IN THE CORONERS COURT
OF VICTORIA
AT MELBOURNE

Court Reference: COR 2007 2110

FINDING INTO DEATH WITH INQUEST

Form 37 Rule 60(1)
*Section 67 of the **Coroners Act 2008***

Inquest into the Death of:	HAROLD CLAUDE LONG
Delivered On:	21 October 2013
Delivered At:	Coroners Court of Victoria Level 11, 222 Exhibition Street Melbourne 3000
Hearing Dates:	19-21, 25, 28-29 January 2011 11-15, 18-22, 25-29 July 2011 1-3, 25-26, 29 -30 August 2011 1, 14, 21, 27-28 September 2011
Findings of:	JANE HENDTLASS, CORONER
Representation:	MR S. OMEARA with DR M. RUSH appeared on behalf of Ambulance Victoria. MR R. NIALL SC with MR P. DOYLE appeared on behalf of V/Line. MS C. MELIS appeared on behalf of the Victoria Police. MS M.A. HARTLEY SC with MS S. HINCHEY appeared on behalf of VicTrack and Department of Transport. MR R. RAY QC with MR R. TAYLOR appeared on behalf of VicRoads MS L. SIMONS appeared on behalf of the Stubbs Family

	MS A. MAGEE for Gannawarra Shire Council and Municipal Association of Victoria.
	MS D MORTIMER SC with MS E. BENNETT appeared on behalf of Transport Safety Victoria.
	MR S. McGREGOR appeared on behalf of the Department of Health.
	MR DAVIS appeared on behalf of Standards Australia.
	MR I. HILL QC appeared on behalf of Canny Carrying Company.
	MR S. PETROVICH appeared for Adrienne Rowell
Counsel Assisting the Coroner	MR J. GOETZ was present to assist the Coroner.

I, JANE HENDTLASS, Coroner having investigated the death of HAROLD CLAUDE LONG

AND having held an inquest in relation to this death on 19-21, 25, 28-29 January 2011;
11-15, 18-22, 25-29 July 2011;
1-3, 25-26, 29 -30 August 2011; and
1, 14, 21, 27-28 September 2011

at MELBOURNE

find that the identity of the deceased was HAROLD CLAUDE LONG
born on 11 October 1923
and the death occurred 5 June 2007
at the level crossing about 5 km north of Kerang at Fairlie, Victoria
from:

1 (a) ACUTE BLOOD LOSS AND SHOCK/TRAUMA IN A MAN WITH CARDIOMEGALY, MYOCARDIAL FIBROSIS AND ISCHAEMIC CORONARY ARTERY DISEASE

in the following circumstances:

1. Harold Claude Long was 83 years old when he died. He lived with his wife, Janet Long, at 21 Kent Street in Knoxfield.

2. Mr Long's medical history included chronic obstructive airways disease, a stent in his circumflex coronary artery and a moderately enlarged heart.

3. At 1:05pm on 5 June 2007, Mr Long caught the V/Line passenger train service from Swan Hill. The train was bound for Southern Cross Station in Melbourne.

4. Mr Long was seated near the rear of carriage B near the toilet on the left side of the train.

5. At 1:34pm on 5 June 2007, a semi-trailer driven by Christian Scholl collided with the V/Line passenger train at a level crossing about 5 km north of Kerang at Fairlie (the "Kerang level crossing").

6. As a result of the collision, Mr Long was trapped by the lower leg under three seats and other casualties on the floor in Carriage B. Only his hand was visible from under the seats that had moved in the collision. He was presumed dead.

7. However, at about 2:25pm, the conductor on the train, Haydn Buckland and Senior Constable Troy Hafner noticed that Mr Long's hand had moved. Mr Hafner climbed over a section of seat and felt Mr Long had a strong pulse.

8. State Emergency Service workers set about extracting Mr Long from under the displaced seats and debris with the assistance of Mr Hafner and Mr Buckland. By now, Mr Long was responding to questions but his condition was deteriorating.

9. At about 2:30pm, the community ambulance officer, Stephen Humphreys, diagnosed Mr Long with fractures to his lower leg and a large laceration. He stabilised Mr Long and placed him on a spinal board. Mr Long was the second person transferred to the Casualty Collection Post on the Murray Valley Highway in Mr Gillingham's utility driven by Mr Hafner.

10. The senior ambulance officer on site, Neil Harrop, assessed Mr Long as conscious and alert but in shock due to his severe right lower leg which was of compound in nature and large tissue damage.

11. Mr Harrop stabilised Mr Long and the Health Commander at the scene arranged for his transfer to a Trauma Centre in Melbourne by Air Ambulance Victoria.

12. At 2:50pm, Mr Long arrived at the airport. A fixed wing aircraft with a transfer patient already on board had been waiting for 31 minutes.

13. The flight paramedic, Troy Fosbender, noted Mr Long had an open fracture in the right lower leg. He noted no abnormalities relating to his chest. His condition was stable.

14. Trevor Salvado was the pilot of the fixed wing plane used to transfer Mr Long to Melbourne. He does not remember Mr Fosbender asking him to adjust the cabin pressure of his plane. Mr Fosbender does not remember whether he discussed altitude with the pilot and no record was kept.

15. At 3:21pm, the fixed wing aircraft left Kerang airport.

16. At 3:25pm, 3:39pm, 3:45pm and 3:51pm and 3:57pm, Mr Fosbender gave Mr Long five doses of 2.5mg intravenous morphine.

17. Further, Mr Fosbender assessed Mr Long five times on the way to Melbourne:

    - At 3:21pm, his pulse declined to 69 beats per minute, his blood pressure was 125/86mmHg and his respiration rate remained 18 breaths per minute.
    - At 3:25pm, Mr Fosbender gave Mr Long 10mg morphine.
    - At 3:37pm, his pulse returned to 92 beats per minute, his blood pressure was 151/102mmHg and his respiration rate had declined 16 breaths per minute. He was sweaty, agitated and restless.

- At 3:50pm, his pulse was about 100 beats per minute. His conscious state had deteriorated and Mr Fosbender was unable to take his observations.
- At 3:57pm he became combative. Mr Fosbender remained unable to take his observations.

18. Although these reactions are not inconsistent with onset of a tension pneumothorax at about 3:37pm, none include any reference to respiratory distress. Further, Mr Fosbender denies that Mr Long suffered from a tension pneumothorax while in the aircraft and Mr Long's medical condition could have alternative explanations.

19. At 4:03pm, Mr Long arrived at Essendon airport.

20. At 4:10pm, Mr Fosbender handed Mr Long over to Mobile Intensive Care Ambulance Flight paramedic, Matthew Davidson, for transfer to the Royal Melbourne Hospital. He was still very restless and uncooperative. His Glasgow Coma Scale was less than 10.

21. Mr Davidson confirmed Mr Fosbender's assessment that Mr Long was pale, cold and unwell-looking with an altered conscious state. His blood pressure was unrecordable and he was critically unstable. There were no obvious signs of tension pneumothorax.

22. At 4:24pm, Mr Long left Essendon airport in an ambulance with lights and sirens operating.

23. At 4:30pm, Mr Davidson intubated Mr Long without sedation because he could not re-gain intravascular access and commenced assisted ventilation with 100% oxygen. Mr Long's conscious state and respiratory status declined further.

24. At 4:33pm, Mr Davidson noted that Mr Long developed symptoms consistent with right-sided tension pneumothorax. He was able to hear decompression of the pneumothorax when he introduced bilateral intercostal catheters and Mr Long's condition improved immediately. Therefore, Mr Davidson formed the view that he was probably correct in diagnosing a tension pneumothorax.

25. However, at about 4:41pm, Mr Long deteriorated again. Mr Davidson commenced cardiopulmonary resuscitation. He was continuing this procedure when they presented at the Emergency Department of the Royal Melbourne Hospital.

26. At 4:44pm, Harold Long presented at the Trauma Centre of the Royal Melbourne Hospital. He was triaged Category 1.

27. Mr Long's treating doctor was an emergency physician, Dr Jonathon Papson. However, Dr Papson emphasised that he was just one of a trauma team which typically included an anaesthetist, three

emergency nurses, a trauma registrar or surgeon, one or two emergency physicians and one or two emergency registrars.

28. Dr Papson recorded that Mr Long was receiving cardiopulmonary resuscitation. He was also intubated and ventilated by hand, his lungs were unequal in distension, he had suffered a cardiac arrest and had no pulse or recordable blood pressure. His GCS was < 9.

29. Dr Papson diagnosed a recurring minor right pneumothorax and relieved it with a further intercostal catheter. This condition was not considered significant in causing Mr Long's condition because there was no blood loss through the decompression needle.

30. At 5:10pm, resuscitation ceased and Harold Long died.

31. Harold Long was identified by DNA matching as the parent of Dennis Long.

32. The forensic pathologist who performed the autopsy formed the opinion that the cause of death was acute blood loss and shock/trauma in a man with cardiomegaly, myocardial fibrosis and ischaemic coronary artery disease.

33. Mr Long was stable after Mr Harrop re-established his fluids at Kerang. Further, the transfer time from Kerang was always going to be greater than 30 minutes from the time of the incident. Therefore under the trauma protocols, Mr Long should have been transferred to the nearest designated trauma service, that is Swan Hill or Bendigo, before or instead of transfer to a Major Trauma Centre by fixed wing aircraft.

34. Professor Anne-Maree Kelly is an Emergency Physician and Academic Head of Emergency Medicine at Western Hospital.

35. In Professor Kelly's opinion, it was appropriate to transfer Mr Long to a Major Trauma Centre because of his age, his loss of consciousness in the collision, his severe leg injuries, and his hypotension at the scene.

36. However, Professor Kelly also noted that, in the circumstances of Mr Long's injuries, the decision to transfer him required balance of the need for expert services against the risks associated with air transfer.

37. Professor Kelly also told the Court there were a number of possibilities that would explain Mr Long's deterioration during fixed wing air transfer from Kerang to Melbourne. These include:

- Head injury;
- Underlying tension pneumothorax that became evident on assisted ventilation; and/or

- Primary cardiac event.

38. Although Mr Long suffered some abrasions, I note that the forensic pathologist did not note any suggestion of major head injury in his observations of Mr Long' head and brain. Accordingly, I exclude the possibility that head injury was of major significance.

39. Further, Professor Kelly also said that, if his tension pneumothorax was the major issue for Mr Long during his transfer to the Royal Melbourne Hospital, she would have expected his pulse and blood pressure to improve when Mr Davidson relieved it in the ambulance. She would then expect a slow steady decline in his conscious state.

40. However, I note that Mr Davidson recorded much improved pulse and respiratory effort after he decompressed Mr Long's suspected tension pneumothorax.

41. Therefore, I do not necessarily accept that Mr Long's tension pneumothorax was not a factor in his death.

42. Further, in circumstances where the tension pneumothorax became obvious when Mr Davidson intubated Mr Long and commenced assisted ventilation, I do not necessarily accept that Mr Long did not develop an underlying tension pneumothorax during transport in a fixed wing aircraft when his respiration was assisted by a mask.

43. Professor Kelly, Dr Papson and another emergency physician, Dr Sandra Neate, agree that another process was the major influence on Mr Long's death. They were also of the opinion that the tension pneumothorax may have been a contributing factor but it was not the overwhelming factor in Mr Long's death. Rather, the cause of death was probably related to compromise of Mr Long's cardiac condition by the circumstances of his entrapment at the scene and his leg injury.

44. Dr Papson and Dr Neate also said that a tension pneumothorax would have contributed to his cardiac deterioration but they were uncertain about the degree of this contribution.

45. In determining whether to change the cause of death volunteered by the forensic pathologist, I accept their opinion without necessarily excluding a contribution by the tension pneumothorax diagnosed and treated by Mr Davidson at 3:37pm on 5 June 2007.

46. Accordingly, I adopt the cause of death determined by the forensic pathologist at autopsy.

47. I find that Harold Long died from acute blood loss and shock/trauma in a man with cardiomegaly, myocardial fibrosis and ischaemic coronary artery disease.

48. Harold Long's death is one of a cluster of 26 level crossing fatalities I have investigated in an attempt to prevent other people dying for the reasons that Mr Long died.

49. Further analysis, comments and recommendations pursuant to sections 67(3) and 72(2) of the *Coroners Act 2008* in relation to this cluster of level crossing deaths are included in Attachment A to this finding.

I direct that a copy of this finding be provided to the following:

Greg Sassella, Chief Executive Officer, Ambulance Victoria, 375 Manningham Road, Doncaster 3108

Martin Dolan, Chief Commissioner, Australian Transport Safety Bureau, 62 Northbourne Avenue, Canberra, Australian Capital Territory 2601

National Heavy Vehicle Regulator, Level 9, Green Square North Tower, 515 St Pauls Terrace, Fortitude Valley, Queensland 4006

Colin Blair, Chief Executive, Standards Australia Limited, Level 10, 20 Bridge Street, Sydney New South Wales 2000

Alan Osborne, Director, Transport Safety Victoria, 121 Exhibition Street Melbourne 3000

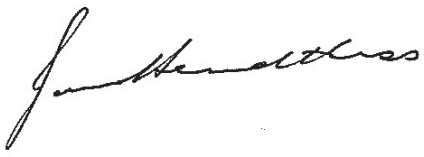
Gary Liddle, Chief Executive, VicRoads, 60 Denmark St, Kew 3101

Bob Annells, Chair, Victorian Rail Track (VicTrack), VicTrack Head Office, Level 8, 1010 LaTrobe Street, Docklands 3008

Ian Dobbs, Chief Executive Officer, Public Transport Victoria, Department of Transport, Planning and Local Infrastructure, 121 Exhibition Street Melbourne 3000

Theo Taifalo, Chief Executive Officer, V/Line Corporation, GPO Box 5343, Melbourne VIC 3001

Signature:



DR JANE HENDTLASS
CORONER
Date: **21 October 2013**

Coroners Court of Victoria

ATTACHMENT A

Coronial Investigation of Twenty-six Rail Crossing Deaths in Victoria, Australia

- Adam Dunning Case No. 3174/02;
- Adrian Kiely Case No. 3175/02;
- Ian Pettersen Case No. 3176/02;
- Jamie Webb, Case No. 1965/06;[1]
- Tony Massaria Case No. 3881/06;[2]
- James Gordon Case No. 4307/06;
- Harold Long Case No. 2110/07;
- Nicholas Parker Case No. 2114/07;
- Stephanie Meredith Case No. 2125/07;
- Jaeseok Lee Case No. 2126/07;
- Danielle Meredith Case No. 2127/07;
- Chantal Meredith Case No. 2128/07;
- Geoffrey McMonnies Case No. 2129/07;
- Matthew Stubbs Case No. 2130/07;
- Margaret Wishart Case No. 2131/07;
- Rosanne McMonnies Case No. 2132/07;
- Ercil Jean Webb Case No. 2133/07;
- Geoffrey Young Case No. 3307/07;
- Kay Stanley Case No. 417/08;[3]
- Fiona Smart Case No. 468/08;
- Haldane Nelson Case No. 801/08;
- Caitlin Angel Case No. 1231/08;
- Susan Angel Case No. 1230/08;
- Jillian McCormack Case No. 5159/08;
- Mariam Yousif Case No. 1656/09; and
- Mark Winter Case No. 3471/09.[4]

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1 Completed by Coroner Ronald Saines, Finding with Inquest, Jamie Webb, Case No. 1965/06.

2 Completed by Coroner Jacinta Heffey, Finding into Death without Inquest, Anthony Massaria, Case No. 3881/06.

3 Completed by Coroner Jacinta Heffey, Finding into Death with Inquest, Kay Stanley, Case No 417/08.

4 Completed by Coroner Jacinta Heffey, Finding into Death with Inquest, Mark Winter, Case No 3471/09.

RECOMMENDATIONS

Pursuant to section 72(2) of the *Coroners Act* 2008, I make the following recommendations connected with the deaths of 22 people in this cluster of 26 level crossing fatalities:[5]

THE DRIVER AND THE ROAD VEHICLE

1. That Transport Safety Victoria, Public Transport Victoria, and VicRoads adopt a systematic approach to collecting routine detailed human factors information about level crossing collisions.

2. That Transport Safety Victoria and VicRoads investigate and implement new level crossing infrastructure which is designed to alert road vehicle drivers to an approaching train who are unresponsive to the current suite of level crossing warning signs.

3. That Transport Safety Victoria and VicRoads commit themselves to joint sophisticated human factors research and innovative technology to determine how best to alert drivers who will otherwise not notice an approaching train in the context of current level crossing warnings.

4. That VicRoads and Standards Australia amend their standards to require warning signs and visibility of the train must be at least 131 metres before the level crossing, more on B double and B-triple combination routes.

5. That the National Heavy Vehicle Regulator amend their Code of Practice to require inspection of brake pads and push rod extensions weekly or fortnightly.

6. That the National Heavy Vehicle Regulator ensure that the National Heavy Vehicle Accreditation Scheme is expanded to include all Victorian heavy vehicle operators who perform their own maintenance in-house.

7. That the National Heavy Vehicle Regulator ensure that the Code of Practice adopted by the National Heavy Vehicle Accreditation Scheme also ensures that mechanics performing maintenance work on heavy vehicles have access to and comply with manufacturers' maintenance instructions.

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5 Coroner Saines and Corner Heffey have completed Findings in their investigations of the deaths of Tony Massaria, Kay Stanley and Mark Winter: Coroner Ronald Saines, Finding into Death with Inquest, Jamie Webb, Case No. 1965/06; Coroner Jacinta Heffey, Finding into Death without Inquest, Anthony Massaria, Case No 3881/06.; Coroner Jacinta Heffey, Finding into Death with Inquest, Mark Winter, Case No 3471/09; Coroner Jacinta Heffey, Finding into Death with Inquest, Kay Stanley, Case No 417/08.

THE INFRASTRUCTURE INCLUDING REGULATION OF THE LEVEL CROSSING AND THE LOCOMOTIVE

8. That Transport Safety Victoria and Public Transport Victoria investigate the way in which directed sounds from horns and sirens can be used to increase the conspicuity of locomotives in regional areas and increase the likelihood of road vehicle drivers' awareness of an approaching train.

9. That Transport Safety Victoria, Public Transport Victoria and VicRoads extend their development and evaluation of new level crossing countermeasures with specific reference to the countermeasure's capacity to alert road vehicle drivers to the presence of an approaching train.

10. That Standards Australia review Australian Standard AS1742.7-2007 to include advice in relation to left turn slip lanes where level crossings are on side roads and specifications for light emitting diodes ("LEDs") in flashing red light infrastructure.

11. That Standards Australia implement a schedule of more frequent routine reviews of Australian Standard AS1742.7-2007 for currency and compatibility with new infrastructure and technology.

12. That Transport Safety Victoria, Public Transport Victoria and VicRoads establish formal cooperative arrangements in relation to sharing of information required for to predictive risk assessment of level crossings, prioritisation of level crossing upgrades and development of innovative train warning systems (see below).

13. That Transport Safety Victoria cooperate with the National Rail Safety Regulator in establishing a system for undertaking and analysing the results of root cause analyses for fatal level crossing collisions to better inform improvements in level crossing infrastructure and level crossing safety.

14. That Transport Safety Victoria and Public Transport Victoria improve the accuracy, content and relevance of data used in predictive risk analysis used to inform decisions about upgrading of level crossings in Victoria.

15. That the Australian Transport Safety Bureau, through the Transport Safety Victoria, continue to apply the systematic analysis procedures in their analysis of fatal rail incidents.

16. That the Transport Safety Victoria continue to maintain and improve a comprehensive reliable data base of all level crossing incidents that occur in Victoria.

17. That VicTrack, VicRoads, Transport Safety Victoria and rail operators cooperate with each other to implement innovative in-vehicle warning systems as the next stage of warning road vehicle drivers who fail to respond to existing level crossing paraphernalia that a train is approaching.

THE EMERGENCY RESPONSE TO THE KERANG LEVEL CROSSING COLLISION

18. That Ambulance Victoria and Air Ambulance Victoria carefully consider the risks of tension pneumothorax when triaging trauma patients for transfer by fixed wing aircraft without Mobile Intensive Care Ambulance support.

19. That V/Line provide train drivers and conductors with formal instruction and scenario practice events to ensure they understand their role as Interim Site Controllers.

20. That V/Line provide the same with equipment, formal instruction and scenario practice events for all trained conductors to enable them to assist the train driver and the conductor in their Interim Site Control duties.

21. That V/Line provide first aid supplies on all regional trains including blankets and bandages appropriate for use in major emergencies.

22. That V/Line provide tools and gloves on all regional trains adequate for removing seats and freeing of passengers trapped in the debris in a major collision involving a heavy vehicle combination.

23. That Victoria Police ensure that Incident Commanders and Emergency Management Coordinators are aware of the importance of including representatives of all the support organisations involved in the emergency response in the Emergency Management Team.

24. That V/Line review their management arrangements to ensure that trained V/Line Rail Incident Controllers are within access to all level crossings in regional Victoria in a timely manner to support train crews and Victoria Police in the case of an emergency.

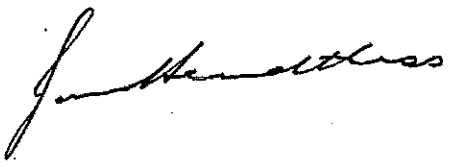
25. That V/Line involve the train crews and management staff in local desk top and scenario emergency service training so that inadequacies in communication and management can be identified and corrected.

I direct that this report of my investigation be published on the Internet.

I also direct that a copy of this finding be provided to the following:

- Greg Sassella, Chief Executive Officer, Ambulance Victoria, 375 Manningham Road, Doncaster 3108
- Martin Dolan, Chief Commissioner, Australian Transport Safety Bureau, 62 Northbourne Avenue, Canberra, Australian Capital Territory 2601
- National Heavy Vehicle Regulator, Level 9, Green Square North Tower, 515 St Pauls Terrace, Fortitude Valley, Queensland 4006
- Colin Blair, Chief Executive, Standards Australia Limited, Level 10, 20 Bridge Street, Sydney New South Wales 2000
- Alan Osborne, Director, Transport Safety Victoria, 121 Exhibition Street Melbourne 3000
- Gary Liddle, Chief Executive, VicRoads, 60 Denmark St, Kew 3101
- Bob Annells, Chair, Victorian Rail Track (VicTrack), VicTrack Head Office, Level 8, 1010 LaTrobe Street, Docklands 3008
- Ian Dobbs, Chief Executive Officer, Public Transport Victoria, Department of Transport, Planning and Local Infrastructure, 121 Exhibition Street Melbourne 3000
- Theo Taifalo, Chief Executive Officer, V/Line Corporation, GPO Box 5343, Melbourne VIC 3001

Signature:



DR JANE HENDTLASS
CORONER
Date: **21 October 2013**

TABLE OF CONTENTS

EXECUTIVE SUMMARY

INTRODUCTION

1. In Australia, road and rail transport is a particularly important part of our social fabric: we live long distances apart; we travel long distances; we transport goods long distances.[6]

2. Level crossing accidents have been identified as a key risk to safety in the rail industry:[7]

   - There are 1,872 road-rail level crossings in Victoria.[8]
   - There were 192 collisions between road vehicles and trains at level crossings in Victoria between 2002 and 2012.[9]
   - About 8% of all level crossing crashes result in death.[10]

3. National statistics also indicate that about 8% of all level crossing collisions in Australia result in death and heavy trucks are involved in 15% of these level crossing fatal collisions.[11] These figures indicate that the severity or relative likelihood of fatalities is higher for level crossing collisions involving heavy vehicles in regional Victoria than it is for other road collisions or for collisions with other vehicles.

4. In each financial year between 2000 and 2006, between one and six people were accidentally killed in Victorian level crossing collisions each year. Further, between 1970 and 2008, fatalities resulting from accidents between road vehicles and trains at level crossings reduced by about 70 per cent.[12]

5. In both Victoria and the United States, the decrease in level crossing fatalities has also been partly attributed to level crossing closures.[13]

6. Further, improvements in crossing safety cannot be viewed in isolation to general changes in highway safety. In the United States, the effect of road safety initiatives on level crossing

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6 Department of Transport, Facts and Figures: 2001-2011.

7 Australian Transport Safety Bureau, "ATSB rail safety investigation: key lessons learnt", Rail safety bulletin RR-2008-008, July 2008.

8 Road Safety Committee, Parliament of Victoria, "Inquiry into Improving Safety at Level Crossings", December 2008.

9 Australian Transport Safety Bureau, "Australian Rail Safety Occurrence Data: 1 July 2002 to 30 June 2012", Rail safety report RR-2012-0010, 23 November 2012.

10 Australian Transport Council, National Railway Level Crossing Behavioural Strategy, August 2003.

11 Australian Transport Council, National Railway Level Crossing Behavioural Strategy, August 2003; Australian Transport Safety Bureau, Monograph 10, level Crossing Accidents, 1988-1998.

12 See for example, Australian Transport Safety Bureau, "Railway Level Crossing Safety Bulletin", 2008; Victorian Auditor-General's Office, "Audit summary of Management of Safety Risks at Level Crossings", tabled in Parliament of Victoria, 24 March 2010.

13 Road Safety Committee, Parliament of Victoria, "Inquiry into Improving Safety at Level Crossings", December 2008.

incidents and fatalities is estimated to be about twice that resulting from the installation of active warning devices.[14]

7. For example, trauma experts believe that about 35% of all deaths following road trauma are preventable or potentially preventable when appropriate trauma management systems are activated.[15]

8. Therefore, the effectiveness and efficiency of the emergency medical response can also be expected to influence the number of deaths and severity of injuries that arise from a multi-victim trauma incident like that at the level crossing at Fairlie about five kilometres north of Kerang (the "Kerang level crossing") on 5 June 2007.

9. In 2008, Bob Pearson advised VicRoads that the likelihood of a collision between a heavy vehicle and a train resulting in multiple train passenger fatalities was about once in five years.[16]

10. Road and rail traffic in Victoria has increased significantly since 1989 and even 2008. This change is likely to continue for the foreseeable future.[17]

11. This increase in exposure of the heavy vehicle combinations and passenger train services can be expected to continue to increase their involvement in collisions at level crossings.[18] Further, with the increasing size and speed of modern trains and road vehicles involved in level crossing collisions, Victorians can expect more severe injuries and deaths arising from level crossing collisions.

12. On or about 11 February 2008, the State Coroner directed me to investigate a cluster of 26 level crossing deaths in order to identify ways in which they could have been prevented.[19]

13. In Victoria, the number of fatalities arising from level crossing collisions has consistently been too small to attribute statistical significance to the effectiveness of individual features of the current safety program. However, the overall decline in level crossing fatalities in Victoria has allowed this coronial investigation to focus on the residual issues that continue to underlie fatal level crossing collisions.

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14 S Mok & I Savage. "Why has Safety Improved at Rail-Highway Grade Crossings?" *Risk Analysis* 25 (2005) 867.

15 State Trauma Committee, "A Trauma Education Framework for Victoria", October 2001.

16 Bob Pearson, Risk Analysis of Trick Train Collisions of Significant Severity, Final report, 28 November 2008.

17 Department of Transport, Facts and Figures: 2001-2011; Department of Infrastructure, SWITCHPOINT: Victorian Rail Freight Network Review, p.4; Department of Transport, "Transport Demand Information Atlas for Victoria", 2009; Public Accounts and Estimates Committee, Parliament of Victoria, Review of the Findings and Recommendations of the Auditor-General's Reports –2007, June 2009.

18 See for example, Austroads, "Measures for Managing Safety of Heavy Vehicles at Passive and Active Railway Level Crossings" NS 1587 Sydney 2010.

19 Investigation of a level crossing incident at Trawalla remains incomplete and has been transferred to Coroner Phillip Byrne. Victor Greensill Case No. 1552/06; Gwenda Glasson Case No. 1553/06.

14. This coronial investigation focuses on the particular risks associated with the increasing numbers of road vehicles, particularly heavy combination vehicles, in regional Victoria.

15. It attempts to extend what is already known about road user behaviour at level crossings to look at the small group of road vehicle drivers who fail to become aware of an approaching train despite a plethora of level crossing warnings and become involved in fatal level crossing collision.

16. In applying systems analysis to examine this cluster of fatal level crossing incidents,[20] I have attempted to consider the residual issues in the context of the potential for specific increased risk that is associated with changes in road and rail traffic expected in regional Victoria over the next ten years.

17. In particular, this coronial investigation of the cluster of level crossing deaths has concentrated on three issues:

- The driver and the road vehicle;
- The infrastructure including effectiveness of current level crossing infrastructure; and
- The emergency response in regional areas with particular emphasis on the Kerang incident.

18. The report of this cluster investigation should be read as an Attachment to and in conjunction with the individual findings relating to the 21 level crossing deaths that I have completed on 21 October 2013.[21]

19. As provided by sections 67(3) and 72(2) of the *Coroners Act* 2008, the comments and recommendations in this cluster report are intended to prevent further deaths occurring for the reasons that 26 people died in level crossing collisions in Victoria between 2002 and 2009.

THE DRIVER AND THE ROAD VEHICLE

20. On 5 June 2007, Chris Scholl was driving a 1999 Kenworth Aerodyne cab-over prime mover towing a 1996 Krueger Tautliner tri-axle semi-trailer ("Mr Scholl's semi-trailer") north along the Murray Valley Highway.

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20 Reason, J., "Human Error", Cambridge University Press: Cambridge, 1990. See also e.g. James Reason, "Human error: models and Management", British Medical Journal 328 (2000) 768; J Reason. 1997, Managing the Risks of Organisational Accidents, (Ashgate Publishing Limited: Aldershot) adopted by Australian Transport Safety Bureau, "Level Crossing collision between Steam Passenger Train 8382 and a Loaded B-Double Truck-Benalla Victoria 13 October 2002", Rail Safety Investigation 2002/003, September 2004.

21 Coroner Ronald Saines has completed the coronial investigation of the death of Jamie Webb: Finding with Inquest, Jamie Webb, Case No. 1965/06; Coroner Jacinta Heffey has completed the coronial investigations of the deaths of Tony Massaria, Kay Stanley and Mark Winter: Finding into Death without Inquest, Anthony Massaria, Case No 3881/06; Finding into Death with Inquest, Kay Stanley, Case No 417/08; Finding into Death with Inquest, Mark Winter, Case No 3471/09.

21. Mr Scholl held a full and current Victorian drivers licence endorsed for commercial heavy vehicles. He had 31 years experience as commercial heavy vehicle driver in the Netherlands as well as in Australia. He had no relevant prior traffic convictions.

22. Mr Scholl was deaf in one ear and his right eye required him to wear glasses.

23. The heavy vehicle combination was currently registered to carry about 29 tonnes. The trailer was loaded with timber, drums and pipe fitting with a total weight of about 14 tonnes including 12.34 tonnes of wood destined for South Australia.

24. The prime mover and trailer were owned by the Canny Carrying Company ("Cannys").

25. Mr Scholl's semi-trailer was travelling generally north on the Murray Valley Highway after it negotiated a slight right hand curve which is completed about 165 metres south of the level crossing on the Murray Valley Highway at Fairlie about five kilometres north of Kerang (the "Kerang level crossing").

26. Mr Scholl saw the light structure but he did not see the red lights flashing and he did not see the train approaching. He did not hear the train horn either.[22]

27. Mr Scholl told police:

> *"I didn't expect the train because I looked at the lights and the lights were not flashing, therefore I didn't expect the train to be there."*

28. Mr Scholl said he noticed the train when it emerged from behind trees and he then saw the cars stopped on the other side of the level crossing when he was about 90 metres south of the level crossing.

29. Mr Scholl immediately applied his brakes. The brakes on his prime mover continued to operate in anti-lock mode. The brakes on his trailer locked up causing flat spots on the tyres.

30. Mr Scholl was unable to stop or turn his semi-trailer sufficiently before the left hand corner of his trailer hit the second carriage of the train.

31. After the collision, about two thirds of the left hand wall was missing and the roof was badly distorted. Carriage C also became detached from the rest of the train and completely derailed.

32. Mr Scholl lost consciousness as the result of the collision and was subsequently treated for concussion.[23] He was transferred first to Kerang Hospital and then by air ambulance to The Alfred Hospital. Mr Scholl was later transferred to the Epworth Hospital.

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22 Scholl trial transcript, pp. 550, 555.
23 Scholl trial transcript, p. 549.

33. A blood sample taken at 3:15pm on 5 June 2007. It contained no alcohol or other drugs.

34. Mr Scholl had travelled on the Murray Valley Highway on trips to and from Adelaide once a week for seven years and had crossed the Kerang level crossing many times in the course of his work. Mr Scholl had never seen a train or activated level crossing warning signals at the Kerang level crossing before.

35. Mr Scholl did not usually work on Mondays. However, on 4 June 2007, he drove to Melbourne and Ballarat and to Benalla. The computer records from the prime mover also indicate that it was working from 1:19am to 2:19pm.

36. Further, Mr Scholl and Michael Canny both say that Mr Scholl did not work on 2 or 3 June 2007. The diary used to record drivers' work also has no record of anyone working on 2 or 3 June 2007.

37. At about 10:00am on 5 June 2007, Mr Scholl arrived at work. This was at least 90 minutes later than usual. His semi-trailer had already been loaded.

38. The characteristics of the 13 road vehicle drivers in this cluster of fatal level crossing collisions were consistent with other investigators findings:

- All but one were experienced drivers;[24]
- None was affected by alcohol or other drugs;
- All but three were very familiar with the crossing; and
- All but one never or rarely saw a train at the level crossing.[25]

39. This investigation has also identified a number of other issues common to the heavy vehicle combination drivers in this coronial investigation of fatal level crossing collisions and those investigated by other agencies in Victoria. These issues include:

- The train or road vehicle travelling is at a different time from usual;
- There are no boom gates;
- The road vehicle driver is working long hours and/or at different times from usual; and
- They occur in daylight when the weather is good.[26]

40. Many of these circumstances interact with each other and should be considered in that context.

41. The *Road Safety Act* 1986 requires a driver to take appropriate care, not recklessly enter a level crossing when the warning bells are operating or a train is approaching or travel at a speed which is dangerous in all the circumstances.[27]

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24 cf Mariam Yousif Case No. 1656/09

25 Jillian McCormack Case No. 5159/08.

26 cf Coroner Ronald Saines, Finding into Death with Inquest, Jamie Webb, Case No. 1965/06. Fog contributed to Jamie Webb's death.

27 Ss.64, 65, 68B *Road Safety Act* 1986.

42. However, Dr Ian Johnston reported that an analysis of 87 fatal level crossing crashes carried out by the Australian Transport Safety Bureau reported that over 90% did not involve any of alcohol, speeding or fatigue - the three high frequency risk factors in road crashes more generally - and also that unintended error/violation was about twice as common in level crossing fatal crashes as appears to be the case in road crashes generally.

43. While it did not include level crossings, the results of this Austroads research are informative. The 25 drivers who participated made an average of 12 errors/violations per drive, over half of which occurred at intersections and most of the violations were inadvertent.

44. Dr Johnston is supported by James Reason who summarised the situation:

> *"...doing routine jobs in an automatic state releases the mind to be elsewhere"*[28]

45. Therefore, I make no recommendations to strengthen the provisions of the *Road Safety Act* 1986 relating to drivers entering a level crossing when active warnings are operating or a train is approaching.

46. However, Dr Johnston cautioned:

> *"Most experts have applied their general human factors knowledge to the level crossing situation to deduce what may be important. It is critical to stress the need for systematic research to assess whether what follows is an accurate picture and to test possible measures for their effectiveness in decreasing the likelihood of critical errors."* [29]

47. Further, in the context of their investigation of the Benalla B-double collision in which three train passengers died, the Australian Transport Safety Bureau explained that the propensity for individuals to experience skill-based slips and lapses, slips in attention and perceptual errors while undertaking well-practiced, familiar and largely automatic tasks, with only intermittent checks on progress by conscious attention.[30]

48. In these circumstances, it is important for investigations of level crossing incidents to adopt a systematic approach to collecting routine detailed human factors information about level crossing collisions. **Recommendation 1**

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28 James Reason, "Human Error", Cambridge University Press: Cambridge, 1990. See also e.g. J Reason, "Human error: models and Management", British Medical Journal 328 (2000) 768; J Reason, 1997, Managing the Risks of Organisational Accidents, (Ashgate Publishing Limited: Aldershot) adopted by Australian Transport Safety Bureau, "Level Crossing collision between Steam Passenger Train 8382 and a Loaded B-Double Truck-Benalla Victoria 13 October 2002", Rail Safety Investigation 2002/003, September 2004.

29 Ian Johnston, "Expert Report for use as evidence in a series of inquests into deaths at level crossings in Victoria between 2006 and 2009", prepared at the request of Transport Safety Victoria by Ian Johnston Transport Safety Pty Ltd, 5 July 2011.

30 Australian Transport Safety Bureau, "Level Crossing collision between Steam Passenger Train 8382 and a Loaded B-Double Truck-Benalla Victoria 13 October 2002", Rail Safety Investigation 2002/003, September 2004.

49. It is clear from this review of fatal collisions at 12 level crossings with varying levels of infrastructure, that 12 of the road vehicle drivers were not alerted to the approach of a train in time to stop or at all.

50. This investigation has also confirmed the findings of the Australian Transport Council[31] and Bob Pearson[32] that the road vehicle drivers who were familiar with the level crossing did not expect to see a train.

51. For example, Mr Scholl had never seen a train before at the Kerang level crossing. The only reason that he was able to provide for failing to see the level crossing lights:

> *"No, no because I didn't expect it, like I said I've been travelling on the road for seven years and never seen those lights on. Never... How stupid."*

52. Another heavy vehicle driver, Peter Scott, described one reason for failing to notice level crossing warning signs was:

> *"Well, I was in a world of me own as truck drivers usually are...."*

53. Accordingly, I confirm that familiarity contributes to fatal level crossing collisions which occur in circumstances where the driver unintentionally fails to comply with the *Road Safety Act* 1986 and fails to respond to warning paraphernalia intended to alert the road vehicle driver to the possibility that a train is approaching.

54. Associated with this familiarity with the level crossings, 10 of the 13 road vehicle drivers involved in this cluster of level crossing fatalities did not see or hear the level crossing warnings or the train before it hit their vehicle.[33,34,35,36] Two more saw the train too late to stop.[37]

55. Accordingly, new level crossing infrastructure intended to alert road vehicle drivers to an approaching train must include warnings that are capable of attracting their attention in circumstances where:

- They are familiar with the level crossing,

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31 Australian Transport Council, National Railway Level Crossing Safety Strategy, August 2003.

32 Bob Pearson, Risk Analysis of Trick Train Collisions of Significant Severity, Final report, 28 November 2008.

33 James Gordon Case No. 4307/06; Fiona Smart Case No. 468/08; see also Coroner Ronald Saines, Finding into Death with Inquest, Jamie Webb, Case No. 1965/06; Australian Transport Safety Bureau, "Collision between Rigid Tipper Truck/Quad Axle Trailer and Freight Train 4AM3 Lismore, Victoria 25 May 2006", Rail Occurrence Investigation 2006004, January 2007.

34 Coroner Jacinta Heffey, Finding into Death without Inquest, Anthony Massaria, Case No 3881/06.

35 Coroner Jacinta Heffey, Finding into Death with Inquest, Kay Stanley, Case No 417/08.

36 Coroner Jacinta Heffey, Finding into Death with Inquest, Mark Winter, Case No 3471/09.

37 Fiona Smart Case No. 468/08; Haldane Nelson Case No. 801/08; Caitlin Angel Case No. 1231/08; Susan Angel Case No. 1230/08. See also Coroner Ronald Saines, Finding into Death with Inquest, Jamie Webb, Case No 1965/06.

- They are not expecting a train,
- They are not likely respond to current infrastructure,
- They are not deliberately committing road rules offences,
- They are not affected by alcohol or drugs,
- They cannot provide any conventional explanation for failing to become aware of the approaching train; and
- They cannot stop in time to avoid a collision.

56. As Monash University researchers have understood, it is not sufficient to just warn drivers that there is a level crossing ahead. The first priority for safety related level crossing infrastructure is to warn road vehicle drivers that a train is approaching the level crossing and the road vehicle driver is at risk.[38]

57. By definition, this priority has also not been achieved in the circumstances of the 12 unintentional fatal level crossing collisions which are the focus of this coronial investigation of 26 level crossing deaths in Victoria between 2002 and 2009.

58. Transport Safety Victoria and VicRoads are now responsible for level crossing safety infrastructure in Victoria. Therefore they should cooperate to investigate and implement new level crossing infrastructure which is designed to alert road vehicle drivers to an approaching train who are unresponsive to the current suite of level crossing warning signs. **Recommendation 2.**

59. I am unable to attribute the Mr Scholl's failure to respond to either active or passive level crossing warning paraphernalia to any particular characteristic or personal event.

60. Other road vehicle drivers in the cluster who survived the collision also said they were unaware of the level crossing warning signs and the approaching train.

61. Therefore, I have formed the view that there is a group of road vehicle drivers who cannot be reached by the current active or passive level crossing warnings at the time they are approaching a level crossing. There is no evidence before me to suggest that these drivers are otherwise inattentive or pre-disposed to failing to respond to stimuli.

62. Sophisticated research and innovative technology is required to determine how best to alert drivers who will otherwise not notice an approaching train in the context of current level crossing warnings. **Recommendation 3**

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38 J. Edquist, K. Stephan, E. Wigglesworth & M. Lenne, "A Literature Review of Human Factor Safety Issues at Australian Level Crossings", Monash University Accident Research Centre, February 2009.

63. In the United States, 55 out of 60 trains involved in level crossing fatalities sounded their horn prior to impact but only four of 14 road vehicle drivers reported hearing the horn. Eight of the drivers who did not hear the horn reported being distracted by internal or external sounds.[39]

64. Further, none of the 11 other road vehicle drivers involved in this cluster of level crossing fatalities heard the activated train horn. [40,41, 42]

65. Therefore, I find that it is unlikely that sight and hearing deficits contributed to the collisions involving drivers who suffered these problems.

66. The minimum total stopping distance for a semi-trailer with the braking and load characteristics of Mr Scholl's semi-trailer was 89 metres on a sealed road. At least 42 metres must be added to include reaction time make a total minimum stopping distance of 131 metres.

67. Further, in 2002, three people on a scenic train died when their train hit a B-double combination at the Saleyards Road level crossing in Benalla.[43] The Saleyards level crossing is 36 metres from the T-intersection with Gillies Street. Although it is easily visible to road traffic turning on to Saleyards Road from Gillies Street, the B-double driver was not aware of the approaching train until the last second.

68. Accordingly, warning signs and visibility of the train must be at least 131 metres before the level crossing, more on B double and B-triple combination routes.

69. Therefore, I recommend that VicRoads and Standards Australia amend their standards to require warning signs and visibility of the train to heavy vehicle combination drivers when they are at least 131 metres before the level crossing, more on B double and B-triple combination routes. **Recommendation 4**

70. As best he could remember, the evidence of Cannys' Service Manager, Christopher Penney, was that:

- He serviced Mr Scholl's semi-trailer on 28 May 2007;
- He found that the brake linings on Mr Scholl's trailer required replacement;

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39 Michelle Yeh and Jordan Multer, "Driver Behavior at Highway-Railroad Grade Crossings: A Literature Review from 1990–2006", U.S. Department of Transportation Federal Railroad Administration, October, 2008.

40 Fiona Smart Case No. 468/08; Caitlin Angel Case No. 1231/08; Susan Angel Case No. 1230/08; see also Coroner Ronald Saines, Finding into Death with Inquest, Jamie Webb, Case No. 1965/06; Australian Transport Safety Bureau, "Collision between Rigid Tipper Truck/Quad Axle Trailer and Freight Train 4AM3 Lismore, Victoria 25 May 2006", Rail Occurrence Investigation 2006004, January 2007.

41 Coroner Jacinta Heffey, Finding into Death without Inquest, Anthony Massaria, Case No 3881/06.

42 Coroner Jacinta Heffey, Finding into Death with Inquest, Kay Stanley, Case No 417/08.

43 Adam Dunning Case No. 3174/02; Adrian Kiely Case No. 3175/02; Ian Pettersen Case No. 3176/02.

- Michael Canny told him there was no time to replace the brake linings on the trailer because the semi-trailer had to go back into service;
- He adjusted the push rods to accommodate the worn brake linings;
- He noted the service on the white board on 28 May 2007; and
- He did not check the brakes on Mr Scholl's semi-trailer after 28 May 2007.

71. Therefore, Mr Scholl's semi-trailer was used from 28 May 2007 to 5 June 2007 and travelled about 7000 kilometres without remediation of the trailer brakes.

72. Further, use of Mr Scholl's semi-trailer between 28 May and 5 June 2006 resulted in severe deterioration of the push rod travel to the extent that it rendered the trailer unroadworthy.

73. Cannys' heavy vehicle maintenance procedures in 2007 would not have complied with the requirements now imposed by the National Heavy Vehicle Regulator for accreditation under this National Heavy Vehicle Accreditation Scheme.

74. Mr Scholl's prime mover was registered and driven in Victoria on 5 June 2007. Therefore, it was always subject to the provisions of the *Road Safety Act* 1986 and the Road Safety (Vehicles) Regulations 1999.

75. In particular, the *Road Safety Act* 1986 provided and still provides:

> "*A person must not use, or cause or permit to be used, on a highway a vehicle or a combination of vehicles that is not in a safe and roadworthy condition. Penalty: In the case of a large vehicle or a combination including a large vehicle-10 penalty units.*"[44]

76. Offences under the *Road Safety Act* 1986 and associated regulations are summary offences. Therefore, charges must be laid within 12 months of commission of the offence.

77. The Chain of Responsibility component of the National Heavy Vehicle legislation also imposes liability on an operator, manager, or scheduler of a business involved in road transport for breaches of fatigue management requirements, speed limits and mass, dimension, loading requirements.

78. The new Heavy Vehicle National Law does not yet include liability for inadequate maintenance of heavy vehicles.

79. However, the National Heavy Vehicle Regulator has introduced a voluntary National Heavy Vehicle Accreditation Scheme.[45]

80. Dr Peter Hart noted that the pushrod extensions of the semi-trailer brakes on Mr Scholl's trailer were in the range 45 – 63 mm. This suggested to him that the semi-trailer brakes were

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44 R 259 Road Safety (Vehicles) Regulations 2009.

45 See National Heavy Vehicle Regulator, Maintenance Management Accreditation Guide, January 2013.

not in tight adjustment. The pushrod extension with tight brake adjustment is likely to be about 30 mm.

81. Accordingly, Dr Hart believes that the brakes on Mr Scholl's trailer should have been inspected more frequently than every three months. An inspection can be done relatively easily. He says a weekly or fortnightly check is advisable.

82. Therefore, the Code of Practice for maintenance of heavy vehicles should require inspection of brake pads and push rod extensions weekly or fortnightly. **Recommendation 5**

83. Dr Hart also advised that, in circumstances where the prime mover is fitted with anti-lock brakes, these were more likely to reduce the rate of deceleration of the semi-trailer than the failure of the trailer brakes to comply with roadworthy requirements.

84. I am unable to say that Mr Scholl's semi-trailer would have stopped before it hit the train on 5 June 2007 if his prime mover had not been fitted with anti-lock brakes. However, I am confident that the force of the collision would have been reduced and the consequences less severe.

85. Later in 2013, the National Heavy Vehicle Regulator is expected to deliver a comprehensive range of services (including the regulation of heavy vehicle standards and modifications) under a consistent regulatory framework and Code of Practice.

86. Therefore, following my investigation of the death of Graeme Dunn, I recommended that the National Heavy Vehicle Regulator expand the National Heavy Vehicle Accreditation Scheme to include all Victorian heavy vehicle operators who perform their heavy vehicle maintenance in-house. I repeat that recommendation in relation to this coronial enquiry. **Recommendation 6**

87. At a more specific level, the Code of Practice adopted by the National Heavy Vehicle Accreditation Scheme should also ensure mechanics performing maintenance work on heavy vehicles have access to and comply with the manufacturers' instructions in relation maintenance. **Recommendation 7**

THE INFRASTRUCTURE INCLUDING REGULATION OF THE LEVEL CROSSING AND THE LOCOMOTIVE

88. The Murray Valley highway approached the railway line from the south at an oblique angle. It was a two lane, two way carriageway with a bitumen surface in good condition. Each lane was 3.7 metres wide.

89. The speed limit for road vehicles on the Murray Valley Highway was 100kph. The 100 kph speed limit at the time of the collision was in accordance with the VicRoads' Speed Limit Guidelines for arterial roads.

90. The current suite of level crossing infrastructure includes train conspicuity as well as passive and active components of level crossing warning signs:

- Passive level crossing infrastructure includes speed limits, Stop signs or Give Way signs, road markings, warning signs and rumble strips.
- Active infrastructure includes warnings activated by the approaching train, that is flashing red lights, bells, boom gates and automatic advance warning lights as well as some or all of the passive infrastructure.

91. On 5 June 2007, the train was displaying its head light and ditch lights. Further, the train driver activated his horn as required at the whistle board and again for seven seconds when he realised Mr Scholl was not stopping at the level crossing.

92. However, Mr Scholl failed to hear the train horn.

93. Further, 11 of the 12 road vehicle drivers included in this cluster of fatal level crossing collisions failed to respond to the Leslie RSN 5-chime air horns on the locomotives in time to stop or at all.

94. Deputy State Coroner Graham Johnstone also found that of the six of the road vehicle drivers in the seven fatal level crossing incidents he investigated in 1989 failed to hear the train horn.[46]

95. Similarly, in the United States, 55 out of 60 trains involved in level crossing fatalities sounded their horn prior to impact but only four of 14 road vehicle drivers reported hearing the horn. Eight of the drivers who did not hear the horn reported being distracted by internal or external sounds.[47]

96. Accordingly, I recommend that Transport Safety Victoria investigate the factors influencing road vehicle drivers' capacity to hear aural warnings like horns and sirens with a view to developing a train horn that alerts drivers to the approach of a train. **Recommendation 8**

97. On 5 June 2007, the Kerang level crossing was controlled by flashing lights, road markings and level crossing warning signs. The infrastructure at all the level crossings included in this

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46 Margaret Campbell, 17 March 1989; Michael Welsh, 7 May 1989; Lyle Staehneke, 25 May 1989; Ionnis Karagiannis, 19 June 1989; Richard Church & Sally Tracey 20 June 1989; John Shrubsole, 18 July 1989; Alfred Malia, 20 July 1989.

47 Michelle Yeh and Jordan Multer, "Driver Behavior at Highway-Railroad Grade Crossings: A Literature Review from 1990–2006", U.S. Department of Transportation Federal Railroad Administration, October, 2008.

cluster of fatal level crossing collisions generally complied with Australian Standard AS1207.7-2007.

98. A combination heavy vehicle that has the minimum permitted deceleration capability and is braked to a stop from 100kph will require a stopping distance of 138 metres.[48] Longer stopping distances may be required because of tyre lock of some wheels of the semi-trailer but optimum retardation force occurs before the tyres lock up.[49]

99. Therefore, Mr Scholl became aware of the train when his semi-trailer was about 90 metres from the Kerang level crossing or 40 metres and 1.5 seconds too late for it to be able to stop before it hit the train.

100. Put another way, if he had been alerted to the approaching train two seconds earlier, Mr Scholl would have been able to avoid the collision in which 11 passengers died.

101. In circumstances where heavy vehicles are likely to create the greatest risk of severe and/or multiple fatal injuries to train passengers, it is particularly important that cues to make all road vehicle drivers aware of an approaching train have effect on heavy vehicle drivers early enough for them to be able to respond safely.

102. However, the infrastructure at Kerang level crossing on 5 June 2007 did not and could not achieve this purpose for the following reasons:

- The speed limit on the approach was 100 kph;
- The right hand curve preceding the level crossing allowed semi-trailer drivers only 0.5 seconds to see and respond to flashing red lights and other infrastructure indicating a train was approaching to avoid a collision;
- The flashing red filtered incandescent lights were focussed at car drivers and would never have been within the focus of semi-trailer drivers;
- The red filtered incandescent light bulbs had not been replaced by or upgraded to LEDs which are more conspicuous; and
- Mr Scholl looked but did not see the red lights flashing and therefore presumed that no train was approaching.

103. The infrastructure at the Kerang level crossing now includes boom gates, flashing red LEDs, electronic bells, rumble strips, warning signs and road markings consistent with the standards applied under Australian Standard AS1207.7-2007. The speed limit has been reduced to 80kph.

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48 Peter Hart, "Kerang Train Crash Inquest Braking Capability of the Truck", 12 May 2011. This is the inherent capability and does not include distance travelled whilst the driver reacts to the command to stop. The requirement applies irrespective of the load level.

49 Peter Hart, "Kerang Train Crash Inquest Braking Capability of the Truck", 12 May 2011. This is the inherent capability and does not include distance travelled whilst the driver reacts to the command to stop. The requirement applies irrespective of the load level.

104. In 2008, a survey of drivers who cross level crossings reported that one in five have travelled over a level crossing and not realised until after they had crossed.[50] Therefore, even in the absence of a subsequent collision, level crossing infrastructure does not always alert drivers to the approaching level crossing.

105. Furtber, as Monash University researchers have understood, it is not sufficient to just warn drivers that there is a level crossing ahead. The first priority for safety related level crossing infrastructure is to warn road vehicle drivers that a train is approaching the level crossing and the road vehicle driver is at risk.[51]

106. By definition, this priority has also not been achieved in the circumstances of the 12 unintentional fatal level crossing collisions which are the focus of this coronial investigation of 26 level crossing deaths in Victoria between 2002 and 2009.

107. None of the information presented to me includes specific reference to the countermeasure's capacity to alert road vehicle drivers to the presence of an approaching train.

108. Accordingly, I recommend that Transport Victoria and VicRoads extend their development and evaluation of new level crossing countermeasures with specific reference to the countermeasure's capacity to alert road vehicle drivers to the presence of an approaching train.
Recommendation 9

109. Level crossing standards are intended to ensure that the level crossing infrastructure is capable of performing its task of preventing level crossing collisions.

110. In Australia, level crossing infrastructure is required to comply with Australian Standard AS1742.7-2007, Rail Industry Safety and Standards Board standards, Public Transport Corporation Infrastructure Division Signalling Design and Documentation Version 1.1[52] and codes of practice for the rail industry and Austroads Part 4, Guide to Traffic Engineering Practice Series, Investigation and treatment of crash locations including countermeasures for Railway Level Crossing Crashes.

111. In circumstances where 11 out of 12 road vehicle drivers involved in this cluster of fatal level crossing collisions were unaware that a train was approaching in time to prevent the collision, there is no evidence that non-compliant level crossing infrastructure contributed to the collision.

112. However, inversely, this also means that the standard infrastructure supported by Australian Standard AS1742.7-2007 was ineffective in preventing the 12 fatal level crossing collisions.

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50 K Taylor, "Addressing road user behavioural changes at railway level crossings", Joint ACRS-Travelsafe National Conference, 2008

51 J. Edquist, K. Stephan, E. Wigglesworth & M. Lenne, "A Literature Review of Human Factor Safety Issues at Australian Level Crossings", Monash University Accident Research Centre, February 2009.

52 Specification ENG-SE-SPE-0001.

113. By its nature, the Australian Standard AS1742.7-2007 is concerned more about road drivers becoming aware that they are approaching a level crossing rather than that a train is approaching.

114. In Victoria, the accredited rail operator and the relevant road authority are required to ensure that the level crossing infrastructure complies with the Australian and Victorian standards and Codes of Practice and the *Rail Safety Act* 2006 which requires it to be safe "So far as is reasonably practical".

115. These requirements do not always coincide. For example:

- The formula in Australian Standard AS1742.7-2007 for sighting distances was inadequate for very large vehicles. [53] This has now been corrected.
- State Codes of Practice[54] required flashing red-filtered incandescent lights to be focussed at a distance from the level crossing that is appropriate for car drivers. This investigation has found that this focus point the may interfere with the lights' capacity to influence heavy vehicle combination drivers. Incandescent lights in flashing lights at level crossings in Victoria have now been replaced by LEDs.
- Australian Standard AS1742.7-2007 does not specify a standard emission level for light sources within the active light warnings or reference alternative standards that apply to the strength of light sources. Further, LEDs do not require this focussing but are their maximum luminosity is now specified by Victorian Rail Industry Operators Group Standard 012.7.20.[55]
- The road markings and other infrastructure for level crossings on a side road does not include a requirement for a left turn slip lane on the main road. In circumstances where neither Mr Murphy nor Mr Winter was aware of the train in time to stop,[56] a left turning slip lane would force road vehicles to make a tighter left hand turn when railway line runs parallel and close to a major highway. In the absence of sight limitations, this would allow turning drivers the opportunity to see the approaching train and stop before entering the level crossing.

116. In circumstances where all flashing red-filtered incandescent lights have been replaced by LEDs, I make no recommendation in relation to the standard for flashing red-filtered incandescent lights.

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53 Australian Transport Safety Bureau, "Level Crossing Collision between The Ghan Passenger Train (1AD8) and a Road-Train Truck, Ban Ban Springs, NT, 12 December 2006", 13 Feb 2008.

54 Public Transport Corporation Infrastructure Division Signalling Design and Documentation Version 1.1, Specification ENG-SE-SPE-0001.

55 Victorian Rail Industry Operators Group Standard VRIOGS 012.7.20, "Flashing Light Units" 6 November 2009.

56 Adam Dunning, Case No. 3174/02; Adrian Kiely, Case No. 3175/02; Ian Pettersen, Case No. 3176/02; Coroner Jacinta Heffey, Finding into Death with Inquest, Mark Winter, Case No 3471/09.

117. However, with full introduction of LEDs in Victoria, the time is right for Standards Australia to review Australian Standard AS1742.7-2007 with respect to its advice in relation to left turn slip lanes where level crossings are on side roads and specifications for light emitting diodes ("LEDs") in flashing red light infrastructure. **Recommendation 10**

118. In circumstances where the rail and road authorities rely heavily on compliance with Australian Standard AS1742.7-2007 and other State and Federal to assess whether their level crossings are appropriately protected, I also recommend that Standards Australia implement a schedule of more frequent routine reviews of Australian Standard AS1742.7-2007 for currency and compatibility with new infrastructure and technology. **Recommendation 11**

119. Responsibility for managing the risks at level crossings in regional Victoria is now documented in a series of contractual agreements and leases involving VicTrack, the Director of Public Transport, V/Line Passenger Services Pty Ltd and railway operators.

120. Accordingly, responsibility for level crossing safety infrastructure in Victoria is complicated by several levels and differences in responsibility and by Victorian Government commitments to National programmes.

121. As the Municipal Association of Victoria commented:

> *"It became apparent that the responsibilities of road and public transport operators at road and rail interfaces are not entirely understood and that demarcation issues need to be formally resolved."*[57]

122. The complexity of previous transport arrangements in Victoria has been recognised by the *Transport Integration Act* 2010.

123. The prime purpose of this legislation is to drive collaboration and consistency across government in transport and land use decisions and activities. This is achieved by:

- creating the Transport Corporation with integrates rail and marine transport entities;
- requiring transport bodies and key non-transport bodies to have regard for the objectives and decision-making principles of the *Transport Integration Act* 2010;
- requiring planning to be undertaken in line with this policy framework;
- establishing these transport bodies under one piece of legislation, with a common goal to work together to foster greater integration and sustainability.

124. Further, from 2 April 2012, Transport Safety Victoria has performed the functions formerly undertaken by a number of different bodies, including the Director of Public Transport and some of the operational functions previously undertaken by the Department of Transport.

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57 The Municipal Association of Victoria, "Rail Safety Improvement Project: Progress Report", October 2008.

125. Accordingly, I make no recommendations in relation to the system of management of level crossing infrastructure in Victoria.

126. I note that VicRoads is not included in the Transport Corporation. I also note that communication between VicRoads and previous level crossing management arrangements appears to have been inconsistent in relation to their involvement in ALCAM assessments and development of innovative train warning systems (see below).

127. I also note that Austroads,[58] Dr Johnston,[59] and Monash University researchers,[60] have all recommended implementation of rail incident databases consistent with those used by road safety authorities.

128. Therefore, I encourage Transport Safety Victoria and VicRoads establish formal cooperative arrangements in relation to sharing of information required for to predictive risk assessment of level crossings, prioritisation of level crossing upgrades and development of innovative train warning systems (see below). **Recommendation 12**

129. In January 2013, the National Rail Safety Regulator accepted responsibility for rail safety in Victoria under the Rail Safety National Legislation, supporting regulations, guidelines and policies. This legislation imposes statutory responsibilities for safety of rail operations on accredited rail operators which parallel the existing contractual and lease arrangements.

130. Under this arrangement, the National Rail Safety Regulator expects to operate through Transport Safety Victoria.[61]

131. Further, the Australian Transport Safety Bureau has assumed primary responsibility for rail investigations across Australia as part of a broader national transport reform process. The Australian Transport Safety Bureau already investigate major transport safety events using adaptations of root cause analysis advocated by Dr Reason.[62]

132. Therefore, I recommend that Transport Safety Victoria cooperate with the National Rail Safety Regulator in establishing a system for undertaking and analysing the results of root

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58 Peter Cairney, Thanulla Gunatillake & Eric Wigglesworth, "Reducing collisions at passive level crossings in Australia", Austroads publication No. AP-R208/02, Sydney 2002.

59 Ian Johnston, "Expert Report for use as evidence in a series of inquests into deaths at level crossings in Victoria between 2006 and 2009", prepared at the request of Transport Safety Victoria by Ian Johnston Transport Safety Pty Ltd, 5 July 2011.

60 J. Edquist, K. Stephan, E. Wigglesworth & M. Lenne, "A Literature Review of Human Factor Safety Issues at Australian Level Crossings", Monash University Accident Research Centre, February 2009.

61 See for example, Transport Safety Victoria, "Regulatory Approach Policy", State Government of Victoria 2011.

62 e.g. James Reason, "Human error: models and Management", British Medical Journal 328 (2000) 768; J. Reason. 1990, Human Error, (Cambridge University Press: Cambridge); J Reason. 1997, Managing the Risks of Organisational Accidents, (Ashgate Publishing Limited: Aldershot) adopted by Australian Transport Safety Bureau, "Level Crossing collision between Steam Passenger Train 8382 and a Loaded B-Double Truck-Benalla Victoria 13 October 2002", Rail Safety Investigation 2002/003, September 2004.

cause analyses for fatal level crossing collisions to better inform improvements in level crossing infrastructure and level crossing safety. **Recommendation 13**

133. Funding for level crossing upgrades is specifically allocated by Government as part of the annual Victorian Government Budget.

134. Within that budget allocation, the Department of Transport determines priorities for its expenditure with advice from the Rail Crossing Program Delivery Group which is a sub-committee of the Victorian Rail Crossing Safety Steering Committee.

135. The Australian Level Crossing Assessment Model (ALCAM) method of prioritising level crossings for upgrades has been adopted by the Standing Council on Transport and Infrastructure.

136. VicTrack was responsible for implementing the ALCAM assessments in Victoria in February 2008.[63] However, some ALCAM assessments were performed as early as 23 August 2006.[64]

137. The ALCAM model used a range of indicators of mechanisms, characteristics and controls at a level crossing to create a predictive risk matrix for each level crossing in Victoria.

138. Analysis of these data allowed level crossings to be scored relative to each other with respect to their defined risk characteristics and to be categorised as below the Installation Limit requiring remediation or above the Intervention Limit requiring urgent attention.

139. All but two[65] of the level crossings involved in this review of 12 fatal level crossing incidents had been assessed as low risk and were not subject to consideration for upgrading.[66]

140. ALCAM relied heavily on non-compliance with Australian Standard AS1742.7-2007 as an indicator of risk.

141. The Manager Railway Crossing Safety, Public Transport Division in the Department of Transport, Peter Furnell,[67] also agreed that exposure and traffic flow as expressed by traffic counts were an important component of the ALCAM algorithm used to assess the relative risk of adverse events at individual level crossings and pre-determine their priority for upgrades.[68]

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63 See Terry Spicer, "Australian Level Crossing Assessment (ALCAM) Discussion Paper: Key Responsibilities for Road and Rail Authorities associated with the Victorian Implementation of ALCAM", 30 March 2007.

64 Terry Spicer, in a letter to The Coroner, Geelong Coroners Court dated 16 August 2007.

65 Coroner Jacinta Heffey, Finding into Death with Inquest, Kay Alexandra Stanley, Case No. 416/08, 23 August 2012;

66 VicTrack crossing upgrade program for 2007/2008 31 January 2008.

67 Mr Furnell took over this role from Terry Spicer in February 2011.

68 See also New South Wales Independent Safety Regulator, "Traffic Flow and Collision Likelihood at Australian and NZ Level Crossings: Report for ALCAM Development Group", 5 August 2011.

142. However, the ALCAM data used to prioritise level crossings before 2007 did not necessarily use any objective data for traffic counts.

143. Using the Kerang level crossing as an example, the November 2005 ALCAM assessment of Kerang level crossing was based on a road crossing volume of 100 vehicles a day and seven trains a day. Risks were flagged as high speed trains and non-compliance with the Australian Standard AS1742.7-2007. The length of warning times was designated extreme and allocated 8 points or 10% of the ALCAM score.

144. The November 2007 assessment of Kerang level crossing was based on a traffic count of 2300 vehicles a day, including 10% heavy vehicles, and seven trains a day. The length of warning times was still designated extreme and allocated 8 points or 8.4% of the ALCAM score. Possible sun glare was recorded as effecting road vehicles but this did not change the rating because the level crossing was now fitted with fully active warning devices.

145. However, this coronial investigation heard that the traffic counts used in the 2007 re-assessment of priorities using the ALCAM algorithm used vehicle numbers collected in surveys performed in 2004. Further, the composition of the traffic was unable to be detected from the data collection procedures used so that the 'proportion of heavy vehicles reported reflected the opinion of local VicRoads staff.

146. Therefore, I also do not accept that the relative risks assessed for the Kerang level crossing and the other level crossings in Victoria in 2007 were relevant to objective assessment of a priority list for allocation of funding for upgrades.

147. Similarly, in 2010, VicRoads provided the Department of Infrastructure with traffic count data to allow further re-assessment of level crossings under the ALCAM model. Mr Furnell explained to the Court that this data was identical to that provided by VicRoads in 2007.

148. However, VicRoads data provided to the Court shows that they undertook vehicle counts on the Murray Valley Highway in 2000, 2004, 2008 and 2011. This VicRoads data shows that:

- In November 2000, on average 992 vehicles used the Murray Valley Highway in each direction each day. This is inconsistent with the estimates of 100 vehicles used in the November 2005 ALCAM assessment of Kerang level crossing.
- In April 2004, on average, 1206 vehicles used the Murray Valley Highway in each direction each day. This is consistent with the information provided to the Department of Infrastructure in 2007.
- In October/November 2008, on average, 1161 vehicles travelled in each direction on the Murray Valley Highway each day.
- In March 2011, on average, 1471 vehicles travelled in each direction on the Murray Valley Highway each day.

149. Further, contrary to the information provided in Court by VicRoads, the VicRoads vehicle count data includes Austroads vehicle categories based on length of vehicle and number of axles.

150. These data also shows that the proportion of heavy vehicles[69] travelling on the Murray Valley Highway has increased from 17% in 2000 to 22% in 2011. By 2011, 640 heavy vehicles were crossing the Kerang level crossing in each direction each day and the estimate of 10% used by the Department of Infrastructure was always an underestimate.

151. In the context of this VicRoads data provided to the Court, I am unable to understand why the Department of Infrastructure did not use the same VicRoads information to populate the ALCAM algorithm in 2005, 2007 and 2011. However, in the absence of the same data and analyses for other level crossings in the cluster, I am unable to say whether it would have made a difference to their relative prospective risk assessment of the Kerang level crossing.

152. In 2011, the National ALCAM Model Development Committee commissioned a separate review of the ALCAM consequence model (the "2011 review") to advise on further development using an updated consequence matrix.[70]

153. The 2011 review advised the National ALCAM Model Development Committee to revert to a formula based approach to predicting the likelihood of level crossing incidents because a matrix which included all the known significant variables would be too large to quantify.

154. The 2011 review modelling also demonstrated that fatalities and injuries arising from a level crossing collision were strongly correlated with a number of factors not already included in the ALCAM model.

155. I have formed the opinion that consequential risk analyses like the ALCAM algorithm and the 2011 review[71] cannot appropriately assess the risk of fatalities occurring at individual level crossings in Victoria because of their inherent assumptions and the data upon which they rely including:

- Out of date and inaccurate exposure data for vehicle use;
- Inadequate criteria to predict drivers' failure to become aware of an approaching train in time to stop;
- Use of data that is un-related to risk;
- Inaccurate recording of information used to populate the ALCAM algorithm;

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69 As defined by Austroads as Vehicle Category >2.

70 Sotera Risk Solutions, "ALCAM Consequence model development", 28 January 2011.

71 See also New South Wales Independent Safety Regulator, "Traffic Flow and Collision Likelihood at Australian and NZ Level Crossings: Report for ALCAM Development Group", 5 August 2011 for review of Stott Theory, Peabody Dimmick Formula, U.S.Department of Transportation Accident Prediction Model.

- Failure to take into account human factors that limit responses to existing or planned infrastructure; and
- Failure to include factors like emergency response that are known to be related to outcome.

156. The findings of this coronial investigation of 26 deaths arising from 12 level crossing collisions have largely restated those arising in Kerang and in previous enquiries into level crossing fatalities.

157. In particular, these circumstances include:

- All but three of the road vehicle drivers in this cohort were familiar with the level crossing;
- Road vehicle driver's not expecting to see a train;
- Non-compliance with Australian Standard AS1742.7-2007 did not contribute to any of these collisions; and
- The Kerang incident followed a series of reported near misses and prior incident not categorised as a rail incident because not train was involved.

