Australian Government
Australian Transport Safety Bureau

Level crossing collision between truck and passenger train 8753

Phalps Road, Larpent, Victoria | 13 July 2016

Investigation

ATSB Transport Safety Report
Rail Occurrence Investigation
RO-2016-009
Final – 28 June 2019

Cover photo: Chief Investigator, Transport Safety (Victoria)

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Addendum

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Safety summary

What happened

At about 1541 on 13 July 2016, a Warrnambool-bound passenger train collided with a semi-trailer at the Phalps Road level crossing in Larpent, Victoria. The level crossing was fitted with Stop signs and the truck entered the crossing in front of the train.

As a result of the collision, the train's locomotive and all passenger cars derailed. The locomotive driver, train conductor, 18 passengers and the truck driver were injured. There were no fatalities.

What the ATSB found

The ATSB found that when the truck driver stopped to look for trains, his view along the track was restricted due to the acute road-to-rail angle and the limited view through the truck passenger-side window. The driver's view was less than that required to see the train and the truck driver entered the crossing and into the path of the train unaware of the train's approach.

The acute road-to-rail angle of the intersection at the Phalps Road level crossing also meant that the required viewing angle from a road vehicle exceeded the requirements of the Australian Standard for crossing design. At the time of the incident, many other public road crossings on the V/Line regional rail network, including 35 on passenger lines, were also non-compliant with the Australian Standard for crossing design due to their acute road-to-rail angle.

In February 2015, the Phalps Road level crossing was approved for upgrade to active protection. However, neither V/Line nor the Colac Otway Shire Council took measures to mitigate the known risks associated with the sighting limitations at the crossing, pending this upgrade.

At many other acute-angle crossing locations on the network, processes used by V/Line did not result in the deployment of available risk controls.

The train was operated within the speed limit and the handling of the train did not contribute to the collision.

What's been done as a result

The Phalps Road level crossing was upgraded to active protection in August 2016.

V/Line has taken several further safety actions. Of the 35 passenger line crossings non-compliant with sighting angles, 24 have been either upgraded to active protection, had train speed restrictions applied, or in one instance, restricted access gates fitted. Safety actions on the remaining 11 crossings were pending. Several other crossings with sighting non-compliance have been prioritised for upgrade. One has been reassessed as compliant with the standard.

In addition, the Victorian Level Crossing Safety Committee has established a Passive Crossing Working Group. The Group's activities will include work around low cost technologies for active crossing protection, and exploring the option of including 'limited sighting' crossings on the VicRoads heavy vehicle network maps.

Safety message

Rail infrastructure and road managers should ensure that risk assessment processes take account of available risk controls for hazards stemming from poor sighting at acute-angle level crossings and actively pursue their implementation.

Road users should be particularly cautious at passively-controlled acute-angle level crossings where their vision to the left may be affected by the road vehicle cabin design.

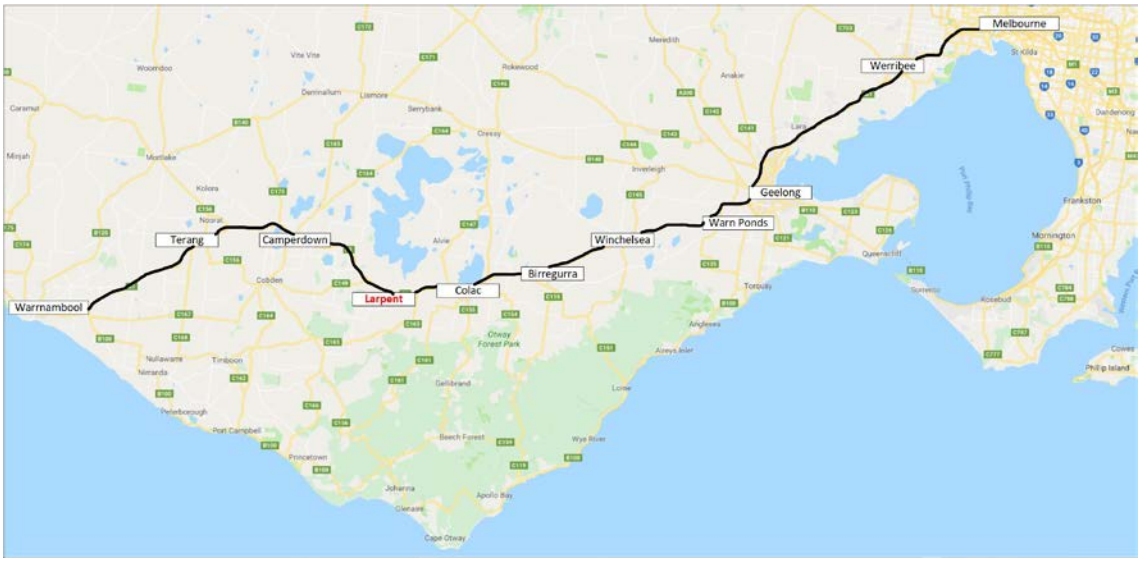
Contents

The occurrence

On 13 July 2016, V/Line train 8753 was the 1321[1] passenger service from Melbourne to Warrnambool. It consisted of an N Class locomotive and four passenger cars and was crewed by a locomotive driver and conductor.

The Phalps Road level crossing was located in Larpent about 85 km west of Geelong. The crossing was 163.886 rail-kilometres from Melbourne on the Broad-Gauge line connecting Melbourne and Warrnambool (Figure 1).

Figure 1: Melbourne to Warrnambool line, and the location of Larpent



The figure depicts the route between Melbourne and Warrnambool. It shows the locations of stations between Geelong on Colac and of the Phalps Road level crossing in Larpent, west of Colac.
Source: Google Earth 2016, annotated by Chief Investigator, Transport Safety (Vic)

The train departed Southern Cross station on schedule. It travelled to Geelong and then to Waurn Ponds where there was a change of driver.

The train departed Waurn Ponds at about 1447. It then stopped at Winchelsea, Birregurra and Colac Railway Stations and departed Colac one minute behind schedule at 1535. Departing Colac, the train was carrying 99 passengers.

On the same day, a truck was to transport stock feed to a farm on Phalp's Road in Larpent, west of Colac. The truck first travelled to Brooklyn in inner western Melbourne in a stag B Double[2] configuration. In Brooklyn, the truck's lead trailer was loaded with 26.5 t of bulk stock feed and the rear (stag) trailer remained unloaded.

After departing Brooklyn, the truck travelled to Colac to drop-off the empty rear trailer at the company depot. It then continued towards its destination with the prime mover and lead trailer in a semi-trailer configuration.

Both vehicles were fitted with devices allowing their final approaches to be analysed. The locomotive was fitted with a data logger that recorded train speed and key actions by its driver. The truck location was monitored by a GPS based system.[3]

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1 All times are Eastern Standard Time (EST).
2 The stag B Double configuration allows both tipper trailers to be unloaded without uncoupling the rear trailer.
3 Transtech.

At around 1540, the truck was travelling south along Phalps Road at mostly between 40 and 50 km/h[4] and the train was travelling west (Figure 2).

Figure 2: Overview of truck and train approach to the Phalps Road level crossing

The figure shows an aerial view of the level crossing location, and the direction of each vehicle approaching the crossing.
Source: Image courtesy of MapInfo annotated by Chief Investigator, Transport Safety (Vic)

When the train was about 520 m from the level crossing, the locomotive driver commenced sounding the locomotive's country horn.[5] At this point the train was travelling at about 109 km/h. The locomotive driver reported observing a truck appear from behind a line of trees along Phalps Road and stop at the level crossing.

The truck stopped 8-to-10 m before the track for about 3 seconds. It then started to move to cross when the train was between 220 and 260 m from the crossing. On observing that the truck had started moving, the locomotive driver again sounded and held the country horn. At this point, the train was about 178 m from the crossing and travelling at about 106 km/h. When the train was about 139 m from the crossing, the locomotive driver made an emergency brake application and braced for collision.

The truck was travelling in first gear and was crossing at around 10 km/h.

When the train arrived at the crossing, the prime mover had cleared the track but its semi-trailer had not. The truck driver heard the train horn shortly before impact and recorded data indicated that the truck speed increased to about 15 km/h in the moment before the collision. The truck driver did not see the train.

At 1541, the locomotive collided with the truck's semi-trailer at a speed of 95 km/h. The truck was rotated anticlockwise by the collision, and the left side and front corner of the prime mover impacted the side of the train.

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4 The maximum speed of the truck on Phalps Road was 55 km/h.

5 N-class locomotives are equipped with two separate horn systems. One is a high-note (sometimes called a 'country' horn) for sounding a loud signal as a safety warning at level crossings and to warn the public who might not be expecting a train; the other is a low-note (sometimes called a 'town' horn) typically used around a depot or workshop.

The locomotive and all four passenger cars derailed but stayed upright. Both the locomotive driver and the truck driver were seriously injured. The train conductor and 18 passengers sustained minor injuries.

