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Insights from 20 Years of OTSI Safety Investigations 2004 - 2023

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Contents

Table of figures

Introduction

Since 2004, the Office of Transport Safety Investigations (OTSI) has completed more than 240 investigations, each accompanied by a detailed report. These investigation reports harness learnings and insights from bus, ferry, and rail incidents to help stakeholders make informed decisions to improve safety systems and prevent similar incidents from reoccurring.

To commemorate the 20th anniversary of OTSI, this report showcases 20 investigations from 2004 to 2023 to highlight the value of independent, 'no-blame' investigation and its impact on transport safety. Each investigation is summarised into a one-page outline of the event, key investigation findings, and safety lessons for industry to consider.

The selected investigations highlight a range of deficiencies in systems and processes that could have prevented these incidents.

Despite making significant strides in the management of safety, these historical incidents contain safety lessons that are still valid and relevant today.

Many of these safety lessons are universal and applicable across modes as they relate to incident prevention, the robustness of safety management systems, their error tolerance, the implementation of those systems, and the competency of staff when applying the systems.

While the specific incidents may no longer have direct applications today, the learnings about failures in safety systems and the management of people responsible for those systems are still relevant and necessary.

These incident investigations provide opportunities and insights to enhance the robustness and error tolerance of safety management systems.

The full details of these safety investigations can be viewed on the OTSI website: https://www.otsi.nsw.gov.au/investigations/completed-investigations

Bus Investigations

Fatal Bus Accident, Jamberoo Mountain Road (2005)

What happened

On 5 September 2005, a 24-seat minibus towing a loaded trailer was descending a steep and winding section of Jamberoo Mountain Road on the NSW South Coast when the brakes overheated and the driver lost control, causing the vehicle to collide with a guard rail before rolling onto its roof and coming to stop against a small tree. Three passengers were fatally injured and 14 sustained injuries that required hospitalisation.

What OTSI found

The accident occurred when the bus brakes failed, preventing the driver from safely negotiating a corner on a steeply descending road. The overheating brakes were caused by an inappropriate selection of gears and poor braking technique for the section of road that the bus was travelling on.

The driver had held an overseas driving licence for 19 years and had operated heavy vehicles before moving to Australia, but they had only obtained their NSW bus licence on 29 July 2005 which meant their local bus driving experience was limited to five weeks.

The bus operator required the driver to use a route which was sign-posted as being unsuitable for coaches, and with which they were largely unfamiliar. The bus was also being driven with a defective air brake pressure alarm system.

The investigation found the bus was registered by the (then) Roads and Traffic Authority (RTA) but did not meet its preregistration requirements. Prior to registration, the RTA initially received certification from a consulting engineer. However, the engineer became concerned some of the Australian Design Rules (ADR) may have been misinterpreted and sought clarification from the RTA that determined the bus did not comply with Australian Design Rules 59 and 68. These rules required that the bus meet rollover strength parameters and that all occupants be provided with a three point or 'lap-sash' seatbelt.

The engineer reported they had contacted the operator to advise the certified buses did not comply with pre-registration standards and should not be operated. The operator reported no knowledge of this communication.

Safety lessons

Management of risk

The involved operator did not apply effective risk management processes to adequately identify or address the risks associated with operating on a route unsuitable for medium and heavy vehicles, a defective air brake pressure alarm system, and vehicle noncompliance with ADR requirements. A robust approach to the identification and management of safety risk is vital for safe operations.

Proper route risk assessment

The identification and management of safety risk, especially regarding route selection and route familiarisation of bus drivers, was critical to mitigate the escalation and causation of a similar incident.

Driver training and experience

The incident highlighted the importance of bus driver training, route and vehicle familiarisation, and competency testing, to help prevent similar incidents. This report also led to the OTSI Systemic Investigation into the Importation and Registration of Overseas-Sourced Buses in NSW.

Download the Fatal Bus Accident, Jamberoo Mountain Road, 2005 report

Figure 1: Signage on the Illawarra Highway, approximately 100 m before its intersection with Jamberoo Mountain Road.

Bus Accidents Occasioning Death and Serious Injury, West Pennant Hills, Rutherford, and Sydney CBD (2007)

What happened

During the period of 19 – 27 June 2007, two pedestrians and a cyclist were killed, and a fourth person was seriously injured, in separate incidents, after being struck by buses. The involved incidents were as follows:

- 19 June – a pedestrian sustained fatal injuries after being struck by a bus in the 'Buses Only' lane after alighting from a car and attempting to cross three lanes of traffic, on the M2 Hills Motorway at West Pennant Hills.
- 19 June – a pedestrian sustained fatal injuries after being struck by a bus while crossing Clarence Street, near its intersection with Druitt Street, in the Sydney CBD.
- 20 June – a cyclist sustained fatal injuries after they lost control of their bicycle and slid under the rear wheels of a bus in Rutherford.
- 27 June – a pedestrian sustained serious injuries after being struck by a bus while crossing Druitt Street, near its intersection with Kent Street, in the Sydney CBD.

What OTSI found

It is significant that in each instance the ensuing accident could not be attributed to the actions of the bus driver. In all four incidents, the actions of the pedestrians and the cyclist increased the risk of impact with a bus.

The two Sydney accidents involved pedestrians crossing the road away from marked crossings, a common behaviour noted by OTSI investigators during observations of pedestrian behaviour on streets throughout the Sydney CBD.

At the time of these incidents, most buses operating within the Greater Sydney area were fitted with CCTV that was mounted internally with rear-facing cameras which were of little value in revealing the circumstances around accidents at the front of the vehicle. In addition, buses operating outside the Sydney, Newcastle and Wollongong metropolitan areas were not required to be fitted with any form of CCTV.

In each incident, the emergency response was timely and efficient.

Safety Lessons

CCTV cameras

This report recommended that all large buses operating on regular passenger and school service routes, and those operating over longer distances on a regular or chartered basis throughout NSW, be equipped with forward-looking and rear-facing digital CCTV equipment. This would provide a significant long-term situational enhancement to the safety of bus drivers and passengers and assist in understanding the circumstances of an incident.

Download the Bus Accidents Occasioning Death and Serious Injury, West Pennant Hills, Rutherford, and Sydney CBD, 2007 report

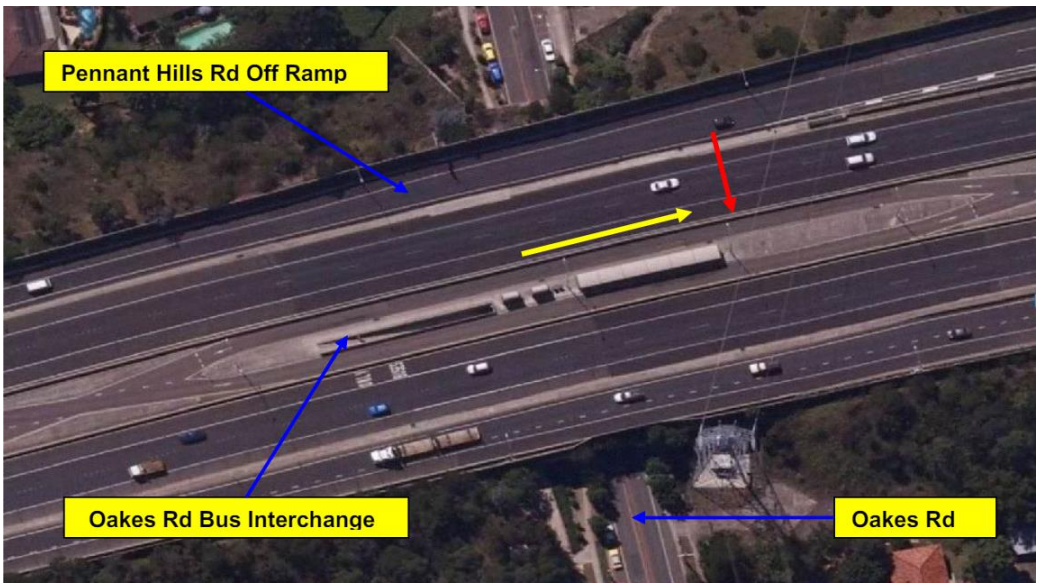

Figure 2: Overview of Oakes Road Bus Interchange, Pennant Hills, with the approximate paths of the pedestrian and the bus shown in red and yellow, respectively.

