OTSI Office of Transport Safety Investigations

RAIL SAFETY INVESTIGATION REPORT

TRAIN COLLISION WITH ROAD MOTOR VEHICLE

WOY WOY

2 SEPTEMBER 2011

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THE OFFICE OF TRANSPORT SAFETY INVESTIGATIONS

The Office of Transport Safety Investigations (OTSI) is an independent NSW agency whose purpose is to improve transport safety through the investigation of collisions and incidents in the rail, bus and ferry industries. OTSI investigations are independent of regulatory, operator or other external entities.

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ACRONYMS AND ABBREVIATIONS

ARR ..... Australian Road Rules

AS ..... Australian Standard

DIP ..... Directly Involved Party

EMU ..... Electric Multiple Unit

ICP ..... Interface Coordination Plan

ITSR ..... Independent Transport Safety Regulator

OSCAR ..... Outer Suburban Car

OTSI ..... Office of Transport Safety Investigations

RMC ..... (RailCorp) Rail Management Centre

RMV ..... Road Motor Vehicle

EXECUTIVE SUMMARY

At approximately 6.17pm[1] on 2 September 2011, CityRail's Sydney to Wyong interurban passenger service 289G, carrying approximately 200 passengers, struck a stationary, unoccupied road motor vehicle (RMV) on the Down Main line at the Rawson Road level crossing at Woy Woy on the Central Coast of NSW. The RMV had become stuck on the line after its driver became disoriented and turned onto the line from the crossing while trying to locate a street running parallel to the line.

The driver of the RMV had been unable to move the RMV after it became stuck despite the assistance of a number of passers-by who saw him attempting to move it off the line. However, shortly after they commenced attempting to assist the driver, the automatic protection equipment at the level crossing activated, indicating an approaching train. The driver, and those assisting, immediately moved off the tracks out of the path of trains.

The driver of 289G was unable to stop before striking the RMV which, after impact, became wedged underneath the train and was pushed for approximately 300 metres along the track but without derailing the train.

While no persons were reported injured in the incident, a number of safety issues were identified during the course of the investigation. These included:

- an inadequate obstruction deflection system on passenger rolling stock used on interurban routes to prevent larger obstructions from becoming wedged underneath and potentially derailing the train;
- information overload from signage at the crossing;
- the lack of road markings inside the rail corridor defining the roadway; and
- the lack of emergency contact information provided at level crossings.

Recommendations are made to RailCorp to take action in relation to the identified safety issues. Full details of the Findings and Recommendations of this rail safety investigation are contained in Parts 2 and 3 respectively.

1 All times referred to in this report are in Australian Eastern Standard Time (UTC + 10 hours).

CIRCUMSTANCES OF THE COLLISION

Synopsis

1.1 At approximately 6.17pm on 2 September 2011, CityRail's Sydney to Wyong interurban passenger service 289G, struck a stationary, unoccupied road motor vehicle (RMV) on the Down Main line approximately 10 metres North of the Rawson Road level crossing at Woy Woy on the Central Coast of NSW (see *Figure 1*). The RMV had become stuck on the line after its driver became disoriented while trying to locate a street running parallel to it. 289G pushed the RMV, which had become wedged underneath the leading car, for approximately 300 metres along the track without derailing, before coming to a stand.