The locomotive sustained significant damage and came to a rest about 120 m beyond the crossing (Figure 3). The collision resulted in severe damage to the prime mover and the semi-trailer (Figure 4).

Figure 3: The damaged locomotive following the collision

The image shows the resting position of the locomotive, its angle of around 45 degrees to the longitudinal direction of the track and the severe impact damage to its leading end. The locomotive and passenger cars remained upright.
Source: Chief Investigator, Transport Safety (Vic)

Figure 4: The damaged prime mover and semi-trailer following the collision

The image shows the severe damage to the prime mover and semi-trailer. The damage to the driving cab was most severe on its left side and the left-front corner.
Source: Chief Investigator, Transport Safety (Vic)

Context

Railway and road

Rail approach

The rail infrastructure was managed by V/Line. The Warrnambool-bound rail approach to the crossing was on tangent track with a true bearing[6] of 253 degrees. The track was on an ascending grade of about 1:63 and the line speed limit was115 km/h. A whistle board was located about 400 m from the crossing.

Drivers of west-bound trains had a direct, straight-ahead view of the level crossing but their view of road traffic on Phalps Road approaching from the north was obstructed by a line of trees along the eastern edge of the road (Figure 5).

Road approach

The road was unsealed gravel and had a posted speed limit of 80 km/h. The level crossing was about 2.3 km south of the Princes Highway and the approach from the north was on a true bearing of about 190 degrees. The line of trees on the eastern edge of Phalps Road extended to within about 50 m of the crossing. The road manager for Phalps Road was the Colac Otway Shire Council.

At the time of the collision, the weather was fine with good visibility. The sun was behind the truck driver and did not affect his observations (Figure 5).

Phalps Road level crossing

Level crossing standard

At the time of the incident, the applicable standard for level crossings was *Australian Standard, Manual of uniform traffic control devices, Part 7: Railway crossings* (*AS 1742.7:2016).*[7] The Standard included detailed specifications for level crossing signage and methodologies for evaluating the sighting needs of road users. Compliance with the Standard was not mandated.[8]

Level crossing protection

The movement of road traffic across the Phalps Road level crossing was managed by passive protection[9] that consisted of approach warning signage and Stop signs at the crossing. Road users were required to stop and detect the approach of a train by observation.

The signage provided on Phalps Road approaching the level crossing was consistent with AS 1742.7:2016. Warning signage on the northern approach included *Railway Crossing Ahead (W7-7)* signs located 220 m before the crossing and a *Stop Sign Ahead (W3-1)* sign as the second warning sign (Figures 6 and 7). The W3-1 sign was located about 167 m in advance of the crossing, within the 120-180 m specified in the Australian Standard.

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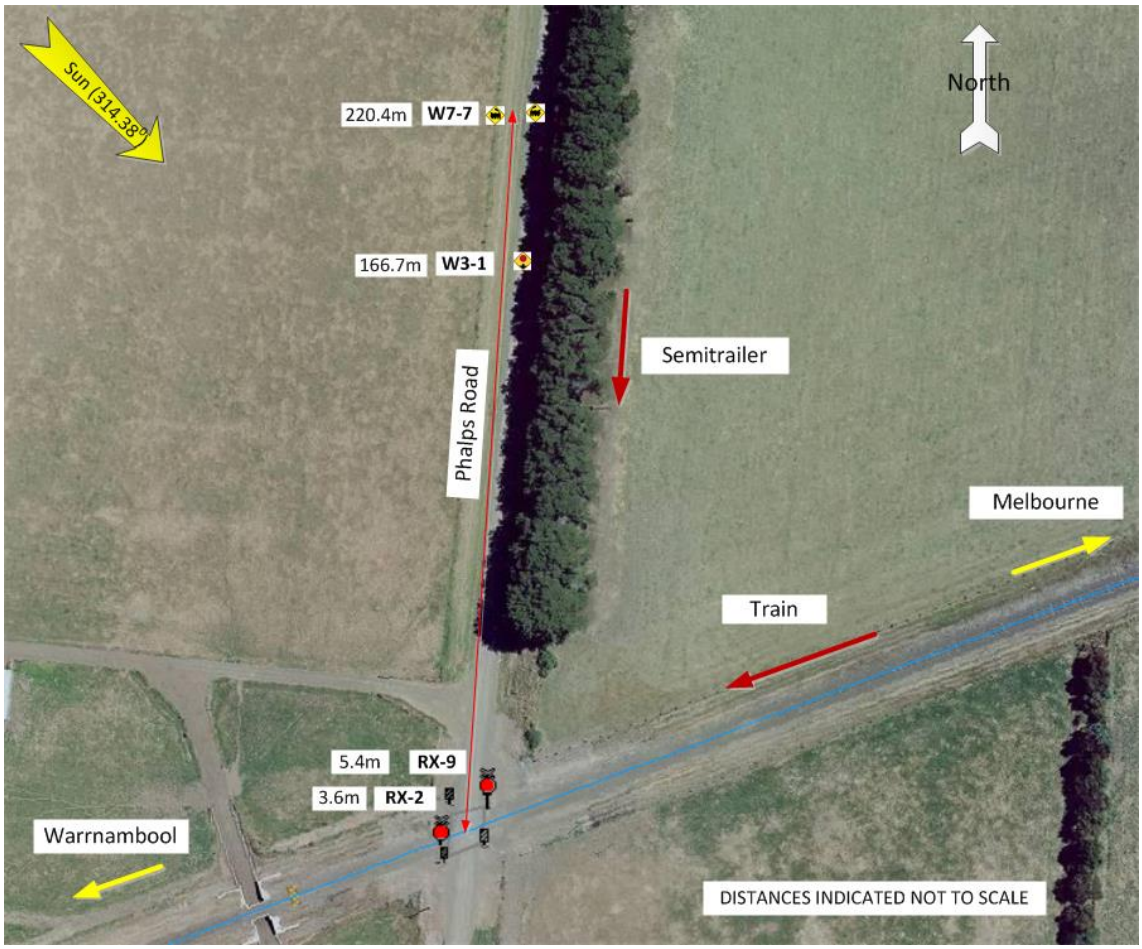
6 A horizontal angle measured clockwise from true north.

7 This edition of the Standard was published on 21 March 2016 and superseded AS 1742.7—2007.

8 Legislation does not mandate the use or adoption of this standard.

9 Passive protection refers to the control of the movement of vehicular traffic across a railway crossing by signs and devices, none of which are activated during the passage of a train. There is therefore a reliance on the road user to detect the approach of a train.

Figure 5: Signage on approach to Phalps Road level crossing from the north



This figure depicts an aerial view of the level crossing and the distances to road signage.
Source: Pass Assets, Public Transport Victoria, annotated by Chief Investigator, Transport Safety (Vic)

Figure 6: Signage on Phalps Road approaching from north.

The image shows the view for a road-user about 250 m from the crossing. The Railway Crossing Ahead signs (W7-7) are in the foreground, and the Stop Sign Ahead sign (W3-1) beyond.
Source: Chief Investigator, Transport Safety (Vic)

Signage at the crossing was in good condition. It included a *Railway Crossing Stop Assembly (RX-2)* and *Railway Crossing Width Marker Assembly (RX-9)* located a short distance in advance of the crossing (Figure 7).

Figure 7: Signage at the crossing when approaching from the north

The image is a close-up view of the crossing showing the level crossing signage.
Source: Chief Investigator, Transport Safety (Vic)

Level crossing geometry

Following this incident, an independent[10] survey was made of the Phalps Road level crossing. The results were compared with a previous survey conducted in 2009 as part of the Australian Level Crossing Assessment Model (ALCAM) process (Figure 8).

Figure 8: Comparison of Phalps Road level crossing surveys (true bearings)

	Post-incident survey	ALCAM 2009 survey	Difference in surveys
Direction of track towards Melbourne	073°	032°	41°
Direction of track towards Warrnambool	253°	227°	26°
Direction of road to the North	010°	336°	34°
Direction of road to the South	190°	156°	34°
Acute angle to left (Z, Figure 9)	63°	56°	7°

The table shows the measured bearings of track and road at the Phalps Road level crossing, and the substantial errors of up to 41 degrees in the survey conducted in 2009.
Source: ALCAM data from VicTrack, post-incident survey contracted by the Office of the Chief Investigator, Transport Safety (Vic).

