

RAIL SAFETY INVESTIGATION REPORT

SHUNTING FATALITY PORT BOTANY RAIL YARD 1 JULY 2004



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**Office of Transport Safety Investigation
Level 22, 201 Elizabeth Street
Sydney NSW 2000**

The Office of Transport Safety Investigation (OTSI) is an independent NSW agency whose purpose is to improve transport safety through the investigation of accidents and incidents in the rail, bus and ferry industries.

Established on 1 January 2004 by the *Transport Administration Act 1988*, the Office is responsible for determining the causes and contributing factors of accidents and to make recommendations for the implementation of remedial safety action to prevent recurrence.

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Information about OTSI is available on its website or from its offices at

Level 22, 201 Elizabeth Street
Sydney NSW 2000
Tel: (02) 8263 7100

PO Box A2633
Sydney South NSW 1235

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EXECUTIVE SUMMARY

The Accident

1. At approximately 1.50PM on 1 July 2004, an employee of Lachlan Valley Rail Freight Pty Ltd (LVRF) was fatally injured whilst involved in shunting operations at the Port Botany rail yard. The employee, a qualified train driver, hereafter referred to as the "Shunter", is believed to have fallen from the decking of a flat top container wagon through a gap in the wagon's floor during a shunting movement. Following this fall, the Shunter was run over by the train's wheels.
2. The Driver of the train (T250) involved in the shunting operation went in search of the Shunter, as the Shunter had failed to respond to a planned radio communication. The Shunter was subsequently located across the track by the Driver. There were no eye witnesses to the accident. The Driver then contacted the Port Botany Yard Controller and requested the attendance of the Ambulance and Police. The Shunter was later transported to Royal Prince Alfred Hospital where he was pronounced deceased.

Findings

3. The position of the Shunter, the nature of his injuries and markings on his body, blood on the wheels of the 2nd last wagon's rear bogie¹, the location of his radio and other equipment items, and disturbances to the ballast at the accident site were consistent with:
 - a. the Shunter having fallen, between the skeletal wagon decking on which he had been riding, onto the track, and
 - b. subsequently, being run over directly across the abdominal region by the wheels on the rear bogie of the 2nd last wagon.

Contributing Factors

4. Those factors that were determined to have directly contributed to the occurrence of the accident include:
 - a. the Shunter being on top of the wagon's decking, without the means of a physical restraint, whilst the wagon was in motion, and
 - b. the design of the wagon which featured a smooth skeletal decking and did not incorporate any form of protection against the danger of falling onto the track.
5. Those factors that are considered to have indirectly contributed to the accident include the following.
 - a. The limitations of LVRF's risk assessment and risk management processes as reflected in:
 - (1) LVRF's risk assessment that did not consider the operational activities of a shunter;
 - (2) LVRF's Operator Specific Procedures that did not articulate accepted practices for riding on wagon side steps or end steps, and

¹ A bogie is a 4 wheeled (in some cases 6 wheeled) load bearing frame that supports one end of a rail vehicle.

- (3) LVRF's inability to stop the practice of riding on the top of un-walled wagons.
- b. The limitations of LVRF's approach to training, competency assessment and supervision, noting the following:
 - (1) the absence of training documentation designed to instruct a shunter in acceptable shunting practices;
 - (2) the absence of competency assessment guidelines and criteria, and
 - (3) the absence of an effective system of worker supervision that would have enforced LVRF's informal practices of riding safely on freight wagons.
- c. The design of side and end steps of some freight wagon types do not facilitate a safe/ergonomic riding position and may have encouraged the use of alternate, and unsafe, riding positions.

Emergency and Safety Responses

- 6. Ambulance Services and the Police were notified of the accident at 2.14PM and were on site by 2.38PM and 2.46PM respectively.
- 7. The Work Cover Authority of NSW and the Independent Transport Safety and Reliability Regulator (ITSRR) issued prohibition notices on 2 July 2004 and 6 July 2004 respectively. These prohibition notices restricted certain shunting practices in response to the accident.

Recommendations

- 8. The following recommendations have been made to the specified responsible entity:

Lachlan Valley Rail Freight

- a) Conduct a risk assessment of those operational activities associated with shunting. This risk assessment should be performed in a manner consistent with the Rail Safety Act 2002 and the *Occupational Health and Safety Act 2000*. As one of the potential outcomes of the risk assessment, LVRF should ensure procedures are documented detailing how safety critical activities of a shunter are carried out.
- b) Formally establish competencies for shunting and the procedures associated with the delivery and assessment of those competencies. LVRF should note that such assessments must be conducted by qualified persons in accordance with the ITSRR Guidelines for Certification of Competency.
- c) Ensure training of shunting staff is carried out in accordance with the defined procedures and in compliance with the ITSRR Guidelines for Certification of Competency.
- d) Ensure that a system of regular worker supervision is implemented to improve the compliance and understanding of shunters undertaking their operational activities. Accountabilities for the system's management and operation should be clearly specified and communicated amongst LVRF staff. Such a system should be audited on a regular basis with the audit results communicated to LVRF management and staff.

- e) Ensure that the inspection and maintenance routine for Hasler locomotive event recorders provides reliable recording. The level of reliability should be in accordance with RIC's Minimum Operating Standards for Rolling Stock.
- f) Document acceptable practices in the use of mobile phones across LVRF's operational environment. The implementation of these practices should be supported by a suitable training program.

RailCorp

- g) Review the current Safeworking rules pertaining to shunting to assess the adequacy of these rules. Consideration should be given to the safety concerns highlighted in the WorkCover and ITSRR prohibition notices and those risk assessments conducted by rail freight operators.
- h) Provide advice to operators within the Safeworking Rules Policy as to the purpose of Operator Specific Procedures and why such procedures are an integral part of the Network Safeworking system.
- i) Review the condition of walkways in all yards. Where the walkways do not provide safe passage for shunters, upgrade the walkways as required.
- j) Conduct a feasibility study into the expansion of CCTV coverage for the Port Botany rail yard. This study should consider the benefits of providing wider coverage of the yard's operational infrastructure. It is also recommended that RailCorp offer operators access to CCTV footage so they can review compliance with the Safeworking rules and Operator Specific Procedures.

The Independent Transport Safety & Reliability Regulator

- k) Amend the certification requirements for competency assessors to ensure they are consistent with VETAB requirements. The particular certifications include the "Work Place Assessor" and "Certificate IV in Assessment in Work Place Training".
- l) Ensure the ITSRR audit program tests compliance of LVRF and other operators against the ITSRR's Guidelines for Certification of Competency.
- m) Advise operators of the necessity to review their operations in order to determine if Operator Specific Procedures are required to support compliance with the Safeworking Rules. The content of this advice may reflect on the future requirements to produce process control procedures required under the National Rail Safety Accreditation Package that is due for implementation by 30 June 2006.
- n) Review exemptions already provided to selected operators in relation to the ITSRR prohibition notice in the light of this report.
- o) Advise operators of the Australian Standard (AS 1567:1992) requirements for walkways. Operators should note that compliance with this standard is required for the design of walkways on freight wagons regardless of whether a wagon's walkway is used whilst the wagon is stationary or moving.

PART 1 INTRODUCTION

Appointment

- 1.1 **Details of Incident:** Fatal injury to Lachlan Valley Rail Freight Shunter during the conduct of shunting operations in the Port Botany Rail Yard.
- Date of incident:** 1 July 2004
- Location:** Port Botany rail yard
- Type of Investigation:** Railway Investigation, Section 67 of the Rail Safety Act 2002.
- Owning Railway:** RailCorp²
- Operator:** Lachlan Valley Rail Freight Pty Ltd (LVRF)
- Infrastructure Maintainer:** RailCorp
- 1.2 The Chief Investigator of the Office of Transport Safety Investigation has authorised the investigation and publication of this report pursuant to the provisions of Sections 67 and 68 of the Rail Safety Act 2002 NSW.

Terms of Reference

- 1.3 The terms of reference established by the Chief Investigator required the investigation to:
- a. Identify the factors, primary and contributory, which caused the accident.
 - b. Identify whether the accident might have been anticipated and assess the effectiveness of Lachlan Valley Rail Freight's risk management strategies.
 - c. Identify whether the accident might have been anticipated and assess the effectiveness of risk management strategies adopted in the Safeworking rules, Port Botany Yard operational management and yard infrastructure.
 - d. Advise on any matters arising from the investigation that would enhance the safety of rail operations.

Conduct of the Investigation

- 1.4 The investigation has been conducted in accordance with the principles of Australian Standard AS 5022:2001, Guidelines for Railway Safety Investigation. The objective of the investigation is to determine the circumstances surrounding the accident and provide information to prevent the recurrence of similar events.
- 1.5 The investigation is not intended to attribute blame or liability. However, all relevant factual information is included to support the analysis and conclusions. Some information may reflect on the performance of individuals and organisations and how their actions have contributed to the outcomes of the matter under investigation.

²RailCorp is responsible for the infrastructure maintenance, train control and Safeworking rules applied to the Metropolitan Freight Network. Port Botany rail yard is a part of this freight network.

- 1.6 System safety accident investigation (SSAI) techniques have been applied to structure the investigation and analyse the evidence. The SSAI approach taken by the investigation included:
- a. application of the Reason and Incident Cause Analysis Method (ICAM) models to analyse accident causation;
 - b. identifying and analysing human factor issues;
 - c. identifying and analysing the risk management strategies that should have prevented the accident, and
 - d. using events and conditions charting to develop and understand the accident sequence.

Report Structure

- 1.7 This report is presented in five parts as identified in the contents page. Supplementary information to Parts 2 and 3 is provided in Annexes A-C.

PART 2 CIRCUMSTANCES OF THE ACCIDENT

The Occurrence

- 2.1 At approximately 12.24PM on 1 July 2004 Lachlan Valley Rail Freight Service T250 (T250) arrived at the Port Botany Rail Yard on the Up Main Master Siding Road. Following an authority from the Rail Infrastructure Corporation (RIC) Yard Controller, T250 propelled³ from the Up Main Master Siding Road onto the Patrick⁴ Branch line and into the Patrick Rail Siding. At this siding 13 of the train's container wagons were to be unloaded.
- 2.2 The two person crew, consisting of a Driver and a Shunter, were cross-trained. This allowed the crew to alternate roles as required. After unloading containers, an operation taking approximately 40 minutes, the crew reversed roles with the Driver assuming the Shunter's role. The new Driver climbed into the locomotive cab and blew the train whistle to signal the conclusion of that phase of unloading and the train's readiness to depart the container terminal (see Figure 1, Position 1). He also established mobile phone contact with the Shunter. The Shunter then performed a number of functions to assist the Driver with the preparation and conduct of the shunting operation. These functions were accompanied by hand-held radio communication.
- 2.3 During the second last hand-held radio communication between the crew, the Shunter advised the Driver that he was on the last freight wagon. The Driver responded, advising the Shunter that the train was going to the next yard Stop Board (see Figure 1, Position 2) where they would await clearance from the RIC Yard Controller before propelling into the P & O Trans Australia shipping terminal for reloading.
- 2.4 On reaching the Stop Board, the Driver sought and gained approval to proceed providing that a nearby train, operated by another company, had cleared an adjoining branch line junction (see Figure 1, CTAL branch). As this train cleared the branch line, the Driver contacted the Shunter and advised him of their approval to proceed; this was the last verbal communication between the Driver and Shunter.
- 2.5 The Shunter's next task was to advise the Driver when the train's rear had passed a set of track movement points (see Figure 1, Position 3). After travelling past those points and having estimated that the rear of the train would also have passed the points, the Driver awaited confirmation of that fact from the Shunter. In the absence of a call from the Shunter, the Driver tried to raise the Shunter on the radio.