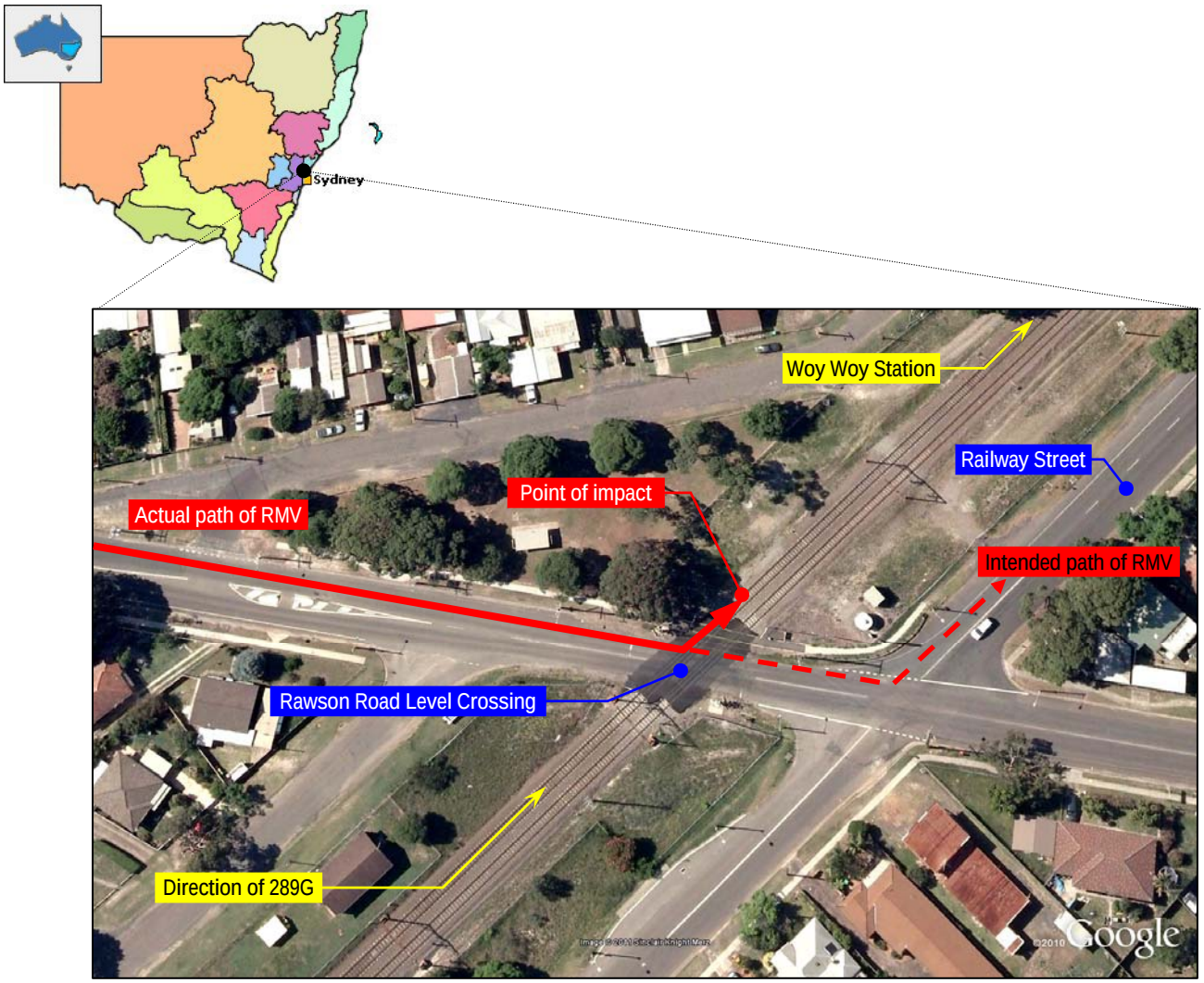


Figure 1: Incident location

1.2 Although both the RMV and the leading car of 289G were extensively damaged, there were no reported injuries. However, 200 passengers from 289G had to be detrained and later transhipped to their destinations. The incident caused

significant delays to following services with passengers from a number of these trains also having to be transhipped to various Central Coast stations by bus.

The Crossing

General

1.3 The incident occurred at the Rawson Road level crossing located at 71.513kms on the Main North line, the rail distance measured from a reference point at Central Station in Sydney. Rawson Road intersects the rail line at an angle of 130° and spans two tracks.

1.4 The RMV had been travelling along Rawson Road in an Easterly direction with the driver intending to turn left into Railway Street, a street running parallel to the line immediately past the crossing.

1.5 The crossing measures approximately 13 metres in width and is fitted with active ("F" type) protection consisting of several flashing light assemblies, audible warning devices and half boom gates on both approaches (see *Figure 2* and *Photographs 1 and 2*). The equipment conforms to the requirements of Australian Standard AS 1742.7, Manual of uniform traffic control devices, *Part 7: Railway crossings*. A pedestrian crossing protected by fencing and automatic swing gates on its approaches also spans the tracks in conjunction with the roadway on the crossing's Northern side. All the equipment functioned as designed on the approach of 289G.

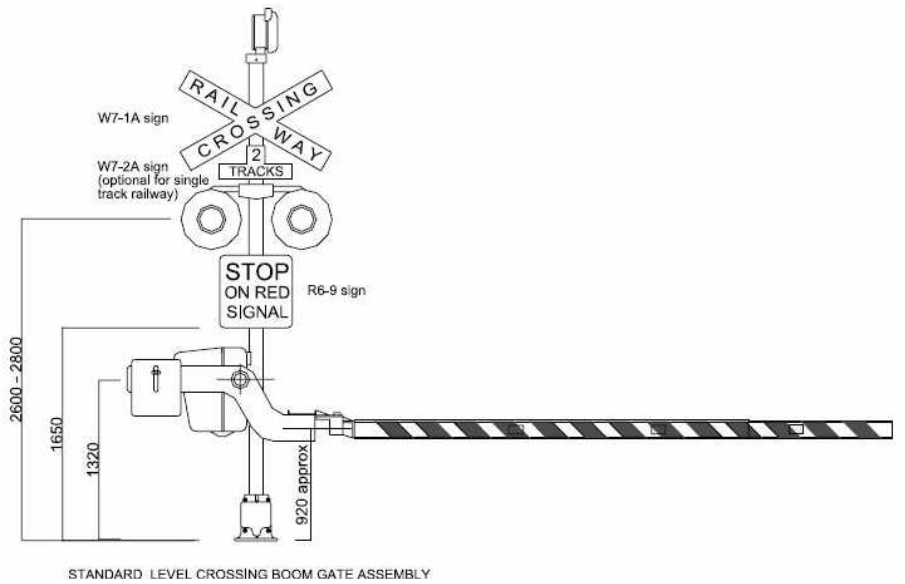


Figure 2: Diagram of F Type protection

Photograph 1: Rawson Rd level crossing (flashing lights and boom gates operating)

Photograph 2: Level crossing area where RMV driver entered rail corridor

1.6 The crossing is one of two public level crossings in the section between Hawkesbury River and Gosford. An alternative crossing to Rawson Road is provided by a single lane underpass located approximately 1.3kms to the South.

Responsibilities for level crossing signage and road markings

1.7 Standards for the equipment, signage and road markings at level crossings are contained in Australian Standard AS 1742.7.

1.8 Under Division 3 of the *Rail Safety Act 2008*, rail transport operators, rail infrastructure managers and roads authorities are required to enter into an Interface Coordination Plan (ICP) to identify and manage risks to safety at railway crossings. The ICP includes provisions for:

- *implementing and maintaining measures to manage those risks;*
- *the evaluation, testing and, if appropriate, revision of those measures;*
- *the respective roles and responsibilities of each party to the agreement in relation to those measures;*
- *procedures by which each party to the agreement will monitor compliance with the obligations under the agreement; and*
- *a process for reviewing and revising the agreement.*

1.9 Under the ICP between RailCorp and Gosford City Council, RailCorp, as network owner, is responsible for the maintenance of the nominated signage, infrastructure and road surface within the rail corridor at the crossing. This includes the road surface and flashing lights and bells on the half boom gates (see *Figure 2*). Gosford City Council, as road owner, has responsibility for the maintenance of the advance warning signage to the crossing, the road surface and markings on the approaches to one metre outside the rails (in accordance with the boundaries defined in the ICP), and all other traffic control devices outside the corridor.

1.10 However, at the time of the incident, the ICP between RailCorp and Gosford City Council was still in draft form and had not been completed. Although the risk assessment for the ICP had been conducted in May 2010, the ICP was not formally agreed to and signed by either organisation until 21 December 2011.

