OTSI Office of Transport Safety Investigations

RAIL SAFETY INVESTIGATION REPORT

SHUNTING FATALITY
LACHLAN VALLEY RAILWAY SOCIETY (LVRS)
HERITAGE STEAM TRAIN SS84
ARIAH PARK

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OTSI File Ref: 04255

Date: 30 April 2007

Office Of Transport Safety Investigations
Level 17, 201 Elizabeth Street
Sydney NSW 2000

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GLOSSARY OF TERMS

Brake Valve	Used to control the air pressure in the brake pipe/train line in order to apply or release the brakes as required.
Buffer	A cushioning device mounted on the extreme ends of rail vehicles to absorb shocks arising during coupling and when in motion. The buffer consists of a plate on the end of a spring-loaded plunger which compresses upon contact with another buffer. Buffers are mounted either singly in the centre of the underframe ends or in pairs towards the corners.
Buffer Beam	Component of a locomotive, tender, carriage or wagon underframe which goes across the extreme end of the vehicle, and onto which the buffers and draw gear are mounted. They can be either timber or steel and are also commonly referred to as the "Headstock".
Diaphragm connection	Component of a passenger carriage which, when connected to another carriage, provides a walkway between carriages.
Regulator	A Driver's control which regulates the flow of steam into the cylinders and acts like a throttle, or accelerator.
Screw Couplings	Screw couplings were a predecessor to automatic couplings. They have been retained on some rolling stock where it was thought uneconomical to replace them and where draw gear capacity issues are not paramount. Screw couplings incorporate a three-part coupling in which the centre section can be tightened by the use of a screw-thread to eliminate any slack within the coupling.
Shunt	To marshal or rearrange rolling stock, typically within the bounds of a station, or yard.
Shunter	A person who organises shunting movements from the trackside.
Staff	Staffs are metal objects, commonly referred to as "tokens", used to control single movements within a section of rail line. The staffs are housed in a device called an 'electric staff instrument' and each particular staff is marked with an identifying number and the names of the locations at either end of the rail section over which it is to be used. The absence of a particular staff indicates that the related section is occupied by a train. The staff remains in the driver's cab while the train is in the related rail section.
Tender	A rail vehicle which carries water or coal and which is attached to a steam locomotive.

Transition Link	The transition link consists of three links – two chain links and a “D” shaped link - and is used when one of the two pieces of rolling stock to be coupled is fitted with a hook. A transition link was used by LVRS at Ariah Park to couple an FS type passenger carriage to the steam locomotive 3237. Refer to “Screw Couplings” for another commonly used coupling arrangement.
Westinghouse Brake	This is the most common type of train brake. It uses compressed air to apply the brake block (or pad) to the wheel and to control the operation of the brake along the train. The compressed air is supplied by a motor driven compressor on the locomotive or train. The brake control is actuated from a "driver's brake valve". This valve is used to feed air to the brake pipe or to allow air to escape from the brake pipe. A fall in brake pipe air pressure causes a brake application on each vehicle whilst a restoration of pressure causes the brake to release.

ACRONYMS AND ABBREVIATIONS

ARTC	Australian Rail Track Corporation
DIP	Directly Involved Parties
ICAM	Incident Cause Analysis Method
ITSRR	Independent Transport Safety and Reliability Regulator
LAC	Local Area Command (NSW Police)
LVOP	Lachlan Valley Railway Society Coop Standard Operating Procedures
LVRS	Lachlan Valley Railway Society Cooperative Ltd
OTSI	Office of Transport Safety Investigations
RAC	Rail Access Corporation (later became RIC)
PTA	*Passenger Transport Act 1990* (NSW)
RIC	Rail Infrastructure Corporation
RSA	*Rail Safety Act 2002* (NSW)
SMS	Safety Management System
SRA	State Rail Authority

ACKNOWLEDGEMENTS

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EXECUTIVE SUMMARY

The Accident

On 15 April 2006, a heritage passenger steam train operated by Lachlan Valley Railway Society Cooperative Ltd (LVRS) was participating in an event to celebrate the centenary of the opening of the rail line between Temora and Ariah Park[1].

The train consisted of a 32 Class steam locomotive, No. 3237, its tender and five passenger carriages. For the journey from Temora to Ariah Park, it was designated SS83 and configured with the tender of the locomotive leading. It arrived at Ariah Park at 10:30am with approximately 160 passengers who disembarked at the platform and moved on foot to the site of a commemorative ceremony adjacent to the Coolamon Street level crossing. The locomotive and tender were detached from the carriages and moved around the rail loop to take up a position near the level crossing for the ceremony.

On completion of the ceremony at about 11:40am, the locomotive and tender had to be reversed towards the Ariah Park platform to be re-coupled with the carriages for the return journey to Temora as heritage service SS84. The train's Guard directed this reversing movement with hand signals and was responsible for connecting the couplings between the locomotive's tender and the leading passenger carriage.

To engage the hook and link of the coupling mechanism, the Guard stepped into the gap between the tender and the carriage on two occasions; initially to align the coupling link and subsequently to place the carriage's coupling link over the tender's coupling hook. At approximately 11:52am, as the Guard attempted to effect the coupling manoeuvre, he was crushed between the tender and the carriage.

The Guard received immediate emergency treatment at the site of the incident and was then transported by ambulance to Temora Hospital where he died shortly afterward from the injuries he had sustained.

Findings

In relation to those matters prescribed by the Terms of Reference as the principal lines of inquiry, OTSI finds as follows:

[1] Ariah Park is located 536km South West of Sydney and the Ariah Park platform is located 522.111km by rail from the Sydney Rail Terminal.

a. Causation

i. The accident occurred when the Guard placed himself in an unsafe position between a moving tender and a stationary carriage in order to manually couple the two pieces of rolling stock.

b. Contributory Factors

i. The Guard had worked 18 shifts over the preceding 20 days and had been involved in preparation of the train well into the evening before, and in the early morning on the day of, the accident. It is likely, therefore, that the Guard was affected by fatigue. He may also have been distracted by the presence of spectators in very close proximity to him as he attempted to couple the tender and the carriage.

ii. The Guard was an experienced rail safety worker but his primary experience lay in signalling, and LVRS could not provide evidence to show that he had formally qualified as a shunter or that he had the competence to carry out manual coupling tasks.

iii. When the Guard stepped between the tender and the first carriage, he lost contact with the Driver of the locomotive because he did not employ another crew member to repeat his hand signals to the Driver, as was required by *Lachlan Valley Operating Procedure (LVOP) 16.*

iv. LVRS did not anticipate and manage a range of risks that were associated with their operations on the day of the accident, and their wider operations more generally.

c. Compliance with Accreditation Requirements

i. LVRS was authorised to conduct the type of service being provided by SS83 and SS84 on the day of the accident. However, under the terms of its accreditation, LVRS was obliged to have a Safety Management System (SMS) within which it was required to identify and manage risk. LVRS's SMS had been identified by the rail regulator, ITSRR, as having major deficiencies in 2005. OTSI's examination of LVRS's SMS during its investigation led it to conclude that, quite apart from any deficiencies, LVRS was failing to employ its SMS and as such, was in breach of the terms of its accreditation.

ii. Under the terms of the *Rail Safety Act 2002* and its accreditation, LVRS was obliged to comply with all Notices served on it by the Regulator, ITSRR. Video footage taken immediately prior the incident showed the Guard and Chairman of LVRS riding on a ladder on the end of the locomotive's tender which contravened a prohibition notice*, 02346/1 – 04/001105,* issued by ITSRR on 7 July 2004.

d. Crew Qualifications and Compliance with the Network Rules

i. Documentation provided by LVRS confirmed that the Driver was fully qualified to operate SS84 but similar records could not be produced to substantiate the qualifications of the remainder of the crew. In addition, such documentation that was produced caused OTSI to have reservations about how the related assessments may have been conducted.

ii. The certificates of competency issued to the Fireman, Supernumerary Fireman and LVRS's Trainer/Assessor had expired[2].

iii. The Supernumerary Fireman should have been required to submit to an updated health assessment before returning to crew duties following a serious injury, but this requirement had not been complied with.

e. Existence and Appropriateness of, and Conformance to, Operator Procedures

i. LVRS had established procedures for propelling, shunting and coupling operations, including *LVOP 10* (Propelling Movements) and *LVOP 16* (Screw Couplings & Transition Links). However, its operating procedures had not been amended to reflect the requirements of a prohibition notice, issued by ITSRR in July 2004, in relation to riding on moving rolling stock. Nor had LVOPs been amended to reflect requirements identified during successive audits by the Regulator.

ii. The decision to operate SS84 with a carriage that did not have buffers and to attach it to the locomotive's tender, had risks that were not appreciated on the day. It was also inconsistent with LVOP 16 which required crews to "*Ensure that vehicles with buffers are only coupled to other vehicles fitted with buffers or diaphragms*".

f. Anticipation and Management of Risk

i. LVRS did not have a proper understanding of its risks.

[2] The Trainer/Assessor was not part of the train crew on the day of the incident.

ii. LVRS did not have an effective risk management framework in place as evidenced by the absence of:

(1) effective fatigue management arrangements;

(2) an effective competency management process;

(3) effective emergency plans, and

(4) adequate arrangements to control the movement of spectators at Ariah Park.

g. Emergency Response

i. In the absence of a proper assessment of the risks that might present on the day, and limited emergency training over time, LVRS was not well prepared to respond to the accident when it occurred.

ii. LVRS had not provided ARTC, the organisation controlling operations on the network, with an updated list of the representatives to be contacted in the event of an emergency and ARTC was unable to establish early contact with LVRS. However, off-duty ARTC personnel who were attending the celebration took control of the situation at the scene until the arrival of LVRS's acting Operations Manager. One of the ARTC personnel was also a member of LVRS and had helped organise the event.

iii. Notwithstanding the limitations of emergency planning, the Guard received timely and qualified medical assistance at the scene of the accident.

h. Other Matters that would enhance the safety of Rail Operations

i. Rail heritage operations are sustained by volunteer effort. By virtue of their part-time nature, heritage operators face distinct challenges in meeting the conditions attached to their accreditation. Successive rail regulators have found it difficult to reconcile the contribution that such operators make to the State's rail heritage; the public's interest in seeing such operators continuing to function, and the limited capacity of some operators to maintain effective safety systems. OTSI believes that this will continue to be the case unless heritage operators are provided with directed education and training in the formulation and maintenance of such systems.

ii. There was room for improvement in ITSSR's audit processes but that ITSRR has acted to address the related deficiencies.

iii. ARTC's policy on secondary employment *"External Employment (Policy Number HR06-004)"* and the rostering processes which underpin its management of fatigue, warrant internal review.

Recommendations

In order to prevent a recurrence of this type of accident, the following remedial safety actions are recommended for implementation by the organisations specified below:

a. Independent Transport Safety and Reliability Regulator

i. Undertake a thorough review of LVRS to determine whether it is appropriate for it to continue to be an accredited heritage operator.

ii. If it is deemed that LVRS should retain its accreditation, prioritise any deficiencies that must be rectified and work with the operator to rectify these deficiencies.

iii. Increase its monitoring of LVRS, giving particular emphasis to the functioning and focus of its Board and the extent to which the operator is meeting its compliance obligations.

iv. Reiterate the requirements of *Prohibition Notice 02346/1 – 04/001105*, perhaps making them more explicit, to all operators.

v. Recognising that there are lessons that might benefit others from this accident, ensure that this report is bought to the attention of all accredited heritage operators in NSW.

vi. Continue to refine its audit and compliance processes to ensure that matters identified in previous audits and compliance activities that have not been closed-out are carried forward to future audits and inspections. Ensure that any related reports are made available to the operator in a timely fashion.

vii. In recognition of the important contribution made by rail heritage operators and the distinct challenges they face as part-time organisations, examine its capacity and assess the desirability of devoting dedicated staff effort within ITSRR to provide education and training in the formulation and maintenance of Heritage Safety Management Systems, and to refer operators to others whose systems and procedures represent "good practice" in particular aspects of heritage operations.

b. Lachlan Valley Railway Society Limited (LVRS)

i. Review the operations and focus of its Board to ensure that it is meeting its legal obligations. If the Board does not have the expertise to address fundamental requirements such as risk management, act to acquire or engage the necessary expertise.

ii. Seek guidance from ITSRR to re-build its Safety Management System.

iii. Conduct an immediate audit of its rolling stock to identify the risks associated with varying buffer, diaphragm and coupling arrangements, and act to either prohibit the use of certain combinations of equipment, or to properly manage such use.

iv. Conduct an immediate check on all certificates of competency and the health assessments of any members engaged in crewing to ensure that they are valid and appropriate to the duties being performed.

v. Immediately review its arrangements for managing fatigue, giving particular attention to situations where it is known that a LVRS crew member performs rail safety work in their primary employment.

vi. Seek immediate clarification from ITSRR in relation to *Prohibition Notice 02346/1 – 04/001105* to ensure that members only ride on rolling stock in an approved manner and/or under approved circumstances.

vii. Consistent with the priorities determined by ITSRR, review *LVOP 10* (Propelling Movements) and *LVOP 16* (Screw Couplings & Transition Links) to ensure that communication and coupling requirements are made more explicit, competency assessments are more soundly-based and that emergency training is conducted.

viii. Recognising that considerable effort will be required to undertake the above activities, review, and where necessary amend, its service program to ensure that LVRS does not further compromise the safety of its operations.

c. Australian Rail Track Corporation

i. Amend *"External Employment (Policy Number HR06-004)"* to require that employees undertaking rail safety work on a voluntary basis declare such work, given that such work is considered as 'employment' under the NSW *Rail Safety Act 2002.*

ii. Review its rostering processes to ensure that changes made to 'master' rosters at a local level are advised to those responsible for the maintenance of the master rosters.