³ A propelling movement is defined by the management of a train's operation from a driver's cabin that is not in the lead vehicle of a train. Under this type of operational movement the Safeworking rules require safeworking personnel to direct the train movement in advance of the train.

⁴ Patrick is a privately owned company that has a road/rail/shipping loading and unloading terminal at Port Botany. This terminal connects to the Port Botany rail yard as depicted in Figure 1.

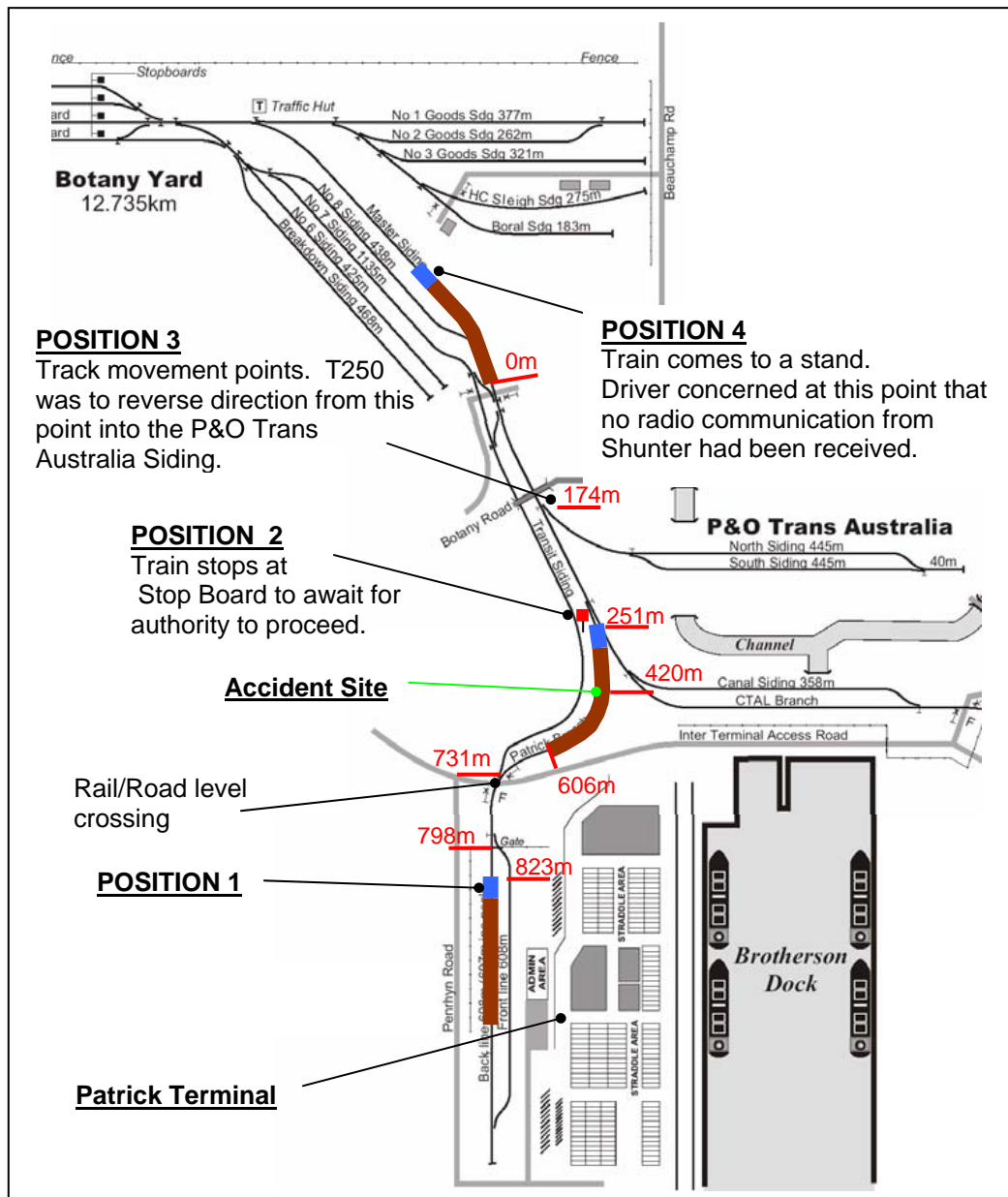


Figure 1 – Port Botany Rail Yard layout and progressive movements of LVRF T250

- 2.6 Not having received a response, the Driver stopped the train (See Figure 1, Position 4) and attempted to establish radio and then mobile phone contact with the Shunter. These calls were not returned. The Driver then asked the RIC Yard Controller to attempt a radio check with him to ensure that his (the Driver's) radio was functioning correctly.
- 2.7 Having established that his radio was functional, the Driver then walked back down to the train's end in search of the Shunter. Failing to locate the Shunter, the Driver set off to retrace the train's previous movements from the Stop Board back to a level crossing (where the Shunter had previously operated a series of crossing alarms). Enroute, the Driver located the Shunter motionless across the tracks (see Figures 1, 2 & 3, Accident Site). He then contacted the RIC Yard Controller and requested the attendance of the Ambulance and Police. The Shunter was subsequently transported to Royal Prince Alfred Hospital where he was pronounced deceased.

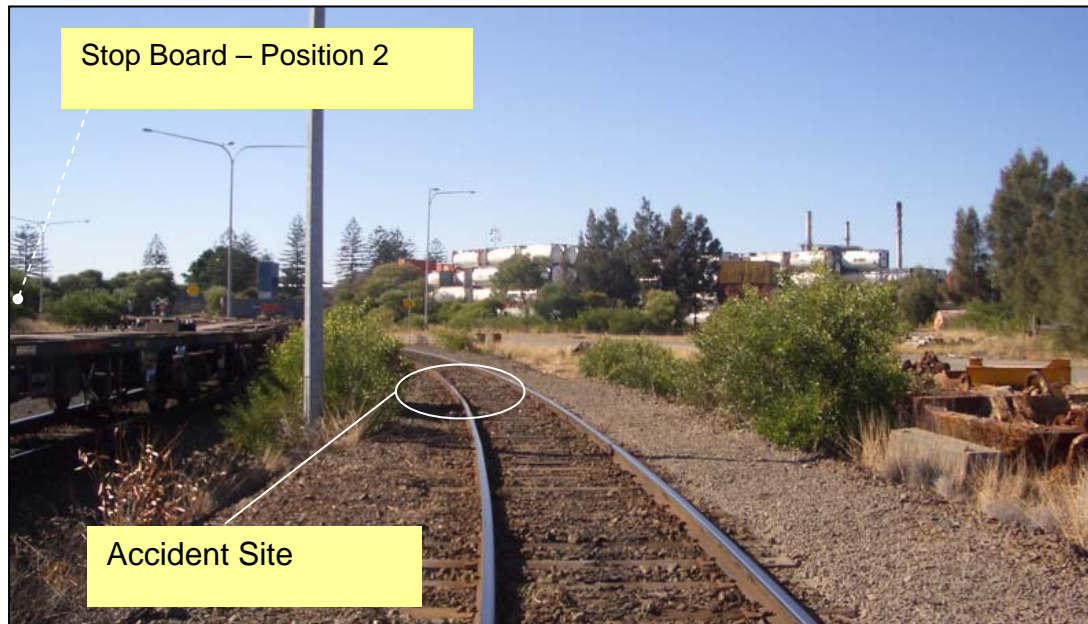


Figure 2 – Accident site at approx. 16.250 km facing the Up direction towards Stop Board.

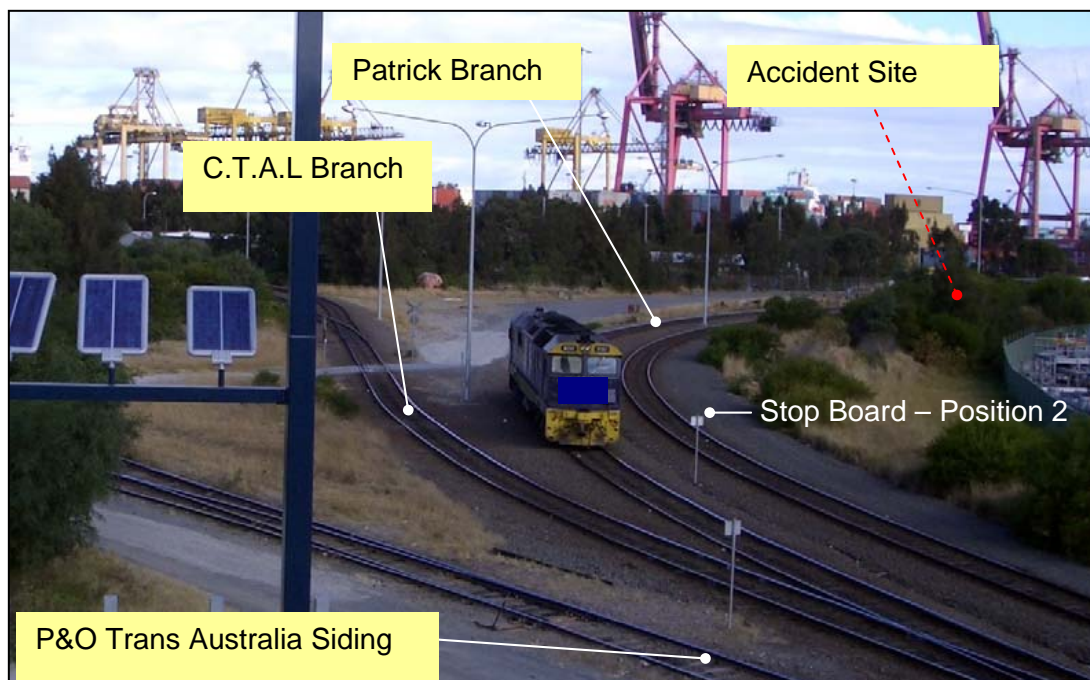


Figure 3 – Stop Board and accident site facing the Down direction towards Stop Board.