Figure 3: Lighting conditions in Clarence Street, with the approximate paths of the pedestrian and the bus shown in red and yellow, respectively.

Bus Fire involving Bus MO4878, Hillsdale (2011)

What happened

On 29 July 2011, a bus powered by compressed natural gas (CNG) caught fire at Hillsdale when returning to the Port Botany depot. There were no passengers onboard at the time of the incident. Despite attempts by the bus driver and Fire and Rescue NSW to extinguish the fire, the bus was destroyed. There were no reported injuries.

What OTSI found

The most likely cause of the fire was found to be coolant being sprayed onto the engine from a split hose connection on the turbocharger coolant return line to the compressor. The water content of the coolant evaporated on the hot surface of the engine allowing the residual ethylene glycol to crystallise and ignite.

As the fire intensified, it burnt through the rear floor hatch and the passenger saloon. Although the timber plywood floor hatches were the most vulnerable area, they were not protected with stainless steel shielding like other areas of the engine bay. About 19 minutes after the fire was detected, the connection of the CNG line at the solenoid valve succumbed to the intense temperature. The resultant increase in pressure vented in a jet of flame.

At no stage did the driver shut off the CNG supply which could have been done either internally or externally. Depriving the fire of this fuel source may have impeded its rate of development giving fire fighters greater opportunity to contain and extinguish it.

It was found there were deficiencies in the training of drivers in handling a vehicle fire, in the provision of conversion training on the introduction of a new make or model of bus, and in providing refresher training. It was also identified that control centre personnel could assist in emergencies involving gas powered buses by reminding drivers to shut off fuel supplies, and by forewarning emergency services personnel of any known additional hazards they may confront at the fire site.

Safety lessons

Fire suppression systems
This investigation highlighted the importance of fitting engine bay fire suppression systems to buses to mitigate fire risks and the severity of a fire.

Awareness of ethylene glycol-based coolant fires
This incident raised awareness of ethylene glycol-based coolant fires. At the time, there was limited research on these fires, the flammability of coolants, and safety measures for these coolants.

Servicing and maintenance
The split hose connection on the turbocharger coolant line should have been replaced by the manufacturer during a recall program of the part but the manufacturer missed the bus. A regular maintenance and inspection regime is critical to identify defects and prevent similar occurrences.

Driver training
Deficiencies were found in the training of drivers in relation to isolating the CNG supply, passenger evacuation procedures, and the use of dry powder extinguishers. Effective training programs for all bus drivers are needed to safely manage the risk and severity of fires and similar emergencies.

This investigation was one of several that led to the OTSI investigation into Bus Fires in NSW 2005-2012 and the Annual Bus Fire Summary Report.

Download the Bus Fire involving Bus MO4878, Hillsdale, 2011 report

Figure 4: Fire damage to the bus exterior.

Figure 5: Fire damage to the bus interior.

An Investigation into Bus Fires in NSW 2005 – 2012

What happened

An examination of the nature and circumstances of bus and coach fires investigated by OTSI in 2010 to mid-2012 revealed several common safety issues. As a result, this investigation was initiated to explore these issues in detail, draw on the experience of other national and international jurisdictions, and to identify courses of action that if implemented, would contribute to enhancing the safety of bus and coach operations in NSW.

What OTSI found

Between January 2005 and June 2012, OTSI received 115 reports of fires in buses and coaches. Examination of these incidents highlighted six recurring safety issues:

- *Warning and reaction times*
  On most occasions, the driver was unaware of the fire until alerted by another party. Few buses were fitted with fire or smoke detection sensors and alarms.
- *Fire initiation and development*
  Two major concerns in bus fires are the speed at which fire engulfs the vehicle once it enters the interior and the toxic gases generated when the flammable materials used in the interior fit-out catch fire.
- *Passenger evacuation*
  The flammability and toxicity of materials used in internal furnishings influences the amount of time available to evacuate passengers once a fire enters the passenger compartment. Therefore, the immediate evacuation of bus passengers is critical.
- *Portable firefighting equipment*
  It was observed that portable firefighting equipment had a general inability to make any inroads into supressing or extinguishing a fire once it had gained a hold.
- *Fire suppression systems*
  At the time of the investigation, few buses had fire suppression systems installed to reduce the severity and consequences of a fire in and around the engine or suppress a fire until emergency services arrived.
- *Driver training and emergency procedures*
  The provision and detail of driver training for fire-related emergencies delivered by operators was identified as being inconsistent. The report emphasised the importance of ongoing refresher training programs and ‘conversion’ training for drivers unfamiliar with their assigned vehicle model.

Safety lessons

OTSI Bus Fires and Thermal Incidents in NSW Report
This investigation initiated the annual report which OTSI provides to the industry with data on the causes and nature of bus fires and thermal events in NSW.

Bus fire suppression systems
OTSI’s recommendations brought further attention to the technology. In 2015, Transport for NSW (TfNSW) and the (then) State Transit Authority began the program to institute requirements for automatic engine bay fire suppression systems on buses. This was completed in 2018.

Recommendations
The report provided recommendations to improve bus fire safety that remain relevant today.

Download the An Investigation into Bus Fires in NSW 2005 – 2012 report

Bus Fire, Sydney Harbour Bridge, Milsons Point (2016)

What happened

During the afternoon peak on 15 September 2016, bus MO3726 caught fire on the Sydney Harbour Bridge at Milsons Point. At the time, the bus was travelling with 22 passengers. The driver noticed smoke and flames coming from the exterior rear of the bus as it approached the bridge's north-west pylon.

The driver stopped the bus in lane two and all passengers were evacuated onto the road in lane one. The driver and two passengers suffered from smoke inhalation and were transported by ambulance to the hospital where they were treated and released later that evening.

What OTSI found

The investigation found that the fire started due to an electrical malfunction in the engine bay at the rear of the bus. The fire intensified, consuming flammable materials in the engine bay and eventually spread into the passenger saloon. The rear half of the bus suffered substantial damage.

It is likely that the fire was initiated by a short circuit of the auxiliary alternator cables where they crossed the edge of the near side rear chassis rail. Another short circuit likely occurred in the primary alternator cable when consequential damage occurred to its insulation following the development of the fire.

The main battery switch was left in the 'on' position after the driver shut the engine down and evacuated the bus. This meant that there was an ongoing supply of battery power to the source of the fire in the engine bay. This may have caused the fire to intensify due to the continuous supply of thermal energy.

The bus was not fitted with an engine bay fire suppression system. The suppression system was scheduled to be installed in the month following the fire.

While the driver made the correct decision to evacuate the bus quickly, the passengers entered an adjacent smoke-filled live traffic lane which created a risk of them being struck by vehicles travelling in the lane. However, the investigation acknowledged that ideal actions are not always possible in high workload emergency situations.

The driver had completed initial training in the use of fire extinguishers but received no refresher training after the start of their employment with the operator.

Safety lessons

Maintenance of high amperage electrical circuits
This incident highlighted the importance of maintenance, design and placement of electrical cables, especially high amperage electrical circuits, to reduce the likelihood of short circuit events.

Driver training and emergency preparedness
All passengers in this incident were safety evacuated from the bus, but the incident highlights the importance of driver training and refresher training with emergency procedures. This includes fire extinguisher techniques, passenger evacuation into traffic, and the operation of the engine bay fire suppression systems.

Download the Bus Fire, Sydney Harbour Bridge, Milsons Point, 2016 report

Figure 6: Flames from the rear of the bus.

Figure 7: Bus on bridge, Fire and Rescue NSW extinguishing fire.

Source: Peter Mullen pmullen.com

Bus and Pedestrian Fatal Accident, Brunker Road, Adamstown (2019)

What happened

On 5 November 2019, a driver on a school bus route became incapacitated and lost control of the bus. As a result, a person standing at a pedestrian crossing was struck and fatally injured. Several parked cars were also damaged by secondary collisions.