Visibility to crossing

1.11 In the prevailing visibility conditions, the driver of the RMV had a sight distance to the crossing of approximately 150 metres (see *Photograph 3*) while the train driver's sight distance was approximately 300 metres.

Photograph 3: RMV driver's view to level crossing

Level crossing approach speeds

1.12 The maximum track speed for interurban passenger trains at the crossing is 115km/h. The maximum speed for road traffic travelling on Rawson Road is 60km/h (although the ICP (p46) incorrectly lists a 50km/h speed limit for road traffic).

The Train and Crew

1.13 289G consisted of two OSCAR electric multiple unit (EMU) sets (H15 and H24) coupled together measuring approximately 160m in length and weighing 400 tonnes (see *Photograph 4*).

1.14 It was crewed by a driver based at Gosford Depot and a guard based at Sydney Depot. Both were familiar with and qualified for the route.

1.15 The service had departed Central Station at 5.00pm en route to Wyong under fixed signals, and was running to schedule.

Photograph 4: An OSCAR EMU set approaching the level crossing

The RMV and Driver

1.16 While NSW Police withheld the identity and contact details for the RMV driver, they indicated that the male driver was not local to the area. They also indicated that he held a current NSW driver licence and was the owner of the NSW registered Honda Prelude coupe involved in the incident.

The Collision

1.17 NSW Police indicated that the RMV driver had stated that he had become disoriented while trying to find the street leading into Woy Woy and had driven off the crossing thinking it was the street. After realising that he had instead turned onto the railway line, he attempted to reverse the RMV back onto the crossing. However, his vehicle had become stuck and he was unable to move it.

1.18 A number of passers-by saw the RMV on the line with the driver attempting to move it and went to his assistance. However, shortly after they commenced assisting, the automatic protection equipment at the level crossing activated, indicating an approaching train. The driver, and those assisting, immediately moved off the tracks out of the path of trains.

1.19 Data logger evidence from 289G indicated that, when the train exited the Woy Woy Tunnel some three kilometres before the crossing (68.800kms), it was travelling at 109km/h. Shortly after, the driver coasted to under 100km/h in accordance with the speed board located near 69.000kms.

1.20 After passing a level crossing warning sign located at 70.013kms, some 1500 metres before the crossing, 289G rounded a curve. The track then continued to curve until near overhead wiring stanchion N71+151 (71.200kms) where it straightened towards the level crossing, approximately 300 metres ahead, and Woy Woy Station beyond. 289G was travelling at about 98km/h at this point.

1.21 At 6.15.37pm, the driver sounded the horn in accordance with Network Rule NTE 408 *Using train whistles*, before making an initial application of the service brakes at 6.15.39pm in anticipation of stopping at Woy Woy Station.

1.22 At 6.15.42pm, the driver made an emergency brake application. The data logger trace indicates that 289G had then impacted with the RMV (which became wedged underneath the train) and continued on until 6.16.09pm when 289G came to a stand some 300 metres after impact.

Emergency Response and Notification

1.23 Immediately after coming to a stand, the driver of 289G used his Metronet radio to notify the Area Controller at Gosford Signal Box of the incident. The Area Controller then arranged for the signals at each end of the section to be placed at STOP and blocking facilities applied. He then notified the emergency services and the Rail Management Centre (RMC) in Sydney.

1.24 In the meantime, the crew ascertained the condition of the passengers on 289G, the RMV driver and the persons assisting him. They reported to Gosford Signal Box that no persons had been injured in the incident.

1.25 Units from Ambulance NSW, NSW Police and Fire and Rescue NSW arrived together on site at approximately 6.30pm.

1.26 OTSI was notified of the collision by RailCorp at 6.25pm and an investigator deployed to the site arriving at 7.40pm.

1.27 At 7.00pm, rail personnel and emergency services commenced detraining the passengers. After the passengers were checked by Ambulance officers, they were escorted on foot approximately 100m to Woy Woy Station. This detraining operation was completed shortly after 7.30pm.

1.28 After completion of a site inspection by RailCorp personnel and the OTSI investigator at 9.20pm, the RMV was towed from under 289G. At 10.10pm, after temporary repairs were completed, 289G departed the site for stabling and further damage inspection at Gosford. The RMV, which was destroyed by the impact, was removed from the site by tow truck (see *Photograph 5*).

Photograph 5: Damage to RMV

Environmental Conditions

1.29 The conditions at the time of the incident were dark, clear and dry. The sun had set at 5.37pm with civil twilight at 6.02pm. There was no fog or rain in the region at the time.

1.30 Although dark, there were seven overhead street lights in the immediate vicinity of the crossing (see *Figure 3*). All these lights were operating at the time.

1.31 There were multiple road and pedestrian signs in varying colours, fonts and sizes on the approach to and immediately after the crossing.

