCO) and a rail operator (RO) were tasked with discharging and loading rail wagons from the *Aratere* after it berthed in Wellington. The shunt team was assisted by a certified train examiner positioned at the forward end of the rail deck (see Figure 3).
- 2.5 The ferry arrived in Wellington at 2315.
- 2.6 At about 2320 the shunt team received clearance from the ferry crew at the linkspan<sup>2</sup> to enter and commence shunting operations.

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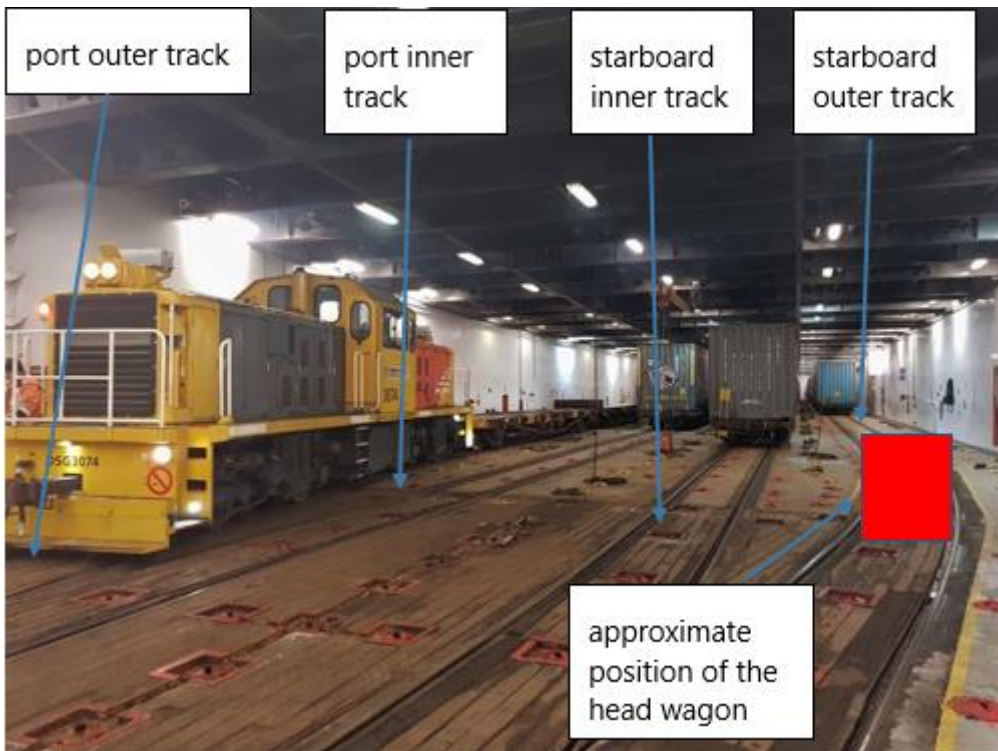
<sup>1</sup> Railway terminology for a series of wagons to be coupled together in preparation for moving.

<sup>2</sup> A type of drawbridge arrangement that connects a ship to the shore over the stern or bow.



**Figure 4: Locations of the RCO and RO relative to the runner and head wagons**

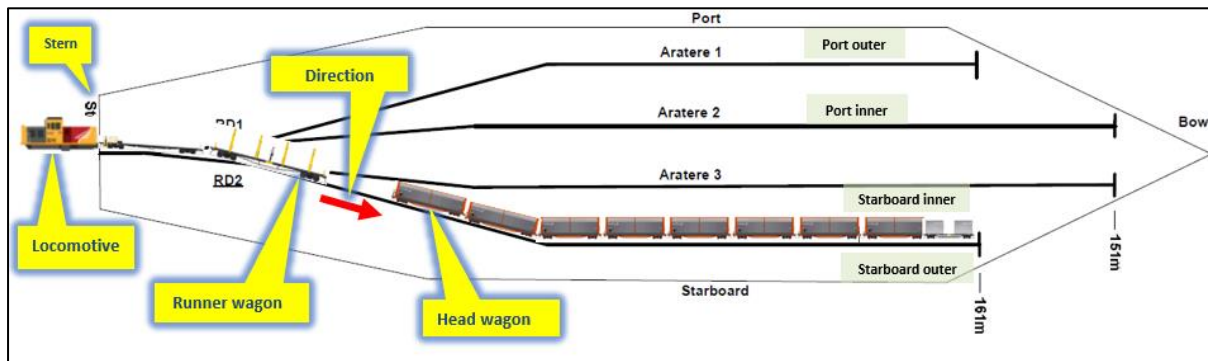
- 2.7 Once on board, the shunt team set about their first task of removing the long outer rake from the starboard<sup>3</sup> side. Due to the length of this rake (134 metres), the head wagon<sup>4</sup> was positioned on a curved part of the track on the rail deck (see Figure 5).



**Figure 5: Approximate position of the head wagon**

<sup>3</sup> The right-hand side of the vessel when facing forward is starboard. The left-hand side of the vessel when facing forward is port.

<sup>4</sup> The first wagon at the locomotive end of a rake.