Emergency Response

- 2.8 Ambulance and Police records establish that they were advised of the accident at 2.14PM. The Ambulance and Police services arrived on site at 2.38PM and 2.46PM respectively.

Response by Regulatory Bodies

- 2.9 The following actions were taken by the applicable safety regulator in response to the accident.
- 2.10 On 2 July 2004, the Work Cover Authority of NSW issued two Prohibition Notices to Lachlan Valley Rail Freight that prohibited:
- a. *“Employees riding or walking on container flats with no floor whilst the trains are moving, and*
 - b. *Persons riding unrestrained and at risk of falling from step ladders on the sides of moving wagons.”*
- 2.11 On 6 July 2004, the Independent Transport Safety and Reliability Regulator (ITSRR) issued a Prohibition Notice to all rail operators in NSW that:
- a. *“Prohibited employees, contractors or other persons under their control from riding railway rolling stock (whether outside, within or upon that rolling stock) unless riding within a designated operating station or other enclosed space specifically designed to protect persons during the movement of the rolling stock, and*
 - b. *Directed operators to take all necessary measures to ensure that rail safety workers and other persons are immediately prohibited from riding on rolling stock, including during train movements in yards, terminals and sidings, unless riding within a designated operating station or other enclosed space specifically designed to protect persons during the movement of the rolling stock.”*

Train Information

- 2.12 T250 entered Port Botany rail yard with 17 freight container wagons weighing approximately 795 tonnes. The entire ‘consist’ was approximately 355m in length.

Lachlan Valley Rail Freight

Accreditation

- 2.13 LVRF was accredited as a rail operator by the Ministry of Transport, Transport Safety and Rail Safety Regulation Division (MoT Rail Regulator), on 11 February 2003.

Port Botany Rail Yard

- 2.14 Port Botany rail yard is a multi-user facility and was under the operational control of RIC at the time of the accident. As such, operators were subject to conditions specified in their individual track access agreement with RIC. At the time of the accident, RailCorp was responsible for the yard infrastructure maintenance and Safeworking rules.
- 2.15 The positioning of CCTV cameras at the Port Botany rail yard provided good visibility of operations within some areas of the yard but not in others. In the case of T250 movements, the CCTV footage recorded the train’s passage into and out

of the Port Botany rail yard. No CCTV coverage was available at the accident site. There was also no eyewitness to the incident.

- 2.16 Patrick provided CCTV footage of the Shunter riding on the last wagon as the train departed from the Patrick rail terminal and level crossing. A sample of this footage can be viewed in Figure 4.

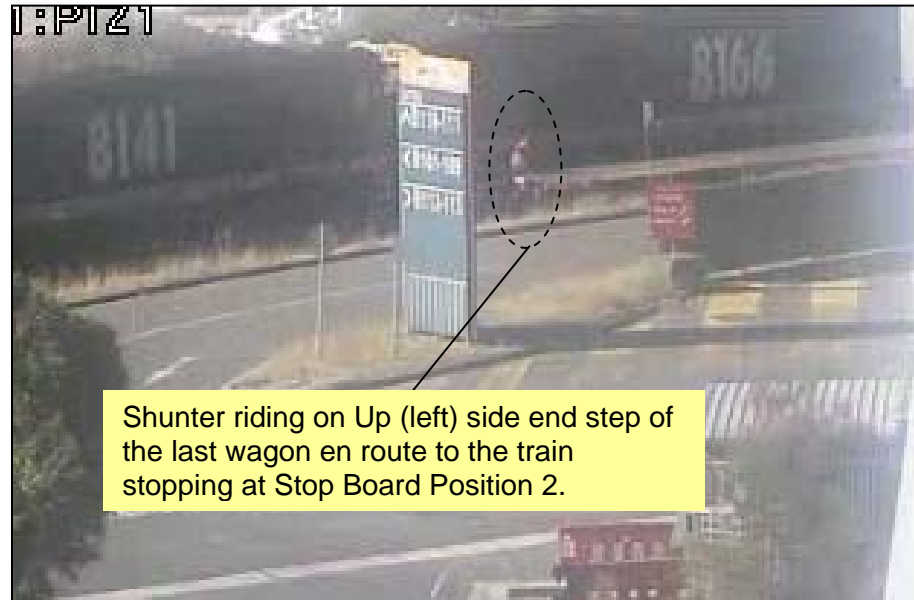


Figure 4 - Port Botany CCTV taken from Patrick Container Terminal Building at 1341 on 1 July 2004.

- 2.17 CCTV footage taken from the Port Botany Rail Yard was reviewed for one week prior to the accident and one week following the accident. This review identified one instance where a rail worker walked on top of an unloaded container flat wagon whilst it was stationary. A sample of this footage has been captured as a still photograph and can be viewed in Figure 5.

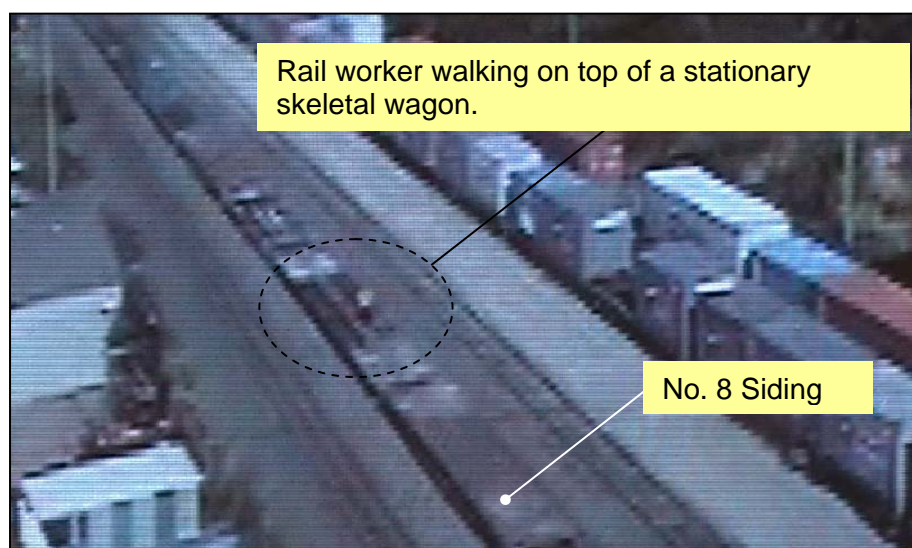


Figure 5 – Port Botany CCTV – Rail worker walking along stationary skeletal wagon.

PART 3 ANALYSIS OF EVIDENCE

Incident Site Evidence

- 3.1 The Shunter's body was found lying intact and face up across the left-hand rail in the direction of the wagon's travel. The approximate mid-point of the Shunter's back was resting on top of the left-hand rail, with his head, shoulders and upper torso positioned between the left-hand and right-hand rails (the "four foot"⁵). The Shunter sustained injuries that were consistent with being run over by wheels across his abdomen and central back area.
- 3.2 Glasses and a Baseball Cap belonging to the Shunter were found in the "four foot" approximately 2.1m and 2.8m respectively to the south of the Shunter's body. The Shunter's radio was found approximately 4.4m to the south of the Shunter's body in line with the outside line of the sleepers. A notable disturbance in the ballast approximately 0.5m adjacent to the outside sleeper line was identified approximately 5.6m to the south of the Shunter's body (refer to Figure 6 and Figure 7 depicting the orientation and location of site evidence).

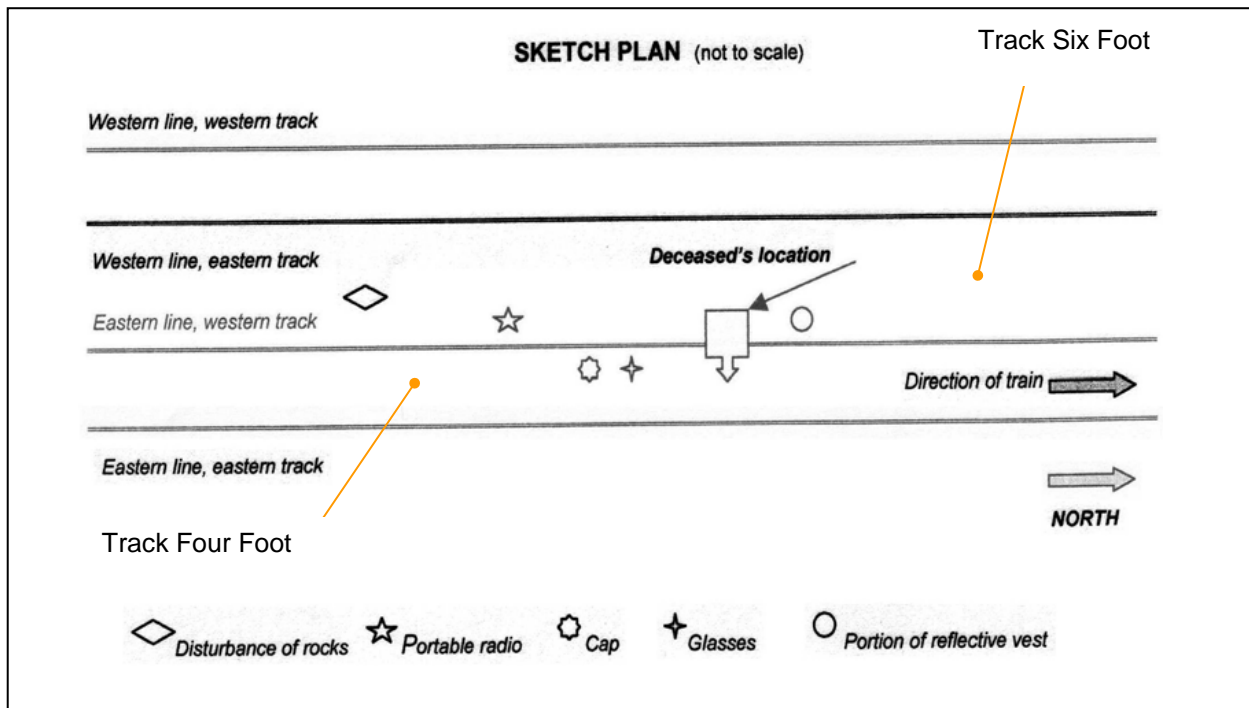


Figure 6 - Sketch of accident site evidence located in the track area

⁵ "Four Foot" denotes the space between the right-hand and left-hand rails of a railway track.