The driver regained consciousness and brought the bus to a stop. Some passengers suffered minor physical injuries.

What OTSI found

The driver's incapacitation and loss of control was likely due to a transient loss of consciousness. There was no other mechanism for controlling the bus once the driver became incapacitated.

TfNSW had a requirement for the medical assessment of drivers. However, this relied on open and honest disclosure by the bus driver of any medical condition that may affect their ability to drive.

The bus driver was cleared to drive in accordance with standards in the Assessing Fitness to Drive (AFTD) Guidelines prior to this incident. The bus driver was aware they were feeling unwell but did not anticipate becoming incapacitated and unable to stop the bus.

Post-accident inspections of the bus did not detect a mechanical malfunction, component failure or design feature that contributed to the accident.

There are continued reports of bus drivers suffering ill health and incapacitation while driving a bus after enforcement of the AFTD Guidelines.

Safety lessons

Fitness to drive
Assessing a bus driver's fitness to drive is crucial to ensure road safety. This incident has highlighted the important roles drivers, health professionals, bus operators and TfNSW have in maintaining fitness to drive.

Driver incapacitations
Unlike other transport modes such as aviation and rail, for buses and coaches, the driver is the last line of defence. There are no other mechanisms for controlling the bus once the driver becomes incapacitated.

Such incidents serve as a reminder to operators to review the completeness and effectiveness of current controls to manage bus driver incapacitation.

Anticipating ill health and incapacitation
This incident highlights the importance of bus drivers being aware of any changes to their health, the range of health issues that could affect their driving, and how these issues should be managed. It is also vital for bus operators to promote a working environment that prompts and supports drivers to report any medical conditions as an operational priority.

Download the Bus and Pedestrian Fatal Accident, Brunker Road, Adamstown, 2019 report

Figure 8: Pedestrian crossing on Brunker Road.

Ferry Investigations

Collision of the MV Louise Sauvage, Rose Bay Wharf (2004)

What happened

On 12 May 2004, the vessel MV Louise Sauvage collided with the wharf at Rose Bay in Sydney Harbour. The crew reported that the vessel had suffered a steering system failure at a critical stage of the approach to berth.

What OTSI found

Earlier in the day of the incident, the vessel experienced a failure of its steering system. The defect was not confirmed during shipyard testing and sea trials, so the vessel was returned to service.

Based on the failure of the steering system earlier in the day, the level of disassembly of the system that occurred before OTSI could inspect the vessel, and the absence of reliable data recording of vessel parameters, the investigation concluded that the most likely cause of the collision was the failure of the steering system.

However, technical investigations by both the vessel operator and OTSI could not establish what caused the steering system failure.

Safety lessons

Risk management
At the time of the incident, the operator did not have a formalised system for managing operational risk. Marine safety has since advanced and all vessels are now required to develop and implement a risk management system that identifies and implements reliable controls for any operational safety hazards in the vessel design, vessel operations, and the operating environment.

Data recording
The absence of reliable data recording of vessel parameters meant that the cause of the collision could not concluded, the cause of the steering failure could not be determined, and the failure could not be replicated. This report stressed the importance of incorporating data recording facilities into all public passenger service vessels.

Accuracy of operating manual
Effective risk management requires an effective safety management system and an accurate operating manual. Training and procedural information in MV Louise Sauvage's Vessel Operations Manual Supercat Class was inaccurate or incomplete. As a result, the ability of the crew to implement appropriate corrective action to avoid a collision was limited.

Importance of training
This incident stressed the importance of structured training and ongoing competency programs. The concepts of Crew Resource Management were also highlighted in managing emergency situations to help operational crew improve on communication, teamwork, and emergency response to achieve safe operations.

Download the Collision of the MV Louise Sauvage, Rose Bay Wharf, 2004 report

Figure 9: MV Louise Sauvage.

Systemic investigation into incidents of collision involving Freshwater class vessels, October 2004 – October 2005

What happened

Throughout the period of October 2004 to October 2005, Freshwater class vessels were involved in 11 reported collisions. In response to what appeared to be recurring safety issues and trends, and in the interest of public safety, a systemic investigation was launched into the incidents.

What OTSI found

Through the incident analysis, OTSI found that many of the contributory factors of these 11 incidents were also present in incidents involving other classes of vessels operated by Sydney Ferries in the same period. In each of the 11 incidents, there were common features identified:

- Nine of the 11 collisions occurred with berthing or preparing to berth, and 10 were while the vessels were in, or being switched to, manoeuvring mode.
- In 10 of the 11 collisions, the Master stated the vessel operated contrary to their expectations.
- One Master and one engineer were involved in six of the collisions, but never together.
- Alcohol and fatigue were not an issue.
- Human error was identified as a primary cause of six collisions and mechanical failure in four.

Safety lessons

The absence, or lack of observance, of standard operating procedures
In several cases, the incidents were caused or exacerbated by either ineffective standard operating procedures or a failure to comply with a specific procedure. OTSI also noted that Vessel Operating Manuals varied in quality and content depending on the vessel.

Operational competency in emergency procedures
There were several instances where Masters were unable to identify or initiate available recovery options and therefore responded in a manner that was ineffective or inappropriate. Often as a result, actions taken, or not taken, exacerbated the situation or initiated an emergency.

Limitations in training and crew resource management
The investigation highlighted how inadequate training hindered the crews' ability to respond appropriately. Several limitations were mentioned, namely deficiencies in non-standard conditions, incomplete equipment checks and a lack of coordinated response during emergencies.

Poor operational communication
The issue of poor operational communication was not confined to the Freshwater class vessels but was apparent in other classes. The key weaknesses were that proper communication protocols were not observed, and communication was very conversational.

Limitations in maintenance
OTSI observed that maintenance processes were often immature and incomplete, that issues had remained open for extended periods of time, performance monitoring of work was poor, and quality assurance of outsourced of maintenance work was sub-optimal.

Poor identification and management of risk
An audit in October 2005 confirmed that the ferry operator was still developing capacity to identify and manage risk and so their Safety Management Systems had many missing or underdeveloped components.

Download the Systemic investigation into incidents of collision involving Freshwater class vessels. October 2004 – October 2005 report

Figure 10: MV Freshwater.

Figure 11: Damage from Freshwater class vessel Collaroy collision at Circular Quay.

Collision between HarbourCat MV Pam Burridge and Motor Launch Merinda (2007)

What happened

On 28 March 2007, a group of 12 people embarked on the vessel Merinda for an evening cruise to Darling Harbour and the Woolloomooloo area in Sydney Harbour. At the same time, public service vessel MV Pam Burridge was on its last service run for the day and proceeded to Circular Quay with no passengers.

At approximately 10:50pm, the starboard hull of Pam Burridge collided with the starboard side of Merinda about midway along its length and continued through the cruiser and tore through the hull. As a result of the collision, Merinda was effectively cut in two. Four passengers on board Merinda were fatally injured and the remaining eight required hospitalisation. Three of the eight surviving passengers were seriously injured.

What OTSI found

The investigation focused on determining why the two vessels did not see each other in time to take action to avoid collision and found several contributory factors, namely human error, vessel visibility, and environmental factors.

The Merinda was not exhibiting the navigation lights it was required to, so it did not become visible to the Master of the Pam Burridge until it was too late to take effective collision avoidance action. A proper lookout was also not maintained onboard the Merinda, so Pam Burridge's approach was either not detected or detected with insufficient time to avoid the ferry.

The supporting pillars that formed part of Merinda's main design would have restricted the Helmsman's and co-owner's field of view. The course taken by Pam Burridge to proceed west out of Sydney Cove did not conform with the requirements of the Code of Conduct for Vessels Operating in Sydney Cove, but still allowed a clear line of sight between the two vessels.

Lighting conditions on the water at night near the Harbour Bridge could vary significantly and may have detracted from the ability of the Helmsman and the Master to detect each other's vessels.

The emergency response was timely and conducted in a highly effective manner.

Safety lessons

Importance of lookout and navigation lights
The safe operation of vessels requires crew to maintain a proper lookout for other vessels, operate at a safe speed, observe relevant navigation and operating rules, and illuminate navigation lights when operating from sunset to sunrise.