158. Prevention of any one of these factors would have saved the lives of 11 people on 5 June 2007. None of these factors is included in the ALCAM or Peabody-Dimmick algorithms to predict the likelihood of an adverse event at a level crossing.

159. Therefore, to the extent that any predictive risk analysis relies on up to date accurate and detailed vehicle counts at individual level crossing sites, the primary data used by the Department of Transport to determine decisions about priorities for level crossing upgrades is flawed and must be corrected.

160. Accordingly, I recommend that Transport Safety Victoria improve the accuracy, content and relevance of data used in predictive risk analysis used to inform decisions about upgrading of level crossings in Victoria. **Recommendation 14**

161. The ALCAM and Peabody-Dimmick algorithms do not include any information about adverse events at each level crossing.

162. Mr Spicer explained that this information was excluded from the ALCAM model because of the small numbers of incidents that occur at each level crossing and the unreliability of predictions that would result from its over-interpretation. I understand this argument.

163. However, it seems to me that, like coronial investigations, adverse events provide the opportunity for in-depth systematic investigation of the types of level crossing incidents that the ALCAM and Peabody-Dimmick algorithms are attempting to predict.

164. Good information about the variables contributing to collisions, near misses and other adverse events will better inform a predictive risk algorithm about the variables that it should use to assess future risk.

165. Austroads,[72] Dr Johnston,[73] Monash University researchers,[74] the House of Representatives Standing Committee on Infrastructure, Transport, Regional Development and Local Government[75] and the Australian Transport Safety Bureau[76] have also recommended improved data collection and a National database has been established.

166. Since 1977, the aircraft industry has developed a well-recognised reputation for professional investigation of fatal and serious incidents. The model investigation techniques that have been developed for aviation adverse events have been adopted by other industries as diverse as health and accounting.

167. Similarly, this coronial investigation has identified a series of risk issues that aligned themselves to cause the Kerang fatal level crossing incident on 5 June 2007.

168. Further, the findings of this coronial investigation of 26 deaths arising from 12 level crossing collisions have largely restated those arising in Kerang and in previous enquiries into level crossing fatalities.

169. Accordingly and in particular, as a first stage, I recommend that the Australian Transport Safety Bureau, through the Transport Safety Victoria, trial the root cause analysis procedures advocated by James Reason[77] in their systematic analysis of rail incidents. This multi-factorial understanding of the interaction of contributing factors can then feed into their advice to rail operators and into the work of Transport Safety Victoria in allocating priority to level crossing upgrades. **Recommendation 15**

170. Improvements in level crossing safety cannot be viewed in isolation from general changes in highway safety and rail safety.

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72 Peter Cairney, Thanulla Gunatillake & Eric Wigglesworth, "Reducing collisions at passive level crossings in Australia", Austroads publication No. AP-R208/02, Sydney 2002.

73 Ian Johnston, "Expert Report for use as evidence in a series of inquests into deaths at level crossings in Victoria between 2006 and 2009", prepared at the request of Transport Safety Victoria by Ian Johnston Transport Safety Pty Ltd, 5 July 2011.

74 J. Edquist, K. Stephan, E. Wigglesworth & M. Lenne, "A Literature Review of Human Factor Safety Issues at Australian Level Crossings", Monash University Accident Research Centre, February 2009.

75 House of Representatives Standing Committee on Infrastructure, Transport, Regional Development and Local Government, "Level Crossing Safety: An Update of the 2005 Train Illumination Report", Canberra, June 2009

76 Australian Transport Safety Bureau, *Annual Review 2006*

77 e.g. James Reason, "Human error: models and Management", British Medical Journal 328 (2000) 768; J. Reason. 1990, Human Error, (Cambridge University Press: Cambridge) ; J Reason. 1997, Managing the Risks of Organisational Accidents, (Ashgate Publishing Limited: Aldershot) adopted by Australian Transport Safety Bureau, "Level Crossing collision between Steam Passenger Train 8382 and a Loaded B-Double Truck-Benalla Victoria 13 October 2002", Rail Safety Investigation 2002/003, September 2004.

171. Reductions in drink-driving, advances in automotive technology such as braking, and improvements in the effectiveness of emergency medical response have as much effect at level crossings as they do at highway-highway intersections.

172. Further, innovations in road infrastructure may have some application specifically to level crossings.

173. Further, Monash University have found that for most of these countermeasures there was little in the way of evaluation to support their widespread use. Accordingly, they noted that there is a need to establish a database to identify where the real problems at level crossings lie.[78]

174. This failure to establish a comprehensive database of level crossing incidents has been noted by the 2011 review of ALCAM and by Dr Johnston.

175. Further, in 2010, the Victorian Auditor General reviewed the management of safety risks at level crossings. He advised, *inter alia*, that the Victorian Railway Crossing Safety Steering Committee could improve the understanding of what causes fatal level crossing collisions.[79]

176. Accordingly, I recommend that the Transport Safety Director continue to maintain and improve a comprehensive reliable data base of all level crossing incidents that occur in Victoria. **Recommendation 16**

177. I have formed the view that there is a group of road vehicle drivers who cannot be reached by the current active or passive level crossing warnings at the time they are approaching a level crossing. There is no evidence before me to suggest that 11 of the 12 drivers in this cluster of fatal level crossing collisions were otherwise inattentive or pre-disposed to failing to respond to stimuli.

178. Sophisticated research and innovative technology is required to determine how best to alert drivers who will otherwise not notice an approaching train in the context of current level crossing warnings.

179. Therefore, I recommend that That Transport Safety Victoria and VicRoads commit themselves to joint sophisticated human factors research and innovative technology to determine how best to alert drivers who will otherwise not notice an approaching train in the context of current level crossing warnings. **Recommendation 17**

180. Examples of technological countermeasures presented to this coronial enquiry include:

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78 J. Edquist, K. Stephan, E. Wigglesworth & M. Lenne, "A Literature Review of Human Factor Safety Issues at Australian Level Crossings", Monash University Accident Research Centre, February 2009.

79 Victorian Auditor-General's Office, "Audit summary of Management of Safety Risks at Level Crossings", Parliament of Victoria, 24 March 2010.

- An automatic road sign recognition system which detects and classifies road signs and communicates directly with the road vehicle driver. [80]
- Solar powered technology intended to improve early warning of drivers approaching passive controlled level crossings. [81]
- Dedicated Short Range Radio Communications.
- Technologies capable of detecting obstacles at level crossings.[82]\
- Radar technology is expected to detect trains and notify road vehicle drivers of their presence.
- Technologies capable of detecting obstacles at level crossings.[83]
- Train conspicuity reflectors or ditch lights, rationalisation of rail lines and co-ordination of traffic lights.[84]

181. For the last 25 years, Australian and international rail safety investigators and researchers have advocated development and introduction of in-vehicle warning systems.[85]

182. However, Mr Sargant told the Court that trials of in-vehicle communications have been abandoned.

183. In evidence, Mr Furnell indicated that the main reasons for failing to implement radio technology included:

- Victoria can only implement new technology in concert with other Australian States and Territories because all of the trains travelling through Victoria would have to be fitted with the equipment;

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80 Y.-Y Nguwi & A.Z Kouzani, "Detection and classification of road signs in the natural environment", Neural Computing and Applications 17 (2008) 265.

81 Rod Bramble, Low Cost Level Crossing Warning Device Comparative Field Trial, Project 2005/RS/0001, Department of Transport Energy and Infrastructure, Transport Services Division, Rail Services Section, Government of South Australia, July 2005, in Gordon file

82 Sinclair Knight Merz Pty Ltd, Level Crossing Obstacle Detection Systems, Department of Infrastructure, 22 June 2006.

83 Sinclair Knight Merz Pty Ltd, Level Crossing Obstacle Detection Systems, Department of Infrastructure, 22 June 2006.

84 referred to by Jim Betts, Director Public Transport, in his letter to D/Sergeant G Rumble dated 8 February 2007.

85 Deputy States Coroner Graeme Johnstone's Findings in Margaret Campbell, 17 March 1989; Michael Welsh, 7 May 1989; Lyle Staehneke, 25 May 1989; Ionnis Karagiannis, 19 June 1989; Richard Church & Sally Tracey 20 June 1989; John Shrubsole, 18 July 1989; Alfred Malia, 20 July 1989; Australian Transport Safety Bureau, "Level Crossing Collision between The Ghan Passenger Train (1AD8) and a Road-Train Truck, Ban Ban Springs, NT, 12 December 2006", 13 Feb 2008; Bob Pearson, Risk Analysis of Trick Train Collisions of Significant Severity, Final report, 28 November 2008; J. Edquist, K. Stephan, E. Wigglesworth & M. Lenne, "A Literature Review of Human Factor Safety Issues at Australian Level Crossings", Monash University Accident Research Centre, February 2009.

- The Rail Industry Safety and Standards Board has imposed a "Fail Safe" standard that requires review before accredited rail managers and operators can implement new technology;[86]
- Overseas car manufacturers have not yet integrated short range radio technology into their routine car specifications; and
- Failure of the device could influence legal liability for any consequential incidents.

184. In these circumstances, none of Mr Furnell's explanations is sufficient to explain how break though in vehicle radio technology can be used in the Burnley Tunnel but is not fit for service on locomotives or at regional level crossings:

- There is no suggestion that the innovative technology replace or change the existing suite of level crossing warnings.
- The Road Safety Committee of the Victorian Parliament advocated Victoria's history of implementing road safety devices such as electronic stability control and side curtained air bags ahead of their adoption by the Australian Design Rules and international vehicle manufacturers.[87]
- In its response to the Road Safety Committee, the Victorian Government stated:

  "The Victorian Government supports the regulation of vehicles through the National ADR process. However, the Victorian Government may consider a state based regulation where... timely national adoption and implementation of the ADR is remote and there is strong net public benefit from doing so."

- There are good risk-associated reasons for implementing the technology in regional Victoria and in locally manufactured prime movers as a first stage.[88]
- The radio emissions could be sent from level crossing infrastructure, not necessarily form the locomotive so that there is no absolute requirement to wait for the Rail Industry Safety and Standards Board.
- Like radar detectors, the reception technology can be voluntary until its usefulness has been demonstrated.
- VicTrack already holds a Telecommunications licence to enable emission of signals if the level crossing option is preferred.

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86 See Department of Transport, "Research and Development Report, April 2009".

87 Road Safety Committee, Parliament of Victoria, "Report of the Road Safety Committee on the Inquiry into the Process of Development, Adoption and Implementation of Australian Design Rules", 9 November 2009.

88 As well as all but one of the Findings in this cluster of fatal level crossing collisions I note the following: Deputy State Coroner Graeme Johnstone's Findings in Margaret Campbell, 17 March 1989; Michael Welsh, 7 May 1989; Lyle Staehneke, 25 May 1989; Ionnis Karagiannis, 19 June 1989; Richard Church & Sally Tracey 20 June 1989; John Shrubsole, 18 July 1989; Alfred Malia, 20 July 1989; Australian Transport Safety Bureau, "Level Crossing Collision between The Ghan Passenger Train (1AD8) and a Road-Train Truck, Ban Ban Springs, NT, 12 December 2006", 13 Feb 2008; Bob Pearson, Risk Analysis of Trick Train Collisions of Significant Severity, Final report, 28 November 2008; J. Edquist, K. Stephan, E. Wigglesworth & M. Lenne, "A Literature Review of Human Factor Safety Issues at Australian Level Crossings", Monash University Accident Research Centre, February 2009.

185. Therefore, I have formed the view that, in the context of their complicated National and Victorian organisational arrangements, railway decision makers have historically adopted a high threshold in relation to implementation of level crossing infrastructure and arranging for warning signals to be emitted from trains or level crossings.

186. In part, any continuing justification for this frame of mind has been minimised by the "So far as is reasonably practical" admonition included in section 19 of the *Rail Safety Act* 2006.

187. The risk management approach enabled by the *Rail Safety Act* 2006 and adopted by Transport Safety Victoria goes some way to predicting the benefits of the systematic investigation approach to adverse events adopted by the airline industry and answer the Mr Furnell's reasons for slow uptake of new technology to warn road vehicle drivers of an approaching train.

188. In 2008, VicRoads was advised that that there was likely to be another multiple fatality level crossing incident involving a train and a heavy combination vehicle every five years.[89]

189. Further, this coronial investigation of 13 fatal level crossing collisions has confirmed again that, even when current level crossing warning infrastructure informs road vehicle drivers that they are approaching a level crossing, the current level crossing infrastructure has demonstrably failed to warn all road vehicle drivers that a train is approaching.[90]

190. Accordingly, I have formed the view that there is a group of road vehicle drivers who cannot be reached by the current active or passive level crossing warnings at the time they are approaching a level crossing. There is no evidence before me to suggest that these drivers are otherwise inattentive or pre-disposed to failing to respond to stimuli.

191. Therefore, it is important for everyone involved in the rail and heavy vehicle transport industries to continue to develop, evaluate and implement relevant innovative level crossing infrastructure that is already operating in the road environment.

192. In particular, VicTrack, VicRoads, Transport Safety Victoria and rail operators cooperate with each other to implement innovative in-vehicle warning systems as the next stage of warning road vehicle drivers who fail to respond to existing level crossing paraphernalia that a train is approaching. **Recommendation 17**

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89 Bob Pearson, Risk Analysis of Trick Train Collisions of Significant Severity, Final report, 28 November 2008.

90 J. Edquist, K. Stephan, E. Wigglesworth & M. Lenne, "A Literature Review of Human Factor Safety Issues at Australian Level Crossings", Monash University Accident Research Centre, February 2009.

EMERGENCY RESPONSE TO THE KERANG LEVEL CROSSING COLLISION

193. At 1:34pm on 5 June 2007, a semi-trailer driven by Christian Scholl collided with the regular Swan Hill to Southern Cross Station V/Line passenger train at the level crossing about five kilometres north of Kerang at Fairlie (the "Kerang level crossing").

194. The train consisted of an N class locomotive and three carriages.[91] The buffet was in the front left hand side of Carriage B.

195. Barry Lidster was driving the train. Haydn Buckland was the conductor. Jodie Burford was serving in the buffet in Carriage B. Mr Lidster, Mr Buckland and Ms Burford were employed by V/Line Passenger Services Ltd ("V/Line").

196. In addition to the V/Line staff, there were:

- Five passengers were seated in Carriage A;
- 24 passengers were seated or standing in Carriage B; and
- Five passengers were seated in Carriage C.

197. In the impact, the left hand side of Mr Scholl's cabin and the front left corner of his trailer peeled open the right rear wall of Carriage B and damaged the right rear corner of Carriage C.

198. By the time the train stopped, the bolts holding the rear right seats in Carriage B had been torn from their mountings so that they concertinaed into the left rear corner of the carriage and the condenser from the refrigeration unit on Mr Scholl's trailer had become dislodged and been thrown through the front right window of Carriage C.

199. Stephanie Meredith, Danielle Meredith, Chantal Meredith, Geoffrey McMonnies, Rosanne McMonnies and Ercil Jean Webb[92] were sitting on the right side of Carriage B and died immediately when Mr Scholl's semi-trailer hit them and dislodged their seats in the impact.[93]

200. Accordingly, I find that the emergency response did not influence the deaths of Stephanie Meredith, Danielle Meredith, Chantal Meredith, Geoffrey McMonnies, Rosanne McMonnies or Ercil Jean Webb.

201. Margaret Wishart[94] also died immediately in Carriage C from a head injury caused by the condenser from the refrigeration unit on Mr Scholl's trailer which was dislodged by the collision.

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91 Designated here as Carriage A, Carriage B and Carriage C.

92 Stephanie Meredith Case No. 2125/07; Danielle Meredith Case No. 2127/07; Chantal Meredith Case No. 2128/07; Geoffrey McMonnies Case No. 2129/07; Rosanne McMonnies Case No. 2132/07; Ercil Jean Webb Case No. 2133/07.

93 In cases of multiple injury, Disaster Victim Identification procedures are used to ensure consistency and prevent mistakes.

202. Accordingly, I find that the emergency response did not influence Margaret Wishart's death.

203. Further, Jaesok Lee[95] and Matthew Stubbs[96] sustained fatal injuries and were immediately unresponsive. They did not regain consciousness and had died before emergency services arrived.

204. Accordingly, I find that the emergency response did not influence the deaths of Jaesok Lee or Matthew Stubbs.

205. Nicholas Parker[97] sustained internal injuries. He was stabilised but he died during transfer to the Casualty Collection Post on the highway. His injuries always had a poor prognosis.

206. Accordingly, I find that the emergency response did not influence Nicholas Parker's death.

207. Harold Long[98] was hidden under seats at the rear of Carriage B. Only his hand was visible. He was presumed dead until about 2:25pm when emergency workers noticed his hand had moved. He was transferred to Melbourne by fixed wing aircraft and died at the Royal Melbourne Hospital.

208. During transfer by fixed wing aircraft Mr Long's condition deteriorated. Further, at about 4:33pm, Mr Long developed a tension pneumothorax when he was in the road ambulance *en route* to the Royal Melbourne Hospital.

209. I cannot exclude the possibility that the tension pneumothorax developed because Mr Long was transferred from Kerang to Melbourne in a fixed wing aircraft.

210. In circumstances of Mr Long's pre-existing cardiac condition, a tension pneumothorax would have contributed to his further deterioration and death.

211. Mr Long died from acute blood loss and shock/trauma in a man with cardiomegaly, myocardial fibrosis and ischaemic coronary artery disease. However, in the circumstances of his pre-morbidities and his injuries, I am unable to exclude a contribution by the tension pneumothorax diagnosed during his transfer to the Royal Melbourne Hospital.

212. Accordingly, Mr Long's death may have been influenced by his transfer by fixed wing aircraft to Melbourne without Mobile Intensive Care Ambulance support:

- A helicopter and Mobile Intensive Care Air Ambulance Victoria paramedic were available to transfer Mr Long. I am unable to say why Mr Long was not transferred to Melbourne in this helicopter.

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94 Margaret Wishart Case No. 2131/07.
95 Jaeseok Lee Case No. 2126/07.
96 Matthew Stubbs Case No. 2130/07.
97 Nicholas Parker Case No. 2114/07.
98 Harold Long Case No. 2110/07.

- I do not accept that Mr Long necessarily required transfer to a Major Trauma Centre.
- Mr Long had penetrating and blunt trauma injuries and he was over 55 years old. Therefore he met the criteria for Pre-hospital Major Trauma triage and transfer to a specialist trauma unit.[99]
- When Mr Long, was triaged at the scene, the risks associated with not transferring him to Melbourne but rather transferring him to Bendigo or Swan Hill were less than those that could be predicted from transferring him to Melbourne. In particular, the travel time was less and he would be less likely to develop tension pneumothorax.
- Accordingly, under the trauma protocols and in Mr Long's condition, he should have been transferred to the nearest designated trauma service, that is Swan Hill or Bendigo Hospital, before or instead of his transfer by fixed wing aircraft to a Major Trauma Centre.

213. Therefore, I recommend that Ambulance Victoria and Air Ambulance Victoria carefully consider the risks of tension pneumothorax when triaging trauma patients for transfer by fixed wing aircraft without Mobile Intensive Care Ambulance support. **Recommendation 18**

214. The trauma response system starts at the roadside or scene of injury, with pre-hospital assessment and stabilisation, transport, pre-hospital triage, emergency reception and resuscitation, surgical and intensive care management and rehabilitation and convalescence. Each step is important in the eventual recovery of the patient. Without an integrated approach there is a high chance that errors will occur in patient management.[100]

215. On 5 June 2007, emergency services responded to the Kerang level crossing incident as required under the *Emergency Management Act* 1986, the State Emergency Response Plan[101], the Emergency Management Manual Victoria and other relevant organisation arrangements.

216. The *Emergency Management Act* 1986 and the V/Line Emergency Response and Crisis Management Plan required the train driver and the conductor to adopt the joint role of Interim Site Controller until Victoria Police arrived at the scene.[102]

217. However, Mr Lidster and Mr Buckland told the Court that neither of them was aware that they were required to accept this role of Interim Site Controller. Neither of them had any specific

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99 Ministerial Taskforce on Trauma and Emergency Services and the Department of Human Services Working Party on Emergency and Trauma Services, "Review of Trauma and Emergency Services Victoria 1999."

100 Monash University: Victorian State Trauma Outcome Registry and Monitoring Group "The Victorian state trauma system June 2001-June 2006" Department of Human Services,2008

101 State Emergency Response Plan Part 3: Emergency Management Manual October 2010.

102 V/Line Passenger Pty Ltd, "V/Line Emergency Response and Crisis Plan", 7 May 2007.

training in what was required of an Interim Site Controller. Neither of them formally assessed the scene and proved situation reports to V/Line or Victoria Police.

218. Accordingly, I recommend that V/Line provide train drivers and conductors with formal instruction and scenario practice events to ensure they understand their role as Interim Site Controllers. **Recommendation 19**

219. As a trained conductor, Ms Burford should also have been trained and equipped to assist the train driver and the conductor in Interim Site Control.

220. Accordingly, I recommend that V/Line provide the same with equipment, formal instruction and scenario practice events for all trained conductors to enable them to assist the train driver and the conductor in their Interim Site Control duties. **Recommendation 20**

221. Mr Lidster, Mr Buckland and Ms Burford and by-standers were attempting to provide first aid but the first aid equipment provided by V/Line was inadequate for the purpose.

222. V/Line must provide first aid supplies that can assist in serious emergencies like the Kerang level crossing incident including blankets and bandages capable for use in major injuries.

223. Accordingly, I recommend that V/Line provide first aid supplies on all regional trains including blankets and bandages appropriate for use in major emergencies. **Recommendation 21**

224. Further, in circumstances like that that occurred on 5 June 2007, proper tools are required to assist in removal of seats and freeing of passengers trapped in the debris.

225. Accordingly, I recommend that V/Line provide tools and gloves on all regional trains adequate for removing seats and freeing of passengers trapped in the debris in a major collision involving a heavy vehicle combination. **Recommendation 22**

226. The *Emergency Management Act* 1986, the State Emergency Response Plan[103] and Victoria Police Emergency Management Response Policies require the most senior Victoria Police member first on the scene of an emergency to assume the dual roles of Incident Commander and Emergency Management Coordinator.

227. At about 1:40pm, Senior Constable Shane Hafner and Senior Constable Andrea Milikins from Kerang Police Station arrived at the scene.

228. Mr Hafner was the Incident Commander and Emergency Management Coordinator until a more senior police officer arrived. He and Ms Milikin immediately assessed the three

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103 State Emergency Response Plan Part 3: Emergency Management Manual October 2010.

carriages and spoke to Mr Buckland. They knew that there were 37 passengers and three crew and multiple casualties.

229. At 1:44pm, Sergeant Brian Gibson took over the role of Incident Commander and Emergency Management Coordinator. He assessed the scene and spoke to Mr Hafner. He then confirmed at least one fatality with Mildura Police Communications Centre.

230. At about 1:45pm, Kerang ambulance officers, Neil Harrop and Stephen Humphreys, arrived at the scene. Mr Harrop took the role of Health Commander and stayed on the road with Mr Scholl and the by-standers. Mr Humphreys walked to Carriage B.

231. Mr Humphreys assessed the scene with Andrea (Min) Peacock. He then commenced triage of the occupants of Carriage B.

232. There is no reason for me to believe that Mr Humphreys' early triage and clinical decisions contributed to the death of any of the 11 train passengers who died on 5 June 2007.

233. By 1:50pm or 16 minutes after the collision at the Kerang level crossing on 5 June 2007, there were five police officers, two ambulance officers and several by-standers, including a nurse, at the scene.

234. Another seven police officers, several detectives, nine ambulance officers and one helicopter and one fixed wing aircraft, the State Emergency Services and the Country Fire Authority had been activated. All were proceeding to the scene with lights and sirens operating.

235. Further, both V/Line Train Control, Mildura Police Communications Centre and Bendigo Rural Ambulance Victoria Communications Centre were all aware that the incident was at the level crossing about five kilometres north of Kerang, that there were 37 passengers and three crew on the train, there was a least one fatality and several seriously injured passengers.

236. Paul Holman is now Operations Manager Ambulance Victoria. Mr Holman told the Court:

> *"...we know from experience that going to these scenes in terms of they're chaotic and they're overwhelming, all of these scenes are; we know that, and that's a world-wide experience and the literature supports all that."*

237. The State Emergency Response Plan, the V/Line Crisis Response and Management Plan and the State Health Emergency Response Plan and other associated support protocols assist emergency workers to effectively continue their work when in a state of hyper-arousal.

238. Although the Health Commander was available, there was no representative from Rural Ambulance Victoria or V/Line on the Emergency Management Team.

239. Further, Mr Bennett established an Emergency Management Team comprising himself, Ross Hamilton from State Emergency Services and the Operations Manager and Rostered Duty Officer for the Country Fire Authority, Stuart Broad. Senior Sergeant Deveson took over the role of Municipal Emergency Response Coordinator for the Gannawarra Shire.

240. There was no representative from Rural Ambulance Victoria or V/Line on the Emergency Management Team.

241. No senior V/Line manager was at the scene until at least 3:30pm. However, at about 2:37pm, a senior ambulance manager capable of managing the scene and taken over as Health Commander.

242. Accordingly, the Health Commander was available to perform the support role. However, he was not included in the Emergency Management Committee.

243. This failure to include the Health Commander or his delegate in the Emergency Management Committee was inconsistent with the Emergency Management Plan. It was also inconsistent with Victoria Police responsibility for co-ordinating health resources, managing pre-hospital resources and co-ordinating resources to manage the health impacts of the incident.

244. Further, under the V/Line Crisis Response and Management Plan, the Interim Rail Controller's role included liaison with and briefing of the Victoria Police Site Controller and communication with Train Control.

245. However, neither Mr Lidster nor any other V/Line staff member participated in the Emergency Management Committee established by Victoria Police Incident Controller.

246. This failure to include Rural Ambulance Victoria and V/Line had implications for communication of situation reports and understanding the implications of the work undertaken by Victoria Police. For example:

- I note that Ms Burford informed V/Line managers that there were 40 people on the train, 37 passengers and three crew. Further, Mr Buckland told Mr Haffner the same figures. However, Victoria Police remained uncertain about the number of passengers on the train until late in the incident.
- I note that Mr Gibson told the Court that Code Brown was not part of the Victoria Police command and control arrangements and therefore he did not understand its implications. Accordingly, he was not aware that, when he notified the local hospitals that they could expect to receive casualties from the incident, they implemented their Code Brown which will be discussed below.

247. These issues would not have arisen if the Emergency Management Team had included representatives of all the support organisations involved in the emergency response including Rural Ambulance Victoria or V/Line.

248. Therefore I recommend that Victoria Police ensure that Incident Commanders and Emergency Management Coordinators are aware of the importance of including representatives of all the support organisations involved in an emergency response in the Emergency Management Team. **Recommendation 23**

249. V/Line Crisis Management Team despatched senior V/Line staff and a V/Line response Team to assist in the incident. Accordingly, Mr Lidster's role as Rail Controller and senior member of V/Line staff was taken over by the V/Line Freight Operations Team leader when he arrived from Swan Hill sometime after 3:30pm.

250. By then the emergency health response was complete. The train crew and all the passengers had left the scene.

251. Accordingly, I recommend that V/Line review their management arrangements to ensure that trained V/Line Rail Incident Controllers are within access to all level crossings in regional Victoria in a timely manner to support train crews and Victoria Police in the case of an emergency. **Recommendation 24**

SECTION 1 – INTRODUCTION

1.1 BACKGROUND

1.1.1.1 In Australia, road and rail transport is a particularly important part of our social fabric: we live long distances apart; we travel long distances; we transport goods long distances.[104]

1.1.1.2 In Victoria, the metropolitan rail infrastructure consists of 17 routes that cover 366 kilometres in metropolitan Melbourne. The intrastate rail infrastructure consists of a further 4000 kilometres of track that transports both freight and passengers.

1.1.1.3 The intrastate railway lines are used by V/Line and other train services to transport passengers throughout regional Victoria.[105]

1.1.1.4 From the perspective of the rail industry, level crossing accidents have been identified as a key risk to safety:[106]

- There are 1,872 road level crossings in Victoria; [107]
- There were 192 collisions between road vehicles and trains at level crossings in Victoria between 2002 and 2012;[108] and
- About 8% of all level crossing crashes result in death.[109]

1.1.1.5 Nationally, heavy vehicles are involved in 15% of these level crossing fatal collisions.

1.1.1.6 The likelihood of fatalities is higher for level crossing collisions involving heavy vehicles in regional Victoria than it is for other road collisions or for collisions with other vehicles.[110]

1.1.1.7 However, this relationship is not necessarily straightforward. In New South Wales, there were 14 fatalities at level crossings between July 2000 and September 2010.[111] Analysis of this New South Wales data has demonstrated that the average number of fatalities per incident is greater for light vehicle collisions than for heavy vehicle collisions, except when there is an associated derailment.[112]

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104 Department of Transport, Facts and Figures: 2001-2011.

105 Public Accounts and Estimates Committee, Parliament of Victoria, Review of the Findings and Recommendations of the Auditor-General's Reports –2007, June 2009.

106 Australian Transport Safety Bureau, "ATSB rail safety investigation: key lessons learnt", Rail safety bulletin RR-2008-008, July 2008.

107 Road Safety Committee, Parliament of Victoria, "Inquiry into Improving Safety at Level Crossings", December 2008.

108 Australian Transport Safety Bureau, "Australian Rail Safety Occurrence Data: 1 July 2002 to 30 June 2012", Rail safety report RR-2012-0010, 23 November 2012.

109 Australian Transport Council, National Railway Level Crossing Behavioural Strategy, August 2003.

110 Australian Transport Council, National Railway Level Crossing Behavioural Strategy, August 2003; Australian Transport Safety Bureau, Monograph 10, Level Crossing Accidents, 1988-1998.

111 Sotera Risk Solutions, "ALCAM Consequence model development", 28 January 2011.

112 Sotera Risk Solutions, "ALCAM Consequence model development", 28 January 2011.

1.1.1.8 This counterintuitive outcome is one example of the often-complicated sequence of issues that can contribute to the consequences for those people involved in level crossing collisions.

1.1.1.9 In 1989, then Deputy State Coroner Graeme Johnstone held an inquest into eight deaths in seven level crossing incidents between March and July 1989.[113]

1.1.1.10 Four of the seven level crossing incidents reviewed by Deputy State Coroner Johnstone in 1989 occurred in regional Victoria. Three occurred at level crossings with active controls. In one incident, the road vehicle seems to have stalled on the track.

1.1.1.11 Since 1989, one of the level crossings involved in the incidents reviewed by Deputy State Coroner Johnstone has been closed and two have been upgraded to full active controls with bells, flashing lights and boom gates.

1.1.1.12 More generally, rumble strips have been implemented on the approach to about 200 level crossings, speed restrictions have been implemented at regional level crossings that were formerly 100kph zones, and incandescent lights are being replaced by light emitting diodes ("LEDs").

1.1.1.13 Investigation of the efficacy of modern technology including active advance warning signals, Global Positioning System-based technology ("GPS") and strobe lights on locomotives continues.

1.1.1.14 From the perspective of road users, the picture differs. Level crossing fatalities constituted less than 1% of all road fatalities in Australia between 1997 and 2002.[114]

1.1.1.15 These numbers have been inflated in subsequent years by the multiple fatalities arising from the Benalla, Kerang and Trawalla level crossing incidents. However, between 2003 and 2007, fatalities arising from collisions at level crossings comprised about 5% of all heavy vehicle fatal collisions in Victoria.[115]

1.1.1.16 In numerical terms, between 1990 and 2002, an average of two people a year died in collisions between road vehicles and a train in Victoria.[116] In each financial year between 2000 and 2006, between one and six people were accidentally killed in Victorian level crossing collisions each year. Kerang created a statistical abnormality that more than doubled the retrospectively assessed risk of level crossing fatalities in Victoria.

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113 Margaret Campbell, 17 March 1989; Michael Welsh, 7 May 1989; Lyle Staehneke, 25 May 1989; Ionnis Karagiannis, 19 June 1989; Richard Church & Sally Tracey, 20 June 1989; John Shrubsole, 18 July 1989; Alfred Malia, 20 July 1989.

114 Australian Transport Safety Bureau, "Level Crossing Accident Fatalities", 23 November 2010.

115 Bob Pearson, Risk Analysis of Truck Train Collisions of Significant Severity, Final Report, 28 November 2008.

116 Eric Wigglesworth, Annette Graham and Virginia Routley, Rail related fatalities in Victoria, Australia: 1990-2002, Road & Transport Research, 14 March 2005.

1.1.1.17 Despite the statistical effect of the Kerang level crossing incident, between 1970 and 2008, fatalities resulting from accidents between road vehicles and trains at level crossings reduced by about 70 per cent.[117] Similarly, the number of collisions and fatalities at level crossings in the United States declined between 1975 and 2001.[118]

1.1.1.18 In both Victoria and the United States, the decrease in level crossing fatalities has been partly attributed to level crossing closures. [119]

1.1.1.19 Tom Sargant was the Deputy Director of Public Transport Engineering and Asset Management at the Department of Transport. Mr Sargant also attributed the decline to the effect of reduced services in the 1970's and 1980's in Victoria. In the United States there have been considerable increases in the volumes of rail and highway traffic.[120]

1.1.1.20 Further, improvements in level crossing safety cannot be viewed in isolation to general changes in road safety. Reductions in drink-driving, advances in automotive technology and improvements in the effectiveness of emergency medical response have as much effect at level crossings as they do at highway-highway intersections.

1.1.1.21 In the United States, the effect of road safety initiatives on level crossing incidents and fatalities is estimated to be about twice that resulting from the installation of active warning devices.[121]

1.1.1.22 For example, trauma experts believe that 32.3% of deaths from all types of trauma and 35% of all deaths following road trauma were preventable or potentially preventable when appropriate trauma management systems are activated.[122]

1.1.1.23 Therefore, the effectiveness and efficiency of the emergency medical response can also be expected to influence the number of deaths and severity of injuries that arise from a multi-victim trauma incident like at the level crossing on the Murray Valley Highway at Fairlie about five kilometres north of Kerang (the "Kerang level crossing") on 5 June 2007.[123]

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117 See for example, Australian Transport Safety Bureau, "Railway Level Crossing Safety Bulletin", 2008; Victorian Auditor-General's Office, "Audit summary of Management of Safety Risks at Level Crossings", tabled in Parliament of Victoria, 24 March 2010.

118 S Mok & I Savage, "Why has Safety Improved at Rail-Highway Grade Crossings?" *Risk Analysis* 25 (2005) 867.

119 Road Safety Committee, Parliament of Victoria, "Inquiry into Improving Safety at Level Crossings", December 2008.

120 S Mok & I Savage, "Why has Safety Improved at Rail-Highway Grade Crossings?" *Risk Analysis* 25 (2005) 867.

121 S Mok & I Savage, "Why has Safety Improved at Rail-Highway Grade Crossings?" *Risk Analysis* 25 (2005) 867.

122 State Trauma Committee, "A Trauma Education Framework for Victoria", October 2001.

123 See for example, Sotera Risk Solutions, "ALCAM Consequence model development", 28 January 2011.

1.1.1.24 Road and rail traffic in Victoria has increased significantly since 1989 and even 2008. Current Government policy and retrospective statistics indicate that this change is likely to continue for the foreseeable future. For example:

- The Victorian Government's buy-back of the State's regional rail network in May 2007 was intended to facilitate the policy target of 30% freight to ports on rail by 2012.[124]

- In the year from June 2008, the number of train passengers on regional train lines increased 4.4%.[125] Since then, more than 22 new V/Locity carriages have been added to the passenger fleet. Further, on 13 December 2010, V/Line added an extra 1230 seats to the Ballarat, Bendigo, Geelong and Seymour line trains.[126]

- Across Victoria's rail system, patronage has increased dramatically since 2006 as a result of a number of factors, including the shift in population to outer suburbs and regional areas, growth of employment in metropolitan Melbourne, congestion on the roads, increased parking costs and high petrol costs. [127]

  In particular, on 2 April 2006, V/Line introduced a new passenger service from Swan Hill to Melbourne departing at 1.20pm on weekdays. Further, on 7 March 2007, the departure time for this afternoon service from Swan Hill changed to 1.00pm.

- Freight volume across all transport modes is expected to grow by close to 50% by 2020 and by around 100% by 2030 from 2008 levels.[128]

  About 92% of freight in Victoria is transported by road.[129] There were over 24,000 articulated trucks registered in Victoria in 2009.[130] With continual introduction of bigger and heavier trucks including B-triples,[131] the number of articulated trucks registered increased by 12% between 2006 and 2009.[132] These numbers do not include interstate registered vehicles or make allowance for regional differences in distances they travel. However, in general terms, the more trucks there are on the road network, the higher the potential for crashes involving them.[133]

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124 Department of Infrastructure, SWITCHPOINT: Victorian Rail Freight Network Review, p. 4.
125 Department of Transport, Facts and Figures: 2001-2011.
126 V/Line Press release, December 2010.
127 Department of Transport, "Transport Demand Information Atlas for Victoria", 2009; Public Accounts and Estimates Committee, Parliament of Victoria, Review of the Findings and Recommendations of the Auditor-General's Reports –2007, June 2009.
128 Department of Transport, Freight Futures: Victorian Freight Network Strategy, 2008, p. 9.
129 Department of Transport, "Transport Demand Information Atlas for Victoria", 2009.
130 Australian Bureau of Statistics, Vehicle Registrations, March 2009.
131 Department of Infrastructure, SWITCHPOINT: Victorian Rail Freight Network Review, p. 13.
132 Australian Bureau of Statistics, Vehicle Registrations, March 2006.
133 Department of Infrastructure, SWITCHPOINT: Victorian Rail Freight Network Review, p. 15.

- Over the last five years, heavy road vehicles such as B-double, B-triple and semi-trailer combinations have also increased in size and numbers:

  "From 2008 to 2013, the number of registered articulated trucks with a GCM [Gross Combined Mass] up to 40 tonnes has decreased by 15.2%, while the number of articulated trucks with GCM over 60 to 100 tonnes and greater than 100 tonnes has increased by 22.5% and 52.8% respectively."[134]

- A recent report by the Economic and Infrastructure Committee of the Parliament of Victoria suggests that regional communities continue to seek extension of rail transport options:

  "Many inquiry participants believed that inefficient access to rail inhibited local economic development. In addition, they noted that this requires industry to transport freight by road, often at considerable cost to businesses and wear on road infrastructure."[135]

1.1.1.25 About two thirds of fatal crashes at level crossings in Victoria occur on roads where the speed limit is 100 kph which suggests that they occur mostly in regional Victoria. Over 80% occur during the day in fine weather on a straight road. In one third of these collisions, the road vehicle hit the train.

1.1.1.26 In 2007, about 14% of total level crossing crashes involved articulated heavy vehicles although these vehicle types only represented less than 1% of the registered vehicles on the Australian road network in 2007.[136]

1.1.1.27 In the years 2003 to 2007, 20% of the road vehicles involved in level crossing crashes in Australia and New Zealand, were heavy vehicles including rigid trucks, articulated trucks, B-doubles, double road trains, and triple road trains. About 14% of these level crossing crashes involved articulated heavy vehicles (rigid heavy vehicles excluded).[137]

1.1.1.28 In 2007, the National Transport Commission identified level crossings as 'the priority' for rail safety reform nationally and 'the most significant source of latent risk' both from a public safety and a commercial perspective. The National Transport Commission cited as examples, the potential for a crash between a train and a heavy vehicle, and the crippling

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134 Australian Bureau of Statistics, "Motor Vehicle Census. Australia", 9309.0 – 2013, 31 January 2013.

135 Economic and Infrastructure Committee, Parliament of Victoria, "Inquiry into local economic development initiatives in Victoria", July 2013.

136 Austroads, "Measures for Managing Safety of Heavy Vehicles at Passive and Active Railway Level Crossings" NS 1587 Sydney 2010.

137 Austroads, "Measures for Managing Safety of Heavy Vehicles at Passive and Active Railway Level Crossings" NS 1587 Sydney 2010.

impact a crash between a heavy vehicle and a freight train has on inter-state freight services.[138]

1.1.1.29 Similarly, in 2008, Dr Peter Cairney, Principal Research Scientist, Transport Management and Safety at the Australian Road Research Board, advised the Road Safety Committee of the Parliament of Victoria that the increasing number of both heavy vehicles and trains increased likelihood of a crash. Dr Cairney stated that:

> *"... the predicted increases in oil prices are likely to drive more freight onto rail ... the rail industry can cope with longer trains, but there is a definite limit as to how far they can manage in that way. The likelihood is that we will be getting a lot more trains at some stage in the future. You increase the number of trains, you increase the exposure of railway level crossings coupled with the higher speeds and perhaps with more very large vehicles, and I think we will be faced with a big problem."* [139]

1.1.1.30 In 2008, Bob Pearson also advised VicRoads that the likelihood of a collision between a heavy vehicle and a train resulting in multiple train passenger fatalities was about once in five years.[140]

1.1.1.31 In 2011, Steven Brown, Executive Director of Regional Services at VicRoads, told the Court:

> *"...freight traffic is growing quite substantially right across the state what we're looking for is for that growth or a larger proportion of that growth to be taken up on rail.... There will be more trucks on roads even if we get the maximum amount of freight on rail."*

1.1.1.32 This increase in heavy vehicle combinations and passenger train services can be expected to continue to increase their involvement in collisions at level crossings.[141] Further, with the increasing size and speed of modern trains and road vehicles involved in level crossing collisions, Victorians can expect more severe injuries and deaths arising from each level crossing collision.

1.1.1.33 In evidence before the Road Safety Committee of the Parliament of Victoria, the Director of Public Transport Safety in Victoria, Alan Osborne, explained the community's

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138 National Transport Commission (NTC), Discussion Paper on NTC Strategic Directions 2008/9 – 2010/11 For Comment, Melbourne, August 2007, p. 22.

139 Parliament of Victoria, Road Safety Committee, "Inquiry into Improving Safety at Level Crossings", 2008, p. 29.

140 Bob Pearson, Risk Analysis of Trick Train Collisions of Significant Severity, Final report, 28 November 2008.

141 See for example, Austroads, "Measures for Managing Safety of Heavy Vehicles at Passive and Active Railway Level Crossings" NS 1587 Sydney 2010.

heightened awareness of the level crossing deaths associated with the Kerang level crossing incident:

> *"Catastrophic risk is dealt with more sensitively than individual risk. I am not quite sure where that fits into societal expectations because it is complex. There is a societal feeling towards 11 people dying all in one event, versus 11 different events that occur in the system at different times. The cost benefit analysis that I have to do in terms of new things and new directions that I might make has to take some account of the aversion of society to catastrophic events; a slightly different way to 11 times the same event."*

1.1.1.34 On 25 June 2007, the Government of Victoria announced a major funding package to improve level crossing safety including:

- Installation of advance warning lights which are train activated at 53 level crossings in regional Victoria;
- Installation of rumble strips at 200 level crossings in regional Victoria;
- Improvements in sight distances at about 75 level crossings;
- Trial of compliance cameras;
- Tougher penalties for level crossing infringements; and
- Updating of the "Don't Risk It" campaign.

1.1.1.35 On 18 July 2007, the Road Safety Committee of the Parliament of Victoria commenced an Inquiry into Improving Safety at Level Crossings.

1.1.1.36 In the introduction to their report, the Road Safety Committee noted that:

> *"Victoria has more level crossings than any other State or Territory in Australia. Of particular concern to the Committee are the 1,087 crossings in regional and rural Victoria which do not provide any warnings to drivers and pedestrians of approaching trains. These crossings, known as passive crossings, only have static Give Way or Stop signs, and safety relies on the ability of users to be able to see a train in time to give way or stop....*
>
> *Crashes and fatalities at crossings are caused, in the main, by the failure of drivers and pedestrians to detect approaching trains, or if the train is detected, to ignore or not to comprehend the risk of a crash. If there is no safety technology at these crossings to warn users of approaching trains, or if the crossings are poorly designed or maintained, the task of the driver or pedestrian to make a judgement about whether it is safe to cross, can be very difficult...*

With the increase of both train and heavy vehicle traffic, and the large number of crossings in this State, the potential for another such catastrophic event is of great concern and was the precursor to this Inquiry..."[142]

1.1.1.37 On 8 April 2008, the Minister for Public Transport announced that an upgrade of the level crossing at Reid Parade in Hastings cost $400,000. Further $33.2m was required to implement 52 automated early warning signs in regional Victoria, rumble strips at 200 crossing and other safety works.

1.1.1.38 On 9 September 2008, the Road Safety Committee of the Parliament of Victoria commenced an Inquiry into the process of development, adoption and implementation of Australian design rules, and to consider other worldwide practices with a focus on improving vehicle safety.[143]

1.1.1.39 In November 2008, the House of Representatives Standing Committee on Infrastructure, Transport, Regional Development and Local Government commenced a review of train conspicuity.[144]

1.1.1.40 In November 2008, the Staysafe Committee of the Parliament of New South Wales also commenced a review of implementation of their previous level crossing recommendations.[145]

1.1.1.41 In 2009, further infrastructure upgrades to 29 level crossings in Victoria were announced in the Commonwealth Government Economic Stimulus Package.

1.2 CORONIAL INVESTIGATION

1.2.1.1 Against this background of activity, on or about 11 February 2008, the then State Coroner Judge Jennifer Coate directed me to investigate a cluster of level crossing deaths to try and identify ways in which they could have been prevented. These deaths included:

- Adam Dunning Case No. 3174/02;
- Adrian Kiely Case No. 3175/02;
- Ian Pettersen Case No. 3176/02;
- Jamie Webb Case No. 1965/06;[146]
- Tony Massaria Case No. 3881/06;[147]

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142 Road Safety Committee, Parliament of Victoria, "Inquiry into Improving Safety at Level Crossings", December 2008.

143 Road Safety Committee, Parliament of Victoria, "Inquiry into Improving Safety at Level Crossings", December 2008.

144 House of Representatives Standing Committee on Infrastructure, Transport, Regional Development and Local Government, "Level Crossing Safety: An Update of the 2005 Train Illumination Report", Canberra, June 2009.

145 Staysafe Committee, Parliament of New South Wales, "Report on Updating Progress on Railway Level Crossing Safety", Report No 2/54, June 2009.

146 Coroner Ronald Saines, Finding with Inquest, Jamie Webb, Case No. 1965/06.

- James Gordon Case No. 4307/06;
- Harold Long Case No. 2110/07;
- Nicholas Parker Case No. 2114/07;
- Stephanie Meredith Case No. 2125/07;
- Jaeseok Lee Case No. 2126/07;
- Danielle Meredith Case No. 2127/07;
- Chantal Meredith Case No. 2128/07;
- Geoffrey McMonnies Case No. 2129/07;
- Matthew Stubbs Case No. 2130/07;
- Margaret Wishart Case No. 2131/07;
- Rosanne McMonnies Case No. 2132/07;
- Ercil Jean Webb Case No. 2133/07;
- Geoffrey Young Case No. 3307/07;
- Kay Stanley Case No. 417/08;[148]
- Fiona Smart Case No. 468/08;
- Haldane Nelson Case No. 801/08;
- Caitlin Angel Case No. 1231/08;
- Susan Angel Case No. 1230/08;
- Jillian McCormack Case No. 5159/08;
- Mariam Yousif Case No. 1656/09; and
- Mark Winter Case No. 3471/09.[149]

1.2.1.2 In Victoria, the number of fatalities arising from level crossing collisions has consistently been too small to attribute statistical significance to the effectiveness of individual features of the current safety program. However, the overall decline in level crossing fatalities in Victoria has allowed this coronial investigation to focus on the residual issues that continue to underlie fatal level crossing collisions.

1.2.1.3 Further, in applying systems analysis to examine this cluster of fatal level crossing incidents,[150] I have attempted to consider these residual issues in the context of the potential for specific increased risk that is associated with changes in road and rail traffic expected in regional Victoria over tbe next ten years. These include:

- More heavy vehicles in regional Victoria,

147 Coroner Jacinta Heffey, Finding into Death without Inquest, Anthony Massaria, Case No 3881/06.

148 Coroner Jacinta Heffey, Finding into Death with Inquest, Kay Stanley, Case No 417/08.

149 Coroner Jacinta Heffey, Finding into Death with Inquest, Mark Winter, Case No 3471/09.

150 Reason, J., "Human Error", Cambridge University Press: Cambridge, 1990. See also e.g. James Reason, "Human error: models and Management", British Medical Journal 328 (2000) 768; J Reason. 1997, Managing the Risks of Organisational Accidents, (Ashgate Publishing Limited: Aldershot) adopted by Australian Transport Safety Bureau, "Level Crossing collision between Steam Passenger Train 8382 and a Loaded B-Double Truck-Benalla Victoria 13 October 2002", Rail Safety Investigation 2002/003, September 2004.

- More frequent and faster passenger trains,
- Larger, longer and faster heavy vehicle combinations; and
- More freight trains.

1.2.1.4 This cluster of level crossing fatalities subject to my coronial investigation includes the following incidents:

- On 13 October 2002, three people in the cabin of the train died when a loaded 'B-double' combination collided with a steam train at the Saleyards Road level crossing in Benalla.[151]
- On 25 May 2006, the driver of a rigid tipper truck with a tri-axle trailer died in a collision with the Overland passenger train at the Barpinba-Poorneet Road level crossing near Wingeel.[152]
- On 5 June 2007, 11 train passengers died when a semi trailer hit a train at the Kerang level crossing. [153]

1.2.1.5 Coroner Ronald Saines has completed the coronial investigation of the death of Jamie Webb.[154]

1.2.1.6 Coroner Jacinta Heffey has completed the coronial investigations of the deaths of Tony Massaria[155], Kay Stanley,[156] and Mark Winter.[157,158]

1.2.1.7 The *Coroners Act* 2008 provides for the independent investigation of reportable deaths in Victoria, to find the causes of those deaths and to contribute to the reduction of the number of preventable deaths, the promotion of public health and safety and the administration of justice.

1.2.1.8 The coroner investigating a death must find, if possible, the identity of the deceased and the cause of death. The coroner may also make findings as to the circumstances of the death if it is in the public interest.

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151 Adam Dunning, Case No. 3174/02; Adrian Kiely, Case No. 3175/02; Ian Pettersen, Case No. 3176/02.

152 Coroner Ronald Saines, Finding with Inquest, Jamie Webb, Case No. 1965/06.

153 Harold Long 2110/07; Nicholas Parker Case No. 2114/07; Stephanie Meredith Case No. 2125/07; Jaeseok Lee Case No. 2126/07; Danielle Meredith Case No. 2127/07; Chantal Meredith Case No. 2128/07; Geoffrey McMonnies Case No. 2129/07; Matthew Stubbs Case No. 2130/07; Margaret Wishart Case No. 2131/07; Rosanne McMonnies Case No. 2132/07; Ercil Jean Webb Case No. 2133/07.

154 Coroner Ronald Saines, Finding with Inquest, Jamie Webb, Case No. 1965/06.

155 Coroner Jacinta Heffey, Finding into Death without Inquest, Anthony Massaria, Case No 3881/06.

156 Coroner Jacinta Heffey, Finding into Death with Inquest, Kay Stanley, Case No 417/08.

157 Coroner Jacinta Heffey, Finding into Death with Inquest, Mark Winter, Case No 3471/09.

158 Investigation of a level crossing incident at Trawalla remains incomplete and has been transferred to Coroner Phillip Byrne.Those cases Victor Greensill Case No. 1552/06; Gwenda Glasson Case No. 1553/06.

1.2.1.9 In the circumstances of deaths arising from collisions at level crossings, the coroner may hold an inquest as part of that investigation. A coroner may hold an inquest that investigates two or more deaths (a "cluster").

1.2.1.10 Further, the coroner may comment on any matter connected with the death, including matters relating to public health and safety, or the administration of justice.

1.2.1.11 The coroner may also make recommendations to any Minister, public statutory authority or entity on any matter connected with a death which the coroner has investigated, including recommendations relating to public health and safety, or the administration of justice.

1.2.1.12 Unless otherwise ordered by a coroner, the findings, comments and recommendations made following an inquest must be published on the Internet.

1.2.1.13 Accordingly, although this cluster of 26 reportable deaths arising from 12 level crossing collisions has wide ramifications in the community, my focus is on the people who died and the circumstances that led to their death.

1.2.1.14 My jurisdiction to investigate this cluster of level crossing collisions does not extend to investigation of the circumstances surrounding the management of injured people who did not die. I am also unable to consider the economic and social consequences of level crossing collisions that inevitably involve extended clean up work and disruption to rail and road services.

1.2.1.15 The 12 level crossing collisions associated with the 26 deaths in this cluster included three collisions between a train and a combination heavy vehicle at Benalla,[159],Lismore[160] and Kerang and 10 level crossing deaths involving a collision between a car and a train.[161]

1.2.1.16 Six of these fatal level crossing incidents, including Kerang, occurred in regional Victoria.[162] All but one of the collisions in the cluster occurred in daylight hours on fine, clear days.[163]

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159 Adam Dunning Case No. 3174/02; Adrian Kiely Case No. 3175/02; Ian Pettersen Case No. 3176/02.

160 Coroner Ronald Saines, Finding into Death with Inquest, Jamie Webb, Case No. 1965/06; Australian Transport Safety Bureau, "Collision between Rigid Tipper Truck/Quad Axle Trailer and Freight Train 4AM3 Lismore, Victoria 25 May 2006", Rail Occurrence Investigation 2006004, January 2007.

161 Two incidents involving a car and a train were determined to be suicides: Michael Boyd Case No. 1025/08 and Julie Love Case No. 2349/09. They raise a number of issues relating to level crossing infrastructure including the engineering of boom gates which allow vehicles to drive around them. Otherwise, they were excluded from the cluster for the purposes of assessing prevention of unintentional deaths.

162 Adam Dunning Case No. 3174/02; Adrian Kiely Case No. 3175/02; Ian Pettersen Case No. 3176/02; James Gordon Case No. 4307/06; Fiona Smart Case No. 468/08; Haldane Nelson Case No. 801/08; Caitlin Angel Case No. 1231/08; Susan Angel Case No. 1230/08.

163 *cf* Coroner Ronald Saines, Finding into Death with Inquest, Jamie Webb, Case No. 1965/06; Australian Transport Safety Bureau, "Collision between Rigid Tipper Truck/Quad Axle Trailer and Freight Train 4AM3 Lismore, Victoria 25 May 2006", Rail Occurrence Investigation 2006004, January 2007. Fog was a factor in this collision.

1.2.1.17 Three of the level crossings involved in these fatalities were equipped with boom gates.[164] Three, including Kerang, had active lights and bells but no boom gates.[165] Three were protected by 'Give Way' or 'Stop' signs and other warning signs. [166, 167] One also had rumble strips.[168]

1.2.1.18 Since the Kerang incident occurred there have also been a number of parallel inquiries undertaken in Victoria, including those undertaken by:

- The Office of the Chief Investigator;[169]
- Public Transport Safety Victoria;[170]
- The Road Safety Committee of the Parliament of Victoria;[171]
- Victoria Police Operational Incident Review;[172]
- Victoria Police all agencies review hosted by Superintendent Eda Whiting;[173]
- V/Line Passenger Pty Ltd;[174]
- Rural Ambulance Victoria;[175]
- The Municipal Association of Victoria;[176] and
- The Country Fire Authority.[177]

1.2.1.19 There have also been a number of other more general investigations relevant to this coronial inquiry including:

- VicRoads commissioned Bob Pearson to assist them to identify which types of level crossings are most likely to be the site of a crash between a train and a heavy vehicle causing multiple casualties among train passengers.[178]

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164 Mariam Yousif Case No. 1656/09; Jillian McCormack Case No. 5159/08; Coroner Jacinta Heffey, Finding into Death with Inquest, Mark Winter, Case No 3471/09.

165 Kay Stanley Case No. 417/08; Geoffrey Young Case No. 3307/07.

166 Adam Dunning Case No. 3174/02; Adrian Kiely Case No. 3175/02; Ian Pettersen Case No. 3176/02; James Gordon Case No. 4307/06; Fiona Smart Case No. 468/08; Haldane Nelson Case No. 801/08; Caitlin Angel Case No. 1231/08; Susan Angel Case No. 1230/08.

167 Coroner Jacinta Heffey, Finding into Death without Inquest, Anthony Massaria, Case No 3881/06.

168 Caitlin Angel Case No. 1231/08; Susan Angel Case No. 1230/08.

169 Office of the Chief Investigator, "Level Crossing Collision V/Line Passenger Train 8042 and a Truck Near Kerang, Victoria 5 June 2007", Rail Safety Investigation, Report № 2007 / 09.

170 Jeff Gouldson, Public Transport Safety Victoria, "Kerang Cold Debrief".

171 Road Safety Committee, "Inquiry into Improving Safety at Level Crossings", Parliament of Victoria, December 2008.

172 Dennis Henry, Operational Incident Review Report", Victoria Police, undated. I agreed to redact this document from the brief in the public interest.

173 Superintendent Eda Whiting, "Division Five Region Three Fatal collision Kerang 5th June 2007", Victoria Police.

174 Tony Henwood & Alan Fleckner, "Safety Investigation into 7855 – Level Crossing Accident - Kerang", 30 September 2007.

175 Rural Ambulance Victoria Board, Review of the Rural Ambulance Victoria Response to the Kerang Rail Incident on 5 June 2007, 31 March 2008.

176 The Municipal Association of Victoria, "Rail Safety Improvement Project: Progress Report", October 2008.

177 Tony O'Day, "CFA,Operational Analysis Level crossing Incident Approximately 4 km North of Kerang, 5th June 2007", 3 August 2007.

- In May 2009, Monash University also published a review of human factor issues involved in level crossing safety.[179] They identified a number of countermeasures directed towards the human contribution to level crossing fatalities.
- In 2010, the Victorian Auditor General reviewed the management of safety risks at level crossings.[180]

1.2.1.20 This review of 26 deaths at 12 level crossings in Victoria[181] has not repeated the work of these other investigators. Rather it has relied on and attempted to integrate their findings with those that have emerged from this coronial investigation.

1.2.1.21 It has also reviewed investigations of a number of other fatal level crossing incidents including The Australian Transport Safety Bureau (ATSB) investigation of the collision between the Ghan passenger train and a road train in Ban Ban Springs.[182]

1.2.1.22 Accordingly, this coronial investigation focuses on the particular risks associated with the increasing numbers of road vehicles, particularly heavy combination vehicles, in regional Victoria.

1.2.1.23 It attempts to extend what is already known about road user behaviour at level crossings to look at the small group of road vehicle drivers who fail to become aware of an approaching train despite a plethora of level crossing warnings and become involved in fatal level crossing collision.

1.2.1.24 In particular, this coronial investigation of a cluster of level crossing deaths has concentrated on three issues:

- The driver and the road vehicle;
- The rail and road infrastructure including the locomotive and the level crossing; and
- The emergency response to the Kerang level crossing collsion.

1.2.1.25 As provided by section 67(3) and section 72(2) of the *Coroners Act* 2008, tbis investigation also comments and makes recommendations under these headings that are intended to prevent further deaths occurring for the reasons that 22 people in the cluster of 26 level crossing fatalities died.

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178 Bob Pearson, "Risk Analysis of Truck Train Collisions of Significant Severity, Final report", 28 November 2008.

179 J. Edquist, K. Stephan, E. Wigglesworth & M. Lenne, "A Literature Review of Human Factor Safety Issues at Australian Level Crossings", Monash University Accident Research Centre, February 2009.

180 Victorian Auditor-General's Office, "Audit summary of Management of Safety Risks at Level Crossings", Parliament of Victoria, 24 March 2010.

181 Excluding the deaths of Victor Greensill and Gwenda Glasson at Trawalla which remains incomplete.

182 Australian Transport Safety Bureau, "Level Crossing Collision between The Ghan Passenger Train (1AD8) and a Road-Train Truck, Ban Ban Springs, NT, 12 December 2006", 13 Feb 2008.

SECTION 2 – THE DRIVER AND THE ROAD VEHICLE

2.1 BACKGROUND

2.1.1.1 On 5 June 2007, Chris Scholl was driving a 1999 Kenworth Aerodyne cab-over prime mover towing a 1996 Krueger Tautliner tri-axle semi-trailer ("Mr Scholl's semi-trailer") north along the Murray Valley Highway.

2.1.1.2 The heavy vehicle combination was registered to carry about 29 tonnes. The trailer was loaded with timber, drums and pipe fitting with a total weight of about 14 tonnes including 12.34 tonnes of wood destined for South Australia.

2.1.1.3 The prime mover and trailer were owned by the Canny Carrying Company ("Cannys").

2.1.1.4 Cannys had been operating for 152 years. In 2007, the directors of Cannys were Brian Canny, Michael Canny and Rodney Canny.[183]

2.1.1.5 Mr Scholl's semi-trailer was travelling generally north on the Murray Valley Highway after it negotiated a slight right hand curve which is completed about 165 metres south of the level crossing on the Murray Valley Highway at Fairlie about five kilometres north of Kerang (the "Kerang level crossing").

2.1.1.6 When he was about 90 metres south of the level crossing, Mr Scholl said he noticed the train when it emerged from behind trees and he then saw the cars stopped on the other side of the level crossing.

2.1.1.7 Mr Scholl immediately applied his brakes. The brakes on his prime mover continued to operate in anti-lock mode. The brakes on his trailer locked up causing flat spots on the tyres.

2.1.1.8 At the beginning of his braking, Mr Scholl thought he might avoid the collision. However, as he continued to apply emergency braking, he realised he would not stop before he hit the train. Therefore he deliberately steered the semi-trailer to the left and off the bitumen in an attempt to turn his semi-trailer to move parallel to the train.

2.1.1.9 The semi trailer smashed into the warning light post on the left side of the Murray Valley Highway. The post and lights flew into the air and disintegrated.

2.1.1.10 Mr Scholl was unable to stop or turn his semi-trailer sufficiently before the left hand corner of his trailer hit the second carriage of the train.

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[183] On 5 June 2007, Rodney Canny was on holiday.

2.1.1.11 Mr Scholl lost consciousness as the result of the collision and was subsequently treated for concussion.[184] He was transferred first to Kerang Hospital and then by air ambulance to The Alfred Hospital. Mr Scholl was later transferred to the Epworth Hospital.

2.1.1.12 A blood sample taken at 3:15pm on 5 June 2007 contained no alcohol or other drugs.

2.1.1.13 This section of the findings from the coronial investigation of a cluster of 25 deaths at 12 level crossings in Victoria will focus on the way in which the semi-trailer driver and the semi-trailer influenced the collision the semi-trailer and a train at the Kerang level crossing on 5 June 2007.[185]

2.1.1.14 It will then compare, comment and make recommendations intended to prevent further deaths for the reason that 11 train passengers died as the result of the Kerang incident and 14 other people in this cluster of level crossing deaths died in Victoria between 2002 and 2009.

2.2 CORONIAL INVESTIGATION

2.2.1 The semi-trailer driver

2.2.1.1 Mr Scholl had worked for Cannys for 24 years. He usually worked Tuesday to Friday including an overnight trip to Adelaide and a full day trip to Bordertown.

2.2.1.2 In the course of this work, Mr Scholl had travelled on the Murray Valley Highway to and from Adelaide once a week for seven years. He had crossed the Kerang level crossing many times in the course of his work.

2.2.1.3 Mr Scholl had never seen a train or activated level crossing warning signals at the Kerang level crossing before.

2.2.1.4 Mr Scholl told the criminal trial that he usually entered the Kerang level crossing at about noon when he was travelling to Adelaide. On 5 June 2007, he left Wangaratta about 90 minutes later than usual.

2.2.1.5 Mr Scholl held a full and current Victorian drivers licence endorsed for commercial heavy vehicles. He had 31 years experience as commercial heavy vehicle driver in the Netherlands as well as in Australia. He had no relevant prior traffic convictions.

2.2.1.6 Mr Scholl was deaf in one ear and his right eye required him to wear glasses.

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184 Scholl trial transcript, p. 549.

185 Excluding the deaths of Victor Greensill and Gwenda Glasson at Trawalla which remain incomplete.

2.2.1.7 Further, in 2001, Mr Scholl was diagnosed with left visual field defect caused by left infero-temporal branch retinal artery occlusion. His peripheral vision was and continued to be normal.

2.2.1.8 However, Mr Scholl's ophthalmologist, Dr Glen Fernando, explained:

> *"...he was still left with that blind spot in the upper or superior part of his vision on the left side."*

2.2.1.9 Dr Fernando last saw Mr Scholl on 2 April 2001. The blind spot seemed to have decreased and:

> *"...his central vision had now completely cleared so the blind spot which involved his central vision and his superior vision, now only involved his superior vision."*

2.2.1.10 Dr Fernando expected some permanent residual field defect although this may have improved over time. He cleared Mr Scholl to return to driving.

2.2.1.11 Three subsequent examinations completed on 11 January 2002, suggested Mr Scholl occasionally became aware of and compensated for a small area of field loss in his left eye when he was tired but his medical advisers were unable to detect any clinical defect.

2.2.1.12 Accordingly, Mr Scholl's eyesight deficit identified in 2001 was unlikely to influence his capacity to see the level crossing warnings or the train on 5 June 2007. Dr Fernando told the Court:

> *"I would expect him to perform visually pretty much normally."*

2.2.1.13 In the week commencing 27 May 2007, Mr Scholl's work sheets indicate that he drove return trips from Wangaratta to Adelaide on 28-29 May and to Bordertown on 30 May 2007.

2.2.1.14 Further, the diary used to record drivers' work indicates that Mr Scholl worked in the yard on 1 June 2007. This diary does not record Mr Scholl as working on 28, 29, 30 or 31 May 2007.

2.2.1.15 Mr Scholl did not usually work on Mondays. However, on 4 June 2007, he drove to Melbourne and Ballarat and to Benalla. The computer records from his prime mover also indicate that it was working from 1:19am to 2:19pm.

2.2.1.16 Further, Mr Scholl and Michael Canny both say that Mr Scholl did not work on 2 or 3 June 2007. The diary used to record Cannys' drivers' work also has no record of anyone else working on 2 or 3 June 2007.

2.2.1.17 However, the computer records from the prime mover indicate that the prime mover was working from 5:00am to 10:34pm on Saturday 2 June 2007. The prime mover did not work on 3 June 2007.

2.2.1.18 The Court also heard evidence that Mr Scholl always drove the same prime mover but he was not necessarily the only driver to use the prime mover and it was not always attached to the same trailer.

2.2.1.19 At about 10:00am on 5 June 2007, Mr Scholl arrived at work to drive his semi-trailer to Adelaide. This was at least 90 minutes later than usual. His semi-trailer had already been loaded.

2.2.1.20 Mr Scholl checked and fuelled the semi-trailer. He left Cannys' depot in Wangaratta after 10:20am on 5 June 2007.

2.2.1.21 At about 1:30pm on 5 June 2007, Mr Scholl's semi-trailer was travelling in generally a northerly direction on the Murray Valley Highway. He says he was using cruise control set at about 102 kph after he entered the100 kph speed zone.

2.2.1.22 Mr Scholl says he checked the signals when he was about 300 metres or about 10 seconds before the Kerang level crossing as he passed the first warning signs and before he entered a right hand curve in the road which is completed about 165 metres south of the Kerang level crossing.

2.2.1.23 The event logger on the railway line indicated that the crossing lights and bell circuits were activated 25 seconds before the train entered the level crossing. Therefore, the lights were operating when Mr Scholl checked them before and after he entered the right hand curve.

2.2.1.24 Further, the train driver activated his horn at the whistle board which was 337 metres or about 13 seconds before he entered the level crossing and for a further seven seconds after he noticed that Mr Scholl's semi-trailer was not slowing down.

2.2.1.25 Mr Scholl saw the light structure at the Kerang level crossing but he did not see the red lights flashing and he did not hear the train horn.[186] Further, although vegetation did not fully obscure the train from Mr Scholl's view on 5 June 2007, he did not notice the train until he was about 90 metres south of the level crossing and the locomotive emerged from the trees closest to the highway.

2.2.1.26 Mr Scholl told police:

> *"I didn't expect the train because I looked at the lights and the lights were not flashing, therefore I didn't expect the train to be there."*

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186 Scholl trial transcript, pp. 550, 555.

2.2.1.27 Truck drivers, Peter Scott and Wayne Lynch, were travelling behind Mr Scholl. They also failed to see the lights or hear the bells and were unaware of the train until they saw Mr Scholl's truck braking suddenly.

2.2.1.28 In his record of interview, Mr Scholl denied he was distracted as he approached the Kerang level crossing on 5 June 2007. He was not using the telephone or changing CDs. When asked if he was concentrating 100%, he said:

> *"Obviously not."*

2.2.1.29 However, the only reason that Mr Scholl was able to provide for failing to see the level crossing lights was:

> *"No, no because I didn't expect it, like I said I've been travelling on the road for seven years and never seen those lights on. Never.... How stupid."*

2.2.1.30 In evidence in the Supreme Court and before me, another experienced truck driver familiar with the Kerang level crossing, Mr Scott, described one reason for failing to notice level crossing warning signs was:

> "Well, I was in a *world* of me own as truck drivers usually are...."

2.2.1.31 Mr Scott also said that he would have entered that world about half a kilometre after he left Kerang and before he reached the 100kph zone when he turned on the cruise control to 102kph.

2.2.1.32 Mr Scott denied that he was un-reactive when he was in this 'world of his own'. He told the Court:

> "I've spoken to other truck drivers in our company and they've agreed with me that up to a point you are in a world of your own. You listen to a radio or listen to something or watching something and it's just the way you are. You are not on total concentration all the time but it doesn't take long for it to click in"

2.2.1.33 Alan and Andrea (Min) Peacock lived on a farm close to the Kerang level crossing. They heard the sound of the collision and immediately drove to the site in their car.

