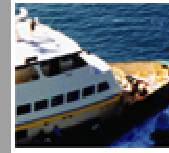


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RAIL SAFETY INVESTIGATION REPORT

FATAL LEVEL CROSSING COLLISION GRAWLIN PLAINS

31 MAY 2005



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FATAL LEVEL CROSSING COLLISION

GRAWLIN PLAINS

31 MAY 2005

OTSI File Ref: 04085

21 December 2005

**Office of Transport Safety Investigations
Level 21, 201 Elizabeth Street
Sydney NSW 2000**

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

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

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The Office of Transport Safety Investigations also provides a Confidential Safety Information Reporting facility for rail, bus and ferry industry employees. The CSIRS reporting telephone number is 1800 180 828.

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EXECUTIVE SUMMARY

At approximately 3.00pm on 31 May 2005, a single locomotive operated by the Australian Railway Group (ARG) collided with a Toyota Landcruiser and trailer on a level crossing at Grawlin Plains, approximately 10 km South of Forbes in the Central West Region of NSW.

The driver of the Landcruiser, a local farmer, was fatally injured in the collision and his vehicle was destroyed. The locomotive remained on the track and came to a stand approximately 350m past the point of impact. The locomotive suffered minor damage to the front headstock region and various side-mounted components. The track infrastructure was not damaged but debris was scattered over 350m of the track. While there were no injuries to the crew of the locomotive, both members were treated for shock.

The major safety issues identified in this report relate to the actions of the driver of the motor vehicle; the immediate response of the Locomotive's crew; passive level crossing safety; train communications and emergency response.

As a result of its investigation, OTSI finds:

- a. In the matter of **causation**, that;
 - i. The collision was caused by the failure of the driver of the Landcruiser to commence braking in sufficient time for him to stop and give way to the Locomotive, as was required by Australian Road Rule 121.
 - ii. The speed at which the driver of the Landcruiser approached the level crossing was not consistent with a prior intention to stop at the crossing.

- b. In the matter of **whether the accident might have been anticipated and the effectiveness of any strategies that were in place to manage the related risks**, that:
- i. The Landcruiser driver's chances of survival were further diminished because he was not wearing a seat belt at the time of the accident and that the seat belt he should have been wearing was defective.
 - ii. Whilst the brakes on the trailer attached to the Landcruiser were not properly adjusted, they did not significantly exacerbate the situation.
 - iii. The road signage on the approaches to, and at, the level crossing did not conform to the minimum requirements prescribed by Australian Standard 1742.7:1993, Manual of Uniform Traffic Control Devices, Part 7: Railway Crossings.
 - iv. Road users approaching the level crossing from the East have their visibility of trains approaching from the South obstructed by the presence of trees, vegetation and a wheat silo.
 - v. Network Rule ANTR 400 and Network Procedure ANPR 720 required the crew to protect their Locomotive by placing detonators on the track, but they did not do so.
- c. In the matter of **the appropriateness of the emergency response**, that:
- i. ARG had not made adequate provision for its crew to contact Train Control in the event of an emergency.
 - ii. Notwithstanding some initial confusion, which resulted from the inability of the crew of the Locomotive to talk directly to Train Control, and vice-versa, the Police, Emergency Services and the rail and track operators responded quickly and effectively.

- d. In consideration of **any other matters arising from the investigation that would enhance the safety of rail operations**, that:
- i. The Hasler data event recorder in the locomotive was not properly set and that this is a recurring problem throughout the rail freight industry in NSW.
 - ii. There is scope for improved communication between ARTC and Forbes Shire Council in relation to the inspection and maintenance of level crossings.