Challenges operating at night
The effects of shadowing, light reflection, scatter on the water, and lower visibility can make the detection of vessels in the vicinity of the Harbour Bridge difficult at night and may increase the risk of accidents occurring.

Safety navigation
This investigation highlighted the need for greater understanding and observation of the Code of Conduct for Vessels Operating in Sydney Cove, and for domestic commercial and recreational vessels to be operated in all circumstances with greater caution.

Download the Collision between HarbourCat MV Pam Burridge and Motor Launch Merinda, 2007 report

Figure 12: MV Pam Burridge.

Figure 13: Merinda, at the time of an earlier sale in 1996.

Systemic Investigation into Training of Ferry Crews Operational Procedures and Emergency Drills, November 2007 – May 2009

What happened

This investigation was initiated after safety concerns were received under the Confidential Safety Information Reporting Scheme (CSIRS). The CSIRS reporters alleged the number of drills undertaken by onboard crews on ferries had decreased since November 2007, when the responsibility for the training was transferred to a different division within the operator. It was also alleged that some personnel participated in numerous drill practices while others received minimal drill practice.

What OTSI found

The investigation focused on the conduct of drills. At the time, there was a requirement to comply with the Uniform Shipping Laws (USL) Code for drills to be conducted at regular intervals on all ferries. The operator also included a requirement for drills in its Safety Management System (SMS).

The investigation found that a rigorous and systematic approach to meeting the requirements of the USL Code and the SMS was lacking. OTSI observed:

- It was left to individual Masters to design, deliver and assess drill practice, without assistance from the responsible division within the operator.
- Ineffective record keeping practices, with records not identifying the vessel on which the drill was conducted, and the partial completion of drills not being recorded.
- Drills not being conducted at regular intervals.
- Inconsistent rostering of crew members, resulting in some individuals not being involved in a drill practice for long periods while others were involved more often.
- Drill practice performance was not independently assessed.
- No collision drills were undertaken during the relevant period.
- Vessel Operating Manuals (VOMs) did not contain an adequate level of detail and were inconsistent in content common to all vessels.
- There were complexities regarding the timeframes available for scheduling vessels for drills and the limited flexibility, due to the diversity of vessels within the operator's fleet.

During the investigation, OTSI provided feedback to the CSIRS reporters, who indicated that the introduction of the new arrangements satisfied the safety concerns raised.

Safety lessons

Onboard emergency drills

The operator responded to OTSI's findings and instituted several changes which resulted in a restructure of how onboard emergency drills were undertaken and recorded, and remedial action in response to safety issues identified during observations of drill practices and general operations.

The objective of these drills was to ensure the maintenance of a high standard of crew competency in emergency situations and preparedness. A quality control regime was also recommended to ensure the content, conduct, and assessment of drills were maintained at a consistent standard and continued to meet the requirements of the USL Code and SMS.

Crew-based rostering

OTSI recommended crew-based rostering to avoid inconsistencies and assist in meeting the challenge of crew competencies in emergency responses on different vessel classes.

Download the Systemic Investigation into Training of Ferry Crews Operational Procedures and Emergency Drills, November 2007 - May 2009 report

Figure 14: Rescue boat drill.

Figure 15: Crew assistance button.

Systemic Investigation into Ferry Close Quarter Incidents, Sydney Harbour, 2010-2016

What happened

While monitoring ferry operations, OTSI observed a significant increase in the number of reported close quarter incidents giving rise to concerns of systemic safety issues associated with ferry operations in Sydney Harbour.

What OTSI found

An analysis of the 2010 to 2016 data revealed 108 close quarter incidents were received by OTSI. There was an increase from five in 2010 to 30 in 2016. It is unclear whether these notifications are an actual increase in incidents or an increase in incident reporting or both. Analysis also showed that most incidents involved a ferry coming into close quarters with another ferry. Close quarter incidents between ferries and recreational vessels were not covered in this report.

OTSI found there were several contributing factors to the increase of these incidents:

- Minimal effective oversight of the wharf booking system operations leading to congestion issues around high usage wharf areas and berthing.
- An increased number of cruise ships berthing in Sydney Harbour impacting the line of sight for ferries accessing the southwestern wharves and ferry handling due to propulsion wash.
- Timetabling of high frequency ferry services creating congestion issues.
- Lack of a prescribed common communication channel.
- Ferry designs, especially to provide all round visibility from the warehouse to improve situational awareness for the Master, the separation of passengers from the wheelhouse, and the fitting of Automatic Identification Systems to all ferries.

Safety lessons

Proper communication
Poor communication contributed to several incidents. Proper communication between Masters and ship operators is necessary to better coordinate vessel movements and safely navigate.

Importance of traffic control
The investigation identified that as an increasing number of operators and vessels operate in Sydney Cove, the importance of an independent common control centre responsible for managing traffic in the Cove became more apparent.

Ferry design
These incidents indicated that some design elements, while not compulsory, offer benefits to operation such as improving a Master's situational awareness and maintaining a lookout.

Ocean liners significant influence adding to congestion
This investigation highlighted the impacts of the increasing presence of cruise ships on the operation of ferries. These impacts included turbulence caused by cruise ship thrusters, reducing the width of navigable waters within the Cove, and restricting the view of berthing vessels to the southwestern wharves.

Download the Systemic Investigation into Ferry Close Quarter Incidents, Sydney Harbour, 2010-2016 report

Passenger Fatality, MV Lady Rose, Sydney Harbour (2019)

What happened

On the afternoon of 2 February 2019, the MV Lady Rose was chartered by a group of 27 passengers for a private function. During the charter, one of the passengers was noticed as missing and, following a short search, was found in an unresponsive state in a toilet cubicle on board the vessel. Emergency services were called and attended but the passenger could not be revived.

What OTSI found

The investigation found that it was likely the passenger was overcome by exposure to hydrogen sulphide that permeated into the toilet cubicle through a tear in the silicon membrane of a waterless basin trap.

The cruise commenced with sewage remaining in the sullage tanks from a previous charter. During the cruise several crew members received complaints from the passengers regarding the presence of foul odours coming from the rear of the vessel. Some passengers were becoming ill. The Master was made aware of the complaints approximately two hours after the first complaint and made the decision to interrupt the cruise to pump out the tanks.

The investigation found several factors that contributed to the build-up of the hydrogen sulphide:

- Sewage system and sullage tank design deficiencies created an environment for hydrogen sulphide to produce and enabled a flow of gas into the toilet cubicle.
- The construction of the sullage tank meant that rising fluid levels forced gases containing hydrogen sulphide into the sewage pipes.
- A lack of a regular scheduled cleaning program of the sullage tanks.
- Deficiency of applicable standards.
- A lack of adequate venting to the main sewer lines.
- A lack of fresh air transfer in the toilet cubicles.
- The lack of urgency from the crew in responding to ‘rotten egg’ like odours on the vessel.

Lady Rose’s Safety Management System (SMS) at the time of the incident did not reflect the change in location for the operation and lacked a risk register or mechanism for identifying risks and mitigating measures. Therefore, the presence of harmful sewage gases onboard the vessel was not considered. Regulatory oversight did not adequately identify these deficiencies within the SMS.

Safety Lessons

Maintenance
The investigation identified issues around the design, construction, and maintenance of the vessel contributed to the build-up of hydrogen sulphide and as a result the fatality. Effective and regular maintenance of the vessel, and documentation of the maintenance program is required.

Management of safety risk
The SMS for Lady Rose was found to be significantly non-compliant with the requirements under National Law. The audit processes of the regulator had been insufficient in ensuring the SMS was a robust document that identified, assessed, and controlled risk.

A lack of standards for plumbing, cubicle design and ventilation
The investigation found that the applicable regulations for domestic commercial vessel (DCV) sewage and plumbing systems as fitted to Lady Rose were inadequate to provide a safe operational environment for crew and passengers.

Download the Passenger Fatality, MV Lady Rose, Sydney Harbour, 2019 report

Figure 17: MV Lady Rose – stern view.