2.2.1.34 Mrs Peacock was a trained nurse. She checked Mr Scholl and Mr Peacock stayed with him until ambulance officers arrived.

2.2.1.35 At 1:50pm on 5 June 2007, ambulance officer Neil Harrop from Kerang Rural Ambulance Service assessed Mr Scholl. Mr Scholl had no life threatening injuries.

2.2.1.36 At 2:22pm, MICA paramedic Brendon Smith from Swan Hill. Rural Ambulance Service assessed Mr Scholl in an ambulance at the scene. He applied a bandage to his right arm and cannulated his left arm and handed him over to Advanced Life Support Qualified Ambulance Officer Michael Allan for transfer to Kerang Hospital.

2.2.1.37 At 4:30pm, paramedic, Peter Salathiel, transferred Mr Scholl from Kerang Hospital to Kerang airport for fixed wing aircraft transfer to Melbourne.

2.2.2 The prime mover

2.2.2.1 Mr Scholl's prime mover was a 1999 Kenworth Aerodyne K104 tandem drive cab and chassis currently registered to carry about 29 tonnes.

2.2.3.2 The prime mover was fitted with a one piece windscreen and a DDEC IV model control device fitted to a Detroit Diesel Engine. The DDEC IV stores data in relation to the engine management system to assist the transport operator to maximise efficiency of the vehicle.[187]

2.2.3.3 Electronic data retrieved from the DDEC IV on Mr Scholl's prime mover after the collision indicated that it had travelled 1,931,821km since the DDEC IV was installed on 30 June 1998. It had recorded 47 hard brake incidents[188] during that time.

2.2.3.4 The last recorded hard brake incident occurred 4:02pm on 20 February 2007. Data about the hard brake on 5 June 2007 was lost because the batteries became disconnected in the collision before the down load was complete.

2.2.3.5 Mr Scholl's prime mover was fitted with a speed limiter but its highest ever speed was 136 kph recorded in 2004. Further, the speed was over 106 kph on 19 occasions between 1 and 5 June 2007. At 3:30pm on 1 June 2007, the top speed hit 111.8 kph. Therefore, I am unable to say that the speed limiter was effective and/or operational.

2.2.3.6 Mr Scholl also said that he set the cruise control at 100-103kph on 5 June 2007 after he entered the 100kph speed zone north of Kerang. In the context of evidence from drivers following him, I accept that evidence.

2.2.3.7 The front and rear brakes on the prime mover were compressed air operated, anti-lock, mechanical Rockwell drum brakes with 12mm lining thickness and manual 140mm slack adjustors.

2.2.3.8 The prime-mover had anti-lock brakes which are mandatory on B-double prime-movers.

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187 The DDEC IV produces distance reports in miles.

188 Deceleration greater than 11.3km/sec.

2.2.3.9 Dr Peter Hart told the court that anti-lock brakes provide the significant benefit of protecting against jack-knife dynamics during emergency braking. They have the disadvantage of increasing the stopping distance in some cases. The momentary release of the brakes that occurs during intervention causes an increase in stopping distance if there is frequent intervention by the antilock system during braking.

2.2.3.10 Mr Scholl's semi-trailer was not fully laden. The braking system was proportioned for a fully laden vehicle so good stopping distance performance is achievable even with some brakes out of adjustment. The prime mover had anti-locking brakes which maintain directional stability during emergency braking but slowed the rate at which the semi-trailer decelerated.

2.2.3.11 Accordingly, in the circumstances that Mr Scholl applied emergency brakes on 5 June 2007, the anti-lock braking system on his prime mover will have been the rate limiting factor slowing the rate of his semi-trailer's deceleration.

2.2.3.12 In an interview with investigators for the ATI insurance company, Michael Canny said that:

- Cannys employ mechanics to service their trucks;
- The prime mover and trailer were last serviced on 28 May 2007;
- No major items required for that service; and
- He believed the vehicle was roadworthy.

2.2.3.13 At 1:34pm on 5 June 2007, Mr Scholl's semi-trailer entered the level crossing about five seconds after Mr Scholl commenced braking. It was travelling at about 30kph when it collided with the second carriage of the train.

2.2.3 The trailer

2.2.3.1 The trailer on Mr Scholl's semi-trailer was a 13.57 meter Krueger Tri-axle Tautliner insulated trailer fitted with compressed air operated mechanical drum brakes with spring brakes fitted to all axles with no anti-lock capability.

2.2.3.2 Mr Scholl's trailer was fitted with a Carrier Ultra XL refrigeration unit, mounted on the front. This refrigeration unit was supplied and fitted by Krueger. The unit compressor was located in the lower section of the refrigeration unit.

2.2.3.3 Notes on the whiteboard used to record service requirements for Canny's trailers indicated that the refrigeration unit on Mr Scholl's trailer was last serviced on 23 April 2006.

2.2.3.4 The compressor from the refrigeration unit on Mr Scholl's trailer seems to have entered Carriage C through the rear right passenger window. The front right corner and the seats in the immediate area were damaged.

2.2.3.5 Nothing else in the third carriage is identifiable as coming from the trailer. In particular, the rest of the refrigerator unit remained attached to the front of the trailer. Most of the load remained in the trailer but some was dispersed on the ground close to the trailer.

2.2.3.6 Therefore, the compressor must have become dislodged by the force sustained by the trailer when it hit Carriage B. Further, this force was large enough to dislodge the compressor and propel it through the window of Carriage C.

2.2.3.7 It seems likely that the compressor was attached to the front of Mr Scholl's trailer in a less secure manner than the rest of the refrigeration unit.

2.2.3.8 Therefore, I have formed the view that the connections between the compressor on the Carrier Ultra XL refrigeration unit and the refrigeration unit on the front of Mr Scholl's trailer were not sufficient to withstand the forces placed on it in the collision.

2.2.3.9 Senior Constable Shane Hafner and the Chief Investigator found the compressor between seats 10 and 19 in a position consistent with its having hit Mrs Wishart in the head.

2.2.3.10 Accordingly, I find that that the compressor from the Carrier Ultra XL refrigeration unit on Mrs Scholl's trailer probably caused Mrs Wishart's death.

2.2.4 Maintenance of Mr Scholl's semi-trailer

2.3.3.1 In December 2006, Mr Penney took over as service manager at Cannys. He was supported by an apprentice mechanic, Joel Puls. No one else performed maintenance on Mr Scholl's semi-trailer in 2007.

2.3.3.2 Mr Penney served his apprenticeship under the previous service manager at Cannys In October 2004, he qualified as a heavy vehicle diesel mechanic Certiificate III in October 2004.

2.3.3.3 Mr Penney was responsible for ensuring the continuing service of about 110 units owned by Cannys; that is rigid trucks, prime movers and trailers. He reported to Rod Canny who was the depot manager at Wangaratta. He accepted responsibility for the work performed by his apprentice, Mr Puls.

2.3.3.4 Mr Penney and Mr Puls performed the regular servicing and most of the repairs to the Cannys fleet. Major engine work was sent to outside providers.

2.3.3.5 Mr Penney told the Court that he felt competent to perform the responsibilities imposed by his position as service manager commencing nine months before 5 June 2007. However, he also said:

> *"It took a while to get used to and a fair bit of responsibility above me head.... Keeping the trucks on the road...."*

2.3.3.6 Mr Penney told the Court that Cannys' prime movers were serviced every 10,000 kilometres. Their previous service manager set the servicing period and Mr Penney just carried on with it.

2.3.3.7 In particular, the prime movers underwent an "A" service every 10,000 km. This involved greasing and adjusting the brakes, checking fluid levels and a general check over the vehicle. A "B" service every 20,000 km also involved an oil change.

2.3.3.8 The brakes on Cannys' fleet were all drum brakes. Mr Penney told the Court that he assessed the need to replace the brake pads on Mr Scholl's prime mover and the brake linings on his trailer from the step indicators that are built into the pads and linings about one millimetre above the rivets.

2.3.3.9 Cannys had no provision for checking that the brakes on the semi-trailer wheels were properly balanced and Mr Penney told the Court that Cannys rarely sent their units for external testing. Further, Mr Penney could only remember one instance in which their unit was tested at a weigh station.

2.3.3.10 If any work was required on a prime mover or trailer outside the usual service requirements, Mr Penney required authorisation from Rod Canny or Brian Canny. When Rod Canny was away, supervision of Mr Penney devolved to Michael Canny.

2.3.3.11 Maintenance records for Mr Scholl's prime mover show that the front brake drums and shoes were replaced in December 2005 when the odometer reading was 13,000km. Although the maintenance cost records show the prime mover was serviced 11 times after this date and the right hand steer rim was replaced on 6 May 2007, there is no subsequent reference to the brakes.

2.3.3.12 Maintenance cost records confirm that Mr Scholl's prime mover was last serviced on 28 May 2007. The odometer reading was 133,000km. These records show that the brakes were adjusted but they make no comment on the adequacy of the brake pads. Mr Penney stated that no issues were raised and the prime mover was roadworthy.

2.3.3.13 After the collision, mechanical inspection of Mr Scholl's semi-trailer found the tyres had sufficient tread and the brake linings on the prime mover were all 10-12mm.[189] However, investigators were unable to measure the push rod travel due to distortion caused by the collision on 5 June 2007.

2.3.3.14 Despite the damage to the prime mover and their inability to determine the effective push rod setting on each brake, investigators stated that it appeared to have been in a roadworthy condition at the time of the collision. The inspection did not reveal any other fault that would have caused or contributed to the collision.

2.3.3.15 Further, between 28 May and 5 June 2007, the DDEC IV indicates that Mr Scholl's prime mover travelled 6969 kilometres.

2.3.3.16 At Cannys, Mr Penney and Mr Puhls routinely serviced the trailers every three months. Their previous service manager set the servicing period and Mr Penney just carried on with it. Mr Penney understood that this frequency complied with the manufacturer's instructions.

2.3.3.17 Mr Penny personally marked the trailers that were due for servicing on a white board in the workshop at Cannys' yard.

2.3.3.18 However, the Krueger Warranty and Service Manual requires the brakes on their trailers to be checked every four weeks:

> *"Check all brake components for tightness of fasteners, adjust brakes....*
>
> *"Check your brake linings for wear. Replace only with Krueger non-asbestos linings for maximum of life" et cetera. Then it's, "Inspect brake drums for cracks or abnormal wear. Replace as necessary."*

2.3.3.19 Further, Krueger require a six monthly service or 100,000 kilometre service that includes:

> *"Check the wheel drum assemblies and thoroughly inspect the brake operating mechanism for wear and correct operation."*

2.3.3.20 There are no historical records to describe earlier service of Mr Scholl's trailer. However, Mr Penny agreed that Cannys' service policy for their trailers did not comply with that advocated by the manufacturer.

2.3.3.21 Mr Penney first stated that he last serviced Mr Scholl's trailer on 5 June 2007. Mr Penney also told the Court that he serviced Mr Scholl's prime mover on 5 June 2007. In evidence, he told the Court:

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189 Leigh Booth, Major Collision Investigation Unit, Victoria Police.

"We definitely serviced it (the trailer). I remember servicing it. As far as timeframes go I can't be specific."

2.3.3.22 On 19 April 2011, Mr Penney made a further statement for this coronial investigation. In that statement, he again noted that he checked the brake linings on 5 June 2007. Some of the trailer wheels were low and he told Michael Canny the brakes needed re-lining. Re-lining of the trailer brakes would take about five hours.

2.3.3.23 On 19 April 2011, Mr Penney also stated that on 5 June 2007 Michael Canny told him there was not time to perform the work. They agreed that the brakes would be re-lined when the trailer returned from Adelaide. Further, Mr Penney adjusted the push rods to compensate for the worn brake pads.

2.3.3.24 Mr Penney says that he did not tell Mr Scholl about the state of the trailer brakes and Mr Scholl denies knowing that the brake pads on his trailer required replacement.

2.3.3.25 However, Mr Penney later changed his evidence to being unable to remember whether he last serviced Mr Scholl's trailer and had the conversation with Michael Penney on 5 June 2007 or on 28 May 2007.

2.3.3.26 In assessing the reliability of Mr Penney's evidence, I also note that he told the Court that he was unaware that there was a hub meter or other odometric device fitted to Mr Scholl's trailer.

2.3.3.27 However, in cross-examination, Mr Penney accepted responsibility for recording the trailer odometer reading of 343,000km on 28 May 2007 on the white board in Canny's workshop, When confronted with this discrepancy, he also acknowledged there must be an odometer reader on the trailer because, to the nearest 1000km, that was what he wrote on the white board.

2.3.3.28 I do not accept that Mr Penney could write an odometer reading on the white board but remain unaware that there was a hub meter on the wheel of Mr Scholl's trailer. Therefore, I have difficulty accepting any of the detail in Mr Penney's evidence.

2.3.3.29 However, as collateral evidence, Mr Puls does not remember Mr Penney servicing Mr Scholl's prime mover or trailer on 5 June 2007. A service would have taken up to five hours and this time is not unaccounted for on the morning of 5 June 2007. Mr Scholl and the semi-trailer worked all of Monday 4 June 2007 so there was not time for the service on that day.

2.3.3.30 On the other hand, Cannys' cost records show that the prime mover was serviced on 28 May 2007. Further, Mr Scholl and his semi-trailer did not work on 28 May 2007. Mr Scholl left Wangaratta as usual on 29 May 2007.

2.3.3.31 Mr Penney's written notes on the whiteboard used to record service requirements for Cannys' trailers also confirmed that Mr Scholl's trailer was serviced on 28 May 2007 when the trailer had travelled 343,000 kilometres.[190] These notes on the whiteboard also indicated that the brake linings on both sides of Mr Scholl's trailer were getting low. This notation was written in red to indicate the adjustment still needed to be performed.

2.3.3.32 Therefore, it seems likely that Mr Penney serviced Mr Scholl's prime mover and trailer on 28 May 2007 and not on 5 June 2005. I assume he had his conversation with Michael Canny on or about the same day.

2.3.3.33 After Mr Scholl's semi-trailer was involved in the collision at the Kerang level crossing, mechanical inspection of Mr Scholl's trailer found the push rod extensions of the brakes were in the range 45-63 mm.[191] Accordingly, the trailer would have been unroadworthy at the time of the collision due to excessive push rod travel on all servo units on the mid and rear axles.

2.3.3.34 Ian Kelly conducted further testing of the trailer brakes at the request of the Major Collision Investigation Unit.[192] These tests also indicated that the braking efficiency of the trailer would not meet the 40% minimum standard set down by VicRoads for roadworthiness.[193]

2.3.3.35 These assessments of the push rod adjustment on Mr Scholl's trailer by Leigh Booth and Mr Kelly are inconsistent with Mr Penney's evidence that he checked the push rod adjustment before Mr Scholl left the yard on 28 May or 5 June 2007.

2.3.3.36 The hub meter on Mr Scholl's trailer recorded that it had travelled a total of about 350066 kilometres when the Kerang incident occurred. Therefore, the trailer travelled about 7000 kilometres between 28 May and 5 June 2006.

2.3.3.37 This means that Mr Scholl's prime mover and trailer had travelled about 7000 kilometres after Mr Penney serviced them and advised Michael Canny that the brakes linings on the trailer required replacing on 28 May 2007.

2.3.3.38 Further, this is slightly more than but within the possible range of Mr Penney's recording process of the distance recorded by the DDEC IV on Mr Scholl's prime mover in the same period.

2.3.3.39 Therefore, I find that Mr Scholl's prime mover and his trailer travelled the same distances between 28 May and 5 June 2007. In the face of consistent evidence that Mr Scholl was

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190 To the nearest 1000km.

191 Leigh Booth, Major Collision Investigation Unit, Victoria Police.

192 Licensed heavy vehicle road worthy tester accredited by VicRoads.

193 VicRoads, Vehicle Safety Information Sheet 26.

the only driver of the combination during that period and that he did not work on 2 June 2007, I am unable to explain who drove Mr Scholl's semi-trailer on Saturday 2 June 2007.

2.3.3.40 The skid marks from the left side wheels of Mr Scholl's trailer commenced about 47 metres back from the closest rail on the Kerang level crossing.

2.3.3.41 However, the skids marks that arise when the trailer brakes become locked up would have commenced some distance after Mr Scholl applied the emergency brakes. Further, Mr Bellion considered driver reaction times of 1.5 and 2.5 seconds. At 100 km/h these would add 42 metres and 69 metres respectively to the stopping distance.

2.3.3.42 Therefore, using these data, Mr Scholl applied emergency braking more than 89 metres before the level crossing. This is consistent with his report that he saw the train when it became visible from behind the trees about 90 metres before the level crossing.

2.3.3.43 Dr Peter Hart told the Court that the minimum total stopping distance for a semi-trailer with the braking and load characteristics of Mr Scholl's semi-trailer was 89 metres on a sealed road. He also added at least 42 metres to include reaction time, making a total minimum stopping distance of 131 metres.

2.3.3.44 Increase beyond this stopping distance occurred because of tyre lock of some wheels of the semi-trailer but optimum retardation force occurred before the tyres locked up.

2.3.3.45 Therefore, Mr Scholl became aware of the train when he was about 40 metres or 1.5 seconds too late for him to be able to stop before his semi-trailer entered the Kerang level crossing.

2.3.3.46 Therefore, in circumstances where heavy vehicles are likely to create the greatest risk of severe and/or fatal injuries to train passengers, it is important that cues to make all road vehicle drivers aware of an approaching train have effect early enough for them to be able to respond safely.

2.3.3.47 Further, this example illustrates that it is not brake capacity that limits the stopping performance of an average semi-trailer combination vehicle. Rather it is the risk of losing directional control when the vehicle is lightly laden. If the driver applies too much brake power, the vehicle is likely to jack-knife or swing unless it has antilock protection.

2.3.3.48 Mr Scholl's semi-trailer was not fully laden. The braking system was proportioned for a fully laden vehicle so good stopping distance performance is achievable even with some brakes out of adjustment. The prime mover had anti-locking brakes which maintain directional stability during emergency braking but slowed the rate at which the semi-trailer decelerated.

2.3.3.49 Accordingly, in the circumstances that Mr Scholl applied emergency brakes on 5 June 2007, the anti-lock braking system on his prime mover will have slowed the rate of his semi-trailer's deceleration.

2.3.3.50 I am unable to say that Mr Scholl's semi-trailer would have stopped before it hit the train on 5 June 2007 if his prime mover had not been fitted with anti-lock brakes. However, I am confident that the force of the collision would have heen reduced and the consequences less severe.

2.3 COMMENTS

Pursuant to section 67(3) of the *Coroners Act* 2008, I make the following comments connected to the deaths of 22 people in this cluster of 26 level crossing fatalities:[194]

2.3.1 Background

2.3.1.1 On 5 June 2007, 11 passengers on a commuter train travelling from Swan Hill to Kerang died when a semi-trailer driven by Christian Scholl hit the train at the level crossing on the Murray Valley Highway in Fairlie about five kilometres north of Kerang (the "Kerang level crossing").

2.3.1.2 Mr Scholl was employed by Canny Carrying Company ("Cannys") in Wangaratta. His prime mover was owned by Cannys His semi-trailer was owned by Cannys. He was carrying a load at the direction of Michael Canny who was a director of Cannys.

2.3.1.3 The Kerang level crossing was protected by flashing lights and bells as well as standard warning road signs and asphalt markings.

2.3.1.4 Despite this suite of warnings, Mr Scholl never saw the lights flashing on 5 June 2007. He did not notice cars stopped on the northern approach to the level crossing. He was not aware of the train until he saw the train emerge from a light cover of trees when he was 90 metres from the level crossing.

2.3.1.5 Mr Scholl was not unusual in his explanations for not seeing the warning signs.

2.3.1.6 In 1989, then Deputy State Coroner Graeme Johnstone held an inquest into eight deaths in seven level crossing incidents between March and July 1989.[195] He explained unintended driver error in terms of visibility issues, and inadequate or confusing prior warning signs.

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194 Coroner Saines and Corner Heffey have completed Findings in their investigations of the deaths of Tony Massaria, Kay Stanley and Mark Winter: Coroner Ronald Saines, Finding into Death with Inquest, Jamie Webb, Case No. 1965/06; Coroner Jacinta Heffey, Finding into Death without Inquest, Anthony Massaria, Case No 3881/06.; Coroner Jacinta Heffey, Finding into Death with Inquest, Mark Winter, Case No 3471/09; Coroner Jacinta Heffey, Finding into Death with Inquest, Kay Stanley, Case No 417/08.

195 Margaret Campbell, 17 March 1989; Michael Welsh, 7 May 1989; Lyle Staehneke, 25 May 1989; Ionnis Karagiannis, 19 June 1989; Richard Church & Sally Tracey 20 June 1989; John Shrubsole, 18 July 1989; Alfred Malia, 20 July 1989.

2.3.1.7 In 2006, the Australian Transport Safety Bureau confirmed that 46% of level crossing fatalities between 1988 and 1998 resulted from unintended road vehicle driver error.[196]

2.3.1.8 The age and intentional behaviour of drivers involved in fatal level crossing collisions has also been shown to differ from the general population of drivers who cross level crossings.[197]

2.3.1.9 Further, Dr Ian Johnston prepared an overview of current knowledge about safety at road-rail crossings for this coronial investigation.[198]

2.3.1.10 Dr Johnston reported that an analysis of 87 fatal level crossing crashes carried out by the Australian Transport Safety Bureau reported that over 90% did not involve any alcohol, speeding or fatigue - the three high frequency risk factors in all road crashes. [199]

2.3.1.11 Dr Johnston also reported that unintended error/violation was about twice as common in level crossing fatal crashes as in road crashes generally. [200]

2.3.1.12 This coronial investigation of the incident in which 11 train passengers died was part of a cluster of 26 unintentional deaths arising from 12 incidents in which a train and a road vehicle collided on a level crossing in Victoria.

2.3.1.13 Only three of the road vehicle drivers involved in these fatal level crossing collisions were aware that a train was approaching before the collision occurred. Mr Scholl and Mr Angel[201] became aware of the train too late to stop before their vehicle hit the train. The vehicle in which Mrs Yousif died was stranded on the railway line before the boom gates descended.[202]

2.3.1.14 The characteristics of the 12 road vehicle drivers in this cluster of fatal level crossing collisions were consistent with other investigators findings:

- All but one were experienced drivers[203];

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196 Australian Transport Safety Bureau, "Fatal Crashes at Level Crossings", Monograph 10, Level Crossing Accidents, 15th November 2006; Austroads, "Measures for Managing Safety of Heavy Vehicles at Passive and Active Railway Level Crossings" NS 1587 Sydney 2010.

197 K Taylor, "Addressing road user behavioural changes at railway level crossings", Joint ACRS-Travelsafe National Conference, 2008

198 Ian Johnston, "Expert Report for use as evidence in a series of inquests into deaths at level crossings in Victoria between 2006 and 2009", prepared at the request of Transport Safety Victoria by Ian Johnston Transport Safety Pty Ltd, 5 July 2011.

199 Ian Johnston, "Expert Report for use as evidence in a series of inquests into deaths at level crossings in Victoria between 2006 and 2009", prepared at the request of Transport Safety Victoria by Ian Johnston Transport Safety Pty Ltd, 5 July 2011.

200 Ian Johnston, "Expert Report for use as evidence in a series of inquests into deaths at level crossings in Victoria between 2006 and 2009", prepared at the request of Transport Safety Victoria by Ian Johnston Transport Safety Pty Ltd, 5 July 2011.

201 Caitlin Angel Case No. 1231/08; Susan Angel Case No. 1230/08.

202 Mariam Yousif Case No. 1656/09.

203 cf Mariam Yousif Case No. 1656/09

- None were affected by alcohol or other drugs; and
- All but three were very familiar with the crossing.
- All but one never or rarely saw a train at the level crossing.[204]

2.3.1.15 This investigation has also identified a number of other issues common to the heavy vehicle combination drivers in this coronial investigation of fatal level crossing collisions and those investigated by other agencies in Victoria. These issues include that:

- The train or road vehicle was travelling at a different time from usual;
- There were no boom gates;
- The road vehicle driver was working long hours and/or at different times from usual; and
- They occur in daylight when the weather is good.[205]

2.3.1.16 Many of these circumstances interact with each other and should be considered in that context.

2.3.2 The driver

2.3.2.1 Mr Scholl was like all the other road vehicle drivers involved in this cluster of 12 fatal level crossing incidents:

- He was an experienced driver;
- He was not exceeding the speed limit;
- He had no relevant history of non-compliance with road laws;[206]
- He was not trying to beat the train; and
- He was familiar with the road and had crossed the level crossing before.[207] Two other car drivers rarely used the level crossing but they were aware of its presence.[208]

2.3.2.2 The *Road Safety Act* 1986 requires a driver to take appropriate care, not recklessly enter a level crossing when the warning bells are operating or a train is approaching or travel at a speed which is dangerous in all the circumstances. [209]

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204 Jillian McCormack Case No. 5159/08.

205 cf Coroner Ronald Saines, Finding into Death with Inquest, Jamie Webb, Case No. 1965/06. Fog contributed to Jamie Webb's death.

206 cf Haldane Nelson Case No 801/08.

207 cf Fiona Smart Case No 468/08.

208 Haldane Nelson Case No. 801/08; Caitlin Angel Case No 1231/08; Susan Angel Case No 1230/08.

209 Ss.64, 65, 68B *Road Safety Act* 1986.

2.3.2.3 Further, Mr Scholl was charged with 11 counts of culpable driving, eight counts of negligent driving causing serious injury, 11 counts of dangerous driving causing death and eight counts of dangerous driving causing serious injury. On 13 June 2009, a jury in the Supreme Court at Bendigo found him not guilty on all charges.

2.3.2.4 Similarly the heavy vehicle driver involved in the Benalla[210] incident was found not guilty of culpable driving and other serious driving offences.

2.3.2.5 Mr Angel was also charged with culpable driving and drive in a manger dangerous causing death and summary charges. On 25 May 2010, he pleaded guilty in the Geelong County Court to drive in a manger dangerous causing death. He was sentenced to a total of three years in prison which was wholly suspended for one year. Mr Angel's licence to drive was also cancelled and he was disqualified from driving for 18 months.[211]

2.3.2.6 Dr Ian Johnston prepared an overview of current knowledge about safety at road-rail crossings – causes, risk factors, prevention models and countermeasure strategies for this coronial investigation.[212]

2.3.2.7 Dr Johnston reported that an analysis of 87 fatal level crossing crashes carried out by the Australian Transport Safety Bureau (ATSB) reported that over 90% did not involve any alcohol, speeding or fatigue - the three high frequency risk factors in road crashes more generally - and also that unintended error/violation was about twice as common in level crossing fatal crashes as appears to be the case in road crashes generally.

2.3.2.8 Further, Dr Johnston noted that Austroads had published a report of research undertaken by the Monash University Accident Research Centre into driver errors and violations measured in an instrumented vehicle during standardised drives through an urban area in Melbourne.

2.3.2.9 While it did not include level crossings, the results of this Austroads research are informative. The 25 drivers who participated made an average of 12 errors/violations per drive, over half of which occurred at intersections and most of the violations were inadvertent.

2.3.2.10 Dr Johnston is supported by James Reason who summarised the situation:

> *"...doing routine jobs in an automatic state releases the mind to be elsewhere."*[213]

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210 Adam Dunning Case No 3174/02; Adrian Kiely Case No 3175/02; Ian Pettersen Case No 3176/02.

211 Caitlin Angel Case No. 1231/08; Susan Angel Case No. 1230/08.

212 Ian Johnston, "Expert Report for use as evidence in a series of inquests into deaths at level crossings in Victoria between 2006 and 2009", prepared at the request of Transport Safety Victoria by Ian Johnston Transport Safety Pty Ltd, 5 July 2011.

213 Reason, J., "Human Error", Cambridge University Press: Cambridge, 1990. See also e.g. James Reason, "Human error: models and Management", British Medical Journal 328 (2000) 768; J Reason. 1997,

2.3.2.11 Therefore, I make no recommendations to strengthen the provisions of the *Road Safety Act* 1986 relating to drivers entering a level crossing when active warnings are operating or a train is approaching.

2.3.2.12 Further, Dr Johnston cautioned:

> *"Most experts have applied their general human factors knowledge to the level crossing situation to deduce what may be important. It is critical to stress the need for systematic research to assess whether what follows is an accurate picture and to test possible measures for their effectiveness in decreasing the likelihood of critical errors."* [214]

2.3.2.13 Dr Johnston is supported by James Reason who summarised the situation:

> *"...doing routine jobs in an automatic state releases the mind to be elsewhere."* [215]

2.3.2.14 In the context of their investigation of the Benalla B-double collision in which three train passengers died, the Australian Transport Safety Bureau[216] also adopted Professor Reason's explanation of the propensity for individuals to experience skill-based slips and lapses, slips in attention and perceptual errors while undertaking well-practiced, familiar and largely automatic tasks, with only intermittent checks on progress by conscious attention:

> *"Attentional slips in which we fail to monitor the progress of our routine actions at some critical choice point, often following a change in either our routine or the surrounding circumstances. The upshot is that we do what is customary or habitual in those circumstances rather than what was then intended.*
>
> *Perceptual errors in which we misrecognize some object or situation. Here, expectation and habit play a large part. Many train accidents, for example, have*

Managing the Risks of Organisational Accidents, (Ashgate Publishing Limited: Aldershot) adopted by Australian Transport Safety Bureau, "Level Crossing collision between Steam Passenger Train 8382 and a Loaded B-Double Truck-Benalla Victoria 13 October 2002", Rail Safety Investigation 2002/003, September 2004.

214 Ian Johnston, "Expert Report for use as evidence in a series of inquests into deaths at level crossings in Victoria between 2006 and 2009", prepared at the request of Transport Safety Victoria by Ian Johnston Transport Safety Pty Ltd, 5 July 2011.

215 Reason, J., "Human Error", Cambridge University Press: Cambridge, 1990. See also e.g. James Reason, "Human error: models and Management", British Medical Journal 328 (2000) 768; J Reason. 1997, Managing the Risks of Organisational Accidents, (Ashgate Publishing Limited: Aldershot) adopted by Australian Transport Safety Bureau, "Level Crossing collision between Steam Passenger Train 8382 and a Loaded B-Double Truck-Benalla Victoria 13 October 2002", Rail Safety Investigation 2002/003, September 2004.

216 Australian Transport Safety Bureau, "Level Crossing collision between Steam Passenger Train 8382 and a Loaded B-Double Truck-Benalla Victoria 13 October 2002", Rail Safety Investigation 2002/003, September 2004.

been due to the driver expecting (on the basis of past experience) to see a green signal, whereas the actual signal was red."[217]

2.3.2.15 In these circumstances, it is important for investigations of level crossing incidents to adopt a systematic approach to collecting routine detailed human factors information about level crossing collisions. **Recommendation 1**

2.3.2.16 As the jury in the Supreme Court decided in relation to the prosecution of Mr Scholl, in the absence of evidence that the non-compliance was intentional, it is not enough to assert that breach of road safety legislation caused the level crossing collision.[218]

2.3.2.17 Similarly, drivers' failure to see and/or respond to level crossing warnings that comply with Australian and other standards is not enough to excuse re-assessment of the capacity of the level crossing paraphernalia to alert the driver to the possibility that a train is approaching.

2.3.2.18 It is clear from this review of fatal collisions at 12 level crossings with varying levels of infrastructure, that 12 of the road vehicle drivers were not alerted to the approach of a train in time to stop or at all.

2.3.2.19 Further, in 2003, the Australian Transport Council reported that:

"Most (level crossing) crashes occur where the driver has a local understanding of the railway level crossing."[219]

2.3.2.20 In 2008, Bob Pearson advised VicRoads that the most common cause of catastrophic collisions between a heavy vehicle and a train was the road vehicle driver not expecting and/or not seeing the train in time to stop or at all.[220]

2.3.2.21 This investigation has confirmed the findings of these other investigations.

2.3.2.22 Mr Scholl had never seen a train before at the Kerang level crossing. The only reason that he was able to provide for failing to see the flashing incandescent red-filtered level crossing lights was:

"No, no because I didn't expect it, like I said I've been travelling on the road for seven years and never seen those lights on. Never... How stupid."

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217 Maurino, D., Reason, J., Johnston, N. and Lee R, "Beyond Aviation Human Factors", Ashgate Publishing, Aldershot, 1995 adopted by Australian Transport Safety Bureau, "Level Crossing collision between Steam Passenger Train 8382 and a Loaded B-Double Truck-Benalla Victoria 13 October 2002", Rail Safety Investigation 2002/003, September 2004.

218 *cf* Submissions on behalf of VicRoads.

219 Australian Transport Council, National Railway Level Crossing Safety Strategy, August 2003.

220 Bob Pearson, Risk Analysis of Trick Train Collisions of Significant Severity, Final report, 28 November 2008.

2.3.2.23 Peter Scott was travelling behind Mr Scholl on 5 June 2007. He also crossed the Kerang level crossing several times a week as part of his work.

2.3.2.24 Mr Scott said he rarely saw a south-bound train on the Kerang level crossing at 1:30pm:

> *"I don't think I've ever had to stop for it. I've probably only seen it two or three times over the 20 years, I reckon."*

2.3.2.25 Mr Scott explained one way in which familiarity prevents road vehicle drivers responding to cues that a train is approaching the level crossing In Court, Mr Scott explained his failure to see the flashing red-filtered incandescent lights:

> *"Well, I was in a world of me own as truck drivers usually are...."*

2.3.2.26 Mr Scott also said that he would have entered that world about half a kilometre after he left Kerang and before he reached the 100kph zone when he turned on the cruise control to 102kph.

2.3.2.27 Mr Scott denied that he was unreactive when he was in this "world of his own". He told the Court:

> *"I've spoken to other truck drivers in our company and they've agreed with me that up to a point you are in a world of your own. You listen to a radio or listen to something or watching something and it's just the way you are. You are not on total concentration all the time but it doesn't take long for it to click in."*

2.3.2.28 Similarly, Daniel Murphy was the driver of the B-double combination involved in a fatal collision at the Saleyards Road level crossing in Benalla.[221] Mr Murphy crossed this level crossing every day as part of his work because it was, and still is, on a VicRoads approved B-double route.[222] Further, the Yarrawonga to Benalla railway line is a historical railway line used by railway enthusiasts and is rarely used.

2.3.2.29 Mr Murphy did not see the train until after the collision.

2.3.2.30 Accordingly, I confirm that familiarity contributes to fatal level crossing collisions which occur in circumstances where the driver unintentionally fails to comply with the *Road Safety Act* 1986 and fails to respond to warning paraphernalia intended to alert the road vehicle driver to the possibility that a train is approaching.

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221 Adam Dunning Case No. 3174/02; Adrian Kiely Case No.3175/02; Ian Pettersen Case No. 3176/02.

222 VicRoads information bulletin *B-double and Higher Mass Limit Trucks, July 2001 (publication number 00170/2)*; VicRoads information bulletin *B-double and Higher Mass Limit Trucks, July 2012 (publication number 07/12).*

2.3.2.31 Associated with this familiarity with the level crossings, 10 of the 12 road vehicle drivers involved in this cluster of fatal level crossing collisions did not see or hear the level crossing warnings or the train before it hit their vehicle.[223,224,225,226]

2.3.2.32 Two more road vehicle drivers, including Mr Scholl, saw the train too late to be able to stop before they hit the train. The road vehicle drivers who saw the train before it collided with their vehicle were both triggered by the train itself rather than the infrastructure.[227]

2.3.2.33 Mr Scholl told police that his failure to expect the train was associated with his failure to see the flashing lights at the Kerang level crossing:

> *"I didn't expect the train because I looked at the lights and the lights were not flashing, therefore I didn't expect the train to be there."*

2.3.2.34 Mr Murphy's approach to the Saleyards Road level crossing required him to travel down Gillies Street parallel to the railway line and make a left hand turn from Gillies Street into Saleyards Road. The level crossing was about 36 metres from the Gillies Street T-intersection. There is no left turn slip lane on Gillies Street.[228]

2.3.2.35 Mr Murphy did not respond to the level crossing warning signs or see the approaching steam train until he heard the locomotive's second steam-operated whistle at the very last second. There is no evidence that Mr Murphy's truck braked prior to entering the Benalla level crossing.

2.3.2.36 Mr Pearson also suggests that competing stimuli are likely to contribute to driver's failure to become aware of the train in time to stop.[229]

2.3.2.37 Further, although road vehicle drivers' failure to see the operating level crossing warnings is attributed to their "inattention", the drivers in the two fatal incidents at Kerang level crossing were aware of the approaching train in one case, and the light infrastructure in the other. However, neither saw the flashing lights.

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223 James Gordon Case No. 4307/06; Fiona Smart Case No. 468/08; see also Coroner Ronald Saines, Finding into Death with Inquest, Jamie Webb, Case No. 1965/06; Australian Transport Safety Bureau, "Collision between Rigid Tipper Truck/Quad Axle Trailer and Freight Train 4AM3 Lismore, Victoria 25 May 2006", Rail Occurrence Investigation 2006004, January 2007.

224 Coroner Jacinta Heffey, Finding into Death without Inquest, Anthony Massaria, Case No 3881/06.

225 Coroner Jacinta Heffey, Finding into Death with Inquest, Kay Stanley, Case No 417/08.

226 Coroner Jacinta Heffey, Finding into Death with Inquest, Mark Winter, Case No 3471/09.

227 Fiona Smart Case No. 468/08; Haldane Nelson Case No. 801/08; Caitlin Angel Case No. 1231/08; Susan Angel Case No. 1230/08. See also Coroner Ronald Saines, Finding into Death with Inquest, Jamie Webb, Case No. 1965/06.

228 Australian Transport Safety Bureau, "Level Crossing collision between Steam passenger Train 8382 and a Loaded B-Double Truck-Benalla Victoria 13 October 2002", Rail Safety Investigation 2002/003, September 2004: The Australian Transport Safety Bureau found that the sighting distance at Saleyards level crossing, based on a train speed of 80 kph, may be insufficient to allow heavy goods vehicles to cross and clear the level crossing in safety.

229 Bob Pearson, Risk Analysis of Trick Train Collisions of Significant Severity, Final report, 28 November 2008.

2.3.2.38 Therefore, it is also not enough to attribute road vehicle drivers' failure to see and respond to level crossing infrastructure to their so-called "inattention".

2.3.2.39 Accordingly, new level crossing infrastructure intended to alert road vehicle drivers to an approaching train must include warnings that are capable of attracting their attention in circumstances where:

- They are familiar with the level crossing;
- They are not expecting a train;
- They are not likely respond to current infrastructure;
- They are not deliberately committing road rules offences;
- They are not affected by alcohol or drugs;
- They cannot provide any conventional explanation for failing to become aware of the approaching train; and
- They cannot stop in time to avoid a collision.

2.3.2.40 As Monash University researchers have understood, it is not sufficient to just warn drivers that there is a level crossing ahead. The first priority for safety related level crossing infrastructure is to warn road vehicle drivers that a train is approaching the level crossing and the road vehicle driver is at risk.[230]

2.3.2.41 By definition, this priority has also not been achieved in the circumstances of the 12 unintentional fatal level crossing collisions which are the focus of this coronial investigation of 26 level crossing deaths in Victoria between 2002 and 2009.

2.3.2.42 Transport Safety Victoria and VicRoads are now responsible for level crossing safety infrastructure in Victoria. Therefore they should cooperate to investigate and implement new level crossing infrastructure which is designed to alert road vehicle drivers to an approaching train who are unresponsive to the current suite of level crossing warning signs.
Recommendation 2

2.3.2.43 In considering other factors that may influence road vehicle drivers' capacity to notice level crossing warnings or trains, I note that Mr Scholl and James Gordon[231] also suffered a hearing loss which could explain their failure to hear the train horn.

2.3.2.44 The Australian Transport Safety Bureau investigation of a collision between a B-double combination and the Ghan in 2006 also found that the ability of the road-train truck driver

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230 J. Edquist, K. Stephan, E. Wigglesworth & M. Lenne, "A Literature Review of Human Factor Safety Issues at Australian Level Crossings", Monash University Accident Research Centre, February 2009.

231 James Gordon Case No. 4307/06.

to hear the first two soundings of the train horn may have been compromised by his severe bilateral hearing loss.[232]

2.3.2.45 Therefore, at first glance, it seems that hearing defects may be contributing to road drivers' deaths at level crossings.

2.3.2.46 However, in the United States, 55 out of 60 trains involved in level crossing fatalities sounded their horn prior to impact but only four of 14 road vehicle drivers reported hearing the horn. Eight of the drivers who did not hear the horn reported being distracted by internal or external sounds.[233]

2.3.2.47 Further, none of the 11 other road vehicle drivers involved in this cluster of level crossing fatalities heard the activated train horn. [234,235, 236]

2.3.2.48 Therefore, I am unable to attribute the failure of Mr Scholl and Mr Gordon and the road vehicle driver in The Ghan incident to hear the train horn solely to their hearing problem.

2.3.2.49 There is also no evidence that Mr Scholl was distracted by his mobile telephone. This distraction is possible in two other car driver fatalities in the cluster. [237]

2.3.2.50 Further, Mr Scholl was wearing his corrective spectacles. Therefore, there is no reason to attribute his failure to see the train in time to his eyesight. It is possible that Jillian McCormack's failure to use her corrective lens contributed to her death.[238] Eyesight was not a factor in any other fatal collisions.

2.3.2.51 Therefore, I find that it is unlikely that sight and hearing deficits contributed to the collisions involving drivers who suffered these problems.

2.3.2.52 On the day before the Kerang incident, Mr Scholl had driven his semi-trailer for over 12 hours commencing at about 2am. He did not usually work on Mondays. He usually started work at about 6am. Therefore, he was working outside his usual circadian rhythm.

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232 Australian Transport Safety Bureau, "Level Crossing Collision between The Ghan Passenger Train (1AD8) and a Road-Train Truck, Ban Ban Springs, NT, 12 December 2006", 13 Feb 2008.

233 Michelle Yeh and Jordan Multer, "Driver Behavior at Highway-Railroad Grade Crossings: A Literature Review from 1990–2006", U.S. Department of Transportation Federal Railroad Administration, October, 2008.

234 Fiona Smart Case No. 468/08; Caitlin Angel Case No. 1231/08; Susan Angel Case No. 1230/08; see also Coroner Ronald Saines, Finding into Death with Inquest, Jamie Webb, Case No. 1965/06; Australian Transport Safety Bureau, "Collision between Rigid Tipper Truck/Quad Axle Trailer and Freight Train 4AM3 Lismore, Victoria 25 May 2006", Rail Occurrence Investigation 2006004, January 2007.

235 Coroner Jacinta Heffey, Finding into Death without Inquest, Anthony Massaria, Case No 3881/06.

236 Coroner Jacinta Heffey, Finding into Death with Inquest, Kay Stanley, Case No 417/08.

237 Coroner Jacinta Heffey, Finding into Death without Inquest, Anthony Massaria, Case No 3881/06; Fiona Smart Case No. 468/08.

238 Jillian McCormack Case No. 5159/08.

2.3.2.53 Mr Scholl said he went to bed at 8:30pm on the 4 June 2007 to compensate for his early morning. This meant he was sleeping at times he would otherwise be awake and *vice versa*.[239]

2.3.2.54 Jamie Webb had also worked from 3:30am to 7:00pm on the day before his tri-axle tipper truck with a tipper trailer loaded with orange pulp was involved in the collision in which he died at Lismore. He had also started driving again at 3:30am on the day he died.[240]

2.3.2.55 The Australian Transport Safety Bureau has investigated the effects of similar operations in the airline industry.[241]

2.3.2.56 In particular, circadian disruption associated with irregular night work can result in impaired performance and impact on safety. However, airline crews were found to sleep prior to commencing their overnight work sufficiently to mitigate the effect of disrupted circadian their performance during the trip.

2.3.2.57 Therefore, Mr Scholl's unusual work on the day before the Kerang incident is unlikely to have influenced his involvement in the collision.

2.3.2.58 Accordingly, I am unable to attribute the Mr Scholl's failure to respond to either active or passive level crossing warning paraphernalia to any particular characteristic or personal event.

2.3.2.59 Other road vehicle drivers in the cluster who survived the collision also said they were unaware of the level crossing warning signs and the approaching train.

2.3.2.60 For example, Mr Angel was probably made aware of the train he was unable to avoid, when his wife raised the warning. As he approached the level crossing, his vehicle crossed three sets of rumble strips and other new level crossing warning signs. The train driver had seen him and sounded his horn continuously.[242]

2.3.2.61 Similarly, Mrs McCormack drove through active level crossing boom gates and train drivers' use of the horn.[243]

2.3.2.62 Therefore, I have formed the view that there is a group of road vehicle drivers who cannot be reached by the current active or passive level crossing warnings at the time they are

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239 Mr Scholl's semi-trailer also worked from 5:00am to 10:34pm on Saturday 2 June 2007. Mr Scholl denies he drove the semi-trailer on this day.

240 Coroner Ronald Saines, Finding into Death with Inquest, Jamie Webb, Case No. 1965/06; Australian Transport Safety Bureau, "Collision between Rigid Tipper Truck/Quad Axle Trailer and Freight Train 4AM3 Lismore, Victoria 25 May 2006", Rail Occurrence Investigation 2006004, January 2007.

241 MJW Thomas, RM Petrilli & GD Roach, "The Impacts of Australian Transcontinental 'Back of Clock' Operations on Sleep and Performance in Commercial Aviation Flight Crew", Australian Transport Safety Bureau, March 2007.

242 Caitlin Angel Case No. 1231/08; Susan Angel Case No. 1230/08.

243 Jillian McCormack Case No. 5159/08.

approaching a level crossing. There is no evidence before me to suggest that these drivers are otherwise inattentive or pre-disposed to failing to respond to stimuli.

2.3.2.63 Sophisticated research and innovative technology is required to determine how best to alert drivers who will otherwise not notice an approaching train in the context of current level crossing warnings. **Recommendation 3**

2.3.3 The vehicle

2.3.3.1 The large size of the heavy vehicle combinations involved in fatal level crossing collisions cause difficulties at level crossings due to their performance factors including slower deceleration, length of vehicle, manoeuvrability, and visibility of trains and infrastructure including lines of sight and angles of approach.[244]

2.3.3.2 In a recent operation to identify unroadworthy heavy vehicles, VicRoads found that 85% of vehicles had defects and 77% posed an imminent and serious risk for road user safety.[245]

2.3.3.3 After the Kerang level crossing incident, the trailer on Mr Scholl's truck was shown to be unroadworthy. In particular, the push-rod distance on several of the brakes was insufficient to compensate for the worn brake pads.

2.3.3.4 Dr Peter Hart told the Court that the minimum total stopping distance for a semi-trailer with the braking and load characteristics of Mr Scholl's semi-trailer was 89 metres on a sealed road. He also added at least 42 metres to include reaction time make a total minimum stopping distance of 131 metres.

2.3.3.5 Further, in 2002, three people on a scenic train died when their train hit a B-double combination at the Saleyards Road level crossing in Benalla.[246] The Saleyards level crossing is 36 metres from the T-intersection with Gillies Street. Although it is easily visible to road traffic turning on to Saleyards Road from Gillies Street, the B-double driver was not aware of the approaching train until the last second.

2.3.3.6 Accordingly, warning signs and visibility of the train must be at least 131 metres before the level crossing, more on B double and B-triple combination routes.

2.3.3.7 Therefore, I recommend that VicRoads and Standards Australia amend their standards to require warning signs and visibility of the train to heavy vehicle combination drivers when they are at least 131 metres before the level crossing, more on B double and B-triple combination routes. **Recommendation 4**

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244 Austroads, "Measures for Managing Safety of Heavy Vehicles at Passive and Active Railway Level Crossings" NS 1587 Sydney 2010.

245 VicRoads, '*Operation Trishula to target unroadyworthy trucks*', Press release, Monday 8 October 2012.

246 Adam Dunning Case No. 3174/02; Adrian Kiely Case No. 3175/02; Ian Pettersen Case No. 3176/02.

2.3.3.8 Mr Scholl's prime mover was registered and driven in Victoria on 5 June 2007. Therefore, it was always subject to the provisions of the *Road Safety Act* 1986 and the *Road Safety (Vehicles) Regulations* 1999.

2.3.3.9 In particular, the *Road Safety Act* 1986 provided and still provides:

> *"A person must not use, or cause or permit to be used, on a highway a vehicle or a combination of vehicles that is not in a safe and roadworthy condition. Penalty: In the case of a large vehicle or a combination including a large vehicle-10 penalty units."*[247]

2.3.3.10 Offences under the *Road Safety Act* 1986 and associated regulations are summary offences. Therefore, charges must be laid within 12 months of commission of the offence.

2.3.3.11 The Chain of Responsibility component of the National Heavy Vehicle legislation also imposes liability on an operator, manager, or scheduler of a business involved in road transport for breaches of fatigue management requirements, speed limits and mass, dimension, loading requirements.

2.3.3.12 However, the National Heavy Vehicle legislation still does not include Chain of Responsibility liability for the maintenance of heavy vehicles.

2.3.3.13 The new Heavy Vehicle National Law does not yet include liability for inadequate maintenance of heavy vehicle.

2.3.3.14 However, the National Heavy Vehicle Regulator has introduced a voluntary National Heavy Vehicle Accreditation Scheme based on that already operating in Queensland.[248]

2.3.3.15 Under this National Heavy Vehicle Accreditation Scheme, heavy vehicle operators accredited in the Maintenance Management module are exempt from the requirement to have vehicles inspected annually for the purposes of registration. To be provided with the exemption vehicles must be adequately maintained and comply with all applicable vehicle standards at all times.

2.3.3.16 Dr Hart noted that the pushrod extensions of the semi-trailer brakes on Mr Scholl's trailer were in the range 45 – 63 mm. This suggested to him that the semi-trailer brakes were not in tight adjustment. The pushrod extension with tight brake adjustment is likely to be about 30 mm.

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247 R 259 *Road Safety (Vehicles) Regulations* 2009.

248 See National Heavy Vehicle Regulator, Maintenance Management Accreditation Guide, January 2013.

2.3.3.17 Accordingly, Dr Hart believes that the brakes on Mr Scholl's trailer should have been inspected more frequently than every three months. An inspection can be done relatively easily. He says a weekly or fortnightly check is advisable.

2.3.3.18 Therefore, the Code of Practice for maintenance of heavy vehicles should require inspection of brake pads and push rod extensions weekly or fortnightly. **Recommendation 5**

2.3.3.19 Further, Dr Hart places responsibility on the service manager to ensure that brake checks are performed at appropriate intervals:

> *"The time interval between brake adjustments must be chosen to ensure that the brakes on a heavy vehicle do not get excessively out of adjustment or need to be re-lined. The service manager should determine this interval depending upon the nature of vehicle use and observed brake wear levels. Frequent inspection of the brakes on a long distance truck is advisable."*

2.3.3.20 Similarly, Krueger Transport Equipment Pty Ltd ("Krueger") advise owners to undertake a weekly and/or pre-trip check of their trailer including checking the brake system for air leaks and spring brake operation and checking the slack adjustors.

2.3.3.21 Krueger also advise owners to perform a monthly or 15,000km service including checking all brake components, brake linings and brake drums.

2.3.3.22 Further, Krueger advise owners to perform a six monthly or 100,000km check which includes checking brake shoes and axle alignment.

2.3.3.23 Further, Cannys' heavy vehicle maintenance procedures in 2007 would not have complied with the requirements now imposed by the National Heavy Vehicle Regulator for accreditation under this National Heavy Vehicle Accreditation Scheme. In particular, maintenance of Mr Scholl's semi-trailer in the three months before the Kerang incident did not include any or adequate:

- Documentation of the daily check;
- Recording of faults;
- Recording of fault repairs;
- Documented roadworthiness of vehicles;
- Documentation of maintenance tasks;
- Routine audits of written documentation; or
- Formal training in the tasks performed by those who allocate the work.

2.3.3.24 I note that the Service Manager at Cannys, Christopher Penney, was a fully qualified mechanic.

2.3.3.25 I also note that Mr Penney told the Court that the prime movers in Cannys fleet did not always pull the same trailers.

2.3.3.26 However, in the case of Mr Scholl's semi-trailer, travel distance recorders on the prime mover and the trailer travelled almost the same number of kilometres between 28 May and 5 June 2007.

2.3.3.27 Further, Mr Scholl did not work on the weekend of 2 and 3 June 2007. However, the prime mover travelled every day but 3 June in that period.

2.3.3.28 Therefore, in the face of consistent evidence that Mr Scholl was the only driver of the combination during that period, I am unable to explain who drove Mr Scholl's semi-trailer on Saturday 2 June 2007.

2.3.3.29 Mr Penney also told the Court that he serviced Mr Scholl's trailer on 5 June 2007. He noted that the brake linings on some of the trailer wheels were low and told Michael Canny the brakes needed re-lining. Re-lining of the trailer brakes would take about five hours.

2.3.3.30 On 19 April 2011, Mr Penney also stated that, on 5 June 2007, Michael Canny told him there was not time to perform the work and they agreed the brakes would be re-lined when it returned from Adelaide. Further, Mr Penney adjusted the push rods to compensate for the worn brake pads.

2.3.3.31 In subsequent cross-examination, Mr Penney changed his evidence on this matter. He now says he had the conversation with Michael Canny about the brake linings and adjusted the push rod travel on the brakes on Mr Scholl's trailer on 28 May 2007.

2.3.3.32 Therefore, as best he could remember, Mr Penney's evidence was that:

- He serviced Mr Scholl's semi-trailer on 28 May 2007;
- He found that the brake linings on Mr Scholl's trailer required replacement;
- Michael Canny told him there was no time to replace the brake linings on the trailer because the semi-trailer had to go back into service;
- He adjusted the push rods to accommodate the worn brake linings;
- He noted the service on the white board on 28 May 2007; and
- He did not check the brakes on Mr Scholl's semi-trailer after 28 May 2007.

2.3.3.33 Therefore, Mr Scholl's semi-trailer was used from 28 May 2007 to 5 June 2007 and travelled about 7000 kilometres without remediation of the trailer brakes.

2.3.3.34 Further, if I accept all of Mr Penney's new evidence, use of Mr Scholl's semi-trailer between 28 May and 5 June 2006 resulted in severe deterioration of the push rod travel to the extent that it rendered the trailer unroadworthy.

2.3.3.35 The current director of Cannys, Rodney Canny told the Court that Cannys has improved its maintenance regimes and documentation since 2007.

2.3.3.36 However, in Victoria, there is no requirement for annual roadworthiness checks as part of re-registration of heavy vehicles.[249] Therefore, heavy vehicle operators in Victoria have less incentive than those in other States to seek and comply with accreditation of their maintenance arrangements under the National Heavy Vehicle Accreditation Scheme.

2.3.3.37 In other words, to the extent that Cannys' management and employees knew, or ought to have known, that the brakes on the trailer of Mr Scholl's semi-trailer were unroadworthy, Victoria Police would still not have been able to enforce the Heavy Vehicle National Law against anyone other than Mr Scholl and no one else would be legally liable under the National Heavy Vehicle legislation.

2.3.3.38 Mr Scholl consistently denied knowing that the trailer brakes had been assessed as unroadworthy before he left Wangaratta. Further, the semi-trailer had no emergency braking episodes since February 2007. Therefore, Mr Scholl did not have the opportunity in the period after they were known to be unroadworthy to assess them for himself

2.3.3.39 Review of the National Coronial Information System identified at least three deaths that were caused by inadequate heavy vehicle maintenance:

- Jason Frank Nicholas Moore[250] died when a rigid tip truck towing a laden dog trailer hit his car at the intersection of the Williamstown/ Melbourne Road at the west bound off-ramp from the West Gate Freeway. Police investigation of the incident in which Mr Moore died showed that the brakes on the tip truck had not been properly maintained and were unroadworthy. There was no evidence that the truck driver was aware that they were faulty.

  On 25 September 2007, Deputy State Coroner Iain West recommended, without holding an Inquest, that:

  "Owners, operators and drivers of commercial heavy vehicles be required to undertake training in basic vehicle maintenance to enhance their understanding and appreciation of regular maintenance in an effort to improve safety awareness."

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249 Section 95(8(b) *Road Safety Act* 1986 prohibits regulations which require annual tests of roadworthiness of registered motor vehicles or trailers.

250 Case No 1562/02.

Deputy State Coroner West further recommended that:

> *"Relevant industry bodies undertake a prevention study to provide insight into motivational factors behind a vehicle owner/operator's failure to regularly maintain their vehicles."*

- Paul Gerard Joseph Robinson[251] died when he lost control of his truck in Conondale, Queensland and the vehicle overturned. The front brakes of the truck had operated to some degree and the rear brakes had not operated at all.

  The Coroner attributed this brake failure to inappropriate speed and inadequate servicing of the brakes. Further, the vehicle and the operator were accredited under the National Heavy Vehicle Accreditation Scheme. However, after Mr Robinson's death, an audit indicated failure to comply with a number of the requirements of the Maintenance Management module of the scheme. The operator's accreditation was temporarily removed but later re-instated.

- Lorraine Patricia Brown[252] died when a fully loaded rigid truck struck the car she was driving at Red Hill in the Australian Capital Territory. The truck driver said he was unable to change into fourth gear as the brakes would not slow it down to be able to go down another gear. The qualified mechanic employed by the truck's owners said that he had conducted a full service including adjusting the brakes eight days before Mrs Brown died.

  The Coroner found that the only inference that could be drawn was that the cause of the accident could be attributed to either incorrectly adjusted brakes or non-adjusted brakes, needing adjustment on the Volvo truck. However:

  > *"[The truck driver] had no warning of the impending drama about to unfold in front of him and that he was unaware of any problems or potential problems with the brakes. Nor was there any evidence that the brakes were not operating correctly before they failed on the downhill run."*

  The Coroner's recommendations included:

  > *"That the ACT Government consider legislating to permit only those persons who are trained to adjust brakes to perform such adjustments on heavy vehicles. This knowledge could be tested when a person presents for their heavy vehicle licence."*

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251 Queensland file No 4454/07.

252 ACT CD185/02.

2.3.3.40 Dr Peter Hart provided independent expert evidence in relation to the effect that the unroadworthy brakes on Mr Scholl's trailer had on his ability to stop, before his semi-trailer hit the train on 5 June 2007.

2.3.3.41 Dr Hart told the Court that, in circumstances involving emergency braking:

> *"If the 'brake balance' on a semi-trailer is poor, then the propensity for gross wheel lockup to occur is increased. Brake balance is defined as the extent to which the braking forces at a wheel is in proportion to the load carried by the wheel. A wheel that is relatively lightly laden has a higher propensity to lock-up than other wheels during braking."*

2.3.3.42 However, Dr Hart also advised that, in circumstances where the prime mover is fitted with anti-lock brakes, these were more likely to reduce the rate of deceleration of the semi-trailer than the failure of the trailer brakes to comply with roadworthy requirements.

2.3.3.43 Mr Scholl's semi-trailer was not fully laden. The braking system was proportioned for a fully laden vehicle so good stopping distance performance is achievable even with some brakes out of adjustment. The prime mover had anti-locking brakes which maintain directional stability during emergency braking but slowed the rate at which the semi-trailer decelerated.

2.3.3.44 Accordingly, in the circumstances that Mr Scholl applied emergency brakes on 5 June 2007, the anti-lock braking system on his prime mover will have slowed the rate of his semi-trailer's deceleration.

2.3.3.45 I am unable to say that Mr Scholl's semi-trailer would have stopped before it hit the train on 5 June 2007 if his prime mover had not been fitted with anti-lock brakes. However, I am confident that the force of the collision would have been reduced and the consequences less severe.

2.3.3.46 Further, on 13 August 2013, I handed down a Finding in relation to the death of Graeme Dunn.[253] In that coronial investigation, I found that Mr Dunn died because he was hit by the axle of a prime mover. Further, the axle broke because of inadequate remediation 20 years earlier that had not been detected by the mechanics who routinely serviced the prime mover.

2.3.3.47 Later in 2013, the National Heavy Vehicle Regulator is expected to deliver a comprehensive range of services (including the regulation of heavy vehicle standards and modifications) under a consistent regulatory framework and Code of Practice.

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253 Case No 3914/07.

2.3.3.48 Therefore, following my investigation of the death of Graeme Dunn, I recommended that the National Heavy Vehicle Regulator expand the National Heavy Vehicle Accreditation Scheme to include all Victorian heavy vehicle operators who perform their heavy vehicle maintenance in-house. I repeat that recommendation in relation to this coronial enquiry. **Recommendation 6**

2.3.3.49 At a more specific level, the Code of Practice adopted by the National Heavy Vehicle Accreditation Scheme should also ensure mechanics performing maintenance work on heavy vehicles have access to and comply with the manufacturers' instructions in relation to maintenance. **Recommendation 7**

2.4 RECOMMENDATIONS

Pursuant to section 72(2) of the *Coroners Act* 2008, I make the following recommendations connected with the deaths of 22 people in this cluster of 26 level crossing fatalities[254]:

1. That Transport Safety Victoria, Public Transport Victoria, and VicRoads adopt a systematic approach to collecting routine detailed human factors information about level crossing collisions.

2. That Transport Safety Victoria and VicRoads investigate and implement new level crossing infrastructure which is designed to alert road vehicle drivers to an approaching train who are unresponsive to the current suite of level crossing warning signs.

3. That Transport Safety Victoria and VicRoads commit themselves to joint sophisticated human factors research and innovative technology to determine how best to alert drivers who will otherwise not notice an approaching train in the context of current level crossing warnings.

4. That VicRoads and Standards Australia amend their standards to require warning signs and visibility of the train to heavy vehicle combination drivers when they are at least 131 metres before the level crossing, more on B double and B-triple combination routes.

5. That the National Heavy Vehicle Regulator amend their Code of Practice to require inspection of brake pads and push rod extensions weekly or fortnightly.

6. That the National Heavy Vehicle Regulator ensure that the National Heavy Vehicle Accreditation Scheme is expanded to include all Victorian heavy vehicle operators who perform their own maintenance in-house.

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254 Coroner Saines and Corner Heffey have completed Findings in their investigations of the deaths of Tony Massaria, Kay Stanley and Mark Winter: Coroner Ronald Saines, Finding into Death with Inquest, Jamie Webb, Case No. 1965/06; Coroner Jacinta Heffey, Finding into Death without Inquest, Anthony Massaria, Case No 3881/06.; Coroner Jacinta Heffey, Finding into Death with Inquest, Mark Winter, Case No 3471/09; Coroner Jacinta Heffey, Finding into Death with Inquest, Kay Stanley, Case No 417/08.

7. That the National Heavy Vehicle Regulator ensure that the Code of Practice adopted by the National Heavy Vehicle Accreditation Scheme also ensures that mechanics performing maintenance work on heavy vehicles have access to and comply with manufacturers' maintenance instructions.

SECTION 3 – THE INFRASTRUCTURE INCLUDING REGULATION OF THE LEVEL CROSSING AND THE LOCOMOTIVE

3.1 BACKGROUND

3.1.1.1 At 1:34pm on 5 June 2007, a semi-trailer driven by Christian Scholl collided with the regular Swan Hill to Southern Cross Station V/Line passenger train at the level crossing on the Murray Valley Highway about five kilometres north of Kerang at Fairlie (the "Kerang level crossing"). Eleven passengers on the train died as the result of the collision.

3.1.1.2 The weather was fine. Visibility was good. Mr Scholl regularly drove his vehicle on the Murray Valley Highway.

3.1.1.3 The Swan Hill to Melbourne railway line carried two regular trains each way each day as well as unscheduled freight services.

3.1.1.4 The railway line through the Kerang level crossing had a speed limit of 90kph. The whistle board marker was 337 metres from the level crossing as required by level crossing standards.

3.1.1.5 The Kerang level crossing was protected by flashing red-filtered incandescent lights and electromechanical bells. Advance warnings of the approaching level crossing also included road markings, train X signage. There were no boom gates.

3.1.1.6 Mr Scholl's semi-trailer was travelling in a northerly direction at about 100 kph after it negotiated a right hand curve which is completed about 165 metres south of the level crossing. He says he was using cruise control set at about 102 kph after he entered the100 kph speed zone.[255]

3.1.1.7 The event logger indicated that the crossing lights and bell circuits were activated 25 seconds before the train entered the level crossing. However, Mr Scholl says he checked the signals when he was about 300 metres prior to the level crossing as he passed the first warning signs of the level crossing. He saw the light fixtures at the level crossing but he did not see the lights flashing and he did not see the train approaching. [256]

3.1.1.8 Therefore, Mr Scholl was unaware of the flashing red-filtered incandescent lights and the bells at the Kerang level crossing on 5 June 2007.

3.1.1.9 Mr Scholl told police:

> *"I didn't expect the train because I looked at the lights and the lights were not flashing, therefore I didn't expect the train to be there."*

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255 Scholl trial transcript, pp. 543, 553.

256 Scholl trial transcript, pp. 550, 555.

3.1.1.10 Although vegetation did not fully obscure the train from Mr Scholl's view on 5 June 2007, he told the Supreme Court that he did not notice the train until he was about 90 metres south of the level crossing and the locomotive emerged from the trees closest to the highway. He immediately applied his brakes and steered hard to the left in an attempt to avoid a collision with the train.[257]

3.1.1.11 However, at 1:34pm on 5 June 2007, Mr Scholl's semi-trailer entered the level crossing and was travelling at about 60kph when it collided with the second carriage of the train.

3.1.1.12 Truck drivers, Peter Scott and Wayne Lynch, were travelling behind Mr Scholl. They also crossed the Kerang level crossing several times a week as part of their work. They also failed to see the lights and hear the bells and were unaware of the train until they saw Mr Scholl's truck braking suddenly.

3.1.1.13 Mr Scott said knew the train was due but he rarely saw a south-bound train on the level crossing at 1:30pm:

> *"I don't think I've ever had to stop for it. I've probably only seen it two or three times over the 20 years, I reckon."*

3.1.1.14 Later, Mr Scott said he thought he saw a train at the Kerang level crossing about 10 times a year.

3.1.1.15 In his record of interview, Mr Scholl denied he was distracted as he approached the Kerang level crossing on 5 June 2007. He was not using the telephone or changing CDs. When asked if he was concentrating 100%, he said:

> *"Obviously not."*

3.1.1.16 However, the only reason that Mr Scholl was able to provide for failing to see the level crossing lights:

> *"No, no because I didn't expect it, like I said I've been travelling on the road for seven years and never seen those lights on. Never.... How stupid."*

3.1.1.17 On the morning of 5 June 2007, Christopher Cuskelly and Allan Edwards cut out and replaced two lengths of track to correct defects identified in area of the line that activates the warning bells and lights at the level crossing.[258] However, there is no evidence before me to suggest that these maintenance procedures contributed to the incident later that day.

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257 This distance was confirmed by investigators relying on the skid marks on the road and known response times for drivers in emergency situations: Peter Bellion, Major Collision Investigation Unit,Victoria Police.

258 Job Number RM0001, Work Order Transaction Report.

3.1.1.18 There are about 1970 level crossings in Victoria.[259] About two thirds of fatal crashes at level crossings occur on roads where the speed limit is 100 kph which suggests that they occur mostly in regional Victoria. Over 80% occur during the day in fine weather on a straight road. In one third of these collisions, the road vehicle hit the train.

3.1.1.19 In 2007, about 14% of total level crossing crashes involved articulated heavy vehicles although these vehicle types only represented less than 1% of the registered vehicles on the Australian road network in 2007. [260]

3.1.1.20 In the years 2003 to 2007, 20% of the road vehicles involved in level crossing crashes in Australia and New Zealand, were heavy vehicles including rigid trucks, articulated trucks, B-doubles, double road trains, and triple road trains. About 14% of these level crossing crashes involved articulated heavy vehicles (rigid heavy vehicles excluded).[261]

3.1.1.21 The circumstances surrounding the Kerang level crossing incident in which 11 people died are generally consistent with these characteristics.

3.1.1.22 They are also consistent with the incident at about 2:55pm on 14 May 1993 when Pamela Rose Brown[262] died when a semi-trailer hit the rear of her station wagon while it was stationary on the south bound carriage way of the Swan Hill-Kerang Highway at the Kerang level crossing.

3.1.1.23 The south-bound Swan Hill-Melbourne train with a G-Class locomotive was approaching the Kerang level crossing at 2:55pm on 14 May 1993. However, it did not collide with Mrs Brown's car or the semi-trailer and, accordingly, this collision was not categorised as a railway incident.

3.1.1.24 Deputy State Coroner West investigated Mrs Brown's death without holding an Inquest. Mr West found that Mrs Brown's car was stationary at the Kerang level crossing because she was aware that the train warnings were activated and a train was approaching. The train driver also sounded his horn three times as he approached the level crossing. The semi-trailer driver did not brake until his semi-trailer had entered the level crossing.

3.1.1.25 The driver of the semi-trailer was aware of the train further up the track and slowed down to 85kph. He had also started to decelerate and then brake as he approached the level crossing. However, the semi-trailer driver did not notice the traffic was already stopped until he was close to the level crossing. Then he saw the flashing lights.

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259 Ernst & Young, Australian Level Crossing (ALCAM) Assessment Model: Victorian Data Summary Version 1.1., VicTrack, 21 February 2008. These include rail lines that cross into New South Wales.

260 Austroads, "Measures for Managing Safety of Heavy Vehicles at Passive and Active Railway Level Crossings" NS 1587 Sydney 2010.

261 Austroads, "Measures for Managing Safety of Heavy Vehicles at Passive and Active Railway Level Crossings" NS 1587 Sydney 2010.

262 Case No 1505/93.

3.1.1.26 In 1993, the semi-trailer driver never saw the train approaching the level crossing or heard the train horn. The driver told police that his vision was affected by glare from the sun as it broke through the clouds and shone directly on to his windscreen.