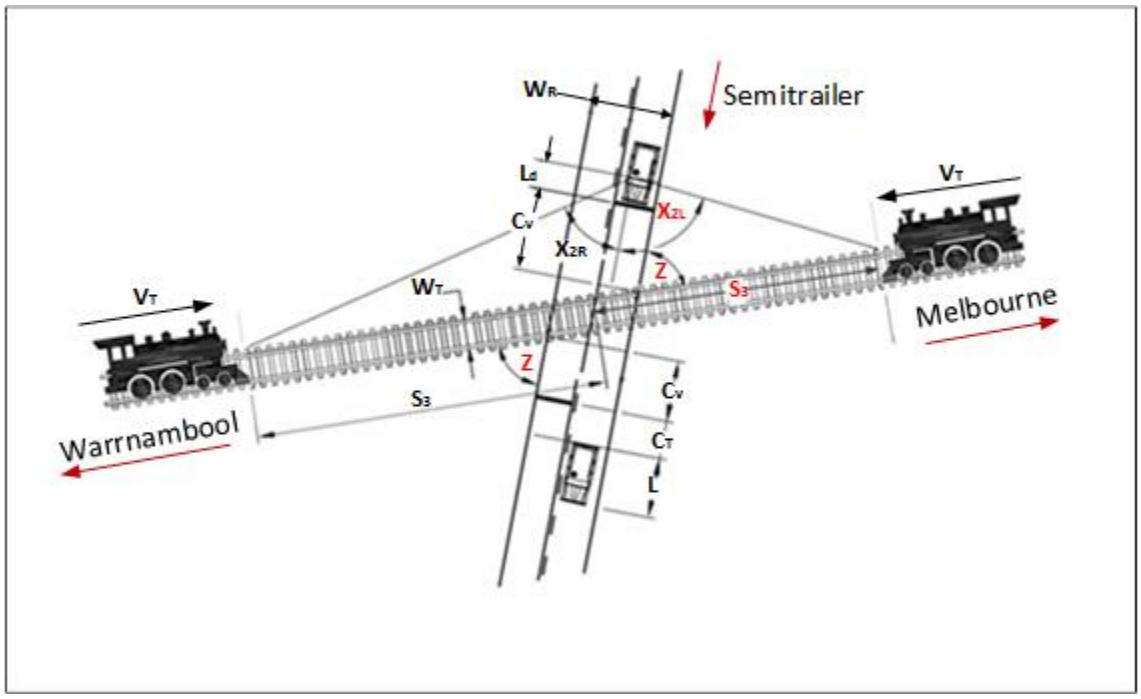
[10] Contracted by the Office of the Chief Investigator, Transport Safety (Vic).

The measurements from the post-incident survey were verified as accurate. The geometry at the site had not altered since the August 2009 survey. At that survey, road and track bearings were made using range/bearing binoculars that were subsequently found to produce inconsistent readings due to magnetic influence and battery condition.[11]

Sighting requirements

AS 1742.7:2016 specified the definitions, methodology and formulae for calculating the sighting distance required by a driver of a road vehicle stopped at a crossing (Figure 9).

Figure 9: Sighting distances and angles as defined in AS 1742.7:2016



The diagram shows the definition of key geometric features including the acute angle between track and road (Z), the viewing angle from the driving cab (X_{2L}) and the sighting distance along the track (S_3).
Source: Based on Figure D2 in AS 1742.7:2016, Appendix D and modified by Chief Investigator, Transport Safety (Vic)

The calculated sighting distance along the track (S_3) was designed to ensure sufficient time for a vehicle to start from stop and clear a crossing before the arrival of a train

Using the assumptions contained in the Australian Standard for a vehicle of the maximum length allowed for this road (design vehicle),[12] the calculated required sighting distance for such a vehicle stopped on the north side of the Phalps Road level crossing was 537 m. For a vehicle with similar specifications to the accident vehicle, the calculated sighting distance requirement was 508 m.

To achieve the required sighting distance of 537 m looking to the driver's left, the required sighting angle (X_{2L}) was 116 degrees (Figure 9). This exceeded the maximum of 110 degrees, specified in the Australian Standard, for level crossings protected by passive controls.[13]

Of note, the driver of the incident vehicle could not see to an angle of 110 degrees from the forward direction of the truck cab. In this and similar cab configurations, a driver may be limited to an angle of between 100 to 110 degrees. The Standard may therefore not fully reflect the limitations that may exist with some cab configurations.

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11 The Contractor responsible for the ALCAM survey in 2009 advised that the type of binoculars used for the August 2009 assessment were replaced with higher-grade binoculars in December 2009.

12 The minimum sighting distance calculation was based on a loaded semi-trailer, 19 m in length (maximum allowable for this road) and having an acceleration of 0.36 m/s².

13 The maximum permitted sighting angle when looking to the right (X_{2R}) is 140 degrees.

When outside a vehicle, there was a clear view along the track (Figure 10).

Figure 10: The view to the track when not encumbered by the road vehicle structure

The image shows the view from Phalps Road along the track in the east. When not restricted to the specified maximum viewing angle, or the structure of the road vehicle, the view along the track exceeded 500 m.
Source: Chief Investigator, Transport Safety (Vic)

Assessment of hazards and risks at Phalps Road level crossing

Australian Level Crossing Assessment Model (ALCAM) survey

ALCAM background

The Australian Level Crossing Assessment Model (ALCAM) was the primary tool for collecting information on each level crossing in Victoria. ALCAM is an assessment tool used to identify hazards and risks at level crossings, and to assist the prioritisation of level crossing upgrade. The project to establish ALCAM commenced in 1999 and was overseen by a committee of representatives from Australian states and territories and New Zealand.

In 2003, the Australian Transport Council (ATC) and the Standing Committee on Transport (SCOT)[14] Rail Group agreed that ALCAM be adopted nationally. In Victoria, the collection and assessment of level crossing data was managed by VicTrack.[15]

Since it was first developed, there have been several modifications made to ALCAM and its risk methodology. The initial model determined a Risk Score that was a measure of the risk posed to each driver approaching a crossing. Exposure in terms of train and road traffic volumes was not directly incorporated into this score, but rather considered when assessing a crossing's score against limit scores for installation (new crossings) and intervention (existing crossings).

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14 Now the Standing Committee on Transport and Infrastructure (SCOTI).

15 VicTrack was the owner of Victoria's railway land and infrastructure. VicTrack leased railway land used for public transport to Public Transport Victoria that then sub-leased it and infrastructure to accredited rail operators.

About 2008, significant changes were made to the model's treatment of exposure with the intention to achieving alignment with the risk management standard AS/NZ4360. An Exposure Factor equal to the product (VxT) of road traffic volume (V) and train traffic volume (T) was incorporated as a multiplier in the Risk Score. This change resulted in substantial re-ordering of the ALCAM-based level crossing upgrade priority list, with a stronger emphasis towards upgrading crossings with high volumes of road and rail traffic. Crossings with low traffic generally moved lower on the priority list.

Release of revised ALCAM in 2014

In 2014, further modifications were made to the ALCAM model. A review commissioned in 2011 found that the (VxT) approach used for exposure did not best replicate the observed collision record, nor adequately consider the effect of the type of crossing on the collision rate. As a result, the ALCAM Exposure Factor was modified using new algorithms. In addition, methodologies for the Infrastructure Factor and Consequence Factor were also updated and a substantially revised ALCAM model released in November 2014 (Figure 11). This had the effect of a further re-ordering of the ALCAM-based level crossing priority list.

Figure 11: ALCAM risk score as defined in the model released in November 2014

ALCAM Risk Score = Infrastructure Factor X Exposure Factor X Consequence Factor
Where the Infrastructure Factor X Exposure Factor = Likelihood

Source: ALCAM in Detail, An introduction to the new ALCAM models (2014), 6 May 2015

The revised ALCAM model was validated by February 2015. The performance of the model was tested using observations of its general behaviour against expected risk factors and statistical comparisons with incident history. The report concluded that the scoring gave due weight to the risk factors known to cause incidents and allowed for the greater consequence known to be possible when certain combinations of factors come into play, such as high speed passenger trains and heavy vehicles. Further, the new ALCAM model was found to perform well against references and to be appropriate for its current use as a level crossing risk assessment tool.[16]

In addition to its risk rating system, ALCAM used flags to highlight specific characteristics or risks that may result in an unacceptable situation, such as queuing, sighting and short stacking. ALCAM flagged areas for further assessment and non-compliance with the requirements of AS 1742.7.

ALCAM assessment of Phalps Road level crossing

Prior to this incident, the most recent ALCAM survey of the Phalps Road level crossing was in August 2009. This assessment identified that there was insufficient sighting to the left of road users when stopped at the crossing. It estimated an S_3 sighting distance of 61 m (when stopped to the north) and 63 m (when stopped to the south), compared to the required sighting distance of over 500 m. The S_3 measurements were made using the maximum permitted sighting angle (X_{2L}) of 110 degrees.

In 2008, the Phalps Road level crossing had a priority ranking of 217[17] in the State's list of passive level crossings. A risk ranking report run on 6 July 2016 using the revised (2014) ALCAM methodology showed the crossing was ranked 103.

Contracted level crossing assessment in 2014

In 2014, V/line engaged a contractor to undertake a review of several passively protected level crossings including the Phalps Road crossing. The review included identifying hazards and potential controls but did not include an assessment against V/Line's safety obligations.

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16 Victorian Railway Crossing Safety Steering Committee meeting 42 on 17 February 2015.