Recommendations

The following recommendations are made to:

a. Forbes Shire Council

- i. Develop a program for the regular inspection of all level crossings in the shire to ensure that road users using such crossings have the benefit of markings and signage that conform with Australian Standard AS1742.7:1993, Manual of Uniform Traffic Control Devices, Part 7: Railway Crossings.
- ii. Act to improve communication with ARTC in relation to the inspection and maintenance of level crossings.

b. The Independent Transport Safety & Reliability Regulator

- i. Formally require rail operators in NSW to equip and maintain communication equipment capable of allowing for direct communication between their train crews and Train Control.
- ii. Formally require all trains operating in NSW to be equipped with properly fitted, maintained and calibrated data event recorders. Such recorders should provide for the accurate and reliable recording of train speed, synchronised to an accurate and reliable time base; direction of motion; distance; brake application and operation; light function; horn application; throttle position; brake cylinder pressure and deadman application (where applicable). There should also be provision for the identification of the train's driver.

c. Australian Rail Group

- i. Ensure that all trains operated by ARG have event recorders that are properly fitted, maintained and calibrated
- ii. Ensure train crews understand what is expected of them following an emergency, especially in relation to the need to communicate with Train Control and the requirements, as specified in Network Rules, in relation to train protection.
- iii. Ensure that train crews are provided with a simple and effective system to communicate directly with Train Control.

d. Australian Rail Track Corporation

- i. Give consideration to the removal of trees and vegetation inside the ARTC leased area on the South-Eastern side of the level crossing at Grawlin Plains to improve the view that road users have of trains approaching from the South.
- ii. Act to improve communication with Forbes Shire Council in relation to the inspection and maintenance of level crossings.

e. Chicago Freight Car Leasing Australia

- i. Ensure that all trains it operates or makes available to other operators have event recorders that are properly fitted, maintained and calibrated.

PART 1 INTRODUCTION

Notification and Response

- 1.1 At 3.30pm on 31 May 2005, the Office of Transport Safety Investigations' (OTSI) Duty Officer was notified by the ARTC Train Control Manager that a driver of a motor vehicle had been killed as a result of collision with a freight train, at approximately 3.00pm, at a level crossing at Grawlin Plains in the Central Western Region of NSW.
- 1.2 Based on the information provided by the reporter, the Chief Investigator directed the deployment of two OTSI Investigating Officers to the incident site. The Investigating Officers deployed by Chartered Aircraft and Motor Vehicle and arrived at the incident site at 9.50pm on 31 May 2005 and commenced the inspection, assessment and evidence collection process.
- 1.3 The incident site was released for recovery and repair by the OTSI Investigating Officers at 11.30pm on 31 May 2005.

Initiation of Investigation

- 1.4 As a result of the primary evidence collected by the OTSI Investigating Officers at the incident site, the Chief Investigator determined that the incident constituted a Category 2 accident and initiated a Rail Safety Investigation in accordance with s67 of the *Rail Safety Act 2002*.

Interim Factual Statement

- 1.5 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 10 June. This was preceded, on 8 June, by communication from the Chief Investigator to all of the Directly Involved Parties (DIP) notifying them that OTSI was investigating the collision and requesting that an officer be nominated in each organisation 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

- 1.6 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 the accident might have been anticipated and assess the effectiveness of any strategies that were in place to manage the related risk/s;
 - c. assess the effectiveness of emergency actions in response to the accident, and
 - d. advise on any matters arising from the investigation that would enhance the safety of rail operations.

Methodology

- 1.7 The methodology adopted for this investigation is based on the Incident Cause Analysis Method (ICAM) and involves the process of:
- a. Collection of primary physical evidence at incident site;
 - b. Collection of witness evidence;
 - c. Collection of documentary evidence;
 - d. Collection of other relevant and/or corroborating evidence, including results of technical inspections and/or test results;
 - e. Analysis and interpretation of evidence;
 - f. Determination of those factors which:
 - i contributed directly to accident causation;
 - ii contributed indirectly to accident causation, and
 - iii are relevant safety issues but did not contribute to accident causation;
 - g. Establishing the cause of the accident, and
 - h. Determining recommendations to improve safety and prevent recurrence.
- 1.8 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

- 1.9 On 16 November 2005, a copy of the investigation Draft Report was forwarded to all DIPs to provide them 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 7 December 2005. Although not provided by the specified date, submissions were received from Forbes Shire Council, the Independent Transport Safety and Reliability Regulator and the Australian Rail Track Corporation.
- 1.10 The Chief Investigator considered all representations made by DIPs and where appropriate, reflected their advice in this Final Report. On 21 December 2005, 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

- 1.11 This report describes the level crossing collision which occurred at Grawlin Plains on 31 May 2005 and explains why it occurred. The recommendations that are made are designed to minimise the potential for a recurrence of this type of accident.