3.1.1.27 Deputy State Coroner West found that the semi-trailer driver contributed to Mrs Brown's death.[263]

3.1.1.28 Mr Scholl's failure to see the flashing lights or the other vehicles stopped at the level crossing in time to stop is also consistent with all in the experience of the three of the four other road vehicle drivers in the cohort of level crossing fatalities at active crossings I have investigated.[264]

3.1.1.29 Further, the circumstances of all 12 collisions in this coronial investigation of a cluster of fatal level crossing collisions are generally similar to those reported for the rest of Victoria and in Kerang:

- Seven occurred in regional Victoria.265
- Three involved a heavy vehicle combination.266
- All of the collisions occurred in daylight hours on find clear days.267
- Two of the level crossings were equipped with boom gates, flashing red lights and bells.268
- Two of the level crossings were equipped with flashing red lights and bells but no boom gates.269 At least one of these flashing light fixtures used light emitting diodes ("LEDs").270
- In two collisions, including Kerang, the road vehicle hit the train.271
- Two collisions involved a left hand turning driver failing to become aware of a train approaching on a line parallel to the road.

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263 This 1993 collision differs from the collision on 2007 because the road vehicles were in the south bound carriage way.

264 cf Mariam Yousif Case No. 1659/09.

265 Adam Dunning Case No. 3174/02; Adrian Kiely Case No.3175/02; Ian Pettersen Case No. 3176/02; Victor Greensill Case No. 1552/06; Gwenda Glasson Case No. 1553/06; James Gordon Case No. 4307/06; Fiona Smart Case No. 468/08; Haldane Nelson Case No. 801/08; Caitlin Angel Case No. 1231/08; Susan Angel Case No. 1230/08.

266 Adam Dunning Case No. 3174/02; Adrian Kiely Case No.3175/02; Ian Pettersen Case No. 3176/02; Victor Greensill Case No. 1552/06; Gwenda Glasson Case No. 1553/06.

267 cf Coroner Ronald Saines, Finding into Death with Inquest, Jamie Webb, Case No. 1965/06; Australian Transport Safety Bureau, "Collision between Rigid Tipper Truck/Quad Axle Trailer and Freight Train 4AM3 Lismore, Victoria 25 May 2006", Rail Occurrence Investigation 2006004, January 2007. Fog was a factor in this collision.

268 Jillian McCormack Case No. 5159/08; Mariam Yousif Case No. 1656/09; Mark Winter Case No. 3471/09.

269 Kay Stanley Case No. 417/08; Geoffrey Young Case No. 3307/07.

270 Kay Stanley Case No. 417/08.

271 Caitlin Angel Case No. 1231/08; Susan Angel Case No. 1230/08.

- One collision involved a car stranded on a level crossing.272

3.1.1.30 Further, the road vehicle drivers in 12 collisions in this coronial investigation of a cluster of fatal level crossing collisions were consistent in their characteristics:

- All but one[273] were experienced drivers;
- None was affected by alcohol or other drugs;
- All but one were familiar or very familiar with the crossing;
- All but one never or rarely saw a train at the level crossing[274];
- All but one[275] had a driving history and reported driving attitude that indicated general compliance with road rules and other relevant legislation;
- One was using his mobile telephone[276] and two others[277] may have been similarly distracted.

3.1.1.31 Therefore, the findings that nine of the 12 drivers of road vehicles in this cluster never became aware of the approaching train, two became aware too late to stop and one was stranded on the level crossing is likely to represent the general circumstances in most fatal level crossing collisions in Victoria.

3.1.1.32 Transport Safety Victoria also recorded seven previous incidents at the Kerang level crossing between 1991 and 2006. Three of these incidents involved a train and a private car. One involved a train and a motorcycle. Four involved near misses, one with a cattle truck.[278]

3.1.1.33 Accordingly, it is not enough to attribute road vehicle drivers' failure to see and respond to level crossing infrastructure to their so-called "inattention".

3.1.1.34 Level crossing collisions have declined by 70% over the past 10 years despite increased road traffic and trains.[279] In the United States, about 10% of this decline has been attributed to line closures or consolidation of little-used crossings.[280]

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272 cf Mariam Yousif Case No. 1659/09.

273 Mariam Yousif case No. 1656/09

274 Jillian McCormack Case No. 5159/08.

275 Haldane Nelson Case No. 801/08.

276 Haldane Nelson 801/08.

277 Coroner Jacinta Heffey, Finding into Death without Inquest, Anthony Massaria, Case No 3881/06, 21 November 2011; Fiona Smart Case No. 468/08.

278 I also note that the November 2005 ALCAM assessment of Kerang level crossing flagged the length of warning times as extreme and allocated this issue 8 points or 10% of the ALCAM score. I am unable to say whether or to what degree these near misses were related to the observations leading to this ALCAM assessment.

279 See for example, Australian Transport Safety Bureau, "Railway Level Crossing Safety Bulletin", 2008; Victorian Auditor-General's Office, "Audit Summary of Management of Safety Risks at Level Crossings", tabled in Parliament of Victoria, 24 March 2010.

3.1.1.35 In the absence of alternative evidence, I fully accept that the current suite of passive and active level crossing infrastructure and road safety initiatives has also played an important role in achieving this improvement in Victoria.

3.1.1.36 The way in which the different components of the current level crossing protections interact with each other and the precise reasons for their overall effectiveness remain unclear. Therefore, I make no recommendations intended to remove or down grade any of the current commitments.

3.1.1.37 However, level crossing infrastructure intended to alert road vehicle drivers to an approaching train must include warnings that are capable of attracting their attention in circumstances where they are familiar with the level crossing, they are not expecting a train, they do not respond to current infrastructure, they are not deliberately committing road rules offences, they are not affected by alcohol or drugs, they cannot provide any conventional explanation for failing to become aware of the approaching train and they cannot stop in time to avoid a collision.

3.1.1.38 This finding will review:

3.1.1.39 The train including train conspicuity;

3.1.1.40 The Kerang level crossing;

3.1.1.41 Effectiveness of current level crossing infrastructure;

- The standards for level crossing infrastructure;
- Responsibility for managing level crossing infrastructure;
- Risk assessment; and
- Systems for determining priority for upgrading level crossing infrastructure.

3.1.1.42 It will then comment and make recommendations intended to reduce the risk of further fatalities occurring in unintentional collisions between a train and a road vehicle at level crossings in Victoria.

3.2 CORONIAL INVESTIGATION

3.2.1 The train including train conspicuity

3.2.1.1 On 5 June 2007, Barry Lidster was driving the N class locomotive and three carriages travelling between Swan Hill and Southern Cross Railway station.

280 S Mok & I Savage. "Why has Safety Improved at Rail-Highway Grade Crossings?" *Risk Analysis* 25 (2005) 867.

3.2.1.2 The locomotive was fitted with a head light, ditch lights and a Leslie RSN 5-chime air horn.

3.2.1.3 The train left Swan Hill at about 1:05pm. It was approaching the level crossing with the Murray Valley Highway at Fairlie about five kilometres north of Kerang at about 1:34pm on 5 June 2007.

3.2.1.4 The track speed on the Swan Hill to Kerang railway line is 90 kph. However, there is some variability in assessments of the train's speed as it approached the Kerang level crossing on 5 June 2007:

- The event recorder on the locomotive indicated that the speed of the train leading up to the collision was 80 to 100 kph with the highest speed at 102 kph. Immediately before the event, the data logger speed was 91 kph.
- At 24.5 seconds or 665 metres before the train entered the Kerang level crossing it activated the flashing red-filtered incandescent lights and the bells. From this data, Victoria Police Reconstruction expert, Peter Bellion has calculated that the average speed of the train was 95 kph.

3.2.1.5 There is no suggestion that the speed of the train had any influence on Mr Scholl's failure to become aware of its approach.

3.2.1.6 The locomotive's low beam head lamp and ditch lamps were operating as required by train operating standards. [281] Mr Scholl saw the train when he was about 90 metres from the Kerang level crossing. I am unable to say whether or to what degree the locomotive's low beam head lamp and ditch lamps attracted his attention.

3.2.1.7 Mr Lidster sounded his horn at the whistle board as required by operating standards. The whistle board marker was 337 metres from the level crossing as required by level crossing standards.[282] He also sounded the horn a second time for seven seconds from the level crossing after he became concerned that Mr Scholl had not seen the train.

3.2.1.8 This review has shown that the train drivers' ability to see road vehicles approaching the level crossing was restricted until less than 200 metres or four seconds at track speed of 100kph from the crossing in two of 13 fatal level crossing incidents. [283]

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281 Office of the Chief Investigator, Rail Safety investigation report No 2007/09, Level Crossing Collision: V/Line Passenger Train 8042 and a Truck near Kerang, Victoria 5 June 2007, p 18;

282 Office of the Chief Investigator, Rail Safety investigation report No 2007/09, Level Crossing Collision: V/Line Passenger Train 8042 and a Truck near Kerang, Victoria 5 June 2007, p 18; Railways of Australia Compliance requirement.

283 Geoffrey Young Case No. 3307/07; Caitlin Angel Case No. 1231/08; Susan Angel Case No. 1230/08.

3.2.1.9 In particular, the train driver in the Kerang fatal level crossing collision was unable to see road vehicles approaching the Kerang level crossing until he was about 90 metres from the level crossing.

3.2.1.10 Mr Lidster told the Court he became concerned about Mr Scholl's truck when the train was about 50 metres from the level crossing. However, in order to for the second horn to operate for seven seconds while he was travelling at about 96kph it would have been operating for about 186 metres or as soon as he saw Mr Scholl's semi-trailer.[284]

3.2.1.11 Mr Scholl denies that he heard the train horn. Similarly, the coronial investigations of the deaths of Fiona Smart, James Gordon, Anthony Massaria, Geoffrey Young, Kay Stanley, Haldane Nelson[285] have found that the road vehicle drivers also were not aware of an approaching train despite head lights and ditch lights on the locomotives and active use of the locomotives' horns.

3.2.1.12 Therefore, train lighting and active use of the trains' horns were insufficient to attract attention of this small group of road vehicle drivers who routinely use the level crossing during the day but are not expecting a train and have not been alerted to its approach by signs, road markings and flashing red-filtered incandescent lights or LEDs.

3.2.2 Level crossing infrastructure

3.2.2.1 The Murray Valley Highway approached the railway line from the south at an oblique angle. It was a two lane, two way carriageway with a bitumen surface in good condition. Each lane was 3.7 metres wide.

3.2.2.2 The speed limit for road vehicles on the Murray Valley Highway was 100kph. The 100 kph speed limit at the time of the collision was in accordance with the VicRoads' Speed Limit Guidelines for arterial roads.

3.2.2.3 The two lanes on the Murray Valley Highway were divided by double solid white lines that extended to a Stop line which was 11.17m from the nearest rail track through the Kerang level crossing.

3.2.2.4 Beginning about 267 metres from the level crossing, a RAIL X was marked on the Murray Valley Highway surface in white paint. This was followed by yellow level crossing

284 Mr Exton's evidence is that the locomotive stopped 280 metres east of the level crossing.

285 Coroner Jacinta Heffey, Finding into Death without Inquest, Anthony Massaria, Case No 3881/06, 21 November 2011; James Gordon Case No 4307/06; Geoffrey Young Case No 3307/07; Coroner Jacinta Heffey, Finding into Death with Inquest, Kay Alexandra Stanley, Case No. 416/08, 23 August 2012; Fiona Smart Case No. 468/08.Haldane Nelson Case No. 801/08 Caitlin Angel Case No. 1231/08; Susan Angel Case No. 1230/08. see also Coroner Ronald Saines, Finding into Death with Inquest, Jamie Webb, Case No. 1965/06; Australian Transport Safety Bureau, "Collision between Rigid Tipper Truck/Quad Axle Trailer and Freight Train 4AM3 Lismore, Victoria 25 May 2006", Rail Occurrence Investigation 2006004, January 2007.

warning signs on the side of the road. These road markings had been repainted in mid July 2006, less than a year before the crash.

3.2.2.5 Two W7-4 level crossing advisory signs were placed either side of the Murray Valley Highway on the approach to the Kerang level crossing from the south. These signs were positioned 255 meters from the crossing.

3.2.2.6 On the southern approach to the Kerang level crossing, a road vehicle driver's view of the railway line was partially obscured by a sweeping right hand curve from about 800 metres before the crossing until they exit the curve 165 metres from the level crossing

3.2.2.7 Mr Scott told the Court that his view of the Kerang level crossing was also obscured by a tree when he was travelling behind Mr Scholl on 5 June 2007:

> *"...there was a small tree, I don't know, probably eight or ten metres high in line with those particular flashing lights and the front of the truck so I couldn't actually see - I didn't actually see the actual impact."*

3.2.2.8 On the south side of the Kerang level crossing, there were also two sets of two flashing red-filtered incandescent lights visible to north bound traffic, one on the left side and one on the right side of the Murray Valley Highway.[286]

3.2.2.9 On 5 June 2007, these flashing lights were fitted with single incandescent 10V 25 watt globes with a red filter. The lights on the right hand side as the vehicle approached the level crossing were focussed by the reflective backing on a position 122 metres from the Stop line at the level crossing in the centre of roadway. The lights on the left hand side were focussed on a position 15 metres from the Stop line.[287]

3.2.2.10 There was no standard for the luminosity of the flashing red-filtered incandescent lights at level crossings. However, the Court heard that the strength of the light emitted by red filtered incandescent light bulbs was also a function of the operation of the reflective material that sits behind the globe.

3.2.2.11 Further, Mr Sargant confirmed that the view of the Department of Transport is that the light emitted by a red-filtered incandescent bulb for the purposes of a level crossing flashing light was bright enough, that it is safe.

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286 There was an electromechanical bell which has moving parts requiring a maintenance regime. This has been replaced by an electronic bell. These bells are intended to warn pedestrians and would not be heard in the cabin of a heavy vehicle combination. They have not been further investigated.

287 Office of the Chief Investigator, Rail Safety investigation report No 2007/09, Level Crossing Collision: V/Line Passenger Train 8042 and a Truck near Kerang, Victoria 5 June 2007.

3.2.2.12 The operation of the flashing lights was recorded on an event logger which had been was installed on 29 August 2006.[288] This is a continuous real-time general purpose status monitoring and event recording system.[289]

3.2.2.13 The flashing red-filtered incandescent lights and bells at the Kerang level crossing were activated by the train 665 metres before it entered the level crossing. This allowed them to operate for 24.5 seconds if the train was travelling at 96kph. There is no suggestion that the flashing red-filtered incandescent lights at Kerang level crossing were not operating at 1:35pm on 5 June 2007.

3.2.2.14 Accordingly, the level crossing infrastructure on the southern approach to the Kerang level crossing generally complied with Australian Standard AS1207.7-2007.

3.2.2.15 In circumstances where Mr Scholl was familiar with the level crossing and not expecting a train, he was not alerted to an approaching train by the suite of level crossing warning signs and he did not see the flashing red-filtered incandescent lights.

3.2.2.16 In particular, although he looked at and saw the housing for the red-filtered incandescent lights, Mr Scholl failed to see the lights flashing or any of the other warning paraphernalia required by Australian Standard AS1207.7-2007. Therefore, its compliance with Australian Standard AS1207.7-2007 was irrelevant to the collision on 5 June 2007.

3.2.3 Effectiveness of Current Level Crossing Infrastructure

3.2.3.1 One function of the infrastructure at a level crossing is to prevent or reduce the risk of collisions between trains and road vehicles.

3.2.3.2 Therefore, level crossing infrastructure is designed to alert road vehicle drivers that they are approaching a level crossing and there may be a train on the railway line.

3.2.3.3 The current suite of level crossing infrastructure includes passive and active components:

- Passive level crossing infrastructure includes speed limits, Stop signs or Give Way signs, road markings, warning signs and rumble strips.
- Active infrastructure includes warnings activated by the approaching train, that is flashing red lights, bells and boom gates as well as some or all of the passive infrastructure.

3.2.3.4 On 5 June 2007, the Kerang level crossing was fitted with a suite of passive level crossing warnings and with active flashing red filtered incandescent light and bells. It had no boom

288 Bradley William Wooding, statement, Signal Supervisor Warragul, V/Line Passenger Pty Ltd. undated
289 Statement of Bradley William Wooding, 16 February 2010.

gates. These warnings were insufficient to alert Mr Scholl that a train was approaching until it was too late for him to avoid a collision.

3.2.3.5 He was not alone. Eleven of the other road vehicle drivers in this cluster of fatal level crossing incidents were not aware that a train was approaching. Mr Angel also became aware when it was too late to stop.

Stop and Give Way signs

3.2.3.6 In 2005, Tony Radalj and Brian Kidd from Main Roads Western Australia evaluated Give Way and Stop signs with associated signage compliant with Australian Standard AS 1742.7-2007 as part of their trial of rumble strips at 14 passive level crossings in their state.[290]

3.2.3.7 Mr Radalj and Mr Kidd found that the mean speed of vehicles declined from 92kph to 67kph as they approached a level crossing controlled by a Give Way sign without any further intervention.

3.2.3.8 Mr Radalj and Mr Kidd also found that the mean speed of vehicles declined from 83kph to 57kph as they approached a level crossing controlled by a Stop sign without any further intervention.

3.2.3.9 Accordingly, Stop signs and Give Way signs reduce vehicle speeds as they approach level crossings. However, they cannot be expected to have this effect if the road vehicle driver does not notice the signs.

3.2.3.10 Further, Mrs Nelson told the Court in her statement that Haldane Nelson did not believe the Stop sign indicated a real risk of an approaching train:

> *"Haldane would have been aware of the crossing, he knew it was a stop sign. Both he and I had driven over it before it was changed from the give way sign. We both laughed about it because we both thought who would really stop here?"*[291]

Rumble strips

3.2.3.11 One level crossing in this coronial investigation was already fitted with rumble strips.[292] Despite this upgrade and protection with a Stop sign and associated warnings, Mr Angel was not aware of the warning signs, the rumble strips or the Stop sign until it was too late to stop before his vehicle hit the approaching train.

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290 Tony Radalj & Brian Kidd, "A Trial of Rumble Strips as a Means of Alerting Drivers to Hazards at Approaches to Passively protected Railway level crossings on High Speed Western Australian Rural Roads", Main Roads Western Australia, 2005.

291 Haldane Nelson Case No. 801/08.

292 Caitlin Angel Case No. 1231/08; Susan Angel Case No. 1230/08.

3.2.3.12 In 2005, Tony Radalj and Brian Kidd from Main Roads Western Australia trialled rumble strips at 14 passive level crossings in their state. They found that the mean speed of vehicles as they approached a level crossing controlled by a Give Way sign did not decline further six months after installation of a single set of rumble strips and Rail X painted on the pavement.[293]

3.2.3.13 Mr Radalj and Mr Kidd also found that the mean speed of vehicles as they approached a level crossing controlled by a Stop sign further decreased six months after installation of four groups of rumble strips without Rail X road markings further decreased by an average of 5kph and reduced the entry and exit speeds at the level crossing. [294]

3.2.3.14 In 2007, Will Hore-Lacy from Australian Road Research Board also evaluated the effect of three groups of rumble strips at 14 level crossings in Victoria matched against control level crossings.[295] These treatment sites included the Kerang level crossing at Fairlie.

3.2.3.15 Over a seven day period, Mr Hore-Lacy observed 5.3kph median decline in vehicle speeds at level crossings protected by flashing lights and 3.7kph median decline in vehicle speeds 50 metres from passive level crossings.

3.2.3.16 Mr Hore-Lacy noted that the Kerang level crossing at Fairlie was one to the first level crossings to have rumble strips installed and these rumble strips were more aggressive than at other sites. Further, at this site, there was also a 3kph reduction at the control site, suggesting to him that:

> *"the reductions that occurred might have been influenced by something other than rumble strips."*

3.2.3.17 Further, Mr Hore-Lacy undertook further speed evaluations after the rumble strips had been installed for some time and active warning signs and boom barriers had also been installed at the Kerang level crossing at Fairlie. These evaluations showed that the speeds of vehicles approaching the level crossing had returned to the level observed before rumble strips were introduced. However, a few more vehicles were observed to be applying their brakes earlier in both the immediate and later surveys after rumble strips were introduced.

3.2.3.18 Mr Hore-Lacy explained the return to earlier speeds at the Kerang level crossing at Fairlie when other controls were also introduced:

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293 Tony Radalj & Brian Kidd, "A Trial of Rumble Strips as a Means of Alerting Drivers to Hazards at Approaches to Passively protected Railway level crossings on High Speed Western Australian Rural Roads", Main Roads Western Australia, 2005.

294 Tony Radalj & Brian Kidd, "A Trial of Rumble Strips as a Means of Alerting Drivers to Hazards at Approaches to Passively protected Railway level crossings on High Speed Western Australian Rural Roads", Main Roads Western Australia, 2005.

295 Will Hore-Lacy, "Rumble strip effectiveness at rural intersections and railway level crossings", ARRB Consulting report VC73896-1, 2007.

"This leads to two conclusions, one that the rumble strips become less effective over time as people become accustomed to their presence or two, that the additional warning devices give drivers confidence to approach the intersections at higher speeds when they are not warning of an approaching train." [296]

3.2.3.19 In my view, there is a third explanation consistent with Mr Hore-Lacy's observation that there was something influencing the results at Kerang level crossing other than rumble strips: Mr Hore-Lacy's first evaluation was undertaken in the period immediately after the Kerang level crossing collision where 11 train passengers died. Therefore, it is possible that the original effects of the rumble strips were influenced by the immediate history of the Kerang collision and that the short term effect of this memory had worn off when he returned for his later measurements.

3.2.3.20 The immediate effect of rumble strips at passive level crossings protected by a Give Way or a Stop sign was larger and more uniform. Mr Hore-Lacy formed the opinion that these effects were sufficient to attribute them to the rumble strips. However, the evaluation only measured the effect for the first week of installation. Mr Hore-Lacy recommended longer term evaluations.

3.2.3.21 In 2009, the House of Representatives Standing Committee on Infrastructure, Transport, Regional Development and Local Government also recommended further trials of rumble strips at a selection of passive level crossings around Australia, and a program to begin trialling active rumble strips at some of the most dangerous crossings.[297]

3.2.3.22 Accordingly, there remains no evidence that rumble strips have a long-term influence on speeds at level crossings.

3.2.3.23 I cannot exclude the other possibility that rumble strips influence drivers' capacity to respond to other triggers associated with level crossing collisions such as Give Way and Stop signs. However, the single experience of one driver involved in this coronial cluster of fatal level crossing collisions suggests that they may not be sufficient to attract the attention of drivers who are not already aware of other level crossing infrastructure.

296 Will Hore-Lacy, "Rumble strip effectiveness at rural intersections and railway level crossings", ARRB Consulting report VC73896-1, 2007.

297 House of Representatives Standing Committee on Infrastructure, Transport, Regional Development and Local Government, "Level Crossing Safety: An Update of the 2005 Train Illumination Report", Canberra, June 2009

Flashing red lights

3.2.3.24 The Kerang level crossing and two other crossings in this cluster of fatal level crossing incidents were equipped with flashing red lights as well as the suite of passive level crossing warnings.[298] None of these three drivers saw the flashing red lights.

3.2.3.25 However, in the United States, 20% of the reduction in level crossing fatalities has been attributed to the installation of boom gates and/or flashing red lights. [299]

3.2.3.26 Further, Mr Sargant told the Court that traffic signals like those used at road intersections have been trialled by Monash University Accident Research Centre. They found that people were more likely to stop at flashing red ligbts than they were at conventional traffic signals.

3.2.3.27 Flashing red lights are used at active level crossings to alert road vehicle drivers that a train is approaching. In theory, if a road vehicle driver can and does see the flashing red lights there is no need for them to be able to see the approaching train.[300]

3.2.3.28 Looking at the flashing red filtered incandescent lights at the Kerang fatal level crossing:

- Sergeant Geoff Exton said he could see the flashing red-filtered incandescent lights on the southern approach to the Kerang level crossing from one kilometre away when he approached in his police car on 5 June 2007.
- In a re-enactment of the Kerang incident in a prime mover, Mr Exton saw the flashing lights when he exited the right hand bend which is completed about 267 metres south of the Kerang level crossing.[301]
- Senior Constable Shane Hafner also said he could see the red lights on the right side of the Murray Valley Highway from 300 metres before the level crossing.
- Drivers on the other side of the level crossing had stopped in response to the flashing lights on 5 June 2007.
- Local car and truck drivers agreed that they did not usually experience difficulty seeing the flashing lights when they had been activated by the afternoon Swan Hill to Southern Cross train approaching the Kerang level crossing.

298 Geoffrey Young Case No. 3307/07; Coroner Jacinta Heffey, Finding into Death with Inquest, Kay Stanley, Case No 417/08.

299 S Mok & I Savage. "Why has Safety Improved at Rail-Highway Grade Crossings?" Risk Analysis 25 (2005) 867.

300 Austroads Guide to Road Design Part 4: Intersections and Crossings (2009).

301 For the purposes of the re-enactment, the new LED globes on the left hand stanchion were replaced with incandescent globes.

3.2.3.29 Further, Mr Sargant confirmed that the view of the Department of Transport is that the light emitted by an incandescent light for the purposes of a level crossing flashing red-filtered incandescent light is bright enough, that it is safe.

3.2.3.30 However, Mr Scholl has consistently told investigators that he saw the housing for the lights as he approached the Kerang level crossing at 1:34pm on 5 June 2007 but he did not see the red-filtered incandescent lights flashing.

3.2.3.31 On its face it seems that Mr Scholl failed to see the flashing, incandescent, red-filtered lights at the Kerang level crossing on 5 June 2007 after he exited the right hand curve about 267 metres from the level crossing because he was not sufficiently attentive or there was a particular light interference on the day.

3.2.3.32 However, Mr Scholl was not alone in his difficulty with seeing the flashing red-filtered incandescent lights operating at the Kerang level crossing.

3.2.3.33 On 5 June 2007, a local courier, Wayne Lynch, was driving his van behind Mr Scholl's semi-trailer for about one kilometre before they approached the Kerang level crossing. He was unaware of the lights flashing or the train approaching until after he saw Mr Scholl's semi-trailer braking.

3.2.3.34 Further, during Mr Scholl's trial in 2009, the safety manager for V/Line, Laurie Foley, reported that a V/Line safety audit undertaken on 14 August 2006.

3.2.3.35 Mr Foley said that this V/Line audit reported was that there was very little wrong in the way the signage and road markings were set up on the crossing. However, the authors of the report also said:

> *"it was concerning that at approximately 2 pm when we observe the passenger of the Swan Hill train, that is south bound, through the level crossing, the current warning lights were not as distinguishable as they would like to see and from 180 metres away they just don't grab your attention and demand a reaction, like other locations."*

3.2.3.36 The authors of the V/Line audit expressed the view that a motorist would have to be totally switched on to the fact that they were approaching an active level crossing which a train is about to enter in order to see the flashing lights.

3.2.3.37 Mr Foley also told the Supreme Court that the audit identified key points about the Kerang level crossing including the sunlight, the light coloured surface of the roadway and the old technology of the incandescent globes.

3.2.3.38 As well, in July 2006, V/Line also approached the manager of the Swan Hill–Gannawarra–Buloke Police Service Area, Inspector Garry Bennett, to organise a media and enforcement program at the Kerang level crossing to support their efforts to reduce the near-misses. No offences were detected in the three months to March 2007.

3.2.3.39 Further, south-bound V/Line train drivers reported four near misses at the Kerang level crossing which were reported to Pacific National between 26 May 2006 and 15 February 2007.

3.2.3.40 Even, if a semi-trailer driver like Mr Scholl became aware of and responded to the flashing red-filtered incandescent lights at the level crossing when he exited the right hand curve at 100kph, he would still have only 131 metres or about 0.5 seconds to respond and commence braking so that he stopped before he entered the level crossing. This distance would be longer for longer, heavier vehicles.

3.2.3.41 Therefore, from the view point of the driver of a heavy vehicle combination, the flashing red-filtered incandescent lights at Kerang level crossing were not visible early enough to reliably allow them to respond and stop before they entered the level crossing.

3.2.3.42 It seems from these examples, that the flashing red-filtered incandescent lights operating at the Kerang level crossing may have been insufficiently illuminated and/or they may have been directed inappropriately for elevated drivers in heavy vehicles and/or they may be the wrong colour to best attract attention.

3.2.3.43 The tightly-focused narrow beams of the flashing lights using incandescent red-filtered bulbs to signal the approach of a train may have the unintended consequence of hindering their detection in certain circumstances.

3.2.3.44 Although designed to maximize light intensity, the beams may be difficult to detect at close distances to the crossing under non-ideal viewing conditions, when small deviations in where the signal is aimed, or when variation is in the driver's viewing angle on the approach to the crossing (e.g., curves or grade changes on the roadway).[302]

3.2.3.45 Pacific National last checked the flashing light units on the RX-5 unit at the Kerang level crossing on 4 April 2007. This check was for the purpose of ensuring correct focussing of the lights.[303]

3.2.3.46 Focussing of the flashing red-filtered incandescent lights on the road 122 metres from the Stop line at a level crossing may create a problem for heavy vehicle drivers. Mr Exton was

302 Michelle Yeh and Jordan Multer, "Driver Behaviour at Highway-Railroad Grade Crossings: A Literature Review from 1990–2006", U.S. Department of Transportation Federal Railroad Administration, October, 2008.

303 Office of the Chief Investigator, Rail Safety investigation report No 2007/09, Level Crossing Collision: V/Line Passenger Train 8042 and a Truck near Kerang, Victoria 5 June 2007.

clear in his evidence that that a semi-trailer driver's perception of level crossing infrastructure differs from the perception of a car driver.

3.2.3.47 The height of the RX-5 lights is not specified in Australian Standard AS1742.7-2007 but the Office of the Chief Investigator indicated that they were 2.286 metres above the road.[304] Accordingly, if we presume a car driver's eyes are 1.3 metres above the ground, he or she will be within the focus of the flashing light when their vehicle is about 52 metres before the level crossing.

3.2.3.48 On the other hand, if we presume that the truck driver's eyes are about 2.4 metres above the ground, he or she will never be within the focus of the flashing lights when their vehicle is approaching the level crossing.

3.2.3.49 In evidence, Mr Scott and Mr Exton noted that the red LEDs seemed easier to see or brighter that the previous flashing red-filtered incandescent lights. However, there is no evidence before me to explain whether this change is affected by differences between the strength of the incandescent and LEDs or the characteristics of the lights or other factors relating to the way their effect has been assessed.

3.2.3.50 The Court also heard that the strength of the light emitted by the incandescent globe is also a function of the operation of the reflective material that sits behind the globe.

3.2.3.51 Similarly, in Canada, in order to get sufficient intensity from their 18 W bulbs, railway lights use a parabolic mirror to create a focussed beam that is aimed at the motorist. Beam patterns therefore differ dramatically between traffic lights and railway lights, with railway lights having a much narrower and more focussed beam. These narrow beams require precise alignment of the light bulbs, as well as of the signal housings, which in turn requires substantial structures to hold the signal housings precisely in alignment.[305]

3.2.3.52 This does not mean that road vehicle drivers could not see the flashing red-filtered incandescent lights except when they were within the focus area. However, the flashing lights were never focussed directly on Mr Scholl and were therefore less likely to attract his attention when he was not expecting to see them.

3.2.3.53 Canadian research has also shown that LEDs are more conspicuous than the existing incandescent lights, while offering important operational advantages.[306]

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304 Office of the Chief Investigator, Rail Safety investigation report No 2007/09, Level Crossing Collision: V/Line Passenger Train 8042 and a Truck near Kerang, Victoria 5 June 2007, Appendix 2.

305 Transport Canada, "LED technology for improved conspicuity of signal lights at highway-railway grade crossings (TP 14043E)", 13 July 2010. The incandescent lights used in traffic lights differ from those used in railway infrastructure. In Canada, traffic lights on high-speed roads use 150 W bulbs, whereas railway lights use 18 W bulbs to save on energy consumption.

306 Transport Canada, "LED technology for improved conspicuity of signal lights at highway-railway grade crossings (TP 14043E)", 13 July 2010.

3.2.3.54 On 20 September 2006, Pacific National sought a response from the Department of Infrastructure to their reports of near misses. In the interim, they also asked for the incandescent globes in the flashing lights to be replaced by LEDs.

3.2.3.55 Mr Sargant told the Court that the Manager Railway Crossing Safety in the Department of Transport, Terry Spicer, told Pacific National that new globes were within the maintenance component of the below ground lease contract that remained on foot. Accordingly, the flashing red lights at the Kerang level crossing was not upgraded to LEDs before 5 June 2007.

3.2.3.56 Therefore, although police and other car drivers could easily see the flashing lights at the Kerang level crossing, LEDs would have been more conspicuous for semi-trailer drivers than the tightly focussed flashing red-filtered incandescent lights that were in use.

3.2.3.57 I am unable to say whether this improved conspicuity of the flashing red lights at the Kerang level crossing would have been sufficient to attract Mr Scholl's attention on 5 June 2007 in time for him to stop.

Boom gates

3.2.3.58 In his report, Dr Ian Johnston commented that:

> *"What little research has been done suggests, however, that Australian drivers are not generally aware of the difference between active and passive crossings and that expecting more cautious driver behaviour at passive crossings may be unrealistic. Indeed, it may be argued that a passive crossing implies low train frequency and discourages comprehensive search behaviour."*[307]

3.2.3.59 In Dr Johnston's opinion, adding booms to make these crossings fully active is the best solution. The addition of automated enforcement via cameras to raise the probability of detection and punishment to a high level is a lower cost option. Experience with road policing indicates that significant public education is required, along with certainty of detection (cameras active 24/7 at all such crossings), to modify risk-taking where the incentive to avoid a potentially lengthy delay is high.

3.2.3.60 In the circumstances faced by the two drivers in this cluster of fatal level crossing incidents where boom gates were operating[308] and who did not become aware off an approaching train, I am unable to make any recommendation on the relevance of boom gates at level crossings.

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307 Ian Johnston, "Expert Report for use as evidence in a series of inquests into deaths at level crossings in Victoria between 2006 and 2009", prepared at the request of Transport Safety Victoria by Ian Johnston Transport Safety Pty Ltd, 5 July 2011.

308 Jillian McCormack Case No. 5159/08; Coroner Jacinta Heffey, Finding into Death with Inquest, Mark Winter, Case No 3471/09.

3.2.4 Standards for level crossing infrastructure

3.2.4.1 The standards for level crossing protection in Australia are assessed against the Australian Standard AS 1742.7-2007, the Rail Industry Safety and Standards Board standards, Austroads recommendations and V/Line Regional Network and Access Network Operating Requirements.

3.2.4.2 The Standards Australia Council is responsible for general oversight of standardisation in Australia and for governance of Standards Australia.

3.2.4.3 Standards Reference Bodies have been established under the auspice of Standards Australia. They constitute a reference group of specific users, industry, government, community and other interested parties to advise on development of a particular standard.

3.2.4.4 Then Standards Reference Bodies mainly operate through a Technical Committee which is responsible for the content of each draft standard. The draft standard is then subject to further consultation within the wider community before it is put to a ballot.

3.2.4.5 The ballot is achieved if at least 67% of those eligible to vote and 80% of those who do vote affirm the draft standard and no major interest involved with the draft standard votes against it.

3.2.4.6 Therefore, each Australian Standard reflects consensus of the parties most likely to have an interest in the content of the standard at the time of the ballot.

3.2.4.7 At the National level, the Rail Industry Safety and Standards Board also develop standards, codes of practice, Rules and Guidelines for the rail industry.

3.2.4.8 The Rail Industry Safety and Standards Board is a sub-organisation of the Australian Railway Association. Its role is to harmonise the practice of rail safety managers and engage the rail industry and Government.

3.2.4.9 Accredited rail managers and operators are required to comply with the standards imposed by the Rail Industry Safety and Standards Board including consistent practice throughout all States and Territories and the requirement that new technologies are demonstrated to be "Fail Safe' prior to their implementation

3.2.4.10 Further, Austroads provides guidance for design of road infrastructure, including Part 4, Guide to Traffic Engineering Practice Series, Investigation and treatment of crash locations including countermeasures for Railway Level Crossing Crashes.

3.2.4.11 These three organisations (the Australian Railway Crossing Strategy Implementation Group, the Rail Industry Safety and Standards Board and Austroads) were represented on the Technical Committee and approved the application of the Australian Standard

AS1742.7-1993 Manual of Uniform Traffic Control Devices Part 7: Railway crossings for level crossing infrastructure.

3.2.4.12 The Chief Executive Officer of Standards Australia, Colin Blair, told the Court that, in approving a specific standard to apply to level crossing infrastructure, Australia differs from Britain, France, Germany, the United States and Canada who are also members of the International Organisations for Standardisation. He told the Court:

> *"We're the only one where these things are tied to the peak National Standards body."*

3.2.4.13 Australian Standard AS1742.7-1993 was prepared by the Standards Australia Committee MS/12 Road Signs and Traffic Signals to supercede Australian Standard AS1742.7-1987. It was published on 15 February 1993.

3.2.4.14 After 1993, signs at level crossings were required to comply with Australian Standard AS1742.7-1993 Manual of Uniform Traffic Control Devices Part 7: Railway crossings including advanced warning signs at passive level crossings and cross buck signs with greater visibility in adverse weather conditions than was previously specified.

3.2.4.15 Australian Standard AS1742.7-2007 was published on 20 February 2007 to supercede Australian Standard AS1742.7-1993. Amendment No 1 to Australian Standard AS 1742.7-2007 was published on 31 October 2007.

3.2.4.16 Further, on 21 June 2011, Australian Standard AS1742.7-2007 was amended to incorporate new sight distance requirements for the safety of long vehicles at railway crossings as identified by the Australian Transport Safety Bureau in their report on the collision between the Ghan passenger train and a road train in Ban Ban Springs. [309]

3.2.4.17 The Australian Railway Crossing Strategy Implementation Group, the Rail Industry Safety and Standards Board, Austroads through a VicRoads representative, and the Victorian Department of Infrastructure were represented on the Technical Committee and approved the application of Australian Standard AS1742.7-2007 and Amendment No.1.

3.2.4.18 The Introduction to Australian Standard AS1742.7-2007 states:

> *"Standard does not provide guidance on when a crossing should progress from one hierarchical step to the next, eg. Passive to active control. Active control to elimination. Such guidance can be found in risk assessment models such as ALCAM."*

309 Australian Transport Safety Bureau, "Level Crossing Collision between The Ghan Passenger Train (1AD8) and a Road-Train Truck, Ban Ban Springs, NT, 12 December 2006", 13 Feb 2008.

3.2.4.19 Further, Australian Standard AS1742.7-2007 provides for gradual implementation at level crossings which already comply with Australian Standard AS1742.7-1993. In particular, when a level crossing is upgraded in one respect, it should be upgraded to comply with Australian Standard AS1742.7-2007.[310]

3.2.4.20 Australian Standard AS1742.7-2007 and/or the Public Transport Corporation Infrastructure Division Signalling Design and Documentation Version 1.1[311] include sight distance requirements at crossings with passive controls, provision for use of active advance warning signals, specification for focussing of active lights warning signals, promotion of the use of a red background on the assembly (cross buck) sign at the actual crossing and side road signs for level crossings.

3.2.4.21 However, there are a number of deficiencies or issues with Australian Standard AS1742.7-2007. As relevant to this inquiry, these include:

- Australian Standard AS1742.7-2007 does not specify a standard emission level for light sources within the active light warnings or reference alternative standards that apply to the strength of light sources.
- The formula in Australian Standard AS1742.7-2007 for sighting distances is inadequate for very large vehicles.[312, 313]
- The road markings and other infrastructure for level crossings on a side road does not include a requirement for a left turn slip lane on the main road.[314]

3.2.4.22 Further, contrary to the advice of human factors researchers[315], Australian Standard AS 1742.7-2007 focuses on warning road vehicle drivers that there is a level crossing ahead rather than warning them that a train is approaching the level crossing and they are at risk.[316]

3.2.4.23 As well, although the infrastructure at all of the level crossings involved in this cluster of fatal level crossing collisions substantially complied with Australian Standard AS1742.7-

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310 Standards Australia, Australian Standard, Manual of uniform traffic control devices Part 7, Railway crossing, 20 February 2007, para. 4.2.1.

311 Specification ENG-SE-SPE-0001.

312 Australian Transport Safety Bureau, "Level Crossing Collision between The Ghan Passenger Train (1AD8) and a Road-Train Truck, Ban Ban Springs, NT, 12 December 2006", 13 Feb 2008.

313 Clarissa Han, Peter Cairney, Helen Tran, James Luc, "Measures for Managing Safety of Heavy Vehicles at Passive and Active Railway Level Crossings-Progress Report 1", ARRB research, AUSTROADS project No 1587, November 2009, p. 20.

314 Adam Dunning, Case No. 3174/02; Adrian Kiely, Case No. 3175/02; Ian Pettersen, Case No. 3176/02; Coroner Jacinta Heffey, Finding into Death with Inquest, Mark Winter, Case No 3471/09.

315 J. Edquist, K. Stephan, E. Wigglesworth & M. Lenne, "A Literature Review of Human Factor Safety Issues at Australian Level Crossings", Monash University Accident Research Centre, February 2009.

316 J. Edquist, K. Stephan, E. Wigglesworth & M. Lenne, "A Literature Review of Human Factor Safety Issues at Australian Level Crossings", Monash University Accident Research Centre, February 2009.

2007, 12 of the 13 road vehicle drivers were not aware that a train was approaching until it was too late to stop or at all.

3.2.4.24 Kenneth Freeman was the Secretary of the MS12 Committee of Standards Australia. He explained the failure to refer to or include specifications for lights sources in the Australian Standard AS1742.7-2007 this way:

> *"Yes, the reliance was on industry Standards invoked by the railway authorities, at that stage. My understanding is that there is - that there will be proposals put forward for an infrastructure Standard for - for this kind of equipment in the future, but, at this stage, there has been very little developed along those lines, but what is - what is in use by the railway authorities are a variety of overseas and internal industry Standards that specify what the requirements of these things are.... We could have (referenced them) but we were not asked."*

3.2.4.25 Mr Blair also accepted that standards for innovative developments like Intelligent Transport Systems were not included in Australian Standard AS1742.7-2007. He said they could be developed if the industry sought assistance from Standards Australia.

3.2.4.26 The question of colours of road markings has also been considered by Standards Australia Committee MS12 over a number of years, not just in relation to level crossings.

3.2.4.27 Mr Freeman told the Court that the MS12 Committee has advised

> *"you can have any colour you like on the road as long as it's white or yellow because they are the only colours which guarantee enough contrast with typical pavement materials, so that's the fundamental."*

3.2.4.28 Mr Freeman also said that the main reason the MS12 chose to specify white road markings for most uses was that it required less maintenance.

3.2.4.29 Road markings are always accompanied by roadside warning signs and, at least, Give Way or Stop signs at level crossings. Therefore, even if the colour of the road surface in particular weather conditions tends to interfere with visibility of the pavement markings, it seems unlikely that this will be a critical issue in determining the driver's awareness of an approaching train.

3.2.4.30 I am unable to comment further about the appropriate colour for pavement markings to warn of an approaching level crossing.

3.2.4.31 Two level crossing incidents in this cluster involved drivers turning left from a road that runs parallel to the railway line. Both drivers were familiar with the level crossing.

Neither driver became aware of the approaching train. Sighting distances were also an issue in both collisions.[317]

3.2.4.32 Australian Standard AS1742.7-2007 requires level crossings on side roads to have RX-4 or RX-7 assembly warnings on the main road. These warnings include a graphic of a train and a sign indicating the danger is on the side road.

3.2.4.33 Mr Murphy's approach to the Saleyards Road level crossing required him to travel down Gillies Street parallel to the railway line and make a left hand turn from Gillies Street into Saleyards Road. The level crossing was about 36 metres from the Gillies Street T-intersection. There is no left turn slip lane on Gillies Street.[318]

3.2.4.34 Mr Murphy did not respond to the level crossing warning signs or see the approaching steam train until he heard the locomotive's second steam-operated whistle at the very last second. There is no evidence that Mr Murphy's truck braked prior to entering the Benalla level crossing.

3.2.4.35 Similar geography applied to the Chelsea level crossing at which Mark Winter died.[319] Although other factors also influenced Mr Winter's death, there was no left turn slip lane which may have made him aware of the active level crossing lights and booms and prevented his entry into the level crossing at which he died.

3.2.4.36 In circumstances where neither Mr Murphy nor Mr Winter was aware of the train in time to stop, a left turning slip lane would force road vehicles to make a tighter left hand turn when railway line runs parallel and close to a major highway. In the absence of sight limitations, this would allow turning drivers the opportunity to see the approaching train and stop before entering the level crossing.

3.2.4.37 At the State level, implementation of Australian Standard AS1742.7-1993, Australian Standard AS1742.7-2007, Rail Industry Safety and Standards Board standards and Government policy objectives is subject to the V/Line Regional Network and Access Network Operating Requirements as amended from time to time.[320]

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317 Adam Dunning, Case No. 3174/02; Adrian Kiely, Case No. 3175/02; Ian Pettersen, Case No. 3176/02; Coroner Jacinta Heffey, Finding into Death with Inquest, Mark Winter, Case No 3471/09.

318 Australian Transport Safety Bureau, "Level Crossing collision between Steam passenger Train 8382 and a Loaded B-Double Truck-Benalla Victoria 13 October 2002", Rail Safety Investigation 2002/003, September 2004: The Australian Transport Safety Bureau also found that the sighting distance at Saleyards Road level crossing, based on a train speed of 80 kph, may be insufficient to allow heavy goods vehicles to cross and clear the level crossing in safety.

319 Coroner Jacinta Heffey, Finding into Death with Inquest, Mark Winter, Case No 3471/09.

320 Victorian Rail Industry Operators Group Standards, PASS Assets Data requirements-Train, VRIOGS 007.1.1-2008, 8/9/2008; Victorian Rail Industry Operators Group Standards, Criteria for Infrastructure at Rail Level Crossing – General Requirements, VRIOGS 0031 – 2008 23/12/2008; Victorian Rail Industry Operators Group Standards, Criteria for Infrastructure at Rail Level Crossing – Vehicle Crossings, VRIOGS 00303 – 200X Draft 2005.

3.2.4.38 The V/Line Regional Network and Access Network Operating Requirements include Network maximum train speeds and weights.

3.2.4.39 These V/Line Regional Network and Access Network Operating Requirements are developed cooperatively with industry and the State. But ultimately it is up to the accredited rail operator to have those standards within their safety management system and to dictate what infrastructure is provided within the network.

3.2.5 Responsibility for level crossing infrastructure

3.2.5.1 Railway lines are established on State land and are a State responsibility. However, the Commonwealth Government has an over-arching role in directing rail safety policy and investigating level crossing collisions.

3.2.5.2 For example, Ministers for Transport in all Australian States are members of the Standing Council on Transport and Infrastructure (previously the Australian Transport Council).

- In 1997, the Australian Transport Council agreed to creation of the Australian Rail Track Corporation Ltd to facilitate access to the National interstate rail network.
- On 20 January 2013, the Standing Council on Transport and Infrastructure has now established the National Rail Safety Regulator.
- The National Rail Safety Regulator has delegated responsibility for investigating rail collisions to the Australian Transport Safety Bureau.

3.2.5.3 In practical terms, in May 2003, the Australian Transport Council approved the 2003 National Level Crossing Strategy.[321] In 2010, this policy was followed by the National Railway Level Crossing Safety Strategy (2010-2020) with the specific aim to reduce the likelihood of crashes and near misses at Australian level crossings.[322]

3.2.5.4 Within the 2003 National Level Crossing Strategy, the rail industry has established the Australian Railway Crossing Strategy Implementation Group which proposed the Australasian Level Crossing Behavioural Strategy 2006-2011.[323]

3.2.5.5 The Australian Railway Crossing Strategy Implementation Group has also funded a number of level crossing safety initiatives including establishing the Railway Level Crossing Behavioural Coordination Group in 2006, convening an annual two day Australasian railway level crossing behavioural workshop each August and funding level crossing safety initiatives.

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321 Australian Transport Council, National Railway Level Crossing Behavioural Strategy, August 2003.

322 Australian Transport Council, National Railway Level Crossing Behavioural Strategy (2110-2020).

323 Australian Railway Crossing Strategy Implementation Group, Australian Level Crossing Strategy 2006-2011, Proposal 9 February 2006.

3.2.5.6 In Victoria, the *Rail Safety Act* 2006 came into operation on 1 January 2007.

3.2.5.7 Section 11 of the *Rail Safety Act* 2006 included:

> ***"Objects and principles of rail safety***
>
> *(1) The objects of this Act are to promote—*
>
> *(a) the safety of rail operations;*
>
> *(b) the effective management of safety risks in rail operations;*
>
> *(c) continuous improvement in rail safety management;*
>
> *(d) public confidence in the safety of rail transport;*
>
> *(e) the involvement of relevant stakeholders in rail safety."*

3.2.5.8 Therefore, level crossing infrastructure safety was and continues to be acknowledged as an important issue in risk management of rail operations in Victoria. [324]

3.2.5.9 Further, section 13 of the *Rail Safety Act* 2006 provided:

> ***"Principle of shared responsibility***
>
> *Rail safety is the shared responsibility of—*
>
> *(a) rail operators; and*
>
> *(b) rail safety workers; and*
>
> *(c) other persons who—*
>
> *(i) design, commission, construct, manufacture, supply, install, erect, maintain, repair, modify or decommission rail infrastructure or rolling stock; and*
>
> *(ii) supply rail infrastructure operations or rolling stock operations to rail operators; and*
>
> *(d) the Safety Director; and*
>
> *(e) the public."*

3.2.5.10 Within that legislation, primary legal responsibility for the safety role implemented through level crossing infrastructure lies with Victorian Rail Track Corporation ("VicTrack") because they own the State railway land, VicRoads because they own the State land around main highways and other specified roads, and local municipalities who are responsible for minor roads in their regions.

3.2.5.11 Each of these three primary Government agencies has delegated some or all of its level crossing safety roles to secondary agencies.

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324 See also: Department of Transport Victoria, "Rail Level Crossing Safety", February 2010.

3.2.5.12 For example, management of rail infrastructure in Victoria is divided into three networks: metropolitan, intrastate or regional, and interstate which forms part of a national rail network. Prior to 1998, the Victorian Government was responsible for the management and maintenance of these three networks. [325]

3.2.5.13 In 1999, the Victorian Government leased the management of the metropolitan and intrastate networks to accredited rail operators. These leases included responsibility for network maintenance and renewal. [326]

3.2.5.14 From a practical viewpoint:

- VicTrack is responsible for physical work performed on land within 2.1metres of the rails.[327]
- VicTrack is party to three head leases for rail corridors which leases the land to the Department of Transport through the Director of Public Transport.[328]
- There are no enforcement provisions in the Head leases.
- VicTrack is not party to the infrastructure leases to rail operators [329] but is a party to the amendments.[330]
- The Department of Transport leases the railway land to the accredited rail operator.
- VicTrack is responsible for maintenance of level crossing warning devices. [331]
- VicTrack has delegated responsibility to the accredited rail operator for the associated infrastructure including level crossing signals in the lease arrangements.
- The accredited rail operator contracts the maintenance of the level crossing signals to a maintenance company.

3.2.5.15 In 2003, V/Line Passenger Corporation was established as a public authority under section 14 of the *Rail Corporations Act* 1996 to, *inter alia*, operate rural rail passenger services.[332]

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325 Public Accounts and Estimates Committee, Parliament of Victoria, Review of the Findings and Recommendations of the Auditor-General's Reports –2007, June 2009.

326 Public Accounts and Estimates Committee, Parliament of Victoria, Review of the Findings and Recommendations of the Auditor-General's Reports –2007, June 2009.

327 Traffic engineering Manual Vol 1, Chapter 11 – Edition 3, December 1999, 11.2, Level crossing Responsibilities.

328 Greg Holt, Chief Executive, VicTrack in a letter to Mr R Willis, Secretary, Select Committee on Public Land Development, Parliament House dated 13 February 2008.

329 Greg Holt, Chief Executive, VicTrack in a letter to Mr R Willis, Secretary, Select Committee on Public Land Development, Parliament House dated 13 February 2008.

330 e.g. Regional Infrastructure Lease Amendment Deed (No 5), the Director of Public Transport, V/Line Passenger Pty Ltd and Victoria Rail Track, 27 November 2009. but not Regional Infrastructure Lease Amendment Deed (No 1) 29 May 2008

331 Traffic Engineering Manual Vol 1, Chapter 11-Edition 3, December 1999, 11.2, Level crossing Responsibilities.

332 Now the Rail Management Act 1996.

3.2.5.16 V/Line Passenger Services Pty Ltd[333,334] was a private company wholly owned by V/Line Passenger Corporation. V/Line Passenger Services Pty Ltd was a not-for-profit corporation under the *State Owned Enterprises Act 1992*. V/Line Passenger Services Pty Ltd was an accredited rail operator.

3.2.5.17 V/Line Passenger Corporation leased the regional below rail operation to V/Line Passenger Services Pty Ltd. Under these leases, V/Line Passenger Services Pty Ltd (now V/Line Pty Ltd ("V/Line")) provided access to and maintained 3,770 kilometres of broad gauge rail track used by the passenger and freight rail services in Victoria.

3.2.5.18 Accordingly, responsibility for managing the rail-related risks at level crossings in regional Victoria was documented in a series of contractual agreements and leases involving VicTrack, the Director of Public Transport, V/Line Passenger Services Pty Ltd and railway operators.

3.2.5.19 Although the accredited rail operators have changed from time to time, these leases continue to operate.

3.2.5.20 This means that, historically, responsibility for level crossing safety infrastructure in Victoria has been complicated by several levels and differences in responsibility and by Victorian Government commitments to National programmes.

3.2.5.21 As relevant, V/Line is now responsible for safety of and maintenance on the below rail infrastructure within 2.44 metres of the outside running line of the Swan Hill to Melbourne line at the Kerang level crossing.

3.2.5.22 Further, as I understand it:

- VicRoads or the Relevant Road Authority is responsible for funding planning and design of upgrading, widening and rehabilitation of a length of road through a level crossing.
- The relevant highway authority is responsible for level crossing signs, road markings and visibility of road approaches. [335]
- Road authorities are responsible for visibility issues arising for approaching vehicles. These differ for roads of different status. Local roads are the responsibility of the local road authority.

333 On 13 April 2007, the Director of Rail Safety agreed to the surrender and sale of Pacific National (Victoria) Ltd's below rail business to Victorian Rail Transport Corporation (Victrack) and others.

334 Regional Infrastructure Lease, Director of Public Transport and V/Line Passenger Pty Ltd, 4 May 2007.

335 Traffic engineering Manual Vol 1, Chapter 11 – Edition 3, December 1999, 11.2, Level crossing Responsibilities.

- The regional council is the responsible road authority for 1370 level crossings, VicRoads is the responsible road authority for 243 level crossings, Council and Vicroads accept joint responsibility for 350 level crossings and four are on private land.[336]

3.2.5.23 Further, the general hierarchy of responsibility for rail safety issues outlined so far was not necessarily applied in practice.

3.2.5.24 For example, the Manager Railway Crossing Safety, Public Transport Division in the Department of Transport, Peter Furnell[337], told the Court that delegations of authority from the Department of Transport to the rail operators do not apply to decisions about upgrades of level crossings. In evidence, he said:

> *"VicTrack, essentially, manages the ALCAM process on behalf of the Department more or less as a contractor to the Department. And it's tied in with its role in managing the upgrade program."*

3.2.5.25 Further, Mr Sargant told the Court that:

> *"the relationship that we have is primarily with the rail operators and its one around - we - we - they perform a task that we reimburse their costs for. As far as liaison or dealing with the road and rail authorities on - around visibility at - of - of say foliage - with the VicRoads that would be a matter for - for VicRoads or the - or council to deal with and we wouldn't - we wouldn't - something that we wouldn't directly follow up on."*

3.2.5.26 Accordingly, this allocation of responsibility is not always clear. For example:

- VicRoads was only responsible for State Highways. However, VicRoads completed a Serious Accident Report on all fatal incidents. Further, it accepted responsibility for determining compliance with AS1742.7-2007 at all passive controlled rail level crossings, at least in the VicRoads Northern Region.[338]
- Loddon Shire Council installed an advanced automatic warning sign on the western approach to the Hockings Road level crossing because it was hard to view as there were several large trees and a house near the crossing. The accredited rail operator Pacific National, had previously inspected the site and determined it complied with the current standard.[339]

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336 Ernst & Young, Australian Level Crossing (ALCAM) Assessment Model: Victorian Data Summary Version 1.1., VicTrack, 21 February 2008.

337 Mr Furnell took over this role from Terry Spicer in February 2011.

338 Mal Kersting, Regional Director- Northern Region, VicRoads, in a letter to S/C David Hockey dated 6 June 2008 in relation to the death of Nelson.

339 Daniel Lloyd, Technical/GIS Officer infrastructure, Loddon Shire, letter to Dave Hockey, 8 April 2008. on Smart file

3.2.5.27 As the Municipal Association of Victoria commented:

> *"It became apparent that the responsibilities of road and public transport operators at road and rail interfaces are not entirely understood and that demarcation issues need to be formally resolved."*[340]

3.2.5.28 Mr Sargant had difficulty explaining the advantages of having the lease of railway land from VicTrack to the Director of Public Transport and then a second lease from the Director to the accredited rail operator. He told the Court:

> *"that's a question more around policy that was really set up in - prior to '99, it's really beyond what I can - what I can answer....*
>
> *... so you could say that's a value add in that there's clear accountabilities for - the way I like to characterise it in a practical sense and I'm a civil engineer, not a lawyer, is that the - the short term day to day risk or day - of operation is squarely with the operator. The long term is with the State and as - as the time frames get - get closer, the - the - so the risk is - is slightly shared, so on a day to day operation decisions around day to day operation that's squarely with the - with the operator. A week, a year out, it's still primarily with the operator. Beyond that time frame the - the State needs to have a - has a part to - has a part to play. And so that - that's how - in a practical sense that's how the - the framework works. Also I might say that - that the VicTrack relationship adds - adds particular value around telecommunications, being a licensed telecommunication provider and things like that as well."*

3.2.5.29 Co-ordination of risk management at level crossings in regional Victoria is further complicated by divergence of responsibility for road infrastructure and signage.

3.2.5.30 The relevant highway authority is responsible for level crossing signs, road markings and visibility of road approaches from 2.1 metres from the outer running rails.[341]

3.2.5.31 A regional council is the responsible road authority for 1,370 level crossings, VicRoads is the responsible road authority for 243 level crossings. Councils and VicRoads accept joint responsibility for 350 level crossings and four are on private land.[342] VicRoads is the relevant road authority responsible for the road and the road side of the Murray Valley Highway.[343, 344]

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340 The Municipal Association of Victoria, "Rail Safety Improvement Project: Progress Report", October 2008.

341 Traffic Engineering Manual Vol 1, Chapter 11 – Edition 3, December 1999, 11.2, Level crossing Responsibilities.

342 Ernst & Young, Australian Level Crossing (ALCAM) Assessment Model: Victorian Data Summary Version 1.1., VicTrack, 21 February 2008.

343 S. 36 Road Management Act 2004.

344 S. 37 Road Management Act 2004.

3.2.5.32 Despite this allocation of responsibility for road infrastructure between VicRoads and local municipal councils, VicRoads was responsible for installing the rumble strips, upgrading Stop signs and appropriate warning signs and road markings included in the State Government Funding package announced on 25 June 2007. This included Considines Road which is a local road so that the Surf Coast Shire is the responsible road authority. [345]

3.2.5.33 However, despite these general VicRoads responsibilities, VicTrack or the accredited rail operator, in this case V/Line Passenger Services Pty Ltd, remains responsible for maintaining traffic control devices "at a level crossing". These are usually 3.5-5m from the nearest rail at right angle crossings and further out at skewed crossings. [346] Devices regarded as being "at a level crossing" include Two Tracks signs, Stop on a Red Signal signs, Keep Tracks Clear signs, Railway Crossing signs and black and white striped marker signs.

3.2.5.34 In practice, Mr Sargant explained the responsibility for installing automatic active advanced warning signs:

> *"VicTrack installed them but as I understand it the road authorities would maintain the lights and the signage. The cable and the connection to the railing structure would be done by the rail operator."*

3.2.5.35 In 2005, the Victorian Railway Crossing Safety was established to provide advice to the Minister for Transport on all matters related to Victorian railway crossing planning and policy matters and overseas, Australian and Victorian railway crossing safety new technology applications.

3.2.5.36 The Chair of the Victorian Railway Crossing Safety Steering Committee is the General Manager Safety and Asset Management in the Public Transport Division of the Department of Transport.

3.2.5.37 Accordingly, Mr Sargant was also Chair of the Victorian Railway Crossing Safety Steering Committee and represented the Transport Department on that consultative committee.

3.2.5.38 Membership of the committee comprised of Chief Executives or General Managers from the: Department of Transport, Public Transport Division; VicTrack; VicRoads; Municipal Association of Victoria (representing all Local Government Road Authorities in Victoria); Chief Commissioner of Police, and V/Line Passenger. The Office of the Director of Public Transport Safety Victoria attended as an observer.

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345 Letter to Sergeant CJ Carnie, Major Collision Investigation Unit, Victoria Police from Ted Vincent, Executive Director, Regional Services VicRoads dated 15 July 2008 and relating to the deaths of Caitlin Angel Case No. 1231/08 and Susan Angel Case No. 1230/08.

346 Stephen Brown, Executive Director of Regional Services, VicRoads, Statement dated 1 February 2010, p. 4.

3.2.5.39 The Victorian Railway Crossing Safety Steering Committee has the following sub-committees:

- The Railway Crossing Project Delivery Group which consists of key stakeholders responsible for the State railway crossing upgrade program;
- The Railway Crossing Safety Awareness Group, which is responsible for advising the committee on a range of public education awareness programs; and
- The Railway Crossing Technical Group, which is responsible for providing advice to the Steering Committee on all technical and engineering matters relating to railway crossing safety in Victoria.

3.2.5.40 As relevant to this enquiry, Mr Sargant explained that the Department of Transport addresses the issue of appropriate level crossing infrastructure through these sub-groups of the Victorian Railway Crossing Safety Steering Committee:

> *"... we have four sub groups. We have the technical group and program group. The technical group talks about what sort of technology can be deployed. We have - the program group talks about the progress of the upgrade program. We have a - an awareness group or a communications group which talks about - or discusses any awareness programs or things like that. And we have a human factor sub-committee. The human factor sub-committee is where those issues are - are grappled with. It goes into research that we might do and that we might propose. It examines the completed research that's been done and tries to inform the committee on better interventions that might be able to be used."*

3.2.5.41 However, even at this level the arrangements are unclear, the technical group includes a Research and Development Engineering sub-committee. There is also a Grade Separation Steering Committee.

3.2.5.42 In the year leading up to 5 June 2007, these organisational matters were further complicated by changes in the leases to and accreditation of the rail operator in regional Victoria. These changes have particular relevance to the level crossing infrastructure at the Kerang level crossing.

3.2.5.43 Until 4 May 2007, Pacific National (Victoria) Ltd (now called Pacific National (Victoria) Pty Ltd and formerly called Freight Victoria Ltd) was the accredited rail operator for the non-electrified track in metropolitan Melbourne and country rail track. [347]

3.2.5.44 Pacific National was a 50:50 joint venture of Toll Holdings and Patrick Corporation Ltd. In April 2006, Toll Holdings took over Patrick Corporation. The Victorian Government

347 Director of Public Transport and Freight Victoria Limited (Lessee), (Restated) Primary Infrastructure Lease Volume 1 Consolidated Conformed Copy (current to 30 September 2005).

did not consent to transfer of the lease and management of the below rail network to Toll Holdings.

3.2.5.45 Accordingly, VicTrack advised Pacific National that it intended to rescind its lease and management contract as below rail operator for regional Victoria. Transition arrangements continued through out 2006 and early 2007.

3.2.5.46 These changes in responsibility for below rail infrastructure influenced the infrastructure at Kerang level crossing on 5 June 2007. In particular, as previously discussed, failure to replace the flashing red-filtered incandescent lights with LEDs in October 2006 can be attributed to Pacific National refusing to accept Mr Spicer's assertion that, in circumstances where the level crossing had been assessed as low risk by ALCAM, their replacement was part of the rail operator's role under lease agreements.

3.2.5.47 In the interim, Pacific National did not respond to the Department of Transport's suggestion that they upgrade the Kerang level crossing including replacing flashing red-filtered incandescent lights with LEDs. Mr Sargant explained:

> *"what an infrastructure manager is able - has to do is - is a decision for the infrastructure manager and not one for the Department, particularly on a day to day to day basis...the important thing is that the standards are complied with and that PN were meeting their requirements for medium standards."*

3.2.5.48 On 4 May 2007, the Victorian Government completed the transfer of the Regional Network and Access business from Pacific National. Most employees and all inventory, records and files relating to network management as well as plant & equipment items were transferred to a State owned company, V-Line Passenger Services Pty Ltd.[348]

3.2.5.49 The Victorian Government's buy-back of the State's regional rail network in May 2007 was intended to facilitate the policy target of 30% freight to ports on rail by 2010.[349]

3.2.5.50 Accordingly, the then Minister for Transport directed V/Line to execute documents and operate the regional below-rail business following the State's buy-back of the infrastructure from Pacific National, to facilitate track access for the operation of both passenger and freight rail services.[350]

3.2.5.51 In particular, the Regional Infrastructure Lease dated 4 May 2007 between the Director of Public Transport and V/Line Passenger Services Pty Ltd ("V-Line") explicitly states that the objectives of the lease include to minimise the State's exposure to residual risks and liabilities associated with the land, to facilitate the development of an expanding rail freight

348 V/Line Annual Report 2006-07, p. 65.

349 Department of Infrastructure, SWITCHPOINT: Victorian Rail Freight Network Review, p.4.

350 V/Line Annual Report 2006-07, p. 47.

industry in Victoria as a viable alternative to road transport, and to secure a progressive improvement in the quality of services available to freight customers in Victoria.[351]

3.2.5.52 The decision of the Victorian Government to buy back the State's regional rail infrastructure lease led to an expansion of V/Line's role, with the transition of the Regional Network and Access business from Pacific National.[352]

3.2.5.53 One of V/Line's most significant and demanding safety-related challenges during 2006–07 was achieving safety accreditation for the integration of regional network and access activities following the government's buy-back of the business from Pacific National. A major change management program was developed and implemented within a very short time frame to ensure the business could be successfully and safely transferred to V/Line when the buy-back was completed in May 2007. [353]

3.2.5.54 As foreshadowed since 2006, in April 2007 the Minister for Transport directed V/Line to execute documents and operate the regional below-rail business following the State's buy-back of the infrastructure from Pacific National, to facilitate track access for the operation of both passenger and freight rail services.[354]

3.2.5.55 Accordingly, there is reason to wonder whether the Department of Transport, Pacific National and V-Line Passenger Services Ltd were pre-occupied by the transition of the lease and that this properly manage demarcation issues around whether replacing the flashing red-filtered incandescent lights with LEDs was a maintenance issue or an upgrade issue.

3.2.5.56 This failure to accept responsibility for the work led to failure to replace the flashing red-filtered incandescent lights with LEDs or otherwise respond to reported near misses at the Kerang level crossing during the year before 5 June 2007.

3.2.5.57 I also note that, after 5 June 2007, the flashing light infrastructure that was damaged in the collision was replaced with LEDs. However, the other flashing light infrastructure at the Kerang level crossing was not simultaneously changed from incandescent, red-filtered globes.

3.2.5.58 I am unable to say whether the decision to only partly upgrade that part of the infrastructure was also attributable to the continuing contractual relationships between the VicTrack, the Department of Transport and V-Line passenger Services and demarcation decisions

351 Regional Infrastructure Lease, Director of Public Transport and V/Line Passenger Pty Ltd (Subject to Deed of Company Arrangement) 4 May 2007, Background C(a).

352 Frank Tait, Chair, V/Line, V/Line Annual Report 2006-07, p. 5; Rob Barnett, CEO, V/Line Annual Report 2006-07, p. 6.

353 V/Line Annual Report 2006-07, p. 18

354 V/Line Annual Report 2006-07, p. 47

relating to whether changing the flashing red-filtered incandescent lights to LEDs was maintenance or upgrade

3.2.5.59 To further complicate the issue of what is maintenance and what is an upgrade, in other words "who is now responsible for what", in 2008, legal responsibilities for maintenance of aspects of the lease contracts in regional Victoria were:

- Intrastate – V/Line Passenger Services; and
- Interstate – Australian Rail Track Corporation.[355]

3.2.5.60 These complications were repeated in relation to a third rail authority in metropolitan Melbourne.

3.2.5.61 Further, in her investigation of the death of Mark Winter, Coroner Jacinta Heffey noted that there is sometimes difficulty in identifying the physical limits of the responsibility for maintenance around a rail line.[356]

3.2.5.62 For example, vegetation that is not on the rail reserve is the responsibility of the road authority. The road authority sub-contracts the work to another agency. However, the rail operator must notify the road authority if they vegetation is interfering with the visibility of train and road vehicle drivers.

3.2.5.63 In a letter relating to questions raised by the death of Tony Massaria[357], Mr Spicer explained further:

> *"Public railway land and infrastructure in Victoria is owned by the Victorian Rail Track Corporation ("VicTrack"). VicTrack is a statutory body subject to the direction of the Minister for Transport.[358] Railway land and infrastructure is leased by VicTrack to the Director of Public Transport.*
>
> *The Director of Public Transport is a statutory office established under section 8 of the Transport Act 1982. The Director of Public Transport on-leases the railway land and infrastructure to the transport operators.*
>
> *The three primary sub-lessees of rail infrastructure are:*
>
> *1. Connex Trains (Melbourne Transport Enterprises Pty Ltd): metropolitan train infrastructure;*
>
> *2. V/Line Passenger Pty Ltd but previously leased to Pacific National (Victoria) Ltd now called Pacific National (Victoria) Pty Ltd and formerly called*

355 Public Accounts and Estimates Committee, Parliament of Victoria, Review of the Findings and Recommendations of the Auditor-General's Reports –2007, June 2009.

