Australian Government
Australian Transport Safety Bureau

# Fatality at Heyington Railway Station

Toorak, Victoria | 22 February 2014

Investigation

**ATSB Transport Safety Report**
Rail Occurrence Investigation
RO-2014-005
Final – 27 April 2016

Front cover: Chief Investigator, Transport Safety (Vic)

This investigation was conducted under the *Transport Safety Investigation Act 2003* by the Chief Investigator, Transport Safety (Victoria) on behalf of the Australian Transport Safety Bureau in accordance with the Collaboration Agreement entered into on 18 January 2013.

Released in accordance with section 25 of the *Transport Safety Investigation Act 2003*

**Cover photo:** Chief Investigator, Transport Safety (Vic)

**Publishing information**

**Published by:** Australian Transport Safety Bureau
**Postal address:** PO Box 967, Civic Square ACT 2608
**Office:** 62, Northbourne Avenue, Canberra, Australian Capital Territory 2601
**Telephone:** 1800 020 616, from overseas +61 2 6257 4150 (24 hours)
Accident and incident notification: 1800 011 034 (24 hours)
**Facsimile:** 02 6247 3117, from overseas +61 2 6247 3117
**Email:** atsbinfo@atsb.gov.au
**Internet:** www.atsb.gov.au



**Addendum**

| Page | Change | Date |
|---|---|---|
| | | |
| | | |

# Safety summary

## What happened

At about 2355 on 22 February 2014, an 18 year old male was fatally injured at Heyington Railway Station in Toorak, Victoria when he fell between a moving train and the platform. He was running alongside the moving train when he fell attempting to board it, while passengers inside the train were forcibly holding the carriage doors open.

## What the ATSB found

The train was equipped with a traction interlocking device to prevent the train from moving while its carriage doors were open. The device, as designed, deactivated after a period of time and allowed the train to depart with the doors held open.

Due to the curvature of the track, a wide gap existed between the mid-body of the carriage and the platform.

## What's been done as a result

Metro Trains Melbourne (MTM) has commenced a risk review of the door open traction interlock timing on their rolling stock.

In order to minimise the gap between the train and platform, MTM has realigned the track at Heyington railway station and a rubber finger coping has been installed along the entire edge of the platform face. Further, a barrier has been constructed at the platform entrance to deter passengers from running for the train.

MTM has also completed a survey of all the stations with curved track and platforms of higher risk have been identified. In the short term these platforms have had ‘Mind the Gap’ signs painted on them. Announcements are also made to warn passengers of the gap. Works plans have been developed to institute further risk measures in the long term.

## Safety message

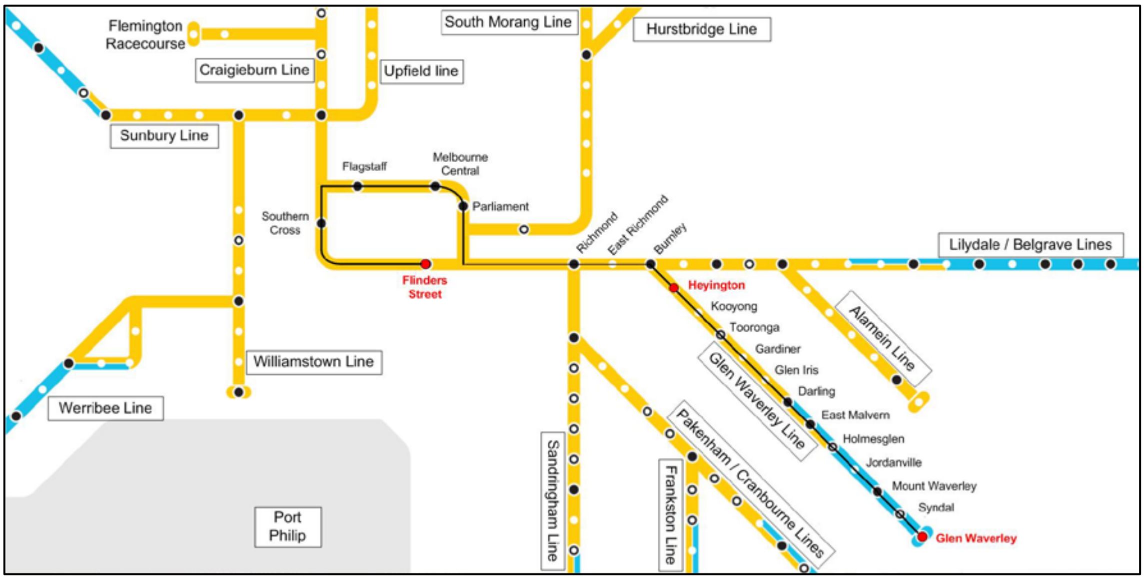
Rail operators should ensure that safety systems fitted to passenger trains are designed and operate to ensure the safety of patrons in the event of interference with the normal operation of train doors.