17 Based on the priority list published in May 2008. The precise ranking would have varied between 2008 and 2015.

The contractor's review of the Phalps Road level crossing identified that it did not meet the sighting distance required by AS1742.7-2007.[18] The contractor explored a number of treatment options with the Colac Otway Shire Council including road closure, restricted access and road realignment. The contractor, V/Line and the Shire Council also conducted a joint site inspection in October 2014. The contractor reported that the Shire Council did not support the road treatment options. The outcomes of the contractor's review and findings were provided to V/Line.

Additional V/Line sighting assessment in 2016

V/Line conducted a further line of sight assessment at the Phalps Road level crossing on 14 February 2016 that indicated that the S_3 sighting requirements of the Australian Standard were met. This assessment was in error, as the S_3 measurements that were made were not restricted to the maximum permitted sighting angle (X_{2L}) of 110 degrees.

Level crossing safety coordination and decision to upgrade

V/Line – Colac Otway Shire Council interaction

Legislation[19] (2006) introduced the requirement for a safety interface agreement (SIA) between rail and road managers. This then took the form of a requirement for an interface agreement (IA) when the Rail Safety National Law commenced in Victoria in May 2014. ONRSR described the purpose of the interface coordination provisions of the Rail Safety National Law as ensuring rail transport operators and road managers identify risks to safety arising from rail or road crossings, determine measures to manage, so far as is reasonably practicable, those risks and seek to enter into interface agreements to manage the risks.

An SIA was endorsed by the Colac Otway Shire Council, V/Line and VicTrack in 2011.[20] This interface agreement listed the rail-road interface locations[21] within the Shire and required all parties to the agreement to undertake inspections and/or audits to identify risks and facilitate any required remedial action. The agreement stated that the parties were to ensure that a risk management process was established, implemented and maintained.

V/Line and the Colac Otway Shire Council (Shire Council) had met prior to this formal agreement. In July 2009 and following a review of level crossings in the district, V/Line recommended to the Shire Council that several level crossings, including the Phalps Road level crossing, be realigned or closed. The Shire Council expressed the opinion that it was difficult to close this crossing, as it provided access between farms and the Princes Highway. The Shire's preferred option was to upgrade the crossing to active protection. V/Line opined that closure was their preferred option and that it would be some years before the crossing would be upgraded due to the light vehicle traffic on the road.

Level crossing upgrade program

Victorian Railway Crossing Safety Steering Committee

The Victorian Railway Crossing Safety Steering Committee (VRCSSC) was established in 2005 under section 36 of the *Transport Act 1983* (Vic) to advise and make recommendations to the Minister of Transport on policy, management and standards for road and pedestrian crossings in Victoria. The VRCSSC had four sub-groups: the Railway Crossing Technical Group (RCTG); the Railway Crossing Human Factors Group (RCHFG), the Railway Crossing Safety Awareness Group (RCSAG) and the Rail Crossing Project Delivery Group (RCPDG).

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18 The edition of the standard applicable at that time. The sighting requirements were similar to those in the 2016 edition.

19 *Rail Safety Act 2006* (Vic).

20 The agreement was signed by these three parties between August and December 2011. VicRoads did not sign the agreement (as supplied to ATSB) even though VicRoads was listed as having primary road responsibility at four level crossings within the Shire.

21 Including the Phalps Road level crossing.

The RCPDG was responsible for delivering the government's program of level crossing upgrades. The group was chaired by VicTrack and its membership included Public Transport Victoria (PTV), road authorities, rail operators and rail infrastructure managers. The rail regulator, Transport Safety Victoria (TSV), was an observer to this group.

Phalps Road upgrade

In February 2015, the VRCSSC endorsed a new 4-year Better Roads for Regional Communities – Road Level Crossing Program (2015-2019) that had been submitted by the RCPDG. The new program included the upgrade of the Phalps Road level crossing to active protection.

Documentation supporting the upgrade proposal indicated that there had been three reported near-collisions at the Phalps Road level crossing.

Regulatory oversight of level crossing safety management

2013 compliance inspection of V/Line by Transport Safety Victoria

Prior to May 2014, the rail safety regulator in Victoria was Transport Safety Victoria (TSV) operating under the statutory authority of the Director, Transport Safety.[22] Following a collision at a passively protected level crossing in September 2013,[23] TSV conducted a rail safety compliance inspection of V/Line. The key audit finding was that TSV was unable to determine whether V/Line was ensuring the safety, so far as is reasonably practicable (SFAIRP),[24] of passive railway level crossings without assessing the risk specific to each crossing. The final inspection report was issued to V/Line on 14 April 2014. In its cover letter, TSV advised V/Line that TSV was not entirely satisfied with the adequacy of the safety management of passive level crossings and flagged an intention to look further into the issue. The finding was closed within the TSV audit and compliance system, and a Projected Compliance Activity Plan (PCAP) raised as a trigger for future audit activity.

V/Line responded to the inspection report on the 28 April 2014, stating that it believed it was managing the risk SFAIRP. V/Line argued that substantial work had been completed on the management of safety risks at passive level crossings and advised of further site-specific assessments on a prioritised basis.

Transition to Office of National Rail Safety Regulator

On 19 May 2014, the regulation of rail transport in Victoria transitioned from TSV to the Office of the National Rail Safety Regulator (ONRSR). From that point, ONRSR became the agency responsible for rail regulation in Victoria, supported in day-to-day regulatory functions by TSV under a Service Level Agreement.

The outcomes of the September 2013 compliance inspection of V/Line, together with the inspection report, was provided to ONRSR on 16 April 2014. In response, ONRSR advised TSV that it was developing a policy position on level crossings, and that ONRSR expectations around risk assessment of level crossings would be considered as part of that process.

ONRSR has advised that it took, and continues to take, a risk-based approach to its regulatory effort. In practical terms, ONRSR advised its focus was on those issues that presented the highest overall risk and its resources were allocated to achieve the greatest safety benefit.

From the time regulatory oversight changed to ONRSR in May 2014, to the time of this occurrence on 13 July 2016, ONRSR regulatory activity regarding level crossing safety was focussed primarily on crossings with active protection that ONRSR advised presented a higher overall risk than passive level crossings. ONRSR advised that during this period Victoria had a number of

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22 s171 of Transport Integration Act 2010 (Vic).

23 ATSB investigation RO-2013-024 Collision between a truck and passenger train 8205, Pettavel Road, Mount Moriac, Victoria on 7 September 2013.

24 s46 of Rail Safety National Law (RSNL). Refer to the ONRSR website for the application of the RSNL to Victoria.

significant incidents involving active level crossings that required their sustained attention. Regarding passive crossings, ONRSR advised liaising with V/Line on its management of risks associated with corrosion of buried rail,[25] and conducting post-incident compliance inspections at Dunbar Road, Merrigum in June 2016. ONRSR did not engage with V/Line on its risk assessment of passive level crossings, the matter raised with ONRSR in April 2014 following TSV's compliance inspection of V/Line.

Road vehicle

The road vehicle was a 2013 Kenworth K200 'cab-over-engine' prime mover (Figure 12) that was hauling a semi-trailer. The overall length of prime mover with trailer was about 14.6 m.[26]

The vehicle was certified to Australian Design Rules (ADR) 64/00 standard for Road Train and/or B-Double use and was fitted with an ADR compliance plate. Maintenance was up-to-date.

ADR 42/04 – General Safety Requirements also applied to this prime mover. It specified that a motor vehicle must not be constructed or equipped in such a manner as to prevent the driver from having an adequate view of traffic on either side of the vehicle and in all directions in front of the vehicle to enable the vehicle to be driven safely. There was no detail in the design rules on a required viewing arc rearward of 'either side' of the vehicle.

Figure 12: A similar Kenworth prime mover to that involved in the collision

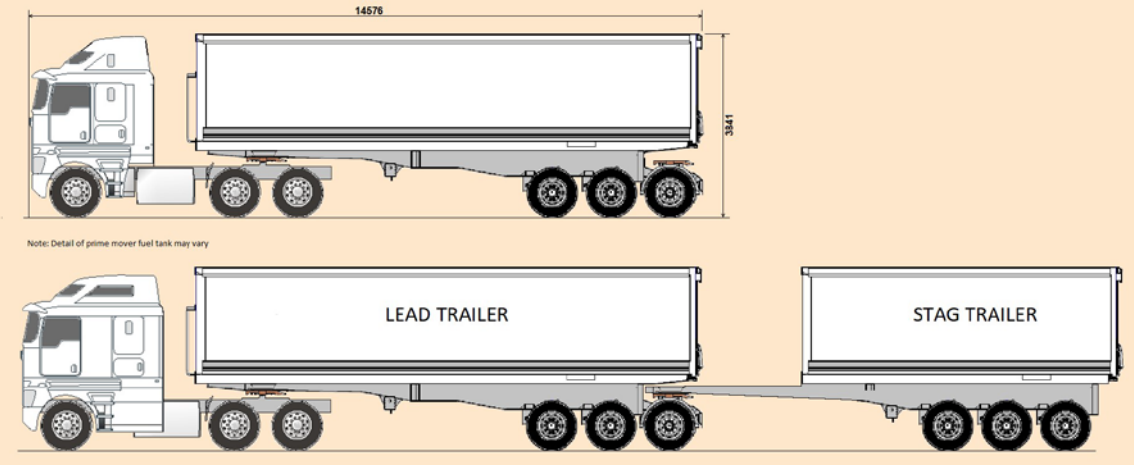
Source: Kenworth Trucks

At the time of the collision, the truck was running in a semi-trailer configuration with stag trailer removed (Figure 13). Its semi-trailer was loaded with 26.5 t of Canola meal giving the truck a total mass of approximately 45 t.