Figure 7 - Photograph of Ballast Disturbance, Shunter's Radio and Shunter's Glasses

Potential Cause of the Accident

- 3.3 The position of the Shunter, with his upper torso lying in the four foot across the left-hand rail, the nature of injuries suffered, and in particular the abrasions and markings on his body are consistent with the shunter having been run over by T250 and having been dragged a short distance in the process.
- 3.4 In attempting to determine how the Shunter was run over, OTSI examined the following possibilities.
 - a. That the Shunter fell whilst walking along side of the wagons.
 - b. That the Shunter fell whilst riding on one of the steps to the rear or side of a wagon.
 - c. That the Shunter deliberately placed himself in harm's way.
 - d. That the Shunter fell from on top of a wagon's decking.
- 3.5 Assessments of scenarios a - d are attached in Annex A.
- 3.6 OTSI considers the most likely cause is that the Shunter fell from on top of a wagon's decking (scenario 3.4 d.), based on the following supporting evidence.
 - a. Blood matching that of the Shunter's was found on the trailing wheels of the 2nd last wagon.

- b. Boot prints, similar in pattern and size to those of the Shunter's were located on top of the 2nd last wagon, indicating that the wagon decking had been previously used as a walkway (see Figure 8).
- c. The wagon decking was of a skeletal design (see Figure 9).
- d. The relative position of a disturbance in the ballast to the Shunter's radio, cap, glasses and his body and the track (see Figures 6 and 7).
- e. The clearance of 80cm between the wagon decking and rail.
- f. The orientation of the Shunter's body, which lay perpendicular across the left-hand rail with his head positioned in the four foot.
- g. The orientation of injuries to the Shunter (see Annex B).

Sequence of Events Leading to Injury

- 3.7 Based on the above information and forensic reports, OTSI's view is that the most probable sequence of events leading to the fatality included the following.
- a. The Shunter lost his footing, through either a jolting movement, a slip or as a consequence of a momentary loss of concentration, whilst standing on top of an un-walled and only partially decked wagon during shunting.
 - b. On falling, the Shunter pivoted, in an anti-clockwise direction as his legs dropped down into the gap between the left side centre longitudinal beam and the wagon's left side beam (the gap between these two beams measured 81cm – see Figure 8).
 - c. Having fallen approximately 1.2m to the ballast, the Shunter has then fallen backwards with the middle of his back resting across the left-hand rail. In this position the Shunter has then been run over by the approaching trailing wheels.

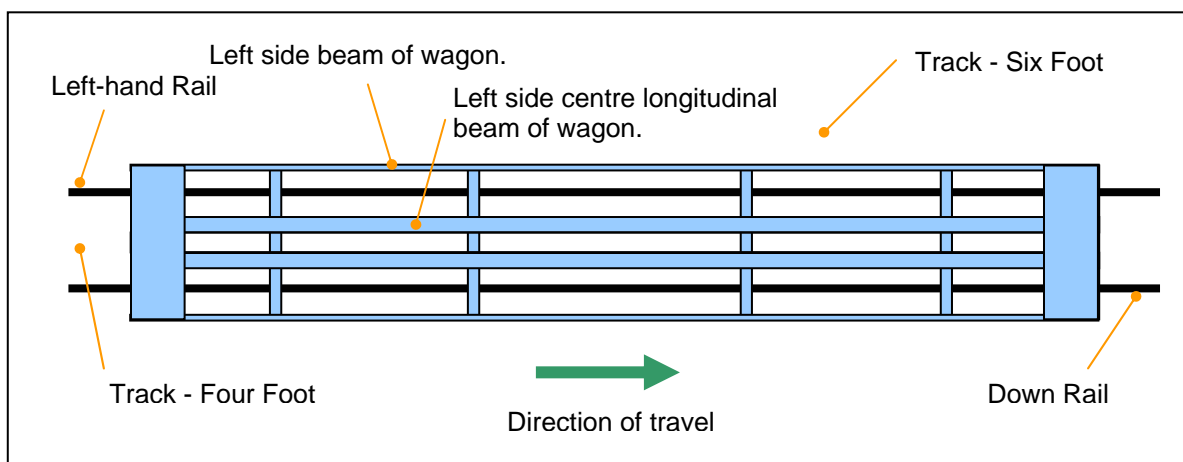


Figure 8 - Representation of wagon decking relative to rail (approximate scale 1:13)

Potential Contributing Factors

Shunting – the Rules, Regulations and Practices.

- 3.8 In attempting to understand how the Shunter might have been run over, OTSI sought to better understand the rules and procedures that govern shunting practices throughout the rail industry. In the process, it became apparent that whilst there have been specific amendments in response to specific accidents⁶,

⁶ A shunter was fatally injured at Trangie on 27 October 1998 whilst conducting a propelling movement (Annex C).

and notwithstanding a review of the Safeworking rules in NSW by Rail Infrastructure Corporation (RIC) in 2001, there is considerable discretion for operators to determine what constitutes safe shunting practices. Following the Safeworking rules review and amendments in 2001, these practices were to be documented by operators in Operator Specific Procedures. This requirement acknowledged the roles and responsibilities of operators to manage those risks under which they have direct control. Operators have responsibility for the safe design and operation of rolling stock through their rail safety accreditation. They likewise have responsibility over how a shunter interacts safely with the rolling stock.

- 3.9 The Safeworking rules at the time of the accident specified that qualified workers directing propelling train movements “must safely: ride in or on the leading vehicle, or walk beside the leading vehicle”.⁷ A number of operators have applied this rule to allow shunters to ride “in the leading vehicle” where he/she can either be:
 - a. in a vehicle’s cabin;
 - b. on a leading wagon during a propelling movement from a step on either the side or front of the wagon, or
 - c. on a wagon’s decking where the wagon has side walls.
- 3.10 These Safeworking rules do not specify safety requirements for a shunter riding in or on rolling stock during a hauling train movement.⁸ The type of train movement conducted during the accident was a hauling movement.
- 3.11 Following the Safeworking rules review and amendments in 2001 shunting practices were removed from the Safeworking rules. A number of these shunting practices addressed shunter occupational health and safety risks. However, the risk of a shunter falling from a wagon was not contained within these documented practices. In 2002, each operator was requested by the MoT to determine if the Network Rules and Procedures were self sufficient in the particular context of the operator’s operations. The requirement to produce Operator Specific Procedures covering safe shunting practices was therefore not mandatory under the Rail Safety Act or rail accreditation requirements at that time. The RIC Safeworking Policy manual notes that Operator Specific Procedures play a role in the Safeworking system, however there is no further information provided within the Policy that describes the requirement or reason for Operator Specific Procedures. LVRf did not have any documented Operator Specific Procedures or company instructions that detailed how shunters were to meet the Safeworking rule requirements of riding safely in or on freight wagons.
- 3.12 During January 2004, RIC received reports that a major freight operator had prohibited employees riding on rail vehicles unless the vehicle was designed with a work station to protect the employee. This operator implemented an alternate practice to riding on wagons. The practice required shunters to use motor vehicles for transportation whilst propelling movements were undertaken. As these practices contravened the Safeworking rules, RIC requested the operator to provide justification for the company’s revised shunting practices.⁹ The

⁷ The current RailCorp and ARTC Safeworking rules for shunting are consistent with the RIC Safeworking rules that existed at the time of the accident.

⁸ Hauling denotes the movement of a train with the train’s locomotive at the front position of the train.

⁹ Current RailCorp Safeworking rules require a shunter to be located at the point of shunt (on the lead vehicle or walking in advance of the lead vehicle) during a propelling movement. The operator’s revised shunting practices,

operator subsequently provided risk assessments to RIC. These risk assessments considered additional risks to those identified by RIC in the Safeworking rules review of 2001. The operator's risk assessment determined that the risk of employees riding on freight wagons was unacceptable.

- 3.13 OTSI notes that LVRF were aware of the operator's revised practices and that they were also aware of instances where shunters within the industry had ridden on the decks of un-walled wagons prior to the accident.

Wagon Design

- 3.14 The wagons being hauled within T250 varied in type. The 2nd last wagon consisted of a skeletal load-bearing frame with two wagon bogies supporting this frame, as depicted in Figures 9, 10 & 11. The limited decking surface on this wagon was noted to be of a smooth painted finish. In contrast, the last wagon on T250 was fully decked with a non-slip chequered plate surface, as depicted in Figure 12. Wagons of this type typically have a ground clearance of 80cm.
- 3.15 No physical or administrative (warning signs) barriers, that might have reduced the likelihood of a person falling through the wagon's decking, were found on the wagons. OTSI also noted the centre longitudinal beams of wagon CQDY 054S, which had clearly been used as a walkway (see Figure 13), did not meet the Australian Standard design for a walkway (AS 1657:1992). This standard requires the width of a walkway to be no less than 55cm and for any metal surface to be chequered, indented, or other suitable slip-resistant type. The centre longitudinal beams of wagon CQDY 054S were spaced approximately 35.5cm apart and were each approximately 27.5cm in width. The surface of these beams was of a smooth painted finish (see Figure 13). Multiple boot imprints were identified on the deck of the last and second last wagons of T250. Some of these imprints were consistent with the size and type of boot worn by the Shunter. Police Investigators noted that the platform appeared (by the number and types of impressions) to be commonly used as a walkway.



Figure 9 - CQDY 054S skeletal wagon



Figure 10 - Underside view of CQDY 054S facing direction of travel

using motor vehicles to transport shunters during propelling movements, does not explicitly comply with the Safeworking rule's point of shunt requirement.