356 Coroner Jacinta Heffey, Finding into Death with Inquest, Mark Winter, Case No 3471/09.

357 Undated letter to A/Sgt Greigory McFarlane.

358 Section 8(1) *Rail Corporations Act* 1996.

Freight Victoria Ltd: non electrified track in metropolitan Melbourne and country rail track;[359]

3. *Australian Rail Track Corporation: two interstate rail lines.*

3.2.5.64 The Department of Transport reports that there are 1872 road level crossings in Victoria on active main line and heritage/tourist rail lines, not including those crossings on Victorian rail lines which cross the border into New South Wales.

3.2.5.65 However, in February 2008, Ernst and Young reported on a three year survey[360] of 1967 road level crossings in Victoria.[361] These included rail lines that cross into New South Wales, 1729 level crossings were in non-metropolitan Victoria and 1154 level crossings the road speed limit was 100kph.[362]

3.2.5.66 Further, until 2007, policy with regard to accident prevention at level crossings also occurred under the Victorian Railway Level Crossing Protection Upgrade Programme. This programme emphasised upgrade from passive to active safety measures. Other programmes included the "Don't Risk It" safety awareness programme, rumble strips prior to some level crossings and rail operators' safety programmes.

3.2.6 Predictive Risk Assessment

3.2.6.1 Funding for level crossing upgrades is specifically allocated by Government as part of the annual Victorian Government Budget.

3.2.6.2 Within that budget allocation, the Department of Transport determines priorities for its expenditure with advice from the Rail Crossing Program Delivery Group which is a sub-committee of the Victorian Rail Crossing Safety Steering Committee.

3.2.6.3 Since the 1980s, level crossings have been prioritised for upgrade to active controls based on a risk assessment model developed by VicRoads[363] consisting of an initial assessment of several criteria including:

a) Train and traffic volume and speed
b) A cost-benefit ratio;
c) Accident history;

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359 Director of Public Transport and Freight Victoria Limited (Lessee), (Restated) Primary Infrastructure Lease Volume 1 Consolidated Conformed Copy (current to 30 September 2005).

360 The tender was let in October 2005: Department of Infrastructure, "Fact Sheet No. 3, Australian Level Crossing Assessment Model (ALCAM)", March 2006.

361 Ernst & Young, Australian Level Crossing (ALCAM) Assessment Model: Victorian Data Summary Version 1.1., VicTrack, 21 February 2008.

362 Ernst & Young, Australian Level Crossing (ALCAM) Assessment Model: Victorian Data Summary Version 1.1., VicTrack, 21 February 2008.

363 Terry Spicer, in a letter to The Coroner, Geelong Coroners Court dated 16 August 2007.

d) Traffic engineering factors such as restriction of approaches, visibility for motorists, proximity of other roads/intersections, and the presence of traffic control devices, and

e) Number of tracks through the crossing and whether there is bi-directional running.

3.2.6.4 Under the VicRoads model, a secondary assessment of the high priority sites predicted increases in rail or road traffic volumes and treatment of nearby level crossings. VicTrack was responsible for implementing this programme.

3.2.6.5 In Queensland a different model for improvement of level crossing risk has been applied.[364] This is founded on a Level Crossing Risk Scoring matrix to assess each level crossing. The ALCAM system attempted to determine the relative likelihood of an accident occurring on a level crossing based on its physical characteristics and its protective controls compared with a matrix of accident mechanisms.

3.2.6.6 Accordingly, the ALCAM sets out a process to assist in decision making for level crossings as well as a method to help determine the optimum safety improvements for individual sites. ALCAM does not include weighting for accident history or near misses.

3.2.6.7 This Queensland programme has evolved into the Australian Level Crossing Assessment Model (ALCAM). This method of prioritising level crossings for upgrades has been adopted by the Standing Council on Transport and Infrastructure.

3.2.6.8 VicTrack was responsible for implementing the ALCAM assessments in Victoria in February 2008.[365] However, some ALCAM assessments were performed as early as 23 August 2006. [366]

3.2.6.9 The ALCAM model used a range of indicators of mechanisms, characteristics and controls at a level crossing to create a predictive risk matrix for each level crossing in Victoria.

3.2.6.10 Analysis of these data allowed level crossings to be scored relative to each other with respect to their defined risk characteristics and to be categorised as below the Installation Limit requiring remediation or above the Intervention Limit requiring urgent attention.

3.2.6.11 In Victoria ALCAM assessments are provided to assist stakeholders to understand assess and discuss issues of rail crossing safety. It is only one type of assessment tool and is intended to be used in conjunction with other relevant safety assessment tools.[367]

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364 GHD Pty Ltd, Submission to the Road Safety Committee, Victoria for the Inquiry into Improving Safety at Level Crossings, 5 October 2007.

365 See Terry Spicer, "Australian Level Crossing Assessment (ALCAM) Discussion Paper: Key Responsibilities for Road and Rail Authorities associated with the Victorian Implementation of ALCAM", 30 March 2007.

366 Terry Spicer, in a letter to The Coroner, Geelong Coroners Court dated 16 August 2007.

367 Terry Spicer, letter to Greig McFarlane undated re Massaria investigation.

3.2.6.12 Mr Sargant and Mr Furnell told the Court that decisions about prioritising level crossing upgrades are also guided by a set of business rules that have been developed and agreed by the Victorian Railway Crossing Safety Steering Committee (the "business rules"). These rules are state-based and not necessarily followed by other States when they prioritise their level crossings.

3.2.6.13 Under the business rules the priority list for level crossing upgrades goes through the following stages:

- The business rules start with the ALCAM assessment for each level crossing.
- The level crossings at the top of the list that are already protected by boom gates and flashing lights and bells are removed.
- The list for upgrades is then put to the accredited rail operators and/or the local municipalities for a response. This response would include their knowledge of near-misses and other operational issues.
- After re-evaluating the priority list in the light of the operators' response, other level crossings near the remaining highest priority level crossings that would be appropriate and cost effective to upgrade at the same time are considered and re-positioned in the list.
- Then the level crossings on the list are scheduled for upgrades in priority order depending of the funding available.

3.2.6.14 ALCAM relied heavily on non-compliance with Australian Standard AS1742.7-2007 as an indicator of risk.

3.2.6.15 In particular, Australian Standard AS1742.7-2007 specifies adequate sight distances for rail and road vehicles as a crucial factor in determining whether passive level crossing warnings remain appropriate. However, AUSTROADS project 1563 looked at sight distances for B doubles and road trains and recommended review of the AS 1742.7-2007 sight distance recommendations. [368]

3.2.6.16 Further, in 2006, Ernst & Young audited all the level crossings in Victoria for compliance with Australian Standard AS1742.7-2007. This audit published in 2008 indicated that 93% of level crossings failed to comply with AS1742.7-2007.[369] This data was used to establish the first ALCAM priority list.

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368 Clarissa Han, Peter Cairney, Helen Tran, James Luc, "Measures for Managing Safety of Heavy Vehicles at Passive and Active Railway Level Crossings-Progress Report 1", ARRB research, AUSTROADS project No 1587, November 2009, p. 20.

369 Ernst & Young, Australian Level Crossing (ALCAM) Assessment Model: Victorian Data Summary Version 1.1., VicTrack, 21 February 2008.

3.2.6.17 This 2006 audit that predetermined these ALCAM ratings was useful in determining the level crossings that did not yet comply with Australian Standard AS 742.7-2007 Uniform traffic control devices-Railway crossings and elevating their priority for remediation.

3.2.6.18 After 2006, the Department of Infrastructure in Victoria gradually introduced the ALCAM model for prioritising level crossings for upgrade.

3.2.6.19 On 21 February 2008, VicTrack published the Australian Level Crossing (ALCAM) Assessment Model: Victorian Data Summary Version 1.1.

3.2.6.20 From July 2008, ALCAM has been administered by the Department of Transport.

3.2.6.21 The second ALCAM survey commenced in January 2009.

3.2.6.22 VicTrack also began consulting with a number of rail and road operators about the possible closure of some level crossings.

3.2.6.23 The next generation of the National ALCAM database – where all level crossing data is stored – was also rolled out throughout Australia and New Zealand in 2008–09, starting with lines managed by the Australian Rail Track Corporation."[370]

3.2.6.24 However, all but two[371] of the 13 level crossings involved in this cluster of level crossing fatalities also had low ALCAM scores in 2007 and 2011 and remained low in the priority list for upgrading. [372]

3.2.6.25 For example, in November 2005, Kerang ALCAM score was assessed as low risk with an ALCAM score of 78 where scores over 200 attracted active intervention.

3.2.6.26 Using Kerang level crossing as an example, Mr Sargant said the Kerang level crossing was always low in the priority list for upgrade.

3.2.6.27 Mr Sargent also told the Court that this placement of Kerang level crossing low on the list of priorities was never the subject of comment from the rail operator, Pacific National:

> *".... there was no advice to say that it was in the wrong spot."*

3.2.6.28 Mr Sargant added that the Department of Infrastructure responded to complaints about near-misses from Pacific National and V/Line:

> *"and we also included it on the upgrade list as a result. Previously it hadn't been highlighted on the (previous) list at all."*

370 VicTrack, "Second Risk Survey Underway", Press Release.

371 Coroner Jacinta Heffey, Finding into Death with Inquest, Kay Stanley, Case No 417/08; Geoffrey Young Case No. 3307/07.

372 VicTrack crossing upgrade program for 2007/2008 31 January 2008.

3.2.6.29 However, Mr Sargent is contradicted by a letter written by Mr Spicer to Pacific National on 4 October 2006.

3.2.6.30 In this letter, the Department of Infrastructure stood by the ALCAM assessment which categorised the Kerang level crossing as low risk and low in priority for upgrade. In particular, Mr Spicer wrote to Pacific National:

> *"ALCAM has been designed to deliberately not score or provide weightings in the accident mechanisms for collisions/incidents, and is quite deliberately not accident-history driven, a concept which has been applauded by Victoria State Coroner. The whole philosophy of embracing a risk management to railway crossing safety is to accept that accidents are things that just happen, including at railway crossings...*
>
> *"There is no point putting escalator on your 1 list as the whole purpose of this exercise is for all ALCAM to rank all of the crossings nominated in highest to lowest risk order."*

3.2.6.31 Further, Mr Sargant explained the rapid elevation of the Kerang level crossing to include boom gates, rumble strips and advanced warning signals after the incident on 5 June 2007 in which 11 people died:

> "Coroner: *It looks as if this one was pulled out and put up to the top?*
>
> Mr Sargant: *It was, yes, it was.*
>
> Coroner: *And what does that say about your system of prioritising?*
>
> Mr Sargant: *That it's flexible."*

3.2.6.32 Although Mr Furnell told the Court that the upgrade priority list was undertaken once a year as part of allocation of the allocated budget and that the priorities changed each year depending on whether there is a better set of data, the information provided to me included ALCAM assessments performed in 2005, 2007 and 2011.

3.2.6.33 Mr Furnell agreed that exposure and traffic flow as expressed by traffic counts were an important component of the ALCAM algorithm used to assess the relative risk of adverse events at individual level crossings and pre-determine their priority for upgrades.[373]

3.2.6.34 Using the Kerang level crossing as an example, the November 2005 ALCAM assessment of Kerang level crossing was based on a road crossing volume of 100 vehicles a day and seven trains a day. Risks were flagged as high speed trains and non-compliance with the Australian Standard AS1742.7-2007. The length of warning times was designated extreme and allocated 8 points or 10% of the ALCAM score.

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373 See also New South Wales Independent Safety Regulator, "Traffic Flow and Collision Likelihood at Australian and NZ Level Crossings: Report for ALCAM Development Group", 5 August 2011.

3.2.6.35 Mr Furnell told the Court that the ALCAM data used to prioritise level crossings before 2007 did not necessarily use any objective data for traffic counts. He said:

> *"I understand they probably didn't have very much directly provided data at the point of doing the first survey - then they had a process of making an estimation of that traffic volume which was based on the class of road and the proximity to a major town and that kind of thing. So the 100 vehicles that was put down for the crossing initially was the product of, essentially, an estimate as were, I believe, quite a number of the vehicle volumes in the interim prioritisation list"*

3.2.6.36 Therefore, I do not accept that the relative risks assessed for the Kerang level crossing and all of the other level crossings in Victoria before 5 June 2007 were relevant to objective assessment of a priority list for allocation of funding for upgrades.

3.2.6.37 On 2 November 2007, the ALCAM survey was repeated at the Kerang level crossing. On this assessment, the ALCAM score was assessed as 95 where scores over 350 attracted intervention.[374]

3.2.6.38 The November 2007 assessment of Kerang level crossing was based on a traffic count of 2300 vehicles a day, including 10% heavy vehicles, and seven trains a day. The length of warning times was still designated extreme and allocated 8 points or 8.4% of the ALCAM score. Possible sun glare was recorded as effecting road vehicles but this did not change the rating because the level crossing was now fitted with fully active warning devices.

3.2.6.39 However, this coronial investigation heard that the traffic counts used in the 2007 re-assessment of priorities using the ALCAM algorithm used vehicle numbers collected in surveys performed in 2004. Further, the composition of the traffic was unable to be detected from the data collection procedures used so that the 'proportion of heavy vehicles reported reflected the opinion of local VicRoads staff.

3.2.6.40 Therefore, I also do not accept that the relative risks assessed for the Kerang level crossing and the other level crossings in Victoria in 2007 were relevant to objective assessment of a priority list for allocation of funding for upgrades.

3.2.6.41 Similarly, in 2010, VicRoads provided the Department of Infrastructure with traffic count data to allow further re-assessment of level crossings under the ALCAM model. Mr Furnell explained to the Court that this data was identical to that provided by VicRoads in 2007.

3.2.6.42 Stephen Brown was Executive Director of the Regional Services Division in VicRoads in 2011. He told the Court heard that the road vehicle numbers and distributions used in

374 By this time, the Kerang level crossing had been upgraded to include a speed limit of 80kph, rumble strips, automated advance warning signs and boom gates

ALCAM rely on routine data that is routinely collected by VicRoads and regional municipalities. Therefore, they do not necessarily reflect current circumstances, they do not discriminate between vehicle types and they do not necessarily relate to the site of the level crossing but rather to the road on which the level crossing is placed.

3.2.6.43 If specific information is required, VicRoads has to undertake a specific traffic count. There is no evidence that this occurs. Further, Mr Brown said that VicRoads staff usually knows what proportion of vehicles are carrying freight on specific roads. They also know that this proportion does not change much over time. Therefore, the heavy vehicle contribution to the ALCAM assessments is, at best, "anecdotal evidence".

3.2.6.44 However, VicRoads data provided to the Court shows that they undertook vehicle counts on the Murray Valley Highway in 2000, 2004, 2008 and 2011. This VicRoads data shows that:

- In November 2000, on average 992 vehicles used the Murray Valley Highway in each direction each day. This is inconsistent with the estimates of 100 vehicles used in the November 2005 ALCAM assessment of Kerang level crossing.
- In April 2004, on average, 1206 vehicles used the Murray Valley Highway in each direction each day. This is consistent with the information provided to the Department of Infrastructure in 2007.
- In October/November 2008, on average, 1161 vehicles travelled in each direction on the Murray Valley Highway each day.
- In March 2011, on average, 1471 vehicles travelled in each direction on the Murray Valley Highway each day.

3.2.6.45 Further, contrary to the information provided in Court by VicRoads, the VicRoads vehicle count data includes Austroads vehicle categories based on length of vehicle and number of axles.

3.2.6.46 These data also shows that the proportion of heavy vehicles[375] travelling on the Murray Valley Highway has increased from 17% in 2000 to 22% in 2011. By 2011, 640 heavy vehicles were crossing the Kerang level crossing in each direction each day and the estimate of 10% used by the Department of Infrastructure was always an underestimate.

3.2.6.47 In the context of this VicRoads data provided to the Court, I am unable to understand why the Department of Infrastructure did not use the same VicRoads information to populate the ALCAM algorithm in 2005, 2007 and 2011. However, in the absence of the same data and analyses for other level crossings in the cluster, I am unable to say whether it would

375 As defined by Austroads as Vehicle Category >2.

have made a difference to their relative prospective risk assessment of the Kerang level crossing.

3.2.6.48 V/Line knew the ALCAM assessments were inconsistent with their experience: on 5 June 2007, Mr Lidster had been qualified to drive trains on the Swan Hill route for six months. During that training, he was told that the Kerang crossing could be dangerous because of the road traffic conditions. Mr Lidster told the Court:

> *"He just said the volume of traffic is pretty high on occasions, holidays and so forth, there's a lot of traffic on that having to cross."*

3.2.6.49 Further, the Municipal Association of Victoria found the ALCAM system was not user-friendly and encountered difficulties in accessing the ALCAM data from its on-line repository and applied further detail including Global Positioning System-based technology ("GPS") coordinates to integrate it into its project plan. [376]

3.2.6.50 The Municipal Association of Victoria and VicTrack also encourage municipalities to use ALCAM data as a risk assessment tool rather than an indisputable guide to prioritising their contribution to the consultative process around level crossing upgrades.[377]

3.2.6.51 Mr Sargant also explained that there is no one in the Department of Transport was responsible for coordinating with the road authorities:

> *"Coordination would be - information would be available on the ALCAM website and they have - they have the ability to interrogate ALCAM and get the information that relates to every crossing in - that's their responsibility."*

3.2.6.52 Further, the ALCAM model tried to take into account human factors, for example unduly long waiting periods, the effect of familiarity with the physical arrangements at the level crossing and sky larking.

3.2.6.53 However, although the ALCAM analysis included over 70 risk factors[378], these risk factors did not necessarily reflect the known risk factors at level crossings.

3.2.6.54 For example, road vehicle drivers' familiarity with the level crossing has been identified in this cluster as a factor involved in the so-called "inattention" that contributed all but one of the fatal level crossing collisions.

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376 The Municipal Association of Victoria, "Rail Safety Improvement Project: Progress Report", October 2008.

377 The Municipal Association of Victoria, "Rail Safety Improvement Project: Progress Report", October 2008.

378 Department of Infrastructure, "Fact Sheet No. 3, Australian Level Crossing Assessment Model (ALCAM)", March 2006.

3.2.6.55 Familiarity has been confirmed by a number of other investigators since at least 1989. It is particularly likely to apply to local drivers and drivers of commercial vehicles. Therefore, it is appropriate to include frequency of use in predictive risk assessments.

3.2.6.56 Bob Pearson also attempted to evaluate the likely effectiveness from a road authority's perspective of the indicators used by ALCAM to calculate the relative risk of a catastrophic incident occurring at a level crossing. [379] He suggests that competing stimuli are likely to contribute to driver's failure to become aware of the train in time to stop. Again, ALCAM defines this category as "inattention".

3.2.6.57 Competing stimuli could be assessed by ALCAM assessors at each level crossing.

3.2.6.58 Further, heavy vehicle drivers' failure to see the operating level crossing warnings is not necessarily attributable to inattention. For example, the drivers in the two Kerang fatal incidents were aware of the approaching train in one case, and the light infrastructure in the other. However, neither saw the flashing lights. ALCAM also defines this category as "inattention" when it may be related to infrastructure.

3.2.6.59 On another issue, trauma experts believe that about 35% of all deaths following road trauma are preventable or potentially preventable when appropriate trauma management systems are activated.[380]

3.2.6.60 The "2011 review" considered the effect of emergency services on outcomes of level crossing incidents. It was excluded from ALCAM because it was not specific to individual crossings.

3.2.6.61 In the circumstances where the emergency response contributes to 35% of fatalities and the distributions of these responses is as geographical as the level crossings themselves, this decision was a mistake at least as ALCAM and its successors apply in Victoria.[381]

3.2.6.62 Other data used to populate the ALCAM algorithm was also not always accurate.

3.2.6.63 For example, Coroner Saines found that VicRoads had incorrectly assessed the sight distances as good at the Barpinba-Poorneet Road level crossing near Wingeel.[382] Further, the fog at the level crossing on the morning of that collision interfered with the truck driver's capacity to see the train but was not included in the ALCAM assessment.

3.2.6.64 Further, I note that the information about sun glare entered into ALCAM in 2005, 2007 and 2011 surveys differed for the Kerang level crossing. It seems unlikely that this variable

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379 Bob Pearson, Risk Analysis of Trick Train Collisions of Significant Severity, Final report, 28 November 2008.

380 State Trauma Committee, "A Trauma Education Framework for Victoria", October 2001.

381 This issue is discussed further in the emergency response section of this report.

382 Jamie Webb, Case No. 1965/06, Finding of Ronald Saines.

would change in any two year period although, of course, it would depend on the time and weather situation on the day observations were made.

3.2.7 New innovations

3.2.7.1 The road vehicle drivers in 12 collisions in this coronial investigation of a cluster of fatal level crossing collisions were consistent in their characteristics:

- All were experienced drivers;
- None was affected by alcohol or other drugs;
- All but three were very familiar with the crossing;
- All but one never or rarely saw a train at the level crossing[383];
- All had a driving history that indicated general compliance with road rules and other legislation;
- Ten never knew that a train was approaching. Two became aware of a train too late to stop before a collision occurred.

3.2.7.2 No incidents in this cluster of fatal level crossing incidents could be attributed to non-compliance with Australian Standard AS1742.7-2007 or rail operators' Book of Rules and Operating Procedures.

3.2.7.3 The greatest risk of multiple fatalities and serious injuries is associated with the potential for a collision between a train and a combination heavy vehicle in regional Victoria where speed limits are higher:

- Six, including the Kerang incident, occurred in regional Victoria.[384]
- Two, including the Kerang incident, involved a heavy vehicle combination.[385]
- All of the collisions occurred in daylight hours on find clear days.[386]
- Three of the level crossings were equipped with active lights and bells but no boom gates.[387]
- In three collisions, including Kerang, the road vehicle hit the train.[388]

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383 Jillian McCormack Case No. 5159/08.

384 Adam Dunning Case No. 3174/02; Adrian Kiely Case No.3175/02; Ian Pettersen Case No. 3176/02; James Gordon Case No. 4307/06; Fiona Smart Case No. 468/08; Haldane Nelson Case No. 801/08; Caitlin Angel Case No. 1231/08; Susan Angel Case No. 1230/08.

385 Adam Dunning Case No. 3174/02; Adrian Kiely Case No.3175/02; Ian Pettersen Case No. 3176/02.

386 cf Coroner Ronald Saines, Finding into Death with Inquest, Jamie Webb, Case No. 1965/06; Australian Transport Safety Bureau, "Collision between Rigid Tipper Truck/Quad Axle Trailer and Freight Train 4AM3 Lismore, Victoria 25 May 2006", Rail Occurrence Investigation 2006004, January 2007. Fog was a factor in this collision.

387 Kay Stanley Case No. 417/08; Geoffrey Young Case No. 3307/07.

388 Caitlin Angel Case No. 1231/08; Susan Angel Case No. 1230/08

3.2.7.4 Accordingly, this coronial investigation of 12 fatal level crossing collisions has confirmed the opinions expressed by Deputy State Coroner Johnstone in 1989 following an Inquest as part of his investigation of eight deaths arising from seven level crossing incident.

3.2.7.5 In his Findings, Deputy State Coroner Johnstone found that the common theme was road vehicle drivers' lack of awareness of an approaching train. Accordingly he recommended:

> *"It is considered essential that available technology be utilised to develop inexpensive reliable methods of detecting an approaching train and transmitting a signal to a device erected at a level crossing to warn motorists."*[389]

3.2.7.6 In 2000, the National Highway Transport Safety Administration also stated:

> *"The introduction of automotive collision warning systems potentially represents the next significant leap in vehicle safety technology by attempting to actively warn drivers of an impending collision event, thereby allowing the driver adequate time to take appropriate corrective actions in order to mitigate or completely avoid the event."*[390]

3.2.7.7 Dr Johnston also raised the opportunities provided by developing technology for train triggered arrays and for vehicle to vehicle communication using, for example the road vehicle radio system or satellite navigation aids.[391]

3.2.7.8 In 2009, the House of Representatives Standing Committee on Infrastructure, Transport, Regional Development and Local Government examined technological solutions to level crossing safety. It reiterated its support of Intelligent Transport Systems, as stated in the 2004 report, and recommended that the Government support ongoing research into this important technology to speed its implementation.

3.2.7.9 The House of Representatives Standing Committee on Infrastructure, Transport, Regional Development and Local Government also recommended that the Australian Government, through the Australian Transport Council, encourage further research into the feasibility of a radio cut-in warning system which would warn motor vehicle drivers, as they approach a level crossing, of the presence of an oncoming train.[392]

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389 Cited in Terry Spicer, "Consolidating 29 Coronial Investigations from 15 RLX Crashes 2002-2009 in Victoria, Australia into 4 Coronial Inquests", Level Crossing 29012 Conference, London.

390 P.L. Zador, S.A. Krawchuk, R.B. Voas, "Final Report -- Automotive Collision Avoidance System (ACAS) Program", National Highway Traffic Safety Administration, August 2000.

391 Ian Johnston, "Expert Report for use as evidence in a series of inquests into deaths at level crossings in Victoria between 2006 and 2009", prepared at the request of Transport Safety Victoria by Ian Johnston Transport Safety Pty Ltd, 5 July 2011.

392 House of Representatives Standing Committee on Infrastructure, Transport, Regional Development and Local Government, "Level Crossing Safety: An Update of the 2005 Train Illumination Report", Canberra, June 2009

3.2.7.10 Similarly, in 2009, the Staysafe Committee of the Parliament of New South Wales were more strategic in their recommendation that their level Crossing Strategy Council review the impact of increased heavy vehicle traffic on collision risks at railway level crossings and include an examination of the potential of GPD tracking at railway level crossings of part of that review.[393]

3.2.7.11 Austroads has also investigated alternative ways for train drivers to communicate with road drivers as they approach passive level crossings like the one in Dingee.[394] They accepted the attraction of an active warning signal emitted from all level crossings when a train is approaching and detected by an in-vehicle reception and audible warning system. However, at that time, the technical limitations of electronics at that time limited its feasibility until road vehicles were general Intelligent Transport System co-pilot systems became available as part of the standard control system in motor vehicles.

3.2.7.12 Further, in 2013, Austroads published a review of the potential infrastructure and intelligent transport systems to improve heavy vehicle safety, including roadside infrastructure systems, in-vehicle systems and cooperative systems.[395]

3.2.7.13 In this 2013 review, Austroads refer to some recent work performed by Transport Certification Australia with VicRoads on the use of technology to interact between vehicles and trains at passive level crossings an interactive warning from trains to vehicles and railway crossings-to-vehicles that are simultaneously approaching a level crossing using dedicated short range radio communication technology.

3.2.7.14 Austroads note that costs for Intelligent Transport Systems may involve outfitting individual vehicles and developing system infrastructure. Effectiveness therefore involves the market uptake of in-vehicle equipment associated with these systems.

3.2.7.15 Accordingly, even after more than ten years, they say it is still difficult to quantify the cost of these developments and see them as a medium term option.

3.2.7.16 Mr Furnell also argued against introducing radio braking and the dedicated short range communication technology in Victoria without its introduction elsewhere in Australia. He explained that:

> *"The main issue with a single State implementation is inconsistency in the driver's experience of the warnings and so if we in Victoria introduced a system whereby the*

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393 Staysafe Committee, Parliament of New South Wales, "Report on Updating Progress on Railway Level Crossing Safety", Report No 2/54, June 2009.

394 Austroads, "Reducing Collisions at passive level crossings in Australia", Austroads Publication No. AP-R208-02, 2002.

395 D. McTiernan & Michael Levasseaur, "Improving the Safety of Heavy Vehicles in Urban Areas – A Crash Analysis and Review of Potential Infrastructure and ITS Countermeasures", Austroads Publication No. AP-R425-13, March 2013.

car provided warnings to the driver at, say, passive level crossings, then there will be some affect on how drivers see such crossings and how they behave at those crossings and potentially some reliance on the technology will emerge and therefore it is - if it is used in Victoria but not South Australia, for example, a vehicle will travel out of the State and suddenly the warnings won't work....

As I said, the concern is that if those vehicles move outside the State, you are in fact having, in fact, a negative safety impact at those kinds of crossings...

These technology have been discussed - introduced to and discussed by the national committee and the committee has formed the view that a national approach should be taken."

3.2.7.17 Mr Furnell also explained that overseas car manufacturers were working towards integrating short range radio technology into their products. However, the radio braking programme was not on their agenda.

3.2.7.18 In 2006, the Department of Infrastructure commissioned Sinclair Knight Merz to review and available level crossing obstacle detection systems.[396]

3.2.7.19 Sinclair Knight Merz advised the Department of Infrastructure that there were a number of systems already available and that they would provide benefit to the rail operator by reducing the number of accidents at level crossings. In their opinion, Intelligent Video Monitoring held the greatest promise for use in a level crossing obstacle system. However, further work was required to develop a set of rules or guidelines for categorising the detected threats and appropriate responses to these threats.

3.2.7.20 In circumstances like those facing the train drivers involved in the death of Mariam Yousif, where the road vehicle was stranded on the level crossing[397], and Julie Love[398], where she deliberately stopped her car on the level crossing before the train was due, notification of the car on the level crossing would have allowed him to avoid the collision.

3.2.7.21 Further, Public Transport Safety Victoria also recorded that the level crossing infrastructure was not working on 24 July 2007. Direct notification of train drivers that a level crossing infrastructure was not operational would allow him to change his approach speeds and horn signals appropriately to remove the associate risk.

3.2.7.22 However, this notification would have no application where vehicles entered the level crossing or level crossing infrastructure failed too late for the train to stop.[399]

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396 Sinclair Knight Merz, "Level Crossing Obstacle Detection", 22 June 2006.

397 Marian Yousif Case No 1656/09.

398 Julie Love Case No. 2349/09.

399 For example, Michael Boyd Case No. 1025/08.

3.3 COMMENTS

Pursuant to section 67(3) of the *Coroners Act* 2008, I make the following comments connected to the deaths of 21 people in this cluster of 26 level crossing fatalities[400]:

3.3.1 Background

3.3.1.1 This section of the findings from the coronial investigation of a cluster of 27 level crossing deaths will focus on the way in which the train and level crossing infrastructure influenced the collision between a semi-trailer and a train at the Kerang level crossing on 5 June 2007.

3.3.1.2 It will then comment and make recommendations intended to prevent further deaths for the reason that 11 train passengers died as the result of the Kerang incident and 16 other people in this cluster of level crossing deaths died in Victoria between 2002 and 2009.

3.3.1.3 A level crossing is the intersection of a road and a railway line. By implication, collisions at level crossings usually involve a train and a road vehicle.

3.3.1.4 In February 2008, Ernst and Young reported there were 1967 road level crossings in Victoria.[401] These included about 150 rail lines that cross into New South Wales, 1729 of these level crossings in non-metropolitan Victoria and 1154 level crossings the road speed limit was 100kph.[402]

3.3.1.5 Between 1990 and 2002, an average of two people a year were killed in collisions between road vehicles and a train in Victoria.[403] In each financial year between 2000 and 2006, between one and six people were accidentally killed in Victorian level crossing collisions.[404] Kerang created a statistical abnormality that more than doubled the retrospectively assessed risk of level crossing fatalities in Victoria.

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400 Coroner Saines and Corner Heffey have completed Findings in their investigations of the deaths of Tony Massaria, Kay Stanley and Mark Winter: Coroner Ronald Saines, Finding into Death with Inquest, Jamie Webb, Case No. 1965/06; Coroner Jacinta Heffey, Finding into Death without Inquest, Anthony Massaria, Case No 3881/06.; Coroner Jacinta Heffey, Finding into Death with Inquest, Mark Winter, Case No 3471/09; Coroner Jacinta Heffey, Finding into Death with Inquest, Kay Stanley, Case No 417/08.

401 Ernst & Young, Australian Level Crossing (ALCAM) Assessment Model: Victorian Data Summary Version 1.1., VicTrack, 21 February 2008.

402 Ernst & Young, Australian Level Crossing (ALCAM) Assessment Model: Victorian Data Summary Version 1.1., VicTrack, 21 February 2008. See also Department of Infrastructure, "Fact Sheet No. 3, Australian Level Crossing Assessment Model (ALCAM)", March 2006.

403 Eric Wigglesworth, Annette Graham and Virginia Routley, "Rail related fatalities in Victoria, Australia: 1990-2002", Road & Transport Research, 14, March 2005.

404 Public Transport Safety Victoria, "Railway Crossing Accident Data", 2000-2006 Financial years.

3.3.1.6 Despite the statistical effect of the Kerang disaster, between 1970 and 2008, fatalities resulting from collisions between road vehicles and trains at level crossings reduced by about 70 per cent.[405]

3.3.1.7 Tom Sargant was the Deputy Director of Public Transport Engineering and Asset Management at the Department of Transport. Mr Sargant also attributed the decline in fatal level crossing incidents to the effect of reduced services in Victoria during the 1970's and 1980's. In contrast, in the United States there have considerable increases in the volumes of rail and highway traffic. [406]

3.3.1.8 The primary indicator of risk of a collision at these level crossings is related to exposure, that is, the number of trains and motor vehicles approaching each level crossing at any particular time. Accordingly, in both Victoria and the United States, the decrease in level crossing fatalities has been partly attributed to level crossing closures. [407]

3.3.1.9 Accordingly, the Municipal Association of Victoria is working with other agencies to promote level crossing closures in north-east Victoria. [408] This important countermeasure is otherwise outside the scope of the coronial investigation of a cluster of 12 level crossing collisions resulting in of 27 deaths and will not be further considered here.

3.3.1.10 A train is limited in its capacity to change direction or stop quickly when an emergency arises. Accordingly, level crossing infrastructure intended to preventing collisions is directed towards warning road vehicle drivers that they are approaching a level crossing when a train may be or is approaching.

3.3.1.11 This is achieved by providing a suite of signs and road markings intended to alert the road vehicle driver to the risks associated with a level crossing. Flashing lights, bells and boom gates activated by the approaching train are also installed at so-called "active level" crossings considered most at risk. Trains sound their horns to attract road vehicle drivers' attention.

3.3.1.12 In 2006, the Australian Transport Safety Bureau confirmed that 46% of level crossing fatalities between 1988 and 1998 resulted from unintended road vehicle driver error. This

405 See for example, Australian Transport Safety Bureau, "Railway Level Crossing Safety Bulletin", 2008; Victorian Auditor-General's Office, "Audit summary of Management of Safety Risks at Level Crossings", tabled in Parliament of Victoria, 24 March 2010.

406 S Mok & I Savage. "Why has Safety Improved at Rail-Highway Grade Crossings?" *Risk Analysis* 25 (2005) 867.

407 Road Safety Committee, Parliament of Victoria, "Inquiry into Improving Safety at Level Crossings", December 2008.

408 The Municipal Association of Victoria, "Rail Safety Improvement Project: Progress Report", October 2008.

proportion is greater than the involvement of unintended driver error in 22% of other fatal crashes.[409]

3.3.1.13 In 2008, Bob Pearson advised VicRoads that the most common cause of catastrophic collisions between a heavy vehicle and a train was the road vehicle driver not expecting and/or seeing the train in time to stop or at all. [410]

3.3.1.14 In 2003, the Australian Transport Council reported that:

> *"Most (level crossing) crashes occur where the driver has a local understanding of the railway level crossing."*[411]

3.3.1.15 After investigating the Ghan fatal collision, the Australian Transport Safety Bureau also concluded that the driver of the truck crossed the level crossing many times during the course of his 'working day' and had been in the habit of slowing rather than stopping at the level crossing 'Stop' sign. He did not expect to see a train and he did not see the approaching train.[412]

3.3.1.16 In the introduction to their report, the Road Safety Committee noted that:

> *"Crashes and fatalities at crossings are caused, in the main, by the failure of drivers and pedestrians to detect approaching trains, or if the train is detected, to ignore or not to comprehend the risk of a crash. If there is no safety technology at these crossings to warn users of approaching trains, or if the crossings are poorly designed or maintained, the task of the driver or pedestrian to make a judgement about whether it is safe to cross, can be very difficult...*
>
> *With the increase of both train and heavy vehicle traffic, and the large number of crossings in this State, the potential for another such catastrophic event is of great concern and was the precursor to this Inquiry..."*[413]

3.3.1.17 Therefore, over the last 25 years, most of the fatal collisions between a road vehicle and a train at a level crossing occurred because the road vehicle driver failed to become aware of the approaching train in circumstances where they were very familiar with the level crossing.

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409 Australian Transport Safety Bureau, "Fatal Crashes at Level Crossings", Monograph 10, Level Crossing Accidents, 15th November 2006; Austroads, "Measures for Managing Safety of Heavy Vehicles at Passive and Active Railway Level Crossings" NS 1587 Sydney 2010.

410 Bob Pearson, Risk Analysis of Trick Train Collisions of Significant Severity, Final report, 28 November 2008.

411 Australian Transport Council, National Railway Level Crossing Safety Strategy, August 2003.

412 Australian Transport Safety Bureau, "Level Crossing Collision between The Ghan Passenger Train (1AD8) and a Road-Train Truck, Ban Ban Springs, NT, 12 December 2006", 13 Feb 2008.

413 Road Safety Committee, Parliament of Victoria, "Inquiry into Improving Safety at Level Crossings", December 2008.

3.3.1.18 As with previous reviews of level crossing collisions, 10 of the road vehicle drivers in this investigation were not aware of the approaching train at all. A further two became aware of the train too late to before a collision occurred. In one incident the car seemed to stall on the level crossing.

3.3.1.19 Similarly, 11 of 12 road vehicle drivers subject to this coronial inquiry were familiar with the level crossing. Most used the level crossing at least twice a week.

3.3.1.20 Serious adverse events provide an opportunity to identify failures in the countermeasure system and targets for countermeasures. Further, accurate prediction of future risk and appropriate remediation requires good information about systems failures.

3.3.1.21 Sometimes the causal factors and best remedies are counterintuitive. Therefore, it is important for analysis to be objective, independent and thorough.

3.3.1.22 Here are a few examples identified during this enquiry:

- Dr Johnston commented that road vehicle drivers may interpret passive level crossing infrastructure as denoting the level crossing carries less risk than a crossing fitted with flashing lights and boom gates. This observation may be compounded every time a driver crosses the passive level crossing and does not see a train.

- Not all road vehicle drivers believe that passive level crossing infrastructure is associated with real risk of an approaching train. Gor example, a few weeks before he died at the same level crossing Haldane Nelson and his wife laughed about introduction of a Stop sign. [414]

- Focusing flashing lights on the roadway at a distance from the level crossing appropriate for car drivers may limit the capacity of heavy vehicle drivers to notice them.

- Roadworthiness of trailer brakes does not necessarily influence the braking capacity of a semi-trailer when the prime mover is fitted with anti-lock brakes.

- Rumble strips are effective in reducing speeds of vehicles approaching a level crossing when they are new but their effect is short-lived. They are more effective in combination with Give Way or Stop signs.

- In New South Wales, the average number of fatalities per incident is greater for light vehicle collisions than for heavy vehicle collisions except when there is no associated derailment.[415]

414 Haldane Nelson Case No. 801/08.

415 Sotera Risk Solutions, "ALCAM Consequence model development", 28 January 2011.

- Drivers familiar with a route are more likely than infrequent commuters to persist in reducing their speeds at intersections protected by Stop signs.[416]

3.3.1.23 Against this background, it is also difficult to determine the separate effects of the components of level crossing safety infrastructure schemes.

3.3.1.24 However, this investigation of 12 fatal level crossing collisions has identified a number of systems failures which, indirectly or directly, contributed to the collisions either because the infrastructure failed to alert the road vehicle drivers who were familiar with the level crossing to the approach of a train or because they failed to predict and therefore prioritise upgrades in the level crossing infrastructure.

3.3.1.25 These include:

- Train conspicuity;
- Effectiveness of current level crossing infrastructure;
- The standards for level crossing infrastructure;
- Responsibility for level crossing infrastructure;
- Predictive risk assessment of level crossings and prioritisation of upgrades; and
- Innovative level crossing infrastructure.

3.3.2 Train Conspicuity

3.3.2.1 When level crossing infrastructure fails to alert a road vehicle driver to an approaching train, the train itself becomes the next source of warnings.

3.3.2.2 However, road vehicle drivers' view of a train approaching the level crossing was impeded in four of the 13 fatal level crossing incidents in this cluster of fatal level crossing collisions including Kerang.[417]

3.3.2.3 Two of these level crossing incidents involved drivers turning left from a road that runs parallel to the railway line. Both drivers were familiar with the level crossing. Neither driver became aware of the approaching train.[418]

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416 Russell G. Smith & Austin Lovegrove, "Danger compensation effects of stop signs at intersections", Accident Analysis & Prevention 15 (1983) 95.

417 Adam Dunning, Case No. 3174/02; Adrian Kiely, Case No. 3175/02; Ian Pettersen, Case No. 3176/02; Geoffrey Young Case No. 3307/07; Caitlin Angel Case No. 1231/08; Susan Angel Case No. 1230/08; Coroner Jacinta Heffey, Finding into Death with Inquest, Mark Winter, Case No 3471/09.

418 Adam Dunning, Case No. 3174/02; Adrian Kiely, Case No. 3175/02; Ian Pettersen, Case No. 3176/02; Coroner Jacinta Heffey, Finding into Death with Inquest, Mark Winter, Case No 3471/09.

3.3.2.4 In the re-enactment of the Kerang fatal level crossing incident, Mr Exton could see the train at various points in time leading up to the level crossing from a distance of at least one kilometre prior to reaching the crossing.

3.3.2.5 However, within the overall view of a north travelling semi-trailer driver, a train approaching the Kerang level crossing from the north was partially obscured from about 800 metres to about 200 metres before the level crossing by some by trees in a paddock and along the alignment of the rail line.

3.3.2.6 Further, Mr Scott was following Mr Scholl's semi-trailer. He did not see the approaching train until he saw the collision with Mr Scholl's semi-trailer.

3.3.2.7 Submissions from the Department of Transport and VicTrack acknowledge:

> *"However the evidence indicates that the train was still visible as it passed behind trees and foliage: it was not the case that the train was ever completely hidden from view as it approached the crossing."*

3.3.2.8 When the train is within view of the road vehicle driver, initiatives designed to attract attention to the train include both visual and audible cues.

3.3.2.9 Applying Dr Cairney's logic for attempting to increase conspicuity of trains:

> *"there are fewer locomotives (approximately 2300) than passive crossings (approximately 6000), and since locomotive lighting treatments are likely to cost less than even the low-budget active warning systems currently being trialled, treating locomotives appears to be an attractive option. However, there is presently insufficient research evidence to estimate the proportion of collisions at passive crossings that would be prevented by such treatments."*[419]

3.3.2.10 In the United States, 59 out of 60 trains involved in level crossing fatalities in the United States had a head light in use. Further all the trains in this cluster of fatal level crossing collisions had operational head lights. [420] Therefore, the head light alone seems to have been ineffective in attracting road vehicle drivers' attention during the day.

3.3.2.11 In the United States, 14% of the decline in the number fatalities at level crossings over the thirty years to 2001 has been attributed to the installation of additional lights on locomotives in the mid 1990s. Accordingly, ditch lights would appear to be a successful component of the suite of level crossing infrastructure that is intended to attract road

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419 Peter Cairney, "Prospects for improving the conspicuity of trains at passive railway crossings", ARRB Transport Research Ltd, CR 217 Nov 2003.

420 Michelle Yeh and Jordan Multer, "Driver Behavior at Highway-Railroad Grade Crossings: A Literature Review from 1990–2006", U.S. Department of Transportation Federal Railroad Administration, October, 2008.

vehicle drivers' attention. The triangle of locomotive lights has been effective in allowing motorists to judge how far a train is from a crossing and the speed at which it is moving. [421]

3.3.2.12 Ditch lights were operational in all the level crossing incidents in this cluster for whom information is available. Mr Scholl and Mr Angel became aware of the approaching train when it became clearly visible from their vehicles. Therefore, at least in those two cases, sight of the train itself triggered a response albeit too late to avoid a collision. I am unable to say whether or to what extent they were influenced by the ditch lights.

3.3.2.13 However, Dr Ian Johnston stated:

> *"Research into locomotive headlights, including strobe lights, is not conclusive. To be seen during the day locomotive lights need to be especially bright and the ATSB research cited earlier found that some 80% of the 87 fatal crashes they investigated occurred in daylight. While efforts to improve locomotive conspicuity are laudable they are unlikely to be a major contributor to increasing the awareness of the imminent arrival of a train at a crossing."* [422]

3.3.2.14 The rail operators' Book of Rules and Operating Procedures requires train drivers to activate their horns at the whistle board that is placed about 350 metres before a level crossing. They also sound their horns again as they approach the level crossing.

3.3.2.15 Further, the train drivers activate their horn when they become aware that there is a road vehicle that is not slowing down as it approaches the level crossing. [423] This action relies on train drivers becoming aware of the road vehicle early enough to warn them to stop.

3.3.2.16 All the train drivers in this cluster of fatal level crossing collisions sounded their horns at least twice as they approached the level crossing. None of the road vehicle drivers heard the activated train horns. [424, 425]

3.3.2.17 The Office of the Chief Investigator noted that the Leslie RSN 5-chime air horn has operating specifications of 115 db at 30.5 metres and 97db at 244 metres.

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421 S Mok & I Savage. "Why has Safety Improved at Rail-Highway Grade Crossings?" *Risk Analysis* 25 (2005) 867.

422 Ian Johnston, "Expert Report for use as evidence in a series of inquests into deaths at level crossings in Victoria between 2006 and 2009", prepared at the request of Transport Safety Victoria by Ian Johnston Transport Safety Pty Ltd, 5 July 2011.

423 Office of the Chief Investigator, Rail Safety Investigation Report No 2007/10, Level Crossing Collision Connex Passenger Train 8504 with a Motor Vehicle at Bungower Road Somerville Victoria 22 August 2007.

424 Coroner Jacinta Heffey, Finding into Death without Inquest, Anthony Massaria, Case No 3881/06.

425 Coroner Jacinta Heffey, Finding into Death with Inquest, Kay Stanley, Case No 417/08.

3.3.2.18 In the coronial investigation of the death of Fiona Smart, the investigating police officer noted that the locomotive's Leslie RSN 5-chime air horn could barely be heard at 70 metres when the windows of his car were closed.

3.3.2.19 Therefore, the Leslie RSN 5-chime air horn was not loud enough or did not have characteristics that would alert Mr Scholl, Mrs Smart, Mr Gordon, Mr Massaria, Ms Stanley, Mr Young, Mr Angel or any other driver who was distracted or otherwise unaware of the train's approach.

3.3.2.20 Accordingly, the volume and other characteristics of the Leslie RSN 5-chime air horn can not be relied on as a safety measure to alert road vehicle drivers that a train is approaching the level crossing.

3.3.2.21 Further, in the circumstances of Mr Young's death, the Office of the Chief Investigator recommended that the train operator, Connex, amend the Book of Rules and Operating procedures to specify the length of time which locomotive and train drivers must sound their horns when approaching a level crossing.[426]

3.3.2.22 However, in the circumstances of Mr Gordon's death, the Leslie RSN 5-chime air horn was sounded continuously about 10 seconds from the whistle board 400 metres before the level crossing without alerting Mr Gordon to its approach.

3.3.2.23 Therefore, the issue seems to be the characteristics of the sound emitted by the Leslie RSN 5-chime air horn rather than the time that it sounds.

3.3.2.24 In particular, 12 of the 13 road vehicle drivers included in this cluster of fatal level crossing collisions failed to respond to the Leslie RSN 5-chime air horns on the locomotives in time to stop or at all.

3.3.2.25 Similarly, in the United States, 55 out of 60 trains involved in level crossing fatalities sounded their horn prior to impact but only four of 14 road vehicle drivers reported hearing the horn. Eight of the drivers who did not hear the horn reported being distracted by internal or external sounds.[427]

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426 Office of the Chief Investigator, Rail Safety Investigation Report No 2007/10, Level Crossing Collision Connex Passenger Train 8504 with a Motor Vehicle at Bungower Road Somerville Victoria 22 August 2007.

427 Michelle Yeh and Jordan Multer, "Driver Behavior at Highway-Railroad Grade Crossings: A Literature Review from 1990–2006", U.S. Department of Transportation Federal Railroad Administration, October, 2008.

3.3.2.26 Deputy State Coroner Graham Johnstone also found that of the six of the road vehicle drivers in the seven fatal level crossing incidents he investigated in 1989 failed to hear the train horn.[428]

3.3.2.27 The failure of the Leslie RSN 5-chime air horn to alert drivers to the presence of on-coming trains was explained in the inquest into the Kerang train crash as a consequence of its intended role. Tom Sargant, Deputy Director of Public Transport Engineering and Asset Management at the Department of Transport, told the Court that the train horn is designed as a safety measure for pedestrians crossing the railway line at level crossings rather than a warning for road vehicle drivers approaching the level crossing.

3.3.2.28 However, there is not necessarily any reason to limit the safety benefits of train horns. In circumstances where a vehicle driver fails to respond to railway crossing warning signs preceding a passive level crossing and the train is not visible to the driver until it is too late for the vehicle to stop in time, the train horn is another important way of raising the road vehicle driver's awareness of its approach.

3.3.2.29 Further, train drivers' use of the horn when they anticipate a collision indicates that they do not perceive its role is limited to pedestrians.

3.3.2.30 The effect of the train horn on road vehicle drivers' awareness of an approaching train may be influenced by a number of factors including the frequency with which it is sounded, the period of time it is sounded, the nature of the sound, the loudness of the sound and the road vehicle drivers' capacity to hear the sound emitted.

3.3.2.31 In his 1989 investigation, Deputy State Coroner Graham Johnstone recommended installation of a louder emergency train horn that would be linked to operation of the train's emergency braking system. The Department of Transport rejected this recommendation in favour of mandatory ditch lights on locomotive.

3.3.2.32 Without suggesting that ditch lights are ineffective in increasing conspicuity of the train, they do not replace the potential role for better audible warnings of trains approaching level crossings.

3.3.2.33 Emergency services have developed and continue to improve the way in which their sirens and horns impinge on drivers' consciousness even in built up areas.

3.3.2.34 Transport Safety Victoria could use the experience of emergency services in developing horns and sirens with directed varying sounds to extend the usefulness of train horns and increase the likelihood of driver awareness of an approaching train.

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428 Margaret Campbell, 17 March 1989; Michael Welsh, 7 May 1989; Lyle Staehneke, 25 May 1989; Ionnis Karagiannis, 19 June 1989; Richard Church & Sally Tracey 20 June 1989; John Shrubsole, 18 July 1989; Alfred Malia, 20 July 1989.

3.3.2.35 Accordingly, Transport Safety Victoria investigate the way in which directed sounds from horns and sirens can be used to increase the conspicuity of locomotives in regional areas and increase the likelihood of road vehicle drivers' awareness of an approaching train. **Recommendation 8**

3.3.3 Effectiveness of cnrrent level crossing infrastructure

3.3.3.1 Mr Scholl and four of the other drivers in the cluster of fatal level crossing collisions also failed to respond to active level crossing lights and other Australian Standard AS1207.7-2007 compliant level crossing infrastructure.[429]

3.3.3.2 However, Kerang level crossing was the only one of these five level crossings still fitted with flashing incandescent red-filtered lights. The others were fitted with LEDs.

3.3.3.3 Further two of these other level crossings were fitted with boom gates as well as flashing lights.[430]

3.3.3.4 A combination heavy vehicle that has the minimum permitted deceleration capability and is braked to a stop from 100kph will require a stopping distance of 138 metres. At 60kph, the minimum stopping distance is 49.6 metres.[431] Longer stopping distances may be required because of tyre lock of some wheels of the semi-trailer but optimum retardation force occurs before the tyres lock up.[432]

3.3.3.5 Further, Dr Hart said that most of the effective deceleration occurred in the first seconds of braking before the brakes seized up.

3.3.3.6 Therefore, Mr Scholl became aware of the train when his semi-trailer was about 90 metres from the Kerang level crossing. This was about 40 metres and 1.5 seconds too late for the semi-trailer to be able to stop before it entered the Kerang level crossing.

3.3.3.7 Put another way, if he had been alerted to the approaching train two seconds earlier, Mr Scholl would have been able to avoid the collision in which 11 passengers died.

3.3.3.8 In circumstances where heavy vehicles are likely to create the greatest risk of severe and/or fatal injuries to train passengers, it is particularly important that cues to make all road

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429 Geoffrey Young Case No. 3307/07; Coroner Jacinta Heffey, Finding into Death with Inquest, Kay Stanley, Case No 417/08; Jillian McCormack Case No. 5159/08 Coroner Jacinta Heffey, Finding into Death with Inquest, Mark Winter, Case No 3471/09.

430 Jillian McCormack Case No. 5159/08 Coroner Jacinta Heffey, Finding into Death with Inquest, Mark Winter, Case No 3471/09.

431 Peter Hart, "Kerang Train Crash Inquest Braking Capability of the Truck", 12 May 2011. This is the inherent capability and does not include distance travelled whilst the driver reacts to the command to stop. The requirement applies irrespective of the load level.

432 Peter Hart, "Kerang Train Crash Inquest Braking Capability of the Truck", 12 May 2011. This is the inherent capability and does not include distance travelled whilst the driver reacts to the command to stop. The requirement applies irrespective of the load level.

vehicle drivers aware of an approaching train have effect on heavy vehicle drivers early enough for them to be able to respond safely.

3.3.3.9 The infrastructure at Kerang level crossing on 5 June 2007 could not achieve this purpose for the following reasons:

- The speed limit on the approach was 100 kph;
- The right hand curve preceding the level crossing allowed semi-trailer drivers only 0.5 seconds to see and respond to flashing red lights and other infrastructure indicating a train was approaching to avoid a collision;
- The flashing red filtered incandescent lights were focussed at car drivers and would never have been within the focus of semi-trailer drivers;
- The red filtered incandescent light bulbs had not been replaced by or upgraded to LEDs which are more conspicuous;
- Mr Scholl looked but did not see the red lights flashing and therefore presumed that no train was approaching.

3.3.3.10 The infrastructure at the Kerang level crossing now includes boom gates, flashing red LEDs, electronic bells, rumble strips, warning signs and road markings consistent with the standards applied under Australian Standard AS1207.7-2007.

3.3.3.11 Further, the speed limit approaching the crossing is reduced to 80 kph. This change was applied to all level crossings on arterial roads in Victoria with an approach speed greater than 80 kph that were operational at the time of the speed reduction project. The State Government directed VicRoads to undertake the speed limit reductions following the collision.

3.3.3.12 Decisions like those made after the Kerang level crossing incident on 5 June 2007 to implement multiple countermeasures at the same time create difficulty is assessing the relative effectiveness of each one in improving road vehicle drivers' awareness of an approaching train and/or preventing collisions.

3.3.3.13 Now, all of the flashing red-filtered incandescent light RX-5 assemblies at level crossings in Victoria are fitted with LEDs. The maximum luminosity of these lights is now specified by Victorian Rail Industry Operators Group Standard 012.7.20.[433]

3.3.3.14 I have attempted to review the information available to me about evaluation of components of the current suite of level crossing infrastructure in Victoria. I acknowledge that there is likely to be further information available from other jurisdictions.

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433 Victorian Rail Industry Operators Group Standard VRIOGS 012.7.20, "Flashing Light Units" 6 November 2009.

3.3.3.15 One function of the infrastructure at a level crossing is to prevent or reduce the risk of collisions between trains and road vehicles.

3.3.3.16 Therefore, level crossing infrastructure is designed to alert road vehicle drivers that they are approaching a level crossing and there may be a train on the line.

3.3.3.17 The current suite of level crossing infrastructure includes passive and active components:

- Passive level crossing infrastructure includes speed limits, Stop signs or Give Way signs, road markings, warning signs and rumble strips.
- Active infrastructure includes warnings activated by the approaching train, that is flashing red lights, bells and boom gates as well as some or all of the passive infrastructure.

3.3.3.18 On 5 June 2007, the Kerang level crossing was fitted with a suite of passive level crossing warnings and with active flashing red filtered incandescent light and bells. It had no boom gates. These warnings were insufficient to alert Mr Scholl that a train was approaching until it was too late for him to avoid a collision.

3.3.3.19 He was not alone. Eleven of the other road vehicle drivers in this cluster of fatal level crossing incidents were not aware that a train was approaching. Mr Angel also became aware of the train when it was too late to stop.

3.3.3.20 Further, in 2008, a survey of drivers who cross level crossings reported that one in five have travelled over a level crossing and not realised until after they had crossed.[434] Therefore, even in the absence of a subsequent collision, level crossing infrastructure does not always alert drivers to the approaching level crossing.

3.3.3.21 Further, in circumstances where a suite of level crossing upgrades is implemented at the same time, it is also difficult to attribute effect to particular components of the programme.

3.3.3.22 In 2010, the Victorian Auditor General reviewed the management of safety risks at level crossings.[435] He advised that the Department of Transport has not adequately assessed treatments before their deployment or, once deployed, evaluated them. This means it has only a partial understanding of the realised benefits.

3.3.3.23 Mr Sargant told the Court that he took exception to the Auditor General's observation. Mr Sargant said the Auditor General had taken the Department's review of available infrastructure out of context:

"we try very hard on every single thing we do to evaluate what we've done to see

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434 K Taylor, "Addressing road user behavioural changes at railway level crossings", Joint ACRS-Travelsafe National Conference, 2008

435 Victorian Auditor-General's Office, "Audit summary of Management of Safety Risks at Level Crossings", Parliament of Victoria, 24 March 2010.

*whether it's (*working*).*"

3.3.3.24 As Monash University researchers have understood, it is not sufficient to just warn drivers that there is a level crossing ahead. The first priority for safety related level crossing infrastructure is to warn road vehicle drivers that a train is approaching the level crossing and the road vehicle driver is at risk.[436]

3.3.3.25 By definition, this priority has also not been achieved in the circumstances of the 13 unintentional fatal level crossing collisions which are the focus of this coronial investigation of 27 level crossing deaths in Victoria between 2002 and 2009.

3.3.3.26 None of the information presented to me includes specific reference to the countermeasure's capacity to alert road vehicle drivers to the presence of an approaching train.

3.3.3.27 Accordingly, I recommend that Transport Victoria and VicRoads extend their development and evaluation of new level crossing countermeasures with specific reference to the countermeasure's capacity to alert road vehicle drivers to the presence of an approaching train. **Recommendation 9**

3.3.4 The standards for level crossing infrastructure

3.3.4.1 Level crossing standards are intended to ensure that the level crossing infrastructure is capable of performing its task of preventing level crossing collisions.

3.3.4.2 In Australia, level crossing infrastructure is required to comply with Australian Standard AS1742.7-2007, Rail Industry Safety and Standards Board standards, Public Transport Corporation Infrastructure Division Signalling Design and Documentation Version 1.1[437] and codes of practice for the rail industry and Austroads Part 4, Guide to Traffic Engineering Practice Series, Investigation and treatment of crash locations including countermeasures for Railway Level Crossing Crashes.

3.3.4.3 Although an audit in 2008, showed that 93% of level crossings in Victoria failed to comply with Australian Standard AS1742.7-2007[438], all of the level crossings in this cluster of fatal level crossing collisions generally complied with the requirements of Australian Standard AS1742.7-2007.

3.3.4.4 Further, in circumstances where 12 out of 13 road vehicle drivers involved in this cluster of fatal level crossing collisions were unaware that a train was approaching in time to prevent

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436 J. Edquist, K. Stephan, E. Wigglesworth & M. Lenne, "A Literature Review of Human Factor Safety Issues at Australian Level Crossings", Monash University Accident Research Centre, February 2009.

437 Specification ENG-SE-SPE-0001.

438 Ernst & Young, Australian Level Crossing (ALCAM) Assessment Model: Victorian Data Summary Version 1.1., VicTrack, 21 February 2008.

the collision, there is no evidence that non-compliant level crossing infrastructure contributed to the collision.

3.3.4.5 However, inversely, this also means that the standard infrastructure supported by Australian Standard AS1742.7-2007 was ineffective in preventing the 13 fatal level crossing collisions.

3.3.4.6 By its nature, the Australian Standard AS1742.7-2007 is concerned more about road drivers becoming aware that they are approaching a level crossing rather than that a train is approaching.

3.3.4.7 In Victoria, the accredited rail operator and the relevant road authority are required to ensure that the level crossing infrastructure complies with the Australian and Victorian standards and Codes of Practice and the *Rail Safety Act* 2006 which requires it to be safe "So far as is reasonably practical".

3.3.4.8 These requirements do not always coincide. For example:

- The formula in Australian Standard AS1742.7-2007 for sighting distances was inadequate for very large vehicles. [439] This has now been corrected.

- State Codes of Practice[440] required flashing red-filtered incandescent lights to be focussed at a distance from the level crossing that is appropriate for car drivers. This investigation has found that this focus point the may interfere with the lights' capacity to influence heavy vehicle combination drivers. Incandescent lights in flashing lights at level crossings in Victoria have now been replaced by LEDs.

- Australian Standard AS1742.7-2007 does not specify a standard emission level for light sources within the active light warnings or reference alternative standards that apply to the strength of light sources. Further, LEDs do not require this focussing but are their maximum luminosity is now specified by Victorian Rail Industry Operators Group Standard 012.7.20.[441]

- The road markings and other infrastructure for level crossings on a side road does not include a requirement for a left turn slip lane on the main road. [442] In circumstances where neither Mr Murphy nor Mr Winter was aware of the train in

439 Australian Transport Safety Bureau, "Level Crossing Collision between The Ghan Passenger Train (1AD8) and a Road-Train Truck, Ban Ban Springs, NT, 12 December 2006", 13 Feb 2008.

440 Public Transport Corporation Infrastructure Division Signalling Design and Documentation Version 1.1, Specification ENG-SE-SPE-0001.

441 Victorian Rail Industry Operators Group Standard VRIOGS 012.7.20, "Flashing Light Units" 6 November 2009.

442 Adam Dunning, Case No. 3174/02; Adrian Kiely, Case No. 3175/02; Ian Pettersen, Case No. 3176/02; Coroner Jacinta Heffey, Finding into Death with Inquest, Mark Winter, Case No 3471/09.

time to stop, a left turning slip lane would force road vehicles to make a tighter left hand turn when railway line runs parallel and close to a major highway. In the absence of sight limitations, this would allow turning drivers the opportunity to see the approaching train and stop before entering the level crossing.

3.3.4.9 In circumstances where all flashing red-filtered incandescent lights have been replaced by LEDs, I make no recommendation in relation to the standard for flashing red-filtered incandescent lights.

3.3.4.10 However, I recommend that Standards Australia review Australian Standard AS1742.7-2007 to include advice in relation to left turn slip lanes where level crossings are on side roads and specifications for light emitting diodes ("LEDs") in flashing red light infrastructure. **Recommendation 10**

3.3.4.11 Australian Standard AS1742.7-2007 is only updated every ten years or when the relevant Australian Standards Committee believes it is necessary. This means that it is always providing standards retrospectively and must by its nature be considered as a minimum rather than median standard for level crossing infrastructure.

3.3.4.12 In circumstances where the rail and road authorities rely heavily on compliance with Australian Standard AS1742.7-2007 and other State and Federal to assess whether their level crossings are appropriately protected, I recommend that Standards Australia implement a schedule of more frequent routine reviews of Australian Standard AS1742.7-2007 for currency and compatibility with new infrastructure and technology. **Recommendation 11**

3.3.5 Responsibility for level crossing infrastructure

3.3.5.1 Railway lines are established on State land and are a State responsibility. However, the Commonwealth Government has an over-arching role in directing rail safety policy and investigating level crossing collisions.

3.3.5.2 For example, Ministers for Transport in all Australian States are members of the Standing Council on Transport and Infrastructure (previously the Australian Transport Council).

3.3.5.3 In Victoria, the *Rail Safety Act* 2006 came into operation on 1 January 2007.

3.3.5.4 Section 11 of the *Rail Safety Act* 2006 included:

> ***"Objects and principles of rail safety***
>
> *(1) The objects of this Act are to promote—*
>
> *(a) the safety of rail operations;*
> *(b) the effective management of safety risks in rail operations;*

(c) continuous improvement in rail safety management;

(d) public confidence in the safety of rail transport;

(e) the involvement of relevant stakeholders in rail safety."

3.3.5.5 Therefore, level crossing infrastructure safety was and continues to be acknowledged as an important issue in risk management of rail operations in Victoria. [443]

3.3.5.6 Within this legislation, primary legal responsibility for the safety role implied by level crossing infrastructure lies with Victorian Rail Track Corporation ("VicTrack") because they own the railway land, VicRoads because they own the land around main highways and other specified roads, and local municipalities who are responsible for minor roads in their regions.

3.3.5.7 Each of these three primary Government agencies has delegated some or all of its level crossing safety roles to secondary agencies.

3.3.5.8 Responsibility for managing the risks at level crossings in regional Victoria is now documented in a series of contractual agreements and leases involving VicTrack, the Director of Public Transport, V/Line Passenger Services Pty Ltd and railway operators.

3.3.5.9 Accordingly, responsibility for level crossing safety infrastructure in Victoria is complicated by several levels and differences in responsibility and by Victorian Government commitments to National programmes.

3.3.5.10 As I understand it:

- VicRoads or the Relevant Road Authority is responsible for funding planning and design of upgrading, widening and rehabilitation of a length of road through a level crossing.
- The relevant highway authority is responsible for level crossing signs, road markings and visibility of road approaches. 444
- Road authorities are responsible for visibility issues arising for approaching vehicles. These differ for roads of different status. Local roads are the responsibility of the local road authority.
- The regional council is the responsible road authority for 1370 level crossings, VicRoads is the responsible road authority for 243 level crossings, Council and

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443 See also: Department of Transport Victoria, "Rail Level Crossing Safety", February 2010.

444 Traffic engineering Manual Vol 1, Chapter 11 – Edition 3, December 1999, 11.2, Level crossing Responsibilities.

Vicroads accept joint responsibility for 350 level crossings and four are on private land.445

3.3.5.11 Further, from a practical viewpoint:

- VicTrack is responsible for physical work performed on land within 2.1metres of the rails.[446]
- VicTrack is party to three head leases for rail corridors which leases the land to the Department of Transport through the Director of Public Transport.[447]
- There are no enforcement provisions in the Head leases.
- VicTrack is not party to the infrastructure leases to rail operators [448] but is a party to the amendments.[449]
- The Department of Transport leases the railway land to the accredited rail operator.
- VicTrack is responsible for maintenance of level crossing warning devices. [450]
- VicTrack has delegated responsibility to the accredited rail operator for the associated infrastructure including level crossing signals in the lease arrangements.
- The accredited rail operator contracts the maintenance of the level crossing signals to a maintenance company.

3.3.5.12 Further, the general hierarchy of responsibility for rail safety issues outlined so far is not necessarily applied in practice.

3.3.5.13 For example, Mr Furnell told the Court that delegations of authority from the Department of Transport to the rail operators do not apply to decisions about upgrades of level crossings. In evidence, he said:

> *"VicTrack, essentially, manages the ALCAM process on behalf of the Department more or less as a contractor to the Department. And it's tied in with its role in managing the upgrade program."*

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445 Ernst & Young, Australian Level Crossing (ALCAM) Assessment Model: Victorian Data Summary Version 1.1., VicTrack, 21 February 2008.

446 Traffic engineering Manual Vol 1, Chapter 11 – Edition 3, December 1999, 11.2, Level crossing Responsibilities.

447 Greg Holt, Chief Executive, VicTrack in a letter to Mr R Willis, Secretary, Select Committee on Public Land Development, Parliament House dated 13 February 2008.

448 Greg Holt, Chief Executive, VicTrack in a letter to Mr R Willis, Secretary, Select Committee on Public Land Development, Parliament House dated 13 February 2008.

449 E.g. Regional Infrastructure Lease Amendment Deed (No 5), the Director of Public Transport, V/Line Passenger Pty Ltd and Victoria Rail Track, 27 November 2009. but not Regional Infrastructure Lease Amendment Deed (No 1) 29 May 2008

450 Traffic Engineering Manual Vol 1, Chapter 11-Edition 3, December 1999, 11.2, Level crossing Responsibilities.

3.3.5.14 Accordingly, this allocation of responsibility is not always clear. For example:

- VicRoads was only responsible for State Highways. However, VicRoads completed a Serious Accident Report on all fatal incidents. Further, it accepted responsibility for determining compliance with AS1742.7-2007 at all passive controlled rail level crossings, at least in the VicRoads Northern Region.[451]
- Loddon Shire Council installed an advanced automatic warning sign on the western approach to the Hockings Road level crossing because it was hard to view as there were several large trees and a house near the crossing. The accredited rail operator Pacific National, had previously inspected the site and determined it complied with the current standard.[452]

3.3.5.15 Further, in her investigation of the death of Mark Winter, Coroner Jacinta Heffey noted that there is sometimes difficulty in identifying the physical limits of the responsibility for maintenance around a rail line.[453]

3.3.5.16 For example, vegetation that is not on the rail reserve is the responsibility of the road authority. The road authority sub-contracts the work to another agency. However, the rail operator must notify the road authority if they vegetation is interfering with the visibility of train and road vehicle drivers.

3.3.5.17 As the Municipal Association of Victoria commented:

> *"It became apparent that the responsibilities of road and public transport operators at road and rail interfaces are not entirely understood and that demarcation issues need to be formally resolved."*[454]

3.3.5.18 In 2003, the Government created the Victorian Railway Crossing Safety Steering Committee comprised of Chief Executives or General Managers from the: Department of Transport, Public Transport Division; VicTrack; VicRoads; Municipal Association of Victoria (representing all Local Government Road Authorities in Victoria); Chief Commissioner of Police, and V/Line. The Office of the Director of Public Transport Safety Victoria attended as an observer. The Victorian Railway Crossing Safety Steering Committee also has several sub-committees.

