



Transport Accident  
Investigation  
Commission

# **Final Preliminary Report**

## **Tuhinga Whakamutunga – Mō Tēnei Wā**

***Maritime inquiry MO-2023-201***  
***Passenger vessel Kaitaki***  
***Loss of power***  
***Cook Strait, New Zealand***  
***28 January 2023***

**May 2023**





# 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 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.

### Commissioners

Chief Commissioner	Jane Meares
Deputy Chief Commissioner	Stephen Davies Howard
Commissioner	Paula Rose, QSO
Commissioner	Bernadette Arapere
Commissioner	David Clarke

### Key Commission personnel

Chief Executive	Martin Sawyers
Chief Investigator of Accidents	Naveen Kozhuppakalam
Investigator in Charge	Robert Thompson
Commission General Counsel	Cathryn Bridge

# Notes about Commission reports

## Kōrero tāpiri ki ngā pūrongo o te Kōmihana

### ***Nature of this report***

This preliminary report is made under section 9 of the *Transport Accident Investigation Commission Act 1990*. The Commission may make preliminary reports and recommendations to transport regulators as may be necessary in the interests of transport safety.

This preliminary report is being issued in the initial stages of the investigation. It follows the identification of particular facts and circumstances that the Commission believes have made it necessary to issue an urgent safety recommendation in the interests of transport safety.

### ***Final report***

Upon the completion of the full investigation, which may include further engagement with these preliminary safety issues, the Commission will issue a final report on the accident. That report will contain an analysis of the facts of the accident, findings and possible further recommendations, including on these preliminary safety issues (if any).