PART 1 INTRODUCTION

Notification and Response

1.1 At 12:20pm on 15 April 2006, Australian Rail Track Corporation (ARTC) notified the Office of Transport Safety Investigations (OTSI) Duty Officer that a volunteer employee of Lachlan Valley Railway Society Cooperative Limited (LVRS) had been crushed whilst carrying out shunting operations at Ariah Park.

1.2 Based on the information provided by the ARTC and advice from Wagga Wagga Local Area Command (LAC) Police, the Chief Investigator directed the deployment of an OTSI Investigator by road to the incident site at Ariah Park.

1.3 At approximately 2:40pm, the Wagga Wagga LAC confirmed with OTSI that the volunteer employee had died as a result of his injuries and that the site had been preserved as a crime scene.

1.4 The OTSI Investigator arrived at the incident site at 6:25pm where he liaised with Police officers from Ariah Park and Wagga Wagga and LVRS's acting Operations Manager and commenced the inspection, assessment and evidence collection process.

1.5 A representative from the Independent Transport Safety and Reliability Regulator (ITSRR), who had also deployed by motor vehicle, arrived at the incident site at 7:45pm.

1.6 At approximately 7:55pm, the Police concluded the crime scene examination and released the site for officers from other agencies, including OTSI and ITSRR, to commence their investigation. The OTSI Investigator concluded the site investigation at 10:05pm on 15 April 2006, allowing the operator to remove the train.

Initiation of Investigation

1.7 As a result of the primary evidence collected by the OTSI investigator, the Chief Investigator initiated a Rail Safety Investigation in accordance with s67 of the *Rail Safety Act 2002*.

Interim Factual Statement

1.8 An Interim Factual Statement notifying OTSI's investigation and describing the incident in terms of what had happened was published on the OTSI website on 24 April 2006.

1.9 On 26 April 2006, the Chief Investigator notified all Directly Involved Parties (DIP) that OTSI was investigating the shunting fatality and requested that each organisation nominate an officer to act as the point of contact for all inquiries made by the appointed OTSI Investigator in Charge. The Terms of Reference for the Investigation were provided to the DIPs with this notification.

Terms of Reference

1.10 The Chief Investigator established the following Terms of Reference to determine why the accident had occurred and what to do to prevent recurrence:

a. identify the factors, both primary and contributory, which caused the accident;

b. identify whether Lachlan Valley Railway Society Cooperative Limited had operated within the conditions of its accreditation;

c. identify whether the train had been operated by qualified personnel and in accordance with the Network Rules;

d. identify whether Lachlan Valley Railway Society Cooperative Limited had established procedures for coupling operations and whether those procedures were appropriate and followed on the day of the accident;

e. identify whether the incident might have been anticipated and assess the effectiveness of any strategies that were in place to manage the related risk/s;

f. assess the effectiveness of emergency actions in response to the incident, and

g. advise on any matters arising from the investigation that would enhance the safety of rail operations.

Immediate Safety Actions

1.11 An authorised officer from ITSRR who deployed to the scene of the accident provided verbal directions to LVRS on the evening of 15 April 2006 and again on the morning of 16 April 2006 to cease what was, in its judgment, an unsafe work practice, i.e., the practice of standing between one or more moving pieces of rolling

stock when coupling. On 20 April 2006, ITSRR formally issued a Prohibition Notice[3] to all heritage rail operators operating in NSW, prohibiting the manual coupling of rolling stock by the use of a Transition or Screw type Coupling by a person standing in the 'four foot' (i.e., between the two rails forming the track) between units of rolling stock while one or both units were moving.

1.12 On 19 May 2006, ITSRR issued a Prohibition Notice to all heritage rail operators operating in NSW, prohibiting any activity within the rolling stock outline when any units were moving, or not secured.

1.13 On viewing the video footage provided by the Police from their evidence relating to the incident, OTSI noted a number of unsafe activities taking place both immediately prior to and after the incident. These activities included members of the public entering the rail corridor and danger zone. In addition, the Guard and the Chairman of LVRS were both observed riding on the tender and locomotive (respectively), which appeared to be in contravention of an ITSRR Prohibition Notice which had been issued following a shunting fatality at Port Botany in 2004. OTSI's concerns in relation to this matter were formally conveyed to ITSRR on 30 May 2006.

1.14 On 10 July 2006, ITSRR issued a Rail Industry Safety Notice, *RISN No. 11 General Public Entering the Rail Corridor and Danger Zone.* The Safety Notice identified ITSRR's concerns about the general public entering the rail corridor[4] and danger zone[5] when participating in and/or witnessing events involving heritage rolling stock.

1.15 On 22 August 2006, ITSRR issued a Rail Industry Safety Notice, *RISN No. 12 Being Within the Rolling Stock Outline.* The Safety Notice identified the risk of persons being within the rolling stock outline when either, or both, units of rolling stock were moving or were not secured.

1.16 On 13 November 2006, ITSRR issued a Rail Industry Safety Notice, *RISN No. 13 Accredited Railway Operator's Obligations to Ensure that the Railway Employees are Competent* which reiterated the requirement for all accredited operators to ensure that their railway employees were competent.

[3] Prohibition Notices are issued by the rail regulator ITSRR to the rail industry and are pursuant to section 54 of the *Rail Safety Act 2002* (NSW).

[4] The Rail Corridor is defined in ARTC Network Rule *ANGE 200* as the space between fence-line and fence-line, or 15m from the outside rail, where there are no fences.

[5] The Danger Zone is defined in ARTC Network Rule *ANGE 200* as all space within 3m horizontally from the nearest rail and any distance above or below this 3m, unless a *safe place* exists or can be created. A *safe place* is defined as a place where employees and equipment cannot be struck by rail traffic.

Methodology

1.17 OTSI utilises the ICAM (Incident Cause Analysis Methodology) which is an investigative methodology developed by BHP Billiton and is a practical application of the Reason Model[6] of accident causation developed by the organisational psychologist and human error expert Professor James Reason. OTSI uses this approach in the conduct of its investigations and applies the Reason Model of Active Failures and Latent Conditions to its analysis of causative and contributory factors.

1.18 The underlying feature of the methodology is the Just Culture principle with its focus on safety outcomes rather than the attribution of blame or liability.

Consultation

1.19 On 21 March 2007, a copy of the investigation Draft Report was forwarded to LVRS, ARTC, Wagga Wagga LAC and ITSRR. The purpose was to provide these DIPs with the opportunity to contribute to the compilation of this Final Report by verifying the factual information, scrutinising the analysis, findings and recommendations, and providing any commentary that would enhance the structure, substance, integrity and resilience of the Investigation Report. DIPs were requested to submit their comments by 13 April 2007. Submissions were received from LVRS, ARTC, the Police at Wagga Wagga and ITSRR.

1.20 The Chief Investigator considered all representations made by DIPs and where appropriate, reflected their advice in this Final Report. On 30 April 2007, the Chief Investigator informed DIPs which matters from their submissions had been incorporated in this Final Report and where any proposal was not included, the reasons for not doing so.

Investigation Report

1.21 This report describes the shunting fatality at Ariah Park on 15 April 2006 and explains why it occurred. The recommendations that are made are designed to contribute to the safe operating environment for rolling stock operators and to minimise the potential for a recurrence of this type of incident.

[6] Reason, J., *Reducing the Risks of Organizational Accidents,* Aldershot, UK: Ashgate, 1997

PART 2 FACTUAL INFORMATION

Incident Synopsis

2.1 At approximately 11:52am on 15 April 2006, the Guard on a heritage passenger steam train, operated by Lachlan Valley Railway Society Cooperative Limited (LVRS), was crushed while attempting to couple the locomotive's tender to the rest of the train at Ariah Park, 536km West of Sydney in South West NSW (see *Figures 1* and *2).* The locomotive was being re-attached after featuring in a commemorative ceremony.

2.2 The Guard was subsequently transported by ambulance to Temora Hospital but died shortly afterwards as a result of his injuries.

Figure 1: Incident Location

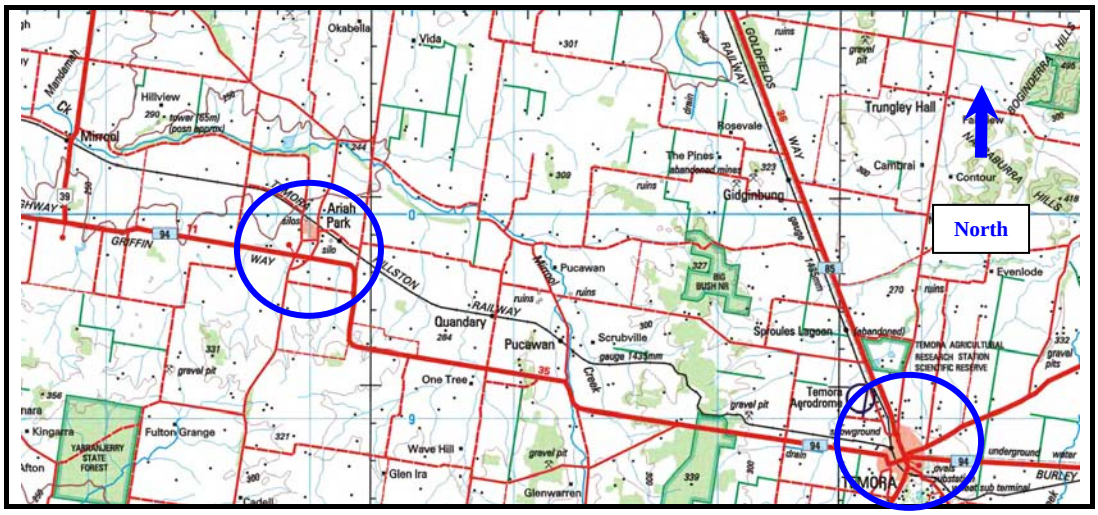


Figure 2: Map showing Ariah Park and Temora

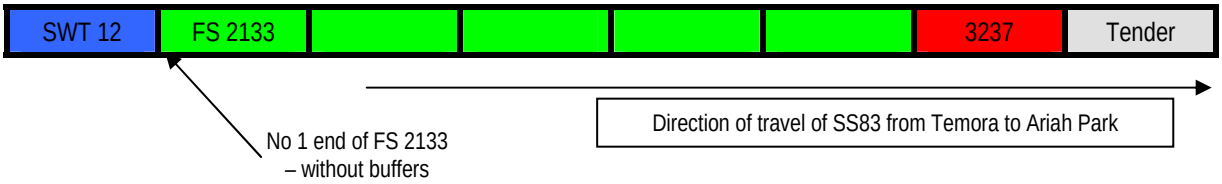
Narrative

Before the Incident

2.3 At approximately 6:00am on 15 April 2006, volunteer staff working for LVRS began preparation of heritage passenger train service SS83 at Temora yard; SS83 was due to depart the yard at 9:30am. The train was to be the centrepiece for an event at Ariah Park celebrating the centenary of the opening of the rail line between Temora and Ariah Park, and was scheduled to make two return journeys between Temora and Ariah Park on the day. The first leg of the first journey was designated as service SS83 and the return leg as SS84.

2.4 During the preparation of the train at Temora yard, a decision was taken to detach the water wagon SWT 12 from the train when it was confirmed that the locomotive's tender could be replenished with water at Ariah Park. The configuration of SS83 prior to the detachment of the water wagon SWT 12 is shown at the top of *Figure 3*. The removal of SWT 12 meant that the rear of SS83 now became the No 1 end of passenger carriage FS 2133[7]. The significance of this fact is that the No 1 end of FS 2133 was not fitted with buffers and for the return journey to Temora as SS84, the tender would have to be coupled to the No 1 end of FS 2133 rather than the water wagon SWT 12 which was fitted with buffers. The proposed configuration of SS84 for the journey from Ariah Park to Temora is shown at the bottom of *Figure 3*.

SS83 - original configuration at Temora prior to detach of the SWT 12 (water wagon)



SS84 - configuration at Ariah Park

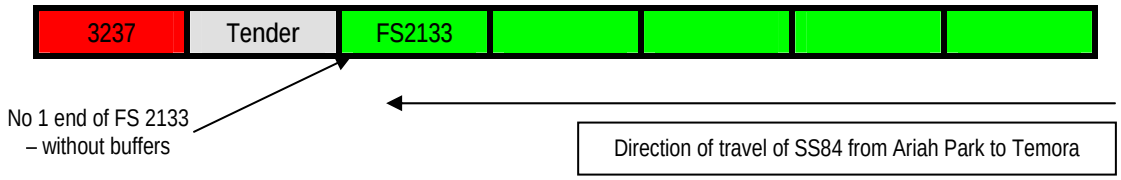


Figure 3: Train Configurations

[7] The two ends of these passenger carriages are simply designated No 1 end and No 2 end. On this class of carriage, No 2 end is distinctive because it is the end closest to the vehicle's handbrake.