PART 2 FACTUAL INFORMATION

Accident Synopsis

- 2.1 At approximately 3.00pm on 31 May 2005, a single Northbound locomotive operated by Australian Rail Group (ARG), but leased on the day of the accident from Chicago Freight Car Leasing Australia Pty Ltd (CFCLA), collided with a Westbound Toyota Landcruiser on a level crossing at Grawlin Plains. The Landcruiser was towing a steel trailer at the time of the collision.
- 2.2 The Grawlin Plains level crossing is located approximately 10km South of Forbes and 370km West of Sydney, as shown in *Figure 1*. The driver of the Landcruiser, a local farmer, was fatally injured in the collision.

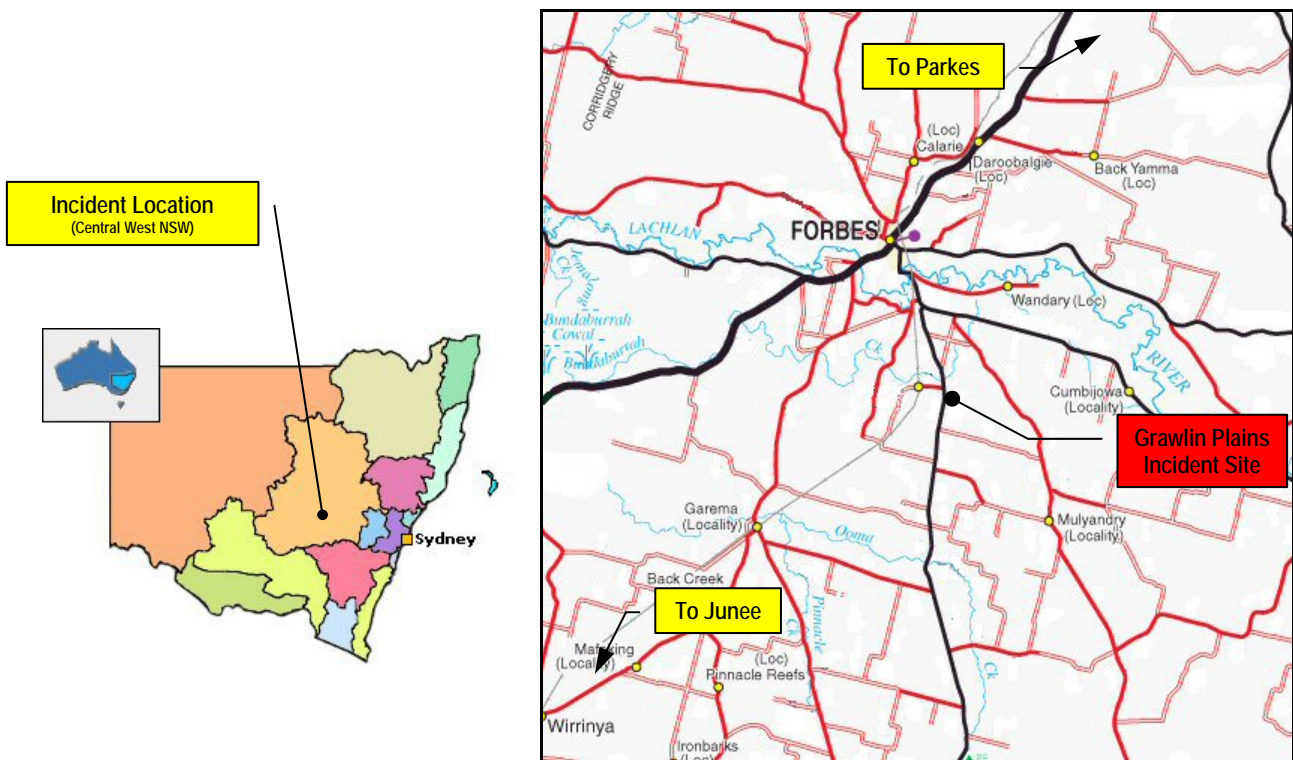


Figure 1 Incident Location and Region

Accident Location

- 2.3 Grawlin Plains, and the area surrounding it, is sparsely populated, relatively flat and used primarily for farming. The sealed road traversing the level crossing at which the accident occurred carries a low volume of largely locally-based traffic. The level crossing at Grawlin Plains is located in the Wirrinya to Forbes rail section. The track is single line and in the area of the level crossing runs in a North-South direction. The road which forms part of the level crossing runs perpendicular to the track i.e. it runs East-West.
- 2.4 The Grawlin Plains level crossing is located 587.370 km by rail from Central Railway Station in Sydney. The crossing is a 'passive' level crossing which means there are no boom gates, bells or electronic signs that can be activated automatically by an approaching train. The approach by rail to the level crossing is virtually straight on a slight downhill gradient of 1:614 and the motor vehicle speed limit in the area is 100km/h.
- 2.5 The nearest main road, Henry Lawson Way, is located 2 km from the Eastern side of the level crossing. RailCorp records indicate that approximately 20 motor vehicles use the level crossing a day. There is no record of any previous collision or near miss at this level crossing. The nearest alternate public level crossings are located at Red Bend and Garema, 5 km North and 13 km South of Grawlin Plains respectively.