1.32 Visibility through the RMV windscreen could not be determined due to the damage sustained in the collision.

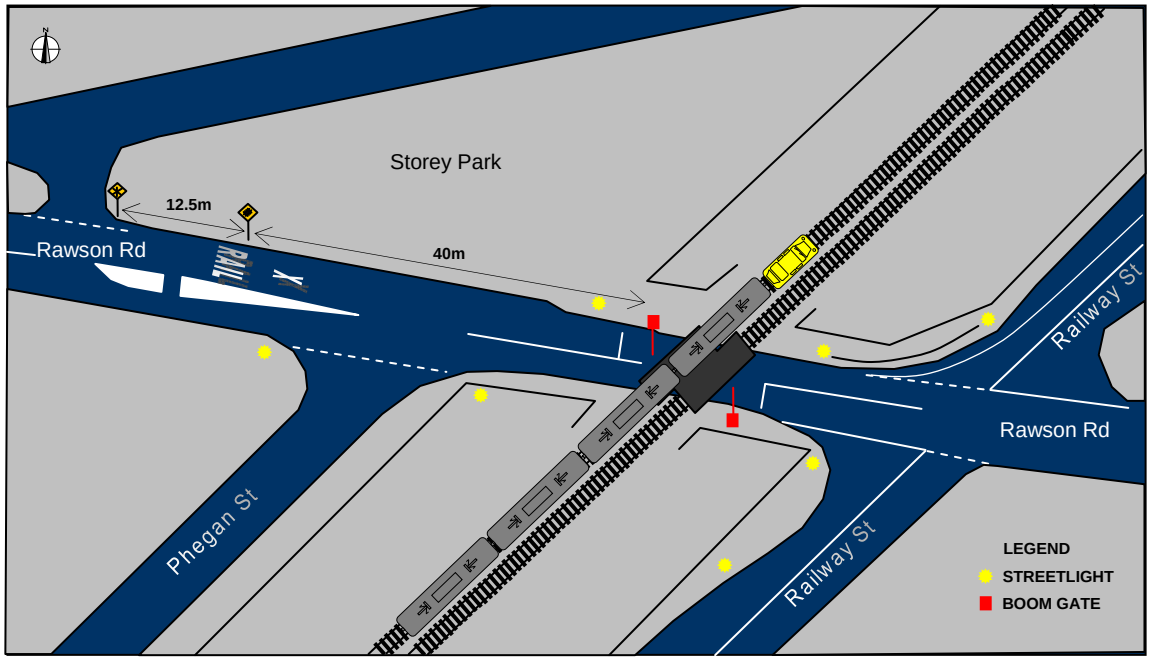


Figure 3: Position of street lighting in vicinity of crossing

Safety Issues

1.33 The following safety issues were identified during the course of the investigation:

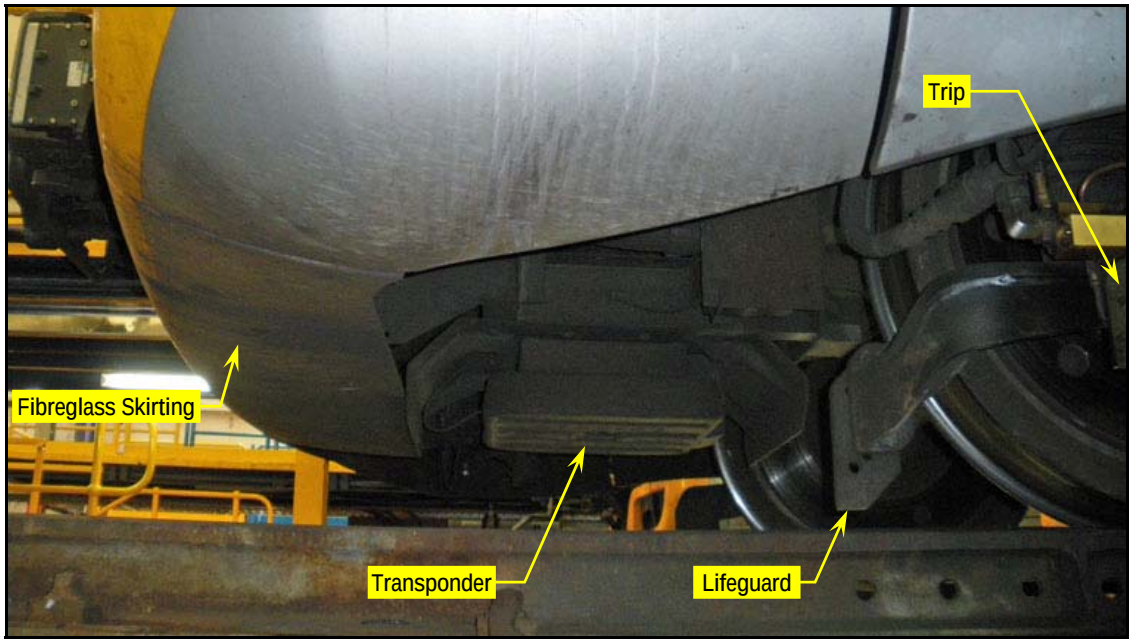
- inadequate obstacle deflection on passenger rolling stock operating on interurban routes to prevent larger obstructions from becoming wedged underneath and potentially derailing the train;
- information overload from signage at the crossing;
- the lack of road markings inside the rail corridor defining the roadway; and
- the lack of emergency contact information provided at level crossings.

Inadequate obstacle deflection

1.34 OSCAR EMU sets entered revenue service with RailCorp progressively from 2008. The vehicles are constructed with modern crash protection systems to mitigate the consequences of collisions between rail vehicles and intrusions into passenger compartments.

1.35 In spite of these systems, it was observed that, after the impact, the RMV had become wedged underneath the leading car (6931) of 289G and was pushed for 300 metres until the train came to a stop. It was also observed that the collision caused significant damage to various safety critical rolling stock components in the headstock region of the car, including couplings, communications equipment and brake equipment (see *Photograph 6*). Fortunately, the RMV did not break up during the incident and derail the train.

Photograph 6: Equipment damaged on leading car (6931) by the RMV



Photograph 7: Front underfloor arrangement of OSCAR EMU

1.36 Although OSCAR EMU sets are constructed to current international rolling stock engineering standards, it was observed that lifeguards, designed to clear only small obstacles or debris from the path of the train wheels, were mounted to the frame of the leading bogie to provide obstacle deflection and protection to the train wheels (see *Photograph 7*). No body-mounted obstacle deflection is fitted to the rolling stock to clear larger obstacles, e.g., RMVs, rocks, shopping trolleys, bicycles, trees or animals, from the path of the train.

1.37 In records related to obstacle strikes on its network bounded by Nowra, Newcastle, Macarthur and Lithgow, RailCorp reported approximately 4,500 obstacle strikes or near hit incidents during the period from 1 January 2007 to 31 December 2011. Included in the 4,500 incidents were:

- 2,045 obstacle strikes;
- 1,322 incidents on routes where OSCAR sets operate;[2]
- 41 incidents, including 23 strikes, in the Woy Woy area;
- a second RMV incursion at the Rawson Road level crossing on 3 December 2011;
- four incidents, in addition to the Rawson Road collision, where trains collided with RMV's which had intruded into the rail corridor; and
- one incident where a passenger train was seriously damaged and had become disabled after striking a large rock on the track in the Hawkesbury River to Wondabyne section.