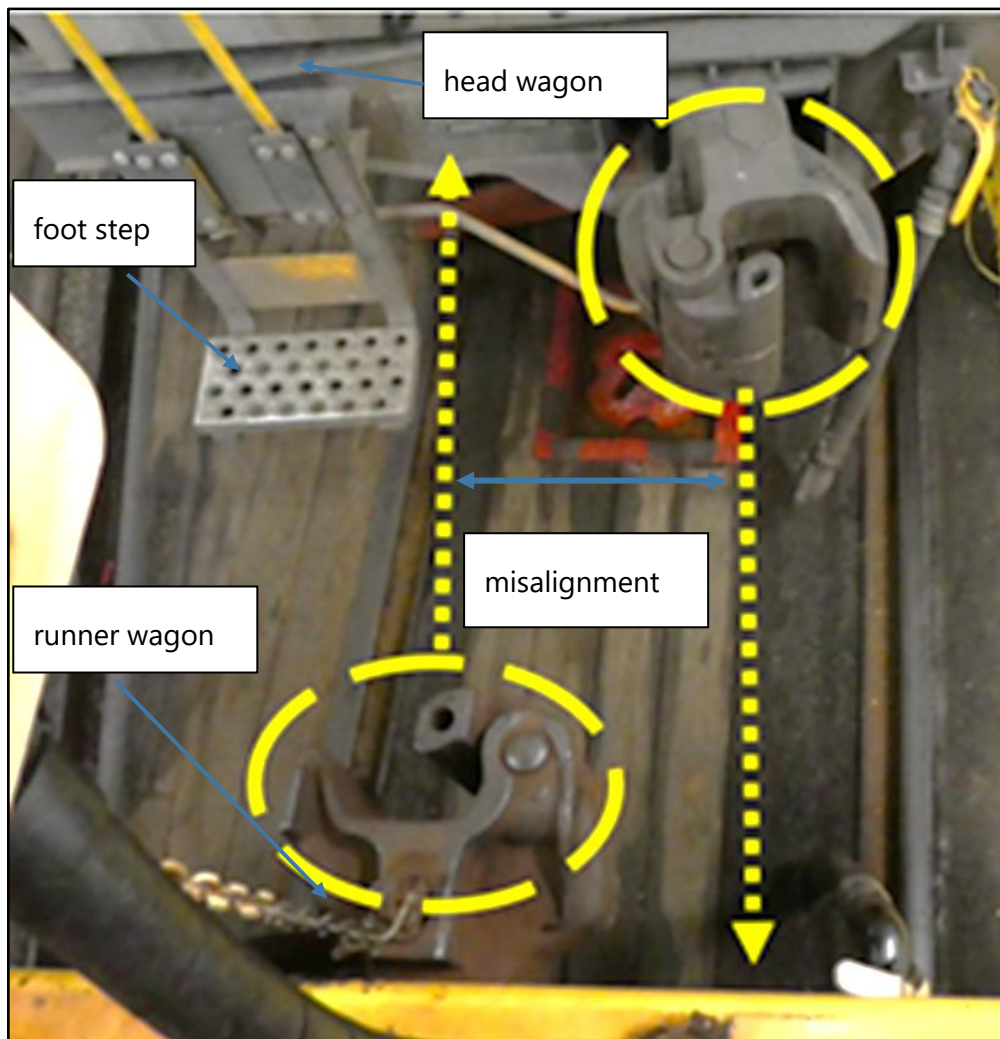


**Figure 6: The head wagon and runner wagon positions on board the Aratere**

- 2.8 The curvature of the track caused a misalignment between the coupler on the runner wagon<sup>5</sup> and the coupler on the head wagon on the rake (see Figures 4, 5 and 6).
- 2.9 The RCO made multiple attempts to couple the wagons. After every unsuccessful attempt the RCO did an 'out short'<sup>6</sup> and went between the wagons to physically realign the couplers and open the knuckles of the couplers of both wagons before the next coupling attempt.
- 2.10 On the seventh attempt to couple the wagons, the RCO remotely operated the shunt locomotive to move the runner wagon towards the rake, without retreating to the safe zone. The couplers were still misaligned and glanced off each other, resulting in the runner wagon moving further forward than expected (see Figure 7).
- 2.11 The RCO's position between the two wagons meant his right leg was jammed forcibly between the runner wagon and the foot step of the head wagon.
- 2.12 The RCO suffered a serious injury to their leg and was subsequently admitted to hospital for treatment.

<sup>5</sup> A specialised wagon, classified as EUF class, that is attached to a shunt locomotive to aid the loading and discharge process.

<sup>6</sup> Pull out a short distance and stop.



**Figure 7: Misalignment between the runner wagon and the head wagon**  
(Credit: KiwiRail)

### **Personnel information**

- 2.13 The RCO had achieved certification for remote-control locomotive operations within Wellington station limits on 24 November 2020. Since certification they had had two safety assessments while remotely controlling a shunt locomotive. Neither of these assessments involved shunting on board the *Aratere* ferry. The RCO was also a certified rail operator and had approximately 20 years' experience in that role.
- 2.14 The RCO was qualified to operate the EUF-class runner wagon<sup>7</sup>.
- 2.15 The RO had gained their certification on 21 November 1996 and had been a qualified RCO since 2005.
- 2.16 The train examiner had been qualified for shunting duties since 27 November 2020.
- 2.17 The investigation found no evidence of any medical issue with the shunt crew that may have contributed to this accident. The investigation found no evidence that either the relief RCO or the RO were likely fatigued during their shift.

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<sup>7</sup> See paragraphs 2.19 – 2.22.

## **Train/Vehicle information**

2.18 The diesel-powered DSG-class shunt locomotive was 12.5 metres long and weighed 56 tonnes. The locomotive was operated remotely by the RCO using a remote-control pack worn in a harness in front of them. The RCO controlled the movement of the locomotive by entering commands into the control pack. These commands were transmitted by radio to the locomotive (see Figure 8).



**Figure 8: Remote-controlled pack worn in harness**  
(Credit: KiwiRail)

### **EUf-class runner wagon**

2.19 Runner wagons are attached to a locomotive when shunting rail wagons on board the *Aratere*. The runner wagons allow the locomotive to remain outside the ferry so that the rail deck is kept free of exhaust fumes.

2.20 The EUf-class runner wagon was developed by KiwiRail in 2015. It has an automatic knuckle coupler that was modified so that it could be moved more easily from side to side using the wagon's air pressure. In addition, the coupler has a top lift release mechanism that can be manually operated from a safe ride position on the wagon deck.