### ***Photographs, diagrams, pictures***

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



**Figure 1: Passenger vessel *Kaitaki***  
(Credit: KiwiRail Limited)



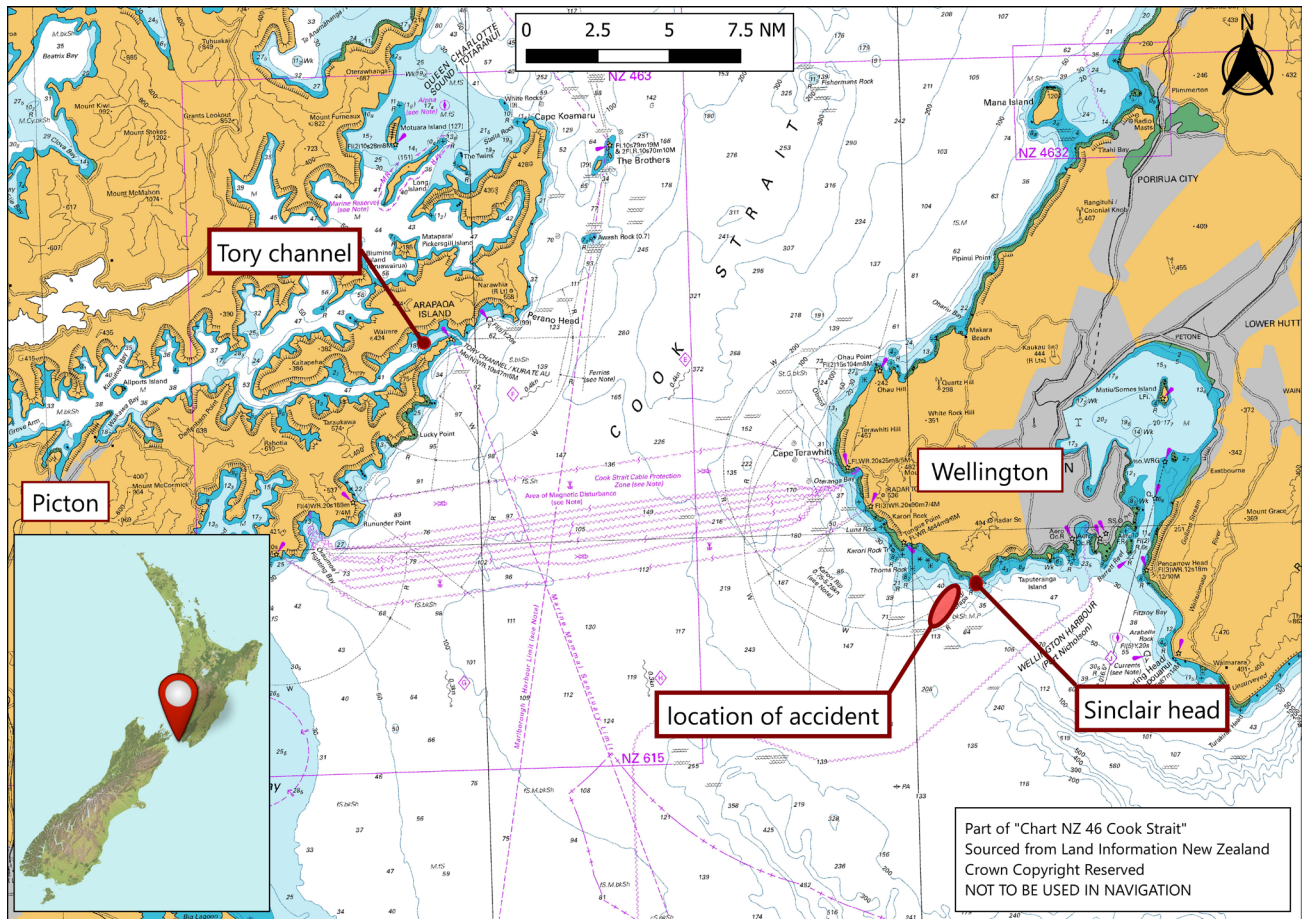


Figure 2: Location of accident

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# 1 Factual information

## Pārongo pono

### Narrative

- 1.1. On Saturday 28 January 2023, the KiwiRail Limited (KiwiRail) Interislander passenger ferry *Kaitaki* was in transit from Picton to Wellington on a scheduled service. The vessel's power plant<sup>1</sup> was comprised of four main engines, two auxiliary engines, two shaft generators and an emergency generator.
- 1.2. Once the vessel had exited the Tory Channel (see Figure 2) the crew began testing the starboard propeller-shaft generator as part of trouble-shooting maintenance operations. When the *Kaitaki* was approximately one nautical mile off Sinclair Head the shaft generator tripped<sup>2</sup>, and the vessel lost all electrical and propulsive power. The vessel's power system immediately switched to one of the auxiliary engines that was on standby, which started up. The emergency generator also started up and continued to supply electrical power to the vessel to supply all services that are essential for safety in an emergency.
- 1.3. At about the same time, a rubber expansion joint (REJ) – a component of the vessel's engines' high-temperature cooling water system – ruptured. This resulted in the cooling water draining out from the cooling system, passing through the ruptured REJ and into the engine room bilge system<sup>3</sup>.
- 1.4. The four main engines and two auxiliary engines all used the same high-temperature cooling water system. Most of the water within that system drained out before the crew was able to isolate the REJ by shutting off the valves.
- 1.5. The loss of water pressure from the cooling system meant the main engines could not be restarted safely and as a result propulsion could not be restored in a timely manner. The emergency generator continued to operate and provide electrical power for safety services.
- 1.6. The *Kaitaki* was without propulsion for approximately one hour before the engines could be restarted and control of the engines returned from the engine room to the bridge ready for vessel manoeuvring.

### The ruptured rubber expansion joint

- 1.7. REJs were inserted as flexible connectors in rigid piping systems and were referred to by various names such as compensators, bellows and flexible connectors.
- 1.8. The purpose of REJs was to alleviate strain in the system by minimising vibration and noise while also compensating for heat expansion, load stress and pumping surges. They also enabled the joining of misaligned pipes and could act as pipe insert pieces to make inspections more straightforward.

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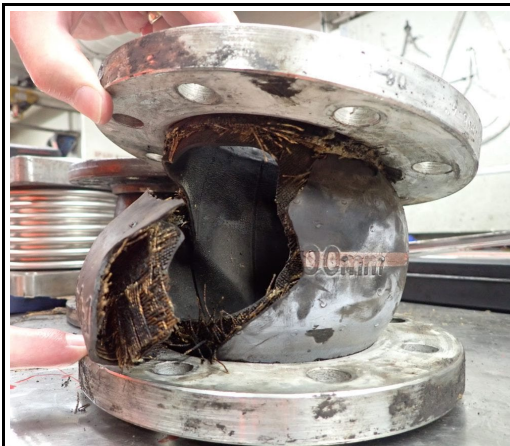
<sup>1</sup> The power plant of a vessel comprises its installed power generation equipment.

<sup>2</sup> Automatically shut down due to overload.

<sup>3</sup> A collection of pumps, pipes and tanks designed to remove water and other liquids that accumulate in the lowermost part of a ship's engine room.