Figure 11 - CQDY 054S Underside view facing opposing direction of travel



Figure 12 - WQCY type flat top wagon

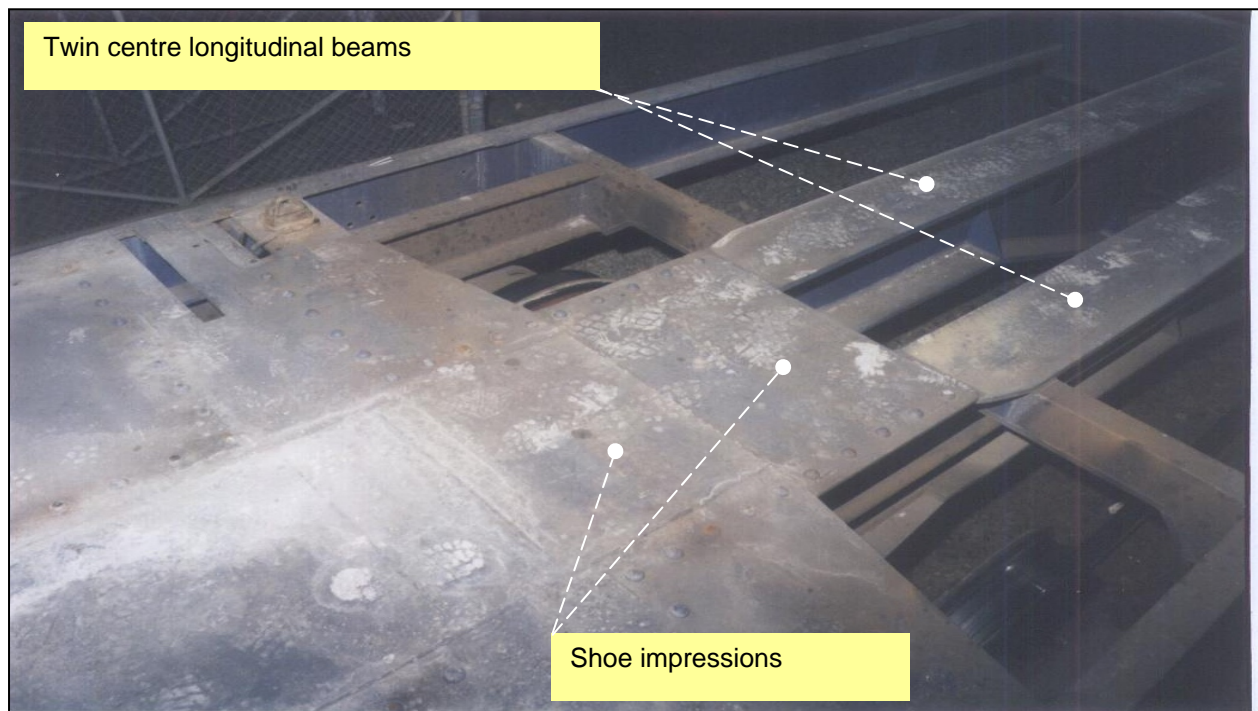


Figure 13 - Multiple shoe impressions identified on Wagon CQDY 054S

- 3.16 The investigation also noted a large variation in the ergonomic design of wagon side and end steps. The variations require shunters to adopt differing riding postures as illustrated in Figures 14 and 15. These positions offer varying degrees of practical functionality and safety. OTSI noted that some of the designs might also encourage shunters to adopt the less difficult option of riding on top of a wagon. OTSI further noted that shunters equipped with hand held radios would need to release one hand from a holding point to successfully operate the radio, thereby adding an additional risk factor.



Figure 14. CQBY type wagon with shunters riding on side steps¹⁰

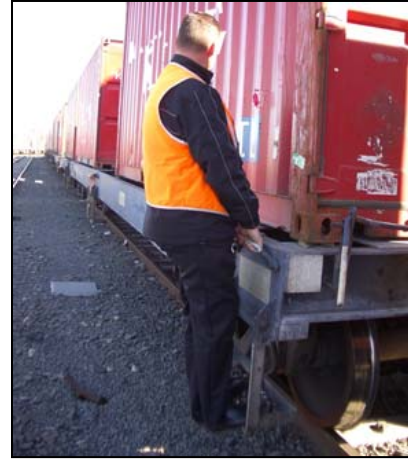


Figure 15. Rail worker simulating the Shunter's riding position on wagon CQDY 054S.

Individual Competency and Fitness for Duty –The Shunter

- 3.17 The Shunter was a 44-year-old male. In September 2000, he successfully completed theoretical training through Southern Cross Rail Training in shunter and driver related Safeworking systems. Thereafter, he was employed as a trainee driver with Silverton Rail. The Shunter successfully completed theoretical training in the new Safeworking rules in November 2002. He resigned from Silverton Rail in October 2003 and commenced working with Southern Short Haul (SSH) as a driver in November 2003.
- 3.18 The Shunter was involved in a yard derailment in January 2004 and SSH terminated his employment at that time. He then gained employment with LVRF and was certified by LVRF as a driver on 27 February 2004.
- 3.19 The Shunter had been assessed as medically fit for his rail duties on 26 September 2003 when employed by SSH. LVRF had been provided, and had retained, a copy of this medical certification.

Individual Competency and Fitness for Duty –The Driver

- 3.20 The Driver was assessed in accordance with LVRF's competency assessment criteria as an Assistant Driver on 18 January 2002, 3 March 2002, 19 June 2003, and 30 June 2003. He was issued a Certificate of Competency as a Driver by LVRF on 15 March 2004.
- 3.21 The Driver was last assessed as medically fit for his work duties on 24 February 2003.

Fatigue and/or Impairment

- 3.22 There was no evidence of the Shunter having been affected by alcohol, medication, or illicit substances. An examination of both the Shunter and Driver's fatigue scores revealed that both were below the recommended FAID level of 80

¹⁰ Shunters photographed riding on the side steps of a CQBY wagon prior to the issue of ITSRR's prohibition notice banning the practice.

at the time of the accident.¹¹ However, a review of the Shunter's fatigue scores for two weeks prior to the accident identified one occasion (21 June 2004) where the Shunter's fatigue score reached 88.2 and thereby exceeded the FAID manufacturer's recommended level of 80. In sum, the rosters for both the Shunter and Driver complied with the Rail Safety Act 2002 fatigue management requirements. It is OTSI's view that fatigue is unlikely to have contributed to the accident.

Train Management

- 3.23 OTSI was unable to examine the locomotive's data logger because the recording tape had been exhausted two weeks before the accident. Contrary to RIC's Minimum Operating Standards for Rolling Stock, the recording tape had not been replaced. OTSI was therefore forced to rely on the Driver for information pertaining to the train's operational movements (train management).
- 3.24 The Driver advised that at the time of the accident, the crew was on schedule and that the move from the Stop Board position to where T250 finally stopped was continuous, uneventful from his perspective and had not exceeded 10km/h. OTSI had no cause to question the Driver's version of events and does not consider train management to have contributed to the accident.

Risk Management

LVRF Risk Management

- 3.25 As previously discussed, rail operators have some discretion in how they apply the shunting Safeworking rules. The exercise of such discretion is required, under the Rail Safety Act 2002, to occur within the context of formal risk analysis and risk management.
- 3.26 LVRF identified in their risk assessment process the potential for rail safety workers to fall from rail vehicles. However, LVRF did not appear to have considered the potential for this risk to be associated with a shunter falling from a freight wagon. LVRF management acknowledged the possibility that shunters could walk along the deck of moving flat top wagons without the benefit of side walls. LVRF management also acknowledged that they were aware of the practice in industry, although they had no knowledge of LVRF staff engaging in the practice. Reports from staff of other Operators indicated that the practice of riding on the top of un-walled wagons was not uncommon at Port Botany rail yard. Whilst LVRF did not condone the practice, it did not formally act to prohibit or mitigate against the potential for this practice to occur. In terms of human error, research has shown that routine violation¹² is common and two factors appear to be important in shaping habitual violations, namely:
 - a. the natural human tendency to take the path of least effort, and
 - b. a relatively indifferent culture, i.e., one that rarely punishes violation or records observance.

¹¹ Fatigue Audit InterDyne (FAID) scores are calculated using four factors that have emerged from research into shiftwork and fatigue over the last few decades. The formulae for this program has been developed and validated by the Centre for Sleep Research at the University of South Australia. Fatigue scores below 80 are considered satisfactory, 80 to 100 suggest a risk assessment of the working should be conducted, and over 100 are considered problematic.

¹² Routine Violation denotes a deliberate deviation from safe operating practices where the breach of procedure has become implicitly accepted, and a normal activity.

- 3.27 Everyday observation shows that if the quickest and most convenient path between two task-related points involves transgressing an apparently trivial and rarely-sanctioned safety procedure, then it will be violated routinely by the operators of the system¹³. In order for LVRF to have reduced the likelihood of shunters riding on the decks of un-walled wagons, shunting procedures in combination with a more rigorous training, supervision and auditing process would have as a minimum been required.
- 3.28 LVRF risk management procedures should have also accommodated the requirements of the *Occupational Health and Safety Act 2000*. This Act requires, amongst other things, that employers assess risks arising out of the activities of employees at work, including the manner of conducting an activity and the plant associated with the performance of the activity. The Act also requires that employees be provided with specific information, instruction, training and supervision to ensure the employees' health and safety at work.
- 3.29 LVRF were noted to have utilised RIC's list of rail hazards to assist in the identification of employee operational risks but could not demonstrate how these risks were assessed against the specific activities of a shunter. The requirement to identify such risk is reflected in both accreditation requirements and Occupational Health and Safety (OHS) legislation.
- 3.30 At least one manager within LVRF completed an OHS instructional course prior to the introduction of the *Occupational Health and Safety Act 2000*, however no LVRF manager had attended an OHS instructional course following the introduction of the new Act. The documented quality of the risk management processes within LVRF is questionable. Questionable risk management practices were evident by the limited nature of documented Operator Specific Procedures and training material that LVRF had provided to their employees to underpin Safeworking.
- 3.31 OTSI notes that at all Operators in NSW by 30 June 2006 will be required to gain reaccreditation under the National Rail Safety Accreditation Package.¹⁴ This package will require operators to document process procedures to ensure critical rail safety worker practices are uniformly communicated and implemented. The desired outcomes of this package, with respect to the analysis and control of shunting activities, are similar to the current requirements of the *Occupational Health and Safety Act 2000*.

LVRF Competency Management

- 3.32 LVRF require shunters to have gained theoretical certifications in their knowledge of the Safeworking rules and to undergo on-the-job training and practical assessment. Theoretical training of shunters is conducted by a Registered Training Organisation (RTO) and would typically cover knowledge of the Safeworking rules. Practical on-the-job training and assessment would include reference to the Safeworking rules and LVRF's Operator Specific Procedures.
- 3.33 The Shunter underwent classroom based training and assessment of his knowledge of the Safeworking rules associated with shunting. This theoretical training covered both the old Safeworking rules and the new Safeworking rules relating to shunting, in November 2000 and November 2002 respectively.

¹³ *Human Error*, James Reason, Cambridge University Press, 1999, Page 196.

¹⁴ The National Rail Safety Accreditation Package – National Rail Safety Accreditation Guideline was endorsed by Ministers at the Australian Transport Council on 19th November 2004.