2.21 The EUf-class runner wagon was designed to:

- reduce the need for operating staff to work in the unsafe spaces between wagons (danger zones) when coupling and uncoupling
- provide enough sideways movement on the coupler to allow its open knuckle to engage the open knuckle on the head wagon
- provide enough centring force to bring the couplers into alignment for locking.

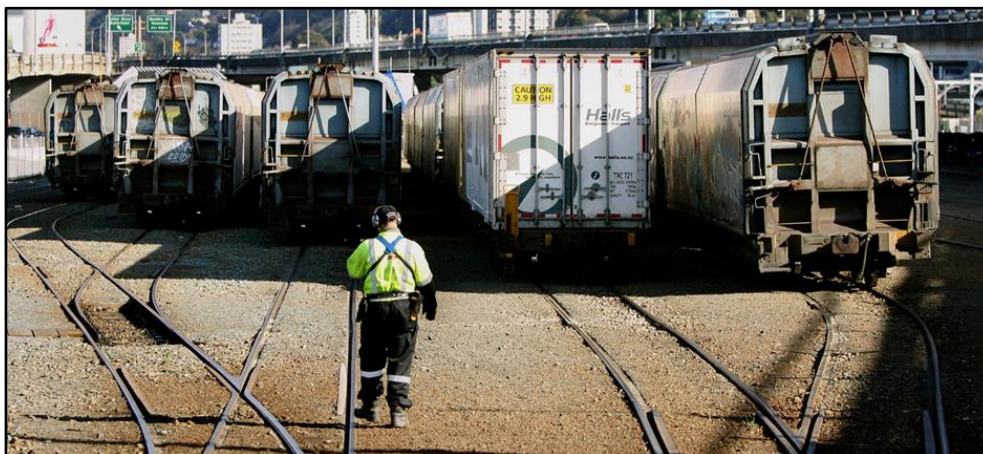
2.22 The operation of the runner wagon is described in Appendix 1, EUf Ferry Shunt Wagon Operating Quick Guide.

### **Aratere Interislander ferry**

2.23 The diesel electric vessel *Aratere* is a roll-on/roll-off rail and vehicle ferry operated by KiwiRail. The vessel has an overall length of 183.5 metres, with the capacity to carry 670 passengers, 230 cars or 30 trucks on the vehicle deck and up to 32 wagons on the four-track rail deck.

## Ferry marshalling yard Wellington

2.24 The ferry marshalling yard consists of five railway tracks (see Figure 9).



**Figure 9: Ferry marshalling yard Wellington**

2.25 KiwiRail is both the network access provider and the rail operator and is licensed by Waka Kotahi NZ Transport Agency for its rail activities.

## Recorded data

2.26 The DSG-class shunt locomotive was fitted with a data-recording system known as Tranzlog. The downloaded data was obtained by the Transport Accident Investigation Commission (the Commission) for analysis.

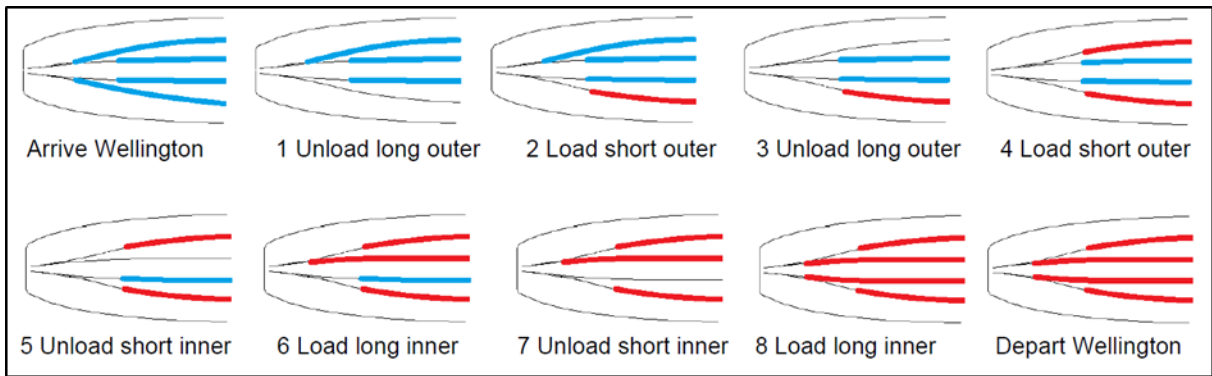
## Previous occurrences

2.27 The Commission requested and received incident data from KiwiRail regarding shunting issues on board the *Aratere* rail ferry. The difficulties associated with coupling to wagons have been a known issue since 2012, when new wagon classes were introduced and automatic knuckle couplers were retrofitted to the existing wagon fleet. The last recorded problem with coupling to the outer starboard rake of the *Aratere* was in March 2020.

## Loading and discharging operations

2.28 The loading and discharging sequence was set out in the *Aratere* Loading and Discharging Manual (the Manual).

2.29 The *Aratere's* loading and discharging sequences in Wellington and Picton are different to facilitate efficient access to the rail deck during loading and discharging operations. The sequence is described in section 10.9 of the Manual. The procedure for Wellington is shown in Figure 10. Blue indicates the rakes unloaded at Wellington and red indicates the rakes loaded at Picton. In summary, the *Aratere* berths at Wellington with the long rakes on the outer tracks and the shorter rakes on the inner tracks. The loading plan for Picton is the reverse, with the longer rakes secured on the inner tracks and the shorter rakes on the outer tracks.



**Figure 10: Aratere loading sequence, Wellington**

### ***KiwiRail Operating Code, Section 5.1, Shunting Procedure***

2.30 The following is an excerpt from the KiwiRail Operating Code, Section 5.1 regarding the procedures for shunting:

**Introduction:**

The instructions contained in this section provide for safe shunting practices and are based on knowledge and experience.