2.5 At approximately 7:30am, a shunting crew moved SS83 from the Yard onto Temora platform. The train's crew, consisting of a driver, assistant driver, supernumerary fireman and guard, took charge of the train at the platform and at 9:30am, SS83 departed Temora for Ariah Park with approximately 160 passengers.

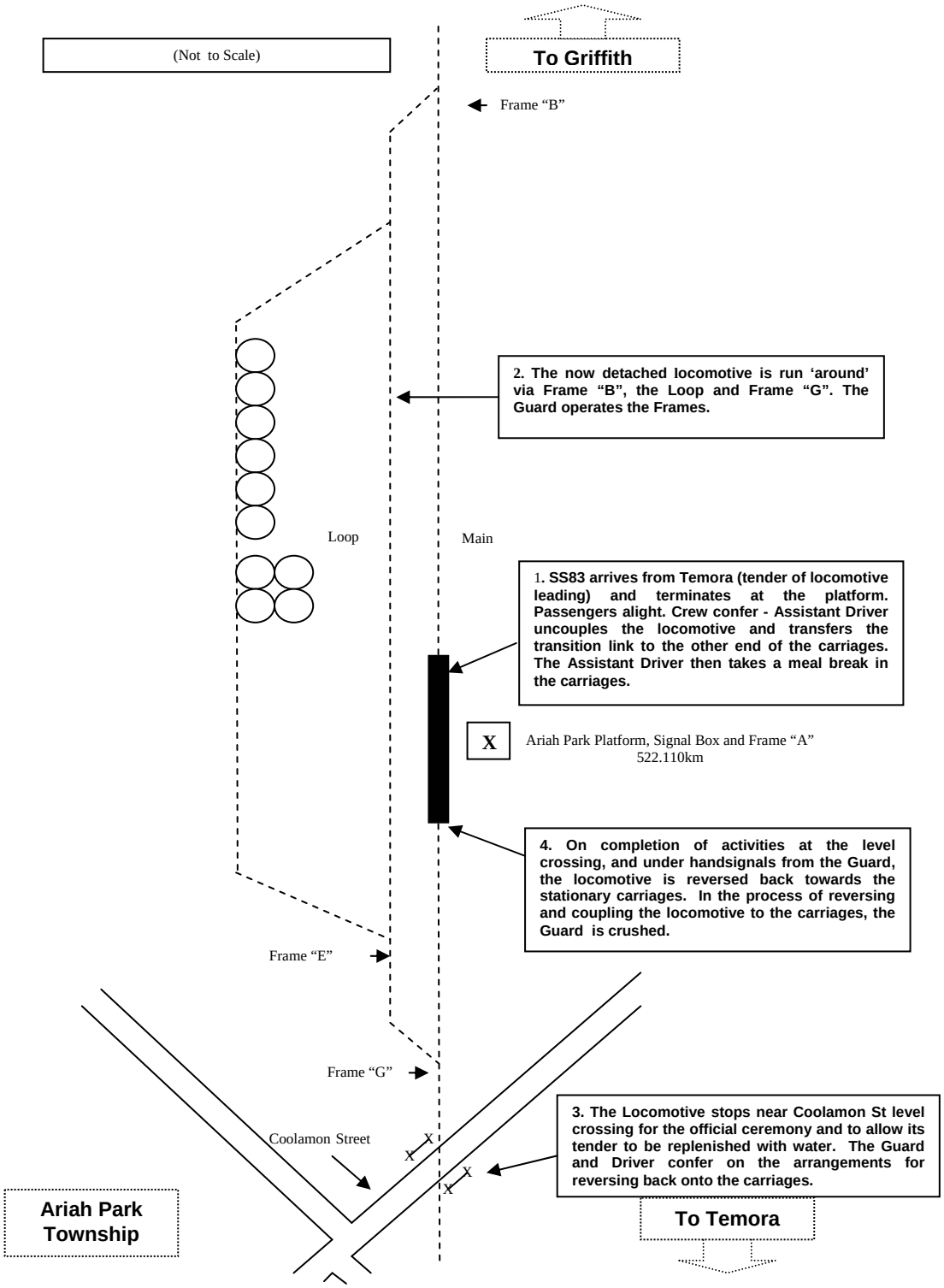


Figure 4: Key Incident Points

2.6 On arrival at the Ariah Park platform at 10:30am, the passengers alighted from the train and walked to the official celebrations in the township. Meanwhile, the crew members conferred regarding the movements that were required to detach the locomotive from the train and to position it at a nearby level crossing in readiness for a ribbon-cutting ceremony. The discussions specifically addressed the requirement for the Guard to operate the various ground-frames and for the Assistant Driver to transfer the transition link[8] to the other end of SS83 in preparation for the return journey to Temora. The sequence of movements up until the point at which the Guard was crushed is depicted in *Figure 4.*

The Incident

2.7 At the completion of the official ceremony at approximately 11:40am, the Guard arranged with the remaining crew[9] to reverse, or propel[10] the locomotive back towards the carriages which were standing at the platform. He climbed onto a ladder on the locomotive's tender to direct the reversing movement (see *Photo 1*).

2.8 The sequence of events that follows was captured on video by witnesses at the event. As the locomotive reversed, the Guard directed the crew by hand signals. At a point approximately 20m from the carriage FS 2133, and whilst the locomotive was still moving at what appeared to be walking pace, the Guard stepped off the tender's ladder and onto the ground and continued to provide hand signals to the Driver (see *Photo 2*).

Photo 1: Guard hanging onto ladder on tender of 3237

Photo 2: Guard hand signalling to the Driver to continue reversing

[8] Transition link - a three-linked chain, consisting of a "D" shaped link (attached to the carriage) and two other normal links. The second of the normal links goes over a hook on the tender of the locomotive and held down by a safety link/latch (refer to *Photos 8* and *9*)

[9] The Assistant Driver was taking a meal break, leaving only the Driver and Fireman on the locomotive.

[10] 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 ARTC *Network Rules and Procedures* require a guard to direct the train movement in advance of the train.

2.9 At a point approximately eight metres from the train, the Guard gave a “stop” hand signal and the Driver stopped the locomotive approximately five metres short of the rest of the train (see *Photo 3*).

Photo 3: Guard hand signalling to the Driver to stop, moments before he stepped into the danger zone

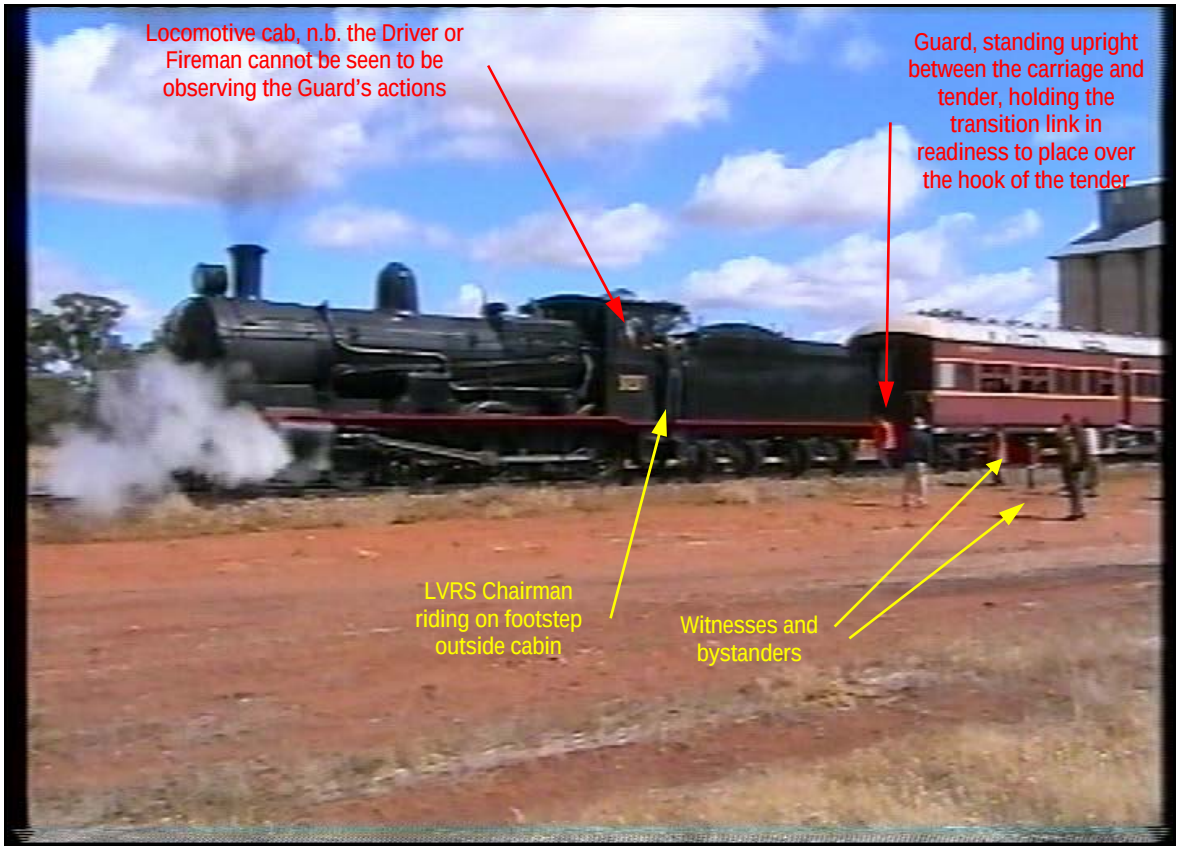


Photo 4: Incident scene at Ariah Park moments before impact

2.10 At this point, LVRS's Chairman boarded the footsteps on the Driver's side of the locomotive, an action that is discussed later in paragraph 3.23. The Guard then stepped into the gap between the tender and the carriage and aligned the transition link in readiness for coupling. He then stepped out of the gap between the tender and the carriage and gave the Driver a "caution hand signal", indicating he could continue to move the locomotive towards the carriage but should do so with caution[11]. As the locomotive commenced to move, the Guard again stepped into the gap between the tender and the carriage in order to complete the coupling process (see *Photo 4,* taken moments before the impact).

2.11 Moments later, and in accordance with normal practice, the Driver applied the locomotive's brakes when he felt the impact between the tender and carriage. Almost immediately, a nearby spectator observed that the Guard was trapped between the tender and the carriage and tried to alert the Driver to the situation. The green shaded areas in *Photos 5* and *6* indicate the area where the Guard was trapped. The photos also show the buffers on the tender and their absence on the carriage.

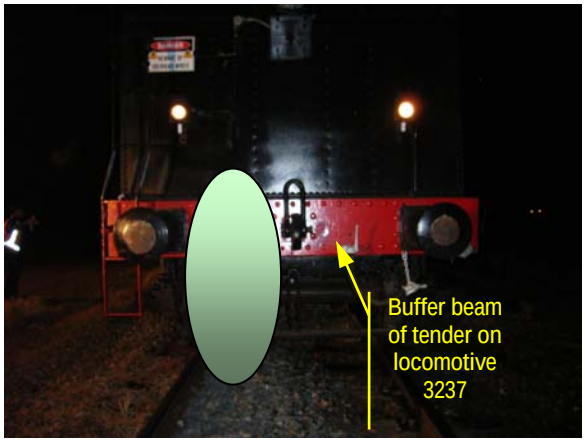


Photo 5: Shaded area indicates area of the tender's buffer beam where the Guard was crushed

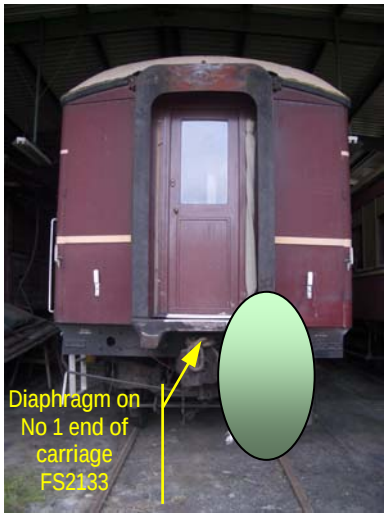


Photo 6: Shaded area indicates the area of carriage's diaphragm where the Guard was crushed

2.12 Another witness in close proximity to the Guard on the Driver's side of the train shouted "*Go forward*" repeatedly and waved his arms to alert the Driver. The Driver, recognising something was amiss, attempted to move the locomotive away from the train. However, because of the type of controls on this steam locomotive (see *Photo*

[11] A caution hand signal indicates to a driver that he/she is to move towards the person giving the caution handsignal, but must be prepared to stop if given a stop hand signal, or if he/she loses sight of the hand signaller (see ARTC *Network Rule ANGE 202)*

7), it took approximately 20 seconds before the locomotive responded to the Driver's control inputs. When the locomotive did move, the Guard slumped onto the track.