Despite the number of incidents, no derailments were recorded as a consequence of an obstacle strike.

1.38 In contract documents (State Rail Authority of NSW Contract No. C03005) for the design and build of OSCAR EMU sets, RailCorp stipulated that the design and supply of the "*obstacle deflectors*" on the rolling stock be in accordance with Section 16 of (British) RailTrack Railway Group Standard GM/RT 2100, *Structural requirements for railway vehicles*. This section relates solely to the design and installation of bogie mounted lifeguards.

1.39 The requirements for obstacle deflectors were incorporated into the British Standard following the derailment of a high speed passenger train after it struck a cow on the line at Polmont, near Falkirk in Scotland, in 1984.[3] Section 12 deals specifically with the design and application of body-mounted obstacle deflection, requiring that:

> *12.1 Obstacle deflectors shall be fitted as stipulated below with the aim of minimising the risk of derailment in the event of a collision between the train and a large obstacle, such as an animal or car, on the track.*
>
> *12.2 Obstacle deflectors shall be fitted to all leading vehicles of trainsets with a maximum operational speed of 145 km/h (90 mile/h) and above, unless the axleload is 170 kN or*

2 By line breakdown, there were 342 incidents on the Western line, 70 incidents on the North Shore line, 271 incidents on the Main North line, 109 incidents on the Inner West line and 530 incidents on the Illawarra line.

3 Refer also to Rail Accident Investigation Branch reports into *Passenger train collision with a road vehicle at Swainsthorpe level crossing, Norfolk, 13 November 2005* and *Fatal collision between a Super Voyager train and a car on the line at Copmanthorpe, 25 September 2006.*

more, or if operation is exclusively on third-rail d.c. lines. For vehicles which operate only on third-rail d.c. lines, obstacle deflectors shall be fitted if the maximum operating speed is greater than 160 km/h. Obstacle deflectors shall be mounted on vehicle body structures and not on bogies.

12.3 Where the maximum operational speed is greater than 160 km/h, the axleloads of the leading bogie of the leading vehicle shall be at least 120 kN.

12.4 An obstacle deflector shall:

(a) be as large as the kinematic envelope will allow, and angled symmetrically in plan about the vehicle centre-line to produce an included angle of 160°.

(b) be designed to take advantage of the low deflector height permitted above the rails by including lifeguards so as to maximise the ability to sweep small objects from the rails.

(c) be vertical in elevation.

(d) be able to resist without permanent deformation a static longitudinal force applied uniformly over the complete leading surface of the deflector of:
300 kN for a maximum operating speed of 145 km/h,
375 kN for a maximum operating speed of 160 km/h,
450 kN for a maximum operating speed of 175 km/h,
600 kN for a maximum operating speed of 200 km/h and over.

(e) be able to resist without permanent deformation a static longitudinal force, applied at any point along its bottom edge (including the deflector-mounted lifeguards) of:
300 kN for a maximum operating speed of 145 km/h,
375 kN for a maximum operating speed of 160 km/h,
450 kN for a maximum operating speed of 175 km/h,
600 kN for a maximum operating speed of 200 km/h and over.

(f) be designed so that progressive collapse starts at a static longitudinal force, applied at any point along its bottom edge (including the deflector-mounted lifeguards), which is at least as high as the appropriate value in (e) and subsequently it shall continue to sustain a force equal to at least 80% of this value for a longitudinal deflection of the bottom edge of at least 150 mm.

(g) be designed so that, if it is permanently deformed by an impact, no part of it shall go below rail level, encroach on the wheel-rail interfaces or interfere with the operational performance of the bogie.

(h) satisfy the requirements of reference [5].

12.5 The underneath of the vehicle body, forward of the deflector, shall be designed to be smooth so as not to impede the flow or ejection of debris from the deflector

1.40 Despite the British Standard being a reference standard for the construction of OSCAR EMU sets, the requirements of Section 12 were not specified in the Contract and so no body-mounted obstacle deflectors were fitted to the rolling stock. This left the lifeguards as the only defence against obstacles on the line but they were not substantial enough to prevent the RMV from becoming wedged underneath the train after impact.

1.41 Further, it has been noted from finite element modelling that some types of lifeguards, although designed and fitted in accordance with Section 16, were limited in their effectiveness with the attachment joint likely to slip during impacts

at speeds as low as 15km/h and failure of one or more of the bolts occurring at 35km/h.[4] A subsequent 2009/2010 review of the lifeguard design now enables it to protect the wheel path at much higher speeds.

1.42 Other types of EMU passenger rolling stock are not fitted with any form of obstacle deflection or wheel protection equipment and so are equally susceptible to damage from obstacles or other debris often encountered when operating on interurban routes.

Signage information overload

1.43 As the driver of the RMV approached the crossing, he was faced with a total of nine regulatory, warning, traffic control and information signs erected within a distance of 60 metres while trying to locate the road leading to Woy Woy Shopping Area (see *Photograph 8*).