3.3.5.19 In the year leading up to 5 June 2007, these organisational matters were further complicated by changes in the leases to and accreditation of the rail operator in regional

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451 Mal Kersting, Regional Director- Northern Region, VicRoads, in a letter to S/C David Hockey dated 6 June 2008 in relation to the death of Nelson.

452 Daniel Lloyd, Technical/GIS Officer infrastructure, Loddon Shire, letter to Dave Hockey, 8 April 2008. on Smart file

453 Coroner Jacinta Heffey, Finding into Death with Inquest, Mark Winter, Case No 3471/09.

454 The Municipal Association of Victoria, "Rail Safety Improvement Project: Progress Report", October 2008.

Victoria. These changes have particular relevance to the level crossing infrastructure at the Kerang level crossing.

3.3.5.20 In 2006, the Department of Transport notified Pacific National that it intended to buy back the lease of the intrastate infrastructure which included the Swan Hill to Southern Cross Station line. The final transfer was completed on 4 May 2007.

3.3.5.21 As already discussed, the flashing red filtered incandescent lights at the Kerang level crossing were not replaced by LEDs during this transition period because of demarcation issues around whether replacing the flashing red-filtered incandescent lights with LEDs was a maintenance issue or an upgrade issue.

3.3.5.22 This failure to accept responsibility for the work led to failure to replace the flashing red-filtered incandescent lights with LEDs or otherwise respond to reported near misses at the Kerang level crossing during the year before 5 June 2007.

3.3.5.23 Further, on 4 May 2007, the Victorian Government completed the transfer of the Regional Network and Access business from Pacific National. Most employees and all inventory, records and files relating to network management as well as plant & equipment items were transferred to a State owned company, V/Line Passenger Pty Ltd ("V/Line").[455] V-Line already ran the above rail passenger business on the Swan Hill to Southern Cross line.

3.3.5.24 This meant that V/Line management took over the Train Control one month before the Kerang fatal level crossing incident. As is discussed in the Emergency Response section of this coronial investigation, this lack of experience also seems to have influenced their capacity to respond and manage the immediate aftermath and support their on-train staff.

3.3.5.25 The complexity of previous transport arrangements in Victoria has been recognised by the *Transport Integration Act* 2010.

3.3.5.26 The prime purpose of this legislation is to drive collaboration and consistency across government in transport and land use decisions and activities. This is achieved by:

- requiring transport bodies and key non-transport bodies to have regard for the objectives and decision-making principles of the Transport Integration Act 2010;
- requiring planning to be undertaken in line with this policy framework;
- establishing transport bodies under one piece of legislation, with a common goal to work together to foster greater integration and sustainability.

3.3.5.27 In particular, section 142 of the *Transport Integration Act* established The Transport Corporation which integrates:

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455 V/Line Annual Report 2006-07, p. 65.

- The Linking Melbourne Authority;
- The Victorian Rail Track;
- The V/Line Corporation;
- The Port of Melbourne Corporation; and
- The Victorian Regional Channels Authority.

3.3.5.28 Further, from 2 April 2012, Transport Safety Victoria has performed the functions formerly undertaken by a number of different bodies, including the Director of Public Transport and some of the operational functions previously undertaken by the Department of Transport.

3.3.5.29 Accordingly, to the extent that the Department of Transport previously attempted to devolve responsibility for the maintenance and safe operation of level crossings to accredited rail operators under their infrastructure leases, this legislation now makes it clear that ultimate responsibility for enforcement of the safety responsibilities of the rail operators lies with Transport Safety Victoria.

3.3.5.30 Tom Sargant was the Deputy Director of Public Transport Engineering and Asset Management at the Department of Transport. Mr Sargant told the Court that Victrack remains responsible for maintaining the condition of the infrastructure. However, in terms of its current safe operation he explained:

> *"That's a subject of the Rail Safety Act which is directly a matter between the operator and TSV (Transport Safety Victoria)."*

3.3.5.31 I note that VicRoads is not included in the Transport Corporation. I also note that communication between VicRoads and previous level crossing management arrangements appears to have been inconsistent in relation to their involvement in ALCAM assessments and development of innovative train warning systems (see below).

3.3.5.32 Therefore, I encourage the Transport Safety Victoria and VicRoads to establish formal cooperative arrangements in relation to predictive risk assessment of level crossings and prioritisation of upgrades and development of innovative train warning systems. **Recommendation 12**

3.3.5.33 I also note that Austroads,[456] Dr Johnston,[457] Monash University researchers,[458] the House of Representatives Standing Committee on Infrastructure, Transport, Regional

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456 Peter Cairney, Thanulla Gunatillake & Eric Wigglesworth, "Reducing collisions at passive level crossings in Australia", Austroads publication No. AP-R208/02, Sydney 2002.

457 Ian Johnston, "Expert Report for use as evidence in a series of inquests into deaths at level crossings in Victoria between 2006 and 2009", prepared at the request of Transport Safety Victoria by Ian Johnston Transport Safety Pty Ltd, 5 July 2011.

Development and Local Government[459] and the Australian Transport Safety Bureau[460] have all recommended improved data collection and a National data base has been established.

3.3.5.34 In January 2013, the National Rail Safety Regulator accepted responsibility for rail safety in Victoria under the Rail Safety National Legislation, supporting regulations, guidelines and policies. This legislation imposes statutory responsibilities for safety of rail operations on accredited rail operators which parallel the existing contractual and lease arrangements.

3.3.5.35 Under this arrangement, the National Rail Safety Regulator expects to operate through Transport Safety Victoria.[461]

3.3.5.36 Further, the Australian Transport Safety Bureau has assumed primary responsibility for rail investigations across Australia as part of a broader national transport reform process. The Australian Transport Safety Bureau already investigate major transport safety events using adaptations of root cause analysis advocated by Dr Reason.[462]

3.3.5.37 Therefore, I recommend that Transport Safety Victoria cooperate with the National Rail Safety Regulator in establishing a system for undertaking and analysing the results of root cause analyses for fatal level crossing collisions to better inform improvements in level crossing infrastructure and level crossing safety. **Recommendation 13**

3.3.6 Predictive risk assessment of level crossings and prioritisation of upgrades

3.3.6.1 In Victoria, the State Budget allocates a specific amount of money each year to upgrading level crossings. In 2009, further infrastructure upgrades to 29 level crossings in Victoria were announced in the Commonwealth Government Economic Stimulus Package.

3.3.6.2 Upgrade of a passive level crossing fitted with Give Way or Stop signs and appropriate level crossing warnings to active level crossings with flashing lights, bells and boom gates

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458 J. Edquist, K. Stephan, E. Wigglesworth & M. Lenne, "A Literature Review of Human Factor Safety Issues at Australian Level Crossings", Monash University Accident Research Centre, February 2009.

459 House of Representatives Standing Committee on Infrastructure, Transport, Regional Development and Local Government, "Level Crossing Safety: An Update of the 2005 Train Illumination Report", Canberra, June 2009

460 Australian Transport Safety Bureau, *Annual Review 2006*

461 See for example, Transport Safety Victoria, "Regulatory Approach Policy", State Government of Victoria 2011.

462 e.g. James Reason, "Human error: models and Management", British Medical Journal 328 (2000) 768; J. Reason. 1990, Human Error, (Cambridge University Press: Cambridge); J Reason. 1997, Managing the Risks of Organisational Accidents, (Ashgate Publishing Limited: Aldershot) adopted by Australian Transport Safety Bureau, "Level Crossing collision between Steam Passenger Train 8382 and a Loaded B-Double Truck-Benalla Victoria 13 October 2002", Rail Safety Investigation 2002/003, September 2004.

can cost up to $500,000 depending on who is responsible for the work and who bears the costs.[463]

3.3.6.3 The Department of Transport allocates level crossing funding to passive level crossings according to a priority determined by assessment of predictive risk factors according to a the Australian Level Crossing Assessment Model (ALCAM) approved by the National ALCAM Model Development Committee and then application of business rules agreed by the Victorian Railway Safety Crossing Safety Steering Committee.

3.3.6.4 The Municipal Association of Victoria and VicTrack also encourage municipalities to use ALCAM data as a risk assessment tool rather than an indisputable guide to prioritising their contribution to the consultative process around level crossing upgrades.[464]

3.3.6.5 Mr Furnell told the Court that upgrade of level crossings which already have boom gates was determined outside the ALCAM process and is funded separately.

3.3.6.6 Further, low cost treatments such as vegetation clearance are considered to be maintenance rather than upgrade processes. Therefore, they are outside the risk assessment process and become the responsibility of the accredited rail operator or the municipal council.

3.3.6.7 Between 1996 and 2005, funding allowed upgrade to active protection of 8-10 rail/road level crossings a year. Additional crossings were upgraded as part of the Regional Fast Rail project.[465]

3.3.6.8 Over the 2007-2008 year, 45 crossings were completed under the program and one pedestrian crossing managed by the Department of Transport. This compares with 37 and 20 crossing upgrades managed by VicTrack over the previous two years respectively.

3.3.6.9 Similarly, during the 2008-2009 year, VicTrack upgraded 45 level and pedestrian crossings and installed automatic advance warning signs at 22 level crossing sites. VicTrack project managed tbe upgrade works on behalf of the Victorian and Australian Governments.

3.3.6.10 All but two[466] of the level crossings involved in this review of 12 fatal level crossing incidents had been assessed as low risk and were not subject to consideration for upgrading.[467]

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463 Victorian Auditor-General's Office, "Audit summary of Management of Safety Risks at Level Crossings", Parliament of Victoria, 24 March 2010.

464 The Municipal Association of Victoria, "Rail Safety Improvement Project: Progress Report", October 2008.

465 Jim Betts, Director of Public Transport, letter to Detective Sergeant G Rumble, 8 February 2007.

466 Coroner Jacinta Heffey, Finding into Death with Inquest, Kay Alexandra Stanley, Case No. 416/08, 23 August 2012;

467 VicTrack crossing upgrade program for 2007/2008 31 January 2008.

3.3.6.11 The New South Wales Independent Safety Regulator has also shown that ALCAM predictions in all States are almost inversely related to historical data, with it predicting higher crash rates for boom crossings than lower forms of protection.[468]

3.3.6.12 Therefore, from the perspective of predicting the likelihood of a fatal level crossing collision, the ALCAM system was flawed.

3.3.6.13 Mr Sargant agreed that, using this tool, the Kerang level crossing was near the bottom of the prioritisation list for upgrade. He also agreed that there was something going on at the Kerang level crossing that was not being picked up by ALCAM and the business rules.

3.3.6.14 This investigation has identified a number of reasons why decisions about level crossing upgrades based on the ALCAM algorithm of predictive risk assessment are unlikely to reduce the risk of fatal level crossing fatalities in Victoria. These include:

- Decision making systems in rail safety management;
- Assumptions underlying the variables used in the algorithm; and
- Data used in applying the algorithm.

Decision making systems in rail safety management

3.3.6.15 This coronial investigation of 13 fatal level crossing collisions, has confirmed the findings of the Road Safety Committee of the Parliament of Victoria in relation to level crossing infrastructure and the complexity of rail management:

> *"The Committee found that a major impediment to improving safety at crossings is the lack of clarity and the shared responsibility for safety by the different rail and road stakeholders."*[469]

3.3.6.16 In a joint submission to the Parliamentary Road Safety Committee Inquiry by then Department of Infrastructure, now Department of Transport, VicRoads, in association with the Victorian Railway Crossing Safety Steering Committee (Joint Submission), the Committee were advised that it is aware of the 'considerable confusion' regarding railway crossing safety responsibilities between the various stakeholders.

3.3.6.17 Mr Sargant also had difficulty explaining the advantages of having the lease of railway land from VicTrack to the Director of Public Transport and then a second lease from the Director to the accredited rail operator. He told the Court:

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468 New South Wales Independent Safety Regulator, "Traffic Flow and Collision Likelihood at Australian and NZ Level Crossings: Report for ALCAM Development Group", 5 August 2011.

469 Road Safety Committee, "Inquiry into Improving Safety at Level Crossings", Parliament of Victoria, December 2008.

"that's a question more around policy that was really set up in - prior to '99, it's really beyond what I can - what I can answer....

... so you could say that's a value add in that there's clear accountabilities for - the way I like to characterise it in a practical sense and I'm a civil engineer, not a lawyer, is that the - the short term day to day risk or day - of operation is squarely with the operator. The long term is with the State and as - as the time frames get - get closer, the - the - so the risk is - is slightly shared, so on a day to day operation decisions around day to day operation that's squarely with the - with the operator. A week, a year out, it's still primarily with the operator. Beyond that time frame the - the State needs to have a - has a part to - has a part to play. And so that - that's how - in a practical sense that's how the - the framework works. Also I might say that - that the VicTrack relationship adds - adds particular value around telecommunications, being a licensed telecommunication provider and things like that as well."

3.3.6.18 Further, this confusion in roles and responsibilities of the major stake holders was compounded in 2006 and 2007 when the Government was negotiating termination of the Pacific National lease of the regional infrastructure. Transfer of these responsibilities to V-Line Passenger Pty Ltd was completed on 4 May 2007 that is four weeks before the Kerang fatal level crossing collision.

3.3.6.19 During that year, Pacific National reported a number of near-misses at the Kerang level crossing to the Department of Transport and sought replacement of the flashing red-filtered incandescent lights to LEDs. Their request was refused as it was designated a maintenance issue and therefore within the purview of the lease contract that was undergoing rescission.

3.3.6.20 Other drivers in the cohort who failed to stop despite activated flashing red lights fitted with LEDs and no boom gates include Kay Stanley[470] and Geoffrey Young.[471]

3.3.6.21 Neither Ms Stanley nor Mr Young was driving a heavy vehicle combination. However, like Mr Scholl, both Ms Stanley and Mr Young were very familiar with the level crossing at which they died. Both were travelling at a different time from usual. There is no evidence that Mr Young was not looking in the direction of the level crossing.

3.3.6.22 Therefore, we will never know whether Mr Scholl would have seen the flashing lights in time to stop before he collided with the Swan Hill to train if the lights had been replaced by LEDs before 5 June 2007.

Assumptions underlying the variables used in the predictive risk assessment algorithm

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470 Coroner Jacinta Heffey, Finding into Death with Inquest, Kay Stanley, Case No 417/08.

471 Geoffrey Young Case No. 3307/07

3.3.6.23 Decisions about the implementation of further protection devices at level crossings have historically been prioritised using the ALCAM predictive risk assessment algorithm[472] and/or a risk assessment model developed by VicRoads.[473]

3.3.6.24 ALCAM was a computer-based nationally agreed algorithm which relied heavily on exposure and risk-related data. The data set used to predict risk of collisions at level crossings was agreed by the National ALCAM Model Development Committee.

3.3.6.25 The Court also beard from Simon Meiers about an alternative way of prioritising level crossings for upgrades: the Peabody-Dimmick program. This model has been developed in 1941 and reviewed for the National ALCAM Model Development Committee.

3.3.6.26 An investigation of how the Peabody Dimmick formula predicts crashes and near misses for passive and flashing light crossings, compared to ALCAM (without consequences), has been performed in Victoria. The results show the Peabody Dimmick algorithm predicted more of the crossings with crashes in the top 50 rates based on vehicle and train counts per day than did ALCAM.[474]

3.3.6.27 Peter Furnell was Manager Railway Crossing Safety, Public Transport Division in the Department of Transport. He took over the position from Mr Spicer.

3.3.6.28 Mr Furnell told the Court that the Peabody-Dimmick program had been evaluated and would be integrated with the ALCAM algorithm used in Victoria by the end of 2011. Preliminary manual analysis confirmed that the updated program provided better predictions of incidents, collisions and near misses at the top 50 level crossings without boom gate protection. They all had Give Way signs, Stop signs or flashing lights and bells. However, it was no better at predicting risk at level crossings protected by boom gates.

3.3.6.29 Further, Mr Furnell told the Court that the National ALCAM Model Development Committee has accepted the integrated model of exposure to be incorporated within the ALCAM model at a national level.

3.3.6.30 As well, Mr Furnell said that the Department of Transport had commissioned work to re-assess the indices of 'consequence of entry into the level crossing' data used in the updated ALCAM Peabody-Dimmick algorithm. In the original ALCAM program, these data included number of train tracks, proportion of heavy vehicles in the traffic count, school bus routes and road geography that could interfere with visibility. It did not include the

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472 Terry Spicer, Australian Level Crossing Assessment Model, 30 March 2007. See also V/Line Annual Report 2006-07, p. 8.

473 Terry Spicer, in a letter to The Coroner, Geelong Coroners Court dated 16 August 2007.

474 See New South Wales Independent Safety Regulator, "Traffic Flow and Collision Likelihood at Australian and NZ Level Crossings: Report for ALCAM Development Group", 5 August 2011.

level crossing history of adverse events. It did not include any indicator of the likely emergency response which we know can account for up to one third of fatal outcomes.

3.3.6.31 On its face, information provide to the Court to compare the ALCAM and Peabody-Dimmick algorithms suggests that about 80% of incidents reported at passive level crossings and crossings with flashing lights are near misses reported by train drivers and VicRoads collision and near miss data which is derived from police reported incidents.[475]

3.3.6.32 Mr Lidster told the Court that train drivers making the reports are not necessarily applying consistent criteria in their observations:

> *"reporting near misses depends on the attitude of the driver or the mental aspect of the driver as to whether it's - to some drivers a near miss, is 500 metres, a car moves on the crossing he jumps and calls it a near miss, whereas other drivers might be 50 metres away and one car has crossed(indistinct). All what he thinks of if he keeps going and doesn't report t so a near miss is up to the (driver)."*

3.3.6.33 However, the Court heard that Transport Safety Victoria now provides train drivers with standard reporting criteria for near misses. These include incidents where the train driver has taken or would have taken evasive action or activated the horn if he or she had time.

3.3.6.34 I also note that the Rail Industry Safety and Standards Board is developing a reporting procedure for near misses.[476]

3.3.6.35 Therefore, this data will increase the reliability of the reported incident numbers.

3.3.6.36 In 2011, the National ALCAM Model Development Committee commissioned a separate review of the ALCAM consequence model (the "2011 review") to advise on further development using an updated consequence matrix.[477] It is unclear whether this 2011 review is the same review that Mr Furnell alluded to.

3.3.6.37 I note that this 2011 review used New South Wales accident data because the Victorian data provided to the assessment contained insufficient detail to be useful. Further, it supplemented the New South Wales data with United Kingdom data about the approach speeds where accidents have occurred because New South Wales did not collect than information.[478]

3.3.6.38 The 2011 review assessed a number of characteristics of the level crossings that were not previously considered. These included train speeds, dangerous goods and secondary

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475 In the top 50 risk assessed level crossings using both the ALCAM and the Peabody-Dimmick algorithms.

476 Rail Industry Safety and Standards Board, Near Misses Reporting guideline, due to be implemented 1 June 2011.

477 Sotera Risk Solutions, "ALCAM Consequence model development", 28 January 2011.

478 Sotera Risk Solutions, "ALCAM Consequence model development", 28 January 2011.

collisions. Further, the 2011 review concluded that there were more variables that have a significant effect on the outcome of a level crossing collision than were envisaged when the ALCAM model was developed.

3.3.6.39 In particular, the 2011 review advised the National ALCAM Model Development Committee to revert to a formula based approach to predicting the likelihood of level crossing incidents because a matrix which included all the known significant variables would be too large to quantify.

3.3.6.40 The 2011 review modelling demonstrated that fatalities and injuries arising from a level crossing collision were strongly correlated with a number of factors not already included in the ALCAM model. These include:

- train speed,
- passenger train loading,
- passenger train proportion,
- escalation features[479] within 500 metres of the level crossing.

3.3.6.41 On the other hand, the number of train tracks is included in the ALCAM model but has only weak correlation to outcomes in the 2011 review modelling.

3.3.6.42 The 2011 review underlined the inadequacy of the level crossing data collection system in Victoria in its inability to use the incident data provided to it, the preference for New South Wales data sets and its need to supplement this information with English data to assist its work.[480]

3.3.6.43 Accordingly, the 2011 review recommended a simplified formula using a number of assumptions for estimating the consequences of level crossing collisions with a reasonable degree of accuracy. The formula predicted vehicle losses accurately with only 1% of crossings producing an error of more than 25%. On train and platform losses were less accurate.

3.3.6.44 To the extent that the 2011 review adds another perspective to predicting the consequences of collisions at level crossings and prioritising their upgrades, it has emphasised to me the difficulty faced by policy makers who must spend a large amount of money to prevent events that happen rarely but may be catastrophic when they occur.

3.3.6.45 The problem with insisting on importing a series of so-called 'risk factors' into an algorithm to predict the likelihood of collisions or other adverse events at level crossings is that, no matter how good the mathematical formula is at weighting the information

479 For example, points, platforms, underbridges, steep and medium embankments, tunnels and overbridges.

480 Sotera Risk Solutions, "ALCAM Consequence model development", 28 January 2011.

appropriately, the accuracy of the predictions it makes will always be limited by the relevance of the risk factors used in the analyses and the accuracy of the data collected to measure these risk factors.

3.3.6.46 As Dr Ian Johnston observed:

> *"Most experts have applied their general human factors knowledge to the level crossing situation to deduce what may be important. It is critical to stress the need for systematic research to assess whether what follows is an accurate picture and to test possible measures for their effectiveness in decreasing the likelihood of critical errors."* [481]

3.3.6.47 Therefore, the risk factors that are used to indicate propensity for collisions must be rigorously derived from systematic analysis of adverse events and the data reflecting these risk factors must be the most accurate available..

3.3.6.48 Further, the algorithm's predictive capacity is always measured by its failures rather than by its successes. In circumstances where adverse incidents are rare, it is impossible to say that the non-reporting of collisions or near misses at a particular level crossing that has been predicted to be low risk proves the prediction is correct.

3.3.6.49 For example, the accuracy with which the ALCAM, Peabody-Dimmick or any other system is capable of predicting risk remains highly dependent on exposure data, in particular road traffic counts and train traffic counts. Road safety history shows that exposure is the best predictor of collisions and, even better, same time exposure is required for the incident to occur at all.

3.3.6.50 The frequency of road vehicles and trains using the level crossing is an index of exposure to risk of a level crossing collision.[482] Accordingly, whatever system is used to analyse it, the accuracy of the road traffic data is crucial to predicting subsequent collisions.

3.3.6.51 This coronial investigation heard that vehicle numbers used to calculate the ALCAM scores for the Kerang level crossing in 2005 were based on estimates rather than objective evidence.

3.3.6.52 Further, on 2 November 2007, the ALCAM survey was repeated at the Kerang level crossing. On this assessment, the ALCAM score was assessed as 95 where scores over 350 attracted intervention.[483]

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481 Ian Johnston, "Expert Report for use as evidence in a series of inquests into deaths at level crossings in Victoria between 2006 and 2009", prepared at the request of Transport Safety Victoria by Ian Johnston Transport Safety Pty Ltd, 5 July 2011.

482 Mr Furnell also agreed that exposure as expressed by traffic counts was an important component of the ALCAM algorithm used to assess relative risk at level crossings.

3.3.6.53 However, this coronial investigation heard that the traffic counts used in the 2007 re-assessment of priorities using the ALCAM algorithm used vehicle numbers collected in surveys performed in 2004. Further, the composition of the traffic was unable to be detected from the data collection procedures used so that the proportion of heavy vehicles reported reflected the opinion of local VicRoads staff.

3.3.6.54 Similarly, a further ALCAM assessment performed in 2011 used the same traffic count data as had been used in 2007 and was collected in 2004.

3.3.6.55 Therefore, I also do not accept that the relative risks assessed for the Kerang level crossing and the other level crossings in Victoria in 2005, 2007 or 2011 were relevant to objective assessment of a priority list for allocation of funding for upgrades.

3.3.6.56 Stephen Brown, Executive Director of the Regional Services Division in VicRoads, explained that the road vehicle counts and distributions used in ALCAM rely on routine data that is routinely collected by VicRoads and regional municipalities.

3.3.6.57 Further, Mr Brown said that VicRoads staff usually knows what proportion of vehicles are carrying freight on specific roads. They also know that this proportion does not change much over time. Therefore, the heavy vehicle contribution to the ALCAM assessments is, at best, "anecdotal evidence".

3.3.6.58 For the purposes of predicting risk at individual sites, exposure as reflected by the number of road and rail vehicles using the crossing in a day or a week may be mitigated by separation in the times that these vehicles enter the level crossing. This data requires special road traffic counts over a number of days at each level crossing.

3.3.6.59 Similarly the mix of road vehicle types can change their drivers' capacity to see and respond to trains and level crossing infrastructure. For example, the view from a car driver's seat differs from the elevated view of a truck driver.

3.3.6.60 The stopping distance for cars is also very different from the stopping distance for laden heavy vehicle combinations. Therefore, the level crossing warning information needs to be placed to accommodate their different response times.

3.3.6.61 Therefore, the road vehicle counts and distributions used in ALCAM do not necessarily reflect current circumstances, they do not discriminate between vehicle types, they do not necessarily relate to the site of the level crossing but rather to the road on which the level crossing is placed and they are not necessarily comparable. If specific information is required, VicRoads has to undertake a specific traffic count. There is no evidence that this occurs.

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[483] By this time, the Kerang level crossing had been upgraded to include a speed limit of 80kph, rumble strips, automated advance warning signs and boom gates

3.3.6.62 VicRoads is represented on the Victorian Railway Crossing Safety Steering Committee. Therefore, I cannot understand why the Department of Transport has relied on traffic count data that was so demonstrably out of date and inadequate for the task of predicting risk at individual sites level crossing sites.

3.3.6.63 Similarly, other information required to populate the ALCAM and Peabody-Dimmick predictive risk algorithm relies on individual observations by Department of Transport staff or their delegates. This data is also not always accurate

3.3.6.64 For example, Coroner Saines found that VicRoads had incorrectly assessed the sight distances as good at the Barpinba-Poorneet Road level crossing near Wingeel.[484] Further, the fog at the level crossing on the morning of that collision interfered with the truck driver's capacity to see the train but was not included in the ALCAM assessment.

3.3.6.65 Further, I note that the information about sun glare entered into ALCAM in 2005, 2007 and 2011 surveys differed for the Kerang level crossing. It seems unlikely that this variable would change in any two year period although, of course, it would depend on the time and weather situation on the day observations were made.

3.3.6.66 The 2011 review also concluded that there were more variables that have a significant effect on the outcome of a level crossing collision than were envisaged when the ALCAM model was developed. These included train speeds, dangerous goods and secondary collisions.[485]

3.3.6.67 Therefore, to the extent that any predictive risk analysis relies on up to date accurate and detailed vehicle counts at individual level crossing sites, the primary data used by the Department of Transport to determine decisions about priorities for level crossing upgrades is flawed and must be corrected.

3.3.6.68 Therefore, I recommend that Transport Safety Victoria improve the accuracy, content and relevance of data used in predictive risk analysis used to inform decisions about upgrading of level crossings in Victoria. **Recommendation 14**

3.3.6.69 The ALCAM and Peabody-Dimmick algorithms do not include any information about adverse events at each level crossing.

3.3.6.70 Mr Spicer explained that this information was excluded from the ALCAM model because of the small numbers of incidents that occur at each level crossing and the unreliability of predictions that would result from its over-interpretation. I understand this argument.

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484 Jamie Webb, Case No. 1965/06, Finding of Ronald Saines.

485 Sotera Risk Solutions, "ALCAM Consequence model development", 28 January 2011.

3.3.6.71 However, it seems to me that, like coronial investigations, adverse events provide the opportunity for in-depth systematic investigation of the types of level crossing incidents that the ALCAM and Peabody-Dimmick algorithms are attempting to predict.

3.3.6.72 Good information about the variables contributing to collisions, near misses and other adverse events will better inform a predictive risk algorithm about the variables that it should use to assess future risk.

3.3.6.73 Austroads,[486] Dr Johnston,[487] Monash University researchers,[488] the House of Representatives Standing Committee on Infrastructure, Transport, Regional Development and Local Government[489] and the Australian Transport Safety Bureau[490] have also recommended improved data collection and a National data base has been established.

3.3.6.74 Since 1977, the aircraft industry has developed a well-recognised reputation for professional investigation of fatal and serious incidents. The model investigation techniques that have been developed for aviation adverse events have been adopted by other industries as diverse as health and accounting.

3.3.6.75 Similarly, this coronial investigation has identified a series of risk issues that aligned themselves to cause the Kerang fatal level crossing incident on 5 June 2007.

3.3.6.76 Further, the findings of this coronial investigation of 27 deaths arising from 12 level crossing collisions have largely restated those arising in Kerang and in previous enquiries into level crossing fatalities.

3.3.6.77 In particular, these circumstances include:

- All but three of the road vehicle drivers in this cohort were familiar with the level crossing.
- Road vehicle driver's not expecting to see a train;
- Non-compliance with Australian Standard AS1742.7-2007 did not contribute to any of these collisions; and
- The Kerang incident followed a series of reported near misses and prior incident not categorised as a rail incident because not train was involved.

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486 Peter Cairney, Thanulla Gunatillake & Eric Wigglesworth, "Reducing collisions at passive level crossings in Australia", Austroads publication No. AP-R208/02, Sydney 2002.

487 Ian Johnston, "Expert Report for use as evidence in a series of inquests into deaths at level crossings in Victoria between 2006 and 2009", prepared at the request of Transport Safety Victoria by Ian Johnston Transport Safety Pty Ltd, 5 July 2011.

488 J. Edquist, K. Stephan, E. Wigglesworth & M. Lenne, "A Literature Review of Human Factor Safety Issues at Australian Level Crossings", Monash University Accident Research Centre, February 2009.

489 House of Representatives Standing Committee on Infrastructure, Transport, Regional Development and Local Government, "Level Crossing Safety: An Update of the 2005 Train Illumination Report", Canberra, June 2009

490 Australian Transport Safety Bureau, *Annual Review 2006*

3.3.6.78 Prevention of any one of these factors would have saved the lives of 11 people on 5 June 2007. None of these factors is included in the ALCAM or Peabody-Dimmick algorithms to predict the likelihood of an adverse event at a level crossing.

3.3.6.79 In 2002, Austroads commissioned a review of passive level crossings. This review recommended that rail authorities collect data for level crossing incidents consistent with that already collected for road crashes.[491] In that report, they explained:

> *"Linking cross inventory data to other road systems and crash data will greatly increase the opportunities for understanding factors associated with railway level crossing crashes while reducing the time and cost for such studies. It would also simplify the identification of candidate crossings for upgrading or closure."*

3.3.6.80 In 2008, the Road Safety Committee of the Parliament of Victoria recommended:

> *"That the Department of Transport consolidates Victorian level crossing reportable data and regularly publishes up-to-date statistics that would assist rail and road authorities to gain a greater understanding of level crossing vehicle and pedestrian crashes to enable appropriate countermeasures."* [492]

3.3.6.81 In his report prepared for this coronial investigation, Dr Ian Johnston also commented on the inadequacy of the information collected by train authorities and recommended they adopt the same data collection system as used by road authorities. [493]

3.3.6.82 Accordingly and in particular, as a first stage, I recommend that the Australian Transport Safety Bureau, through the Transport Safety Victoria, trial the root cause analysis procedures advocated by James Reason[494] in their systematic analysis of rail incidents. This multi-factorial understanding of the interaction of contributing factors can then feed into their advice to rail operators and into the work of Transport Safety Victoria in allocating priority to level crossing upgrades. **Recommendation 15**

3.3.7 Innovative level crossing infrastructure

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491 Peter Cairney, Thanulla Gunatillake & Eric Wigglesworth, "Reducing collisions at passive level crossings in Australia", Austroads publication No. AP-R208/02, Sydney 2002.

492 Road Safety Committee, "Inquiry into Improving Safety at Level Crossings", Parliament of Victoria, December 2008.

493 Ian Johnston, "Expert Report for use as evidence in a series of inquests into deaths at level crossings in Victoria between 2006 and 2009", prepared at the request of Transport Safety Victoria by Ian Johnston Transport Safety Pty Ltd, 5 July 2011.

494 e.g. James Reason, "Human error: models and Management", British Medical Journal 328 (2000) 768; J. Reason. 1990, Human Error, (Cambridge University Press: Cambridge) ; J Reason. 1997, Managing the Risks of Organisational Accidents, (Ashgate Publishing Limited: Aldershot) adopted by Australian Transport Safety Bureau, "Level Crossing collision between Steam Passenger Train 8382 and a Loaded B-Double Truck-Benalla Victoria 13 October 2002", Rail Safety Investigation 2002/003, September 2004.

3.3.7.1 Improvements in level crossing safety cannot be viewed in isolation from general changes in highway safety and rail safety.

3.3.7.2 Reductions in drink-driving, advances in automotive technology such as braking, and improvements in the effectiveness of emergency medical response have as much effect at level crossings as they do at highway-highway intersections.

3.3.7.3 In the United States, this effect of general road vehicle-related safety initiatives on level crossing incidents and fatalities is estimated to be about twice the size of that due of the installation of active warning devices. [495] Trauma experts believe that about 35% of all deaths following road trauma are preventable or potentially preventable when appropriate trauma management systems are activated.[496]

3.3.7.4 Further, innovations in road infrastructure may have some application specifically to level crossings.

3.3.7.5 In May 2009, Monash University published a review of human factor issues involved in level crossing safety.[497] They identified a number of countermeasures directed towards the human contribution to level crossing fatalities. However, they also found that for most of these countermeasures there was little in the way of evaluation to support their widespread use. Accordingly, they noted that there is a need to establish a database to identify where the real problems at level crossings lie.

3.3.7.6 This failure to establish a comprehensive database of level crossing incidents has been noted by the 2011 review of ALCAM and by Dr Johnston.

3.3.7.7 Further, in 2010, the Victorian Auditor General reviewed the management of safety risks at level crossings. He advised, *inter alia*, that the Victorian Railway Crossing Safety Steering Committee could improve the understanding of what causes fatal level crossing collisions.[498]

3.3.7.8 Accordingly, I recommend that the Transport Safety Director continue to maintain and improve a comprehensive reliable data base of all level crossing incidents that occur in Victoria. **Recommendation 16**

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495 S Mok & I Savage. "Why has Safety Improved at Rail-Highway Grade Crossings?" *Risk Analysis* 25 (2005) 867.

496 State Trauma Committee, "A Trauma Education Framework for Victoria", October 2001.

497 J. Edquist, K. Stephan, E. Wigglesworth & M. Lenne, "A Literature Review of Human Factor Safety Issues at Australian Level Crossings", Monash University Accident Research Centre, February 2009.

498 Victorian Auditor-General's Office, "Audit summary of Management of Safety Risks at Level Crossings", Parliament of Victoria, 24 March 2010.

3.3.7.9 Mr Pearson recommended a number of infrastructure changes relevant to VicRoads' jurisdiction. As supported by the evidence in this coronial enquiry into 29 deaths associated with level crossing collisions, these include:

- Continuing vigilance of sight distances between road vehicles and trains;
- Improving train conspicuity;
- Speed limit reductions;
- Automated Advance Warning Signs; and
- Intelligent Transport Systems.

3.3.7.10 In 2008, Japanese investigators working with Deakin University have assessed an automatic road sign recognition system which detects and classifies road signs and communicates directly with the road vehicle driver.[499]

3.3.7.11 In 2004, VicRoads and VicTrack also jointly funded development of a Low Cost Level Crossing Warning Device by Hi-Lux Technical Services Pty Ltd.[500] This solar powered technology is intended to improve early warning of drivers approaching passive controlled level crossings. A trial of this technology was conducted in Yendon in March 2011.

3.3.7.12 Although the trial was successful, trials of a further development were required to assess the viability of implementing this option compared to alternative solutions, Mr Sargant told the Court that the trial had been abandoned.

3.3.7.13 Peter Furnell was the Manager of Railway Crossing Safety, Public Transport Division, Department of Transport. In 2011, he told the Court that the National Railway Level Crossing Group had endorsed formation for a national strategy for the implementation of in-vehicle level crossing warning systems to ensure the optimal application of these technologies.

3.3.7.14 Further, Mr Furnell told the Court that implementation of in-vehicle level crossing warning systems still required funding from government, cooperation from international vehicle manufacturers and other states and territories, and allocation of an appropriate broadcast spectrum.

3.3.7.15 Also, all of the trains travelling through Victoria would have to be fitted with the equipment for in-vehicle level crossing warning systems

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499 Y.-Y Nguwi & A.Z Kouzani, "Detection and classification of road signs in the natural environment", Neural Computing and Applications 17 (2008) 265.

500 Rod Bramble, Low Cost Level Crossing Warning Device Comparative Field Trial, Project 2005/RS/0001, Department of Transport Energy and Infrastructure, Transport Services Division, Rail Services Section, Government of South Australia, July 2005, in Gordon file

3.3.7.16 Further, the Department of Transport has funded research into dedicated Short Range Radio Communications. Mr Furnell told the Court that motor vehicle manufacturers in the United States, the European Union and Japan have been collaborating for over ten years to develop standards for of in-vehicle level crossing warning systems technologies.

3.3.7.17 Similarly, in August and November 2004 and 2005, Public Transport Safety Victoria (now Transport Safety Victoria) studied the practices of road users at the Springvale Road level crossing using video recording.[501]

3.3.7.18 Further, in June 2006, the Department of Infrastructure funded a review of currently available technologies capable of detecting obstacles at level crossings.[502] This review advised that Intelligent Video Monitoring held the greatest promise for use in detecting obstacles at level crossings but its usefulness was limited by the capacity of the rail and road systems to respond appropriately to the detected threat of a collision.

3.3.7.19 In 2009, work was also proceeding on implementation of radar technology. This innovation is expected to detect trains and notify road vehicle drivers of their presence.

3.3.7.20 Other safety initiatives include train conspicuity reflectors or ditch lights, rationalisation of rail lines and co-ordination of traffic lights.[503]

3.3.7.21 In the absence of adequate assessment of adverse events (see above) it is difficult to understand how proper evaluations can occur.

3.3.7.22 Similarly, in 2009, the House of Representatives Standing Committee on Infrastructure, Transport, Regional Development and Local Government became increasingly aware that there exists a distinct lack of aggregate data which details the causes of these crashes across Australia. With this in mind, the Committee recommended the establishment of a national database to collate data from all level crossing crashes and fatalities, nationwide. It also recommends the updating of the National Level Crossing Safety Strategy, to provide better national policy guidance with regards to level crossing safety.[504]

3.3.7.23 I have formed the view that there is a group of road vehicle drivers who cannot be reached by the current active or passive level crossing warnings at the time they are approaching a level crossing. There is no evidence before me to suggest that 12 of the 13 drivers in this

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501 MA Britton and IE Knightly, A Study of Unsafe Practice by Road Users at a Railway level Crossing in Melbourne Victoria, Public Transport Safety Victoria in Gordon file.

502 Sinclair Knight Merz Pty Ltd, Level Crossing Obstacle Detection Systems, Department of Infrastructure, 22 June 2006.

503 referred to by Jim Betts, Director Public Transport, in his letter to D/Sergeant G Rumble dated 8 February 2007.

504 House of Representatives Standing Committee on Infrastructure, Transport, Regional Development and Local Government, "Level Crossing Safety: An Update of the 2005 Train Illumination Report", Canberra, June 2009

cluster of fatal level crossing collisions were otherwise inattentive or pre-disposed to failing to respond to stimuli.

3.3.7.24 Sophisticated research and innovative technology is required to determine how best to alert drivers who will otherwise not notice an approaching train in the context of current level crossing warnings.

3.3.7.25 For the last 25 years, Australian rail safety investigators and researchers have advocated development and introduction of in-vehicle warning systems.[505]

3.3.7.26 In the United States, specific research commenced in 2000:

> *"Automotive collision warning systems potentially represents the next significant leap in vehicle safety technology by attempting to actively warn drivers of an impending collision event, thereby allowing the driver adequate time to take appropriate corrective actions in order to mitigate or completely avoid the event. With this as an impetus, the Automotive Collision Avoidance System Program was launched."*[506]

3.3.7.27 Several options have been trialled. However, none has been implemented. Mr Sargant told the Court that trials of in-vehicle communications have been abandoned.

3.3.7.28 In evidence, Mr Furnell indicated that the main reasons for failing to implement radio technology included:

- Victoria can only implement new technology in concert with other Australian States and Territories because all of the trains travelling through Victoria would have to be fitted with the equipment;
- The Rail Industry Safety and Standards Board has imposed a "Fail Safe" standard that requires review before accredited rail managers and operators can implement new technology;[507]
- Overseas car manufacturers have not yet integrated short range radio technology into their routine car specifications; and
- Failure of the device could influence legal liability for any consequential incidents.

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505 Deputy States Coroner Graeme Johnstone's Findings in Margaret Campbell, 17 March 1989; Michael Welsh, 7 May 1989; Lyle Staehneke, 25 May 1989; Ionnis Karagiannis, 19 June 1989; Richard Church & Sally Tracey 20 June 1989; John Shrubsole, 18 July 1989; Alfred Malia, 20 July 1989; Australian Transport Safety Bureau, "Level Crossing Collision between The Ghan Passenger Train (1AD8) and a Road-Train Truck, Ban Ban Springs, NT, 12 December 2006", 13 Feb 2008; Bob Pearson, Risk Analysis of Trick Train Collisions of Significant Severity, Final report, 28 November 2008; J. Edquist, K. Stephan, E. Wigglesworth & M. Lenne, "A Literature Review of Human Factor Safety Issues at Australian Level Crossings", Monash University Accident Research Centre, February 2009.

506 P.L. Zador, S.A. Krawchuk, R.B. Voas, "Final Report -- Automotive Collision Avoidance System (ACAS) Program", National Highway Traffic Safety Administration, August 2000.

507 See Department of Transport, "Research and Development Report, April 2009".

3.3.7.29 In these circumstances, none of Mr Furnell's explanations is sufficient to explain how break though in vehicle radio technology can be used in the Burnley Tunnel but is not fit for service on locomotives or at regional level crossings:

- There is no suggestion that the innovative technology replace or change the existing suite of level crossing warnings;
- The Road Safety Committee of the Victorian Parliament advocated Victoria's history of implementing road safety devices such as electronic stability control and side curtained air bags ahead of their adoption by the Australian Design Rules and international vehicle manufacturers. In their report the Road Safety Committee stated:

  "While harmonised standards are desirable, road safety objectives should not be compromised by a process that does not reflect Australia's needs";[508]

- In its response to the Road Safety Committee, the Victorian Government stated:

  "The Victorian Government supports the regulation of vehicles through the National ADR process. However, the Victorian Government may consider a state based regulation where... timely national adoption and implementation of the ADR is remote and there is strong net public benefit from doing so."

- There are good risk-associated reasons for implementing the technology in regional Victoria and in locally manufactured prime movers as a first stage;[509]
- The radio emissions could be sent from level crossing infrastructure, not necessarily form the locomotive so that there is no absolute requirement to wait for the Rail Industry Safety and Standards Board;
- Like radar detectors, the reception technology can be voluntary until its usefulness has been demonstrated;
- VicTrack already holds a Telecommunications licence to enable emission of signals if the level crossing option is preferred;

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508 Road Safety Committee, Parliament of Victoria, "Report of the Road Safety Committee on the Inquiry into the Process of Development, Adoption and Implementation of Australian Design Rules", 9 November 2009.

509 As well as all but one of the Findings in this cluster of fatal level crossing collisions I note the following: Deputy States Coroner Graeme Johnstone's Findings in Margaret Campbell, 17 March 1989; Michael Welsh, 7 May 1989; Lyle Staehneke, 25 May 1989; Ionnis Karagiannis, 19 June 1989; Richard Church & Sally Tracey 20 June 1989; John Shrubsole, 18 July 1989; Alfred Malia, 20 July 1989; Australian Transport Safety Bureau, "Level Crossing Collision between The Ghan Passenger Train (1AD8) and a Road-Train Truck, Ban Ban Springs, NT, 12 December 2006", 13 Feb 2008; Bob Pearson, Risk Analysis of Trick Train Collisions of Significant Severity, Final report, 28 November 2008; J. Edquist, K. Stephan, E. Wigglesworth & M. Lenne, "A Literature Review of Human Factor Safety Issues at Australian Level Crossings", Monash University Accident Research Centre, February 2009.

3.3.7.30 Therefore, I have formed the view that, in the context of their complicated National and Victorian organisational arrangements, railway decision makers have historically adopted a high threshold in relation to implementation of level crossing infrastructure and arranging for warning signals to be emitted from trains or level crossings.

3.3.7.31 In part any continuing justification for this frame of mind has been minimised by the "So far as is reasonably practical" admonition included in section 19 of the *Rail Safety Act* 2006:

> ***The concept of ensuring safety***
>
> *(1) To avoid doubt, a duty imposed on a person under this Act or the regulations to ensure, so far as is reasonably practicable, safety requires the person to—*
>
> *(a) eliminate risks to safety so far as is reasonably practicable; and*
>
> *(b) if it is not reasonably practicable to eliminate risks to safety, to reduce those risks so far as is reasonably practicable.*
>
> *(2) To avoid doubt, for the purposes of Divisions 2 and 3 or regulations made for the purposes of those Divisions, regard must be had to the following matters in determining what is (or was at a particular time) reasonably practicable in relation to ensuring safety—*
>
> *(a) the likelihood of the hazard or risk concerned eventuating;*
>
> *(b) the degree of harm that would result if the hazard or risk eventuated;*
>
> *(c) what the person concerned knows, or ought reasonably to know, about the hazard or risk and any ways of eliminating or reducing the hazard or risk;*
>
> *(d) the availability and suitability of ways to eliminate or reduce the hazard or risk;*
>
> *(e) the cost of eliminating or reducing the hazard or risk."*

3.3.7.32 Mr Furnell told the Court that, from his perspective, this legislation reduced the level of reliability required for implementation of innovative level crossing safety infrastructure. However, it only allowed its use:

> *"for crossings which are in remote areas the actual chance, risk of failure would be outweighed by the benefit of the warnings produced."*

3.3.7.33 Transport Safety Victoria has issued a tool kit to:

- provide guidance to demonstrate the meaning of "So far as is reasonably practical";
- provide a suggested adaptable framework to assist industry to undertake a thorough "So far as is reasonably practical" process,
- through four risk management steps, and

- provide a worked case study example of how to apply this framework.[510]

3.3.7.34 Under the new arrangements, Transport Safety Victoria also advises rail operators to assess risks as cumulative:

> *"Consider the effects of hazards occurring in combination to lead to an event (chain of events where one event is triggered by another). There may be several independent hazards or combination of hazards, each of which can lead to an event, and*
> *Consider the overall picture for a hazard or event. A hazard can have many causes. However, the risks associated may be very low when considered in isolation"*

3.3.7.35 Transport Safety Victoria also advises rail operators to create an event tree to better understand the systems and the relationships between technical components, humans and the operating environment.

3.3.7.36 The risk management approach enabled by the *Rail Safety Act* 2006 and adopted by Transport Safety Victoria goes some way to predicting the benefits of the systematic investigation approach to adverse events adopted by the airline industry and answer the Mr Furnell's reasons for slow uptake of new technology to warn road vehicle drivers of an approaching train.

3.3.7.37 However, I note that Transport Safety Victoria still assesses the cumulative risk at a passive level crossing as high rather than extreme when a multi-fatality collision is assessed as likely to occur every one to 10 years. [511] Applying historical data to that assessment regime, none of the level crossings in Victoria would have been assessed as extreme risk requiring immediate review either before or after the fatal incident occurred.

3.3.7.38 In 2008, VicRoads was advised that that there was likely to be another multiple fatality level crossing incident involving a train and a heavy combination vehicle every five years.[512]

3.3.7.39 Further, this coronial investigation of 13 fatal level crossing collisions has confirmed again that, even when current level crossing warning infrastructure informs road vehicle drivers that they are approaching a level crossing, the current level crossing infrastructure has demonstrably failed to warn all road vehicle drivers that a train is approaching.[513]

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510 Public Transport Safety Victoria, ""So Far As Is Reasonably Practicable" (SFAIRP) Guidance Note and Toolkit, A PTSV practical guide to assessing SFAIRP for the rail industry", Consultation draft, 2011.

511 Public Transport Safety Victoria, ""So Far As Is Reasonably Practicable" (SFAIRP) Guidance Note and Toolkit, A PTSV practical guide to assessing SFAIRP for the rail industry"", Consultation draft, 2010.

512 Bob Pearson, Risk Analysis of Trick Train Collisions of Significant Severity, Final report, 28 November 2008.

513 J. Edquist, K. Stephan, E. Wigglesworth & M. Lenne, "A Literature Review of Human Factor Safety Issues at Australian Level Crossings", Monash University Accident Research Centre, February 2009.

3.3.7.40 Accordingly, I have formed the view that there is a group of road vehicle drivers who cannot be reached by the current active or passive level crossing warnings at the time they are approaching a level crossing. There is no evidence before me to suggest that these drivers are otherwise inattentive or pre-disposed to failing to respond to stimuli.

3.3.7.41 Therefore, it is important for everyone involved in the rail and heavy vehicle transport industries to continue to develop, evaluate and implement relevant innovative level crossing infrastructure that is already operating in the road environment.

3.3.7.42 In circumstances where fatal level crossing collision are so infrequent that only one has occurred in Victoria at a site of a previous rail fatality and another prior fatal level crossing collision at Kerang was not categorised as a rail incident, this assessment is of no assistance in accelerating uptake of innovative infrastructure.

3.3.7.43 Transport Safety Victoria can go further in its advice to accredited rail operators about how to understand and remediate the interaction of risks identified when an adverse event occurs.

3.3.7.44 In particular, VicTrack, VicRoads, Transport Safety Victoria and rail operators must cooperate with each other to implement innovative in-vehicle warning systems as the next stage of warning road vehicle drivers fail to respond to existing level crossing paraphernalia that a train is approaching. **Recommendation 17**

3.4 RECOMMENDATIONS

Pursuant to section 72(2) of the *Coroners Act* 2008, I make the following recommendations connected with the deaths of 21 people in this level crossing cluster.

8. That Transport Safety Victoria and Public Transport Victoria investigate the way in which directed sounds from horns and sirens can be used to increase the conspicuity of locomotives in regional areas and increase the likelihood of road vehicle drivers' awareness of an approaching train.

9. That Transport Safety Victoria, Public Transport Victoria and VicRoads extend their development and evaluation of new level crossing countermeasures with specific reference to the countermeasure's capacity to alert road vehicle drivers to the presence of an approaching train.

10. That Standards Australia review Australian Standard AS1742.7-2007 to include advice in relation to left turn slip lanes where level crossings are on side roads and specifications for light emitting diodes ("LEDs") in flashing red light infrastructure.

11. That Standards Australia implement a schedule of more frequent routine reviews of Australian Standard AS1742.7-2007 for currency and compatibility with new infrastructure and technology.

12. That Transport Safety Victoria, Public Transport Victoria and VicRoads establish formal cooperative arrangements in relation to sharing of information required for to predictive risk assessment of level crossings, prioritisation of level crossing upgrades and development of innovative train warning systems (see below).

13. That Transport Safety Victoria cooperate with the National Rail Safety Regulator in establishing a system for undertaking and analysing the results of root cause analyses for fatal level crossing collisions to better inform improvements in level crossing infrastructure and level crossing safety.

14. That Transport Safety Victoria and Public Transport Victoria improve the accuracy, content and relevance of data used in predictive risk analysis used to inform decisions about upgrading of level crossings in Victoria.

15. That the Australian Transport Safety Bureau, through the Transport Safety Victoria, continue to apply the systematic analysis procedures in their analysis of fatal rail incidents.

16. That the Transport Safety Director continue to maintain and improve a comprehensive reliable data base of all level crossing incidents that occur in Victoria.

17. VicTrack, VicRoads, Transport Safety Victoria and rail operators cooperate with each other to implement innovative in-vehicle warning systems as the next stage of warning road vehicle drivers who fail to respond to existing level crossing paraphernalia that a train is approaching.

SECTION 4 – EMERGENCY RESPONSE TO THE KERANG LEVEL CROSSING COLLISION

4.1 BACKGROUND

4.1.1.1 In 2008, Bob Pearson advised VicRoads that the likelihood of a collision between a heavy vehicle and a train resulting in multiple train passenger fatalities was about once in five years.[514]

4.1.1.2 Collisions between trains and heavy vehicle combinations are generally more likely than collisions with lighter vehicles to result in multiple injuries and deaths.[515]

4.1.1.3 Victoria has the greatest number of level crossings in Australia. There are:

- 1,872 road level crossings; [516]
- 17 level crossing collisions a year;[517]
- 8% of all level crossing collisions result in death.[518]
- 15% of these level crossing fatal collisions involve heavy vehicles.[519]
- Fatalities at level crossings reduced by about 70% between 1970 and 2008.[520]
- Level crossing accidents remain a key risk to safety in the rail industry.[521]

4.1.1.4 At about 1:35pm on 5 June 2007, the regular Swan Hill to and Southern Cross Railway station V/Line passenger train was approaching the level crossing at the Murray Valley Highway about five kilometres north of Kerang at Fairlie (the "Kerang level crossing").

4.1.1.5 The train consisted of an N class locomotive and three carriages.[522] The buffet was in the front left hand side of Carriage B.

4.1.1.6 Barry Lidster was driving the train. Haydn Buckland was the conductor. Jodie Burford was serving in the buffet in Carriage B. Mr Lidster, Mr Buckland and Ms Burford were employed by V/Line Passenger Services Ltd ("V/Line").

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514 Bob Pearson, Risk Analysis of Trick Train Collisions of Significant Severity, Final report, 28 November 2008.

515 For example, Parliament of Victoria, Road Safety Committee, "Inquiry into Improving Safety at Level Crossings", 2008.

516 Road Safety Committee, Parliament of Victoria, "Inquiry into Improving Safety at Level Crossings", December 2008.

517 Australian Transport Safety Bureau, "Australian Rail Safety Occurrence Data: 1 July 2002 to 30 June 2012", Rail safety report RR-2012-0010, 23 November 2012.

518 Australian Transport Council, National Railway Level Crossing Behavioural Strategy, August 2003.

519 Australian Transport Council, National Railway Level Crossing Behavioural Strategy, August 2003; Australian Transport Safety Bureau, Monograph 10, level Crossing Accidents, 1988-1998.

520 See for example, Australian Transport Safety Bureau, "Railway Level Crossing Safety Bulletin", 2008; Victorian Auditor-General's Office, "Audit summary of Management of Safety Risks at Level Crossings", tabled in Parliament of Victoria, 24 March 2010.

521 Australian Transport Safety Bureau, "ATSB rail safety investigation: key lessons learnt", Rail safety bulletin RR-2008-008, July 2008.

522 Designated here as Carriage A, Carriage B and Carriage C.

4.1.1.7 In addition to the V/Line staff, there were six passengers allocated seats in Carriage A which was the first class carriage, 22 passengers in Carriage B and 6 passengers in the third carriage, Carriage C. [523]

4.1.1.8 The passengers had moved around a little after they left Swan Hill so that, as the train approached the Kerang level crossing, some passengers were not in their allocated seats. It seems that:

- Five passengers were seated in Carriage A;
- 24 passengers were seated or standing in Carriage B; and
- Five passengers were seated in Carriage C.

4.1.1.9 At 1:34pm on 5 June 2007, a semi-trailer driven by Christian Scholl collided with the regular Swan Hill to Southern Cross Station V/Line passenger train at the level crossing about five kilometres north of Kerang at Fairlie (the "Kerang level crossing").

4.1.1.10 In the impact, the left hand side of Mr Scholl's cabin and the front left corner of his trailer peeled open the right rear wall of Carriage B and damaged the right rear corner of Carriage C.

4.1.1.11 By the time the train stopped, the bolts holding the rear right seats in Carriage B had been torn from their mountings so that they concertinaed into the left rear corner of the carriage and the condenser from the refrigeration unit on Mr Scholl's trailer had become dislodged and been thrown through the front right window of Carriage C.

4.1.1.12 Stephanie Meredith, Danielle Meredith, Chantal Meredith, Geoffrey McMonnies, Rosanne McMonnies and Ercil Jean Webb[524]were sitting on the right side of Carriage B and died immediately when Mr Scholl's semi-trailer hit them and dislodged their seats in the impact.[525]

4.1.1.13 Margaret Wishart[526] also died immediately in Carriage C from a head injury caused by the condenser from the refrigeration unit on Mr Scholl's trailer which was dislodged by the collision.

4.1.1.14 Further, Jaesok Lee[527] and Matthew Stubbs[528] sustained fatal injuries and were immediately unresponsive. They did not regain consciousness and had died before emergency services arrived.

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523 Conductors manifest: 5 June 2007.

524 Stephanie Meredith Case No. 2125/07; Danielle Meredith Case No. 2127/07; Chantal Meredith Case No. 2128/07; Geoffrey McMonnies Case No. 2129/07; Rosanne McMonnies Case No. 2132/07; Ercil Jean Webb Case No. 2133/07.

525 In cases of multiple injury, Disaster Victim Identification procedures are used to ensure consistency and prevent mistakes.

526 Margaret Wishart Case No. 2131/07.

4.1.1.15 Nicholas Parker[529] sustained internal injuries. He was stabilised but he died during transfer to the Casualty Collection Post on the highway. His injuries always had a poor prognosis.

4.1.1.16 Harold Long[530] was hidden under seats at the rear of Carriage B. Only his hand was visible. He was presumed dead until about 2:25pm when emergency workers noticed his hand had moved. He was transferred to Melbourne by fixed wing aircraft and died at the Royal Melbourne Hospital.

4.1.1.17 Four other train passengers were seriously physically injured and were transferred to Major Trauma Centres by helicopter. Seven passengers were treated for relatively minor injuries at Kerang Hospital.[531] The crew and many of the passengers have also suffered psychological injuries as the result of the collision.

4.1.1.18 Mr Scholl hit his head as the result of the collision. He suffered from concussion and cuts on his legs. He was transferred first to Kerang Hospital and then by air ambulance to The Alfred Hospital. Mr Scholl was later transferred to the Epworth Hospital.

4.1.1.19 Improvements in level crossing safety cannot be explained in isolation from general changes in highway safety.

4.1.1.20 In particular, the effectiveness of emergency medical response has as much effect on the consequences at level crossings as it does at highway-highway intersections.[532] In the United States, the medical emergency response is about twice as effective as installation of active warning devices in reducing level crossing fatalities.[533]

4.1.1.21 The emergency response to the collision at Kerang level crossing on 5 June 2007 involved a number of different responders including:

- Train passengers, by-standers and local residents;
- V/Line staff;
- Victoria Police;
- Rural Ambulance Victoria;

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527 Jaeseok Lee Case No. 2126/07.

528 Matthew Stubbs Case No. 2130/07.

529 Nicholas Parker Case No. 2114/07.

530 Harold Long Case No. 2110/07.

531 Rural Ambulance Victoria Board, Review of the Rural Ambulance Victoria Response to the Kerang Rail Incident on 5 June 2007, 31 March 2008.

532 S Mok & I Savage. "Why has Safety Improved at Rail-Highway Grade Crossings?" *Risk Analysis* 25 2005) 867. See also: Charles Mock, Jean-Dominique Lormand, Jacques Goosen, Manjul Joshipura, Margie Peden., "Guidelines for essential Trauma Care", World Health Organisation, 2004.

533 S Mok & I Savage. "Why has Safety Improved at Rail-Highway Grade Crossings?" *Risk Analysis* 25 (2005) 867.

- State Emergency Service;
- Country Fire Authority;
- Medical practitioners; and
- Air Ambulance Victoria.

4.1.1.22 This coronial review of 26 deaths at 13 level crossings in Victoria[534] has evaluated the emergency response to the collision at Kerang level crossing on 5 June 2007. My jurisdiction as a coroner necessarily restricts my investigation to the emergency management of the scene and the passengers who died.

4.1.1.23 I have reviewed the contribution made by each of these groups and organisations separately in the context of their legal and professional obligations and my jurisdiction to investigate the circumstances surrounding the deaths of 11 train passengers. I have also reviewed the injuries and management of Harold Long.

4.1.1.24 I then comment and make recommendations intended to prevent further people dying for the reasons that 11 passengers died as the result of injuries they received in the Kerang level crossing incident on 5 June 2007.

4.2 CORONIAL INVESTIGATION

4.2.1 Train passengers, by-standers and local residents

4.2.1.1. At 1:34:41pm, Gerard Tuohey had stopped his truck on the north side of the Kerang level crossing when the collision occurred. There were no vehicles in front of him.

4.2.1.2. Mr Tuohey was the first person to contact '000'. He was put through to the Bendigo Rural Ambulance Victoria Communications Centre. Mr Tuohey told the Rural Ambulance Service call taker that a truck had hit a semi-trailer about 10 kilometres north of Kerang. He did not know how many casualties there were. He did not know the exact location of the level crossing.

4.2.1.3. The Rural Ambulance Service call taker immediately notified the despatcher of the incident. She then returned to clarify the information provided by Mr Tuohey with another south travelling truck driver, Rodney Lusty. The call taker also confirmed with Mr Lusty that the truck driver was out of his truck.

4.2.1.4. Mr Tuohey stayed in his truck while Mr Lusty and other by-standers assisted Mr Scholl. Mr Lusty did not realise the train was badly damaged until one of the passengers came to the highway and told him. This occurred after the first ambulance had arrived.

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534 Excluding the deaths of Victor Greensill and Gwenda Glasson at Trawalla which remain incomplete.

4.2.1.5. Peter Scott was driving his semi-trailer north. He was two vehicles behind Mr Scholl. He stopped when he realised there had been a collision and got out of his cab. Mr Scott immediately realised this was a serious accident and hopped back into his cab to call '000'.

4.2.1.6. Mr Lidster waved to Mr Scott from Carriage B and called him over. For 20 minutes, Mr Scott assisted in moving seats and helping train passengers climb down on the de-train ladder provided by Mr Buckland.

4.2.1.7. Wayne Lynch was driving his courier van behind Mr Scholl north on the Murray Valley Highway when the collision occurred at the Kerang level crossing. Mr Lynch stopped his courier van and ran to Carriage C. At 1:36pm, when he realised that someone had died in Carriage C he returned to his vehicle and rang '000'.

4.2.1.8. Mr Lynch then returned to Carriage C to help the survivors until police arrived.

4.2.1.9. Geoffrey Charleson was driving a tanker behind Mr Scott. He stopped when he saw Mr Scholl's semi-trailer was damaged and rang '000' immediately. By the time he got to the truck, Mr Scholl had already been removed from his cabin.

4.2.1.10. Mr Charleson stayed in his tanker at the scene for about an hour. He then moved the vehicle to make way for the helicopters and went on his way. He did not assist the passengers because of concern about his load.

4.2.1.11. Robyn Farnsworth was a mail contractor travelling south on the Murray Valley Highway when the collision occurred. Ms Farnsworth was unable to climb up into Carriage B because it was too high. However, she helped passengers to climb down and otherwise assisted for about an hour.

4.2.1.12. Christopher Beale and Brian Frichot were in a car travelling south and saw the collision occur. They went to Mr Scholl and helped him out of his cabin. They then assisted at the train until they were no longer required.

4.2.1.13. At first, passengers used a seat to assist with extricating the injured through the hole in the right side of Carriage B.

4.2.1.14. Andrew Bruton got off the carriage and spoke to another local farmer, Trevor Bennett, looking for tools to help release passengers trapped by broken and dislodged seating. Mr Bruton went to Mr Bennett's utility parked on the highway and got some bolt cutters and a crow bar and returned to the carriage. He passed the tools up into the carriage to people that were helping to move the seats.

4.2.1.15. By the time the local witnesses reached Carriage B, the passengers from Carriage C and some of those from Carriage A had evacuated. Able-bodied passengers from Carriage B

were progressing through Carriage A to a ladder that Mr Buckland had set up for the purpose.

4.2.1.16. Alan and Andrea (Min) Peacock lived on a farm close to the Kerang level crossing. They heard the sound of the collision and immediately drove to the site in their car.

4.2.1.17. Mrs Peacock was a trained nurse. She checked Mr Scholl and Mr Peacock stayed with him until ambulance officers arrived.

4.2.1.18. Then Mrs Peacock went to Carriage B. About the same time as she arrived at Carriage B the ambulance paramedic, Steve Humphreys, was walking behind her.

4.2.1.19. Mr Peacock also rang another local resident, Wade Gillingham, and he brought a four wheel drive vehicle to the site to assist with carrying injured passengers from the site to the Casualty Collection Post on the Murray Valley Highway. He accessed the site across a paddock rather than using the boggy track beside the railway line.

4.2.1.20. Other than the memories of other participants, there is no official record of the local and by-stander civilians who were not part of the formal emergency response.

4.2.1.21. Not only do these people need follow up in the de-brief phase. Their heavy commitment on 5 June 2007 should be acknowledged.

4.2.2 V/Line

4.2.2.1. On 25 June 1999, the Director of Public Transport leased the franchise to operate passenger services on the Swan Hill to Southern Cross station rail line to V/Line Passenger Pty Ltd ("V/Line Passenger").[535]

4.2.2.2. Accordingly, V/Line Passenger has employed the on train staff and operated the Swan Hill to Southern Cross Station above ground service throughout most of the period from 1999 to the present time, even during periods when V/Line Pty Ltd and its predecessors (V/Line") was not the accredited rail operator.

4.2.2.3. From 1 May 1999 until 4 May 2007, Pacific National (Victoria) Ltd (now called Pacific National (Victoria) Pty Ltd and formerly called Freight Victoria Ltd) was the accredited rail operator for the non-electrified track in metropolitan Melbourne and country rail track under a sub-lease agreed by the Director of Public Transport. [536]

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535 On 22 December 2002, V/Line Passenger appointed receivers and managers. However, on 1 July 2003, they were discharged as part of a new franchise agreement with V/Line Passenger.

536 Director of Public Transport and Freight Victoria Limited (Lessee), (Restated) Primary Infrastructure Lease Volume 1 Consolidated Conformed Copy (current to 30 September 2005).

4.2.2.4. Under this sub-lease of the below ground infrastructure, the Director of Public Transport assigned all existing agreements to Pacific National including the franchise agreement with V/Line Passenger.

4.2.2.5. Accordingly, although Pacific National was the accredited rail operator and ran the Train Control and emergency response operations from 1 May 1999 to 4 May 2007, V/Line Passenger staff had continued to run the on-train V/Line passenger service between Swan Hill and Southern Cross station during that period.

4.2.2.6. On 4 May 2007, V/Line formally took over the below ground lease from Pacific National and became the accredited rail operator for the Swan Hill to Southern Cross Station line.

4.2.2.7. This change meant that the train control arrangements were transferred from Pacific National to V/Line. Some but not all of the Pacific National staff remained. The agreement with V/Line Passenger to operate train services from Swan Hill to Southern Cross Station was re-assigned to V/Line.

4.2.2.8. Therefore, although the train crew and rolling stock and their administration through 'CARS'[537] had been the responsibility of V/Line Passenger since 1999, the management systems and overall control that was in place on 5 June 2007 had only been operating for a month.

4.2.2.9. On 5 June 2007, V/Line staff were required to comply with the V/Line Emergency Response and Crisis Management Plan in circumstances such as those that occurred at the Kerang level crossing.

4.2.2.10. V/Line had adopted the existing Emergency Response and Crisis Management Plan from Pacific National when they took over as network operator of below rail operations on 4 May 2007. This role included responsibility for Train Control and infrastructure.

4.2.2.11. V/Line also had a number of other relevant policies and procedures which had been introduced on 2 April 2007 including Conductor Radio Procedures, Conductor Emergency Procedure and Conductor Public Address Announcements.

4.2.2.12. Further, on 6 February 2006, V/Line had introduced First Aid Training, Facilities and Minimum Requirements.

4.2.2.13. Mr Lidster had been a fully qualified locomotive driver since about 1976. He had been qualified to drive on the Swan Hill route for six months. He had no experience with near-misses.

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537 'CARS' is the administrative office responsible for allocating, tracking and managing rolling stock and crews on V/Line trains.

4.2.2.14. Mr Buckland and Ms Burford had undertaken training in the application of these policies and procedures in the six months before 5 June 2007. They also held Level 2 First Aid Certificates including wound management, shock, epileptic and diabetic management. Mr Buckland was also a Division 2 trained nurse.

4.2.2.15. Mr Lidster told the Court that he was trained in first aid including cardiopulmonary resuscitation. However, when asked whether he had sufficient training to cope with the circumstances that he was facing, Mr Lidster responded:

> *"I don't think anybody's trained (indistinct) no, the training we had would not have dealt with that."*

4.2.2.16. At 1:34pm on 5 June 2007, Mr Lidster was driving the train, Mr Buckland was performing administrative tasks in the Carriage A and Ms Burford was working in the buffet in Carriage B.

4.2.2.17. Mr Lister saw Mr Scholl's semi-trailer approaching the level crossing without slowing down when the locomotive was about 50 metres from the Kerang level crossing.

4.2.2.18. However, Mr Lidster also saw Mr Scholl turning his prime mover to the left. When his locomotive entered the Kerang level crossing on 5 June 2007, Mr Lidster was still hoping that Mr Scholl's semi-trailer would be able to avoid hitting the train.

4.2.2.19. Mr Lidster knew the semi-trailer had collided with the train because he heard the air lines to the locomotive break. He activated the emergency brakes but he remained unaware of the extent of the damage that had occurred.

4.2.2.20. After the locomotive stopped, Mr Lidster looked in his rear view mirror and could see a carriage at an angle. He presumed it was partially de-railed.