Shunting involves the moving and assembling of vehicles making maximum use of the motive power with the least number of movements while ensuring the safety of rail personnel and equipment.

**Personal safety 3.1 p11 (effective date 06.10.2019)**

When connecting vehicles equipped with automatic couplers don't stand between the vehicles, or the locomotive and vehicle while they come together. There is insufficient clearance and you may be crushed.



## 3 Analysis

### Tātaritanga

#### Introduction

- 3.1 The shunt team discharging freight wagons from the *Aratere* experienced difficulties connecting the runner wagon to the head wagon on the outer starboard track, because it was positioned on a curved section of the track.
- 3.2 After several failed attempts to couple the wagons, the RCO entered the danger zone to realign the couplers manually. Prior to their repositioning to a safe area, the RCO operated the shunt locomotive, resulting in their leg being caught between the headstock of the runner wagon and the foot step of the head wagon.
- 3.3 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.

#### Shunting on board the *Aratere*

- 3.4 The automatic knuckle couplers fitted to freight wagons are designed for shunting on straight or near-straight track. Difficulties can occur when personnel attempt to couple wagons on tightly curved track. During normal discharge operations on the *Aratere*, one of the shunt team is positioned at the head of the rake in order to give verbal instructions to the RCO to aid the coupling process. Should there be any difficulty with the coupling, the coupler can be aligned from a safe position on the deck of the runner wagon. Immediately prior to this accident, the RCO disembarked from the safe position on the runner wagon to attempt to align the coupler of the head wagon manually. In doing so they placed themselves within the danger zone (see Figure 11).
- 3.5 In this case, the impediment to what is typically a straightforward process was caused by the degree of curvature of the track where the wagons were positioned. While the amount of sideways movement possible on the coupler on the EUF-class runner wagon is greater than that on standard wagons, it was still difficult to align it with the open knuckle of the coupler on the head wagon.

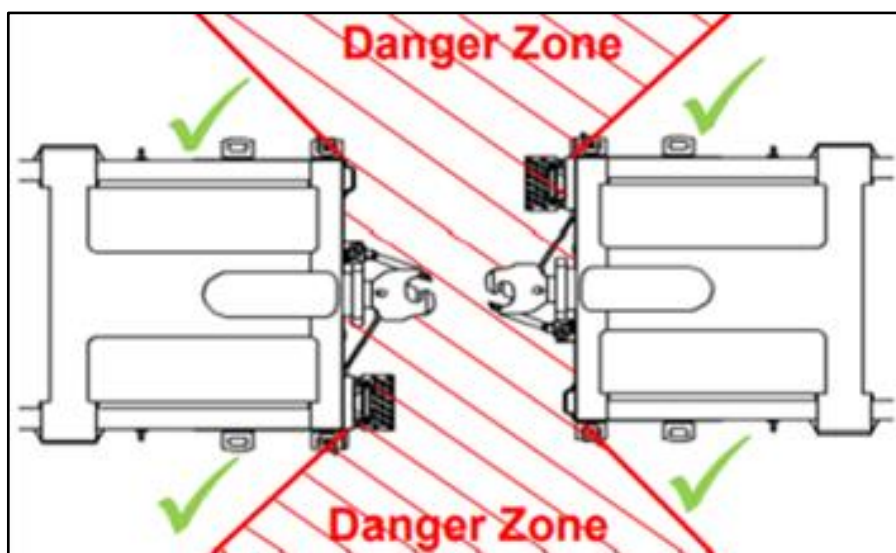


Figure 11: Danger zone between wagons

- 3.6 The shunting team with the RCO at the head of the runner wagon conducted several coupling manoeuvres without success. At this point the RCO elected to move between the wagons to adjust the head wagon's coupler manually.
- 3.7 Moving into the danger zone to align the couplers manually was not in contravention of KiwiRail's operating procedures when it was an operational necessity. It was likely that the RCO responded in a more automated, unconscious manner to rectify the situation after several unsuccessful attempts to couple the rake.
- 3.8 Once the RCO had manually adjusted the coupler, they attempted the next coupling manoeuvre while still within the danger zone. By this seventh attempt to couple, it is likely that the RCO had become fixated on the task at hand and experienced a lapse in concentration during which they did not reposition themselves clear of the danger zone before attempting to couple the wagons again.
- 3.9 The KiwiRail operating procedures warned shunting staff: "When connecting vehicles [wagons or locomotives] equipped with automatic couplers don't stand between the vehicles, or the locomotive and vehicle while they come together. There is insufficient clearance and you may be crushed."
- 3.10 The RCO was positioned on the inside of the curve between the wagons when bringing the locomotive and runner wagon onto the rake. The couplers were still misaligned, and as a result the couplers glanced off each other when the locomotive moved. This caused the runner wagon to move towards the head wagon unexpectedly. The RCO, standing between the runner wagon and the head wagon, was struck with sufficient force that their leg moved rapidly forward and connected with the footstep of the head wagon positioned at shin height, and this resulted in an injury to the leg.
- 3.11 Had the RCO vacated the danger zone before commanding a coupling movement towards their position, it is **virtually certain** that this accident would not have occurred.