Photo 7: The locomotive's controls

Emergency Response

2.13 LVRS members nearby rushed to render first aid whilst others called for an ambulance. Two off-duty ambulance officers, who were spectators at the ceremony, moved to the scene of the accident and relieved the members attending to the Guard. Local Police from Ariah Park arrived on site shortly thereafter.

2.14 At approximately 12:01pm, an off-duty Train Controller who had earlier been a passenger on SS83, advised the Train Controller at Junee of the accident. He also advised that the emergency services had been notified. The Train Controller at Junee then commenced ARTC's incident notification procedures. While this was occurring, an off-duty Station Master from Temora who was a member of LVRS, a co-organiser of the event and part of the official party, relieved the off-duty Train Controller of his assumed responsibility as the rail incident commander. The new incident commander, under instructions from the Train Controller at Junee, ensured that the train was properly secured.

2.15 At 12:20pm, ARTC's Manager Train Control at Broadmeadow notified OTSI's Duty Officer of the incident. OTSI's duty investigator of the day commenced to deploy, by road, at 12:30pm. Five minutes later the Police Radio Room at Wagga Wagga

advised the Train Controller at Junee that WorkCover had been advised of the incident.

2.16 LVRS's acting Operations Manager arrived on site at approximately 12:40pm and immediately liaised with Police and assumed the role of rail incident commander.

2.17 The ambulance departed the scene of the accident at 12:41pm with the Guard's condition being described as critical. At 2:40pm, the Police Radio Room advised OTSI that the Guard had died as a result of his injuries and that they had declared the accident site to be a crime scene and, as such, were assuming overall responsibility at the scene.

2.18 ARTC's Safety Officer, who had deployed from Goulburn, assumed the role of rail incident commander at 3:15pm. OTSI's investigator arrived on site at 6:30pm and was followed by a representative from ITSRR at 7:45pm. By 10:05pm OTSI's investigator and ITSRR representative had sufficient information to release the site to ARTC.

Medical and Toxicological Information

2.19 The three remaining crew members of SS84 were breath-tested on site by NSW Police and returned negative results. The crew members were then allowed to depart the scene.[12]

Train Information

2.20 Train SS83/SS84 consisted of a 32 Class steam locomotive, No. 3237, a tender and five passenger carriages. The train measured approximately 120 metres in length and was hauling 201 tonnes. Additional Rolling Stock information is attached at Appendix 1.

Crew Information

2.21 The four crew members operating SS83/84 were volunteer employees of LVRS. The Guard was also a permanent employee of the Rail Infrastructure Corporation (RIC), seconded to ARTC, and in the normal course of his employment was a signaller at Temora.

[12] The requirement for persons directly associated with such an accident to under undergo mandatory drug testing was not established until 4 August 2006.

Meteorological Information

2.22 Weather conditions at the time of the incident were fine with scattered cloud. Bureau of Meteorology (BOM) readings recorded at Temora Airport on the day indicate a minimum temperature of 8.0°C on the night before the incident and a maximum temperature of 16.9°C on the day of the incident.

Track & Train Control Information

2.23 The rail section between Ariah Park and Temora is non-electrified, single line[13]. The line is classified as Class 2 track, with predominately timber sleepers interspersed with steel sleepers. The track was considered to be in satisfactory condition and was not at issue in this incident.

2.24 Train movements between Ariah Park and Temora are controlled under ARTC's Network Rule *ANSY 504* (Electric Staff System), with Miniature Electric Staff Instrument Machines located at both ends of the section. Train movements within the yard at Ariah Park are conducted under ARTC Network Rule *ANTR 418* (Yard Limits and Yard Working). The maximum operating speed for passenger trains travelling between Ariah Park and Temora is 100km/hr, with steam locomotives being restricted to a maximum speed of 40km/hr when operating tender first.

[13] "Single line" is referred to in ARTC Network Rule *ANSY 504* as a section of line where only one track is provided for both directions of travel. Trains travelling on this section of line must carry a metal token called a staff, which is the authority to occupy that section of line.

PART 3 ANALYSIS

Causal and Contributing Factors

Causation

3.1 Exclusions. On the basis of the autopsy result, OTSI was able to exclude the possibility that the Guard may have been affected by drugs and/or alcohol at the time of the accident. On the basis of testing, OTSI was also able to exclude the possibility that the driver of the locomotive was affected by alcohol. An examination of medical documentation also allowed health issues to be excluded, although anomalies in the area of health assessment within LVRS are the subject of comment in paragraphs 3.27 to 3.29 of this report. Whilst the use of a piece of rolling stock without buffers was a significant factor in this accident, the condition of the rolling stock on SS84 was otherwise not. The weather and track condition were also not at issue.

3.2 Coupling Practices. Modern rolling stock is fitted with 'auto couplers' which automatically engage when two pieces of rolling stock are bought in direct contact during a shunting operation. Older rolling stock, unless it has been retrofitted, must be manually coupled by means of mechanical linkages called transition links (see *Photo 8*). These transition links are used to couple vehicles fitted with automatic couplers (such as that on the FS type carriages) to vehicles fitted with hooks (such

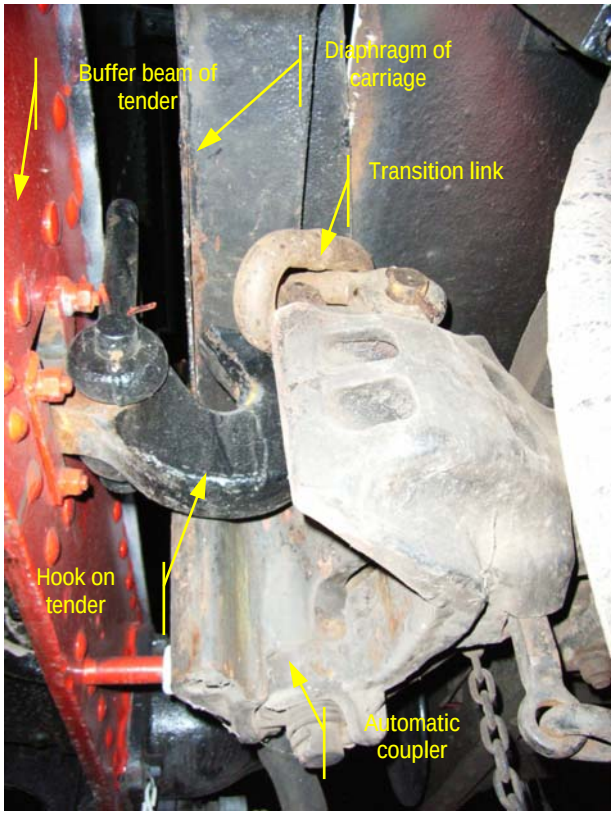


Photo 8: Tender and carriage coupling components (bottom view)

as that on steam locomotive *3237*).

3.3 During coupling, the forces at the moment of impact are lessened by buffers which protrude from the end of the rolling stock. At the low speeds at which shunting operations should be conducted, the buffers compress slightly but the actual bodies of the rolling stock remain separated.

3.4 OTSI noted that the carriage was not fitted with buffers and had a narrow diaphragm. The sole purpose of a narrow diaphragm is to allow passengers to cross between passenger vehicles, whereas wider diaphragms can also act as a buffer. The only safe way to have coupled the pieces of rolling stock in this instance would have been for the Guard to have remained outside the wagon outline until the locomotive had come to rest in very close proximity to the locomotive and then crawled underneath the locomotive's buffers to place the link over the hook (see *Photos 9* to *11*).

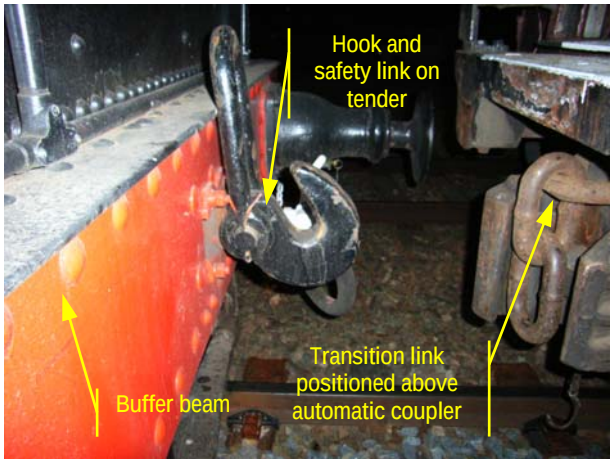


Photo 9: Uncoupled hook and transition link

Photo 10: Tender fully coupled to carriage (side view)

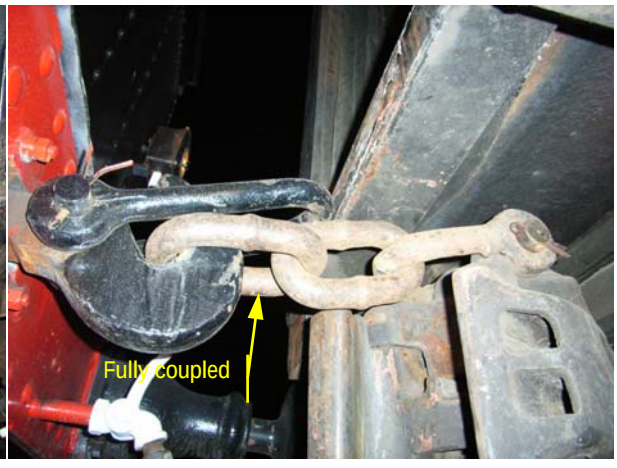


Photo 11: Tender fully coupled to carriage (bottom view)

3.5 While this procedure might have been attempted safely, OTSI has reservations about whether these two pieces of rolling stock should have been considered as suitable for coupling. Given their configuration, there was a possibility that the safety link (which acts as a locking lever) could have lifted thereby causing it to come off the hook (see *Photos 10* and *11*). Had this occurred, the locomotive and carriage would have separated and the train's brakes would have applied when the supply of air through the brake pipe was interrupted.

3.6 In attempting to determine why a decision had been taken to couple two pieces of rolling stock that were basically incompatible, OTSI learned that at the beginning of the day of the accident, SS83 had a water wagon SWT 12 attached to the locomotive and both it and the locomotive tender were fitted with buffers. However, during the preparation of the train in the morning, a decision was taken to remove the water wagon because it was identified that it was possible to replenish the locomotive's water supply at Ariah Park. As a consequence of this decision, the locomotive tender was to be coupled to a carriage that was not fitted with buffers. This meant that there were new risks that had to be managed during any shunting operations that were required throughout the day. At interview, the crew admitted to being preoccupied with getting SS83 underway and therefore did not appreciate the risks associated with the decision to remove the water wagon.

Contributing Factors

3.7 Crew Competency. In attempting to establish how such a fundamental error had been made, OTSI first examined the training records and backgrounds of the crew. While all of the members were experienced rail workers, the following matters concerned OTSI:

a. Although the Guard had been employed in the rail industry for 40 years, most of his experience, not unexpectedly, had been on other than heritage rolling stock. Of more significance, was the fact that the Guard's recent experience was largely confined to signalling. The Guard had joined LVRS in June 2004 and in a matter of days of having done so had undertaken an in-house competency assessment on the duties of a Guard. A subsequent periodical assessment was undertaken in August 2005. However, neither of these required him to demonstrate proficiency in manual coupling and uncoupling. OTSI also noted that these assessments were conducted in different rail sections and there was no evidence provided to indicate that the Guard had ever qualified on the route

between Temora and Ariah Park. OTSI was advised that the Guard had coupled two pieces of heritage rolling stock, fitted with buffers, on a weekend activity with LVRS in October 2005. It was further advised that the Guard had also coupled two pieces of rolling stock, using a similar transition link as that used on the day of the accident, in Temora Yard on 14 April 2006. However, on these occasions, both pieces of rolling stock were fitted with buffers. In addition, OTSI understands that on the latter occasion, the Guard waited until both pieces of rolling stock were stationary before crawling underneath the buffers to position the transition link. This was a different approach to the one employed by the Guard, with tragic consequences, on the following day. In sum, OTSI had reason to believe that LVRS had not properly established the Guard's level of competency in the coupling of heritage rolling stock.

b. The certificates of competency issued to the Trainer Assessor, the Fireman and the Acting Driver had expired by two weeks and two and four months respectively.

c. None of the LVRS certificates of competency had dates of issue and only the Guard's certificate had been signed by the holder.

d. The Driver was the only member of the crew to have formally demonstrated his knowledge of the route between Temora and Ariah Park. His qualifications were made available to OTSI, but LVRS was unable to provide records to substantiate that any of the other persons on the crew had qualified to operate the 32 Class locomotive. On the day of the accident, the Driver was "piloting" the other crew members, i.e., helping them familiarise with the route and operation of the 32 Class as a pre-requisite to their formal assessment on the locomotive and the route.