Sequence of Events

- 2.6 On the morning of the accident, Train 2952 carrying grain departed Parkes at 4.27am for Junee, via Cootamundra. The locomotive driver and his assistant started duty at 4.00am. The train arrived in Junee at 9.40am, after which the wagons were detached from the locomotive. The driver and his assistant departed Junee at 10.10am for the return journey to Parkes with a single locomotive only (hereafter referred to as the Locomotive) which was designated as D386.

- 2.7 Enroute to Parkes, the Locomotive was held up for approximately one hour by an earlier collision involving track maintenance vehicles. Prior to entering each rail section on the journey, the driver of the Locomotive sought clearance to do so, in accordance with normal working arrangements, from Junee Train Control. At approximately 2.40pm, the assistant got out of the cab at Wirrinya, 32km South of Grawlin Plains, and obtained the train staff for the Wirrinya to Forbes section from the electric train staff instrument and notified Junee Control of his intention to traverse the Wirrinya to Forbes section.
- 2.8 Having been given permission to enter the Wirrinya to Forbes section, the driver recommenced his journey, operating the Locomotive at a speed of approximately 80km/h. The Locomotive's speed was reduced to 75 km/h as it approached the level crossing at Grawlin Plains.
- 2.9 On approaching the level crossing, the assistant driver sounded the horn in accordance with network rules and procedures. Whilst sounding the horn, the assistant driver saw a motor vehicle travelling from the East towards the crossing, as depicted in *Figure 2*, and he continued sounding the horn to alert the driver of the motor vehicle. He said he recalled that the motor vehicle appeared to slow as if to stop, but then recalled seeing smoke coming from the vehicle's tyres as it continued towards the crossing. The Locomotive driver, seated on the opposite side of the cabin, could not see the approaching motor vehicle but applied the emergency brakes in reaction to the continual sounding of the horn by his assistant.