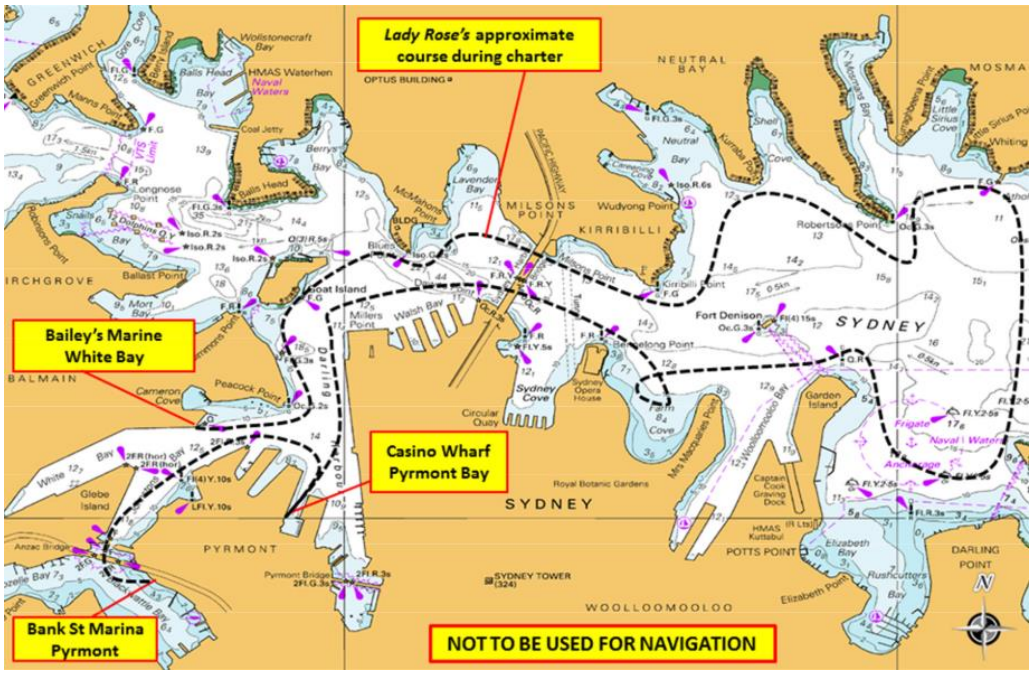

Figure 16: The incident location and approximate course of MV Lady Rose.

Ferry MV Pemulwuy Loss of Control, Sydney Harbour (2020)

What happened

On 2 July 2020, ferry MV Pemulwuy was returning to Circular Quay when there was a loss of primary steering control. This resulted in a sudden and unexpected turn to starboard at full speed and placed the ferry in the intended path of the ferry Narrabeen. Pemulwuy's Master switched to back-up steering and manoeuvred the ferry into safe water.

On 23 November 2020, Pemulwuy experienced a second, almost identical loss of control. This also resulted in a sudden and unexpected turn to starboard. There were no vessels in the immediate vicinity. There were no injuries or damage reported from either incident, but such events had the potential for serious consequences.

What OTSI found

The investigation found that the amount of current flowing through Pemulwuy's steering toggles likely caused premature deterioration of the toggle switch block contacts. This deterioration considerably shortened the stated service life of the switch blocks and resulted in them sending unprompted command signals to the rudders.

It was also found that the switch block service life was not considered or included in the operator's asset management plan for the Emerald Class ferries. There was no maintenance plan for the toggle switches that incorporated their service life expectancy under either operating condition. The toggles were replaced as they failed. The potential for deterioration of the toggle switches from higher than recommended current flow was not identified by the designer, builder or during plan approval checks carried out by the regulator.

Following the first incident, neither the operator nor Pemulwuy's master reported the loss of control to authorities. The operator also returned Pemulwuy back into service without determining the underlying cause of the steering toggle switch failure. The operator did not follow its own Safety Management System (SMS) instructions to preserve data from the vessel following an incident to assist any subsequent investigation.

The regulator's classification of the 2 July 2020 incident as a less serious incident did not align with its own incident severity classifications. As a result, the potential risks associated with a loss of control of a high capacity, high-speed passenger ferry were not considered.

Safety lessons

Asset management of safety critical systems
Operators need to ensure fleet wide asset maintenance plans include preventative maintenance of vessel safety critical systems. Further examination may also be needed to improve assurance processes for the procurement of domestic commercial vessels.

Incident reporting and classification
Incidents must be reported and responded to in a manner consistent with their level of risk to safety. Otherwise, the potential risks associated with high capacity or high-speed passenger ferries may not be considered.

Fault analysis
SMS procedures need to be followed, namely critical failures should be identified and rectified before vessels return to service and safety critical data recording should be captured and saved to prevent similar incidents from occurring and to ensure the safe operation of vessels of the water.

Download the Ferry MV Pemulwuy Loss of Control, Sydney Harbour, 2020 report

Figure 18: MV Pemulwuy.

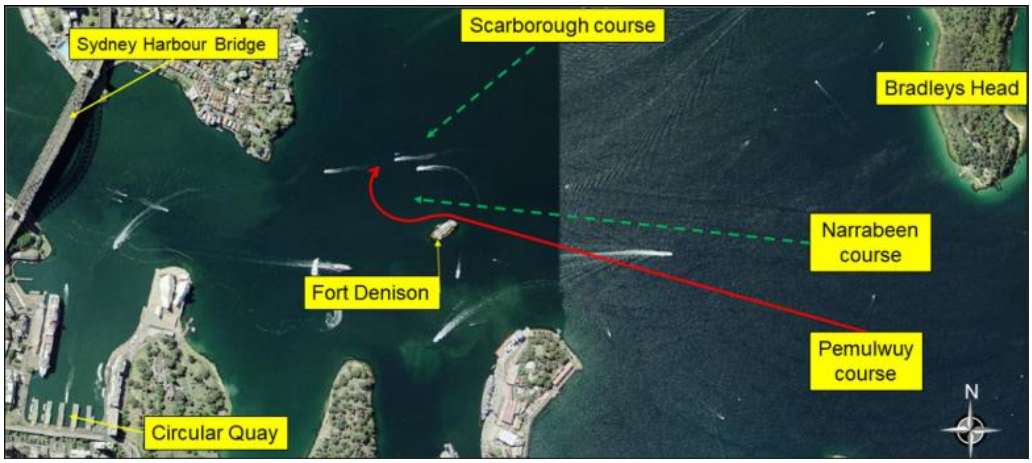

Figure 19: 2 July 2020 incident location Sydney Harbour.

Rail Investigations

Fatal Injuring of Two Rail Maintenance Workers, Singleton (2007)

What happened

At approximately 5:48am on 16 July 2007, a signal electrician and their assistant were struck and fatally injured by northbound coal service HV161 at No.56A points about 445m south of Singleton railway station. The two rail maintenance workers had been called out to attend to the points which had malfunctioned earlier in the morning.

At 5:44am, shortly before the collision, a southbound coal service HV388 observed the two workers on an adjacent line and sounded the horn to alert them of their presence. At 5:46:22 a northbound coal service HV161 observed HV388 ahead and the driver of HV161 extinguished their train's headlights, as per ARTC's Network Rules. As the two trains were in the process of passing each other HV161 struck and fatally injured the two maintenance workers.

What OTSI found

The two workers were working under a method of worksite protection known as NAR (No Authority Required). This required that a lookout keep watch for approaching rolling stock and other dangers. In the instant before the two workers were struck, the driver of HV161 reported that neither worker was keeping a lookout.

HV161's approach was likely masked due to the noise generated by the passing of HV388 and because HV161 was operating with its headlight extinguished, as per the network manager's Network Rules.

OTSI was unable to determine whether a safety assessment was undertaken prior to commencing track work, as required by the network manager, in the absence of any record of the protection arrangements.

Safety lessons

Anticipation and management of risk
This investigation highlighted the importance of:

- undertaking safety assessments and documenting protection requirements prior to the commencement of any work in the rail corridor
- ensuring protection arrangements are undertaken in accordance with the procedures

Worksite protection technologies
The effectiveness of NAR as a method of worksite protection was entirely dependent on the diligence of those tasked with looking-out. Implementing other methods of worksite protection or investigating existing technologies that automatically alert those working in or approaching the danger zone would provide more protection to critical safety workers. NAR was subsequently replaced by the Lookout Protection method, with additional requirements.