3.8 Fatigue. All rail safety workers have a significant responsibility to their primary employer to report for duty in a condition which allows them to conduct their duties in a safe and professional manner. However, like all accredited rail operators in NSW, LVRS was obliged under Section 43 of the NSW *Rail Safety Act 2002* and under the terms of its accreditation to implement a program for the management of fatigue. OTSI noted that ITSRR had provided all accredited operators with related guidance, entitled "G*uidelines to the Management of Fatigue"* on 1 January 2004. Paragraphs 2.2 and 2.3 of these guidelines reminded all rail operators that they "…*have a responsibility to establish and maintain working conditions that allow Railway employees sufficient opportunity to obtain adequate rest between shifts"* and that they *"… must place a duty on railway employees to report for work rested and fit for*

duty" respectively. LVRS's Safety Management System (SMS) indicates that Supervisors should *"…rely on visual assessment to ensure staff are sufficiently rested and alert to perform their duties……..Rostering techniques are also used to avoid fatigue".*

3.9 An examination of the Guard's volunteer commitments with LVRS and work commitments with ARTC indicated that he had worked 18 of the 20 days[14] preceding the accident. This situation came about because the planned breaks built into ARTC's master roster were removed when changes to the roster were made at a local level. These changes had the unintended effect of negating ARTC's attempts to ensure that their employees were sufficiently rested. This was compounded by the fact that neither LVRS nor ARTC had visibility of the Guard's commitments in the other organisation.

3.10 A closer examination of ARTC's rosters revealed that the Guard had worked nine consecutive days in his fulltime role as a Signaller with ARTC during the period 6 -14 April 2006. The first three of the nine shifts were night shifts, commencing at midnight, and the following six were evening shifts, finishing at midnight. Had the Guard not been fatally injured at Ariah Park, he would have been required to commence an afternoon shift with ARTC the same day, i.e., he would have worked one shift with LVRS and another shift with ARTC on 15 April 2006. He was also due to work shifts with ARTC on 16 and 17 April 2006. Had he done so, this would have seen the Guard working 22 shifts in 23 days.

3.11 The NSW *Rail Safety Act 2002* does not define "employment", however, it does define a railway employee as being *"…a person who, without remuneration or reward, voluntarily and without obligation performs railway safety work for an operator of the railway*." LVRS had no system to provide itself with visibility of the Guard's roster within ARTC and ARTC was unaware of the fact that the Guard was a volunteer worker with LVRS. ARTC does have a policy on secondary employment (*External Employment, Policy Number HR06-004)* which states that *"Employees shall not, during the term of their employment, engage in any other employment without the prior written consent of the relevant General Manager".* However, OTSI spoke with a number of ARTC employees in the area who were also working with LVRS on a voluntary basis and it was apparent that they did not appreciate that under the NSW *Rail Safety Act 2002,* such work is regarded as employment and that, as such,

14 Note that three of the preceding 20 days were shifts that were of three hours or less duration, the third of these short shifts being worked on 2 April 2006.

they were obliged to declare this work to ARTC.[15] OTSI considers that ARTC should make its external employment policy more explicit in this regard.

3.12 The 'net effect' of the limitations in LVRS's fatigue management arrangements and ARTC's external employment policy, and its rostering arrangements, was that both operators were rostering the Guard for rail safety duties in the absence of knowledge of his shifts with the other party and had, unwittingly, placed an excessive level of demand upon the Guard in the weeks leading up to the accident.

3.13 Work Load and Distraction. There are a number of factors which could have added to the workload of the Guard, or distracted him, on the day of the incident. The incident occurred at 11:52am, eight minutes prior to the scheduled departure time of SS84 from Ariah Park. During this period, the Guard was required to couple the locomotive to the carriage; arrange for passengers to board; contact train control and seek authorisation to depart; carry out the necessary safe-working procedures and then signal the Driver to confirm that he was clear to depart. This was a high work load for someone who was inexperienced in the performance of such duties.

3.14 In addition, video footage of SS83/84 on approach to Ariah Park shows a number of instances of spectators, including children, in very close proximity to the train and the Guard. These spectators were well within what is considered to be the 'danger zone'[16] and their presence could have constituted a source of distraction to the Crew and the Guard in particular. Finally, OTSI was advised that in addition to his commitments to the train's preparation and his specific responsibilities as a member of the crew while it was in service, the Guard had also played a major role in the overall arrangements for the Centenary celebrations. It is possible, therefore, that the program for the rest of the day might also have been a source of distraction.

Compliance with Conditions of Accreditation

3.15 LVRS was founded in 1974 and was first accredited to operate within defined locations as a heritage operator in 1995. Under the terms of its current accreditation, LVRS is authorised as an owner of infrastructure at Cowra and an operator of rolling stock, and is permitted to conduct heritage operations on both ARTC's and RailCorp's networks. Under the terms of its accreditation, LVRS is also obliged to have a Safety Management System (SMS) within which it must systematically identify, analyse and treat risk.

[15] The Guard was technically an employee of RIC but under the terms of his secondment, was bound by ARTC's policies.

[16] Refer to section 1.14 for a definition of the danger zone.

3.16 OTSI viewed the results of a number of compliance audits dating back to 2000 and concluded the LVRS had, over time, a 'mixed' compliance record. An audit of LVRS's rail safety plan (SMP) and environmental plans (EMP) by the Rail Access Corporation (RAC) in July 2000 identified two major and six minor non-conformances within the SMP and four major and one minor non-conformance with the EMP. The non-conformances related to the design and control of documentation; the content and dissemination of safety policies; health and fitness assessments; risk assessments and the testing and inspection of rolling stock. OTSI noted that at a meeting in February 2001, LVRS expressed strong objections to the then rail regulator, the Department of the Transport (DoT), concerning RAC's auditing process. The meeting closed without agreement being reached on action plans to address the non-conformances.

3.17 DoT conducted a compliance inspection of LVRS in May 2002 but limited its audit activity to the inspection of rolling stock and infrastructure, and there was no reference in the audit report to the other deficiencies that had been identified in July 2000. By late 2002, the Board of LVRS was considered dysfunctional and described itself as such in a letter to the Regulator, because of internal conflict. At this time, LVRS was also under investigation by the Department of Fair Trading. The AGM held in December 2002 was declared invalid and a new Board was not elected until March 2003. During the period between the AGM and the Board's election, the organisation's annual obligation to provide evidence to support ongoing accreditation[17], due annually on the 14th January, lapsed; a matter that escaped the attention of the Regulator.

3.18 OTSI noted that the most recent audit of LVRS was conducted by ITSRR (the current Rail Regulator) on 22 March 2005. There was no reference to the deficiencies identified in previous reports, but ITSRR did identify, in its own right, deficiencies in the following areas:

a. document control;

b. the definition of the roles and responsibilities of the Board;

c. incident management procedure and responsibilities;

d. record keeping, especially in the area of competency assessment;

e. operator specific procedures (OSPs);

f. interface coordination plans (ICPs);

[17] This annual obligation of accredited operators includes submitting an annual safety report, declaring freight/passenger figures and declaring variations, or amendments to their accreditation.

g. fatigue management, and

h. risk management.

3.19 When OTSI sought to discuss these observations with LVRS, its representatives advised that they had not sighted ITSRR's 2005 audit report, nor were they aware of its detailed findings. It was subsequently confirmed that the report had not been provided to LVRS due to an administrative oversight within ITSRR. OTSI drew on the findings and was not surprised, given that they had not been communicated to LVRS, that there were few indicators to suggest that there had been real progress in the related areas. The most significant of these matters are discussed later in this report under the heading of 'Anticipation and Management of Risk'. OTSI formed the view that LVRS did not have an effective SMS, and in particular, did not have proper systems to identify and manage risk. It concluded, therefore, that LVRS was in breach of its conditions of accreditation.

Conformance with Established Procedures

3.20 Prior to 2002, shunting procedures in NSW had been prescribed in the Rail Infrastructure Corporation's (RIC) *Safeworking Procedures*. These procedures, and the shunting rules therein, were replaced with *Network Rules and Procedures* in December 2002. Under the revised procedures, operators were permitted to undertake their own assessment of their operational risks and to develop their own operator specific procedures to manage those risks provided those procedures were not inconsistent with broader requirements identified in the overarching *Network Rules and Procedures.*

3.21 LVRS has its own operational procedures (LVOPs) and these do describe the actions required to undertake coupling activities. *LVOP 10* (Propelling Movements) required the Driver and Guard to regularly communicate with each other during any propelling movement and *LVOP 16* (Screw Couplings & Transition Links) states that *"When working out of Driver's line of sight, in between vehicles, engage other crew members to repeat verbal directions or hand signals".* The video shows that the Guard communicated with the Driver via hand signals.[18] It also showed a number of instances where the Driver was required to divert his attention from the Guard to focus on the locomotive's controls. This would not have been a problem had a third person been describing the Guard's hand signals and actions to him at the same time. There were two crew members who might have performed this function at

[18] The Guard was equipped with a radio, but like many of his peers preferred to use hand signals when shunting because it left both of his hands free.

Ariah Park during the propelling movement prior to coupling, the Assistant Driver and the Supernumerary Fireman; the former was on a meal break in the dining car at this time. The latter had a disability which made it difficult for him to get into and out of the locomotive[19]. However, the Supernumerary Fireman had been watching for obstructions and onlookers on the left side of the locomotive's cabin and, in the moments before the Guard stepped into the 'four foot', described stepping across to the Driver's side of the cabin to see if he could assist the Driver, because he was busy with the locomotive's controls, and then returning to the left of the locomotive "when everything seemed to be in hand".

3.22 *LVOP 16* states that crews must *"Ensure that vehicles with buffers are only coupled to other vehicles fitted with buffers or diaphragms".* This instruction was clearly deficient in that it should have prohibited the coupling of non-buffered vehicles or one non-buffered vehicle to one that was buffered. Alternatively, if provision was to be made for the coupling of non-buffered vehicles in certain circumstances, then the procedure should have specified how this was to be safely accomplished.

3.23 OTSI also noted that the LVOPs had not been amended to reflect the prohibition notice, issued by ITSRR in July 2004[20], in relation to riding on moving rolling stock. Nor had LVOPs been amended to reflect requirements identified during successive audits. It also noted that the Guard's and the Chairman's actions of riding on the tender's ladder contravened ITSRR's prohibition notice.

Anticipation and Management of Risk

3.24 The key risks that must be managed by any rolling stock operator are those that might arise from the condition of their rolling stock and the actions of their crews. The condition of LVRS's rolling stock was not at issue throughout this investigation, but the competency of the crew of SS83/84 was.

3.25 Under the terms of its accreditation, LVRS, like all rail operators, is required to have a system to ensure that crew members hold, and maintain, appropriate qualifications and knowledge to operate specific equipment over specific routes and to ensure that

[19] This person was returning to crewing after having been involved in a serious vehicle accident which had permanently impaired his mobility. On the day of the accident, this person was being 'trialled' to establish if he had sufficient mobility to undertake the training necessary to re-qualify in a new role.

[20] The Prohibition Notice issued in July 2004 read in part: "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 "*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.*"

they are capable of responding appropriately in degraded and/or emergency conditions. LVRS is also obligated to ensure that its crews have been medically assessed as being fit enough to perform rail safety duties and to ensure, on an ongoing basis, that they are sufficiently rested.

3.26 Competency Assessments. As indicated in paragraph 3.7, there were a number of indicators to suggest that LVRS's system for ensuring that crew held and maintained relevant competencies was not effective. When OTSI examined the crew assessment sheets provided by LVRS, it noted that there were no references to driving standards or any assessment criterion thereon. At interview, LVRS's Trainer/Assessor[21] indicated that he was unaware of Guidelines published by ITSRR's *Guidelines for Certification of Competency*. He described LVRS as drawing heavily upon "recognition of prior learning' and indicated that volunteers who were fulltime rail employees were generally regarded as requiring little additional training. He was unable to provide any documentation which indicated that the Guard had formally qualified as such, nor any rationale to indicate why LVRS should have assumed that a Signaller was competent to perform a Guard's duties. Nor could he provide any record of the Guard having ever received any practical assessment in the use of coupling arrangements using transition links.

3.27 Health Assessments. Category 1 and 2 rail safety workers[22] are required by regulation to undergo a health assessment every five years until the age of 50, then two years until the age of 60, from which time they must submit to annual assessment. The Guard was aged 58 and had undergone a medical assessment, under ARTC's arrangements, in December 2004. When he commenced voluntary work with LVRS, the Guard provided proof of his medical assessment. LVRS accepted this as being sufficient to allow him to perform the duties of a guard without considering that their might be different risks attached to the Guard's employment within its organisation.

3.28 Both the Driver and the Assistant Driver were over 60, and as such were required to undergo a health assessment on a yearly basis. LVRS's records indicated that both employees had undergone a medical assessment in July 2005 i.e., their health assessments were 'current'.

[21] This person was also responsible for the development of LVRS's operational procedures and the development and maintenance of its competency database.

[22] Workers whose roles are considered as being safety critical eg drivers, assistant drivers, firemen and guards can undergo either a Category 1 or 2 level health assessment. The level of assessment is determined by the employer, based on their assessment of the level of risk attached to the related work.