- 1.9. There were 46 REJs installed onboard the *Kaitaki*, serving various systems; 12 of these were installed in the high-temperature cooling water system. Figure 3 shows the ruptured REJ alongside an example of a REJ that is in serviceable condition. Figure 4 shows an *in situ* REJ installed on the *Kaitaki*.

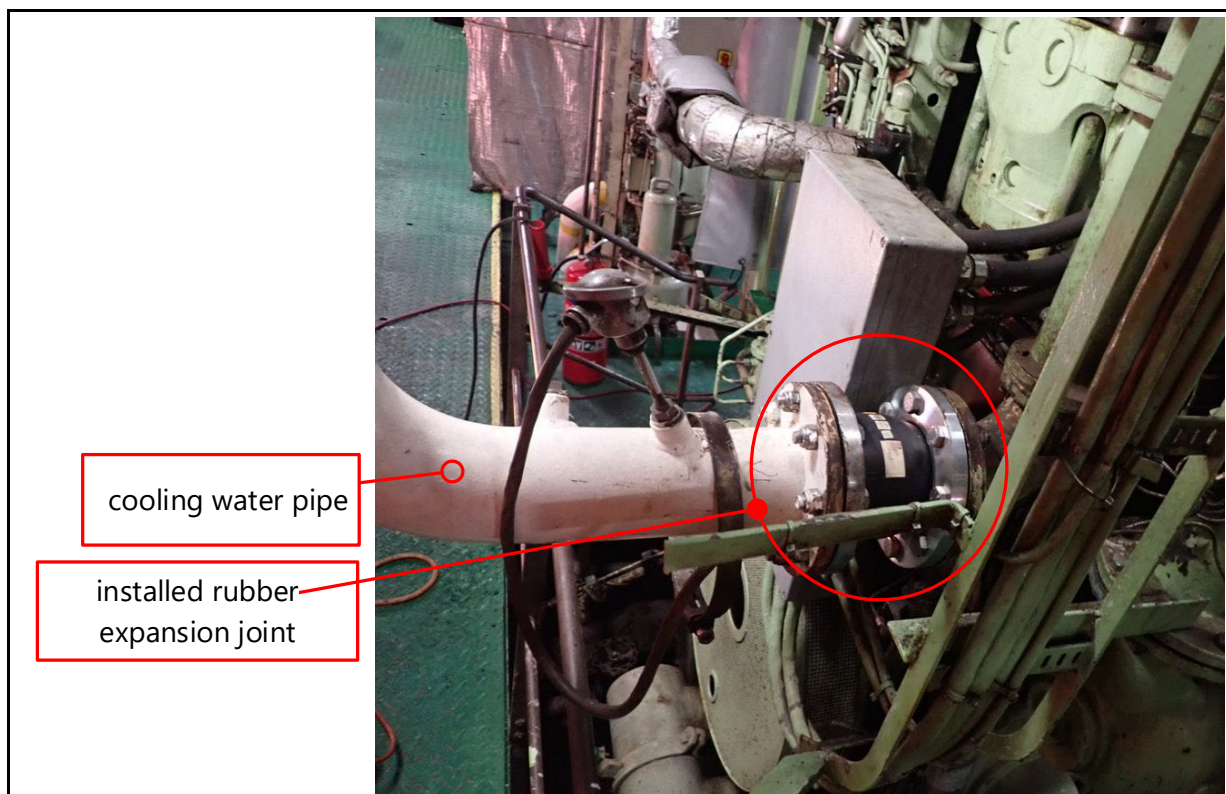


A photo of the ruptured rubber expansion joint from the high temperature cooling water system of the *Kaitaki*



A photo showing an example of a rubber expansion joint in serviceable condition, also from the *Kaitaki*