Using train lights
OTSI recommended changes to the network manager and operator's procedures relating to the requirement to extinguish headlights when approaching another train. These procedures were later revised to instruct drivers to dim rather than extinguish their headlights.

Personal Protective Equipment
OTSI recommended the need for the rail industry to identify safety clothing and equipment that is visible in the danger zone at night and not solely dependent on external sources of illumination.

Download the Fatal Injuring of Two Rail Maintenance Workers, Singleton. 2007 report

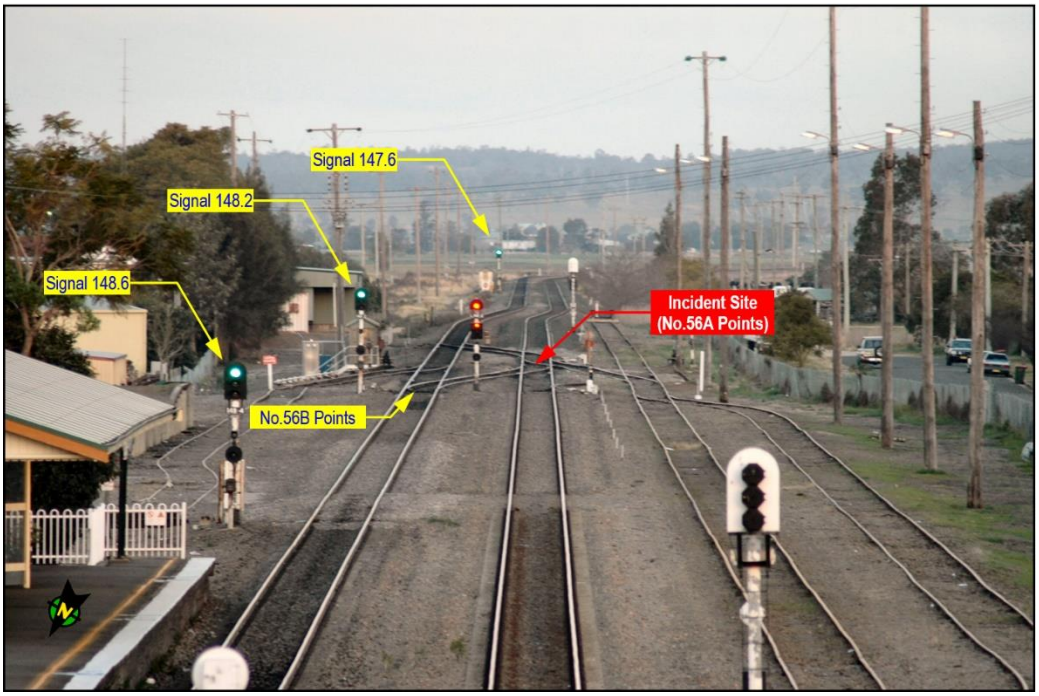

Figure 20: Singleton Yard, looking south.

Derailment of El Zorro Grain Services 8996, near the Township of Peak Hill (2009)

What happened

At approximately 5:23pm on 8 February 2009, grain service 8996 derailed nine grain wagons approximately 7km north of Peak Hill in western NSW. The train consisted of four locomotives and 38 loaded grain wagons and was enroute from Nyngan to Port Kembla at the time of the derailment. There were no injuries to the crew but there was extensive damage to 370m of track infrastructure and the nine wagons.

What OTSI found

The investigation determined that the derailment was caused by the train travelling at excessive speed. At the point of derailment, the train was travelling at 63km/h through an area on which a 40km/h speed limit had been imposed for the condition of the track in that section.

The driver had increased speed about 13km before the end of a speed limited section, believing the clearance sign was missing despite it being in place.

The driver allowed the train to exceed the speed restriction for 8.5km up to the point of derailment. The speedometer on the locomotive was not working and the driver had been relying on his experience to judge the speed of the train. Continuing to operate the train without a working speedometer was contrary to Network Rule ANTR 410.

The co-driver was incapacitated due to illness and was unable to perform their duties in relation to maintaining a lookout and relaying trackside infrastructure information to the driver.

The track was in less-than-optimal condition and could not constrain the forces on it at point of derailment due to:

- a deflection in a small wooden underbridge which allowed excessive vertical movement causing the train to ‘sway’ when passing over it
- a slight misalignment at the point of derailment
- weaknesses in the track anchorage because of loose fastenings
- poor ballast condition
- inadequate tamping associated with an incomplete steel sleeper replacement program.

OTSI also found many of the wagons had been overloaded by up to 9.15%.

Safety lessons

Track condition and structure
Welded rail track is complex in its structure with high levels of co-dependence between components. Any deficiency in a component affects the strength and rigidity of the track as a whole. Ensuring well-maintained track is critical for safe operations, train stability, and to prevent incidents.

Train handling
It is imperative that train crew understand and comply with Network Rules in relation to speed notices, restrictions, signposting, and safety critical componentry such as speedometers.

Train Loading
It was recommended rail network owners review the management and risks associated with overloading, including the management of interfaces with rail operators.

Download the Derailment of El Zorro Grain Services 8996, near the Township of Peak Hill, 2009 report

Figure 21: Looking towards the rear of the train from the 26th wagon.

Figure 22: Poor quality ballast disturbed by the derailment.

Track Worker Fatality, Kogarah (2010)

What happened

At approximately 1:08am on 13 April 2010, inter-urban passenger service C488, enroute from Kiama to Central Station, struck and fatally injured a track worker at Kogarah Station as they attempted to get clear of the track by climbing up on to Platform 1. The worker was part of a team who were contracted by the network manager to remove rubbish from tracks.

What OTSI found

The investigation found that the track worker was struck because the Area Controller did not identify that the passenger service train C488 had already passed the protecting signal when the Area Controller authorised the Controlled Signal Blocking (CSB) for the protection of the worksite.

When the Area Controller became aware of the situation, instead of using the MetroNet Train Radio system to immediately alert trains, they telephoned the station's Customer Service Attendant to initiate a warning to the track workers over the station's public address system. This resulted in insufficient time for the track workers to comprehend and react to the warning.

A number of safety critical requirements of the Network Rules and Procedures were omitted in the process of implementing the CSB. The Area Controller had not applied blocking facilities when assuring the Protection Officer that the blocks were on, and the Protection Officer did not seek confirmation that the CSB was implemented before commencing work. The investigation also identified a lack of rigour in complying with Network Rules and Procedures involving communication, and the planning, briefing, and documenting of worksite protection.

There was also sufficient evidence to indicate the Area Controller should have been cleared to return to work through a 'triggered health assessment' after a recent long period of sick leave, in accordance with the National Standard for Health Assessment of Rail Safety Workers.

Safety lessons

Network control communications
This incident was an example of how poor practices relating to safety critical communications and deficient signal box procedural compliance can contribute to an incident. Workers on track are reliant on correct communications, and assurances from network control that safety actions are undertaken in accordance with procedures, and emergency response is appropriate.

Emergency management protocols
Regular refresher training and up to date processes and procedures for the management of emergency situations is paramount to ensure workers demonstrate and maintain competency in the management of emergencies.

Worksite protection protocols
Operators and staff must ensure the planning, briefing, and documenting of procedures before commencing worksite protection are risk-assessed, rigorous, complete, and understood, and that a safe place is made available.

Fitness for duty
This investigation highlighted how operators should align policies, procedures, and education with the National Standard for Health Assessment of Rail Safety Workers to assist in identifying when staff may require a health review.