3.29 The Supernumerary Fireman was under the age of 60 and had last undergone a health assessment in May 2003. With the introduction of the *National Standard for Health Assessment of Rail Safety Workers on 1 July 2004,* rail safety workers were to be classified into one of four employment categories for health assessment purposes. Where an employee was considered to be undertaking safety critical roles, i.e., their actions or inactions might lead directly to a serious incident affecting the public or rail network, he/she was to be allocated to either Category 1 or 2, according to their employer's assessment of the related employment risks. Under transitional arrangements that accompanied the introduction of the new health assessment standard, Category 1 and 2 rail safety workers were given 18 and 24 months respectively, from 1 July 2004, within which time they were required to submit to the revised health assessment regime. All of LVRS's crew members should have been deemed Category 1 or 2 members at this time; however, the Supernumerary Fireman was not placed into a specific category at this time. Had LVRS exercised its prerogative to have deemed him a Category 2 worker, the Supernumerary Fireman had until 1 July 2006 to submit to a new medical assessment, i.e., he could have been considered 'current' at the time of the accident. However, Section 9.3 (Volume 1) of the Standard identifies certain events or circumstances as being 'triggers' that require an employee to be automatically re-assessed. OTSI noted that the Supernumerary Fireman was returning to crew duties after an injury that had seriously and permanently restricted his mobility. As such, he should have been required to submit to a new health assessment prior to returning to any form of crew duty, but had not done so.

3.30 Risk Management. Given the number of identified procedural errors, unsafe acts and violations that occurred on the day of this accident, OTSI sought to establish if any risk assessment was conducted prior to the day's operation. It found no such evidence. LVRS Operation's Manager has primary responsibility for the conduct of such assessments. The acting LVRS Operation's Manager on the day, indicated that he had not been entirely conversant or comfortable with the duties at the time and that he had not had any formal training or experience in risk management. However, he was not alone in this regard; OTSI could find no evidence at the time of any Board member having any formal risk management or safety qualification.

3.31 LVRS's SMS identifies the need for risk management plans to be reviewed at every Committee (Board) meeting. A check of the Board's minutes established that only 6 of the 12 scheduled meetings in 2005/2006 had occurred and that, with one exception, safety and risk were not specific agenda items. The exception was April

2006, the first meeting after the accident. The following additional matters attracted OTSI's attention:

a. There was no record of LVRS having reviewed its operational risks and hazards since July 1998 and the very rudimentary risk register that did exist made no mention of the risk of coupling operations involving one or more pieces of rolling stock that were not fitted with buffers.

b. Not all changes to operating procedures had been underpinned by risk assessments and the changes themselves had not always been properly documented and/or promulgated.

c. While LVRS had incident management and environmental management plans, there was no evidence to suggest that its staff had participated in any form of related training.

d. There was little evidence to suggest that LVRS had responded effectively to ITSRR's notice prohibiting the practice of riding on rolling stock unless it was specifically configured to allow such an activity to occur safely. LVRS gave assurances to OTSI that this prohibition notice had been promulgated to staff but were unable to substantiate this. OTSI did establish, by questioning, that there was some awareness of the prohibition amongst LVRS staff but that there were varying interpretations of what it meant in the context of LVRS operations. Some staff thought that the prohibition only applied to freight operators, while others considered that the tender could be considered a permanently attached extension of the locomotive and as such that there was a "*designated operating station or other enclosed space*". No-one within LVRS had sought to clarify these interpretations with ITSRR.

Effectiveness of Emergency Response

3.32 LVRS was not well placed to respond to the emergency. There was no formalised emergency plan for the day and there was no evidence to indicate that its generic emergency arrangements had ever been tested. Notwithstanding, the Guard was attended to very quickly by two off-duty ambulance officers who happened to be attending the celebrations in an informal capacity. They relieved LVRS members administering first aid and commenced more advanced treatment while awaiting the arrival of the ambulance from Temora. Local Police from Ariah Park arrived on site shortly after.

3.33 OTSI noted that ARTC's train controller at Junee was initially advised of the incident by an off-duty ARTC employee at the celebrations and that the person nominated as LVRS's incident response coordinator failed to respond to calls from the Train Controller. In the absence of a defined incident manager for LVRS, two other off-duty ARTC employees provided initial on site communications and coordination with train control until LVRS's acting Operations Manager arrived from Temora. OTSI subsequently established that the contact details available to ARTC reflected arrangements that had prevailed in previous years, but which had long since expired. OTSI also established that the limitations of LVRS's incident management policy had been identified during a compliance audit by the ITSRR in March 2005.

Remedial Actions by LVRS and ITSRR

3.34 LVRS. LVRS reviewed its Incident Management Manual immediately following the incident and subsequently incorporated a risk analysis of the coupling function into its risk register. The latter makes more specific reference to the use of transition links and screw couplings and, importantly, the need for rail safety workers to be clear of the 'four foot' when one or both vehicles are moving, or are not secured. However, the related revised procedure still has limitations, in that it does not allocate tasks during manual coupling operations nor allow for variations in buffer, diaphragm and coupling configurations. OTSI also noted that LVRS had yet to incorporate any reference to the risk of continuing to shunt when the driver is out of sight.

3.35 LVRS has also subsequently updated its risk register, installed buffers to the No 1 end of carriage FS 2133, and is in contact with an overseas heritage operator who is using a portable automatic coupler which is capable of being fitted to manual draw gear, to establish whether this equipment is suitable for use within LVRS.

3.36 ITSRR. In response to this incident, ITSRR issued two prohibition notices and three rail industry safety notices.[23] The first prohibition notice prohibited the manual coupling of rolling stock by the use of a Transition or Screw type Coupling by a person standing in the 'four foot' (i.e., between the two rails forming the track) between units of rolling stock while either or both units were moving. The second notice prohibited any activity within the rolling stock outline when any units were moving, or not secured. The three safety notices that were issued by ITSRR addressed the need to prohibit public movement within the rail corridor and specifically the 'danger zone'; reinforced the prohibition notice on activity within the rolling stock outline when any units were moving or were not secured, and reiterated

[23] Referred to earlier in paragraphs 1.11, 1.12 and 1.14 of this report.

the requirement for all accredited operators to ensure that their railway employees were competent.[24]

Other Safety Matters

3.37 Unique Challenges facing Heritage Operators. Given the limitations of crew actions on the day of the accident and the absence of an effective SMS within LVRS, it would have been easy for OTSI to conclude the LVRS was a dysfunctional entity and to recommend that its accreditation be withdrawn. Instead, OTSI found that the Board was extremely committed and that it was the 'glue' that was keeping the LVRS in business. Not only were the members of the Board trying to discharge their governance responsibilities, they were actively involved in nearly all of the operator's routine activities, including crewing.

3.38 Rail Heritage operators make an important contribution to the preservation of the nation's rail heritage and a significant contribution to the community on an unpaid, voluntary basis. In many respects, they are not unlike other sporting or community-based organisations, in that they are required to compete for members and funding and the burden of office falls upon a few. LVRS was no exception. The significant difference between rail heritage operators and other community based volunteer organisations is that they are obliged to have formal risk management systems in place and are required to report, in various forms and at various times, to a significant number of authorities. LVRS cited the challenges it faces in reporting to nine such authorities.[25]

3.39 LVRS operates some form of train service every month and special events during the long weekend periods in April, June and October. It is also available for charters and typically provides one such service a month. This level of activity needs to be underpinned by ongoing maintenance of its rolling stock. The majority of LVRS's funding comes from paying passengers on its scheduled heritage services and special events, charter operations and the leasing of its rolling stock to other operators, augmented by membership fees and donations, all of which requires considerable administrative effort. LVRS advised OTSI that it has approximately 250 members of whom 10% could be considered as being actively involved in the running of its operations. Clearly, this places a significant level of demand upon a relatively small group of people and under such circumstances, it is not difficult to see why

[24] The latter safety notice was triggered after a series of incidents, one of which included the incident at Ariah Park.

[25] These entities are ITSRR, ARTC, ARTC Rail Estate, RailCorp, the Department of Fair Trading, the Department of Gaming & Racing, the Environmental Protection Authority, WorkCover, and the Cowra Shire Council.

matters as the development and maintenance of an SMS, and the subsystems therein, did not receive due attention.

3.40 LVRS has not suffered from a lack of scrutiny by regulators over time and its many deficiencies have been apparent, albeit in varying forms, for some time. Successive regulators have struggled to strike a balance between providing LVRS with some 'margin' in recognition of the difficulties it faces as an operation sustained by volunteers, and their regulatory obligation to ensure that LVRS operates safely. OTSI would observe that this dilemma has also been posed by other heritage operators from time to time.

3.41 Under the current regulatory regime in NSW, ITSRR accredits all operators on the basis of their demonstrating that they have an appropriate and effective SMS, and it has issued guidelines as to what should be contained in a SMS. ITSRR recognises that not all operators are required to manage the same degree, or types, of risk and appreciates that the SMS of a heritage operator will be less sophisticated than that of a major public passenger or freight operator's. However, the onus remains on all operators to identify the risks that are inherent in their operation and to have systems in place to manage those risks. This is a significant challenge for even major operators and one which is proving very problematic for heritage operators; a matter that has not escaped ITSRR's attention.

3.42 In 2005, ITSRR commenced work, on behalf of the National Rail Safety Regulators' Panel (RSRP) to provide guidance on SMS requirements for tourist and heritage operators. This guidance was subsequently published by the RSRP in April 2006. ITSRR also made the guidance available on its website and distributed hard copies of the guidance to heritage operators. To support the publication of the guidance by the RSRP, ITSRR also held a workshop for heritage operators in Sydney on 6 May 2006. The workshop included a session on the guidance material and all accredited NSW heritage operators were invited to attend. In the second half of 2006, ITSRR provided funding to Rail Heritage Australia to engage a consultant to help heritage operators develop and document their SMSs. OTSI understands that this assistance was made available only to smaller, non-mainline, heritage operators because it was felt that they were having the most difficulty in meeting the new SMS requirements. LVRS did not therefore benefit from this particular endeavour. This project has since been suspended whilst ITSRR reviews alternative ways of supporting heritage operators to meet their SMS obligations.

3.43 OTSI believes, however, that further effort is required to bridge the gap between ITSRR's requirements of heritage operators, and the difficulties heritage operators

are having in satisfying those requirements. Most heritage operators lack either the expertise and/or the time to document procedures and to build systems of the required standard. Many also lack proficiency in risk management. OTSI believes that rather than continuing to simply identify the limitations in heritage operators' SMSs, ITSRR also needs to work more directly with these operators to develop their systems. OTSI appreciates that adopting such a role involves some risk because in the event of a heritage operator having a major accident, ITSRR might be seen as being implicated by association. However, OTSI believes that by allowing heritage operators with deficient systems to continue to operate, ITSRR is exposed to greater risk. Moreover, that risk is likely to persist for a longer period than otherwise would be the case if ITSRR engaged in active intervention.

3.44 OTSI believes that ITSRR needs to devote dedicated staff effort to building the capacity of heritage operators to operate safely. This effort should not be focused on auditing heritage operators, but to providing education and training in the requirements of accreditation audits and compliance inspections, and the means by which to effect rectification of deficiencies that are identified during accreditation audits and compliance inspections. In addition, to provide an additional layer of safety, ITSRR might deem it a requirement for the risk management plans for major events on the calendars of heritage operators to be submitted to it for technical clearance before the event is conducted. In performing these functions, ITSRR would acquire a better understanding of heritage operations as a whole, and be in an informed position to identify systems and solutions that have been successfully applied by particular heritage operators to whom others can be directed as examples of "good practice".

3.45 Quite apart from the need to work with heritage operators before and after audits and inspections, OTSI believes there is scope for improvement in ITSRR's conduct of audits and inspections. As previously identified, OTSI noted several instances where major deficiencies in one audit were not the subject of comment in a subsequent audit. Such an absence of commentary leaves unanswered the question whether the deficiencies previously noted have been rectified. OTSI believes that while the focus of an audit or inspection might change, there should be commentary in subsequent audit reports to indicate that matters previously identified as being deficient have been the subject of satisfactory rectification or otherwise. OTSI also noted that LVRS does not seem to have been assessed during any operational activities, e.g., while operating on main lines or while conducting real shunting operations, including coupling.

Summary

3.46 Accidents are rarely the result of a single factor and the accident at Ariah Park was no exception. The accident occurred when the Guard stepped into an unsafe position to couple the tender to a carriage. However, the conditions for this accident were established during the preparation of SS83/84 when the crew, which included the Guard, made a decision to remove a water wagon which meant that later in the day, a carriage that was not fitted with buffers would have to be coupled to a tender immediately behind the locomotive. Such an action violated the intent of *LVOP 16* and created new risks which had to be managed when this action was to occur, but these risks were not appreciated by the crew at the time the decision was made.

3.47 LVRS is obliged under the conditions of its accreditation to identify and manage risk within the framework of a Safety Management System (SMS). There was considerable evidence to suggest that LVRS did not have an effective SMS. This was most apparent in the areas of risk management, operational and emergency planning, policies and procedures, competency, health assessments and fatigue management.

3.48 There was no evidence to suggest that LVRS had deliberately sought to ignore its obligations; rather LVRS lacked the competency and capacity to address a number of its key obligations, particularly the requirement to identify and manage risk in a systematic way. This situation is not unique to LVRS as it also confronts other heritage operators. Successive rail Regulators have found it difficult to reconcile the contribution that such operators make to the State's rail heritage, and the public's interest in seeing such operators continuing to function, with the limited ability of heritage operators to maintain effective safety systems. OTSI believes that this will continue to be the case unless heritage operators are provided with directed education and training in the formulation and maintenance of such systems.