**Figure 3: The ruptured REJ (left) and a serviceable REJ (right)**

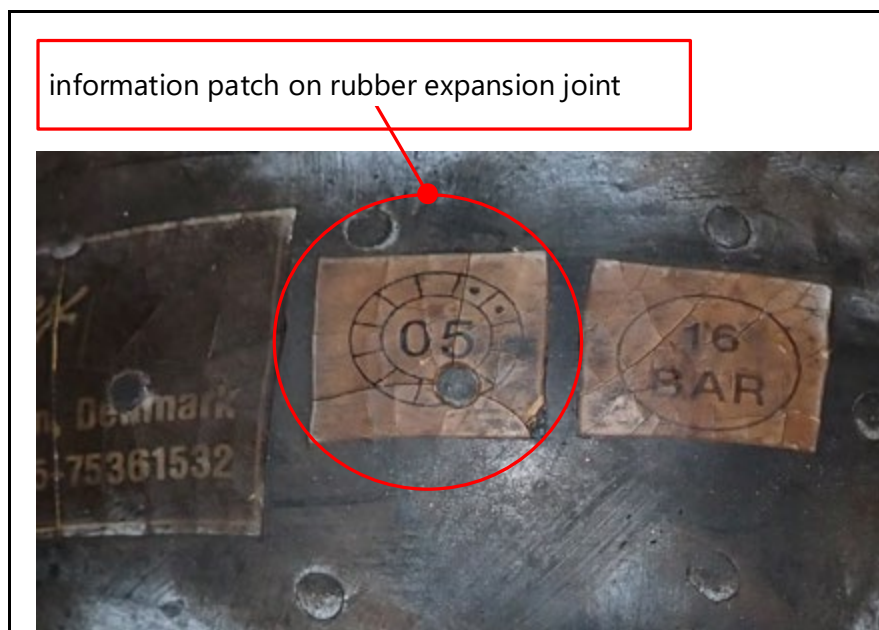


cooling water pipe

installed rubber expansion joint

**Figure 4: An installed REJ onboard the *Kaitaki***

- 1.10. Rubber is a processed natural product that, once manufactured, is subject to degradation associated with oxidation, ozone cracking, heat aging, cracking and liquid absorption<sup>4</sup>. Over time the rubber component of REJs hardens and becomes more susceptible to cracking and delamination<sup>5</sup>. The rubber may also deteriorate and become softer or 'gummy'.<sup>6</sup>
- 1.11. The main engine's cooling water system regulated the temperature of the main engine within certain prescribed limits to prevent the engine from sustaining severe damage. If a deviation from those limits occurred, such as when there was a failure of the cooling water system, sensors on the engine would detect it and trigger an automatic shutdown of the engine to prevent catastrophic failure. The shutdown would result in the immediate loss of the vessel's propulsion system. This means the main engine's cooling water system was critical for the safety of the vessel.
- 1.12. If the failure of any component within the cooling system, such as the REJ, could result in the failure of the system as a whole, then that component would be a safety critical component. As such, it should be identified and tracked through its lifetime and checked to ensure it remained fit for purpose.
- 1.13. The ruptured REJ had information patches attached to it indicating it was manufactured in February or March 2005 (see Figure 5). It had been installed on the Kaitaki in 2018. This information indicates that at the time of rupture, the REJ had been installed when it was about 13 years old, had been in service for about a further five years, and it was about 18 years since it was manufactured.



**Figure 5: The information patch attached to the ruptured REJ**

<sup>4</sup> Samsuri, A. (2010). Shreir's Corrosion. Elsevier

<sup>5</sup> Delamination is a type of failure where the material fractures into layers.

<sup>6</sup> Fluid Sealing Association (2023). Expansion Joints—Piping Technical Handbook 8.1 Edition. The Fluid Sealing Association is an international trade association.

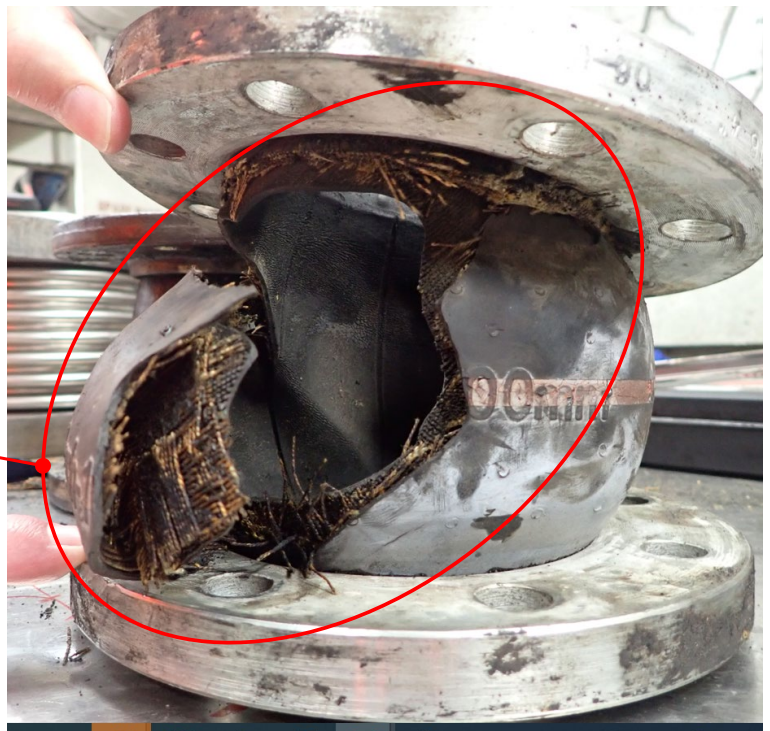
- 1.14. With respect to assuring the serviceability of **safety critical** REJs, the manufacturer told the Commission:
- the REJs should be no older than eight months from the date of manufacture when installed
  - it is highly recommended that they are inspected annually including visual, tactile and hardness measurements
  - regardless of inspection findings, safety critical REJs should be replaced after five years.
- 1.15. KiwiRail has advised the Commission that since the accident they have introduced guidance requiring that REJs are stored for a maximum of four years and can be in use for a further four years before they are replaced. This does not comply with the manufacturer's guidance and does not take into account the date of manufacture. The REJs begin to deteriorate from the date of manufacture. The Commission has made a recommendation to address this safety issue.
- 1.16. At the time of publication of this preliminary report KiwiRail had not provided sufficient evidence to the Commission that the date-of-manufacture of the REJs had been accounted for in the planned maintenance system.
- 1.17. KiwiRail's planned maintenance system monitored each REJ's time in service starting from its date of installation. The planned maintenance system showed that the ruptured REJ was due for replacement about two months before its failure.
- 1.18. The nature of the failure of the *Kaitaki's* REJ, in particular the cracking and delamination as shown in Figure 6, was 'evident of aging failure' according to the manufacturer.