[25] ATSB investigation report RO-2013-010, Derailment of grain train 9054 near Pyramid Hill, Vic. on 5 March 2013

[26] The truck was earlier running in a Stag B-double configuration, and had removed its smaller, rear trailer.

Figure 13: Schematic of truck in semi-trailer configuration and with stag trailer



Source: Adapted by Chief Investigator, Transport Safety (Vic)

Previous incidents at level crossings with acute road-to-rail angle

Trawalla 2006

On 28 April 2006, a Diesel-Multiple-Unit passenger train collided with a semi-trailer on the Ercildoune Road level crossing near Trawalla, about 40 kilometres west of Ballarat. The train was derailed and two persons sustained fatal injuries.

Ercildoune Road was an acute-angle level crossing with passive protection (Stop signs). The road-to-rail angle to the truck driver's left was about 52 degrees. There is no public report with detailed findings.

Lake Charm 2013

On 12 February 2013, a locomotive-hauled passenger train collided with a semi-trailer on the B. McCann Road level crossing near Lake Charm, in northern Victoria. There were no injuries.

The level crossing was equipped with Give Way signs. The angle between the truck's direction of approach and the railway line to the truck driver's left was about 65 degrees. The ATSB investigation[27] into the incident found that the truck driver's view to the left along the track was restricted due to the acute angle.

Following the collision, the road was 'squared up' to the railway, and the level crossing added to the Safer Country Crossings program for upgrade. The crossing was subsequently upgraded in 2017.

Regulatory response to these events

Transport Safety Victoria advised that there was no specific audit or inspection activities initiated following the Trawalla (2006) or Lake Charm (2013) level crossing collisions.

[27] ATSB investigation RO-2013-008, Level crossing collision between passenger train and semi-trailer near Lake Charm, Victoria on 12 February 2013

Safety analysis

The Incident

The truck was travelling south along Phalps Road towards the level crossing at the same time that the passenger train was approaching from the east. Data from the truck and train were used to estimate the timelines for the approach of each vehicle to the point of collision.

When the truck initially stopped at the crossing, the train was more than 300 m away. The truck commenced moving towards the track when the train was between 220 and 260 m from the crossing. While the truck was stopped, the train was beyond the truck driver's view through the truck's passenger-side window.

Unaware that there was a train approaching beyond his line of sight, the truck driver proceeded to enter the level crossing. The driver heard the train's horn shortly before the locomotive impacted the truck's semi-trailer. The data suggests that the driver may have attempted to accelerate the truck just prior to impact. The truck driver did not hear the first sounding of the locomotive horn nor the commencement of the second sounding when the train was 178 m away, probably due to noise within the cabin of the prime mover and a closed passenger-side window.

There was no evidence to suggest that the truck driver was fatigued or that in-cab distractions influenced his ability to observe the train. The driver was unfamiliar with this crossing. In hindsight, he may have taken additional steps to improve his view by angling the truck cab further left. However, there was also no advice provided at the crossing that may have prompted or guided this behaviour.

The train was travelling within the permitted line speed and the locomotive driver took appropriate actions by sounding the horn and making an emergency brake application. The first horn was sounded prior to the whistle board at 400 m, however this was not considered a factor in this event.

Restrictions to viewing train

Road-to-rail angle and driver viewing angle

When stopped at a level crossing, the ability of a road user to see along the railway track to their left can be affected by in-cab obstructions. Crossing design considered that viewing in this direction may be restricted. AS 1742.7:2016 specified that when stopped at a Stop sign, the viewing angle for a driver looking to their left should not exceed 110 degrees from the straight-ahead direction.[28] The standard specified that if this angle is exceeded, passive level crossing controls shall not be used.

For a road vehicle stopped on the northern side of the Phalps Road level crossing, the viewing angle to achieve the required sighting distance was 116 degrees,[29] which exceeded the specified maximum viewing angle of 110 degrees.

View through truck's passenger-side window

Post-incident sighting trials utilising the same model prime mover as that involved in the collision were conducted on the northern approach to the Phalps Road level crossing. The purpose was to gain a better understanding of the potential restrictions to viewing to the left from the driving cab. The prime mover was stopped aligned with the road direction, and with the front of the cab 10 m back from the track centreline.

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[28] AS 1742.7:2016 Appendix D, section D5

[29] Calculated in accordance with AS1742.7:2016

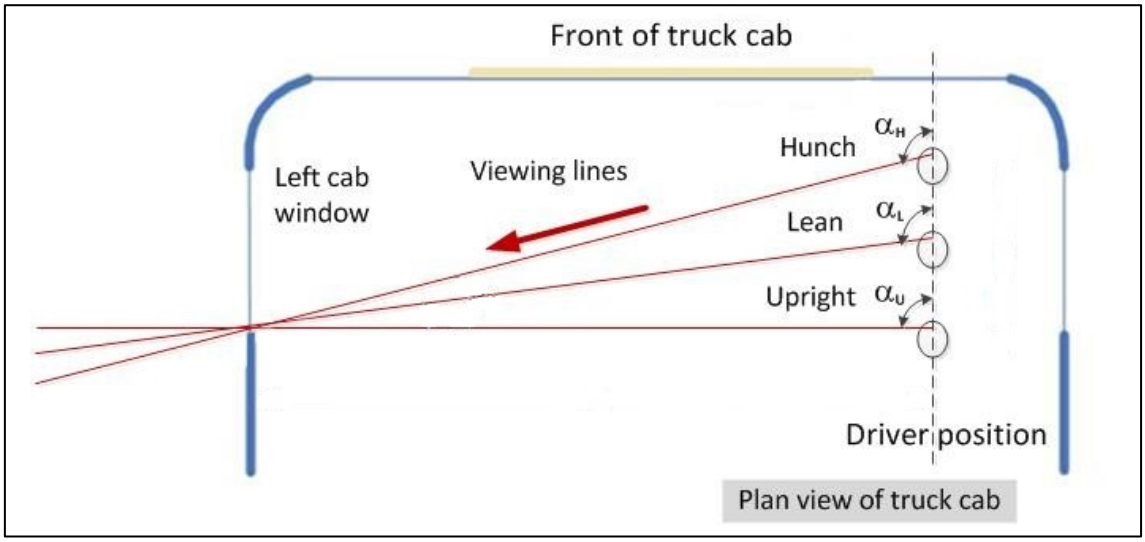
The general finding of the trials was that the view along the track was restricted by the structure of the cab, and the absence of windows rearward of the driver (Figure 14).

Figure 14: The restricted view along the track with the truck stopped 10 m from the track

The image shows a typical view from the truck driving position, taken during the trials. It shows a severely restricted view towards the track. The view is limited to the size and location of the cab's passenger-side window.
Source: Chief Investigator, Transport Safety (Vic)

With the truck at its stopped location, achievable sighting distances (along the track to the left) and the viewing angles (of the driver towards the track) were determined using laser measuring equipment. The measurements were taken for the driver upright (α_U), leant forward (α_L) and hunched forward (α_H) (Figure 15).

Figure 15: Plan view showing driver viewing angles for a range of driver postures



Source: Chief Investigator, Transport Safety (Vic)

For these three driver positions, the achievable sighting distances ranged from 29 to 60 m, and the achievable viewing angle from 90 to 104 degrees (Figure 16). The maximum distance and viewing angle achieved were with the driver hunched forward over the steering wheel. The rear edge of the passenger-side window was the limit of the view towards the track.