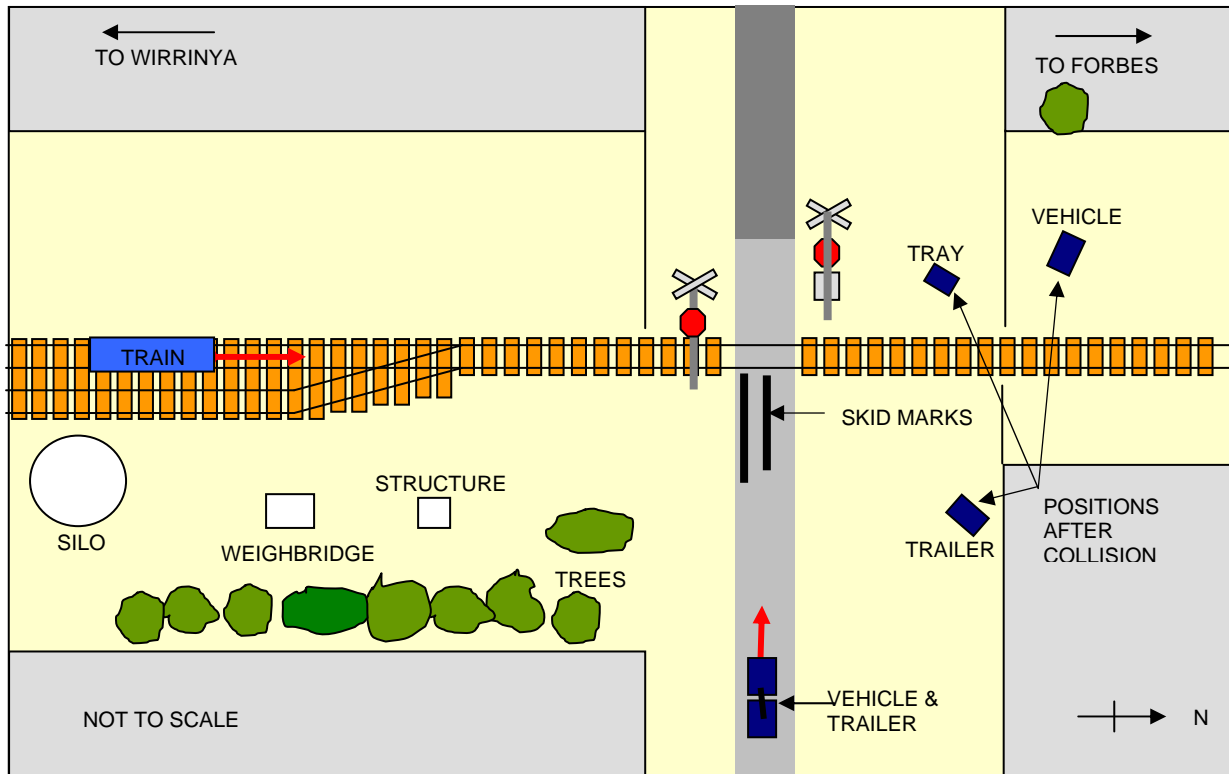


Figure 2: Site Diagram of Grawlin Plains

The Collision

- 2.10 The driver of the motor vehicle involved in the collision, a local farmer, owned property on both sides of the railway track. He was travelling West on a public road as he approached the level crossing. His visibility of the approaching Locomotive would have been partially obscured by trees and scrub.
- 2.11 Upon impact, the coupler on the front of the Locomotive struck the passenger-side of the motor vehicle, a Toyota Landcruiser, behind the cab section. The profile of the coupler was clearly imprinted on the flat steel tray mounted onto the chassis of the Landcruiser. The force of the impact with the train turned the Landcruiser towards the Western side of the crossing and separated it from a steel trailer it had been towing. The trailer was pushed to the Eastern side of the crossing; the tray was separated from the chassis and the Landcruiser rolled a number of times before coming to rest upside down in a paddock on the Western side of the railway line, as seen in *Photo 1*.



Photo 1: Toyota Landcruiser and tray following accident

2.12 The driver of the Landcruiser was ejected from his vehicle by the force of the collision and was fatally injured. However, the Locomotive remained on the tracks and came to a stand approximately 350m past the point of impact. The crew, although shaken, was unharmed. The Locomotive sustained minor damage to the front headstock region and various side-mounted components. The track and related infrastructure was not damaged however debris was scattered over 350m of the track.

After the Collision

2.13 After the Locomotive came to a stand, the driver used a company-supplied mobile phone to inform an ARG representative in Parkes of the accident and to request the assistance of the Ambulance and Emergency Services. The ARG representative alerted Emergency Services accordingly. The Locomotive driver then phoned Parkes Signal Control Box and requested the signaller contact Junee Train Control to inform them of the accident. The driver then went to render assistance to the driver of the Landcruiser but on locating him could not observe any vital signs.

2.14 Once contacted by ARG, the Emergency Services responded immediately. The Ambulance arrived at the accident site at approximately 3.30pm, closely

followed by Police and State Emergency Services. ARG staff arrived several minutes later. An ARTC representative arrived at 4.10pm and closed the line and secured the site pending the arrival of OTSI investigators.

Crew Information

- 2.15 The driver and assistant driver of the Locomotives are employees of ARG. They both started duty at Parkes at 4.00am on the day of the accident. The driver had previously worked a 10-hour shift and had a 14-hour break before starting his shift on the day of the accident. His assistant had been off work for the previous 2 days.
- 2.16 The train driver was an experienced driver, based out of Parkes, who was familiar with, and qualified for, the route. The assistant driver was a trainee locomotive driver who had 10 months rail experience. Both crew members were within their respective medical and competency assessment periods.
- 2.17 Both train crew members were breath tested by Police following the incident; the results of these tests were negative. Subsequent tests for drugs using a blood test also returned a negative result.