- 3.34 LVRF's Operator Specific Procedures, training documentation and company work instructions did not specifically cover the company's accepted practices for riding on wagon side steps or end steps. As such no on-the-job practical training information, relating to how a shunter was to ride safely in or on freight wagons, was available as a reference within LVRF's training system.
- 3.35 With respect to the training and assessment of on-the-job shunter competencies, industry guidance is provided in the Australian National Training Authority's (ANTA) Transport and Distribution Training Package for Shunting Rolling Stock. Competency guidelines, largely mirroring ANTA's were also contained in RIC's Network Rules (Safeworking rules) and Network Procedures Training Framework. LVRF had not referenced or applied the guidelines to the on-the-job training and assessment material provided to their shunters.
- 3.36 Legislative guidelines for training and competency assessment for rail safety workers are provided in the ITSRR Guidelines for Certification of Competency January 2004. The Rail Safety Act 2002, Section 36 requires that those engaged in training and assessing the competency of others must observe the guidelines which require competency assessors to:
- (i) *Possess current qualifications in the competency or competencies being assessed,*
 - (ii) *Possess a minimum of two years' practical experience in each competency being assessed, and*
 - (iii) *As a minimum, be a Category Two Workplace Assessor endorsed by the New South Wales Vocational Education Training Accreditation Board (VETAB¹⁵) or an equivalent registering body in another State or Territory. Where the person is responsible for devising an assessment curriculum, he or she shall be a Category Four Workplace Assessor.*
- 3.37 With respect to the provision of training, the ITSRR guidelines specify further requirements of an operator to:
- a. *In respect of training: (i) Satisfying the relevant competency standards contained in the existing Unit or Units of Competency of a national Training Package endorsed by the Australian National Training Authority (ANTA), or (ii) Satisfying the minimum competency requirements set by an operator in a new competency standard for its own operations,...*
- 3.38 The conduct of an OHS assessment, as described within 3.28, is required in order to satisfy the outcomes of the ANTA Transport & Distribution Training Package TDT02. The training package requires relevant shunter OHS performance requirements to be defined in order to prevent injury and damage.¹⁶ Evidence is to be collected covering the OHS requirements. Documentary evidence detailing how a shunter has satisfied the OHS is seen as a minimum to meet the requirements.
- 3.39 LVRF were of the view that the certification requirements of the ITSRR Guidelines for Certification of Competency at 3.36(iii) were overly prescriptive.

¹⁵ VETAB is a NSW statutory body established by the NSW Vocational Education and Training Accreditation Act 1990. VETAB's three main functions are; to register and monitor training organisations based in New South Wales, to accredit VET courses in accordance with national standards, and to approve training organisations' delivery of VET to overseas students in New South Wales.

¹⁶ ANTA Transport & Distribution Training Package - Rail Operations TDT02 Volume 1 pages 13 & 226.

LVRF expressed this view to the then MoT Rail Regulator prior to the guideline's introduction.

- 3.40 As previously identified the LVRF trainers/assessors involved in on-the-job practical training and assessment were qualified as Work Place Assessors (Category Two qualification). Notwithstanding this qualification and the fact that LVRF's trainers/assessors held the relevant shunting skills and experience, they did not hold the required Category 4 qualification to devise an assessment curriculum as required by the ITSRR Guidelines for Certification of Competency. Such a Category 4 qualification is equivalent to a "Certificate IV in Assessment and Workplace Training."
- 3.41 It is noted however, that ITSRR's guidelines, in amplification of the certification of competencies, refer to Category 4 Workplace Assessors and that no such qualification exists within the Australian Qualification Training Framework (AQTF¹⁷). OTSI also noted that ITSRR's guidelines do not specify the qualifications required to devise a training curriculum or deliver its content.
- 3.42 The practical on-the-job training material that LVRF were able to provide OTSI reflected the limitations of the company's understanding of training design, delivery, assessment and its compliance with ITSRR's requirements for quality training. In essence, the company's documentation was limited to a basic subject checklist and a limited number of procedural documents, only one of which pertained to shunting. Whilst the company was able to provide evidence of "refresher training", it could not indicate how such training was consistently conducted or validated. LVRF's Operations Manual that documented the company's checklists and shunting procedures was also noted to have contained references to Safeworking rules that have been withdrawn since December 2002.
- 3.43 Considering that the practice of riding on un-walled wagons had been previously identified within Port Botany Rail Yard, concerns are therefore raised with LVRF's system of shunter supervision. Had an effective system of shunter supervision been in place within LVRF, their management may have become aware of the practice occurring at Port Botany Yard prior to the accident.

RIC's Risk Management

- 3.44 As previously identified, Port Botany rail yard is a multi-user facility and was under the operational control of RIC at the time of the accident. As such RIC had responsibility for the infrastructure within the yard. Operators were subject to conditions specified in their individual track access agreement with RIC and the interface protocols of the Port Botany Yard.
- 3.45 Prior to the accident, RIC identified the need to improve the walkways alongside the yard tracks in order to reduce the potential for shunters to trip/fall. This project was underway at the time of the accident.
- 3.46 In addition to managing risk at Port Botany, RIC, and now RailCorp, also manages risks more widely through its ownership of the freight network's Safeworking rules. OTSI notes that these rules do not specifically prohibit shunters from riding on rolling stock during movements such as the movement during which the Shunter was fatally injured; nor do they prescribe specific

¹⁷The Australian Quality Training Framework (AQTF) was developed by the National Training Quality Council (NTQC) of the Australian National Training Authority (ANTA) Board in conjunction with States and Territories, the Commonwealth and industry and endorsed by Ministers for vocational education and training on 8 June 2001.

requirements that must be in place before a shunter can ride in rolling stock during like movements.

Regulatory Oversight

- 3.47 Since the time of LVRF's accreditation as a railway operator in February 2003, ITSRR have audited LVRF over breaches in regard to fatigue management and concerns in relation to the maintenance of rolling stock. ITSRR have not specifically audited LVRF training systems or their competence against the Guidelines for Certification of Competency. OTSI notes that application of the guidelines will present some challenges as long as the terminology being used by ITSRR to describe assessor qualifications is inconsistent with that reflected by VETAB.
- 3.48 The previous MoT Rail Safety Regulator's review of LVRF's risk assessment did not identify that LVRF had not considered the risk of rail safety workers falling from wagons. With the benefit of hindsight, the limitations of the previous regulator's review of LVRF's risk assessment are now apparent.
- 3.49 Following the accident, ITSRR issued a prohibition notice to railway operators. This notice prohibited the practice of riding on rolling stock, unless the person is located at an operating station or specifically designed enclosed space. ITSRR has subsequently relaxed certain restrictions of their prohibition notice to operators under defined conditions. OTSI has reservations about this action. These reservations are held considering that a major freight operator banned the practice of riding on all types of freight wagons some six months prior to the accident, having completed a number of detailed shunting risk assessments into riding practices.

PART 4 FINDINGS

- 4.1 The Shunter was determined to have died from extensive injuries, consistent with having being run over directly across his abdomen region, by 6 wheels (three bogies) on the last two wagons of LVRF service T250.

Primary Factors

- 4.2 Those primary factors that were determined to have contributed to the occurrence of the accident include:
- a. The positioning of the Shunter on top of the wagon's decking, without the means of a physical restraint, whilst the wagon was in motion.
 - b. The design of the wagon, which featured a skeletal and smooth decking and which did not incorporate any form of protection against the danger of falling onto the track.

Contributory Factors

- 4.3 Other factors that are considered to have contributed to the accident include:
- a. The limitations of LVRF's risk assessment and risk management processes as reflected in:
 - (1) LVRF's risk assessment not having considered in detail the operational activities of a shunter and the likely risks arising from those activities.
 - (2) LVRF's Operator Specific Procedures which did not specifically cover the company's accepted practices for riding on wagon side steps or end steps.
 - (3) LVRF's inability to stop the practice of riding on the top of un-walled wagons where LVRF had prior knowledge that such a practice had occurred previously within the railway yard environment.
 - b. The limitations of LVRF's approach to training, competency assessment and supervision, noting:
 - (1) the absence of Operator Specific Procedures that defined accepted practices for riding on wagon sides and the supporting training documentation designed to instruct a shunter in these practices;
 - (2) the absence of proper structure and consistency to competency assessment. The assessment arrangements did not meet ITSRR's Guidelines for Certification of Competency and were not conducted by staff with the requisite qualifications, and
 - (3) the absence of an effective system of worker supervision that would have enforced LVRF's informal practices of riding safely on freight wagons.
 - c. The design of side and end steps of some freight wagon types do not facilitate a safe/ergonomic riding position and may have encouraged the use of alternate, and unsafe, riding positions.

Anticipation and Effectiveness of Risk Management Strategies

- 4.4 The prospect of such an accident would have been identified in a robust risk assessment process. Even without the benefit of a robust process, LVRF should have foreseen the potential for such an incident to take place considering that they were aware of instances where shunters had been standing on the decks of un-walled freight wagons.
- 4.5 LVRF's risk management strategies were deficient in their identification, analysis and treatment of the risks associated with shunters riding on freight wagons.
- 4.6 Whilst the primary responsibility for risk assessment of shunting operations rests with operators, the risk assessments carried out by RailCorp in assessing the shunting Safeworking rules require further consideration in light of the accident.

Related Findings

- 4.7 The investigation has determined the following related findings:
 - a. The Shunter did not suffer from any predisposed medical condition that would have contributed to his falling from the wagon's deck (see Annex A).
 - b. There was no evidence to suggest the Driver's operation of the train was outside acceptable train management practice (speed and braking) for the train movement leading up to the accident.
 - c. There was no evidence to suggest that the Shunter was distracted by mobile phone communications just prior to the accident.
 - d. The Driver returned a negative blood alcohol reading.
 - e. The Shunter was reported to be in good spirits by his work colleges and family prior to the accident (see Annex A).
 - f. The Driver's FAID score at the approximate time of the accident was well below the recommended FAID level of 80. The rosters for both the Shunter and Driver were also noted to comply with the Rail Safety Act 2002's maximum length of shift hours worked and the maximum number of consecutive days worked requirements. The Shunter's family also noted that he typically slept well whilst on a day work shift pattern.
 - g. There was no evidence to suggest that the Shunter was riding on top of un-walled wagons in an attempt to save time.

Other Matters Affecting the Safety of Rail Operations

- 4.8 The investigation found that the following matters did not contribute to the accident, but had the potential to affect rail safety:
 - a. The train Hasler recorder of the locomotive hauling LVRF service T250 was found to have expired some two weeks prior to the accident. A freight service operating without a train recorder contravenes the requirements of the RIC Minimum Operating Standards for Rolling Stock.
 - b. The ITSRR Guidelines for Competency Certification refer to outdated trainer and assessment qualification categorisations. The guideline's qualifications referred to as Category 2 and Category 4 are currently referred to as a Work Place Assessor and a Certificate IV in Assessment and Workplace Training. In addition, the guidelines do not stipulate the qualification

requirements of personnel designing training curriculum or delivering its content.

- c. The previous MoT Rail Regulator had reviewed LVRF's risk assessment plan for its operations and found the plan to be appropriate for the risks identified. However, the MoT Rail Regulator's review failed to identify LVRF's lack of risk assessment application to the operational activities of a shunter.
- d. The ITSRR had yet to conduct a review of LVRF's compliance to the Rail Safety Act Guidelines for Certification of Competency.
- e. The Port Botany rail yard, whilst having CCTV coverage in parts of the Yard, does not have coverage over key yard junctions. CCTV could be used to monitor compliance with Safeworking practices at these key yard junctions.
- f. The Port Botany Yard walkways required upgrading to improve walking conditions for shunters.
- g. LVRF's Operations Manual was noted to contain references to Safeworking rules that had been withdrawn in December 2002.
- h. The use of a hand held radio while a shunter rides on a freight wagon increases the likelihood of a shunter falling when responding to radio calls.