## Coupling limitations

**Safety issue:** *The number of wagons loaded on the Aratere's outer tracks at the time of the accident exceeded the limits that could be safely accommodated without presenting difficulty when coupling.*

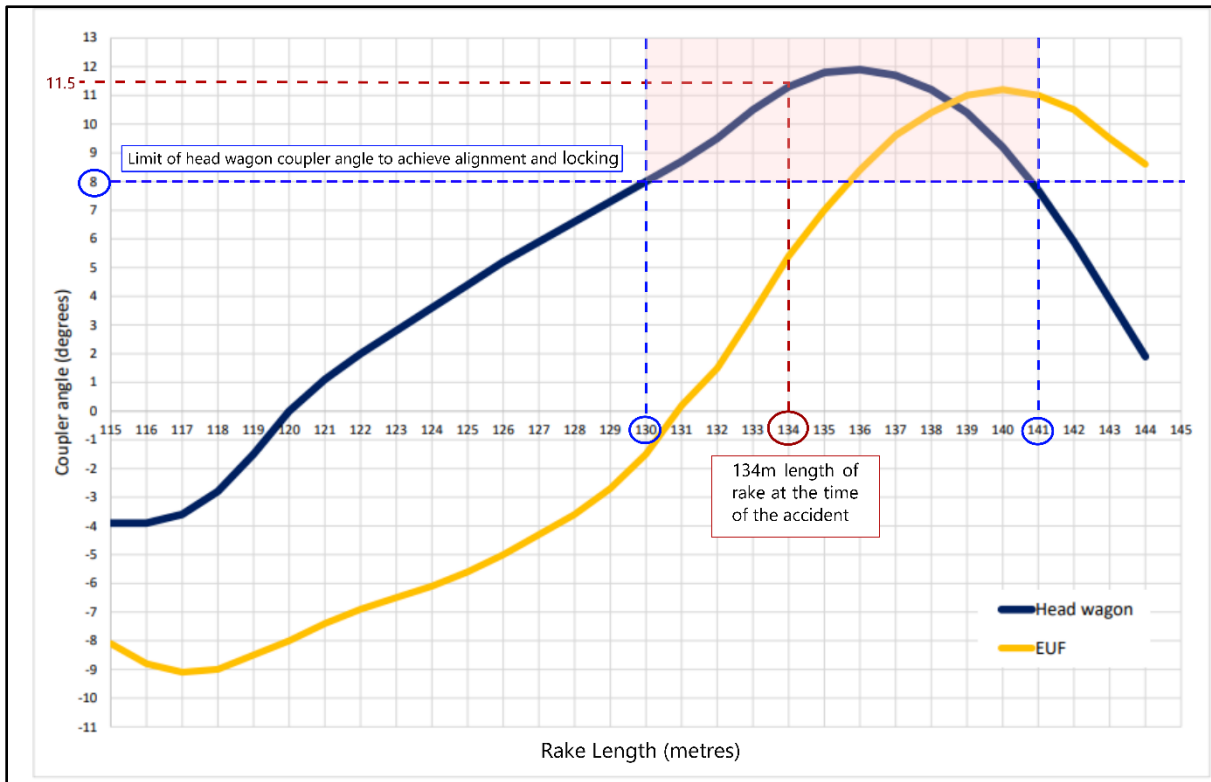
- 3.12 There is a commercial benefit in optimising the number of wagons that can be accommodated safely on a rail deck. However, a combination of the design of the automatic knuckle couplers fitted to the wagons and the curvature on the outer tracks on the *Aratere* limited the carrying capacity on the outer tracks.
- 3.13 The original rake length limit on the *Aratere's* outer starboard track was 143 metres. In 2012, when the automatic knuckle couplers were introduced to new and existing wagons in the fleet, the Wellington ferry shunt started to experience coupling difficulties, especially on the starboard outer track of the *Aratere*. With about 47 minutes allowed for discharging and loading the four rakes of wagons, the difficulties associated with coupling runner wagons to head wagons caused delays that affected the sailing schedules.
- 3.14 As an interim measure, the length of the rake carried on the outer tracks of the *Aratere* was reduced to 115 metres while a mechanical solution was worked on to overcome the coupling problem.
- 3.15 To resolve the coupling issue, KiwiRail modified the existing EUF-class runner wagon with a greater coupler swing, so that the coupler could move further to the left or right if required to facilitate coupling at an angle. The EUF-class runner wagon was trialled for a month on the *Aratere* in late 2015. There were no issues reported when coupling to the head wagon during the trials. Following the trial, KiwiRail issued a Semi-Permanent Bulletin<sup>8</sup>, authorising the rake length limits to be extended from 115 metres to 143 metres.
- 3.16 The Rail Operating Code, Section 1 was amended on 20 November 2017 to extend the maximum carrying capacity on the outer starboard track on the *Aratere* when sailing from Picton to Wellington to 143 metres from 115 metres.
- 3.17 Despite the improvements in the runner wagon coupler, the issue was not fully resolved. The problem of coupling to the outer rakes was recorded again in March 2020.

### Coupling on curves

- 3.18 After the accident, KiwiRail conducted an internal investigation of the coupling issue on the *Aratere*. The investigation assessed, among other things, the theoretical alignment angles of the EUF-class runner wagon coupler and the head wagon coupler at different rake lengths on the outer track.
- 3.19 The coupler angles are shown in Figure 12. Of interest is the blue line, which is the angle at which the coupler on the head wagon would have needed to be moved (to the nearest degree) to achieve alignment and locking at various rake lengths.