Train Information

- 2.18 Train D386 consisted of a single ex-49 Class branch line locomotive with the identification number KL80, which had been leased from Chicago Freight Car Leasing Australia Pty Ltd (CFCLA) by ARG on 31 May 2005. The locomotive is a six-axle, diesel-electric manufactured at Clyde Engineering, Granville, NSW and came into service in 1960. The locomotive measures 15.4m in length and has a mass of 81 tonnes.
- 2.19 The locomotive was painted in CFCLA livery: blue and silver with gold stripes and white reflective patches spaced at regular intervals along each side at eye level, as shown in *Photo 2*. Locomotive warning devices included an air-operated horn mounted on top of the locomotive body, with standard headlight

and marker light configurations. The reflective markings and the warning devices met the relevant operating and safety standards.



Photo 2: Locomotive KL80 (designated as Train D386)

2.20 The locomotive sustained minor damage as a result of the collision. There was damage to the front, left and right side of the locomotive. This included damage to the left-side front steps, hand rails, automatic coupling release handle, right-side fuel tank and the breather and fuel pipes. Some of this damage can be seen in *Photo 3*.



Photo 3: Locomotive's position after the collision

Track Information

2.21 This standard gauge single-line track is part of the Defined Interstate Rail Network (D.I.R.N.). ARTC assumed responsibility for track maintenance and train control functions for this section and other sections of the NSW country rail network on 5 September 2004. This line joins the major rail junctions of Stockinbingal in the South and Parkes on the Main West line. Classified as class 2 line, and consisting of 47 kg/m rail affixed to timber sleepers by dog spikes, the line is predominately used for freight traffic. There are no scheduled passenger services in this section and ARTC indicated that there is an average of 41 train movements a week through the level crossing.

Operations Information

2.22 The safeworking system for the section Werrinya to Forbes is Miniature Electric Train Staff. This system is designed to ensure that on a bi-directional single line, only one train has occupancy of that section of track at any given time. The driver of the Locomotive had been given authority by Junee Train

Control to traverse the section and was in possession of the Electric Train Staff for the section at the time of the incident.¹

Motor Vehicle Driver Information

- 2.23 The driver of the Landcruiser was a 68 year old male, who had lived in the area for most of his life and who lived less than 1 km from the level crossing. He had held a licence for 51 years with no convictions being recorded. He also held an unrestricted HR (Heavy Rigid) NSW driver's licence.
- 2.24 Post mortem tests on the driver of the Landcruiser indicated a positive reading for alcohol (0.007g/100ml), albeit well below the prescribed limit of 0.05g/100ml, and nil indication of drugs.

Motor Vehicle Information

- 2.25 The motor vehicle involved in the collision was a white 1983 Toyota Landcruiser (HJ 47 series, NSW registration URL-171) with a cab and chassis configuration. A flat, steel tray was attached to the chassis. The vehicle was registered until 3 November 2005 and it had 348,002 km showing on its odometer. A photo of the motor vehicle after the collision can be seen in *Photo 4*. However, it should be noted however that the tray, as depicted, is in reverse of its normal position, i.e., the tray barrier would normally be immediately behind the cabin.

¹ Electric Train Staff – a safeworking system whereby a staff is obtained from a electric control device which allows only one staff for that section of track to be out at one time, therefore allowing the presence of only one train in the section at one time. The train crew change the staff at each end of the section. In this case, the section was from Wirrinya to Forbes.



Photo 4: Toyota Landcruiser and Tray

- 2.26 The Landcruiser had an overall length of 4.7m, a wheel base of 2.9 m and a gross vehicle mass of 3.7 tonnes. The engine was a 4-litre, 6-cylinder diesel with vacuum assisted, dual circuit hydraulic disc brakes at the front and drum brakes at the rear.
- 2.27 The Australian-made steel trailer, as shown in *Photo 5*, was manufactured in April 1998 and measured 5.1m in length and 2.1m in width. The trailer's identification plate indicated a mass of 2.0 tonnes. Both the vehicle and trailer were only carrying a few light farming items and some small containers of fuel.