4.2.2.21. At 1:34:04pm, Mr Lidster contacted V/Line Train Control using his in-cabin radio. At 1:34:50pm, Train Control responded and Mr Lidster told them his train had been hit by a semi-trailer and was de-railed and he needed ambulances.

4.2.2.22. At 1:35:45pm, Train Control contacted '000'.

4.2.2.23. The emergency button on the phone connecting the driver to Train Control would also have allowed Mr Lidster to have priority in his communication with them. However, Mr Lidster did not activate the Emergency button in the locomotive cabin on 5 June 2007 as required by the V/Line procedures in an emergency. He told the Court that he did not think of it in the circumstances on the day.

4.2.2.24. Further, Mr Lidster could have diverted the radio he used to contact Train Control so that he could have used it as a hand held device and taken it with him when he left the cabin. However, it did not occur to him to take his radio with him.

4.2.2.25. Mr Lidster also had a V/Line issue mobile phone. He had diverted his private mobile phone to his work mobile phone so he could use it for either work or private calls.

4.2.2.26. After Mr Lidster got out of the cabin, he could see the extent of the damage to Carriage B and rang '000' on his mobile phone while he was standing outside the cabin. He was transferred to Mildura Victoria Police Communications Centre. Mr Lidster told the call taker:

> *"Listen, I'm a train driver and I'm just on the other side of Kerang on the Murray Valley Highway. And a semi's just hit the train... the train's derailed... the whole side of the train's.... Can we get some ambulances and police?"*

4.2.2.27. In Court, Mr Lidster was concerned that he did not know the precise location of the Kerang level crossing because he only saw it from a train driver's perspective. For example, he felt he could have been more assistance to Train Control and the call taker at Mildura Police Communications Centre if he had known how far he was from Kerang and been able to distinguish this crossing from those further north and on the south side of Kerang.

4.2.2.28. Mr Lidster also contacted his V/Line manager and his partner on the work mobile phone and told them what had happened. He did not use his phone on any other occasions until he was able to leave the site and sought release from his V/Line manager who remained in Melbourne.

4.2.2.29. Mr Lidster also had an end-to-end radio to allow him to contact the conductors on the train. There is no evidence that he attempted to make those contacts using his end-to-end radio.

4.2.2.30. After he left his cabin and spoke to Mildura Police Communications Centre, Mr Lidster surveyed Carriage B with the two conductors and went back to get the first aid kit from the locomotive. A passenger from Carriage C also told Mr Lidster that a passenger in his carriage had died. Later, Mr Lidster also obtained a pair of gloves to help move the debris and release the passengers in Carriage B.

4.2.2.31. In these circumstances, the V/Line Emergency Response and Crisis Management Plan required Mr Lidster and Mr Buckland to adopt the role of Interim Site Controller until Victoria Police arrived.[538]

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538 V/Line Passenger Pty Ltd, "V/Line Emergency Response and Crisis Plan", 7 May 2007.

4.2.2.32. Mr Lidster and Mr Buckland told the Court that neither of them was aware that they were required to accept this role of Interim Site Controller. Neither of them had any specific training in what was required of a Interim Site Controller.

4.2.2.33. Mr Lidster also did not accept that he was ever in authority over the conductors:

> *"Well in the general running of the train it's always an argument about who's in charge of the train whether it's the driver or the conductors. On that day it was (indistinct)...*
>
> *Well I'm the boss of the loco and they're the boss of the train so if they say go I go, if they say stop I stop....*
>
> *He (Mr Buckland) was in control of the passengers."*

4.2.2.34. Further, although in retrospect Mr Lidster accepted that he was the Interim Site Controller at the scene, he did not feel his responsibilities differed from those of any one else:

> *"yeah, somebody had to be in control somewhere along the line but everybody was doing their bit. There was no need for anybody to stand back."*

4.2.2.35. Even when he gave evidence in 2011, Mr Lidster still did not understand his responsibilities as Interim Site Controller further than the requirement to contact Train Control and tell them when the incident had occurred.

4.2.2.36. However, after reviewing his responsibilities under the V/Line, Mr Lidster told the Court:

> *"Well all of those critical points in that piece of paper, we were doing as much as we could on that with the - the site hands."*

4.2.2.37. Mr Scott confirmed that, from his perspective as a by-stander who assisted at the scene for about 20 minutes, the three V/Line employees took over initial control of the rescue effort:

> *"Railway employees for a start off. That was the train driver and whoever else was on the train and the police seemed to be fairly quick on the scene..."*

4.2.2.38. Norma Bennett was also assisting passengers in Carriage B throughout the incident. She told the Court that the V/Line staff were in control until police and ambulance arrived:

> *"Yes, with what facilities they had they were doing an excellent job."*

4.2.2.39. As well as providing first aid, another role of the Interim Site Controller is to provide V/Line and the Victoria Police Site Commander with information about the site, the scene and the number of casualties.

4.2.2.40. However, Mr Lidster had no further contact with Train Control:

> *"No opportunity - I couldn't see the point talking to someone and wasting time telling someone, I can't do anything, so I didn't feel the need to talk to anybody, I just helped."*

4.2.2.41. At about 3:00pm, Mr Lidster spoke to his V/Line manager on the mobile phone. He provided his manager with information about the circumstances of the collision and his own current state. From his report of this phone call, I infer that no V/Line staff had yet arrived at the scene to take over or direct Mr Lidster.

4.2.2.42. Mr Buckland became aware of the collision when he heard a scream from a passenger in Carriage A and he was thrown around in his seat:

> *"It was a sideways jolting motion, I would have stood up then and I can recall seeing a large box coming towards the train, through the dust. At this point I knew we were in big trouble."*

4.2.2.43. Mr Buckland picked up the first aid box and his high visibility vest and went to survey the scene. As he walked through Carriage A, he tried to contact Mr Lidster on the end-to-end radio but there was no response.

4.2.2.44. Mr Buckland realised the degree of damage when he entered Carriage B. He successfully contacted Mr Lidster and told him what he knew. He also found the intercom announcement system was not working.

4.2.2.45. Mr Buckland continued to survey Carriage B and offer assistance and reassurance to passengers. He and other passengers threw the dislodged seats out of the side of the carriage to obtain access to the injured. In his statement, Mr Buckland explained the task that confronted him:

> *"I moved further back into the carriage and at this point there were other people assisting and we removed the dislodged chairs which we threw out from the open side of the carriage. We got as far as we could, some of the seats were jammed so I couldn't move them. I could see bodies piled in the corner. I couldn't get a good view because they were covered with chairs. I called out through the gaps to see if there was any response. No one responded at that stage. I then went back towards where I came from and rendered first aid to passengers to stop any bleeding."*

4.2.2.46. Mr Buckland went back to Carriage A and set up the emergency ladder from the luggage compartment. Mr Scott assisted him to perform this task.

4.2.2.47. Mr Buckland, Mr Lidster, Mr Scott and a passenger from Carriage A, Daryl Erck, used the ladder to assist mobile passengers from Carriages A and B to decamp through Carriage A. Other passengers left through the back door of Carriage C. This process was continuing at 1:40pm when the first emergency service workers arrived at the scene.

4.2.2.48. At 3:30pm on 5 June 2007, Mr Buckland was able to provide police with the number of passengers on the train at the time of the collision because he had already walked through the train and performed a head count before he also checked their tickets. He wrote these numbers on a printout sheet.

4.2.2.49. Mr Buckland told the Court:

> *"it's a printout, some conductors use the book, some conductors use a printout sheet."*

4.2.2.50. This sheet included the train configuration and the times of departure and arrival. Further, Mr Buckland said there was no carbon or other copy kept of the head count. He kept it that he kept in his cabin in Carriage A or on his person. He stored them in a file at home.

4.2.2.51. However, Mr Buckland was unable to provide them with the names of passengers who had not pre-booked their tickets; that is passengers who bought their tickets on the day at Swan Hill station. He told the Court that these passengers were usually allocated to seats in Carriage C. Further, we know that one passenger with an allocated seat in Carriage A had moved to Carriage C.

4.2.2.52. In particular, this inability to identify passengers caused problems with identification of Mrs Wishart who died in Carriage C.

4.2.2.53. Ms Burford became aware of the collision when Carriage B began rocking and filling with dust and debris and the seats around her had all moved leaving passengers hurt and screaming.

4.2.2.54. As soon as Carriage B stopped moving, Ms Burford said to the passengers:

> *"Is anyone injured, check on the person next to you, help is on the way."*

4.2.2.55. Ms Burford, then went to Carriage A to collect the first aid kit. She also told the passengers in Carriage A what had happened and asked whether anyone had first aid training. Three passengers from Carriage A went into Carriage B and provided assistance until emergency services arrived.

4.2.2.56. Ms Burford had hung the belt containing her end-to-end radio and mobile phone on a hook in the buffet so that she could move around easily. After the collision, she tried to use her

end-to-end radio to contact Mr Lidster and Mr Buckland but it did not work because the battery was flat. She could not find the phone.

4.2.2.57. Mr Buckland also told the Court that buffet staff were not required to have an operating end-to-end radio because they were not expected to work as conductors even though most of them were trained for that role as well.

4.2.2.58. At 1:47pm, Ms Burford borrowed Mr Buckland's V/Line mobile phone to contact CARS and provide the first substantial situation report to V/Line. CARS transferred Ms Burford to Train Control. In particular, Ms Burford told Train Control:

> *"It's just insane here... We've got police and ambulances but we need more... We've got dead people everywhere.... Please, please."*

4.2.2.59. At this stage, Ms Burford's memory was that she still did not know what had happened to place them in this situation:

> *"(There are) not quite words to describe it but horror is in the ballpark.... I was completely unaware there was a truck involved until the passengers (indistinct) sometime later."*

4.2.2.60. After asking bystanders about where they were, Ms Burford also told Train Control that the incident had occurred at the Murray Valley level crossing three kilometres north of Kerang and they had a detrain ladder.

4.2.2.61. At 1:47pm, Ms Burford also told Train Control there had been 31 economy passengers and six first class passengers on the train. She believed there were six fatalities and another six or ten badly injured passengers.

4.2.2.62. After this conversation, Ms Burford comforted and provided first aid to injured passengers including, in particular, Jaesok Lee.

4.2.2.63. Ms Burford was frustrated that the first aid kits on trains were not sufficient to cater for the injuries sustained in a major collision and there were no emergency blankets that could be used to assist.

4.2.2.64. Accordingly, in cooperation with the conductors, Mr Lidster, Mr Buckland and Ms Burford performed all the tasks allocated to the Interim Site Controller by the V/Line Emergency Response and Crisis Management Plan. [539]

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539 V/Line Passenger Pty Ltd, "V/Line Emergency Response and Crisis Plan", 7 May 2007.

4.2.2.65. These requirements have now been updated to require the train driver to provide Train Control with the length of the train and the precise location of the incident using a stanchion number or kilometre post.[540]

4.2.2.66. Further the tasks of the conductors have been reviewed.[541] This inclndes using the end-to end radio to seek assistance from the Assistant Conductor if rostered, radioing the driver to call for an ambulance at the next stop and advising CARS office. This document includes the following note:

> *"Conductors must not call for an ambulance via their mobile phone. All communications MUST be directed via the driver ensuring all necessary parties remain in the communication loop."*

4.2.2.67. After handing over to the Victoria Police Site Controller, V/Line became a support agency assisting Victoria Police to manage the site. Mr Lidster became the Interim Rail Controller.

4.2.2.68. However, the Interim Site Controller was also required to act under direction of and provide critical information to the Network Controller as well as provide first aid assistance to injured passengers and crew. [542]

4.2.2.69. Further, other than the train crew, no V/Line staff were on site until after 3:30pm. They suggest that access was difficult because they despatched a Swan Hill manager and he could not get through the level crossing closure.

4.2.2.70. It seems paradoxical that the agency that most needed to be at the scene early as the one which misunderstood the directions and was delayed because they approached from the north and could not get across the railway line

4.2.2.71. In the absence of adequate radio and telephone communication with Train Control on 5 June 2007, the train crew were unable to receive on-going direction from the Network Control and there is no evidence before me to suggest they had further contact with their V/Line supervisors until at least 3:00pm. Therefore, they had to manage as best they could.

4.2.2.72. Further, at the management level, on 5 June 2007, the V/Line Crisis Response and Management Plan required V/Line Train Control to notify the V/Line CARS office. The V/Line CARS Office was then required to notify emergency services and the V/Line General Manager Operations to assess the severity of the incident and authorise activation of the V/Line Crisis Management Team.

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540 International Transport Training & Development, "Module 21-Emergency Procedures", 30 September 2010.

541 V/Line, "Conductor Emergency Procedures: Conductor Training", September 2009; V/Line, "Conductor Radio Procedure: Conductor Training, September 2009: V/Line, "Conductor Public Address Announcements: Conductor Training, August 2009.

542 V/Line Passenger Pty Ltd, "V/Line Emergency Response and Crisis Plan", 7 May 2007. see also, V/Line Passenger Pty Ltd, "V/Line Emergency Response and Crisis Management Plan", January 2006.

4.2.2.73. The V/Line Emergency Response and Crisis Management Plan expected the Rail Incident Response team to communicate with and through Victoria Police because they are the Emergency Response Coordinator.

4.2.2.74. V/Line Crisis Management Team despatched senior V/Line staff and a V/Line response Team to assist in the incident. Accordingly, Mr Lidster's role as Rail Controller and senior member of V/Line staff was taken over by the V/Line Freight Operations Team leader when he arrived from Swan Hill. Mr Lidster's evidence suggests this occurred sometime after 3:30pm.

4.2.2.75. Under the V/Line Crisis Response and Management Plan, the Interim Rail Controller's role included liaison with and briefing of the Victoria Police Site Controller and communication with Train Control.

4.2.2.76. However, neither Mr Lidster nor any other V/Line staff member participated in the Emergency Management Committee established by Victoria Police Incident Controller.

4.2.3 Victoria Police

4.2.3.1. At 1:38pm on 5 June 2007, Mildura Police Communications Centre despatched Senior Constable Shane Hafner and Senior Constable Andrea Milikins from Kerang Police Station to the Kerang level crossing with lights and sirens operating.

4.2.3.2. At 1:38pm, as they were leaving the Kerang Police Station, Mr Hafner and Ms Milikins told Sergeant Brian Gibson and Constable Dale Maxwell about the incident. Therefore, I infer that Mildura Police Communications Centre had not already notified Mr Gibson.

4.2.3.3. On their way to the Kerang level crossing, Mr Hafner and Ms Milikins were informed that the incident involved serious injuries but it was unknown if there were any fatalities.

4.2.3.4. At about 1:42pm, Mr Hafner and Ms Milikins arrived at the scene. They were the first professional emergency response workers to arrive. Ms Milikins parked the divisional van on the highway because they came from Kerang and knew that the off-road area and access track could be boggy.

4.2.3.5. At the scene, Mr Hafner ensured that the police radio in the divisional van was turned into 'Repeat'. He then turned his portable radio onto 'Repeat 1' to ensure communications would be kept with the Mildura Communications Centre. However, he could not hear communications with other agencies.

4.2.3.6. Mr Hafner told the Court that he did not think about who was in control of the scene before they arrived or that he and Ms Milikins were now in control of the scene. He said that he played a responsive role:

"... my reaction to that scene was to attend, assess and communicate. Without the communication of us informing Mildura Communications who had the capacity to inform both ambulance, CFA, SES or any - any agency that would be required, if they don't have that information - time was of the essence – that needed to be done."

4.2.3.7. Accordingly, Mr Hafner and Ms Milikins ran along the railway line directly to Carriage C of the train. They told the passengers who had exited Carriage C to sit on the grass. Mr Hafner then entered the Carriage C and confirmed that Mrs Wishart had already died.

4.2.3.8. Mr Hafner and Ms Milikins then went to Carriage B. There, they met Mr Buckland. Mr Buckland told Ms Milikins that he helieved there were thirty passengers in economy and six in first class.

4.2.3.9. After reviewing the three carriages, Mr Hafner radioed the Mildura Police Communications Centre with a situation report and informed that there were multiple deceased and multiple seriously injury passengers.

4.2.3.10. Mr Hafner also told the Court that he did not need any further information from V/Line to provide a situation report at that stage of the incident:

"With the V/Line staff, nothing more than what I saw with my own eyes needed to be communicated to me."

4.2.3.11. The Mildura Police Communications Centre activated the State Emergency Services and VicRoads to set up traffic diversions. By then Victoria Police helieved there were three fatalities and four serious injuries.[543]

4.2.3.12. Mr Gibson and Mr Maxwell left the Kerang Police Station soon after Mr Hafner and Ms Milikins with their lights and sirens operating

4.2.3.13. Mr Gibson told the Court that he was well aware that his role was to take charge of the scene. He said that, in addition to his Victoria Police training:

"I've undertaken training through the SES in relation to emergency management. I've also undertaken training through DSE which is - runs the AIMS program, which is the Australian Incident Management System, so I was well aware of what my role was going to be on arrival at the scene."

4.2.3.14. At 1:44pm, Mr Gibson approached the scene and confirmed with Mildura Police Communications Centre that he would take the role of Forward Controller of the incident.

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543 The transcript does not include times.

4.2.3.15. Mr Gibson assessed the scene and spoke to Mr Hafner as Mr Hafner was exiting Carriage C. He then confirmed at least one fatality with Mildura Police Communications Centre. At 1:50pm, he noted that the first ambulance had arrived and returned to the road.

4.2.3.16. As Mr Gibson was talking to the ambulance officer, Neil Harrop, he watched Senior Constable Greg Grundy attempt to drive his police four wheel drive towards Carriage B and become bogged. Mr Grundy told Mildura Police Communications:

> *"It's impossible to get ambulances in here. I'm bogged to the axles in a 4 wheel drive. So we're going to have to get another route through a paddock."*

4.2.3.17. Therefore, Mr Gibson determined that no ambulances or police vehicles could access the train using the access track and he arranged with the Country Fire Authority Controller, Dennis Greenwood, to assist in recovering patients from Carriage B.

4.2.3.18. At 1:53pm, Mr Gibson asked the Mildura Police Communications Centre to call out the State Emergency Services. Mr Gibson also notified the local hospitals to expect possible casualties. In effect he activated their all hazards external emergency plans nominated as "Code Brown".[544]

4.2.3.19. When Mr Gibson returned to Carriage B he spoke to Mr Lidster and Mr Buckland. They told him there were between 30 and 40 people on the train.

4.2.3.20. Further, Sergeant Troy Hargadon from Swan Hill Police Station heard Mildura Police Communications Centre tasking Mr Hafner and Ms Milikins to attend a collision at the Kerang level crossing. Therefore, he contacted Senior Constable Oakley from Piangil Police Station. Mr Hargadon and Mr Oakley left Swan Hill Police Station at 2:25pm.

4.2.3.21. At 1:40pm on 5 June 2007, Mildura Police Communications Centre despatched Detective Senior Constable Alan Rumble to the Kerang level crossing.

4.2.3.22. At 1:45pm, Mildura Police Communications Centre despatched Senior Constable Mark Griffiths and Leading Senior Constable Beasy from Swan Hill Police Station to the Kerang level crossing.

4.2.3.23. At 1:50pm, Mildura Police Communications Centre also despatched several detectives and Senior Constable Jennifer Atkins from Swan Hill Police Station to the scene.

4.2.3.24. At 1:50pm, Inspector Garry Bennet was told about the collision at the Kerang level crossing when he arrived at work in Swan Hill. He immediately left for the scene.

4.2.3.25. At 2:05pm, Mr Griffiths and Mr Beasy arrived at the scene.

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544 Later articulated in Department of Human Services, "Hospital resilience code brown policy framework", 20 October 2008.

4.2.3.26. At 2:12pm, Mr Bennett arrived at the scene. He took over the role of Incident Commander from Mr Gibson and established an Incident Control Centre at Mr Grundy's Victoria Police four wheel drive vehicle beside Carriage B. Mr Bennett was assisted by Mr Gibson.

4.2.3.27. Mr Bennett also established an Emergency Management Team comprising himself, Ross Hamilton from State Emergency Services and the Operations Manager and Rostered Duty Officer for the Country Fire Authority, Stuart Broad. Senior Sergeant Deveson took over the role of Municipal Emergency Response Coordinator for the Gannawarra Shire.

4.2.3.28. There was no representative of the Rural Ambulance Service on the Emergency Management Team. Mr Bennett explained that they were not able to leave the train carriages. There was also no repsesentative from V/Line.

4.2.3.29. Further, after discussion, the Emergency Management Team decided not to open a Municipal Emergency Coordination Centre because they needed to conserve their resources and it was already clear that the emergency would not be on-going.

4.2.3.30. At about this time, Mr Gibson and Mr Grundy re-assessed Carriage B. They confirmed all casualties and walkers had been removed and there were eight fatalities. This information was communicated to Mildura Police Communications Centre. The initial response was complete and the train was declared a Crime Scene.

4.2.3.31. At 2:16pm, Mr Gordon and the Swan Hill detectives and Ms Atkins arrived at the scene and commenced their investigations.

4.2.3.32. At 2:19pm, Mr Rumble arrived at the scene. He was tasked to direct less severely injured passengers to a holding area.

4.2.3.33. At about 2:25pm, Mr Gibson telephoned Constable Derek Jenkins at the Kerang Police Station and told him to come to the Kerang level crossing to assist Mr Hafner and Ms Milikins. Therefore, I infer that this direction was not made through the Mildura Police Communications Centre.

4.2.3.34. At abut 2:30pm, Mr Jenkins arrived at the scene.

4.2.3.35. At 2:35pm, Ms Atkins drove the ambulance with Mr Scholl and a paramedic, Michael Allen to the Kerang hospital.

4.2.3.36. At 2:54pm, Mr Hargadon and Mr Oakley arrived at the scene. Mr Hargadon sent Mr Oakley to check on police personnel who had been working at the scene for nearly an hour by this time.

4.2.3.37. Further, Mr Gibson was still uncertain about how many passengers had been on the train when the collision occurred. Therefore, Mr Haradon spoke to Mr Buckland again.

4.2.3.38. Mr Gibson and Mr Haradon then retrieved the conductor's folder on a shelf at his desk within the front section of Carriage A. At 3:30pm, after discussion with Mr Buckland, Mr Haradon was able to confirm there had been 37 passengers and three crew on the train.

4.2.3.39. At about 4:30pm, the Bendigo Victoria Police Mobile Command Post arrived at the scene. All the passengers had gone but the investigation and clean up continued.

4.2.4 Ambulance

4.2.4.1. At 1:34pm on 5 June 2007, Bendigo Rural Ambulance Communications Centre received their first notification of the collision at the Kerang level crossing. At 1:37pm, they despatched the Kerang ambulance officers and notified the Area Management Team in Mildura.

4.2.4.2. Neil Harrop was an Advanced Life Support paramedic and Kerang Station officer with 31 years experience as an ambulance officer.

4.2.4.3. Stephen Humphreys was a Community Rural Ambulance Service Level 2 who had worked with the Kerang Rural Ambulance Service team for seven years. This included 30 hours of formal training a year. Mr Humphreys also had extensive experience with the State Emergency Services including in-field training in emergency response and representing the SES at the municipal emergency management meetings.

4.2.4.4. Most recently, in May 2007, Mr Harrop and Mr Humphreys had both been trained in the State Health Emergency Response Plan as part of a one-day in-service programme which included instruction on how to assess patients more accurately, initiate treatment quickly and transport to the most appropriate hospital. If a patient had been assessed as in a time critical condition, both Mr Harrop and Mr Humphreys knew he required transport to the most appropriate trauma hospital as soon as possible.

4.2.4.5. At about 1:40pm, Mr Harrop and Mr Humphreys arrived at the scene. Mr Harrop parked the Kerang ambulance on the north side near Mr Scholl's truck.

4.2.4.6. As required by the Rural Ambulance Victoria Emergency Management Plan, Mr Harrop was the senior ambulance officer and acted in the role of Ambulance Commander. He did not go to the train at all during the incident.

4.2.4.7. At 1:42pm, Graham McGrath delegated staff to the incident and established the Bendigo Rural Ambulance Victoria Communication Centre as the Operations Centre

4.2.4.8. Mr McGrath also notified Mr Harrop that the Cohuna car had been despatched and the senior ambulance personnel had been notified.

4.2.4.9. By this time Mr Gibson had returned to the road from the train. He told Mr Harrop about the soft muddy condition of the road near Carriage B and advised against using it for vehicles. Mr Gibson and Mr Harrop also asked Mr Humphreys to go to Carriage B to commence preliminary triage and treatment.

4.2.4.10. Mr Humphreys agreed to go to Carriage B and took the trauma kit with him to the train. He contacted Bendigo Rural Ambulance Victoria Communications Centre as he walked to say they needed more resources:

> *"Look you'd better - look, I've got multiple patients out here-you'd better get as much as you can coming."*

4.2.4.11. Mr Humphreys then proceeded to triage passengers. He told the Court:

> *"... you 're checking for response. If you've got an airway for breathing, if they've got a pulse. Anything else. If you can't get someone to do something you move on to the next patient. You're -you're looking at the people who can survive... "*

4.2.4.12. Mr Harrop first went to assess Mr Scholl. He quickly assessed Mr Scholl's injuries as serious but not life threatening.

4.2.4.13. Then, at 1:45pm, Mr Harrop surveyed the scene from the road and saw people coming back to get equipment out of the ambulance. He was still unaware of the extent of the incident and had not seen the damage to Carriage B.

4.2.4.14. Accordingly, Bendigo Rural Ambulance Communications Centre upgraded the Cohuna car to lights and sirens and despatched ambulances from Swan Hill and contacted Air Ambulance.

4.2.4.15. Further, at 1:48pm, Mr Humphries contacted the Bendigo Rural Ambulance Communications Centre on his mobile phone as he was walking to Carriage B. He asked for call out of the State Emergency Service because people were trapped but he still did not have any estimate of the number of fatalities or casualties.

4.2.4.16. When Mr Humphreys arrived in Carriage B, Mr Hafner briefed him about his observations of patient acuity. By this time, the police four wheel drive was bogged beside Carriage B and Mr Gibson was trying to manage that situation.

4.2.4.17. Mr Humphreys proceeded to begin initial patient management and triage. He also allocated V/Line staff and other passengers and by-standers to comfort the severely ill and dying. Mr Humphreys told the Court:

> *"I just asked is it OK to stay with them and keep an eye on them for me and they said they would."*

4.2.4.18. At 1:50pm, Bendigo Rural Ambulance Communications Centre notified the Emergency Department at Swan Hill Hospital:

> *"We've got a semi-trailer into a passenger train. Multiple fatalities. Multiple serious injuries. At the moment we've got one car on scene.....I thought I'd just better give you a heads up"*

4.2.4.19. At 1:54pm, Mr Harrop was still managing Mr Scholl. He still thought that his facial injury was the most seriously injured patient. Mr McGrath suggested that Mr Harrop concentrate on his tasks under the Emergency Response plan:

> *"Can I suggest that you concentrate on setting up a TCO and CCO rather than one patient and if you can give us an indication-rough as it may be-as to the number of patients you've got thanks."*

4.2.4.20. At 1:56pm, Mr Harrop provided Mr McGrath with a situation report that there were at least four fatalities and another five seriously injured. Another despatcher updated the Air Ambulance with these figures. One helicopter was already on the way.

4.2.4.21. At 1:57pm, Mr McGrath also confirmed with the Regional Emergency Response Coordinator, Steve Fumberger from Mildura, that the scene looked as if it was going to be quite protracted and he should proceed south.

4.2.4.22. At 1:59pm, Mr Leeder from Cohuna arrived at the scene. Mr Harrop used his radio to direct him to the train. Mr Humphreys briefed Mr Leeder at Carriage B.

4.2.4.23. By about 2:00pm, when Mr Harrop had checked that Mr Scholl had no life threatening injuries, he moved the ambulance to the south side of the level crossing to make room for the helicopter to land.

4.2.4.24. The access to the train was wet so the Forward Commander refused to allow any ambulances closer to the patients for fear of becoming bogged. Mr Harrop established a Casualty Collection Post on the road and all non-ambulant patients were brought up from the train on stretchers by emergency service workers, volunteers and two four-wheel drive vehicles.

4.2.4.25. In effect, Mr Harrop had also appropriately established himself as the Casualty Collection Officer.

4.2.4.26. At 2:00pm, Mr Leeder arrived at the scene. Mr Harrop directed him to Carriage B of the train. Mr Leeder took some equipment with him to the train. He was assisted by Cohuna police officer Greg Grundy.

4.2.4.27. At 2:00pm, a third Advanced Life Support Paramedic, Chris Jewson, from Swan Hill Rural Ambulance Service was recalled from leave. Mr Jewson was despatched with lights and sirens in a fourth Swan Hill ambulance with a fourth Advanced Life Support Paramedic, Michael Allan, and a student Ambulance Paramedic, David Rowlings.

4.2.4.28. At 2:03pm, Mr Harrop informed Bendigo Rural Ambulance Communications Centre that Mr Scholl was quite stable. Bendigo Rural Ambulance Communications Centre responded:

> *"Guys, I really need a CCO/TCO to do an accurate assessment on the patients if you wouldn't mind thanks."*

4.2.4.29. By 2:05pm, Mr Humphreys, Mr Leeder, Mr Grundy and Country Fire Authority Officer Peter Boal were all working in or around Carriage B.

4.2.4.30. At 2:11pm, Mr Boal from Kerang updated the situation report to Bendigo Rural Ambulance Communications Centre: six fatalities including children and five serious or critical injuries. Mr Boal also advised:

> *"Umm and if you've got a manager on the way some coordination would help."*

4.2.4.31. Mr Boal was reassured that Mr Astall was on the way and that two managers had left Mildura.

4.2.4.32. At 2:12pm, Bendigo Rural Ambulance Communications Centre spoke to Kerang Hospital. The nurse was aware of the situation because she had been talking to her husband at the scene. The hospital had already called in 20 staff and set up waiting for patients.

4.2.4.33. At 2:14pm, Advanced Life Support Paramedic, Robert Lawson, and MICA Paramedic, Wes Ewart, from Swan Hill Rural Ambulance Service arrived at the scene. Mr Harrop sent them straight to Carriage B of the train.

4.2.4.34. At 2:22pm, ambulance officer John Hill, and Mobile Intensive Care paramedic Brendon Smith, arrived from Swan Hill. Mr Harrop directed Mr Hill to the train and Mr Smith to assess Mr Scholl.

4.2.4.35. Mr Smith assessed Mr Scholl, applied bandage to his right arm, cannulated his left arm and handed him over to Michael Allen for transfer to Kerang Hospital.

4.2.4.36. Mr Scholl did not have serious injuries and did not meet the criteria for Pre-hospital Major Trauma triage and transfer to a specialist trauma unit.[545] Therefore it was appropriate for him to be transferred to an urgent care service under the Victorian State Trauma Plan.[546]

4.2.4.37. At 2:14pm, Mr Harrop told Bendigo Rural Ambulance Communications Centre:

> *"Can you pass on we've got ten walking wounded, we've got four deceased and five fairly crook people here, five Code 1's. We've got a guy that's pretty damned sick."*

4.2.4.38. Bendigo Rural Ambulance Communications Centre spoke to Cohuna Hospital to warn them there were four fatalities and five seriously injured. The caller also said:

> *"So I don't know if you'll be getting any one but I'm just giving you a heads up. It's just north of Kerang the accident so at the moment just letting the hospitals know just in case we do send someone... We will let you know about it in advance."*

4.2.4.39. At 2:21pm, Bendigo Rural Ambulance Communications Centre spoke to V/Line for the first time. V/Line told the caller that there were 37 passengers and three crew on the train. The conductor had told them at the start there were six fatalities and 12 seriously injured.

4.2.4.40. At 2:22pm, Mr Harrop told the Bendigo Rural Ambulance Communications Centre that there were still four fatalities and five seriously injured.

4.2.4.41. At about 2:30pm, Ambulance Flight Mobile Intensive Care Ambulance paramedic Kelvin Walsh arrived at the scene. Mr Harrop also directed him to Carriage B.

4.2.4.42. Mr Walsh was arriving at Carriage B at the same time as Mr Humphreys was removing Mr Long on a spinal board. Mr Walsh did not assess Mr Long before his transfer to the Casualty Collection Post on the road.

4.2.4.43. By 2:37pm, Station Officer Geoff Astall and Ian Gibson (ambulance scene co-ordination), from Swan Hill had arrived and Mr Astall had taken over the role of Health Commander from Mr Harrop.

4.2.4.44. By this time, Mr Harrop had assessed three patients. The other passengers were either still at Carriage B being extricated or assisting other patients. Others were walking themselves to the patient collection point so they were not seriously injured.

4.2.4.45. Mr Harrop remembered that:

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545 Ministerial Taskforce on Trauma and Emergency Services and the Department of Human Services Working Party on Emergency and Trauma Services, "Review of Trauma and Emergency Services Victoria 1999."

546 Department of Human Services, "Metropolitan and Regional Paediatric and Adult Major Trauma Triage Guidelines", undated.

"But at this stage we were still in the triage and treatment stage. We weren't up to the transporting stage."

4.2.4.46. In these circumstances, Mr Harrop had not called in the local general practitioners to assist him. He explained to the Court that they were not required as much after ambulance officers like him had received Advanced Life Support training so that they could provide airway support using a mask and administer drugs and Air Ambulance was available to transfer to trauma services:

"we have had - back in the early days prior to advanced life support and the advent of helicopter service, we have had doctors at scenes to assist us. But not for a little while now."

4.2.4.47. Further, Mr Harrop denied participating in any decisions to transfer patients by air rather than use road transport. In effect, he had not accepted the role of Transport Coordination Officer because no patients were ready for transport. He said Mr Astall made those decisions:

"I think Jeff (Astall) was in liaison with - and - with the control centre and were making the decisions on that."

4.2.4.48. At 2:37pm, Mr Astall contacted the Bendigo Rural Ambulance Victoria Communications Centre. He confirmed there were problems with vehicles getting bogged and patients requiring manual transfer to the Casualty Collection Post on the highway. He confirmed that Mr Long was ready for transfer to Kerang airport but probably needed a Mobile Intensive Care Ambulance paramedic escort. Mr Astall also told the call taker:

"It's just going to take a little while to work out what's going on as you will understand."

4.2.4.49. At that stage, Mr Scholl was the only other patient they had ready for transfer.

4.2.4.50. At 2:37pm, Mr Walker and Associate Professor Epstein contacted Bendigo Rural Ambulance Communications Centre from the Emergency Control Room they had established at their meeting site. Mr Walker said that Associate Professor Epstein intended to activate a further Field Emergency Officer and they needed the precise location of the incident.

4.2.4.51. At 2:39pm, Bendigo Rural Ambulance Communications Centre told Kerang Hospital that Mr Scholl was on his way with minor head injuries. They did not need a doctor at the site but they would ring them if it became necessary.

4.2.4.52. At 2:49pm, the number of seriously injured patients was downgraded from 12 to seven. Mr Harrop told someone who told the Acting General Manager Operational Services with Rural Ambulance Victoria, Tony Walker, who told Bendigo Rural Ambulance Victoria Communications Centre.

4.2.4.53. At 2:51pm, Mr Walker contacted Bendigo Rural Ambulance Victoria Communications Centre to get his first update. He was unaware that they had already set up as the Operations Centre. Mr McGrath told him that his information was that there were six fatalities, 12 time critical patients and 22 other passengers and crew.

4.2.4.54. At 3:15pm, Bendigo Rural Ambulance Communications Centre believed that:

> *"Everything that needs to be moved is going directly to Melbourne and most of it has already gone."*

4.2.4.55. Further, at 3:16pm, Mr Astall told Bendigo Rural Ambulance Victoria Communications Centre that there were now eight or 10 fatalities and everyone was away from the carriages. He also said that a bus was coming to take the walking passengers to Bendigo. The call taker responded:

> *"Well we've actually, we haven't been told that, the problem is everyone keeps ring everybody else but (not) coming through here, so I'm not sure about the bus."*

4.2.4.56. At 4:19pm, Mr Walker told another ambulance officer from Mildura, Dale Richards, to go to Swan Hill Hospital and take over the role of ambulance coordinator there. Mr Richards rang the Bendigo Rural Ambulance Communications Centre. They did not know about the arrangement and responded to Mr Richards:

> *"Mate there's no point in going there because you're not getting any patients... We've either transported them all by air or they're either deceased or they're at Kerang being assessed.... Oh look to be honest mate, I'd head back to Mildura."*

4.2.4.57. At about 4:24pm, Mr Ewart and Mr Gibson were undertaking the final sweep to confirm the deaths of passengers still in the train He confirmed that there were no more live passengers at the scene.

4.2.4.58. At 4:24pm, the Area Manager, Kerry Strachan, arrived from Mildura with a Logistics Officer and a Clinical Officer. Mr Strachan took over the role of Health Commander. There ws nothing left for him to do at the scene.

4.2.4.59. However, the Bendigo Rural Ambulance Victoria Communication Centre continued to operate.

4.2.4.60. At 4:27pm, Dr Woods sought direction as to whether Mr Scholl would be discharged to Bendigo or to Melbourne. He was advised to organise transfer Mr Scholl to Melbourne because there was already a plane on the ground spare at Kerang.

4.2.4.61. At 4:30pm, Mr Scholl was discharged from Kerang Hospital at the request of Dr Wood.

4.2.4.62. Under the State Health Emergency Response Plan, a mass casualty remains an alert until an ambulance crew arrives at the scene and confirms the reports that have initiated their despatch. [547] Therefore, the initial situation report is crucial in determining subsequent escalation of emergency service responses.

4.2.4.63. The first ambulance crew on the scene retains responsibility for providing the initial situation report and conducting initial triage as soon as possible.[548]

4.2.4.64. However, in June 2007, Rural Ambulance Victoria had been trialling computer-aided despatch in Bendigo Rural Ambulance Control Centre for about six months. The trial programme had a mapping facility but it did not include capacity to automatically locate vehicles.

4.2.4.65. Further, the mobile radios at the scene did not clone properly were unable to clone to their vehicles through the Mobile Repeater System.so that they could be used at the train as well as at the road. This communication was difficult because the mobile radios were unable to clone to their vehicles through the Mobile Repeater System so they could not be used at the train.

4.2.4.66. I also note that all contact between Bendigo Rural Ambulance Control Centre and Mr Astall was by mobile phone until his phone went flat and all contact was lost.

4.2.4.67. At 1:34pm[549] on 5 June 2007, a 000 call taker forwarded a 000 call from a by-stander at the Kerang level crossing through to the Bendigo Rural Ambulance Control Centre. There were several 000 lines into the Bendigo Rural Ambulance Control Centre and there were two call takers on duty.

4.2.4.68. In this way, Rural Ambulance Victoria became aware of an incident involving a semi-trailer hitting a train on the Swan Hill-Kerang Road 10 kilometres north of Kerang. The call-taker handed the call to Graeme McGrath, the Bendigo Communication Centre Northern controller

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547 Ambulance Victoria, "Emergency Response Plan 2009".

548 Ambulance Victoria, "Emergency Response Plan 2009".

549 I note this time was recorded as 1338 in the Bendigo Rural Ambulance Control Centre Communications Log.

4.2.4.69. Mr McGrath was experienced in emergency management and had worked with Melbourne Ambulance Service before he transferred to the Rural Ambulance Service..

4.2.4.70. At 1:37pm on 5 June 2007, Mr McGrath spoke to Advanced Life Support Paramedic, Neil Harrop. At 1:38pm, he despatched Mr Harrop and community ambulance officer, Steven Humphreys, from Kerang Rural Ambulance Service with lights and sirens operating to the incident at the level crossing five kilometres north of Kerang. The call taker told the police that an ambulance was already despatched.

4.2.4.71. At 1:38pm, the Mildura Police Communications Centre first contacted the Bendigo Rural Ambulance Communications Centre to inform them of the incident at the Kerang level crossing.

4.2.4.72. Further, at 1:39pm, Bendigo Rural Ambulance Control Centre despatched a helicopter to the scene and noted that there was a fixed wing aircraft on the ground at Swan Hill on stand by.

4.2.4.73. At 1:39pm, Bendigo Rural Ambulance Control Centre also called the Country Fire Authority and, after some discussion about the site of the incident, arranged for despatch of their appliances. They confirmed that the truck driver was out of his truck but they still had no idea whether there were any injuries in the train.

4.2.4.74. At 1:41pm, Mr McGrath also despatched ambulance officer, Stephen Leeder, from Cohuna Rural Ambulance Service to the incident at the Kerang level crossing on Signal 2 until the situation was confirmed.

4.2.4.75. Mr Harrop was aware of the importance of situation reports. He told the Court:

> *"it's very important for us because it - it gives the control centre a - a picture of what - what we may need and - and what they need to organise to assist us."*

4.2.4.76. At about 1:45pm, Mr Harrop contacted the Bendigo Rural Ambulance Northern Control Centre in his first situation report and to ask for more resources. He told them:

> *"Look I've got multiple patients out here-you'd better get as much as you can coming."*

4.2.4.77. Mr Harrop also confirmed the need for Swan Hill resources and asked for the Cohuna vehicle to be upgraded to Signal 1. At 2:00pm, Mr Leeder arrived at the scene.

4.2.4.78. However, the full extent of the damage of Carriage B and the number of casualties was not obvious to Mr Harrop when he surveyed the scene from the road.

4.2.4.79. Further, in the absence of working radios, Mr Harrop and other ambulance officers resorted to using their mobile phones for communication with each other and Bendigo Rural Ambulance Victoria Communication Centre.

4.2.4.80. Therefore, some communications have not been recorded.

4.2.4.81. At 1:45pm, the Mildura Police Communications Centre also contacted the Bendigo Rural Ambulance Communications Centre and confirmed that there were multiple fatalities and serious injuries at the Kerang level crossing incident.

4.2.4.82. On the basis of this situation report from Victoria Police, at 1:45pm, Mr McGrath arranged for another despatcher to call out Air Ambulance Victoria and seek and sought deployment of one helicopter and one fixed wing aircraft.

4.2.4.83. Bendigo Rural Ambulance Victoria Communications Centre also notified local hospitals and senior Rural Ambulance Victoria management including Mr Walker and the Regional Controller, Steven Fumberger, in Mildura of the possibility of multiple casualties.

4.2.4.84. In the absence of objective information, Bendigo Rural Ambulance Victoria Communications Centre treated these communications as preliminary only.

4.2.4.85. At 1:47pm, the Mr McGrath despatched Mobile Intensive Care Paramedic, Brendon Smith, and Advanced Life Support Paramedic, John Griffiths, from Swan Hill Rural Ambulance Service to the incident at the Kerang level crossing.

4.2.4.86. After Mr Smith and Mr Griffiths left Swan Hill, a second Advanced Life Support Paramedic, Robert Lawson, and a second Mobile Intensive Care Paramedic, Wesley Ewart, from Swan Hill Rural Ambulance Service were also despatched in a second Swan Hill ambulance.

4.2.4.87. At 1:47pm, Bendigo Rural Ambulance Communications Centre called in a third Advanced Life Support Paramedic, Peter Salathiel from leave. At 2.57pm, he left in a third Swan Hill ambulance to the incident at the Kerang level crossing.

4.2.4.88. At 1:48pm, Mr Ewart told the Station Supervisor at Swan Hill, Mobile Intensive Care Paramedic Geoffrey Astall, about the incident. Therefore, I infer that Bendigo Rural Ambulance Communications Centre had not already directly contacted Mr Astall to inform him about the incident at the Kerang level crossing.

4.2.4.89. This is inconsistent with the report prepared for the all agencies debrief which stated:

"Due to the distance to travel from Mildura to Kerang (normally a three hour trip) it was decided to appoint the Swan Hill Station Officer as Health Commander."[550]

4.2.4.90. At 1:52pm, Mr Astall telephoned Mr McGrath and told him he was available to attend the incident as Ambulance Co-ordinator.

4.2.4.91. Although the Area management team was in Mildura and three hours away, Mr McGrath was concerned about authorising Mr Astall's appointment as Ambulance Co-ordinator.

4.2.4.92. He agreed that Mr Astall should move towards Kerang and also advised him to consult with the Area management team in Mildura because they were also being mobilised.

4.2.4.93. At 1:53pm, Peter Boal was at the scene with the Country Fire Authority but he was also an ambulance officer attached to Kerang Rural Ambulance Service. Mr Boal changed his role to ambulance officer. Mr Boal communicated directly with Mr McGrath seeking further organisational assistance.

4.2.4.94. At 1:54pm, Mr Harrop was still managing Mr Scholl. He still thought that his facial injury was the most seriously injured patient. Mr McGrath suggested that Mr Harrop concentrate on his tasks under the Emergency Response plan:

"Can I suggest that you concentrate on setting up a TCO and CCO rather than one patient and if you can give us an indication-rough as it may be-as to the number of patients you've got thanks."

4.2.4.95. At 1:57pm, Mr Harrop provided Mr McGrath with a situation report that there were at least four fatalities and another five seriously injured. Another despatcher updated the Air Ambulance with these figures. One helicopter was already on the way.

4.2.4.96. At 1:57pm, Mr McGrath also confirmed with Steve Fumberger from Mildura that the scene looked as if it was going to be quite protracted and he should proceed south.

4.2.4.97. At 1:59pm, Mr Leeder from Cohuna arrived at the scene. Mr Harrop used his radio to direct him to the train.

4.2.4.98. At 2:05pm, Air Ambulance offered a fixed wing then at Swan Hill but with only a flight paramedic on board. The plan was to put a Mobile Intensive Care Ambulance paramedic on at the scene for the flight to Melbourne if necessary.

4.2.4.99. At 2:51pm, Mr McGrath also told Mr Walker they were already using the fixed wing aircraft to transfer Mr Long:

"basically a signal 3 patient".

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550 Tony Austin, "All Agency Kerang Debrief", Rural Ambulance Victoria, 28 June 2007.

4.2.4.100. Despite this conversation with Mr McGrath, Mr Walker said that he would arrange for a further fixed wing aircraft to be deployed with arrangements made through Bendigo Rural Ambulance Victoria Communications Centre:

> *"OK what we might do Graham is just get the other fixed wing moving up that way, doesn't matter if we cancel it but at least it's on it's way to you."*

4.2.4.101. Further, the State Health Emergency Response Plan required the Health Commander to activate the Field Emergency Medical Officer if they needed assistance to provide field medical assistance advanced medical knowledge and assistance with determining allocation of patients to appropriate medical facilities.

4.2.4.102. Further, in the absence of earlier activation, SHERP 2006 required the Health Commander to consult with the Field Emergency Medical Co-ordinator if they estimated that casualties will still be on site 90 minutes after the event began, in this case that time would be about 3:05pm.

4.2.4.103. Mr Harrop and Mr Astall agreed that there was no need to activate the Field Emergency Medical Coordinator because of the small number of seriously injured patients and their transfer to Kerang or Melbourne hospitals. However, in the absence of any consultation with or involvement in the Emergency Management Committee, I am unable to understand how Mr Harrop or Mr Astall could make this assessment.

4.2.5 Country Fire Authority

4.2.5.1. At 1:43pm, Mildura Police Communications Centre notified the Country Fire Authority of the incident at the Kerang level crossing.

4.2.5.2. At 1:47pm, two Kerang Country Fire Authority units turned out. At 1:52pm, they were on scene. Dennis Greenwood took the role of CFA Commander and directed removal of diesel and other contaminants from the road. Mr Greenwood also directed his crews to assist in recovery of patients from Carriage B.

4.2.5.3. At 1:53pm, Mr Greenwood was updated through the Mildura Police Communications Centre indicating there were at least three fatalities and four serious injuries.

4.2.5.4. From 3.30pm, the Country Fire Authority crews were progressively released. However, the Kerang crew continued to assist with police investigations and recovery.

4.2.5.5. Further, at 1:43:41pm, the Country Fire Authority notified the Region 20 Operations Manager and Rostered Duty Officer, Stuart Broad, of the collision at the Kerang level crossing. This pager is initiated within 30 seconds of the Country Fire Authority receiving notification of the incident.

4.2.5.6. At 1:45pm, Mr Broad left Teddywaddy with lights and sirens operating.

4.2.5.7. As he travelled to Kerang, Mr Broad confirmed the nature of the incident and directed the Swan Hill Operations Manager to meet him at the scene. He also directed activation of the Kerang and Cohuna fire appliances.

4.2.5.8. Mr Broad also deployed the Golden Square Fire Brigade Mobile Communications Centre. It arrived on scene at 4:04pm.

4.2.5.9. I infer from Mr Broad's statement that this equipment was volunteered without discussion with the Victoria Police Incident Commanders, Mr Bennett and Mr Deveson, or the Rural Ambulance Health Commander on scene, Mr Harrop.

4.2.5.10. The Country Fire Authority reviewed their contribution to the incident. [551]

4.2.6 State Emergency Services

4.2.6.1. At 1:53pm, the Kerang State Emergency Services Unit responded immediately to a request through the Mildura Police Communications Centre.

4.2.6.2. At 1:55pm, the State Emergency Services Controller, Shane Leerson, was on site with three crew. As Incident Controller, Mr Gibson told them:

"All your assistance and all your dedication has to be on Carriage B"."

4.2.6.3. By 2:23pm, it was clear that no more State Emergency services crews were required and the Swan Hill crew was stood down.

4.2.6.4. However, the State Emergency Services Regional Manager South West Region, Mark Kiely, was in Bendigo. He was alerted to the Kerang level crossing incident through the Emergency Alert Paging system when the Kerang crew were despatched.

4.2.6.5. Mr Kiely told the Court that he liaised with the Country Fire Authority to ensure that the incident was properly resourced and deployed the Swan Hill State Emergency Service Unit to support the Kerang unit.

4.2.7 Medical practitioners

4.2.7.1. On 23 June 2007, Dr Lindsay Sherriff and Dr Mike Moynihan wrote to the State Coroner.

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551 Tony O'Day," CFA,Operational Analysis Level crossing Incident Approximately 4 km North of Kerang, 5th June 2007", 3 August 2007.

4.2.7.2. Dr Sherriff is a general practice and anaesthetics doctor in Kerang. Dr Moynihan is a general practitioner in Swan Hill and voluntary President of the Rural Doctors Association of Victoria.

4.2.7.3. Dr Sherriff and Dr Moynihan expressed the view that there was minimum evaluation, response and alleviation of pain in the first hour of the incident at the Kerang level crossing on 5 June 2007 because of delays in Mobile Intensive Care Ambulance paramedic arrival and failure to call out the local medical practitioners.

4.2.7.4. Further, in evidence, Dr Moynihan expressed the view that the call out of medical practitioners was compromised by the role of the Field Emergency Medical Controller, Dr Joe Epstein.

4.2.7.5. In particular, Dr Moynihan told the Court:

> *"I have to say that I know Joe quite well. I did feel that this exposed extreme limitation of the then disaster control and I'm not quite sure what - you know, how and if it has changed since then, but, really, this was a situation which demanded a far greater technical capability. It's required really activation of an office in Melbourne, rather than an individual and it required lots of telephones and quite a few people...*
>
> *I can't specifically criticise him because I'm not aware of the details, but all I can imagine is - is that the necessary orders were not given and that it was probably partly his responsibility. I cannot understand why, when there was a fully cleared reception area at the hospital, why a reception area was set up in town, that is a mystery to me. I mean, was it forgotten that hospitals had Code Brown's? Did the police - were the police involved? You know, did Dr Epstein talk to the police commander involved? Was the police commander assisting with the development of the response? I don't know the answers to these questions."*

4.2.7.6. However, it became clear during the course of the Inquest that Dr Moynihan had been basing his opinions on information provided to him by passengers and by-standers at the scene. Not all of this information was correct in content and/or in sequence of events. Further, Dr Moynihan's evidence does not directly relate to the passengers who died or to Mr Scholl.

4.2.7.7. Therefore, I have treated Dr Moynihan's evidence as an expression of the depth of local public opinion about the failure to call local medical officers to the scene.

4.2.7.8. For example, Mr Peacock also expressed the views felt by his wife and many of the other local residents when he told the Court that the Kerang general practitioners should have been called out because they could have got to the scene:

"A lot sooner than a lot of the ambulance that arrived. He could have been there in six minutes if he was asked to come. You said ambulances came from Cohuna. Cohuna is 25 minutes away. Swan Hill's 35 or 45 minutes away. There was one ambulance - as far as I know only one ambulance came from Kerang."

4.2.7.9. Mrs Bennett also said that Dr Sherriff was angry because he wasn't allowed to the scene and none of the other hospital workers who were all able and ready to go weren't allowed on to the scene.

4.2.7.10. It is true that no medical practitioners were involved in initial management and triage of patients at the scene. Certainly none provided assistance at the scene to Mr Long, Mr Parker or Mr Scholl who are the three patients within my jurisdiction.

4.2.7.11. Further, Mr Parker died during transfer to the Casualty Collection Post, Mr Long was transferred directly to Melbourne by Air Ambulance without initial assessment at a Trauma Centre, and Mr Scholl was transferred to Kerang Hospital. He was subsequently transferred by Air Ambulance at the request of his treating doctor.

4.2.7.12. The State Disaster Plan and State Health Emergency Response Plan provide for Field Emergency Medical Officers to be called out by the Incident Commander and/or the Health Commander as required.

4.2.7.13. Field Emergency Medical Officers are funded by the Department of Human Services (now the Department of Health) and coordinated by the Field Emergency Medical Director, Associate Professor Joe Epstein.

4.2.7.14. On 5 June 2007, there were no Field Emergency Medical Officers appointed in the Kerang area.

4.2.7.15. It is also true that no other medical practitioners were called out by the Health Commander or Rural Ambulance Victoria Communications Centre. In particular, neither the Health Commander nor the Rural Ambulance Victoria Communications Centre believed that the incident required the involvement of medical officers in the initial stage of their response.

4.2.7.16. Accordingly, neither the Health Commander nor Rural Ambulance Victoria Communications Centre believed they needed medical assistance and neither of them activated the Field Emergency Medical Director.

4.2.7.17. Associate Professor Epstein found out about the incident because he was at a meeting in Camperdown with Mr Walker[552]. Associate Professor Epstein and Mr Walker established a disaster response facility at their conference table. This group activated Associate

552 Acting General Manager Operational Services with Rural Ambulance Victoria.

Professor Epstein without reference to the Health Commander nor Rural Ambulance Victoria Communications Centre.

4.2.7.18. At 2:07pm, Associate Professor Epstein notified the Field Emergency Medical Office and, in the absence of a Field Emergency Medical Officer appointed at Kerang, he arranged despatch of the Swan Hill Field Emergency Medical Officer, Dr Godfrey Williamson. Dr Williamson did not get the message until 3:00pm.

4.2.7.19. At 2:30pm, Associate Professor Epstein also contacted the Director of the Victorian Adult Emergency Retrieval Service, Dr Andrew Rosengarten. Professor Epstein asked Dr Rosengarten to deploy the Ambulance Emergency Operations Centre in South Melbourne.

4.2.7.20. The Ambulance Emergency Operations Centre was part of the Metropolitan Ambulance Service Emergency Management precinct and was open for normal work on week days to coordinate air ambulance movements and perform other day-to-day tasks relating to emergencies. Therefore, in effect, Dr Rosengarten moved his office to the Metropolitan Ambulance Victoria building on 5 June 2007.

4.2.7.21. Dr Rosengarten deployed Dr Nick Jansen who was the first on-call physician for the Victorian Adult Emergency Retrieval Service[553] and a Field Emergency Medical Officer. He then proceeded to the Ambulance Emergency Operations Centre. Dr Rosengarten remained there in an advisory capacity but did not provide any advice.

4.2.7.22. At 3:00pm, Dr Williamson responded Associate Professor Epstein's message. He was in Bendigo and suggested Associate Professor Epstein despatch the Echuca Field Emergency Medical Officer, Dr James The, because he was currently closer to the scene. Dr Williamson then proceeded towards Kerang.

4.2.7.23. At 3:10pm, Associate Professor Epstein despatched Dr The.

4.2.7.24. Further, at 3:16pm, Mr Astall told Bendigo Rural Ambulance Communications Centre that there were now eight or 10 fatalities and everyone was away from the carriages.

4.2.7.25. Mr Astall also refused an offer of assistance of a medical team from Swan Hill due to minimal number of priority one patients with ready transport for those patients available, no trapped patients and the time for the team to arrive.

4.2.7.26. At 3:38pm, Mr McGrath had reviewed the situation report that indicated that all the severe injuries had been despatched. He told Mr Walker:

> *"So, I believe you guys had a FEMO, there was a FEMO team or something going out. I'm not sure, I don't think they're required to be honest, mate."*

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553 Adult Emergency Retrieval Service is co-located with the flight coordinators at Essendon Airport.

4.2.7.27. At 4:10pm, Dr The arrived at the scene. There was no need for his services there but Dr The was referred to the Kerang Community Centre to assist with less severely injured patients.

4.2.7.28. At 5:30pm, Dr Williamson arrived at the scene but his assistance was not required.

4.2.7.29. Associate Professor Epstein told the Court that he also despatched Dr Nicholas Jensen from Melbourne. However, Mr Holman said:

> *"I asked that one of the FEMOs go to Kerang Hospital, because the information that we kept getting was that there were more patients than - we couldn't match up the numbers of patients, and that's not unusual, so I said, well, put Dr Jansen on the plane and he can go to Kerang Hospital, provide advice, assistance and work out exactly what they've got in the hospital itself."*

4.2.7.30. Dr The contacted Associate Professor Epstein to tell him there was no need for Dr Jensen to continue but the decision was taken to continue his despatch. Therefore, Dr The stayed on and met Dr Jensen at the Kerang Hospital.

4.2.7.31. In evidence, Associate Professor Epstein told the Court:

> *"I mobilised three Field Emergency Medical Officers who in honest evaluation probably didn't contribute that much to patient care in the end but we didn't know that at the time and in analogous to a military situation it is always easier to over-respond initially rather than a step-wise catching up process."*

4.2.7.32. However, Associate Professor Epstein still does not accept that there was no need to call out the Field Emergency Medical Officers. He told the Court:

> *"it's a hard reality that the dead don't count because we don't have to respond to those. So, we are looking at a situation where there are half a dozen or so seriously injured people and that, for Ambulance, is not an infrequent occurrence and it wasn't apparent initially as I understand it, that this was an incident of greater magnitude in the sense of producing a number of seriously injured patients, major trauma patients, so it took some time for ambulance to decide that the Field Emergency Medical Co-ordinator should become involved....*
>
> *I don't believe there was a disadvantage in terms of the patients but I think - and this is very important - I think the community would have felt much happier had one of their members particularly a Field Emergency Medical Officer participated in the response"*

4.2.7.33. Associate Professor Epstein told the Court:

"....the best thing that has come out of the SHERP is that we now know how all the different emergency services relate to each other specifically the relationship between ambulance and doctors and ambulance and other emergency services and I think setting that out and describing and delineating how that should best occur is extremely useful and it particularly avoids unnecessary arguments which contribute to unsatisfactory responses to a high arousal state."

4.2.7.34. Further, Associate Professor Epstein told the Court that his operational decisions and ambulance operational decisions are informed by the structural relationships set out in State Health Emergency Response Plan.

4.2.7.35. Associate Professor Epstein also agreed that the ambulance response on 5 June 2007 was both competent and professional on the basis of everything that he had seen and heard in circumstances where people were making decisions in a high arousal state.

4.2.7.36. However, Associate Professor Epstein also implied that his involvement in the Kerang level crossing incident occurred because the people responsible for implementing the State Health Emergency Response Plan and ambulance protocols for pre-hospital emergency response did not have sufficient expertise:

"I think that guideline decision, protocol driven decision making is better than not doing that but it still requires an expert to make those decisions. You can't make those decisions according to a pre-ordained algorithm and just follow it. You need a human agent and preferably a highly trained, experienced and competent agent who has had training and who has participated both in exercises and, if possible, previous incidents and that applies, I might say, to paramedics as much as it does to medical officers."

4.2.7.37. In particular, Associate Professor Epstein did not acknowledge that his involvement in the incident occurred because he and Mr Walker by-passed the State Health Emergency Response Plan and ambulance protocols for pre-hospital emergency response which place responsibility for decisions about triage, management and transfer of patients on the senior ambulance officer at the scene in cooperation with the Victoria Police Incident Controller and the Bendigo Rural Ambulance Victoria Communications Centre.

4.2.8 Local hospitals

4.2.8.1. The Victoria Police Incident Controller, Mr Gibson, formally notified the local hospitals of the incident. He told the Court that he made this communication as a warning or 'heads up' that there may be injuries and they may need extra staff.

4.2.8.2. Mr Gibson also told the Court that, Code Brown was not part of the Victoria Police command and control arrangements and that he did not understand the implications of a

Code Brown. Further, he was not aware that a Code Brown or any code had been implemented. Further, Mr Gibson denied that he told Mildura Police Communications Centre to alert hospitals to a certain number of casualties. He did not know how many there would be at that stage.

4.2.8.3. However, at 1:53pm, local hospitals responded to Mr Gibson's notification to expect casualties by activating their all hazards external emergency plans nominated as "Code Brown".

4.2.8.4. Code Brown interfaces with the State Health Emergency Response Plan and is activated when the hospital is notified of an external incident likely to result in a surge of patients presenting for treatment. Code Brown plans are intended to coordinate an entire hospital response to this expected unusual surge in patients while still performing as much as possible their usual day-to-day responsibilities.[554]

4.2.8.5. Accordingly, in implementing a Code Brown, each hospital is required to assess the likely impact on the hospital and the degree to which this impact can be managed through their usual management practices.

4.2.8.6. Kerang, Ballarat, Cohuna and Swan Hill Hospitals issued Code Brown alerts in anticipation of casualties. Ballarat Base Hospital was a regional trauma centre and Kerang, Cohuna, and Swan Hill Health Services were urgent care services under the Victorian State Trauma Plan.[555]

4.2.8.7. Swan Hill Hospital was one hour from Kerang, 35 minutes with ligts and sirens.

4.2.8.8. Bendigo Health Care Group was 1 hour and 50 minutes travel by road from Kerang or one hour with lights and sirens.

4.2.8.9. At 3:00pm, they contacted the Bendigo Rural Ambulance Communications Centre for a situation report. No patients were to be transported there at that time and there is no evidence that Bendigo activated its Code Brown plan.

4.2.8.10. In particular, at 1:58pm, Margaret Kendrick was the Director of Nursing and Chief Warden at Kerang Hospital. Ms Kendrick issued a Code Brown alert because she expected there would be multiple casualties presenting at Kerang Hospital from the incident at the Kerang level crossing.

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554 Later articulated in Department of Human Services, "Hospital resilience code brown policy framework", 20 October 2008.

555 Department of Human Services, "Metropolitan and Regional Paediatric and Adult Major Trauma Triage Guidelines", undated.

4.2.8.11. This activation included clearing the Emergency Department, calling in five doctors and 20 staff, acting as a receiving and medical assessment site for patients requiring on-transfer to specialist services and arranging to receive patients with minor injuries.

4.2.8.12. At 2:35pm, Ms Atkins, Mr Scholl and Mr Allen arrived at the Kerang District Hospital. At the Kerang Hospital, he was treated by Dr Dianne Sherriff. At about 4:39pm, Mr Scholl was discharged for air transport to the Royal Melbourne Hospital after consultation with the general practitioner at Kerang Hospital and the Bendigo Rural Ambulance Communications Centre.

4.2.8.13. At 2:41pm, a nurse at Kerang Hospital rang the Bendigo Rural Ambulance Communications Centre for an update because they had not received any patients. Bendigo Rural Ambulance Communications Centre told Kerang Hospital that Mr Scholl was on his way with minor head injuries. They did not need a doctor at the site but they would ring them if it became necessary.

4.2.8.14. In total, seven patients presented at Kerang Hospital. Mr Long and several other survivors were not medically assessed before transfer by air ambulance to Melbourne.

4.2.8.15. At about 1:50pm, a passenger in Carriage A, Adrienne Rowell, told the Court that she rang someone she knew at Swan Hill Hospital because she was concerned about the emergency services' slow response. Ms Rowell believed:

"I was the first contact with Swan Hill Hospital."

4.2.8.16. Ms Rowell understood that, in response to her notification, the hospital had been placed on Brown Alert and someone would be at the scene soon.

4.2.8.17. However, Kathy Wright was the Executive Director Clinical Services at Swan Hill District Health. Ms Wright told the Court that their Code Brown Plan was implemented in response to a request from Victoria Police.

4.2.8.18. In particular, Ms Wright closed the Emergency Department and cleared the operating theatres. Dr Mike Moynihan is a general practitioner and visiting hospital medical officer in Swan Hill. He was called in to Swan Hill Hospital and acted as their medical coordinator. He closed his practice and established an emergency team in the Emergency Department.

4.2.8.19. The medical team rang the Mildura Police Communications Centre to ask whether they should proceed to the incident site. Dr Moynihan told the Court he had been involved in one simulation of a bus crash but he had never attended the internal practices of the Swan Hill Hospital Code Brown procedures.

4.2.8.20. Mr Bennett spoke to Mr Harrop who postponed the decision about the Swan Hill emergency team until Mr Astall arrived.

4.2.8.21. Mr Astall decided they were not needed because

4.2.8.22. At 3:03pm, Ms Wright contacted Bendigo Rural Ambulance Communications Centre. Her hospital was still on shut down and Rural Ambulance Service was unable to confirm whether there would be any patients transferred there from the scene. No patients from the Kerang level crossing incident were received at Swan Hill Hospital.

4.2.8.23. On 5 June 2007, Dan Garlick was the Ballarat Health Services Incident Management Centre Coordinator. Mr Garlick activated their Code Brown Plan. No patients from the Kerang level crossing incident were received at Ballarat Health Services.

4.2.9 Air Ambulance Victoria

4.2.9.1. Air Ambulance Victoria operates out of the Ambulance Emergency Operations Centre in South Melbourne. Paul Holman is now Operations Manager Ambulance Victoria. He told the Court that his team was responsible for deciding how many fixed wing aircraft and helicopters to deploy to the Kerang level crossing incident. There is also a flight coordination centre at Essendon Airport.

4.2.9.2. Further, Ambulance Service Melbourne deployed air response in accordance with the guidelines established by the State Trauma Committee. However, they accepted direction from Mr Walker and/or Associate Professor Epstein rather than relying on the health Commander at the scene or Bendigo Rural Ambulance Victoria Communications Centre direction.

4.2.9.3. These guidelines encourage transfer of trauma patients to designated Trauma Centres in Melbourne or regional Victoria within 30 minutes. The emphasis is on time to expert trauma response. Helicopters can often get to Melbourne from regional centres quicker than a road vehicle can get to a regional trauma centre.

4.2.9.4. Bendigo was the closest regional Trauma Centre to Kerang. Transfer by road from Kerang to Bendigo in 1 hour 53 minutes or one hour with lights and sirens.

4.2.9.5. Further, Ambulance Service Melbourne deployed air response in accordance with the guidelines established by the State Trauma Committee. However, they accepted direction from Mr Walker and/or Associate Professor Epstein rather than relying on the Health Commander at the scene or Bendigo Rural Ambulance Victoria Communications Centre direction.

4.2.9.6. These guidelines encourage transfer of trauma patients to designated Trauma Centres in Melbourne or regional Victoria within 30 minutes. The emphasis is on time to expert trauma response. Helicopters can often get to Melbourne from regional centres quicker than a road vehicle can get to a regional trauma centre.

4.2.9.7. Bendigo was the closest regional Trauma Centre to Kerang. Transfer by road from Kerang to Bendigo in 1 hour 53 minutes or one hour with lights and sirens.

4.2.9.8. At 1:56pm on 5 June 2007, Bendigo Rural Ambulance Victoria Communications Centre notified Air Ambulance Victoria of the incident at Kerang level crossing and requested one helicopter and one fixed wing aircraft response. At that time, latest information was that that there were at least four fatalities and another five seriously injured.

4.2.9.9. From my understanding of the information Mr Holman provided and the requirements of the State Health Emergency Plan, Bendigo Rural Ambulance Victoria Communications Centre was then expected to communicate directly with the flight coordinator at Essendon Airport to find out where aircraft were placed when they were needed.

4.2.9.10. Bendigo Rural Ambulance Victoria Communications Centre and the flight coordinator would agree which and when aircraft would travel to Kerang. Then the Health Commander at the scene would decide which patients to send where in these aircraft.

4.2.9.11. However, at 1:56pm, Bendigo Rural Ambulance Victoria Communications Centre was informed that one helicopter was already on the way.

4.2.9.12. At 2:05pm, Air Ambulance offered Bendigo Rural Ambulance Victoria Communications Centre a fixed wing then at Swan Hill but with only a flight paramedic on board. The plan was to put a Mobile Intensive Care Ambulance paramedic on at the scene for the flight to Melbourne if necessary.

4.2.9.13. Further, at 2:06pm, without further communication with Bendigo Rural Ambulance Victoria Communications Centre, Air Ambulance Victoria advised Melbourne Ambulance Service that it was responding to the Kerang level crossing incident with two helicopters and two fixed wing aircraft.

4.2.9.14. It seems that this decision was influenced by Associate Professor Epstein who was with Mr Walker in Camperdown and had accessed information about the number of severely injured patients at the scene which the conductor on the train had communicated to V/Line and had been handed on to Victoria Police.

4.2.9.15. At 2:09pm, Air Ambulance Victoria notified the Royal Melbourne Hospital to expect three or four patients and the Royal Children's Hospital to expect one patient. This notification also seems to have derived from Associate Professor Epstein and Mr Walker because it

foreshadows information that was not yet available to the Bendigo Rural Ambulance Victoria Communications Centre.

4.2.9.16. At 2:32pm, the first fixed wing Air Ambulance pilot notified Bendigo Rural Ambulance Victoria Communications Centre he was on the ground in Kerang. However, the Bendigo Rural Ambulance Communications Centre did not know the flight had left.