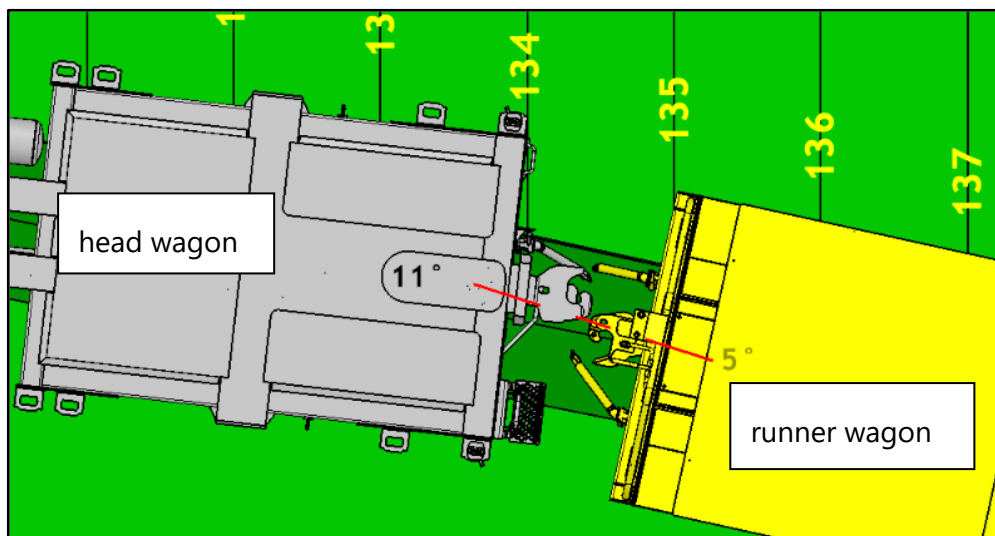
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<sup>8</sup> A document used by KiwiRail to disseminate instructions that will apply until they are cancelled or made permanent rules.



**Figure 12: Coupler angles at different rake lengths**

3.20 The limit of the coupler angle on the head wagon (see Figure 12) to achieve alignment and locking is about 8 degrees. When rake lengths are between 130 and 141 metres, the head wagon requires a coupler angle greater than 8 degrees to achieve alignment and locking. This region of the head wagon coupler angle curve (highlighted red in figure 12) is the most difficult section of the starboard track on which to achieve coupler alignment and therefore coupling of wagons.



**Figure 13: Head wagon 134 metres from buffer**

(Credit: KiwiRail)

- 3.21 With a rake of 134 metres<sup>9</sup>, the head wagon is within the range where coupling is most difficult. The coupler of the head wagon is required to be moved 11 degrees to couple to the runner wagon (see Figure 13). The 11-degree angle movement required is well past the 'free' movement of the head wagon coupler, and even if coupling is achieved there may not be sufficient capacity for the pneumatic system on the runner wagon to shift the head wagon coupler into a good enough alignment to allow the couplers to lock. (Refer Appendix 1 for the runner wagon operating quick guide.)
- 3.22 The length of the rake on the starboard outer track was 134 metres when the accident happened. Figure 14 shows that at 134 metres the physical carrying capacity would have been equivalent to eight 50-foot (15-metre) wagons.

134		Number of fifty-foot wagons									
		0	1	2	3	4	5	6	7	8	9
Number of sixty-foot wagons	0	0.0	16.8	33.5	50.3	67.0	83.8	100.5	117.3	134.0	150.8
	1	19.3	36.0	52.8	69.6	86.3	103.1	119.8	136.6	153.3	170.1
	2	38.6	55.3	72.1	88.8	105.6	122.4	139.1	155.9	172.6	189.4
	3	57.9	74.6	91.4	108.1	124.9	141.6	158.4	175.2	191.9	208.7
	4	77.1	93.9	110.7	127.4	144.2	160.9	177.7	194.4	211.2	227.9
	5	96.4	113.2	129.9	146.7	163.5	180.2	197.0	213.7	230.5	247.2
	6	115.7	132.5	149.2	166.0	182.7	199.5	216.3	233.0	249.8	266.5
	7	135.0	151.8	168.5	185.3	202.0	218.8	235.5	252.3	269.1	285.8

**Figure 14: Coupling angle of head wagon and runner wagon at a rake length of 134 metres**  
(Credit: KiwiRail)

- 3.23 It is very likely that the length of the rake on the outer starboard track and the limitation of the coupler movement on the head wagon significantly increased the difficulty for the shunt team to achieve the alignment and coupling of the wagons.
- 3.24 Since this accident KiwiRail has reduced rake lengths to a maximum of 123 metres, which has improved the alignment of the couplers and reduced the risk to operational staff.
- 3.25 The Commission was also advised by KiwiRail that the alignment of couplers will not be a safety issue on board the rail ferries to be introduced in 2025, due to the improved track design on board the new ships.
- 3.26 The Commission has not made a recommendation due to the safety actions taken by KiwiRail to address the safety issue.

<sup>9</sup> The length of rake on the starboard outer track at the time of the accident.

## 4 Findings

### Ngā kitenge

- 4.1 The automatic knuckle couplers fitted to most of the KiwiRail wagon fleet are not designed to couple on tight curves.
- 4.2 The difficulties experienced by the remote-control operator when attempting to align the couplers likely led to their becoming fixated on the task. This likely resulted in a lapse in concentration, whereby the remote-control operator moved the runner wagon prior to repositioning themselves clear of the danger zone.
- 4.3 Had the remote-control operator vacated the danger zone before moving the runner wagon towards their position, it is **virtually certain** this incident would not have occurred.
- 4.4 The length of the outer starboard rake was 134 metres, and this resulted in the head wagon being positioned at one of the most difficult locations for the remote-control operator to have attempted to couple it to the runner wagon.
- 4.5 It is **very likely** that the length of the rake on the outer starboard track, and the limitation of the coupler movement on the head wagon, significantly increased the difficulty for the shunt team in achieving coupler alignment and therefore coupling to wagons.

## 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 typically describe a system problem that has the potential to adversely affect future operations on a wide scale.
- 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 One safety issue is identified in this report.