PART 4 FINDINGS

4.1 In relation to those matters prescribed by the Terms of Reference as the principal lines of inquiry, OTSI finds as follows:

a. Causation:

i. The accident occurred when the Guard placed himself in an unsafe position between a moving tender and a stationary carriage in order to manually couple the two pieces of rolling stock.

b. Contributory Factors

i. The Guard had worked 18 shifts over the preceding 20 days and had been involved in preparation of the train well into the evening before, and in the early morning on the day of, the accident. It is likely, therefore, that the Guard was affected by fatigue. He may also have been distracted by the presence of spectators in very close proximity to him as he attempted to couple the tender and the carriage.

ii. The Guard was an experienced rail safety worker but his primary experience lay in signalling, and LVRS could not provide evidence to show that he had formally qualified as a shunter or that he had the competence to carry out manual coupling tasks.

iii. When the Guard stepped between the tender and the first carriage, he lost contact with the Driver of the locomotive because he did not employ another crew member to repeat his hand signals to the Driver, as was required by *Lachlan Valley Operating Procedure (LVOP) 16*.

iv. LVRS did not anticipate and manage a range of risks that were associated with their operations on the day of the accident, and their wider operations more generally.

c. Compliance with Accreditation Requirements

i. LVRS was authorised to conduct the type of service being provided by SS83 and SS84 on the day of the accident. However, under the terms of its accreditation, LVRS was obliged to have a Safety Management System (SMS) in place within which it was obliged to identify and manage risk. LVRS's SMS had been identified by the rail regulator, ITSRR, as having major deficiencies in 2005. OTSI's examination of LVRS's SMS during its

investigation led it to conclude that, quite apart from any deficiencies, LVRS was failing to employ its SMS and as such, was in breach of the terms of its accreditation.

ii. Under the terms of the *Rail Safety Act 2002* and its accreditation, LVRS was obliged to comply with all Notices served on it by the Regulator, ITSRR. Video footage taken immediately prior the incident showed the Guard and Chairman of LVRS riding on a ladder on the end of the locomotive's tender which contravened a prohibition notice, *02346/1 – 04/001105*, issued by ITSRR on 7 July 2004.

d. Crew Qualifications and Compliance with the Network Rules

i. Documentation provided by LVRS confirmed that the Driver was fully qualified to operate SS84 but similar records could not be produced to substantiate the qualification of the remainder of the crew. In addition, such documentation that was produced caused OTSI to have reservations about how the related assessments may have been conducted.

ii. The certificates of competency issued to the Fireman, Supernumerary Fireman and LVRS's Trainer/Assessor had expired.

iii. The Supernumerary Fireman should have been required to submit to an updated health assessment before returning to crew duties following a serious injury, but this requirement had not been complied with.

e. Existence and Appropriateness of, and Conformance to, Operator Procedures

i. LVRS had established procedures for propelling, shunting and coupling operations, including LVOP 10 (Propelling Movements) and LVOP 16 (Screw Couplings & Transition Links). However, its operating procedures had not been amended to reflect the requirements of a Prohibition Notice, issued by ITSRR in July 2004, in relation to riding on moving rolling stock. Nor had the LVOPs been amended to reflect requirements identified during successive audits by the Regulator.

ii. The decision to operate SS84 with a carriage that did not have buffers and to attach it to the locomotive's tender, had risks that were not appreciated on the day and was also inconsistent with LVOP 16 which required crews to "Ensure that vehicles with buffers are only coupled to other vehicles fitted with buffers or diaphragms".

f. Anticipation and Management of Risk

i. LVRS did not have a proper understanding of its risks.

ii. LVRS did not have an effective risk management framework in place as evidenced by the absence of:

(1) effective fatigue management arrangements;

(2) an effective competency management process;

(3) effective emergency plans, and

(4) adequate arrangements to control the movement of spectators at Ariah Park.

g. Emergency Response

i. In the absence of a proper assessment of the risks that might present on the day, and limited emergency training over time, LVRS was not well prepared to respond to the accident when it occurred.

ii. LVRS had not provided ARTC, the organisation controlling operations on the network, with an updated list of the representatives to be contacted in an emergency and ARTC was unable to establish early contact with LVRS. However, off-duty ARTC personnel who were attending the celebration took control of the situation at the scene until the arrival of LVRS's acting Operations Manager. One of the ARTC personnel was also a member of LVRS and had helped organise the event.

iii. Notwithstanding the limitations of emergency planning, the Guard received timely and qualified medical assistance at the scene of the accident.

h. Other Matters that would enhance the Safety of Rail Operations

i. Rail heritage operations are sustained by volunteer effort. By virtue of their part-time nature, heritage operators face distinct challenges in meeting the conditions attached to their accreditation. Successive rail Regulators have found it difficult to reconcile the contribution that such operators make to the State's rail heritage; the public's interest in seeing such operators continuing to function, and the limited capacity of some operators to maintain effective safety systems. OTSI believes that this will continue to

be the case unless heritage operators are provided with directed education and training in the formulation and maintenance of such systems.

ii. There was room for improvement in ITSSR's audit and inspection processes, but that ITSRR has acted to address the related deficiencies.

iii. ARTC's policy on secondary employment "External Employment (Policy Number HR06-004)" and the rostering processes which underpin its management of fatigue, warrant internal review.

PART 5 RECOMMENDATIONS

5.1 In order to prevent a recurrence of this type of accident, the following remedial safety actions are recommended for implementation by the organisations specified below:

a. Independent Transport Safety and Reliability Regulator

i. Undertake a thorough review of LVRS to determine whether it is appropriate for it to continue to be an accredited heritage operator;

ii. If it is deemed that LVRS should retain its accreditation, prioritise any deficiencies that must be rectified and work with the operator to rectify these deficiencies;

iii. Increase its monitoring of LVRS, giving particular emphasis to the functioning and focus of its Board and the extent to which the operator is meeting its compliance obligations;

iv. Reiterate the requirements of Prohibition Notice 02346/1 – 04/001105, perhaps making them more explicit, to all operators;

v. Recognising that there are lessons that might benefit others from this accident, ensure that this report is bought to the attention of all accredited heritage operators in NSW;

vi. Continue to refine its audit and compliance processes to ensure that matters identified in previous audits and compliance activities that have not been closed-out are carried forward to future audits and inspections. Ensure that any related reports are made available to the operator in a timely fashion;

vii. In recognition of the important contribution made by rail heritage operators and the distinct challenges they face as part-time organisations, examine its capacity and assess the desirability of devoting dedicated staff effort within ITSRR to provide education and training in the formulation and maintenance of Heritage Safety Management Systems, and to refer operators to others whose systems and procedures represent “good practice” in particular aspects of heritage operations.

b. Lachlan Valley Railway Society Limited (LVRS)

i. Review the operations and focus of its Board to ensure that it is meeting its legal obligations. If the Board does not have the expertise to address fundamental requirements such as risk management, act to acquire or engage the necessary expertise.

ii. Seek guidance from ITSRR to re-build its Safety Management System.

iii. Conduct an immediate audit of its rolling stock to identify the risks associated with varying buffer, diaphragm and coupling arrangements, and act to either prohibit the use of certain combinations of equipment, or to properly manage such use.

iv. Conduct an immediate check on all certificates of competency and the health assessments of any members engaged in crewing to ensure that they are valid and appropriate to the duties being performed.

v. Immediately review its arrangements for managing fatigue, giving particular attention to situations where it is known that a LVRS crew member performs rail safety work in their primary employment.

vi. Seek immediate clarification from ITSRR in relation to *Prohibition Notice 02346/1 – 04/001105* to ensure that members only ride on rolling stock in an approved manner and/or under approved circumstances.

vii. Consistent with the priorities determined by ITSRR, review *LVOP 1*0 (Propelling Movements) and *LVOP 16* (Screw Couplings & Transition Links) to ensure that communication and coupling requirements are made more explicit, competency assessments are more soundly-based and that emergency training is conducted.

viii. Recognising that considerable effort will be required to undertake the above activities, review, and where necessary amend, its service program to ensure that LVRS does not further compromise the safety of its operations.

c. Australian Rail Track Corporation

i. Amend *"External Employment (Policy Number HR06-004)"* to require that employees undertaking rail safety work on a voluntary basis declare such work, given that such work is considered as 'employment' under the NSW *Rail Safety Act 2002*.

ii. Review its rostering processes to ensure that changes made to 'master' rosters at a local level are advised to those responsible for the maintenance of the master rosters.

APPENDIX 1
ADDITIONAL ROLLING STOCK INFORMATION

Locomotive 3237

3237[26] was built by Bayer Peacock, in Manchester, England, in 1892 and was in active service in NSW from 26 February 1893. It travelled 3,581,052km until it was withdrawn from service in November 1971. Following its withdrawal, it was sold to Lachlan Vintage Village at Forbes and was ultimately on-sold to LVRS in 1980. At that time, 3237 was fitted with the hook, link and buffers which remain in place today. LVRS completed its restoration in August 2005, at which time it was believed to be one of only four surviving 32 class locos and the only one in full working order.

3237 began local trials in Cowra Yard in September 2005 and was used locally again on the long weekend in October 2005 as part of Cowra's rail celebrations. 3237 was not used again until 9 April 2006, when it travelled from Cowra to Temora in preparation for the following Easter weekend Centenary celebrations at Ariah Park.

Carriage FS 2133

FS 2133 is a second class corridor carriage built by Clyde Engineering Company Ltd (Granville) in November 1937 and was in service until condemned in March 1986. The carriage was purchased from the former State Rail Authority by LVRS on 30 June 1987, along with other railway carriages including FS 2091 and FS 2029. Anecdotal evidence suggests that FS 2133 was purchased in its current condition, i.e., with auto couplers (which would have been retrofitted at some time prior) and provision for transition links at both ends, but with buffers fitted only at the No. 2 end.

The original configuration of an FS carriage and that of FS 2133 on the day of the accident are depicted in *Photos 12* and *13* respectively, n.b., the absence of buffers in *Photo 13*.

[26] The 32 class locos can also be referred to as a "P" class steam locomotive; this class includes all locomotives numbered with the prefix 32xx, and 33xx (source "Standards in Steam, The 32 Class" by R.G. Preston)

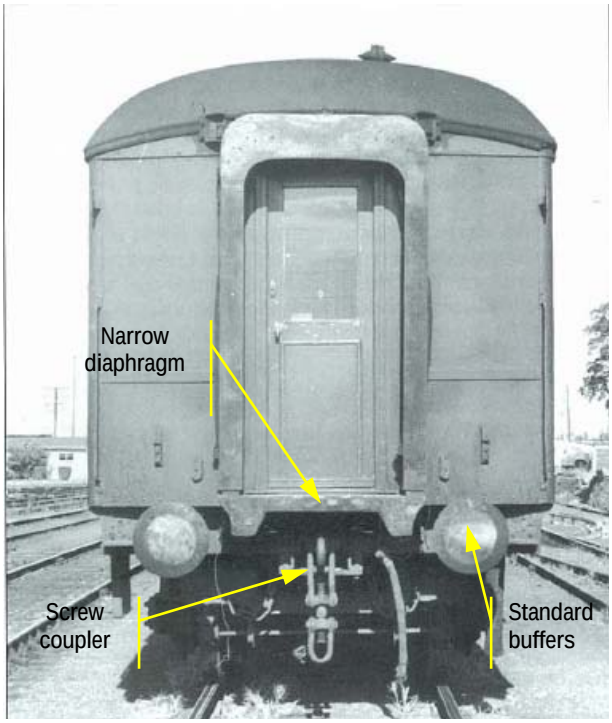


Photo 12: Original configuration of FS type carriage with buffers, screw couplers and narrow diaphragm connection.