ruptured rubber with  
cracking and delamination



ruptured rubber with  
cracking and delamination



**Figure 6: Ruptured REJ with cracking and delamination**

## 2 Safety issues and remedial action

### Ngā take haumanu me ngā mahi whakatika

#### General

- 2.1 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.
- 2.2 Safety issues may be addressed by safety actions taken by a participant, otherwise the Commission may issue a recommendation to address the issue.

***Safety issue: Rubber expansion joints deteriorate over time not only due to service conditions but also due to age, starting from the date of manufacture. Therefore, maintenance schedules must consider both the date of manufacture and the date of installation to ensure reliability of the rubber expansion joints.***

- 2.3 REJs begin to deteriorate from their date of manufacture. Over time the rubber hardens and becomes more susceptible to cracking and delamination. The REJs associated with the engines, high-temperature water cooling system were a safety critical component onboard the *Kaitaki* and as such consideration should be given to replacement around five years from the date of manufacture.
- 2.4 The ruptured REJ that was installed on the *Kaitaki* had been in service about five years, but evidence indicates it was manufactured in 2005. The nature of the failure of the *Kaitaki's* REJ, in particular cracking and delamination, was consistent with deterioration due to age.
- 2.5 The Commission is concerned that similar safety critical components in the KiwiRail Interislander fleet may be at risk of failure if their dates of manufacture have not been accounted for in the replacement schedule. KiwiRail has taken the following safety actions in response to the *Kaitaki's* loss of propulsion:
  - replaced all REJs onboard *Kaitaki*
  - assessed the condition of all REJs installed on all vessels in the KiwiRail fleet
  - started a detailed assessment of critical equipment by an independent expert for all vessels in the KiwiRail fleet
  - started an internal review of critical components and sub-components and equipment of all vessels in the KiwiRail fleet
  - updated the planned maintenance software component structures for REJs,
  - distributed a Facilities Management policy for REJ management
  - reviewed the Material Data Safety Sheet and Chief Engineer Decision Support System processes across the fleet.
- 2.6 The Commission welcomes the safety action taken to date by KiwiRail. However, the Commission is concerned that there remain REJs in operation in the KiwiRail Interislander fleet that do not meet the manufacturer's guidance and are at increased risk of failure. Therefore, the Commission has made a recommendation in section 3.3 to address this.

## 3 Recommendations Ngā tūtohutanga

### General

- 3.1 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.
- 3.2 In the interests of transport safety, it is important that these recommendations are implemented without delay to help prevent similar accidents or incidents occurring in the future.