*The number of wagons loaded on the Aratere's outer tracks at the time of the accident exceeded the limits that would have put them in a position to be safely accommodated without presenting difficulty when coupling.*

- 5.4 The operator (KiwiRail) has taken the following safety action to address this issue.
- 5.5 On 8 July 2021 KiwiRail promulgated Semi-Permanent Bulletin No. 525. This bulletin reduced the maximum rail-lane metres on the outer tracks of the *Aratere* to 115 metres.
- 5.6 Following this accident, KiwiRail carried out an investigation of coupling-on issues on the *Aratere*. The investigation determined the theoretical alignment of the EUF-class runner wagon coupler with the head wagon at various locations on the curved outer track of the *Aratere*. These calculations were based on rakes ranging from 115 metres to 144 metres long, in order to determine the best scenario from a coupling perspective.
- 5.7 On 24 September 2021 KiwiRail approved a risk assessment based on its engineering report FT31510-4, to extend the maximum rail metres on the outer tracks on the *Aratere* from 115 metres to 123 metres.
- 5.8 On 1 October 2021 Semi-Permanent Bulletin No. 525 was cancelled and replaced with Semi-Permanent Bulletin No. 752. This bulletin extended the maximum rail lane metres on the outer tracks of the *Aratere* to 123 metres.
- 5.9 The Commission welcomes the safety actions taken since the accident. In this case no new recommendation has been issued.

## **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 No new recommendations were issued.



## **7 Key lessons**

### **Ngā akoranga matua**

- 7.1 Shunting rail vehicles is a safety-critical task. Safety-critical tasks should be designed in such a way so as not to cause additional or unnecessary risks for employees.
- 7.2 Experiencing difficulties with a procedure can lead to task fixation. This can create an environment conducive to risk-taking activity and error-producing conditions.

## 8 Data summary

### Whakarāpopoto raraunga

#### *Vehicle particulars*

Train type and number:	DSG shunt locomotive 3210 and runner wagon EUF24
Classification:	shunt
Operator:	KiwiRail

***Date and time*** 9 April 2021, 2330

***Location*** on board vessel *Aratere* at Wellington

***Operating crew*** one remote-control operator

***Injuries*** injury to remote-control operator

***Damage*** nil

## 9 Conduct of the inquiry

### He tikanga rapunga

- 9.1 On 10 April 2021, the rail regulator Waka Kotahi NZ Transport Agency 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 On the same day, three investigators deployed to the site and boarded the *Aratere* to conduct a site examination.
- 9.3 The Commission investigators secured closed-circuit television footage recorded on board the *Aratere* at the time of the accident and the Tranzlog download data from KiwiRail, and obtained records of training, shift rosters, certification and other relevant documentation.
- 9.4 The Commission investigators conducted interviews with the rail operator and the RCO.
- 9.5 A meeting between the Commission investigators and KiwiRail managers was held on 19 October 2021 regarding this accident.
- 9.6 The Commission obtained further documentary evidence from KiwiRail and Interislander pertaining to the loading and discharging operations on board the *Aratere*.
- 9.7 On 22 June 2022 the Commission approved a draft report for circulation to three interested persons for their comment.
- 9.8 The Commission received three submissions, and any changes as a result of these submissions have been included in the final report.
- 9.9 On 24 August 2022, the Commission approved the final report for publication.

## Abbreviations

### Whakapotonga

Commission	Transport Accident Investigation Commission
RCO	remote-control operator (shunt engine)
RO	rail operator
the Manual	the <i>Aratere</i> Loading and Discharging Manual

# Glossary

## Kuputaka

couple	connect rail vehicles together
head wagon	the first wagon at the locomotive end of a rake
KiwiRail	KiwiRail Limited
port	the left-hand side of the vessel when facing forward
rake	a series of wagons to be coupled together in preparation for moving
runner wagon	a vehicle used when marshalling restrictions as identified in rules, codes or instructions designate the separation of some vehicles from others
Semi-Permanent Bulletin	a document used by KiwiRail to disseminate instructions that will apply until they are cancelled or made permanent rules
shunt	the movement of one or more rail vehicles by means of pulling or pushing
starboard	the right-hand side of the vessel when facing forward
terminal	wharf, buildings and marshalling area
wagon	a railway vehicle used for transporting goods and equipment

# Appendix 1 EUF Ferry Shunt Wagon Operating Quick Guide

M9203-95

EUF Ferry Shunt Wagon Operating Quick Guide



## EUF Ferry Shunt Wagon Operating Quick Guide

### 1. Description

The EUF ferry shunt wagon is designed to reduce the hazards of coupling on to wagons on the rail ferry. The EUF wagon allows the shunt crew to line up the coupler and couple on to wagons on the rail deck of the ferry when the wagons are on curved track. The coupler can be moved from side to side using air controls fitted to the shunt refuge front guard rail. The coupler can also be released and the knuckle thrown open from on board the shunt wagon.



### 2. Hazards

- Do not operate the air controls when the train is coupled and moving.
- The coupler may move suddenly. Keep well clear of moving parts.
- The control system reservoir will remain pressurised and the controls active even if the wagon air brake air has bled off.
- Always check COUPLER RELEASE LEVER HANDLE for damages and cracks before operating.

### 3. Before use

Do a pre-use safety check on Wagon and Operator interface areas ensuring there are no obvious damages or abnormalities.

The control system on the EUF is powered by air supplied from the train pipe. The wagon must be coupled to a running locomotive with the brake hoses connected to charge the system. The air reservoir should be fully charged before using the wagon. This can take a few minutes if the reservoir is empty. The turnaround time for the ferry is very short so make sure the system is fully charged before the ferry berths.

### 4. Coupling to wagons on straight track

Coupling to wagons on the inner roads of the ferry will not normally require the use of the air controls. The EUF coupler has a top lift release mechanism which is operated using the COUPLER RELEASE LEVER mounted on the refuge top hand rail. Pull the lever up firmly to

release the coupler and throw the knuckle open. The coupler can also be released from the ground by pulling straight up on the chain.

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## 5. Coupling to wagons on curves

The most common problem encountered is coupling onto wagons on the starboard outer track of the rail deck. The following instructions are based on this situation. A similar process can be used for wagons on the port side.