Figure 16 Viewing angles and sighting distances with the truck about 10 m from track

Sighting angle and distance measurements from three driving postures		
Position	***Angle (α)***	***Sighting distance***
Upright	90°	29 m
Lean	96°	46 m
Hunched	104°	60 m

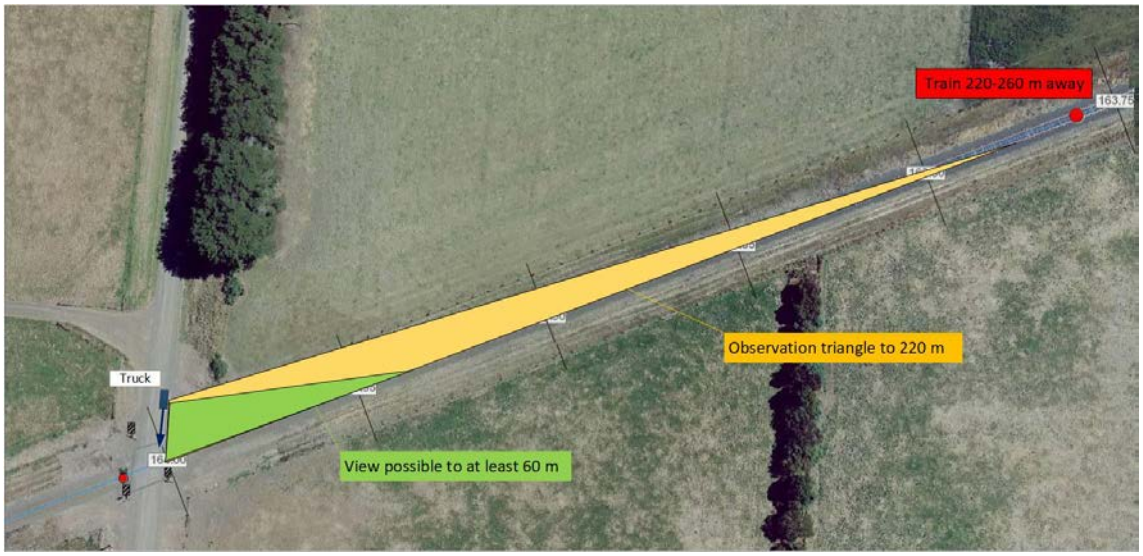
The table summarizes the measured viewing angles and sighting distances achieved from the driving cab during trials.
Source: Chief Investigator, Transport Safety (Vic)

Implications of the restricted view

The extent to which the driver of the incident truck leant forward to look for trains, or may have squared his driving cab towards the track [30] to improve the view, is uncertain. However, based on the post-incident measurements and available evidence, it is very probable that when stopped and looking left through the passenger window, the driver's view was restricted. This restriction was a consequence of the acute road-to-rail angle at this location and the design of the truck's cab. Similar sighting restrictions would exist for other vehicles not fitted with passenger-side windows rearward of the driving position or a rear window in the cab.

The implications of the restricted view was that the driver did not observe the approaching train when stopped prior to moving towards the crossing. The view along the track was significantly less than that required to observe the train, probably at least 60 m but no further than 220 m (Figure 15).

Figure 17: The position of the train when the truck started moving towards the crossing.



The figure is an aerial view of the level crossing and the track to the crossing's east. The figure depicts the estimated position of the train at the time the truck started moving from its stopped position, the minimum distance of 60 m that the truck driver could probably see, and the observation triangle to a distance of 220 m. The train was 220-260 m from the crossing, and is shown at 240 m.
Source: Pass Assets, Public Transport Victoria, annotated by Chief Investigator, Transport Safety (Vic)

[30] The cab turned more to the left (away from the road direction) to improve the sighting along the track.

Risk management of the Phalps Road level crossing

Decision to upgrade

The ALCAM risk ranking was not sufficient to have this crossing prioritised for upgrade within the 4-year program of 29 passive crossing upgrades. Its elevation was in response to three reported near-collision incidents. In addition, there had been long-term discussions between V/Line and the Shire Council regarding the sighting deficiencies at the crossing. The decision to upgrade the Phalps Road level crossing was endorsed by the VRCSSC in February 2015.

Managing risk so far as is reasonably practicable

The Rail Safety National Law (RSNL)[31] applied to the management of risk and safety at the Phalps Road level crossing. Under rail safety national law, duty holders are required to eliminate risks so far as is reasonably practicable (SFAIRP); and if it is not reasonably practicable to eliminate risks to safety, to minimise those risks SFAIRP. In this case, as the crossing was not closed and the risk eliminated, then the risks would need to be minimised SFAIRP.

The Office of the National Rail Safety Regulator (ONRSR) established under the RSNL provided guidelines[32] on the background, intent and application of the concept of SFAIRP. The guidance points out that although what is reasonably practicable is ultimately assessable by a court of law, that in minimising risks SFAIRP, duty holders would need to consider:

- the likelihood of the hazard or the risk concerned occurring;
- the degree of harm that might result from the hazard or the risk;
- what the person concerned knows, or ought reasonably to know, about the hazard or risk, and ways of eliminating or minimising the risk;
- the availability and suitability of ways to eliminate or minimise the risk; and
- after assessing the extent of the risk and the available ways of eliminating or minimising the risk, the cost associated with available ways of eliminating or minimising the risk, including whether the cost is grossly disproportionate to the risk.

Available risk controls not deployed

The sighting deficiencies due to the acute road-to-track interface at the Phalps Road level crossing were identified in the ALCAM survey of 2009 and were discussed between the V/Line and the Colac Otway Shire Council from that time. Further site assessments in 2014 confirmed the sighting issues. However, available controls were not applied to the level crossing even though the hazards were known. There was an opportunity for V/Line and/or Colac Otway Shire Council to implement available risk controls prior to and after the decision to upgrade.

Interface Agreement

Management of the risks associated with level crossings is a shared responsibility between rail and road managers. An interface agreement (IA)[33] between V/Line and the Colac Otway Shire Council existed and provided a basis for dialogue and risk management of the Phalps Road level crossing. Active dialogue had commenced in 2009 and a formal interface agreement signed in 2011.[34]

Even though an interface agreement existed, it was not an effective mechanism for achieving timely safety outcomes. All parties to the agreement were aware of the sighting issues at the

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31 The Rail Safety National Law (RSNL) refers to the applicable Acts and Regulations and commenced in Victoria in 2014. Avalable on ONRSR website.

32 ONRSR Guideline – Meaning of duty to ensure safety so far as is reasonably practicable – SFAIRP, retrieved 13/09/2018 www.onrsr.com.au/__data/assets/pdf_file/0009/2412/Guideline-Meaning-of-Duty-to-Ensure-Safety-SFAIRP.pdf

33 Initially established as a Safety Interface Agreement in 2011.

34 VicTrack was also a signatory to this agreement.

Phalps Road level crossing for at least seven years prior to the collision. However, their interaction was ineffective at addressing the identified level crossing hazards.

Limitations of the interaction between road and rail managers included the difficulty in achieving an agreed position on timely risk treatments. The rail and road managers had competing operational and resource priorities that led to an impasse on what actions should be taken and by whom, and as a result level crossing upgrade became the default solution.

Network exposure to acute-angle crossings

Acute-angle crossings

A driver typically needs to be able to look parallel along a track to check for approaching trains. Therefore subtracting the AS1742.7:2016[35] maximum viewing angle (to the left) of 110 degrees from 180 degrees gives a nominal minimum road-to-track crossing angle (Z in Figure 9) of 70 degrees. Crossings with an acute interface angle (to the left) of 70 degrees or greater would typically comply with the viewing angle requirement of the standard and those with lower values would generally not meet the standard.

At the time of this incident, there were a reported 166[36] passively protected level crossings (35 at intersections of passenger lines and public roads) in the V/Line regional network[37] with a road-to-track interface angle to an approaching driver's left of less than 70 degrees,[38] and therefore unlikely to comply with the Australian Standard specified maximum viewing angle of 110 degrees. There were also a further 76 level crossings with left-side road-to-track angles of between 70 and 80 degrees. Based on the measured maximum viewing angle of 104 degrees from a prime mover similar to the incident truck, some of these crossings may also have restricted viewing from some types of road vehicle.

Strategy used for managing network exposure to acute-angle crossings

ALCAM was the primary tool used to evaluate level crossing risk in Victoria. The methodology used to evaluate the ALCAM risk score has changed significantly since the model was first introduced. This has meant that the ALCAM system of prioritisation has also changed over time. Prior to the 2014 model update, the prioritisation was excessively weighted toward crossings with higher traffic volumes. This may have contributed to a reduced safety focus on regional passive level crossings with low traffic, including those crossings with acute road-rail angles.

Following further review of the model's methodology, there was a new release in 2014 that validation has showed improved correlation between risk score and incident history. The supporting ALCAM guidelines[39] to this release described ALCAM as a comprehensive tool for the assessment of level crossing hazards.

Consistent with ALCAM guidelines, collision, and near-collision, data was also analysed by the Rail Crossing Project Delivery Group (RCPDG) to moderate the ALCAM-based priority list. Incident data provided an additional indicator of the likelihood of an event and was used in conjunction with ALCAM prioritisation to identify a final listing of those crossing proposed for upgrade. The committee process was then the final filter used to arrive at those crossings listed and approved for upgrade in any given program cycle.

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35 The viewing angle requirement was the same in the 2007 edition of this standard.

36 V/Line advised that several of these crossings were only marginally non-compliant with the Australian Standard and at the time of the collision through to April 2019, 26 of the 166 crossings were on line sections with no trains in operation.

37 Within the network managed by V/Line.

38 This is when a driver of a road vehicle is looking to the left, through a passenger-side or rear window.

39 ALCAM in Detail, An introduction to the new ALCAM models (2014), 6 May 2015.

ALCAM flags for hazards and non-compliance

To support risk assessment and treatment processes, ALCAM also identified particular hazards at level crossings for consideration regardless of the overall ALCAM Risk Score. Flags were used to highlight specific characteristics or hazards (such as queuing, sighting and short stacking). The ALCAM system also included flags indicating non-compliance with the Australian Standard.