1.44 Finding the applicable sign in a cluttered visual sign-scape can distract a driver from the driving task. According to research on human factors in level crossing accidents, the limited span of human attention means that "*Drivers can in general only attend to one thing at a time"*.[5] This means that drivers can be distracted when street names are difficult to locate and there are other signs in their field of vision. Other research has found that visual clutter can impact on safety by distracting drivers from the driving task, impairing their ability to conduct a visual search and increasing their workload.[6] Drivers reported that they were more stressed and more likely to be distracted from the driving task when presented with a high level of visual clutter. An inquiry into driver distraction concluded that "*too many poorly considered road signs can create visual clutter, resulting in one form of driver distraction".*[7]

1.45 Although the approach signage to the crossing conformed to AS 1742.7 and was clean and legible, the signs varied in size, mounting, background colour, font size, font colour and visual impact from headlights and artificial lighting which was on at the time. All except one sign were positioned on the left hand side of

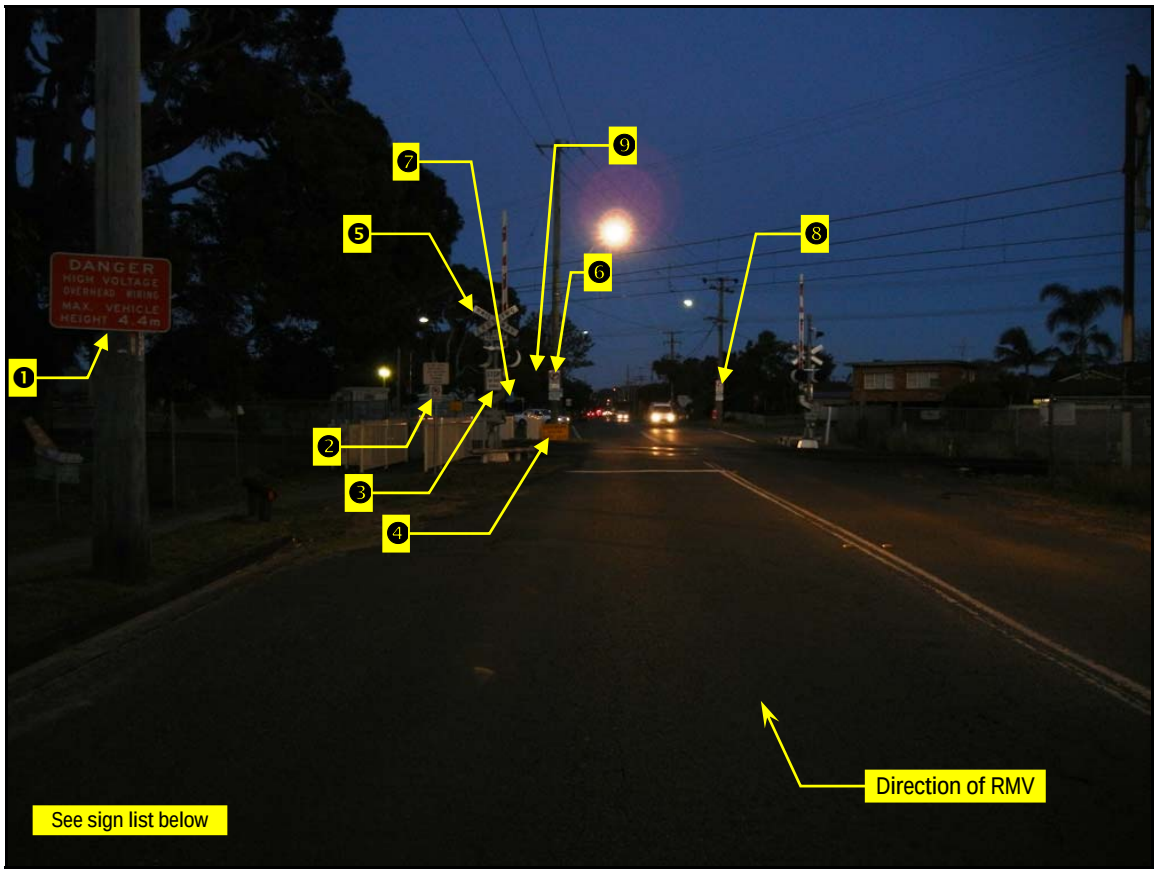
4 Rail Safety and Standards Board '*Optimal design and deployment of obstacle deflectors and lifeguards*' Research Brief T189, September 2009, Revised June 2010.

5 EC Wigglesworth, 'Human Factors in Level Crossing Accidents', *Journal of Accident Analysis and Prevention*, vol. 10, 1978, pp. 229-240.

6 J Edquist, T Horberry, M Regan & I Johnston, 'Visual clutter and external-to-vehicle driver distraction', Monash University Accident Research Centre, Presentation, *Proceedings International Conference on Driver Distraction*, Sydney, 2-3 June 2005.

7 Road Safety Committee, 'Inquiry into Driver Distraction', *Parliament of Victoria*, August 2006, p104.

the road amongst many off-road visual distractions that were also in the RMV driver's field of vision at the time, e.g., fencing, bus shelter, trees.



Photograph 8: Signage at RMV's approach to crossing (dark conditions)