Photo 5: Trailer

Meteorological Information

2.28 The weather at the time of the accident was fine and sunny. There had been very little rainfall in the area in the preceding month and none within the previous 24 hours.

2.29 The accident occurred at approximately 3.00pm at which time the sun was setting in the North-West at an approximate altitude of 20°. Sunset was predicted at 5.09pm.

PART 3 ANALYSIS

Accident Discussion

- 3.1 *Speed and Braking.* The Landcruiser was travelling along a section of straight, level, sealed road as it approached the level crossing. There was 23 metres of fresh tyre skid marks readily apparent prior to, and which stopped just short of, the level crossing, that matched exactly the wheel base profile of the Landcruiser. OTSI calculated, using the same formula employed by the NSW Police Crash Investigations Unit, that the Landcruiser had been travelling in excess of 50 km/h when the brakes were applied.
- 3.2 The Landcruiser was of a type and model typically operated by many farmers in NSW. It was in a serviceable condition and had functioning brakes. The tyres on both the Landcruiser and the trailer were within standards and all had adequate tread depth. However, braking would not have been assisted by the trailer's brakes which were not properly adjusted.
- 3.3 The speed limit for Grawlin Siding Road is 100 km/h, however Australian Road Rule 121 requires that a driver of a motor vehicle approaching a level crossing with a stop sign: "must: stop at the stop line; or, if there is no stop line, at the stop sign and give way to any train approaching or entering the crossing." The point at which the braking was initiated and the estimated speed of the Landcruiser at the time was not consistent with a prior intention to stop at the level crossing.
- 3.4 OTSI noted that in its 1998 study on safety at passive level crossings, the US National Transportation Safety Board concluded that: "A driver's decision to look for a train may be adversely affected by the driver's familiarity with and expectations at a specific grade level crossing and the driver's experience with level crossings in general." The NSW Level Crossing Strategy Council (LCSC) arrived at a similar conclusion following a review of accidents in NSW.

The driver in this instance was familiar with the level crossing and the random movements of train services over the line; perhaps overly familiar.

- 3.5 *Weather & Visibility.* The weather was fine and dry at the time of the accident. Although the sun was setting in the direction in which the vehicle was travelling, it was not at an elevation which would have blinded the driver to the presence of an approaching train. There was nothing inside the Landcruiser that should have obstructed the view of the driver. The view from any motor vehicle of any train approaching from the South is partially obscured by trees and other vegetation until approximately 30m from the crossing. This might have been the first point at which driver of the Landcruiser became aware of the approaching train and would explain the skid marks commencing 23m from the crossing. OTSI acknowledges that ARTC is under no obligation to provide road users with an unobstructed view of approaching trains; indeed it would be impossible for it to do so in many circumstances. STOP signs at passive level crossings are an indication to road users that they do not enjoy an unrestricted view of an approaching train and that they must stop. That said, any driver who stops at the STOP sign indicated in *Photo 11* enjoys an unobstructed view of any train approaching from the South for over 300m, which is within the minimum sighting distance recommended by the Roads and Traffic Authority Standard (Traffic Engineering Manual, Section 6, Railway Level Crossing, 1994). The photos below depict the view, as seen by a road user on the Eastern approach to the level crossing. *Photos 6, 7, 8 and 10* depict the view, on the same approach to the South, i.e., towards the direction from which the Locomotive approached.