1. Make sure the air reservoir is full.
2. Fully open the knuckle on the target wagon coupler before approaching with the shunt wagon.
3. Approach the target wagon with the shunt wagon and stop just before the couplers meet.
4. Open the knuckle on the shunt wagon coupler using the COUPLER RELEASE LEVER mounted on the refuge top hand rail. Pull the lever up firmly to release the coupler and throw the knuckle open.
5. Use the air CONTROL lever to move the shunt wagon coupler to the right far enough for the open knuckles to engage. The HOLD button can be used to stop the coupler moving back to centre when the CONTROL lever is released.
6. Move the locomotive in **slowly** so that the couplers engage. If the couplers are a long way out of line they will probably engage, but not lock.
7. If the couplers do not lock, use the air control lever to move the coupler to the left. This will align the couplers so that they can lock. Once the couplers engage fully and both couplers lock, no further use of the air controls is required.
8. Connect the brakes and pull the wagons from the ferry.

## 6. Coupling to wagons with hook and pin couplers

If the target wagon has a hook and pin coupler, fit a transition head (bull hook) to the target wagon before coupling. The transition head does not have an opening knuckle so more movement of the shunt wagon coupler may be required.

## 7. Shut down and maintenance

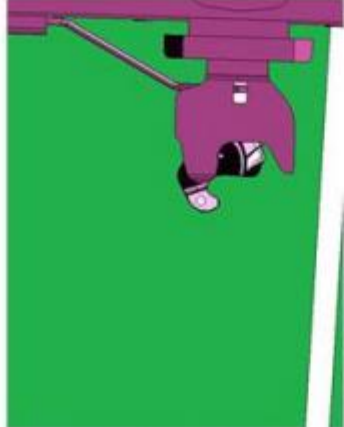
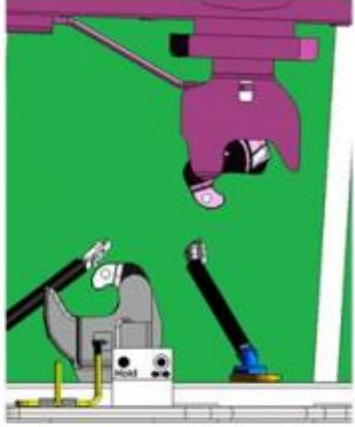
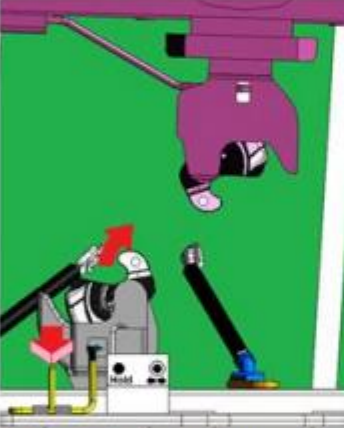
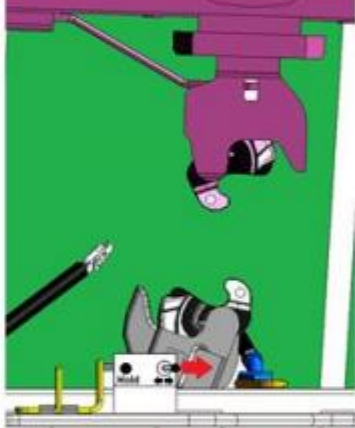
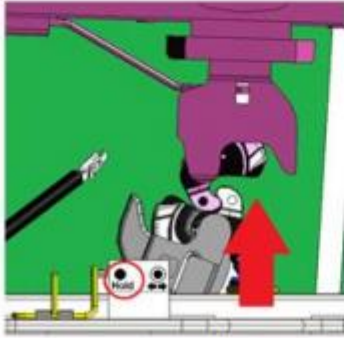
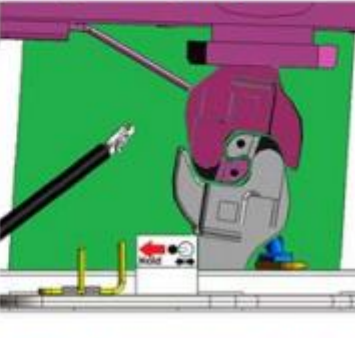
There is no shutdown procedure for the wagon.

- When the air controls are released the drawgear becomes standard KiwiRail drawgear.
- The air reservoir will recharge from the train pipe as required and will remain pressurised for a long period (several days).
- If the air control system is damaged or leaking, it can be isolated from the brake system using the shutoff cock under the deck on the tool box side.
- Maintenance staff should be aware that the air control system is isolated from the train pipe by a non-return valve. The reservoir will remain pressurised even if wagon air is bled off. If any maintenance work is required on the control system, isolate the system by closing the shutoff cock and then empty the reservoir by repeated left and right movements of the coupler using the control valve before disconnecting any fittings.





## EUF ferry shunt wagon operation

1	Make sure the reservoir is full before using the controls
2	 <p data-bbox="293 734 740 770">Open the knuckle on the end wagon</p>
3	 <p data-bbox="874 734 1315 770">Stop the shunt near the end wagon</p>
4	 <p data-bbox="284 1214 756 1249">Open the knuckle on the shunt wagon</p>
5	 <p data-bbox="849 1214 1347 1285">Use CONTROL lever to move the shunt wagon coupler right</p>
6	 <p data-bbox="252 1630 788 1666">Move the shunt wagon <b>slowly</b> in to couple</p>
7	 <p data-bbox="849 1630 1347 1702">Use CONTROL lever to move the shunt wagon coupler left until couplers lock</p>
8	Connect the brake hoses and pull the wagons from the ferry.

For full operating instructions see M9203-95 EUF Ferry Shunt Wagon Operating Quick Guide

## 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 haumarū) 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 'haumarū' is 'safe' or 'risk free'.

### **Corporate: Te Ara Haumarū - 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: rewhenua - 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

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