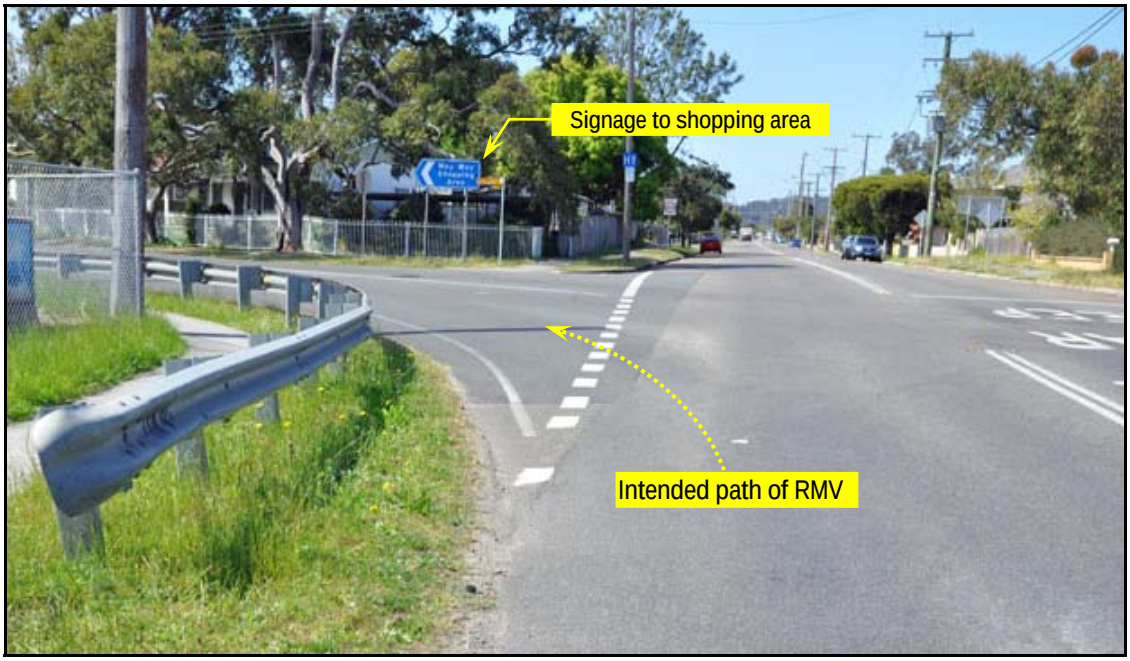
Sign No.	Description
1	Danger: High Voltage Overhead Wiring Max. Vehicle Height 4.4m
2	• Do not Cross while lights are displayed or alarms are sounding 2 tracks • Cyclists dismount
3	Stop on Red Signal
4	Roadwork Ahead
5	Railway Crossing – 2 tracks
6	No Right Turn 6.30am – 9.30am 3.30pm – 6.30pm Mon-Fri
7	Woy Woy Shopping Area
8	No Right Turn 6.30am – 9.30am 3.30pm – 6.30pm Mon-Fri
9	Railway Street

1.46 The first of these signs was positioned near or at his point of decision and, given his state of disorientation and heightened concentration, most likely caused an information overload that reduced the available time for him to decide when to turn his vehicle. Further, not all the signs in the RMV driver's view were relevant to road users; one providing directions for pedestrians and cycle riders using the pedestrian crossing.

1.47 While recognising the need to conform to the applicable Australian Standard for level crossing signage, the responsible authority should minimise signage and consider the overall visual environment presented to the driver approaching level crossings.

Shopping area sign

1.48 Although on a major thoroughfare, the sign indicating the direction to Woy Woy Shopping Area was positioned after the crossing and did not give the RMV driver any advance indication of the information he was seeking (see *Photograph 9*). Being unfamiliar with the area, looking for directions and street signs is likely to have diverted his attention from the road to trying to comprehend the information on the various signs.



Photograph 9: Intersection and signage to Woy Woy Shopping Area

Lack of road markings inside the rail corridor

1.49 During a site inspection, investigators were approached by two passing pedestrians who commented that they were aware of a previous incident where a local resident also drove into the rail corridor mistaking it for the roadway. A passing motorist also made unsolicited comment on the problems with visibility of the crossing and roadway at night.

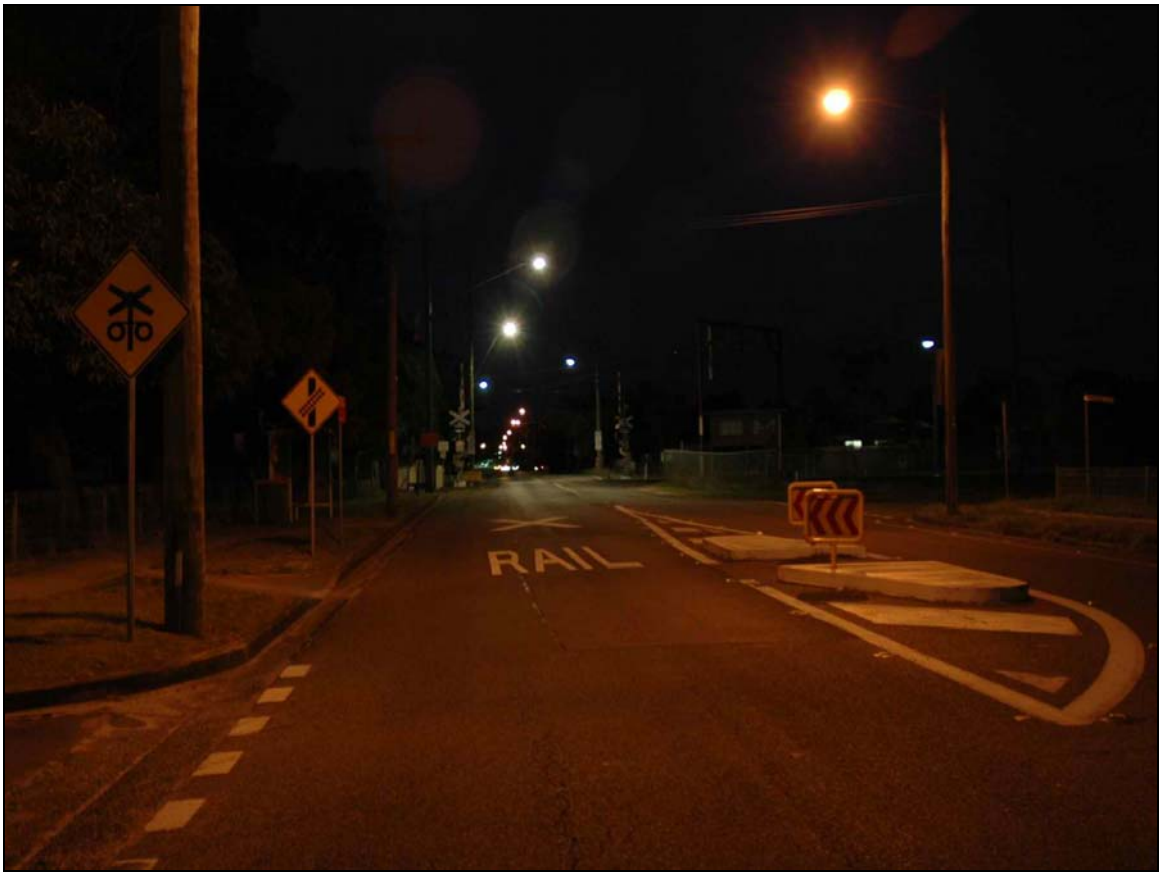
1.50 The road markings conformed to AS 1742.7 with the crossing approach and exit marked with double white lines and kerbing on the Western side of the rail corridor to give lane delineation. However, there were no road markings within the rail corridor to provide visual continuity of the laneway over the crossing (see *Photograph 10*). The kerbing ceased prior to the boom gates and there was no kerbing between the Eastern side of the rail corridor and the Railway Street intersection. The only markings in the corridor were those which delineated the pedestrian crossing and these were in a worn state.