Download the Track Worker Fatality, Kogarah, 2010 report

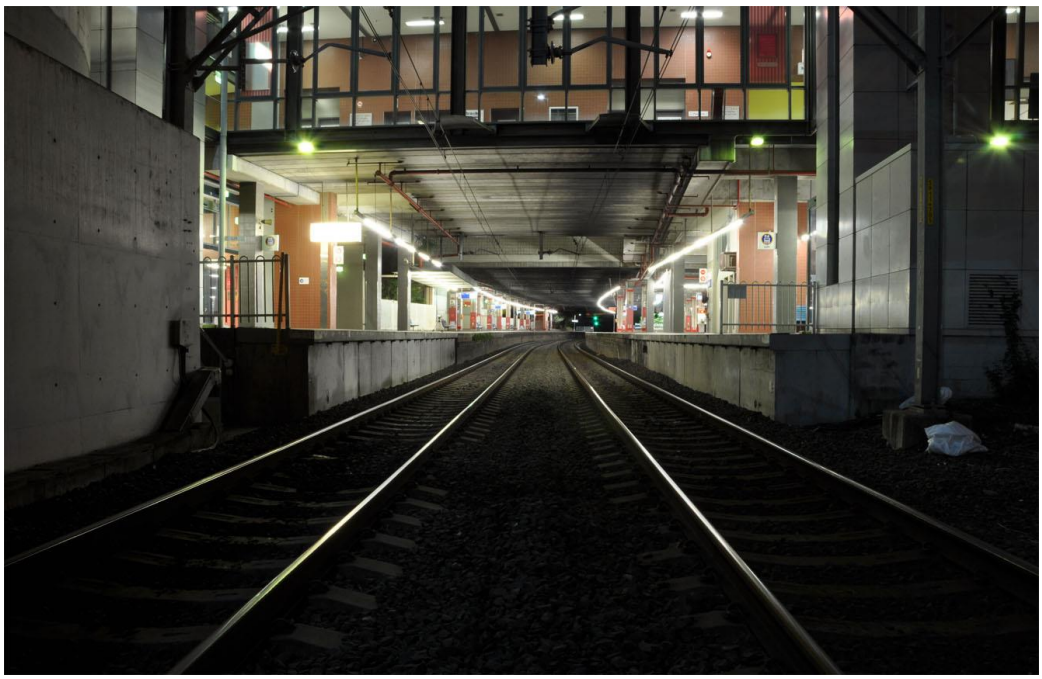

Figure 23: Contrasting lighting conditions at the southern end of Platform 1 at Kogarah Station.

Derailment of Passenger Train 602M, Edgecliff (2014)

What happened

On 15 January 2014, a passenger service made up of two four-carriage units, was travelling through the underground section of the Eastern Suburbs Line heading towards its destination, Bondi Junction. Smoke and a burning smell were emanating from the train at Central station and at all subsequent stations to Bondi Junction. Several station and train crewing staff were aware of this, but the issue was not reported to the appropriate network control officer as required.

The train terminated at Bondi Junction where a different driver took control of the train before it departed on its return journey. It then travelled to the next station, Edgecliff. At 5:26pm, shortly after departure from Edgecliff, the third carriage derailed due to a broken axle on the leading bogie. A piece of angle iron that became dislodged from the track infrastructure penetrated the floor of the third carriage and entered a space occupied by passengers.

What OTSI found

The investigation found that an unauthorised, non-standard repair had been carried out on the axle in 1998 or 1999 which introduced stress initiators, causing a crack to develop. Over time, the crack propagated to the extent that the axle failed in service. The broken axle was an unusual event, and it was considered unlikely that a similar incident with the same cause could occur.

OTSI found that neither the driver who was in control of the train into Bondi Junction, the driver trainer who took it over, nor the guard, were proactive in their response to the defective train as required by the Train Operations Manual. Reporting and communications were not carried out in accordance with operator's rules and procedures, so the Rail Management Centre received delayed and/or partial information and allowed the train to continue in service.

Drivers were desensitised to the wheel slip protection indicator light activations through its regular activation in response to momentary losses of adhesion. This, coupled with the inadequate warning provided by the Traffic Management System, may result in delayed reaction in response to activations that need driver intervention.

There was no appointed Officer in Charge of the incident site prior to the arrival of an Incident Rail Commander, leading to a fragmented response to the incident with no single employee having a recognised leadership role on site. In addition, key staff had not been trained in Rail Resource Management.

Safety lessons

Maintenance procedures
Rail operators should ensure that maintenance procedures are followed, and non-standard repairs comply strictly with an approved variation and do not introduce new risks to operations.

Reporting and verbal communications
Safety critical communication should occur in line with Rail Resource Management principles and effectively within and between operational areas.

Procedures
The management of the defective train from the first manifestation of the defect through to the response to the derailment revealed inadequacies in several areas including communications, training, command and control and culture. A lack of adherence to procedures and reporting lines led to the train continuing in service and subsequently derailing.

Download the Derailment of Passenger Train 602M, Edgecliff, 2014 report

Figure 24: The train after derailing.

Figure 25: Angle iron secured inside the third carriage.

Hawkesbury River Railway Bridge (2015)

What happened

The Hawkesbury River Railway Bridge is a major asset on the network that links Sydney to Newcastle and supports the two electrified Main Northern Lines. The bridge was completed on 1 July 1946 and responsibility for maintenance of the bridge resided with an operator which commenced operations on 1 July 2013.

The maintenance plan for the bridge specified inspection frequencies for all bridge and track components, including conducting an underwater examination of permanently submerged piers every six years. A routine underwater inspection in May 2013 indicated the condition of bridge pier 2 had deteriorated since the previous inspection in 2006, and required rectification works.

On 17 September 2015, the then Minister of Transport and Infrastructure wrote to the OTSI Chief Investigator requesting an investigation after no repairs had taken place.

What OTSI found

Although the structural integrity of pier 2 was deteriorating, the bridge remained above a safe operating threshold. This was confirmed by a load rating assessment which revealed the bridge was capable of sustaining loads above that of normal passenger and freight services.

The new procurement process for the remedial works commenced in September 2015 and a contract was signed with the preferred tenderer on 4 December 2015. The concrete pour at the pier was carried out on 24 April 2016.

The newly created operator was confronted with challenges posed by the marine environment and a unique technical and procurement situation. OTSI identified processes that were contributory to the delay in the rectification of the bridge. These included due diligence, procurement processes, internal and inter-agency communications, risk management, project scoping, reliance on third parties and independent safety assessments.

The then Asset Standards Authority undertook a series of surveillance audits on the operator's systems and processes between May 2013 and September 2015. Several issues were documented to be resolved with some related to asset management.

Safety Lessons

Due diligence
In this investigation it was revealed the operator had relied on tenderers to carry out due diligence on the temporary works design and construction. This highlighted issues around assurance and safety considering the lack of due diligence was at odds with risk management policy and had a flow on effect in delays and costs.

Procurement processes and frameworks
Operators should ensure that documentation or conditions within procurement frameworks are clear and explicit, align with risk management policies, produce information packages and scopes of works to tenderers that are accurate and reflect the level of complexity of works, and include assurance for any significant variables.

Asset management
This investigation highlighted the importance of executing proper asset management including surveillance during the full lifecycle of an asset.

Download the Hawkesbury River Railway Bridge, 2015 report

Figure 26: Current bridge and remnants of original bridge.

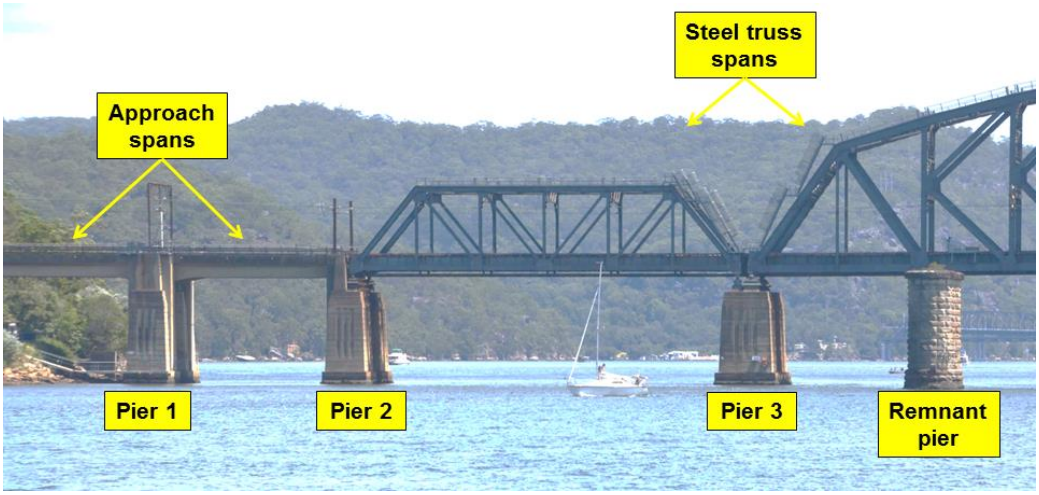

Figure 27: Southern end of bridge showing piers and spans.