ALCAM guidelines stated that ALCAM did not attempt to define a 'safe' or acceptable level of risk. It also provided the guidance that any risk assessment and treatment also needed to consider other factors, including:

- Collision and near-collision history
- Engineering experience (both rail and road)
- Local knowledge of driver or pedestrian behaviour
- Social and economic assessment
- Standards and international best practice.

However, other than collision and near-collision history being considered for upgrade prioritisation, there was no evidence of broad and consistent consideration by V/Line of the other factors identified in the ALCAM guidelines. In addition, the ALCAM Australian Standard non-compliance flags were not used as a trigger for prioritising action by either the rail or road managers.

The high cost of upgrade from passive to active protection meant that a limited number of passive crossings on the V/Line regional network were upgraded each year. The 2015-19 Better Roads upgrade program scheduled 29 upgrades from passive to active protection over the four year period, equating to about seven crossings per year. Based on the number of acute-angle passive crossings on the regional network, and this rate of upgrade, a considerable number of passively protected crossings continued to have restricted sighting due to an acute road-to-track interface.

It is probable that the low traffic volumes at many of these crossings led them to be assessed as low risk and other available risk treatments were not deployed.

That many of these untreated acute-angle passive crossings were on passenger rail corridors also increased risk to the travelling public. Between 2006 and 2016 there were three collisions[40] between heavy transport (trucks) and passenger trains at acute-angle crossings with restricted sighting to the road user's left.

Other available controls for managing this risk

Grade separation and upgrade to active protection are effective risk controls for acute-angle level crossings. However, cost and the annual rate of upgrade means that other risk treatments should be considered for low-use acute-angle passive crossings in regional areas (Figure 18).

Figure 18: Other potential risk treatments at acute-angle level crossings

Control	Potential outcome	Potential barriers
Closure of crossing	Risks eliminated.	Community resistance due to the loss of a road access.
Road realignment	Compliance with AS1742 and reduction in hazard and risk.	Feasibility and cost will vary from site to site. May require land acquisition.
Rail speed restrictions	Reduction in hazard and the consequence of a collision.	Impact on passenger service delivery (timetables). Less impact on freight lines.

[40] Trawalla, Lake Charm and this (Larpent) collision.

Control	Potential outcome	Potential barriers
Alternative forms of active protection with lower cost[41]	Reduction in hazard and risk.	May not meet same standards as full active protection.
Exclusion of heavy vehicles from transiting crossing	Reduction in hazard and risk.	Restricted access for some vehicle types.
Systems that require users to seek permission to cross[42]	Reduction in hazard and risk.	Reduced ease of crossing use.

Source: Chief Investigator, Transport Safety (Vic)

Depending on site-specific characteristics, these risk treatments might be applied as long-term risk control measures, or to assist the management of risk pending an upgrade to active protection.

Regulatory oversight of management of passive level crossings

A compliance inspection of V/Line by TSV in late 2013 concluded that V/Line was rarely assessing passive level crossings on a location-by-location basis and, as a result, TSV was unable to be satisfied that risks were being managed so far is reasonably practicable (SFAIRP). V/Line responded that they believed that they were managing the risk SFAIRP and that a program of level crossing inspections was scheduled.

ONRSR was advised of the key finding of the compliance inspection shortly before the transition to national rail regulation in Victoria in May 2014. From May 2014 to the occurrence in July 2016, ONRSR did not engage with V/Line on the concerns raised by TSV in April 2014. ONRSR advised that it had taken (and continues to take) a risk-based approach to determine its regulatory effort. It described the application of a systematic decision making framework that prioritises regulatory activity and informs decision outcomes based on an assessment of risks to rail safety.

ALCAM surveys in 2009

The ALCAM survey of the Phalps Road level crossing in 2009[43] contained inaccuracies in bearing measurements of up to 41 degrees. This significantly exceeded the *ALCAM Crossing Assessment Handbook* (of that time) that specified a measurement precision to the nearest 5 degrees.[44] The bearings were taken using bearing/range finding binoculars that were subsequently replaced by the surveying firm due to inaccuracies with this measurement equipment.

At the Phalps Road level crossing, the measurement errors resulted in an estimated acute road-to-rail angle 7 degrees less than actual. This measured value resulted in a worse scenario that the actual configuration and the survey error at Phalps Road had no consequence.

However, errors due to using this survey equipment at other locations remained latent within the ALCAM database.

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41 Twenty-six Rail Crossing Deaths in Victoria, Australia (Victorian Coroner, dated 21 October 2013) included recommendations for the development and evaluation of new level crossing countermeasures and the implementation of innovative in-(road) vehicle warning systems. There were a number of related research projects ongoing in 2014.

42 An example of user-worked crossings can be found at Railway Guidance Document on User Worked railway crossings (UWC), Office of Rail and Road, UK.

43 `V/Line and the Colac Shire Council confirmed that the road-to-track interface at the Phalps Road level crossing had not undergone any configuration changes since the 2009 survey.

44 Clause 2.2 of *ALCAM Crossing Assessment Handbook V1.1 09 February 2007.*

Findings

From the evidence available, the following findings are made with respect to the collision between a truck and semi-trailer and V/Line passenger train 8753 at the Phalps Road level crossing at Larpent Victoria on 13 July 2016. These findings should not be read as apportioning blame or liability to any particular organisation or individual.

Safety issues, or system problems, are highlighted in bold to emphasise their importance. A safety issue is an event or condition that increases safety risk and (a) can reasonably be regarded as having the potential to adversely affect the safety of future operations, and (b) is a characteristic of an organisation or a system, rather than a characteristic of a specific individual, or characteristic of an operating environment at a specific point in time.

Contributing factors

- The truck driver entered the Phalps Road level crossing unaware that there was an approaching train beyond his line of sight.
- For southbound road traffic approaching the Phalps Road level crossing, the view along the track to the left was restricted due to the acute road-to-rail angle.
- **Available risk controls to manage the risk posed by known sighting deficiencies at the Phalps Road level crossing were not deployed by V/Line or the Colac Otway Shire Council. [Safety Issue]**
- **The interaction between V/Line and the Colac Otway Shire Council was ineffective at addressing identified sighting issues at the Phalps Road level crossing. [Safety Issue]**

Other factors that increased risk

- **More than 100 level crossings in the V/Line regional rail network (including 35 at the intersection of passenger lines and public roads) were non-compliant with the left-side viewing angle requirements of AS 1742.7:2016. These crossings had an acute road-to-rail angle that affected the ability of drivers to sight trains approaching from their left. [Safety issue]**
- **V/Line's level crossing assessment processes did not result in deployment of available risk controls at many passively protected acute-angle level crossings. [Safety Issue]**
- From May 2014 to the occurrence in July 2016, ONRSR did not engage with V/Line on its approach to risk assessment of passive level crossings, the matter raised with ONRSR by TSV in April 2014. Regulatory resources were directed to other safety priorities.
- **Errors remained within the ALCAM database due to the type of equipment used to measure road and rail bearings during ALCAM surveys in 2009. [Safety Issue]**

Other findings

- The handling of the train did not contribute to the collision.
- The truck driver stopped at the crossing and attempted to observe for trains.

Safety issues and actions

The safety issues identified during this investigation are listed in the Findings and Safety issues and actions sections of this report. The Australian Transport Safety Bureau (ATSB) expects that all safety issues identified by the investigation should be addressed by the relevant organisation(s). In addressing those issues, the ATSB prefers to encourage relevant organisation(s) to proactively initiate safety action, rather than to issue formal safety recommendations or safety advisory notices.

Depending on the level of risk of the safety issue, the extent of corrective action taken by the relevant organisation, or the desirability of directing a broad safety message to the rail industry, the ATSB may issue safety recommendations or safety advisory notices as part of the final report.

All of the directly involved parties were provided with a draft report and invited to provide submissions. As part of that process, each organisation was asked to communicate what safety actions, if any, they had carried out or were planning to carry out in relation to each safety issue relevant to their organisation.

The initial public version of these safety issues and actions are provided separately on the ATSB website to facilitate monitoring by interested parties. Relevant safety issues and actions will be updated on the ATSB website as information comes to hand.

Risk controls at Phalps Road level crossing

Number:	RO-2016-009-SI-01
Issue owner:	V/Line Pty Ltd
Operation affected	Passenger and freight train operations
Who it affects	V/Line Pty Ltd

Safety issue description:

Available risk controls to manage the risk posed by known sighting deficiencies at the Phalps Road level crossing were not deployed by V/Line or the Colac Otway Shire Council.

Status of the safety issue

Issue status: Adequately addressed

Justification: The safety action taken addresses the safety issue.

Proactive safety action taken by V/Line Pty Ltd

Action number: RO-2016-009-NSA-017

The Phalps Road level crossing was upgraded to active protection in August 2016. The survey and assessment data for this crossing was updated on 15 August 2017.