Photograph 10: Crossing surface devoid of road markings

1.51 Although the signage for the pedestrian crossing conformed to AS 1742.7, the tactile markings for disabled users, as stipulated in Section 18.7.9 of RailCorp Engineering Standard ESG 100.18 *Signal Design Principles*, were not present.

Further, the condition of the paintwork on the protective steel barrier surrounding the boom gate mountings was poor and reduced its visual impact (see *Photograph 11*).

Photograph 11: Condition of barrier paintwork and road surface inside rail corridor



Photograph 12: Night time view of approach signage and pavement marking

1.52 The 'Rail X' pavement marking, as required by the Standard, was present approximately 60 metres before the crossing (see *Photograph 12*) in a serviceable condition and with good visual impact. The stop line was also present prior to the boom gate and in a serviceable condition.

Lack of emergency information

1.53 Signage at level crossings throughout the Network provides contact information for persons to report malfunctioning or damaged level crossing equipment (see *Photograph 13*). However, passers-by on the night commented that the signage did not provide any relevant contact information or details in its script for reporting emergencies. While the telephone number listed on the sign is manned 24 hours, seven days a week, it is not direct to the RMC but to the Infrastructure Operating Centre. The operator is required to act as a third party to relay any reports or information of accidents or emergencies at the crossing to the Train Control area in the RMC. As such, valuable time could be taken in providing immediate alerts to trains in the area.

Photograph 13: Information signage for reporting defective level crossing equipment

Future of the Level Crossing

1.54 Gosford City Council has commenced studies into the realignment of Woy Woy Road which include the elimination of the Rawson Road level crossing by upgrading the existing single lane underpass South of it. However, the Council has advised that the timeframe for this project will necessitate continued use of the Rawson Road level crossing for at least another three years. Accordingly, immediate remedial action is warranted to rectify those safety defects identified in the course of this investigation.

FINDINGS

Immediate Cause

2.1 The collision occurred as a result of the driver of the RMV becoming disoriented at Rawson Road level crossing, driving his vehicle onto the railway line and then not being able to remove the vehicle from the line to a safe location.

Contributory Factors

2.2 The number and variety of signage positioned in the vicinity of the crossing created information overload. [*Recommendation 3.1*]

2.3 There were no road markings providing a clear delineation of the roadway inside the rail corridor at the crossing. [*Recommendation 3.2*]

Other Safety Matters

2.4 OSCAR EMU sets incorporate lifeguards to clear small obstacles or debris from the path of the train wheels, designed in accordance with Section 16 of (British) RailTrack Railway Group Standard GM/RT 2100. However, neither the OSCAR sets nor other EMU passenger rolling stock operating on interurban routes incorporate additional protection to deflect more substantial obstacles such as provided for in Section 12 of the Standard. [*Recommendation 3.3*]

2.5 The visual impact of the Rawson Road level crossing needs to be restored through maintenance on the surface markings and boom gate mounting barriers. [*Recommendation 3.4*]

2.6 Emergency contact information is not provided at level crossings but could be incorporated with or into the information signage for reporting level crossing faults and damage. [*Recommendation 3.5*]

RECOMMENDATIONS

To address the safety issues identified in this rail incident, it is recommended that RailCorp undertake the following remedial safety actions:

3.1 In conjunction with Gosford City Council, identify how the signage at the crossing could be rationalised so as to:

- provide road users with advanced and concise notice of the direction to the Woy Woy shopping area; and
- reduce the visual clutter but without compromising safety.

Extend this process by reviewing signage at all level crossings throughout the Network to ensure similar problems are eliminated.

3.2 Mark the level crossing surface to provide continuity of the lane delineation over the crossing.

3.3 Taking into consideration up-to-date incident data, re-evaluate the assessment of risk and adequacy of extant controls associated with electric multiple unit passenger rolling stock striking obstacles on track on interurban routes.

3.4 Ensure proper visual impact of the level crossing equipment at the crossing is maintained at all times.

3.5 Include emergency contact details in the information signage provided at level crossings.

APPENDIX 1: Sources, Submissions and Acknowledgements

Sources of Information

- Bureau of Meteorology
- Gosford City Council
- NSW Police
- RailCorp

References

- Australian Standard 1742.7
- (British) RailTrack Railway Group Standard GM/RT 2100
- Glossary for the National Codes of Practice and Dictionary of Railway Terminology
- Interface Coordination Plan
- Rail Safety Act 2008 (NSW)
- Rail Safety Regulation 2008 (NSW)
- RailCorp Network Rules and Procedures

Submissions

The Chief investigator forwarded a copy of the Draft Report to the Directly Involved Parties (DIPs) to provide them with the opportunity to contribute to the compilation of the Final Report by verifying the factual information, scrutinising the analysis, findings and recommendations, and to submit recommendations for amendments to the Draft Report that they believed would enhance the accuracy, logic, integrity and resilience of the Investigation Report. The following DIPs were invited to make submissions on the Draft Report:

- Gosford City Council
- Independent Transport Safety Regulator
- RailCorp

Responses were received from all three organisations. The Chief Investigator considered all representations made by DIPs and responded to the author of each of the submissions advising which of their recommended amendments would be incorporated in the Final Report, and those that would not. Where any recommended amendment was excluded, the reasons for doing so were explained.

Acknowledgements

Figure 1 was sourced from *Google*. Figure 2 was sourced from RailCorp.