### New Recommendations

- 3.3 **On 30 April 2023, the Commission recommended that Maritime New Zealand require KiwiRail to provide evidence to Maritime New Zealand's satisfaction that safety-critical rubber expansion joints onboard all vessels within KiwiRail's Interislander fleet are fit for purpose taking into account the manufacturer's guidance, namely:**
  - they should be no older than eight months from the date of manufacture when installed
  - they are inspected annually including visual, tactile and hardness measurements
  - regardless of inspection findings, safety-critical REJs should be replaced after five years. (008/23).
- 3.4 **On 30 April 2023, the Commission recommended that Maritime New Zealand alert all vessel operators using rubber expansion joints within a vessel's safety-critical system to the importance of taking into account the date of manufacture, in addition to the time in service, in their maintenance schedules to ensure they are fit for purpose. (009/23).**

On 3 May 2023, Maritime New Zealand replied:

We write to you in response to the Final recommendation MO-2023-201: Passenger Vessel, Kaitaki loss of power, Cook Strait, New Zealand 28 January 2023 notifying Maritime New Zealand of the final shape of recommendation's 008/23 and 009/23 to be included in your report.

Maritime New Zealand accepts the final recommendation 008/23 and 009/23; as outlined in your letter.



## ***Notice of Recommendations***

3.5 On 1 May 2023, the Commission gave notice to KiwiRail:

**On 30 April 2023, the Commission recommended that Maritime New Zealand require KiwiRail to provide evidence to Maritime New Zealand's satisfaction that safety-critical rubber expansion joints onboard all vessels within KiwiRail's Interislander fleet are fit for purpose taking into account the manufacturer's guidance, namely:**

- **they should be no older than eight months from the date of manufacture when installed**
- **they are inspected annually including visual, tactile and hardness measurements**
- **regardless of inspection findings, safety-critical REJs should be replaced after five years. (008/23).**

## 4 Further lines of inquiry

- 4.1 A full inquiry into this accident is continuing. A final report, setting out findings, safety issues and recommendations, if any, will be issued at the completion of this inquiry.
- 4.2 Lines of inquiry include, but are not limited to:
- maintenance and safety systems
  - emergency response and capability.

## 5 Data summary

### Whakarāpopoto raraunga

Name:	<i>Kaitaki</i>
Type:	passenger vessel
Classification:	Lloyd's register
Length:	181.6 m
Breadth:	23.9 m
Gross Tonnage:	22365 GT
Built:	1995
Propulsion:	4 X Sulzer Type 8 ZAL 40S 5760 kW
Service speed:	19 knots
Owner/operator:	Interislander, KiwiRail Limited
Port of registry:	Wellington, New Zealand

***Date and time*** 28 January 2023, 1652

***Location*** Off Sinclair Head, Cook Strait, New Zealand

***Persons involved*** Vessel crew and 854 passengers

***Injuries*** Nil

***Damage*** Nil

## 6 Conduct of the inquiry

### He tikanga rapunga

- 6.1 On 28 January 2023, Maritime New Zealand 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.
- 6.2 Between 29 and 31 January 2023, four Commission investigators boarded the vessel while it was berthed in Wellington to gather evidence and conduct interviews.
- 6.3 On 22 March 2023 the Commission approved a draft preliminary report for circulation to four interested parties for their urgent comment given the nature of the safety concern raised.
- 6.4 The Commission received three submissions, and changes as a result of these have been included in the preliminary report.
- 6.5 On 30 April 2023, Commission approved the publication of this preliminary report with urgent safety recommendations.
- 6.6 The investigation into this occurrence is continuing.









## 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: 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.



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MO-2021-203	Collision between fishing vessel 'Commission' and container ship 'Kota Lembah', 84 nautical miles northeast of Tauranga, Bay of Plenty, New Zealand, 28 July 2021
MO-2021-201	Jet boat KJet 8, loss of control, Shotover River, Queenstown, 21 March 2021
MO-2021-203	Collision between fishing vessel 'Commission; and container ship 'Kota Lembah', 84 nautical miles northeast of Tauranga, Bay of Plenty, New Zealand, 28 July 2021
MO-2020-202	Bulk log carrier Funing, Loss of manoeuvrability while leaving port, Port of Tauranga, 6 July 2020
MO-2018-206	Bulk carrier Alam Seri, loss of control and contact with seabed, Port of Bluff, 28 November 2018
MO-2020-201	Collision between bulk carrier Rose Harmony and fishing vessel Leila Jo, Off Lyttelton, 12 January 2020
MO-2019-204	Capsize of water taxi Henerata, Paterson Inlet, Stewart Island/Rakiura, 12 September 2019
MO-2019-203	Bulk log carrier Coresky OL, Crew fatality during cargo-securing operation, Eastland Port, Gisborne, 3 April 2019
MO-2018-205	Fatality on board the factory trawler San Granit, 14 November 2018
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MO-2019-201	Jet boat Discovery 2, contact with Skippers Canyon wall, 23 February 2019

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