PART 5 RECOMMENDATIONS

- 5.1 It is recommended that the following remedial safety actions be undertaken by the specified responsible entity.

Lachlan Valley Rail Freight

- 5.2 Conduct a risk assessment of those operational activities associated with shunting. This risk assessment should be performed in a manner consistent with the Rail Safety Act 2002 and the *Occupational Health and Safety Act 2000*. As one of the potential outcomes of the risk assessment, LVRF should ensure procedures are documented detailing how safety critical activities of a shunter are carried out.
- 5.3 Formally establish competencies for shunting and the procedures associated with the delivery and assessment of those competencies. LVRF should note that such assessments must be conducted by qualified persons in accordance with the ITSRR Guidelines for Certification of Competency.
- 5.4 Ensure training of shunting staff is carried out in accordance with the defined procedures and in compliance with the ITSRR Guidelines for Certification of Competency.
- 5.5 Ensure that a system of regular worker supervision is implemented to improve the compliance and understanding of shunters undertaking their operational activities. Accountabilities for the system's management and operation should be clearly specified and communicated amongst LVRF staff. Such a system should be audited on a regular basis with the audit results communicated to LVRF management and staff.
- 5.6 Ensure that the inspection and maintenance routine for Hasler locomotive event recorders provides reliable recording. The level of reliability should be in accordance with RIC's Minimum Operating Standards for Rolling Stock.
- 5.7 Document acceptable practices in the use of mobile phones across LVRF's operational environment. The implementation of these practices should be supported by a suitable training program.

RailCorp

- 5.8 Review the current Safeworking rules pertaining to shunting to assess the adequacy of these rules. Consideration should be given to the safety concerns highlighted in the WorkCover and ITSRR prohibition notices and those risk assessments conducted by rail freight operators.
- 5.9 Provide advice to operators within the Safeworking Rules Policy as to the purpose of Operator Specific Procedures and why such procedures are an integral part of the Network Safeworking system.
- 5.10 Review the condition of walkways in all yards. Where the walkways do not provide safe passage for shunters, upgrade the walkways as required.
- 5.11 Conduct a feasibility study into the expansion of CCTV coverage for the Port Botany rail yard. This study should consider the benefits of providing wider coverage of the yard's operational infrastructure. It is also recommended that RailCorp offer operators access to CCTV footage so they can review compliance with the Safeworking rules and Operator Specific Procedures.

The Independent Transport Safety & Reliability Regulator

- 5.12 Amend the certification requirements for competency assessors to ensure they are consistent with VETAB requirements. The particular certifications include the “Work Place Assessor” and “Certificate IV in Assessment in Work Place Training”.
- 5.13 Ensure the ITSRR audit program tests compliance of LVRF and other operators against the ITSRR’s Guidelines for Certification of Competency.
- 5.14 Advise operators of the necessity to review their operations in order to determine if Operator Specific Procedures are required to support compliance with the Network Safeworking Rules. The content of this advice may reflect on the future requirements to produce process control procedures required under the National Rail Safety Accreditation Package that is due for implementation by 30 June 2006.
- 5.15 Review exemptions already provided to selected operators in relation to the ITSRR prohibition notice in the light of this report.
- 5.16 Advise operators of the Australian Standard (AS 1567:1992) requirements for walkways. Operators should note that compliance with this standard is required for the design of walkways on freight wagons regardless of whether a wagon’s walkway is used whilst the wagon is stationary or moving.

ANNEX A

Potential Accident Scenarios

Key Observations and Comments

1. The Shunter's body was found lying intact and face up across the left-hand rail in the direction of the wagon's travel. The Shunter's head was positioned between the left-hand and right-hand rails with the midpoint of the Shunter's back resting on top of the left-hand rail. The Shunter was lying approximately perpendicular to the track with his legs outside of the track (or in the "six foot").
2. There were no eyewitnesses to the accident and therefore each of the scenarios documented below have been reviewed with respect to evidence collected during the course of the investigation. Other potential scenarios may exist however the scenarios represented within this Annex were considered to be the most worthy of closer examination.

Fall Whilst Walking

3. Had the Shunter lost his footing whilst walking alongside a wagon, the possibility exists that his legs would have been positioned within the tracks (or in the "four foot"). Of significance also is the fact that blood was found on the trailing wheel sets of the 2nd last wagon and not all of the wheel sets on both bogies of the wagon. This precludes the possibility that the Shunter fell between wagons.
4. OTSI also considered the possibility that the Shunter lost his footing whilst walking alongside a wagon and was propelled head-first, through the confined space under the wagon. This scenario however was considered improbable. The analysis was made considering the limited clearance between the wagon deck and the tracks at approximately 80cm; the distance the wagon deck protrudes beyond the rail line; and the position of the Shunter's body.

Fall from Either the Side or End Steps

5. Had the Shunter fallen from the end steps, there should have been evidence of blood on the leading wheel set of the 2nd last wagon. No such evidence was identified.
6. Had the Shunter fallen from a side step, the extent of the Shunter's injuries and the orientation of his body across the tracks are highly likely to have been different. A shunter falling from a side step is most likely to fall under a wagon feet-first or come to rest parallel to the track. There was no such evidence identified.
7. If the Shunter had jumped or fallen over the side edge of the wagon decking, the orientation of the Shunter's body would likely to have been similar to that of a fall from the side steps. It is also highly unlikely that such a jump or fall would have resulted in the Shunter's body to have been positioned so far under the wagon's frame and perpendicular to the track.

The Shunter Deliberately Placed Himself in Harm's Way.

8. Given the speed of the train and the limited clearance between the wagon deck and the track, OTSI considers that it would have been extremely difficult for a 44

year old man with a stocky build to propel himself head-first between two moving wagons or between the bogies of a single wagon.

9. In the first instance, had he managed this feat, the Shunter would have been struck by the lead bogie's wheels, rather than just the trailing bogie's wheels. Under this scenario the Shunter's blood would have been identified on the leading wheels of the wagon's leading bogie. There was no such evidence identified.
10. In the second instance, the positioning of brake equipment hanging below the wagon's side frame would have also made such a manoeuvre extremely difficult to ensure an outcome of self-harm.
11. Had the train stopped en route from the Stop Board (see Figures 1 and 3, Position 2), it would have been possible for the Shunter to have laid across the tracks between the leading and trailing bogies of a wagon. In this position the Shunter may have then been run over by the trailing wheels of a wagon once the train recommenced moving. This possibility is not supported by the fact that the train did not stop on route between the Stop Board and the train's final stationary position. It is also not supported by a notable disturbance in the ballast area some 5.6m away from the Shunter's body (see Figures 6 and 7) and the final position of his radio, cap and glasses being some 4.4m, 2.8m and 2.1m away from the Shunter's body respectively.
12. It would have been possible for the Shunter to have deliberately fallen through the wagon's decking and to have been struck by the wagon's trailing wheels. However the outcome from such a fall for someone intent on suicide would have been uncertain. OTSI notes that the Shunter was prescribed anti-depressant medication whilst he had been employed in the trucking industry prior to 2000. Reports from the Shunter's family indicated that he was taking this medication to deal with work place stresses at that time. The Shunter was reported to have stopped taking the medication on his employment in the rail industry during 2000. The toxicology report found no evidence of any prescribed medication, alcohol or illicit substances.
13. The Shunter's family and colleagues described him as being extremely happy in his work and as being in a positive frame of mind since working as a driver in the rail industry. In sum, neither OTSI nor the Police could find any evidence to suggest that the Shunter intended self-harm.

Fall from the Wagon Decking

14. Prior to analysing how the Shunter may have fallen from the wagon's decking, OTSI sought to understand the potential motivators that may have influenced the Shunter to walk across the top decking. OTSI considered a number of potential motivators as described below.
 - a) The Shunter was known to be an enthusiastic worker who enjoyed every opportunity to engage in rail activities. It is conceivable that his enthusiasm for the job contributed to his behaviour of walking along the top of the last two wagons towards the front of the train. In walking along the decking it is possible the Shunter may have been attempting to conduct a number of visual tasks (e.g. checking container twist locks, looking for sticking brakes or dragging equipment etc.).

- b) The Shunter may have alternatively been attempting to position himself on the opposite side of the train to that on which he initially embarked. To achieve this position the Shunter may have decided to climb on top of the wagon's decking whilst the train was in motion. This perceived change in the Shunter's position may have allowed the Shunter a more advantageous position from which to disembark T250 in readiness to operate the track movement points (see Figure 1, Position 3) for the train's next movement into the P&O Trans Australia terminal.
 - c) OTSI considered the possibility that the Shunter was motivated to ride on the wagon's decking in an attempt to reduce the time taken to complete the shunting movement. This motivation was further analysed to assess if there were any operational or personal time pressures placed on the Shunter. Statements provided by a Security Guard who conversed with the Shunter approximately 20 minutes prior to the accident indicated that the Shunter was relaxed with no obvious anxieties. The Driver of T250 also confirmed this assessment. Whilst T250 obtained an early time slot to unload and load the train, there was ample time allocated within the daily planned yard movements to conduct the train operation.
 - d) Any potential time saved by the Shunter disembarking the train as described in b) would have been minimal at best. The entire train was to move past the P&O Trans Australia track movement points (see Figure 1, Position 3) before stopping and propelling back into the siding. The Shunter was required to adjust these track movement points from the ground. Irrespective of whether the shunter was to ride on the last or the second last wagon, the entire train had to travel past the track movement points before coming to a stand. The difference in the time taken progress the shunting movement between these two scenarios would have been marginal.
 - e) The Shunter was known to have been fastidious in maintaining his rostered hours of work and would have been unlikely to have rushed his activities in a desire to leave work early.
 - f) Whilst an assessment of the Shunter's motivation to ride and walk along the top of the wagon's decking can only be theorised, there is no indication from the available evidence that the practice was a result of time pressures placed on the Shunter.
15. Having assessed the likely motivators for riding and walking on the wagon decking, OTSI reviewed the site evidence in conjunction with this scenario. OTSI noted that footprints were located on top of the 2nd last wagon decking and that some of these were similar to those of the Shunter's (see Figure 13). Whilst these footprints were not positively identified to have been imprinted by the Shunter's boots, the presence of the footprints indicated that the wagon decking had been used as a walkway. The position of the Shunter's radio, cap and glasses; disturbance to the ballast in the immediate area; and the orientation of, injuries to, and markings on the Shunter's body (see Annex B) are consistent with a fall from the wagon's decking. Blood found on the trailing wheels of the 2nd last wagon matched that of the Shunter's and is consistent with a fall through the wagon's decking.
16. OTSI considered the potential for the Shunter to have been distracted by either answering or attempting to make a mobile phone call whilst on top of the wagon's decking. A review of the calls received, calls made and missed calls on the

Shunter's mobile phone identified that no such calls were made or received within approximately six minutes of the accident taking place. OTSI also notes that LVRF had no documented procedure that defined how shunters were to respond to mobile phone communications in the conduct of their activities.