4.2.9.17. At 2:51pm, Mr Walker contacted Bendigo Rural Ambulance Victoria Communications Centre to get his first update. He was unaware that they had already set up as the Operations Centre. Mr McGrath told him that his information was that there were six fatalities, 12 time critical patients and 22 other passengers and crew.

4.2.9.18. Mr McGrath told Mr Walker they were waiting for a more accurate situation report before deciding what extra resources they needed. Mr McGrath also told Mr Walker were already using the fixed wing aircraft to transfer Mr Long:

"basically a signal 3 patient".

4.2.9.19. Despite this conversation with Mr McGrath, Mr Walker said that he would arrange for a further fixed wing aircraft to be deployed with arrangements made through Bendigo Rural Ambulance Victoria Communications Centre:

"OK what we might do Graham is just get the other fixed wing moving up that way, doesn't matter if we cancel it but at least it's on it's way to you."

4.2.9.20. By 3:05pm, the Air Ambulance Victoria response included three helicopters and three fixed wing aircraft. Only one helicopter and one fixed wing aircraft had arrived at Kerang. Associate Professor Epstein was to negotiate other hospital beds.

4.2.9.21. At 3:57pm, Mr Walker, in Camperdown with Associate Professor Epstein, advised Air Ambulance Victoria there were 10 fatalities and five time critical patients. However, there is no evidence that any aircraft were stood down. Further, there is no evidence that the Bendigo Rural Ambulance Victoria Communications Centre had this information.

4.2.9.22. At 5:12pm, Air Ambulance contacted Bendigo Rural Ambulance Victoria Communications Centre to arrange for someone to go to Kerang airport to pick up a Victorian Adult Emergency Retrieval Service doctor and a paramedic and take them to Kerang hospital:

"just to do a bit of triage at the hospital".

4.2.9.23. Mr McGrath rang them back. He told them there was nothing left to triage. He said:

"Look mate, I would put a serious hold on it because at the moment, Kerang, we're happy to talk to our guys at the coordination centre but they've asked us for nothing else. I've got to be honest the ones that we took in they were triaged at the scene. We got their details and they're basically signal 2's.... until you hear back from somebody I wouldn't send anyone anywhere."

4.2.9.24. Air Ambulance then rang Kerang Hospital directly to say they had despatched a Victorian Adult Emergency Retrieval Service doctor and a paramedic to triage patients at Kerang Hospital.

4.2.9.25. Kerang Hospital told them they were not needed and contacted Bendigo Rural Ambulance Victoria Communications Centre to warn them of the impending arrival. The response was:

"No we don't need them. Send them home."

4.2.9.26. At 5:25pm, Dr Rosengarten and Mr Holman despatched Dr Jensen to Kerang in a fixed wing aircraft. There were no casualties at the scene and Dr Jensen did not see any patients at Kerang Hospital.

4.2.9.27. Dr Jenson and Dr The performed a table top triage of the remaining patients. Dr Jensen returned to Melbourne on the same plane that delivered him to Kerang.

4.2.10 Management of Harold Long

4.2.10.1. As a result of the Kerang level crossing incident on 5 June 2007, Harold Long was trapped by the lower leg under three seats and other casualties on the floor in Carriage B. Only his hand was visible from under the seats that had moved in the collision. He was presumed dead.

4.2.10.2. However, at about 2.25pm, the conductor on the train, Haydn Buckland heard Mr Long moan. He and Senior Constable Troy Hafner also noticed that Mr Long's hand had moved. Mr Hafner climbed over a section of seat and felt Mr Long had a strong pulse.

4.2.10.3. State Emergency Service workers extracted Mr Long from under the displaced seats and debris with the assistance of Mr Hafner and Mr Buckland. By now, Mr Long was responding to questions but his condition was deteriorating.

4.2.10.4. The community ambulance officer, Stephen Humphreys, diagnosed Mr Long with fractures to his lower leg and a large laceration. He stabilised Mr Long and placed him on a spinal board for transport to the Casualty Collection Post on the Murray Valley Highway in Mr Gillingham's utility driven by Mr Hafner.

4.2.10.5. At about 2:30pm, Ambulance Flight Mobile Intensive Care Ambulance paramedic Kelvin Walsh arrived at the scene. Mr Harrop also directed him to Carriage B.

4.2.10.6. Mr Walsh was arriving at Carriage B at the same time as Mr Humphreys was removing Mr Long on a spinal board. Mr Walsh did not assess Mr Long before his transfer to the Casualty Collection Post on the road.

4.2.10.7. The Health Controller at the Casualty Collection post, Advanced Life Support Qualified paramedic Neil Harrop, assessed Mr Long as conscious and alert but in shock due to his severe right lower leg which was of compound in nature and large tissue damage. He was also concerned about Mr Long's age.

4.2.10.8. Mr Harrop established intravenous access and commenced administering "Hartmanns" solution, to counteract the loss of blood which was causing his shock. He also administered 2 x 5.0 mg morphine to control his pain, 10mg Maxalon and applied a trauma dressing and air splint to his right leg.

4.2.10.9. Graeme Allsop, the incoming Health Commander at the scene, confirmed Mr Harrop's assessment and noted there was a fixed wing plane at the Kerang Airport. He arranged for Mr Long to be transferred to a Trauma Centre in Melbourne by Air Ambulance Victoria.

4.2.10.10. At 2:45pm on 5 June 2007, Mr Humphreys and Mobile Intensive Care Ambulance paramedic, Christopher Jewson, transferred Mr Long to Kerang Airport. Mr Jewson was told he may have to accompany Mr Long on the fixed wing aircraft because Mr Long required Mobile Intensive Care Ambulance paramedic support.

4.2.10.11. At 2:50pm Mr Long arrived at Kerang airport. His fixed wing aircraft with a transfer patient already on board had been waiting at the airport for over 30 minutes. Mr Long was the first patient to arrive at Kerang airport for air transport. Further, Mr Holman was not aware that the Health Commander had specified that Mr Jewson accompany Mr Long to Melbourne.

4.2.10.12. The flight paramedic on Mr Long's fixed wing aircraft, Troy Fosbender, had 16 years experience as a flight paramedic including transport of two or three trauma patients at the same time. He did not know anything about Mr Long's medical history and was provided with a verbal handover about his current condition. There is no written record and no indication whether or not Mr Fosbender was aware of the morphine administered to Mr Long at the Casualty Collection Post.

4.2.10.13. While he was still in the road ambulance, Mr Fosbender further assessed Mr Long's pulse was 90 beats per minute, his systolic blood pressure was 120mmHg and his respiration rate was 20 breaths per minute. He did not have respiratory distress. He had an oxygen mask. He was still receiving intravenous fluids.

4.2.10.14. In Mr Fosbender's opinion, Mr Long's observations were stable but he met the criteria for an emergent time critical patient because of his open fracture in the right lower leg. He noted no abnormalities relating to his chest.

4.2.10.15. Mr Fosbender also told the Court that he accepted Mr Long as a patient because he had been triaged as requiring transfer to a Trauma Centre, he had been directed by phone to pick up a patient at Kerang and he was aware that some patients deteriorate quickly during transport.

4.2.10.16. Mr Fosbender told Mr Jewson he did not think that it would be necessary for him to accompany Mr Long to Melbourne. Mr Jewson accepted this decision and returned to the scene.

4.2.10.17. At 3:13pm, Mr Fosbender reviewed Mr Long while he was in the air ambulance on the ground. His pulse was 81 beats per minute, his blood pressure was 145/100mmHg and his respiration rate had declined to 18 breaths per minute.

4.2.10.18. Trevor Salvado was the pilot of the fixed wing plane used to transfer Mr Long to Melbourne. He does not remember Mr Fosbender asking him to adjust the cabin pressure of his plane. Mr Fosbender does not remember whether he discussed altitude with the pilot and no record was kept.

4.2.10.19. Mr Fosbender does not remember whether he discussed altitude with Mr Salvado and no record was kept. He told the court:

> *"I don't recall discussing the altitude but I certainly suspected a possible pneumothorax....*
>
> *I would've expected it given the described insult to Mr Long...*
>
> *In the air environment that is a possibility of a patient that had received an insult to develop a tension pneumothorax..."*

4.2.10.20. At 3:21pm, the fixed wing aircraft left Kerang airport. Mr Fosbender was of the view that 30 minutes is an acceptable time to prepare and transfer a patient for fixed wing air transport.

4.2.10.21. At 3:25pm, 3:39pm, 3:45pm and 3:51pm and 3:57pm, Mr Fosbender gave Mr Long five doses of 2.5mg intravenous morphine on top of the 10mg already administered by Mr Harrop at about 2:45pm.

4.2.10.22. Mr Fosbender assessed Mr Long five times on the way to Melbourne:

- At 3:21pm, his pulse declined to 69 beats per minute, his blood pressure was 125/86mmHg and his respiration rate remained 18 breaths per minute.
- At 3:37pm, his pulse returned to 92 beats per minute, his blood pressure was 151/102mmHg and his respiration rate had declined 16 breaths per minute. He was sweaty, agitated and restless.
- At 3:50pm, his pulse was about 100 beats per minute. His conscious state had deteriorated and Mr Fosbender was unable to take observations of his respiratory rate or condition.
- At 3:57pm he became combative. Mr Fosbender remained unable to take his observations.

4.2.10.23. At 4:03pm, Mr Long arrived at Essendon airport.

4.2.10.24. At 4:10pm, Mr Fosbender handed Mr Long over to Mobile Intensive Care Ambulance Flight paramedic, Matthew Davidson, for transfer to the Royal Melbourne Hospital. Mr Long remained very restless and uncooperative. His Glasgow Coma Scale was less than 10.

4.2.10.25. Mr Davidson confirmed Mr Fosbender's assessment that Mr Long was pale cold and unwell-looking with an altered conscious state. His blood pressure was unrecordable and he was critically unstable. There were no obvious signs of tension pneumothorax.

4.2.10.26. Mr Davidson decided it would be easier to manage Mr Long in a road ambulance than a helicopter for the trip to the Royal Melbourne Hospital. At 4:24pm, they left Essendon airport with lights and sirens operating.

4.2.10.27. At 4:30pm, Mr Davidson intubated Mr Long without sedation because he could not regain intravascular access and commenced assisted ventilation with 100% oxygen. Mr Long's conscious state and respiratory status declined further.

4.2.10.28. At 4:33pm, Mr Davidson noted that Mr Long developed symptoms consistent with right-sided tension pneumothorax. He was able to hear decompression of the pneumothorax when he introduced bilateral intercostal catheters and Mr Long's condition improved immediately.

4.2.10.29. From these symptoms, Mr Davidson and Dr Papson diagnosed a right-sided pneumothorax that had become evident when positive pressure oxygen was administered.

4.2.10.30. However, at about 4:41pm, Mr Long deteriorated again. Mr Davidson commenced cardiopulmonary resuscitation. He was continuing this procedure when they presented at the Emergency Department of the Royal Melbourne Hospital.

4.2.10.31. At 4:44pm, Mr Long presented at the Trauma Centre of the Royal Melbourne Hospital. He was triaged Category 1.

4.2.10.32. Mr Long's treating doctor at the Royal Melbourne Hospital was an emergency physician, Dr Jonathon Papson. However, Dr Papson emphasised that he was just one of a trauma team which typically included an anaesthetist, three emergency nurses, a trauma registrar or surgeon, one or two emergency physicians and one or two emergency registrars.

4.2.10.33. Dr Papson recorded that Mr Long was receiving cardiopulmonary resuscitation. He was also intubated and ventilated by hand, his lungs were unequal in distension, he had suffered a cardiac arrest and had no pulse or recordable blood pressure, his Glasgow Coma Scale was < 9.

4.2.10.34. Dr Papson diagnosed a recurring minor right pneumothorax and relieved it with a further intercostal catheter. This condition was not considered significant in causing Mr Long's condition because there was no blood loss through the decompression needle.

4.2.10.35. At 5:10pm, resuscitation ceased and Harold Long died.

4.3 COMMENTS

Pursuant to section 67(3) of the *Coroners Act* 2008, I make the following comments connected to the deaths of 11 people in this cluster of train passengers who died on 5 June 2007:

4.3.1 Background

4.3.1.1. At 1:34pm on 5 June 2007, a semi-trailer driven by Christian Scholl collided with the regular Swan Hill to Melbourne V/Line passenger train at the level crossing about five kilometres north of Kerang at Fairlie (the "Kerang level crossing"). Eleven passengers on the train died as the result of the collision.

4.3.1.2. Improvements in level crossing safety cannot be viewed in isolation to general changes in road safety. Reductions in drink-driving, advances in automotive technology and improvements in the effectiveness of emergency medical response have as much effect at level crossings as they do at highway-highway intersections.

4.3.1.3. In the United States, the effect of road safety initiatives on level crossing incidents and fatalities is estimated to be about twice that resulting from the installation of active warning devices. [556]

[556] S Mok & I Savage. "Why has Safety Improved at Rail-Highway Grade Crossings?" *Risk Analysis* 25 (2005) 867.

4.3.1.4. For example, trauma experts believe that 32.3% of death from all types of trauma and 35% of all deaths following road trauma were preventable or potentially preventable when appropriate trauma management systems are activated.[557]

4.3.1.5. Therefore, the effectiveness and efficiency of the emergency medical response can also be expected to influence the number of deaths and severity of injuries that arise from a multi-victim trauma incident like that at the level crossing on the Murray Valley Highway at Fairlie about five kilometres north of Kerang (the "Kerang level crossing") on 5 June 2007.[558]

4.3.1.6. The *Emergency Management Act* 1986 defines an emergency:

> *"**emergency** means an emergency due to the actual or imminent occurrence of an event which in any way endangers or threatens to endanger the safety or health of any person in Victoria or which destroys or damages, or threatens to destroy or damage, any property in Victoria or endangers or threatens to endanger the environment or an element of the environment in Victoria."*

4.3.1.7. Therefore, the Kerang level crossing collision on 5 June 2007 was an emergency.

4.3.1.8. On 5 June 2007, emergency services responded to the Kerang level crossing incident as required under the *Emergency Management Act* 1986, the State Emergency Response Plan[559], the Emergency Management Manual Victoria and other relevant organisation arrangements.

4.3.1.9. Under section 13 of the *Emergency Management Act* 1986, Victoria Police is responsible for coordinating the response to all civil emergencies as well as performing their usual roles such as protecting life and property, investigating possible criminal offense, investigating deaths for the Coroner.

4.3.1.10. Other agencies are required to cooperate with the Victoria Police as support agencies. However, the support agencies also have their own emergency response plans.

4.3.1.11. From the perspective of a coronial enquiry, the medical or health response was relevant to preventing death arising from the Kerang level crossing collision. Therefore, this review has particularly considered the way in which the State Health Emergency Response Plan and other relevant operational procedures integrated with the over-arching State Emergency Response Plan and the degree to which this influenced the deaths of 11 train passengers arising from the Kerang level crossing incident on 5 June 2007.

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557 State Trauma Committee, "A Trauma Education Framework for Victoria", October 2001.
558 See for example, Sotera Risk Solutions, "ALCAM Consequence model development", 28 January 2011.
559 State Emergency Response Plan Part 3: Emergency Management Manual October 2010.

4.3.1.12. Although this coronial review of the emergency response to the Kerang level crossing incident on 5 June 2007 has been limited in scope by my jurisdiction to investigate the circumstances surrounding the 11 deaths that occurred, from the trauma management viewpoint, it has also identified a number of inadequacies in the system for reacting to emergencies which carry wider implications for both management of survivors of level crossing collisions and response to other emergency situations in regional areas like Kerang.

4.3.1.13. When I say 'small scale' I am fully aware that the participants in the Kerang level crossing incident were confronted with what seemed a disaster. It still seems to them to have been a disaster. To the families who lost loved ones of course it was a disaster.

4.3.1.14. Further, I know that the emergency services and V/Line had to contend with a major clean up operation which stretched their resources for some time.

4.3.1.15. However, in terms of a medical emergency response, when nine people died immediately, two died later and six others required time critical management, the Kerang level crossing incident was not really any more overwhelming than a head on car crash involving several vehicle occupants.

4.3.1.16. All the train passengers and crew had been assessed and left the scene within two hours of the incident.

4.3.1.17. This investigation of the emergency response to the Kerang level crossing incident has attempted to apply a systems approach to determining to whether and to what degree the emergency response contributed to the deaths of the 11 train passengers involved in the collision.

4.3.1.18. Accordingly, I now discuss:

- The effect of the emergency response on the outcome for the 11 fatalities arising from the Kerang level crossing incident ;
- The initial emergency response to the Kerang level crossing incident;
- The Operation of the State Emergency Response Plan on 5 June 2007;
- The Operation of the V/Line Crisis Response and Emergency Management Plan on 5 June 2007; and
- The Operation of the State Health Emergency Response Plan on 5 June 2007.

4.3.2 The effect of the emergency response on the outcome for the 11 fatalities arising from the Kerang level crossing incident

4.3.2.1. Eleven train passengers died from trauma sustained in the Kerang level crossing collision on 5 June 2007:

4.3.2.2. Stephanie Meredith, Danielle Meredith, Chantal Meredith, Geoffrey McMonnies, Rosanne McMonnies and Ercil Jean Webb[560] died during the impact of the semi-trailer with Carriage B.

- Accordingly, I find that the emergency response did not influence the deaths of Stephanie Meredith, Danielle Meredith, Chantal Meredith, Geoffrey McMonnies, Rosanne McMonnies or Ercil Jean Webb.[561]

4.3.2.3. Margaret Wishart[562] died immediately from blunt force trauma to the head sustained when the compressor from the Carrier Ultra XL refrigeration unit on Mr Scholl's trailer entered Carriage C during the collision and hit her on the head.

- Accordingly, I find that the emergency response did not influence Margaret Wishart's death.

4.3.2.4. Jaesok Lee[563] sustained fatal injuries and were immediately unresponsive. He did not regain consciousness and had died before emergency services arrived. Further, there is no evidence that he could have recovered from their injuries.

4.3.2.5. Accordingly, I find that the emergency response did not influence Margaret Wishart's death.

4.3.2.6. Matthew Stubbs[564] suffered chest and abdominal injuries in the collision and was immediately unresponsive.

- Norma Bennett was the first by-stander to enter Carriage B. She found Matthew lying face down on the floor with his head towards the rear of the carriage. Mrs Bennett and Andrea (Min) Peacock formed the opinion that Matthew had already died before they entered the carriage.
- Dr Joe Cameri subsequently assessed Matthews's injuries as not individually life threatening. However, he did have a haemopericardium and haemopertioneum

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560 Stephanie Meredith Case No. 2125/07; Danielle Meredith Case No. 2127/07; Chantal Meredith Case No. 2128/07; Geoffrey McMonnies Case No. 2129/07; Rosanne McMonnies Case No. 2132/07; Ercil Jean Webb Case No. 2133/07.

561 Stephanie Meredith Case No. 2125/07; Danielle Meredith Case No. 2127/07; Chantal Meredith Case No. 2128/07; Geoffrey McMonnies Case No. 2129/07; Margaret Wishart Case No. 2131/07; Rosanne McMonnies Case No. 2132/07; Ercil Jean Webb Case No. 2133/07.

562 Margaret Wishart Case No. 2131/07.

563 Jaeseok Lee Case No. 2126/07.

564 Matthew Stubbs Case No. 2130/07.

which, in the circumstances of a collision between a train and a heavy vehicle combination, indicates internal injuries. In particular, the accumulation of blood around Matthew's heart would have caused a cardiac tamponade which would have prevented cardiac function and caused death very quickly; that is, within minutes of the collision.

- Professor Anne-Maree Kelly also reviewed the circumstances of Matthew's death and Dr Cameri's report. Professor Kelly agreed with the opinions of the pathologist and Dr Cameri that the cause of Matthew's death was chest and abdominal injuries. However, in the absence of information about the head, she could not exclude the contribution of head injury.
- Further, even if Matthew had survived the collision, it was very unlikely he would have survived transfer to a specialist hospital.
- Accordingly, I find that the emergency response did not influence Matthew Stubbs' death.

4.3.2.7. Nicholas Parker[565] sustained severe injuries in the collision including visible injury to the back of his head and subsequently diagnosed right transacted pulmonary artery, multiple fractured ribs and a fractured pelvis.

- However, community ambulance officer, Stephen Humphreys, called for an oxygen kit and someone went back to the ambulances on the road to get one. The conductor, Haydn Buckland, stayed with Mr Parker. When the oxygen arrived, Mr Humphreys used a facemask to provide extra oxygen to Mr Parker.
- State Emergency Service crew cut the seats away and extracted Mr Parker. They placed him on a spinal board. Senior Constable Shane Hafner and Mr Lidster assisted in carrying Mr Parker's stretcher up the railway line to the highway and placing him in an ambulance. Mr Hafner formed the opinion that Mr Parker died during this transfer to the road. Ambulance officer, Neil Harrop, confirmed that Mr Parker had suffered a cardiac arrest when he arrived at the Casualty Collection Post on the Murray Valley Highway. He was unable to be revived.
- Emergency physician, Dr Sandra Neate retrospectively assessed Mr Parker's prognosis as always poor because of the severity of his injuries and the degree of haemorrhage.
- Accordingly, I find that the emergency response did not influence Nicholas Parker's death.

565 Nicholas Parker Case No. 2114/07.

4.3.2.8. Harold Long[566] was trapped and hidden under the displaced seats and debris that had accumulated at the rear of Carriage B during the Kerang level crossing collision. Only his hand was visible. He was presumed dead.

- At about 2:25pm, Mr Buckland and Senior Constable Troy Hafner realised Mr Long was alive.
- State Emergency Service workers extracted Mr Long. He was responding to questions but his condition was deteriorating.
- The community ambulance officer, Stephen Humphreys, appropriately assessed Mr Long. He diagnosed fractures to his lower leg and a large laceration. He stabilised Mr Long and, at about 2:30pm, he placed him on a spinal board for transport to the Casualty Collection Post on the Murray Valley Highway in Mr Gillingham's utility driven by Mr Hafner.
- At about 2:30pm, Ambulance Flight Mobile Intensive Care Ambulance paramedic Kelvin Walsh was arriving at Carriage B at the same time as Mr Humphreys was removing Mr Long on a spinal board. Mr Walsh did not assess Mr Long before his transfer to the Casualty Collection Post on the road.

4.3.2.9. I am unable to say why Mr Walsh did not assess Mr Long for transfer to Melbourne in his helicopter.

- When Mr Long had been transferred to the Casualty Collection Post, Advanced Life Support Qualified paramedic Neil Harrop, assessed him as conscious and alert but in shock due to his severe right lower leg which was of compound in nature and large tissue damage. He was also concerned about Mr Long's age.
- Mr Harrop triaged Mr Long as requiring air transport to a Major Trauma Centre. This assessment was confirmed by Graeme Allsop who took over from Mr Harrop as Health Commander at the scene and Casualty Collection Officer and Casualty Transport Officer. Mr Allsop also specified that a Mobile Intensive Care Ambulance paramedic could accompany Mr Long to Melbourne.
- On 7 October 2007, the Medical Standards Committee of Rural Ambulance Victoria also commissioned a review of their performance including the appropriateness of initial triage decisions and the management of Harold Long. This review of Harold Long's management deemed it appropriate in the circumstances.

4.3.2.10. I do not accept that Mr Long necessarily required transfer to a Major Trauma Centre because:

- Mr Long was stable after Mr Harrop re-established his fluids at Kerang.

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566 Harold Long Case No. 2110/07.

- Mr Holman told the Court that the patient's clinical presentation was more important than his age in determining whether and/or where to transfer him.
- Professor Anne-Maree Kelly is an emergency physician and Academic Head of Emergency Medicine at Western Hospital. In Professor Kelly's opinion, it was appropriate to transfer Mr Long to a Major Trauma Centre because of his age, his loss of consciousness in the collision, his severe leg injuries, and a short period of hypotension. However, she also said in the circumstances of Mr Long's injuries, the decision to transfer him required balance of the need for expert services against the risks associated with air transfer.
- If a Major Trauma Service is not within 30 minutes travel time, then the patient should be triaged to the next highest-level trauma service within 30-minute travel time from the accident site. [567]
- Between 30 and 35% of adult trauma patients will be more than 30 minutes from a Major Trauma Service and require transfer to a non-major trauma service hospital first for stabilisation prior to secondary transfer.[568]

4.3.2.11. Mr Long had penetrating and blunt trauma injuries and he was over 55 years old. Therefore he met the criteria for Pre-hospital Major Trauma triage and transfer to a specialist trauma unit.[569]

4.3.2.12. The transfer time from Kerang was always going to be greater than 30 minutes from the time of the incident.

4.3.2.13. Therefore under the trauma protocols, Mr Long should have been transferred to the nearest designated specialist trauma service, that is Swan Hill or Bendigo hospitals.

4.3.2.14. Accordingly I find that, when Mr Harrop and Mr Astall triaged Mr Long, the risks associated with not transferring him to Melbourne but rather transferring him to Bendigo or Swan Hill were less than those that could be predicted from transferring him to Melbourne:

- The total transfer time would be shorter;
- A Mobile Intensive Care Ambulance paramedic could have accompanied him directly from the scene; and
- He would be less likely to develop tension pneumothorax.

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567 Department of Human Services, "Metropolitan and Regional Paediatric and Adult Major Trauma Triage Guidelines", undated.

568 Monash University: Victorian State Trauma Outcome Registry and Monitoring Group, "Victorian State Trauma Registry 1 July 2005 to 30 June 2006 Summary report", Department of Human Services, 2007.

569 Ministerial Taskforce on Trauma and Emergency Services and the Department of Human Services Working Party on Emergency and Trauma Services, "Review of Trauma and Emergency Services Victoria 1999."

4.3.2.15. Further, a review of emergency responses to trauma patients in Victoria has shown that only five of the 82 patients not transferred to a major trauma service died within an hour of arrival at hospital. [570]

4.3.2.16. More importantly, the 77 surviving patients had characteristics and injuries similar to those experienced by Mr Long: their median age was 85 years and their median injury severity score was 16 where 15 defines major trauma.[571]

4.3.2.17. Also, in their review of their management of Mr Long, Rural Ambulance Victoria also acknowledged that it was unusual to transfer a patient with Mr Long's acuity directly to the airport for transfer on fixed wing aircraft to Melbourne without intervening medical assessment.[572] However, these reviewers explained that:

> *"The scene was that of a disaster with multiple patients, many of whom died at the scene or in the following days.*
>
> *Due to the nature of the case, the patient had not been medically assessed as would normally be the case prior to transfer by air ambulance fixed wing."*

4.3.2.18. Further, in the opinion of the emergency physician at the Royal Melbourne Hospital. Dr Jonathan Papson, Mr Long could have been managed at a regional trauma service. Time was the issue in determining appropriate transport:

> *"the state trauma plan is to transport to the nearest appropriate level within half an hour. So if it's more than half an hour to get to Royal Melbourne or to a major trauma centre you should go to a regional trauma centre, you are stabilised there, and then moved on as appropriate."*

4.3.2.19. At 2:51pm, Bendigo Rural Ambulance Victoria Communications Centre told Mr Walker they were waiting for a more accurate situation report before deciding what extra resources they needed. Mr McGrath also told Mr Walker were already using the fixed wing aircraft to transfer Mr Long:

> *"basically a signal 3 patient".*

4.3.2.20. Therefore, under the trauma protocols and in Mr Long's condition, he should have been transferred to the nearest designated trauma service, that is Swan Hill or Bendigo Hospital, before or instead of his transfer by fixed wing aircraft to a Major Trauma Centre.

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570 Monash University: Victorian State Trauma Outcome Registry and Monitoring Group, "Victorian State Trauma Registry 1 July 2005 to 30 June 2006 Summary report", Department of Human Services, 2007.

571 Monash University: Victorian State Trauma Outcome Registry and Monitoring Group, "Victorian State Trauma Registry 1 July 2005 to 30 June 2006 Summary report", Department of Human Services, 2007.

572 Dave Garner & Kerry Power, "Information Paper: Medical Standards Committee", 2 April 2008.

- At 2:50pm Mr Long arrived at Kerang airport. His fixed wing aircraft with a transfer patient already on board had been waiting at the airport for over 30 minutes. Mr Long was the first patient to arrive at Kerang airport for air transport.
- The flight paramedic on Mr Long's fixed wing aircraft, Troy Fosbender, did not know anything about Mr Long's medical history and was provided with a verbal handover about his current condition. There is no written record and no indication whether or not Mr Fosbender was aware of the morphine administered to Mr Long at the Casualty Collection Post.
- Mr Fosbender accepted Mr Long as a patient because he had been triaged as requiring transfer to a major trauma service, he had been directed by phone to pick up a patient at Kerang and he was aware that some patients deteriorate quickly during transport. He did not accept that Mr Long should be accompanied by a Mobile Intensive Care Ambulance paramedic
- Further, Mr Fosbender does not remember whether he discussed altitude with the pilot and no record was kept. He told the court:

  "I don't recall discussing the altitude but I certainly suspected a possible pneumothorax....
  I would've expected it given the described insult to Mr Long...
  In the air environment that is a possibility of a patient that had received an insult to develop a tension pneumothorax..."

- At 3:21pm, or 30 minutes after Mr Long arrived at the airport and 100 minutes after the collision at Kerang level crossing, the fixed wing aircraft left Kerang airport. Mr Fosbender was of the view that 30 minutes is an acceptable time to prepare and transfer a patient for fixed wing air transport.

4.3.2.21. I do not accept that Mr Long was appropriate for transfer by fixed wing aircraft without Mobile Intensive Care Ambulance paramedic because:

- Mr Fosbender confirmed that the likelihood of developing tension pneumothorax increases with altitude.
- Mr Fosbender also told the Court that he was not trained to decompress a tension pneumothorax. Therefore, if he had suspected tension pneumothorax, his clinical response would have been limited:

  "I would have been a bit more aggressive with his oxygen supplementation."

- At 3:25pm, 3:39pm, 3:45pm and 3:51pm and 3:57pm, Mr Fosbender gave Mr Long five doses of 2.5mg intravenous morphine on top of the 10mg already administered by Mr Harrop at about 2:45pm.

- At 3:37pm, Mr Long's condition deteriorated on the fixed wing plane. By 3:50pm, his pulse was about 100 beats per minute. His conscious state had deteriorated and Mr Fosbender was unable to take observations of his respiratory rate or condition.
- Mr Fosbender did not detect any deterioration in Mr Long's respiratory status and did not at any time suspect he was developing a tension pneumothorax.
- At 4:03pm, Mr Long arrived at Essendon airport for road transport to the Royal Melbourne Hospital.

4.3.2.22. I am unable to say whether or not Mr Long's deterioration at 3:37pm was caused by early onset tension pneumothorax.

4.3.2.23. Mr Long's deterioration on the fixed wing aircraft is not inconsistent with early onset of a tension pneumothorax. However, none of Mr Fosbender's observations include any reference to respiratory distress. Further, Mr Fosbender denies that Mr Long suffered from a tension pneumothorax while in the aircraft.

4.3.2.24. Therefore, in retrospect, Mr Long's deterioration at 3:37pm on 5 June 2007 could also be explained by his now known medical conditions, his response to morphine and/or blood loss or any combination of these factors.

- At 4:30pm, the Mobile Intensive Care paramedic responsible for Mr Long's care, Mr Davidson, intubated Mr Long without sedation because he could not regain intravascular access and commenced assisted ventilation with 100% oxygen. Mr Long's conscious state and respiratory status declined further.
- At 4:33pm, Mr Long developed right-sided tension pneumothorax. Mr Davidson decompressed the pneumothorax with bilateral intercostal catheters and Mr Long's condition improved immediately.
- Mr Davidson and Dr Papson diagnosed a right-sided pneumothorax that had become evident when positive pressure oxygen was administered.

4.3.2.25. Accordingly, I accept that Mr Long developed a tension pneumothorax at about 4:33pm when he was in the road ambulance en route to the Royal Melbourne Hospital.

4.3.2.26. Further, and more controversially, I cannot exclude the possibility that the tension pneumothorax developed because Mr Long was transferred from Kerang to Melbourne in a fixed wing aircraft.

4.3.2.27. Dr Papson told the Court:

> *"....it could have been there before. Could have been there from the start. Could have developed at any time."*

4.3.2.28. Professor Kelly accepted that underlying tension pneumothorax that became evident on re-ventilation and/or primary cardiac event could explain Mr Long's deterioration during fix wing air transfer from Kerang to Melbourne.

- At about 4:41pm, Mr Long deteriorated again. Mr Davidson commenced cardiopulmonary resuscitation. He was continuing this procedure when they presented at tbe Emergency Department of the Royal Melbourne Hospital.
- At 4:44pm, Mr Long presented at the Trauma Centre of the Royal Melbourne Hospital. He was triaged Category 1.
- Dr Papson was Mr Long's treating doctor at the Royal Melbourne Hospital. However, Dr Papson emphasised that he was just one of a trauma team which typically included an anaesthetist, three emergency nurses, a trauma registrar or surgeon, one or two emergency physicians and one or two emergency registrars.
- On presentation, Mr Long was receiving cardiopulmonary resuscitation. He was also intubated and ventilated by hand, his lungs were unequal in distension, he had suffered a cardiac arrest and had no pulse or recordable blood pressure, his Glasgow Coma Scale was < 9.
- Dr Papson diagnosed a recurring minor right pneumothorax and relieved it with a further intercostal catheter. This condition was not considered significant in causing Mr Long's condition because there was no blood loss through the decompression needle.
- At 5:10pm, resuscitation ceased and Harold Long died.

4.3.2.29. Professor Kelly, Dr Papson and another emergency physician, Dr Sandra Neate, agree that another process was the major influence on Mr Long's death. They were also of the opinion that the tension pneumothorax may have been a contributing factor but it was not the overwhelming factor in Mr Long's death. Rather, the cause of death was probably more related to compromise of Mr Long's cardiac condition by the circumstances of his entrapment at the scene and his leg injury.

4.3.2.30. The forensic pathologist who performed the autopsy formed the opinion that the cause of death was acute blood loss and shock/trauma in a man with cardiomegaly, myocardial fibrosis and ischaemic coronary artery disease.

4.3.2.31. In determining whether to change the cause of death volunteered by the forensic pathologist, I accept their opinion without necessarily excluding a contribution by the tension pneumothorax diagnosed and treated by Mr Davidson at 3:37pm on 5 June 2007.

4.3.2.32. Accordingly, I find that, in circumstances where Mr Long was vulnerable to development of tension pneumothorax on a pressurised plane, he should have been transferred by road to

the nearest Trauma Centre, that is Swan Hill or Bendigo trauma centres or, alternatively transferred to Melbourne in a helicopter.

4.3.2.33. Therefore, I recommend that Ambulance Victoria and Air Ambulance Victoria carefully consider the risks of tension pneumothorax when triaging trauma patients for transfer by fixed wing aircraft without Mobile Intensive Care Ambulance support. **Recommendation 18**

4.3.3 The initial emergency response to the Kerang level crossing incident

4.3.3.1 The trauma response system starts at the roadside or scene of injury, with pre-hospital assessment and stabilisation, transport, pre-hospital triage, emergency reception and resuscitation, surgical and intensive care management and rehabilitation and convalescence. Each step is important in the eventual recovery of the patient. Without an integrated approach there is a high chance that errors will occur in patient management.[573]

4.3.3.2 In particular, the first hour immediately after sustaining major trauma is critical to patient survival, commonly referred to as the 'golden hour'.[574] This notation recognises that many deaths can be prevented by appropriate care shortly after injury and that the risk of death increases with the time taken to get to definitive care.

4.3.3.3 Further, in the context of the need to work fast in confronting circumstances, failure to identify major trauma cases and activate an appropriate medical response results in suboptimal clinical outcomes and death.[575]

4.3.3.4 When the train came to a stand still south of the Kerang level crossing at 1:34pm on 5 June 2007, Carriage A and Carriage B were still attached to the locomotive in sequence. Carriage C had become detached and was 300 metres north of the rest of the train.

4.3.3.5 As well as Mr Lidster, Mr Buckland and Ms Burford, there were 37 passengers on the train. Within a very short time, by-standers from the road had approached the train.

4.3.3.6 In a letter to the State Coroner, Norma Bennett described the scene that confronted her as "*something from a horror movie or a war zone*".

4.3.3.7 We now know that eight passengers had already died. Mr Lee, Mr Parker and Mr Long were fatally injured. Six other passengers were seriously injured. They were transferred to

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573 Monash University: Victorian State Trauma Outcome Registry and Monitoring Group "The Victorian state trauma system June 2001-June 2006" Department of Human Services,2008

574 Monash University: Victorian State Trauma Outcome Registry and Monitoring Group, "Victorian State Trauma Registry 1 July 2005 to 30 June 2006 Summary report", Department of Human Services, 2007.

575 Ministerial Taskforce on Trauma and Emergency Services and the Department of Human Services Working Party on Emergency and Trauma Services, "Review of Trauma and Emergency Services Victoria 1999."

The Alfred or the Royal Melbourne hospitals by Air Ambulance. Seven passengers including Mr Scholl Mr were transferred to Kerang Hospital

4.3.3.8 Mr Scholl's truck was at the level crossing. It was severely damaged and Mr Scholl remained in the cabin with head and arm injuries.

4.3.3.9 Therefore, the initial response to the incident was crucial in determining the long-term outcomes for the crew, the passengers, the bystanders and Mr Scholl.

4.3.3.10 The *Emergency Management Act* 1986 and the V/Line Emergency Response and Crisis Management Plan required the train driver and the conductor to adopt the joint role of Interim Site Controller until Victoria Police arrived at the scene.[576]

4.3.3.11 Mr Lidster and Mr Buckland performed the tasks required of this position adequately, even admirably:

- They contacted Train Control and '000';
- They calmed the passengers;
- They de-trained passengers able to be moved;
- They moved furniture and release trapped passengers;
- They applied first aid as they were able.

4.3.3.12 One by-stander who assisted at the scene for about 20 minutes, told the Court that the three V/Line employees took over initial control of the rescue effort:

> *"Railway employees for a start off. That was the train driver and whoever else was on the train and the police seemed to be fairly quick on the scene..."*

4.3.3.13 However, Mr Lidster and Mr Buckland told the Court that neither of them was aware that they were required to accept this role of Interim Site Controller. Neither of them had any specific training in what was required of an Interim Site Controller. Neither of them formally assessed the scene and proved situation reports to V/Line or Victoria Police.

4.3.3.14 In circumstances where train driver and the conductor are the most senior people in authority at the scene for the crucial first eight minutes after the collision, I find that Mr Lidster and Mr Buckland were not sufficiently trained and prepared for their roles as Interim Site Controller.

4.3.3.15 Accordingly, I recommend that V/Line provide train drivers and conductors with formal instruction and scenario practice events to ensure they understand their role. **Recommendation 19**

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576 V/Line Passenger Pty Ltd, "V/Line Emergency Response and Crisis Plan", 7 May 2007.

4.3.3.16 Ms Burford was also a trained conductor. However, on 5 June 2007, Ms Burford was working in the kiosk in Carriage B and was not filling a conductor's role on the train. Her telephone was flat.

4.3.3.17 Further, Ms Burford assisted Mr Lidster and Mr Buckland in fulfilling their roles as Interim Site Controller. She also contacted CARS and provided the first interim situation report using Mr Buckland's phone. Mr Buckland and Ms Burford agree that they shared the work as required and according to their skills.

4.3.3.18 At 1:47pm, Ms Burford reported to Train Control that that the incident had occurred at the Murray Valley level crossing three kilometres north of Kerang and that there had been 31 economy passengers and six first class passengers on the train. She believed there were six fatalities and another six or ten badly injured passengers. This was the first substantial situation report from the scene.

4.3.3.19 As a trained conductor, Ms Burford should also have been trained and equipped to assist the train driver and the conductor in Interim Site Control.

4.3.3.20 I recommend that V/Line provide the same with equipment, formal instruction and scenario practice events for all trained conductors to enable them to assist the train driver and the conductor in their Interim Site Control duties. **Recommendation 20**

4.3.3.21 Mr Lidster, Mr Buckland and Ms Burford and by-standers were attempting to provide first aid but the first aid equipment provided by V/Line was inadequate for the purpose.

4.3.3.22 V/Line must provide first aid supplies that can assist in serious emergencies like the Kerang level crossing incident including blankets and bandages capable for use in major injuries.

4.3.3.23 Accordingly, I recommend that V/Line provide first aid supplies on all regional trains including blankets and bandages appropriate for use in major emergencies. **Recommendation 21**

4.3.3.24 Further, in circumstances like that that occurred on 5 June 2007, proper tools are required to assist in removal of seats and freeing of passengers trapped in the debris.

4.3.3.25 Accordingly, I recommend that V/Line provide tools and gloves on all regional trains adequate for removing seats and freeing of passengers trapped in the debris in a major collision involving a heavy vehicle combination. **Recommendation 22**

4.3.3.26 The *Emergency Management Act* 1986, the State Emergency Response Plan[577] and Victoria Police Emergency Management Response Policies require the most senior

[577] State Emergency Response Plan Part 3: Emergency Management Manual October 2010.

Victoria Police member first on the scene of an emergency to assume the dual roles of Incident Commander and Emergency Management Coordinator.

4.3.3.27 At about 1:40pm, Senior Constable Shane Hafner and Senior Constable Andrea Milikins from Kerang Police Station arrived at the scene. In his statement, Mr Hafner described the scene as he saw it when he arrived:

> *"I got up to this carriage and ran along the right side which I could now tell was extremely damaged. There was a large piece of the V/Line passenger carriage wall pushed right back. It had been sheared from approximately half way along the carriage all the way to the back. This piece of wall now resembled a piece of aluminium foil. From outside of this carriage I was able to see inside. The amount of damage that was visible was horrendous. Most of the seating on the damaged side was missing. I could see that there were people still within this carriage and some of them appeared to be assisting some passengers."*

4.3.3.28 Mr Hafner knew when he arrived at the scene that he was the Incident Commander and Emergency Management Coordinator until a more senior police officer arrived.

4.3.3.29 Mr Hafner and Ms Milikin immediately assessed the three carriages and spoke to Mr Buckland. They knew that there were 37 passengers and three crew and multiple casualties.

4.3.3.30 Mr Hafner communicated by radio with Mildura Police Communications Centre:

> *"Multiple fatalities and serious injuries. Everything you can get going that way."*

4.3.3.31 At 1:44pm, Sergeant Brian Gibson and Constable Dale Maxwell approached the scene and Mr Gibson confirmed with Mildura Police Communications Centre that he would take the role of Incident Commander and Emergency Management Coordinator.

4.3.3.32 Mr Gibson assessed the scene and spoke to Mr Hafner near Carriage C. He then confirmed at least one fatality with Mildura Police Communications Centre.

4.3.3.33 At about 1:45pm, Kerang ambulance officers, Neil Harrop and Stephen Humphreys, arrived at the scene. Mr Gibson was already there.

4.3.3.34 Neil Harrop was an Advanced Life Support paramedic and Kerang Station officer with 31 years experience as an ambulance officer.

4.3.3.35 Stephen Humphreys was a Community Rural Ambulance Service Level 2 who had worked with the Kerang Rural Ambulance Service team for seven years. This included 30 hours of formal training a year. Mr Humphreys also had extensive experience with the State Emergency Services including in-field training in emergency response and representing the SES at the municipal emergency management meetings.

4.3.3.36 Mr Harrop parked the Kerang ambulance on the north side near Mr Scholl's truck. As required by the Rural Ambulance Victoria Emergency Management Plan, Mr Harrop was the senior ambulance officer and acted in the role of Ambulance Commander.

4.3.3.37 Mr Harrop proceeded to assess Mr Scholl at the level crossing and establish a Casualty Collection Post on the Highway.

4.3.3.38 Mr Gibson, as Incident Commander and Emergency Management Coordinator, and Mr Harrop, as Ambulance Commander, directed Mr Humphreys to go to Carriage B.

4.3.3.39 Mr Humphreys arrived at Carriage B at the same time as a local resident and trained nurse Andrea (Min) Peacock. They assessed the scene in Carriage B.

4.3.3.40 Although Rural Ambulance Victoria was unable to assess the appropriateness of Mr Humphreys' early triage and clinical decisions[578], there is no reason for me to believe that his decisions contributed to the death of any of the 11 train passengers who died on 5 June 2007.

4.3.3.41 At about 1:45pm, Mr Harrop realised the extent of the damage when someone came back to the highway to obtain oxygen and other equipment. He contacted the Bendigo Rural Ambulance Northern Control Centre in his first situation report and to ask for more resources. He told them:

> *"Look I've got multiple patients out here-you'd better get as much as you can coming."*

4.3.3.42 By 1:50pm or 16 minutes after the collision at the Kerang level crossing on 5 June 2007, there were five police officers, two ambulance officers and several by-standers, including a nurse, at the scene.

4.3.3.43 Another seven police officers, several detectives, nine ambulance officers and one helicopter and one fixed wing aircraft, the State Emergency Services and the Country Fire Authority had been activated. All were proceeding to the scene with lights and sirens operating.

4.3.3.44 Further, both V/Line Train Control, Mildura Police Communications Centre and Bendigo Rural Ambulance Victoria Communications Centre were all aware that the incident was at the level crossing about five kilometres north of Kerang, that there were 37 passengers and three crew on the train, there was a least one fatality and several seriously injured passengers and Mr Scholl was being managed by Mr Harrop.

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578 Rural Ambulance Victoria Board, Review of the Rural Ambulance Victoria Response to the Kerang Rail Incident on 5 June 2007, 31 March 2008.

4.3.3.45 However, a experience like that which confronted the train passengers, the by-standers and the emergency service responders on 5 June 2006 will affect their arousal state, reactions, responses and memories over the longer term of the incident and well into the future.

4.3.3.46 In his review of the Country Fire Authority response to the Kerang level crossing, Tony O'Day, captured the greatest difficulty facing any emergency response:

> *"The confronting nature of the incident provided an extremely traumatic and stressful environment. The pressure on individuals was at times to extreme levels....*

4.3.3.47 Further, Paul Holman is now Operations Manager Ambulance Victoria. Mr Holman told the Court:

> *"...we know from experience that going to these scenes in terms of they're chaotic and they're overwhelming, all of these scenes are; we know that, and that's a world-wide experience and the literature supports all that."*

4.3.3.48 Put another way, the more detailed evidence in the present Inquest has proved more reliable and less emotive than that collected closer to the time of and/or by the people involved in the incident.

4.3.3.49 Associate Professor Joe Epstein told the Court about the need for protocols and processes to ensure that these appropriate responses occurred in circumstances where medical officers and paramedics were in a state of hyper-arousal.

4.3.3.50 Mr Holman also told the Court that one way of managing this issue is:

> *"... to give them specific instructions, so command instructions, and those instructions are also put on their page and then we follow up with them. So we find if we give people something to focus on when they get there and a very definite thing, particularly in these large instances, then we're going to get that order sorted a lot earlier."*

4.3.3.51 As relevant to this enquiry, these plans are contained in the State Emergency Response Plan, the V/Line Crisis Response and Management Plan and the State Health Emergency Response Plan and other associated support protocols.

4.3.4 The Operation of the State Emergency Response Plan on 5 Juue 2007

4.3.4.1 The State Emergency Response Plan identifies the organisational arrangements for managing the response to emergencies that arise in Victoria and applies to all agencies having roles or responsibilities in response to those emergencies.

4.3.4.2 The State Emergency Response Plan requires Victoria Police to appoint an Incident Commander and Emergency Management Coordinator at any civil emergency incident requiring more than one agency to respond, regardless of the size of the emergency.

4.3.4.3 In the circumstances of 5 June 2007, Mr Hafner was the initial Incident Commander and Emergency Management Coordinator. At 1:44pm, he handed the responsibility over to Mr Gibson. At 2:12pm, Mr Gibson handed responsibility to Inspector Gary Bennett.

4.3.4.4 When Mr Bennett took over as Incident Commander and Emergency Management Coordinator, there were at least four support agencies working at the scene including V/Line and Rural Ambulance Victoria.

4.3.4.5 Each of these agencies has there own Emergency Response Plan which is subordinate to the Victorian Emergency Management Plan.

4.3.4.6 Further, Mr Bennett established an Emergency Management Team comprising himself, Ross Hamilton from State Emergency Services and the Operations Manager and Rostered Duty Officer for the Country Fire Authority, Stuart Broad. Senior Sergeant Deveson took over the role of Municipal Emergency Response Coordinator for the Gannawarra Shire.

4.3.4.7 There was no representative from Rural Ambulance Victoria or V/Line on the Emergency Management Team.

4.3.4.8 No senior V/Line manager was at the scene until at least 3:30pm.

4.3.4.9 However, at about 2:37pm, Geof Astall had arrived at the scene from Swan Hill. Mr Astall was a senior ambulance manager capable of managing the scene. Mr Astall took over from Mr Harrop as Health Commander. Mr Astall was available to perform the support role. However, Mr Astall was not included in the Emergency Management Committee.

4.3.4.10 This failure to include the Health Commander or his delegate in the Emergency Management Committee was inconsistent with the Emergency Management Plan. It was also inconsistent with Victoria Police responsibility for co-ordinating health resources, managing pre-hospital resources and co-ordinating resources to manage the health impacts of the incident.

4.3.4.11 Accordingly, failure to include an ambulance representative on the Emergency Management Team was an oversight at least during the patient evacuation stage of the emergency response.

4.3.4.12 This failure to include Rural Ambulance Victoria and V/Line had implications for communication of situation reports and understanding the implications of the work undertaken by Victoria Police. For example:

- I note that Ms Burford informed V/Line managers that there were 40 people on the train, 37 passengers and three crew. Further, Mr Buckland told Mr Haffner the same figures. However, Victoria Police remained uncertain about the number of passengers on the train until late in the incident.
- I note that Mr Gibson told the Court that Code Brown was not part of the Victoria Police command and control arrangements and therefore he did not under stand its implications. Accordingly, he was not aware that, when he notified the local hospitals that they could expect to receive casualties from the incident, they implemented their Code Brown which will be discussed below.

4.3.4.13 These issues would not have arisen if the Emergency Management Team had included representatives of all the support organisations involved in the emergency response including Rural Ambulance Victoria or V/Line.

4.3.4.14 Therefore I recommend that Victoria Police ensure that Incident Commanders and Emergency Management Coordinators are aware of the importance of including representatives of all the support organisations involved in an emergency response in the Emergency Management Team. **Recommendation 23**

4.3.5 The Operation of the V/Line Emergency Response and Crisis Management Plan on 5 June 2007

4.3.5.1 On 5 June 2007, the V/Line Emergency Response and Crisis Management Plan[579] required Mr Lidster and Mr Buckland to take the role of Interim Incident Controller until Victoria Police arrive.

4.3.5.2 After that, the V/Line Emergency Response and Crisis Management Plan also required the Interim Site Controllers to take direction from the Network Controller and to remain in control of the train as a support agency to Victoria Police until relieved by a more senior officer or someone called out by the Network Controller.

4.3.5.3 At the management level, the V/Line Crisis Response and Management Plan required V/Line Train Control to notify the V/Line CARS office when Mr Lidster notified them of an emergency. The V/Line CARS Office was then required to notify emergency services and the V/Line General Manager Operations to assess the severity of the incident and authorise activation of the V/Line Crisis Management Team.

4.3.5.4 The V/Line Emergency Response and Crisis Management Plan expected the Rail Incident Response team to communicate with and through Victoria Police because they were the Emergency Response Coordinator.

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[579] V/Line Emergency Response and Crisis Management Plan, Final Report January 2006.

4.3.5.5 V/Line Crisis Management Team despatched senior V/Line staff and a V/Line response Team to assist in the incident. Accordingly, Mr Lidster's role as Rail Controller and senior member of V/Line staff was taken over by the V/Line Freight Operations Team leader when he arrived from Swan Hill. Mr Lidster's evidence suggests this occurred sometime after 3:30pm.

4.3.5.6 By then the emergency health response was complete. All the passengers had left the scene. Mr Lidster was at the Kerang Police Station assisting them with the prosecution investigation. The conductors were at the Kerang Community Hall with the uninjured passengers.

4.3.5.7 Under the V/Line Crisis Response and Management Plan, the Interim Rail Controller's role included liaison with and briefing of the Victoria Police Site Controller and communication with Train Control.

4.3.5.8 However, neither Mr Lidster nor any other V/Line staff member participated in the Emergency Management Committee established by Victoria Police Incident Controller.

4.3.5.9 The V/Line Crisis Response and Management Plan has now been updated to require V/Line Train Control to notify emergency services, assess the severity of the reported incident, activate the V/Line Crisis Management Team and log all incidents on the regional rail network as well as notify the V/Line General Manager Operations.[580]

4.3.5.10 Accordingly, I recommend that V/Line review their management arrangements to ensure that trained V/Line Rail Incident Controllers are within access to all level crossings in regional Victoria in a timely manner to support train crews and Victoria Police in the case of an emergency. **Recommendation 24**

4.3.5.11 Further, V/Line communication with Victoria Police and other support agencies in emergency situations would be improved with enhanced regional representation in local desk top and scenario emergency service training so that inadequacies in communication and management can be identified and corrected.

4.3.5.12 Accordingly I recommend that V/Line involve their train crews and management staff in local desk top and scenario emergency service training so that inadequacies in communication and management can be identified and corrected. **Recommendation 25**

4.3.6 The Operation of the State Health Emergency Response Plan on 5 June 2007

4.3.6.1 In recognition of the need to work fast in confronting circumstances, failure to identify major trauma cases and activate an appropriate medical response results in suboptimal

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580 International Transport Training & Development, "Module 21-Emergency Procedures", 30 September 2010.

clinical outcomes and death[581] , the Victorian State Trauma System was established following a review of outcomes from major trauma events in Victoria.[582] [583]

4.3.6.2 In April 2006, the Department of Health launched the first version of the State Health Emergency Response Plan.[584] Therefore, this programme was only operating for nine months when the Kerang level crossing incident occurred.

4.3.6.3 Further, in May 2007, the Kerang ambulance officers had in-service training in the operation of the State Health Emergency Response Plan.

4.3.6.4 The State Health Emergency Response Plan does not guide the Emergency Response or dictate clinical guidelines for triage.

4.3.6.5 However, the State Health Emergency Response Plan provides for triage of patients at the scene including those who die during, immediately after or during transport from tbe incident. Their management is determined in cooperation with appropriate agencies through the Emergency Management Team.

4.3.6.6 Further, the State Health Emergency Response Plan acknowledges that Victoria Police was the control agency at the Kerang level crossing incident and that Rural Ambulance Victoria were a support agency.

4.3.6.7 Therefore, Victoria Police was responsible for co-ordinating health resources, managing pre-hospital resources and co-ordinating resources to manage the health impacts of the incident.

4.3.6.8 Further, the State Health Emergency Response Plan establishes that the first ambulance officer on the scene of the Health Commander until he or she is replaced by a more senior ambulance officer.

4.3.6.9 The role of the Health Commander requires creation of the Casualty Command Post and the Casualty Transport Post, communication with the Incident Commander and Emergency Management Coordinator and participation in the Emergency Response Committee.

4.3.6.10 Mr Harrop arrived on the scene at about 1:40pm and became the Health Commander. Geoff Astall arrived at 2:37pm and took over the role. He confirmed Mr Harrop's triage

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581 Ministerial Taskforce on Trauma and Emergency Services and the Department of Human Services Working Party on Emergency and Trauma Services, "Review of Trauma and Emergency Services Victoria 1999."

582 "Trauma towards 2014: Review and future directions of the Victorian State Trauma System", Department of Human Services, 2009.

583 F. McDermott, S. Cordner, D Cooper, and V Winship, "Management Deficiencies and Death Preventability of Road Traffic Fatalities Before and After a New Trauma Care System In Victoria, Australia", Journal of Trauma, Injury, Infection and Critical Care (2007) 63.

584 Department of Human Services, "State health emergency response plan: Health Displan Victoria 2006", State of Victoria 18 April 2006.

decisions in relation to Mr Scholl and Mr Long. No other patients had presented at the Casualty Collection Centre at that time.

4.3.6.11 Further, the Bendigo Rural Ambulance Victoria Communications Centre took on the role of Incident Coordinator in relation to communications and organising the resources required for the health response.

4.3.6.12 Further, by 5 June 2007, the trauma system had undergone substantial changes based on the concept that the right patient be delivered to the right hospital in the shortest time.

4.3.6.13 The State Health Emergency Response Plan distinguishes between Major Trauma Services (The Alfred Hospital and the Royal Melbourne Hospital) and designated trauma services including is Swan Hill and Bendigo Hospitals).

4.3.6.14 As part of these developments, major trauma centres had been established at the Royal Melbourne, The Alfred and the Royal Children's hospitals, the Adult Retrieval Service was improving the coordination and timely transfer of patients and improved ambulance infrastructure including introduction of Air Ambulance and more paramedics with Mobile Intensive Care and Advanced Life Support training.

4.3.6.15 These changes had been successful in:

- Reducing times at the accident scene;
- Triage of patients to hospitals best able to meet the needs of time-critical major trauma patients;
- Improving processes for trauma patients requiring inter-hospital transfer.

4.3.6.16 There is no doubt that, overall, these changes had improved outcomes for serious trauma patients.

4.3.6.17 However, the Acting General Manager Operational Services with Rural Ambulance Victoria, Tony Walker, told the Court that the State Health Emergency Response Plan was not fully rolled out in Rural Ambulance Victoria when the Kerang level crossing collision occurred.

4.3.6.18 Therefore, Mr Walker says that the new State Health Emergency Response Plan remained a work in progress in regional Victoria on 5 June 2007.

4.3.6.19 Craig Lapsley was the director of Emergency Management at the Department of Human Services. He commenced this work I August 2007.

4.3.6.20 Mr Lapsley also told the Court that a Health Services Communication Centre on 5 June 2007 was established but there were problems with communication about patient transfers and communication with regional centres.

4.3.6.21 Further, in July 2008, Rural Ambulance Victoria amalgamated with the Metropolitan Ambulance Service and Air Ambulance Victoria to create Ambulance Victoria. These changes were in progress on 5 June 2007.

4.3.6.22 In particular, the organisational change process influencing Rural Ambulance Victoria on 5 June 2007 included implementation of a revised organisational structure, improved clinical care, introduction of computer-aided despatch, replacement of paper-based patient records with electronic records, and changes in resourcing, training and management of personnel.

4.3.6.23 On 5 June 2006, the new Incident Coordination Room at Ballarat Communications Centre was also not fully functional and processes surrounding its use had not been fully determined.

4.3.6.24 Therefore, the then Metropolitan Ambulance Service Operations Manager, Mr Holman, presumed it was limited in its capacity to assist in coordinating the Rural Ambulance Victoria response.

4.3.6.25 The Rural Ambulance Victoria Review found there was a delay in notification and activation of other health agencies.[585]

4.3.6.26 However, to the degree that this delay included the Field Emergency Medical Coordinator, it was deliberate and justified. Other than at Kerang, the information available to the Bendigo Rural Ambulance Service Communications Centre did not provide any justification for escalating the health response to include any medical officers at the site or for initiating Code Brown procedures in any local hospitals.

4.3.6.27 Further, there was no delay in notifying the local hospitals. Rather, their early notification by the Victoria Police Incident Commander and Emergency Management Coordinator resulted in premature activation of their Code Brown responses. Six patients including Mr Scholl were transferred to Kerang Hospital. No other patients were transferred to any of the other local hospitals who were waiting for them.

4.3.6.28 Similarly, the Rural Ambulance Victoria Review found that incident scene management was delayed and did not align with State Health Emergency Response Plan requirements.[586]

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585 Rural Ambulance Victoria Board, Review of the Rural Ambulance Victoria Response to the Kerang Rail Incident on 5 June 2007, 31 March 2008.

586 Rural Ambulance Victoria Board, Review of the Rural Ambulance Victoria Response to the Kerang Rail Incident on 5 June 2007, 31 March 2008.

4.3.6.29 However, to the extent that Mr Harrop did not establish a Casualty Command Post quickly or provide adequate situation reports to Bendigo Rural Ambulance Service Communications Centre, Mr Holman told the Court that the response from Mr Harrop was appropriate:

> *"...if I was going to write a text book of what I would require that person to do at the arrival of a scene, that's what I would describe, so he's demonstrated a text book response in terms of SITREPs. I think I said to Your Honour before that, you know, one of the first casualties is actually getting accurate information. That he was giving those SITREPs in that time frame, if I was evaluating this case, you know, in a debrief and ticking a box, that would be a big tick."*

4.3.6.30 Accordingly, although there were some complaints at the time, I find that there is little justification for this criticism.

4.3.6.31 The Rural Ambulance Victoria Review also found that there were communication limitations due to staff behaviour and technology.[587]

4.3.6.32 With respect to technology, there is some justification for their concern:

- The roaming radios did not operate;
- Mr Astall's mobile phone went flat.

4.3.6.33 With respect to communications limitations due to staff behaviour, I note the following:

- At 1:34pm on 5 June 2007, Mobile Intensive Care Ambulance paramedic Graham McGrath was in charge of the Bendigo Rural Ambulance Victoria Communication Centre.
- Mr McGrath understood the implications of the reports he was getting about the incident at the Kerang level crossing. He immediately:
  - Delegated staff to the incident and established the Bendigo Rural Ambulance Victoria Communication Centre as the Operations Centre;
  - Despatched the Kerang ambulance crew to the scene with lights and sirens;
  - Despatched the Cohuna ambulance without emergency status but subsequently upgraded it when he heard back from the scene;
  - Despatched four Swan Hill ambulances;
  - Despatched one helicopter and one fixed wing aircraft;
  - Notified the Acting Director Operational of Rural Ambulance Victoria, Tony Walker; and

587 Rural Ambulance Victoria Board, Review of the Rural Ambulance Victoria Response to the Kerang Rail Incident on 5 June 2007, 31 March 2008.

- Notified the Emergency Response Group in Mildura.

4.3.6.34 However, on 5 June 2007, Mr Walker was at a meeting in Camperdown with the Field Emergency Medical Coordinator, Associate Professor Joe Epstein.

4.3.6.35 When Mr Walker was notified about the Kerang level crossing incident, he and Associate Professor Epstein established an emergency response room at the venue in Camperdown.

4.3.6.36 Mr Walker and Associate Professor Epstein then proceeded to contact other emergency services including V/Line and Victoria Police, they updated their situation reports without always communicating with Bendigo Rural Ambulance Victoria Communications Centre and they directed activation of extra resources without consultation and cooperation with and sometimes in direct contradiction to the Rural Ambulance Victoria Coordinator at Bendigo

4.3.6.37 For example:

- At 2:09pm, Air Ambulance Victoria notified the Royal Melbourne Hospital to expect three or four patients and the Royal Children's Hospital to expect one patient. This notification also seems to have derived from Associate Professor Epstein and Mr Walker because it foreshadows information that became available to the Bendigo Rural Ambulance Victoria Communications Centre at 2:11pm.
- At 2:07pm Associate Professor Epstein left a message to activate one Field Emergency Medical Officer without communicating with Bendigo Rural Ambulance Victoria Communications Centre or the Health Commander at the scene. By 3:00pm, when that Field Emergency Medical Officer responded, Bendigo Rural Ambulance Service Communications Centre was already aware that the numbers of time critical patients had been exaggerated. However, Associate Professor Epstein proceeded to activate three more Field Emergency Medical Officers. None were required when they arrived at the scene. Certainly none would have changed the outcome for any of the passengers who died.
- At 2:30pm, Associate Professor Epstein also contacted the Director of the Victorian Adult Emergency Retrieval Service, Dr Andrew Rosengarten. Professor Epstein asked Dr Rosengarten to deploy the Ambulance Emergency Operations Centre in South Melbourne.
- Mr Holman told the Court that he set it up the Emergency Operations Centre in Melbourne on 5 June 2007 at the direction of Associate Professor Epstein but without consultation with the Health Commander at the scene or with the Bendigo Rural Ambulance Victoria Communications Centre.
- At 2:51pm, Mr Walker contacted Bendigo Rural Ambulance Victoria Communications Centre to get his first update. He was unaware that they had

already set up as the Operations Centre. Mr McGrath told him that his information was that there were six fatalities, 12 time critical patients and 22 other passengers and crew. Mr McGrath also told Mr Walker they were already using the fixed wing aircraft to transfer Mr Long who was:

"basically a signal 3 patient".

- At 5:10pm, Associate Professor Epstein directed Dr Jensen to use a fixed wing plane that was available to travel to Kerang to triage patients. He persisted with this direction even though Bendigo Rural Ambulance Victoria Communications Centre and Kerang Hospital and the other Field Emergency Medical Officer at Kerang Hospital told him there were no patients left at Kerang to triage.
- Mr Walker directed a paramedic from Mildura to Swan Hill to triage patients arriving at Swan Hill Hospital. No patients were sent to Swan Hill Hospital.

4.3.6.38 As the Incident Coordinator at Bendigo Rural Ambulance Victoria Communications Centre commented in the transcript of their communications:

".... the problem is that you know the control room is doing pretty well but you've got all sorts of other people and messages going around all over the place and RAV set up their emergency coordination centre at Ballarat and that just confuses things and then the Government department set up their own emergency control centre and you know it was like you just really only need the one in here...

And they were getting messages and ringing people and finding out stuff and then we're hearing second hand stuff information instead of everything coming to here it's going to different areas..."

4.3.6.39 Although the State Health Emergency Response Plan had been operating for six months and Kerang ambulance officers had training in its operation in May 2006, Mr Holman explained that Rural Ambulance Victoria did not have a formal emergency response plan or a full-time emergency operations centre in June 2007.

4.3.6.40 This explanation belies the confusion caused when emergency service managers ignore or work parallel to the protocols and procedures that have been established to protect the system from miscommunication.

4.3.6.41 Further, there is always concern about under-triage of trauma patients because their deterioration from undiagnosed injuries can be delayed in onset and rapid in effect. In these circumstances, it seems to me that over-resourcing with Advanced Life Support paramedics early in the life of an trauma event like the Kerang level crossing incident may be justified because they can triage more accurately, rehydrate to compensate for blood loss

and administer more effective pain relief. All these skills have the potential to save lives in trauma patients.

4.3.6.42 However, over-resourcing with air transport too early in an incident in circumstances where patients are slow to become available and the 'golden hour' has already expired carries its own risks.

4.3.6.43 In particular, knowledge that Air Ambulance Victoria is despatching more helicopters and fixed wing aircraft than are required for the identified time-critical major trauma patients places pressure of the Casualty Collection Officer to over-triage and the Casualty Transport Officer to over-prioritise patients in order to justify the use of expensive resources.

4.3.6.44 As an example, Harold Long's transfer to a Major Trauma Service by fixed wing ambulance without Mobile Intensive Care Ambulance support on 5 June 2007 was directly related to a sequence of events including:

- Early over-estimation of the number of time-critical trauma patients arising from the Kerang level crossing incident ,
- Communication of this inflated data to Mr Walker, Associate Professor Epstein and Air Ambulance Victoria before it was verified,
- Activation of two fixed wing aircraft and three helicopters without authorisation by the Health Commander at the site or the Bendigo Rural Ambulance Victoria Communications Centre, and
- Over-triage associated with transfer by fixed wing ambulance to Melbourne because the aircraft was on the ground at Kerang and he was ready to go.

4.3.2.34. Mr Long died from acute blood loss and shock/trauma in a man with cardiomegaly, myocardial fibrosis and ischaemic coronary artery disease. However, in the circumstances of his pre-morbidities and his injuries, I am unable to exclude a contribution by the tension pneumothorax diagnosed during his transfer to the Royal Melbourne Hospital.

4.3.6.45 Accordingly, I find that failure to comply with the operational and communication requirements of the State Health Emergency Response Plan may have contributed to Mr Long's death.

4.3.6.46 I also note that, in December 2009, the State Health Emergency Response Plan was updated to include:

- Clarification of the functional command structure;
- Clarification of the relationship between the Health Incident Management Team, the Emergency Management Team and the Incident Controller in development of the incident strategy;

- Enhancement of SHERP as a framework for management of public incidents;
- Changes to increase capacity for management of emergencies across sites and sectors;
- Inclusion of a new scene management model that includes management of people with no obvious physical injuries but who need medical attention (for example, those requiring psychological first aid);
- Inclusion of a general practitioner sub-plan and a primary care sub-plan.

4.3.6.47 In the circumstances of these changes, the subsequent creation of Ambulance Victoria and the co-location of emergency service communication centres under the Emergency Service ESTA, I make no recommendations in relation to the issues raised by the health response to the Kerang level crossing incident on 5 June 2007.

4.4 RECOMMENDATIONS

Pursuant to section 72(2) of the *Coroners Act* 2008, I make the following recommendations connected with the deaths of 11 people in this level crossing cluster who died on 5 June 2007:

18. That Ambulance Victoria and Air Ambulance Victoria carefully consider the risks of tension pneumothorax when triaging trauma patients for transfer by fixed wing aircraft without Mobile Intensive Care Ambulance support.

19. That V/Line provide train drivers and conductors with formal instruction and scenario practice events to ensure they understand their role as Interim Site Controllers.

20. That V/Line provide the same with equipment, formal instruction and scenario practice events for all trained conductors to enable them to assist the train driver and the conductor in their Interim Site Control duties.

21. That V/Line provide first aid supplies on all regional trains including blankets and bandages appropriate for use in major emergencies.

22. That V/Line provide tools and gloves on all regional trains adequate for removing seats and freeing of passengers trapped in the debris in a major collision involving a heavy vehicle combination.

23. That Victoria Police ensure that Incident Commanders and Emergency Management Coordinators are aware of the importance of including representatives of all the support organisations involved in the emergency response in the Emergency Management Team

24. That V/Line review their management arrangements to ensure that trained V/Line Rail Incident Controllers are within access to all level crossings in regional Victoria in a timely manner to support train crews and Victoria Police in the case of an emergency.

25. That V/Line involve their train crews and management staff in local desk top and scenario emergency service training so that inadequacies in communication and management can be identified and corrected.