V/Line and Colac Otway Shire Council interaction

Number:	RO-2016-009-SI-02
Issue owner:	V/line and Colac Otway Shire Council
Operation affected	Passenger and freight train operations
Who it affects	V/Line Pty Ltd

Safety issue description:

The interaction between V/Line and the Colac Otway Shire Council was ineffective at addressing identified sighting issues at the Phalps Road level crossing.

Status of the safety issue

Issue status: Adequately addressed

Justification: The safety actions taken addresses the safety issue.

Proactive safety action taken by V/Line Pty Ltd

Action number: RO-2016-009-NSA-018

V/Line has established a new rail interface team that has been tasked with actively engaging Councils.

Proactive safety action taken by Colac Otway Shire Council

Action number: RO-2016-009-NSA-018

Colac Otway Shire Council advised that it was committed to its working relationship with V/Line and documenting solutions agreed by each party. The Council advised it would seek to clarify those crossings with outstanding sighting issues and investigate short-to-medium term solutions for implementation.

Risks at other acute-angle level crossings on network

Number:	RO-2016-009-SI-03
Issue owner:	V/Line Pty Ltd
Operation affected	Passenger and freight train operations
Who it affects	V/Line Pty Ltd

Safety issue description:

More than 100 level crossings in the V/Line regional rail network (including 35 at the intersection of passenger lines and public roads) were non-compliant with the left-side viewing angle requirements of AS 1742.7:2016. These crossings had an acute road-to-rail angle that affected the ability of drivers to sight trains approaching from their left.

Status of the safety issue

Issue status: Partially addressed

Justification: V/Line has reduced the risk associated with several acute road-to-rail level crossings. It continues to implement crossing upgrades and examine options for risk controls at crossings with restricted sighting.

Proactive safety action taken by V/Line Pty Ltd

Action number: RO-2016-009-NSA-019

Of the 35 level crossings at the intersection of passenger lines and public roads that were non-compliant with the left-hand viewing angle requirement:

- 9 have been upgraded to active (4 Warrnambool, 3 Swan Hill and 2 Bairnsdale)
- 1 has restricted access gates (Maryborough)
- 15 are still passive with speed restrictions of no greater than 60km/h (one on the Warrnambool line (scheduled for upgrade in 2019), 11 Swan Hill, 2 Shepparton and 1 Bairnsdale)
- 9 are in service without speed restrictions. one will be closed on the loop line at Bungaree, 8 on the Swan Hill line have ALCAM road usage data of no more than 5 vehicles per day, with some impassable by trucks

One has been reassessed as compliant with the standard.

V/Line has nominated a further 24 crossings for upgrade with priority given to non-compliant passive crossings above higher ALCAM ranked active crossings.

Risk assessment and deployment of available risk controls

Number:	RO-2016-009-SI-04
Issue owner:	V/Line Pty Ltd
Operation affected	Passenger and freight train operations
Who it affects	V/Line Pty Ltd

Safety issue description:

V/Line's level crossing assessment processes did not result in deployment of available risk controls at many passively protected acute-angle level crossings.

Status of the safety issue

Issue status: Partially addressed

Justification: V/Line has undertaken risk assessments of individual crossings with acute road-to-rail interfaces, and used these assessments to deploy additional risk controls. It continues to consider options for risk controls at crossings with restricted sighting.

Proactive safety action taken by V/Line Pty Ltd

Action number: RO-2016-009-NSA-020

V/Line has assessed the risk of individual crossings with acute angles and introduced train speed reductions. V/Line also advised an intention to remove all passive level crossings on its passenger network.

Inaccuracies in ALCAM survey data

Number:	RO-2016-009-SI-05
Issue owner:	VicTrack
Operation affected	Network Safety
Who it affects	All owners and operators of rail transport services in Victoria

Safety issue description:

Errors remained within the ALCAM database due to the type of equipment used to measure road and rail bearings during ALCAM surveys in 2009.

Status of the safety issue

Issue status:	Adequately addressed
Justification:	The safety action taken should address the safety issue.

Proactive safety action taken by VicTrack

Action number: RO-2016-009-NSA-021

A 5 year program of re-survey and assessment of all public level crossings on the Victorian Rail Network commenced in May 2017 and is scheduled to be completed in April 2022. This will ensure that any erroneous data is corrected.

Additional safety actions

Whether or not the ATSB identifies safety issues in the course of an investigation, relevant organisations may proactively initiate safety action in order to reduce their safety risk. The ATSB has been advised of the following proactive safety action in response to this occurrence.

The Victorian Level Crossing Safety Steering Committee (VLCSSC) has established a Passive Crossing Working Group. Of relevance to this report is work around low cost technologies, and an action to explore the option of including the details of ‘limited sighting’ crossings on the VicRoads heavy vehicle road network maps.

General details

Occurrence details

Date and time:	13 July 2016 – 1541 EST	
Occurrence category:	Accident	
Primary occurrence type:	Level crossing collision	
Location:	Phalps Road, Larpent, Victoria	
	Latitude: 38° 21.762' S	Longitude : 143° 28.299' E

Train details

Train operator:	V/Line Pty Ltd	
Registration:	8753	
Type of operation:	Passenger service	
Persons on board:	Crew – 3	Passengers – 99
Injuries:	Crew – 2	Passengers – 18
Damage:	Substantial	

Road vehicle details

Vehicle type:	Prime mover and semitrailer	
Registration:	Private	
Persons on board:	Driver - 1	
Injuries:	Driver – 1	Passengers – 0
Damage:	Significant	

Sources and submissions

Sources of information

The sources of information during the investigation included:

- V/Line
- Colac Otway Shire Council
- VicTrack
- The rail safety regulator
- The truck company
- The truck driver
- The locomotive driver.

Submissions

Under Part 4, Division 2 (Investigation Reports), Section 26 of the *Transport Safety Investigation Act 2003* (the Act), the Australian Transport Safety Bureau (ATSB) may provide a draft report, on a confidential basis, to any person whom the ATSB considers appropriate. Section 26 (1) (a) of the Act allows a person receiving a draft report to make submissions to the ATSB about the draft report.

A draft of this report was provided to V/Line and its level crossing contractor, VicTrack, Colac Otway Shire Council, TSV, ONRSR, the locomotive driver, the truck driver and the truck company. Submissions from those parties were reviewed and where considered appropriate, the text of the draft report amended accordingly.

Australian Transport Safety Bureau

The Australian Transport Safety Bureau (ATSB) is an independent Commonwealth Government statutory agency. The ATSB is governed by a Commission and is entirely separate from transport regulators, policy makers and service providers. The ATSB's function is to improve safety and public confidence in the aviation, marine and rail modes of transport through excellence in: independent investigation of transport accidents and other safety occurrences; safety data recording, analysis and research; fostering safety awareness, knowledge and action.

The ATSB is responsible for investigating accidents and other transport safety matters involving civil aviation, marine and rail operations in Australia that fall within ATSB's jurisdiction, as well as participating in overseas investigations involving Australian registered aircraft and ships. A primary concern is the safety of commercial transport, with particular regard to operations involving the travelling public.

The ATSB performs its functions in accordance with the provisions of the *Transport Safety Investigation Act 2003* and Regulations and, where applicable, relevant international agreements.

Purpose of safety investigations

The object of a safety investigation is to identify and reduce safety-related risk. ATSB investigations determine and communicate the factors related to the transport safety matter being investigated.

It is not a function of the ATSB to apportion blame or determine liability. At the same time, an investigation report must include factual material of sufficient weight to support the analysis and findings. At all times the ATSB endeavours to balance the use of material that could imply adverse comment with the need to properly explain what happened, and why, in a fair and unbiased manner.

Developing safety action

Central to the ATSB's investigation of transport safety matters is the early identification of safety issues in the transport environment. The ATSB prefers to encourage the relevant organisation(s) to initiate proactive safety action that addresses safety issues. Nevertheless, the ATSB may use its power to make a formal safety recommendation either during or at the end of an investigation, depending on the level of risk associated with a safety issue and the extent of corrective action undertaken by the relevant organisation.

When safety recommendations are issued, they focus on clearly describing the safety issue of concern, rather than providing instructions or opinions on a preferred method of corrective action. As with equivalent overseas organisations, the ATSB has no power to enforce the implementation of its recommendations. It is a matter for the body to which an ATSB recommendation is directed to assess the costs and benefits of any particular means of addressing a safety issue.

When the ATSB issues a safety recommendation to a person, organisation or agency, they must provide a written response within 90 days. That response must indicate whether they accept the recommendation, any reasons for not accepting part or all of the recommendation, and details of any proposed safety action to give effect to the recommendation.

The ATSB can also issue safety advisory notices suggesting that an organisation or an industry sector consider a safety issue and take action where it believes it appropriate. There is no requirement for a formal response to an advisory notice, although the ATSB will publish any response it receives.

Australian Transport Safety Bureau

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Investigation

ATSB Transport Safety Report
Rail Occurrence Investigation

Level crossing collision between truck and passenger train 8753
Phalps Road, Larpent, Victoria on 13 July 2016

RO-2016-009
Final – 28 June 2019