Disabled Xplorer Service NP23, Muswellbrook (2016)

What happened

At 1:10pm on 2 December 2016, Sydney to Armidale Xplorer passenger service NP23, was brought to a stand near Muswellbrook after the fire suppression system activated on the fourth position car (EC2525). The activation of the system shut down the auxiliary engine on EC2525 and caused a loss of electrical power supply to it and the third position car.

Although an alternative power feed to the effected cars was available, the driver was unable to restore power and eventually lost power to the entire train. As a result, over 200 passengers were stranded without working air conditioning, ventilation, and toilet facilities for approximately four-and-a-half hours. The outside ambient temperature at this time was reported as a maximum of 39°C.

A maintenance technician was able to restore power to NP23 at 5:05pm. As a result of the conditions within the disabled train, three passengers attended hospital for treatment for heat related conditions.

What OTSI found

The investigation found that this incident was likely initiated by a fire that resulted from a short circuit. The fire was detected by the fire suppression system and the driver was notified by the fire alarm warning light on the driver's cab annunciator panel.

The train driver did not follow the operator's procedures (OSP 10 - Dealing with fires on trains and in the Rail Corridor and TWP 164 - Responding to an on-train pax or fire alarm). The driver instead decided to stop the train three kilometres from Muswellbrook station which escalated the risk to all onboard the train. The train driver disabled the train by pushing the emergency fire extinguish button on the driver's control panel which shut down all engines. The driver and the Eveleigh Maintenance Centre helpdesk were unable to rectify the problem. The disabling of NP23 for more than four hours in hot weather conditions exposed the passengers and crew to uncomfortable conditions inside the train.

The technician who was deployed to the site had difficulty locating NP23, which lengthened the delay before recovery, but they were able to rectify the problem quickly once they arrived. The auxiliary engine on car EC2525 was 17 months overdue for removal and the scheduled 7500-hour service.

Safety lessons

Training and competency
The investigation recommended that driver training curriculums should include relevant information and assessment regarding equipment and operation of the rolling stock they operate, and that drivers are properly assessed in the management of operating and emergency procedures, including for normal and abnormal situations.

Routine maintenance and inspection
Maintenance systems and procedures need to identify that the conditions that can be introduced should a maintenance window be exceeded, are actioned. Operators should risk assess all likely failure modes when considering changes to maintenance intervals.

Emergency response
Incidents require continual monitoring and assessment of impact and severity, and response plans need to be adjusted and escalated accordingly.

Download the Disabled Xplorer Service NP23, Muswellbrook, 2016 report

Figure 28: Xplorer service.

Derailment of Freight Train 4BM4, Nana Glen (2021)

What happened

In the early hours on 25 February 2021, a southbound freight train 4BM4 derailed near Nana Glen, where floodwaters had built up and overtopped the track, washing away ballast. The train was crewed by two drivers and consisted of three locomotives and 37 wagons.

The second driver sustained minor injuries while two locomotives and ten wagons derailed with some wagons entering floodwaters. There was significant damage to the rail line, rolling stock and freight. The rail line reopened after nine days once flood water had receded. A passenger service had travelled through the same section of track 27 minutes before the freight train derailed.

What OTSI found

Network users were not aware of the extent of the severe weather event and had not been advised of an amber alert issued prior to the accident. Neither the network (rail infrastructure) manager or the operator provided guidance for train crew on how to respond to extreme wet weather events or floodwater in the rail corridor.

Neither driver of two previous trains which passed through the derailment area reported the poor weather conditions in the vicinity of Nana Glen, to the network controller.

The risk of flooding in the area the derailment occurred was not adequately identified or addressed by the track manager. The network manager could also not reliably determine the risk of flooding along the Telarah to Acacia Ridge corridor or risks associated with inadequate capacity cross drainage systems. The culvert located nearest to the derailment did not have sufficient capacity to discharge the runoff from the rain event on the night of 24-25 February 2021.

Although the network manager had procedures in place for monitoring and responding to extreme weather events, the process had significant limitations. The network manager was installing remote weather monitoring stations but had not undertaken formal assessments to determine the need for these stations or their locations. Alerts issued by the weather monitor also did not reliably meet the requirements of the network manager's extreme weather monitoring procedure.

Safety Lessons

Extreme wet weather events and response
This investigation highlights the importance of effective risk management by network managers and users in responding to extreme weather events, including flooding, which pose a significant risk to the rail network and are likely to increase in frequency and intensity in the future.

Rail infrastructure managers must ensure that they have sufficient processes in place to actively identify, monitor and manage foreseeable risks in relation to extreme weather.

Rail infrastructure resilience
These events can affect the integrity and exceed the design of rail infrastructure so infrastructure managers must ensure they have effective systems in place to identify, assess and manage the risks to prevent trains from entering sections where the design of the infrastructure will be exceeded.

Guidance
Both rail infrastructure managers and rolling stock operators must ensure that they provide guidance to operational staff to ensure consistent responses to conditions that may affect the integrity of the infrastructure and operational safety.

Download the Derailment of Freight Train 4BM4, Nana Glen, 2021 report

Figure 29: Aerial image of post-derailment site.

Figure 30: Post-derailment site.

About the Office of Transport Safety Investigations

OTSI is an independent NSW agency which contributes to the safe operation of bus, ferry and rail passenger and rail freight services in NSW by investigating safety incidents and accidents and transport safety risks, identifying system-wide safety issues, and sharing lessons with transport operators, regulators, and other stakeholders.

The Chief Investigator is empowered under the *Transport Administration Act 1988* to independently investigate rail, bus, and ferry accidents and incidents in accordance with the provisions of the *Passenger Transport Act 1990* and *Marine Safety Act 1998*. OTSI also conducts rail investigations under the *Transport Safety Investigation Act 2003* (Cth) and a Collaboration Agreement with the Australian Transport Safety Bureau.

OTSI investigations are independent of regulatory, operator or other external entities. OTSI investigates using a 'no-blame' approach to understand why an occurrence took place and to identify safety factors that are associated with an accident and incident. It makes recommendations or highlights actions that transport operators, regulators and government can take to prevent recurrence and improve safety.

OTSI does not investigate all transport safety incidents and accidents but focuses its resources on those investigations considered most likely to enhance bus, ferry or rail safety. Many accidents result from individual human or technical errors which do not involve safety systems so investigating these in detail may not be justified. In such cases, OTSI will not generally attend the scene, conduct an in-depth investigation, or produce an extensive report.

OTSI may request additional information from operators or review their investigation reports which may lead to a number of actions, such as the release of a Safety Advisory or Alert to raise industry awareness of safety issues and action.

OTSI investigators normally seek to obtain information cooperatively when conducting an investigation. However, where it is necessary to do so, OTSI investigators may exercise statutory powers to conduct interviews, enter premises and examine and retain physical and documentary evidence.

OTSI produces a written report on every investigation for the Minister for Transport, as required under section 46BBA of the *Passenger Transport Act 1990*.

Investigation reports strive to reflect OTSI's balanced approach to the investigation, explaining what happened and why in a fair and unbiased manner. All Directly Involved Parties in the investigation are given the opportunity to comment on the draft investigation report.

The final investigation report will be provided to the Minister for tabling in both Houses of the NSW Parliament in accordance with section 46D of the *Passenger Transport Act 1990*. The Minister is required to table the report within seven days of receiving it.

Following tabling, the report is published on the OTSI website — www.otsi.nsw.gov.au — and information on the safety lessons promoted to relevant stakeholders.

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