Photo 6: At 80m from the level crossing



Photo 7: At 60m from the level crossing



Photo 8: At 40m from the level crossing



Photo 9: View of, and 50m from, the level crossing



Photo 10: At 25m. n.b. an approaching train



Photo 11: View of, and 25m from, the level crossing

- 3.6 OTSI noted that the presence of a single locomotive would have been more difficult to detect than one or more locomotives hauling wagons. It also noted that the Landcruiser's passenger-side window had been closed and in combination with the general noise level associated with the vehicle's operation, including that emanating from the trailer and equipment rattling about, may have drowned-out the sound of the train's horn.
- 3.7 *Distraction.* There was no apparent source of distraction within the Landcruiser. There was no evidence of a mobile phone and no evidence of food or beverages being consumed. OTSI could not establish, because of the extent of the damage, whether the radio had been functional and 'on' at the time of the accident. At the time OTSI visited the site, there was also no apparent source of external distraction.
- 3.8 *Medical and Toxicological Information.* Both train crew members were breath tested by Police following the incident and returned negative results. Subsequent tests for drugs also returned negative results. The post mortem tests on the driver of the Landcruiser indicated the presence of alcohol (0.007g/100ml), albeit well below the prescribed limit of 0.05g/100ml.
- 3.9 *Seatbelts.* The Landcruiser rolled after impact and was severely damaged. The immediate area of impact was on the passenger-side of the steel table tray. OTSI noted, however, that the roof above the driver and the general area in which he was seated were relatively undamaged. Whilst the Landcruiser was fitted with retractable lap-sash type seat belts, there were no indications of fraying or loading/stress marks on the driver's-side seat belt that would have been consistent with it having been in use during the collision. The Police formed the view that the driver had not been wearing his seatbelt. OTSI noted that when the tongue of the driver's seat belt was inserted into the fastener it would not lock into place. However, post mortem results did not establish whether the driver was killed upon impact, or died after being ejected from the Landcruiser.

- 3.10 *Train Operation* The train driver was experienced in operating trains over this section of track and the driver's assistant had travelled over this track numerous times in the previous 10 months. Data from the event recorder corroborated the driver's and the assistant's indication of speed and the description of their actions prior to impact. OTSI noted that the accident occurred approximately 11 hours after the crew had signed-on but this extended period of duty was a consequence of being delayed earlier in the day by the derailment of two hi-rail vehicles. The crew's roster for the previous two weeks was analysed using the Fatigue Audit InterDyne (FAID) and both the driver and assistant driver were well below the range where fatigue might be at issue. The train driver and assistant were also within the medical and competency standards, as set down in the *Rail Safety Act 2002*; within defined competency periods, and tested free from the effects of drugs and/or alcohol.
- 3.11 An analysis of the Locomotive's Hasler event recorder was complicated by the failure of the crew to wind-on the clock at the commencement of the day. This meant that whilst speed, braking and throttle readings were available, there was no time function. Notwithstanding this, the analysis indicated that the Locomotive operated at a speeds ranging between 70-87 km/h between Wirrinya and Grawlin Plains, which was well under the speed limit of 100 km/h, and that immediately prior to the application of emergency braking, the Locomotive was travelling at 75 km/h.
- 3.12 *Signage.* The signage at, and prior to, the level crossing did not meet the relevant Australian Standard for passive level crossings (AS1742.7-1993). The RAILWAY CROSSING crossbucks, featured on the cover sheet of this report, was in poor condition, and the requirement for a LOOK FOR TRAINS sign, a symbolic steam train sign, a symbolic stop roadside sign and painted RAIL X warning sign on the road in advance of the level crossing were not met. *Photo 12* and *Photos 13-15* indicate the signage in place before and shortly after the accident respectively. Had the appropriate signage been in place, the driver of the Landcruiser should have encountered warning signage at least 180m before the crossing and then another warning sign and road markings 70m from the crossing. That said, Eck (2002) suggests that drivers

have a negative expectancy of meeting a train at a level crossing, due to infrequent encounters, and that approach warning systems must therefore seek to change drivers' expectancy and alert them to the required actions for a safe crossing. He specifically identifies that a sign such as a faded crossbuck on a leaning post does not elicit the same respect from the motorist as a clean, retro-reflective crossbuck on a solid vertical support.²



Photo 12: Condition of signage at time of accident



Photo 13: Signage at crossing after the accident



Photo 14: Road marking post-accident



Photo 15: Warning sign post-accident

3.13 OTSI established that responsibility for the level crossing and the maintenance is divided between the ARTC and the Forbes Shire Council. ARTC is responsible for the provision and condition of trackside signage (see *Photos 12 and 13*) and the Council is responsible for the provision and condition of signage on the approaches to the crossing (see *Photos 14 and*

² Eck, R.W. *A context-sensitive approach to improving safety at passive level crossings* Proceedings of 7th International Symposium on Railroad Highway Grade Crossing Research and Safety, Monash University, February 2003.