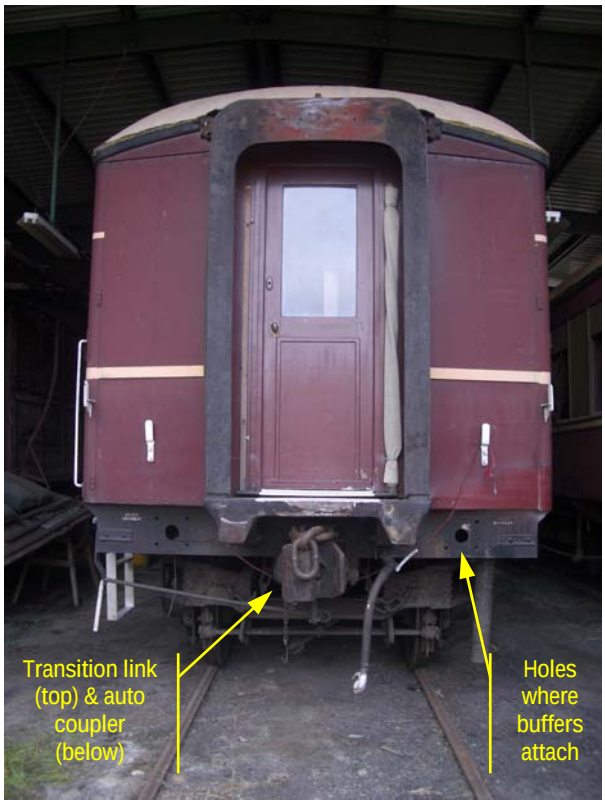


Photo 13: No 1 end of FS 2133 as configured on the day of the accident, n.b., the absence of buffers

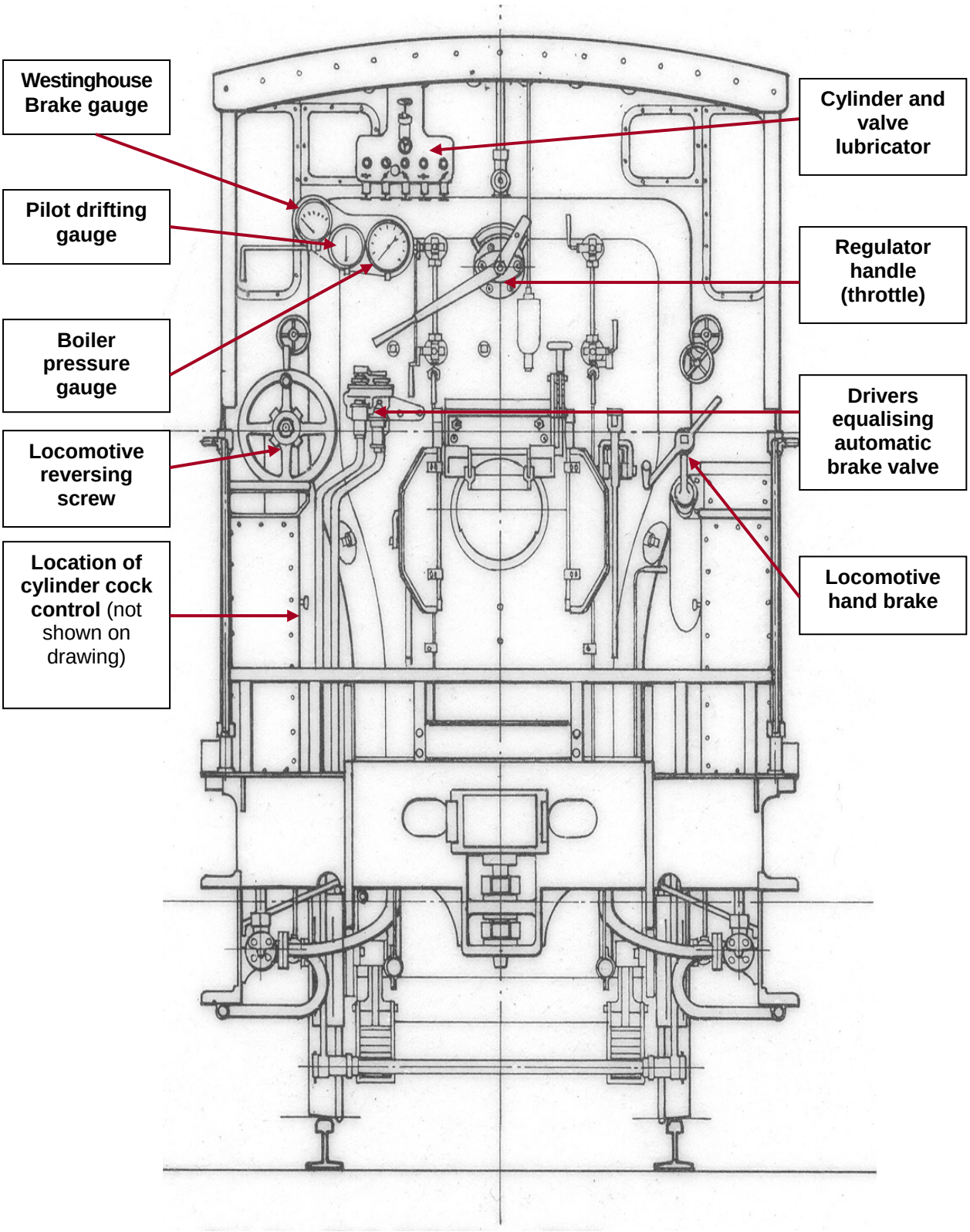


Figure 5: 32 Class Locomotive - Cab Detail

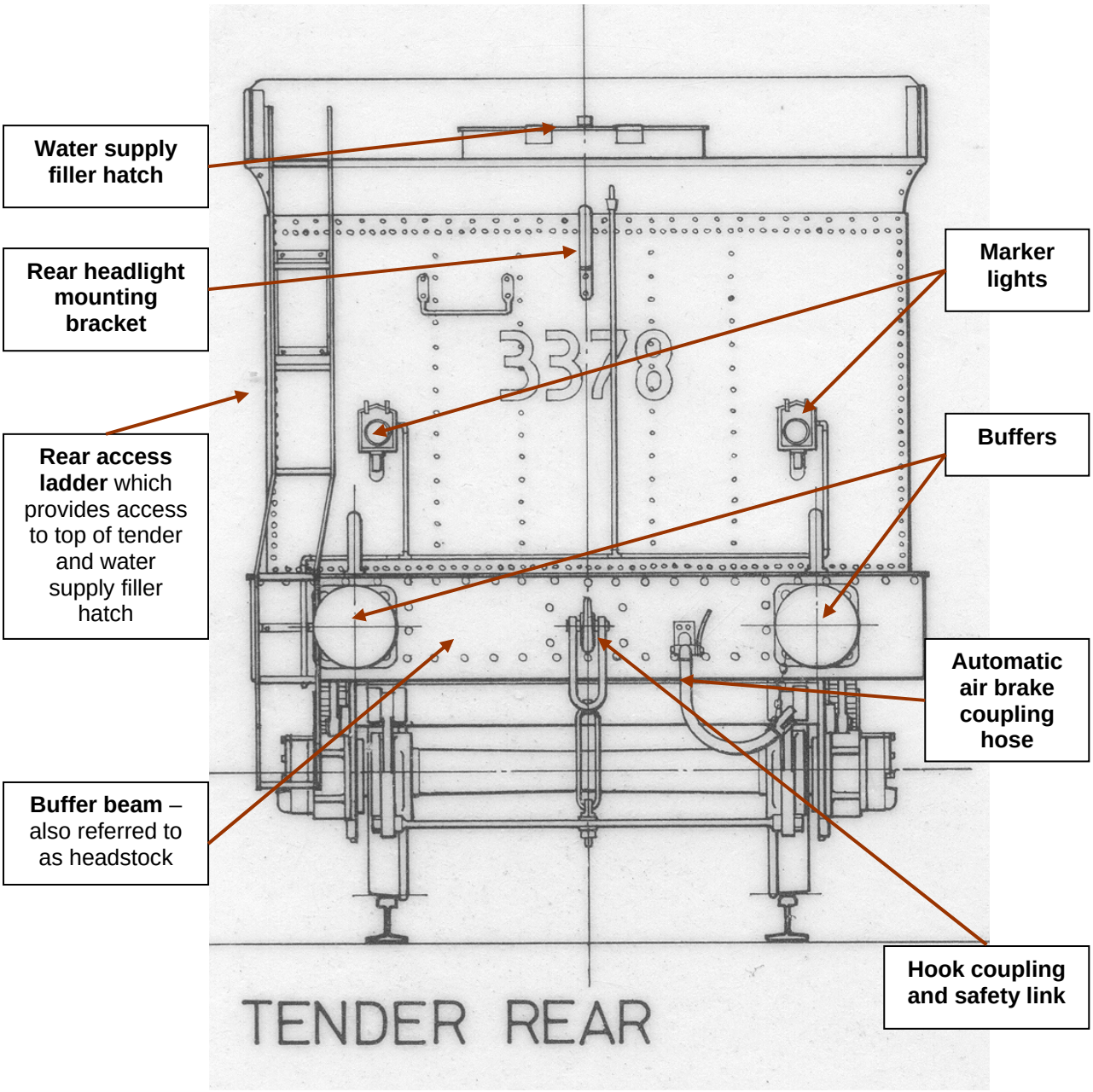


Figure 6: 32 Class[27] Locomotive – Tender Detail (rear view)

[27] Note a total of 191 "P" class locomotives were built and numbering included 32XX and 33XX. OTSI is aware of the existence of four P class locos today, only one of which remains in service. Those interested in more information on the 32 class should refer to "*Standards in Steam, The 32 Class*" by R.G.Preston, NSWRTM.

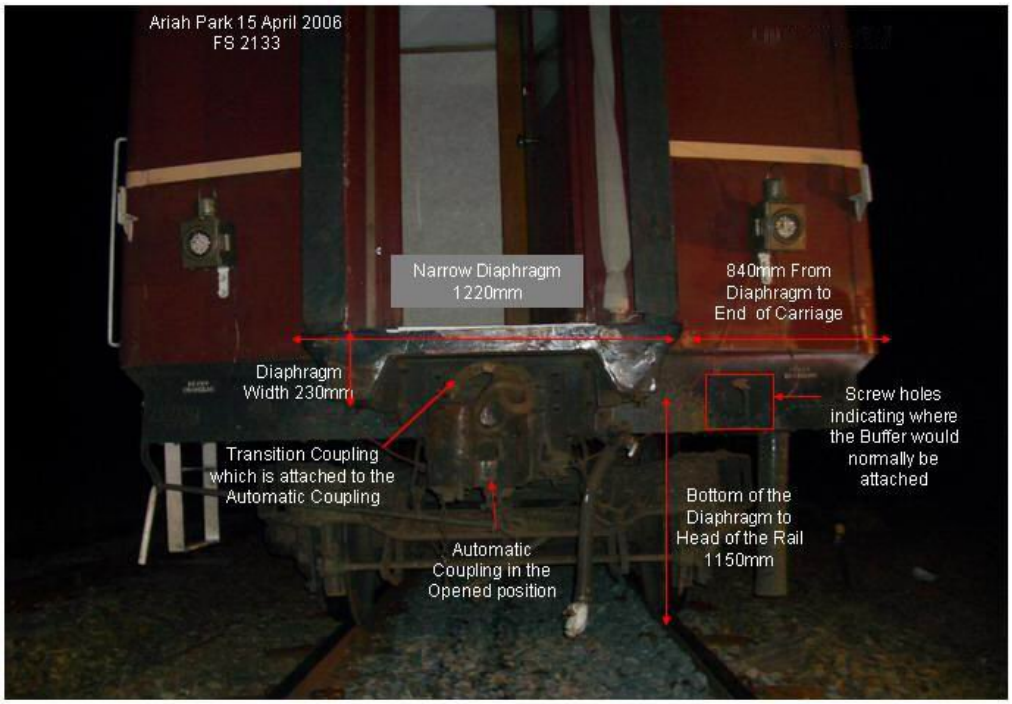


Photo 14: Measurements – No 1 end of carriage FS 2133

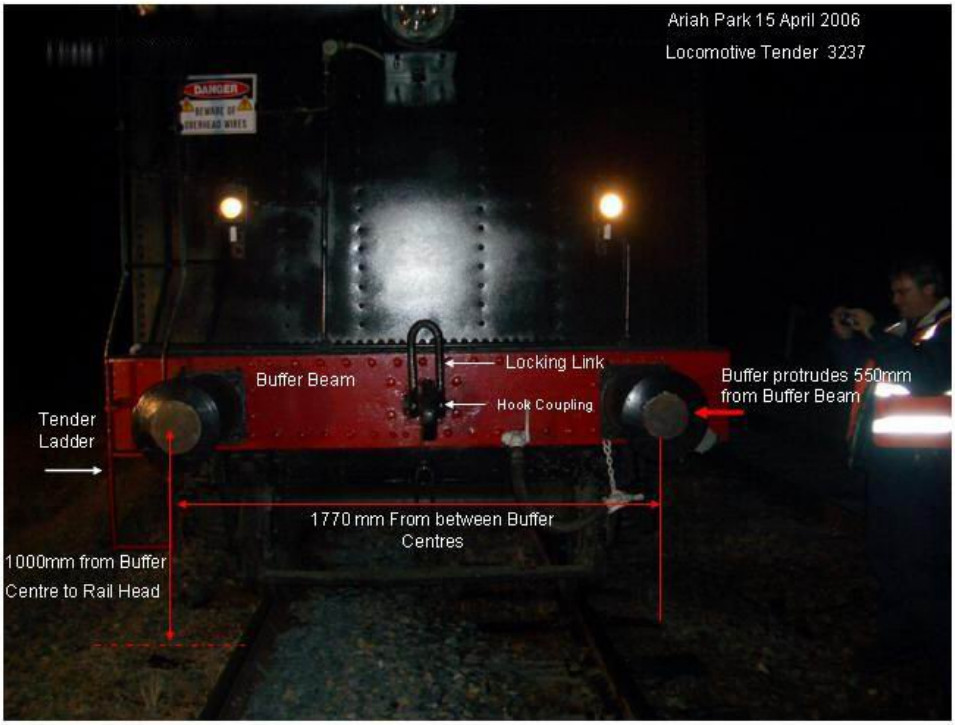


Photo 15: Measurements - rear of tender on 3237