17. Considering the above, OTSI concluded that the Shunter accidentally fell from the top of the second last wagon's decking. Such a fall may have resulted from a slip, a jolting motion, or a momentary lapse in concentration.

Annex B

Shunter's Injuries

1. The Department of Forensic Medicine Pathologist Autopsy report (Autopsy Report) described the Shunter as receiving extensive crushing injuries, consistent with being run over by the wheels of a train or similar mechanism. The most extensive injury was referenced by a band-like area of abrasion, circumferentially extending around the entire trunk, measuring approximately 70 mm in width and passing in a horizontal plane 60 mm above the umbilicus. On the right laterally this wound expanded to measure 160 mm in width. No significant pre-existing disease was identified. Toxicology was negative¹⁸:
2. The Shunter also received a "faint patterned area of bruising measuring 150 x 100 mm" across his "left ear, the left cheek and the left side of the neck."
3. Figure 16 below indicates those areas of the Shunter's body that sustained injuries as noted in the Autopsy report.¹⁹

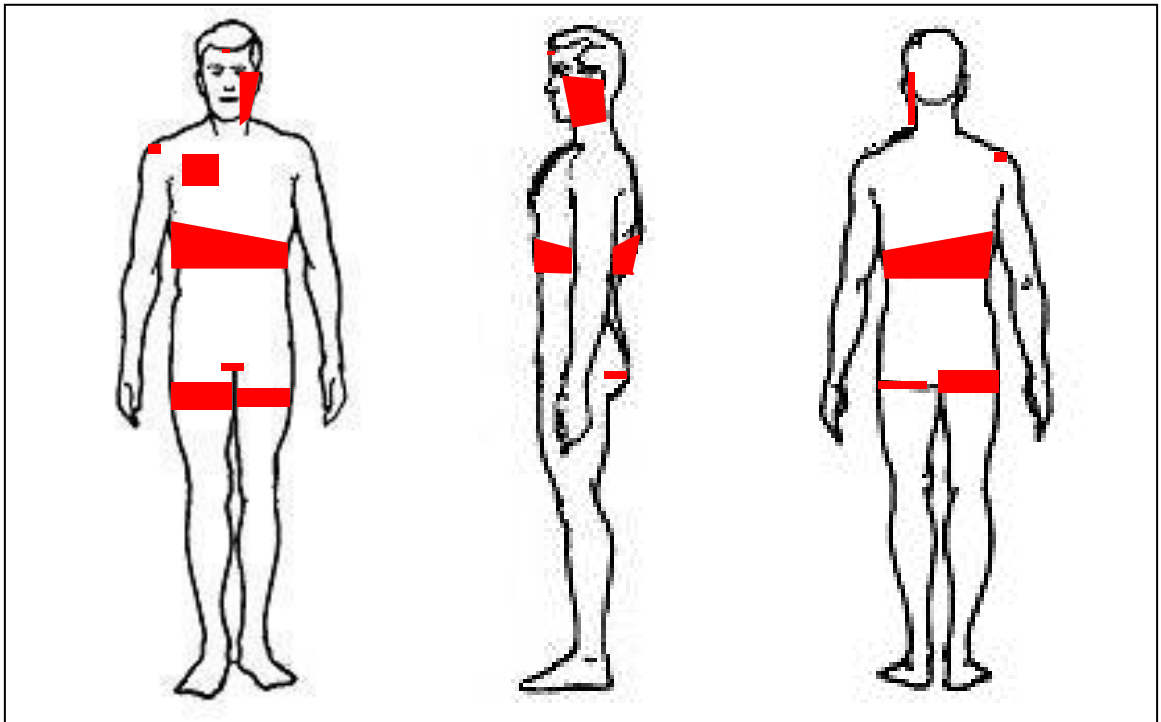


Figure 16 - Representative size and location of injuries sustained to the Shunter

¹⁸ AUTOPSY REPORT FOR THE CORONER – LVRF Shunter, Coroner's Case No. 1138/04

¹⁹ AUTOPSY REPORT FOR THE CORONER – LVRF Shunter, Coroner's Case No. 1138/04 Page 4

Annex C

NSW History - Shunter and Rail Employee Fall Incidents

- At the time of the accident Rail Infrastructure Corporation (RIC) maintained a rail safety incident database (SID) that recorded the occurrence of rail safety incidents on the NSW RIC Network. A review of the records in this database revealed 7 incidents where employees were riding on rolling stock whilst undertaking shunting/guard duties that resulted in either injury, serious injury or fatality (see Figure 17 and Table 1). The most significant shunting accident that has been recorded in the SID database prior to the Port Botany accident on 1 July 2004 occurred at Trangie on 27 October 1998 where a shunter was fatally injured whilst conducting a propelling movement. During the movement the shunter was crushed between the wagon that he was riding on and a wagon standing on an adjacent track. As a result of this accident the Safeworking rules prohibited riding on the side of wagons where reduced clearances between vehicles on adjacent tracks existed.

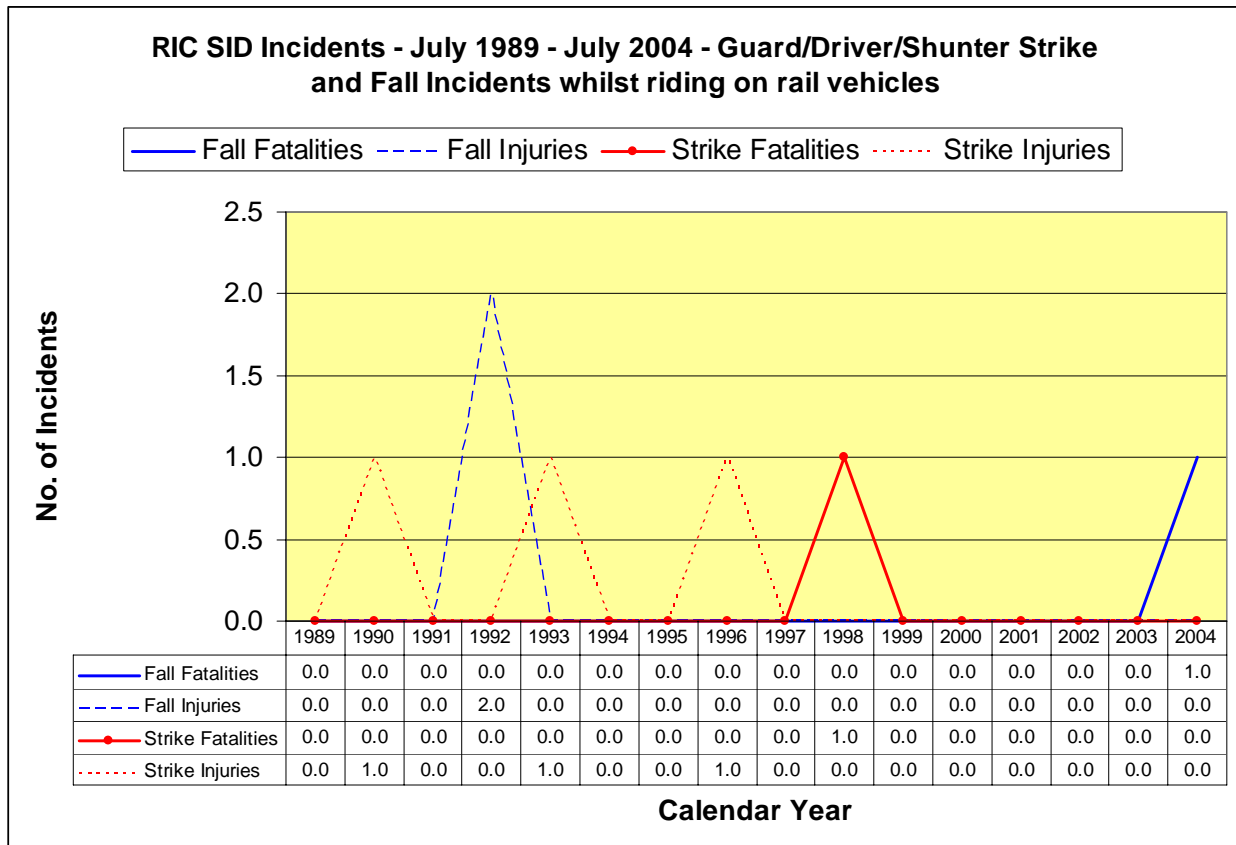


Figure 17 - RIC Safety Incident Database recorded incidents for Driver, Guard or Shunter fall or strike incidents - July 1989 to July 2004

Incident Date	Location	Hazard Code Description	Incident Remarks
31/08/1990	Port Kembla	Strike - By Train or Coach - Occupational	At 1045 hours during shunting, a shunter riding on 4468 fouled NHFF.42896 standing in No.8 road and dislocated his right arm.
13/03/1992	Flemington	Fall - Falls from Train – Employee performance	At 1909 hours a guard fell out of run 253 E/C in depot.
19/11/1992	Springwood	Fall - Falls from Train – Employee performance	At 2249 hours a guard working W589 fell from train at 77.500kms.
29/10/1993	Griffith	Fall - Falls from Train - Employee performance	During shunting operations a Senior Shunter was injured due to rice bags lying on track; due to insufficient clearance between rice bags and track Shunter was unable to get up in time.
18/06/1996	Forbes	Strike - By Train or Coach - Occupational	A Driver was found lying semi-conscious in the 6 foot between the Main Line & the Loop during shunting operations.
27/10/1998	Trangie	Strike - By Train or Coach - Foul of gauge	During shunting operations with No.8158, whilst carrying out a propelling movement in the down direction along the main line with the assistant driver riding on the up side of leading wagon no. NOCY-34666Y, the assistant driver became crushed between the wagon he was riding and a wagon standing in the loop. Emergency Services advised and employee transported to Narromine hospital where he was declared deceased.
1/07/2004	Port Botany	Strike - By Train or Coach - Employee performance	During shunting operations at the Patrick Level Crossing, Patrick Branch Line, a Lachlan Valley Rail Freight employee was struck and fatally injured by train T260. At the time, this employee was travelling on the second last vehicle of T260. After losing radio communication, the driver brought the train, consisting of 17 wagons, to a stand, then proceeded to the rear of the consist, where he found the second person lying dead on the line. Relevant personnel were advised and attended. The driver and the shift manager were breath tested with negative results. A crime scene was established, the line being re-opened at 1858 hours.

Table 1 RIC SID Database – Reported Shunter/Guard/Driver Fall/Strike Injuries and Fatalities