# Contents

# The occurrence

On 22 February 2014, a Metro Trains Melbourne (MTM)[1] passenger train was operating the scheduled 2328 service TD2100 from Glen Waverley Railway Station to Flinders Street Station.

**Figure 1 – Extract of Melbourne metropolitan rail network depicting Glen Waverley line**




**Source: Copyright Metro Trains Melbourne with annotations by Chief Investigator, Transport Safety (Vic)**

The 6-car[2] X'Trapolis Electrical Multiple Unit (EMU) train was operated on the Melbourne metropolitan rail network by a single driver. The driver signed on at about 1400 and after operating several services took a meal break between 1730 and 1830 before resuming his driving duties. After operating several other services, the driver took over the service from Glen Waverley to Flinders Street Station at about 2320. He conducted the prescribed safety checks and departed the Glen Waverley Railway Station at about 2328. The train stopped at several railway stations before arriving at the Heyington Railway Station, Toorak at about 2351.

Shortly after arrival, the train driver activated the left side door open command and the doors[3] opened at 23:51:13. Passengers boarded the train, including a group of youths who boarded through the centre door of the fourth car (162M). This door was located approximately in line with the platform entrance. After boarding, several youths stood in and around the doorway, with two youths standing on either side of the door opening.

The driver activated the door close command at 23:51:24 and shortly after made two attempts to apply traction. The train did not move as the traction interlock system had detected the open door and inhibited the application of power to the motors. The end doors of the fourth car and the doors on all the other cars had closed, but the centre doors of the fourth car were held open by the two youths. After a short delay, the driver made an announcement for passengers to keep the doors clear. During this period, as designed, the doors attempted to close several times, but were held open.

The driver then applied traction again at about 23:53:30 and the train commenced moving along the platform with the doors held open, as the traction interlock system had timed out as designed.

---

[1] MTM is the franchise contract manager for the Melbourne metropolitan rail network. MTM is also responsible for asset maintenance on the network.

[2] Two 3-car sets.

[3] Each carriage has three doors located at the front, centre and rear of the cars.

The train had travelled about 20 metres when another group of youths entered the platform. One member of the group successfully boarded the now moving train through the doors being held open. A second young male ran alongside the train and subsequently fell between the train and platform, sustaining fatal injuries. The doors were released by the youths and they closed at 23:53:56. The train was travelling at about 58 km/h at the time the doors closed. The passenger emergency intercom (PEI) devices in the carriage were not activated by the passengers.

At the time of the incident the station was unmanned. At about 2355 a member of the public made a call on the platform emergency intercom to the MTM Glen Waverley Control Centre reporting the accident and requesting emergency services. A second call was made by the same person to the control centre at about 2357 seeking confirmation that services on the rail line had been terminated. The operator confirmed that the services on the Glen Waverley line had been terminated.

Train TD 2100 continued to Flinders Street Station and arrived at about 0010 on 23 February 2014 without further incident. At this time, the driver of the train was informed of the accident.

# Context

## Location

The incident occurred at Heyington Railway Station, Toorak, located approximately seven km from Flinders Street Station, Melbourne (Figure 2).

**Figure 2 – Location of Heyington Railway Station**


**Source: Copyright Melway Publishing 2014, with annotations by the Chief Investigator, Transport Safety (Vic)**

## Heyington Railway Station

Heyington Railway Station is on the Glen Waverley Line and is located in a cutting (Figures 3 & 4). The station was opened in 1890 and has two side platforms connected by a footbridge. Access to the platforms was via stairs and the footbridge. Both the Up[4] and Down[5] platforms were about 158 m in length. The height of platform 1 from the design rail level ranged from 1070 mm to about 1140 mm.

The Up line track followed the curve of the concave platform 1 and transitioned into the straight section at the Up end of the platform (Figures 3 & 4). The curve of platform 1 had a radius of approximately 380 m.

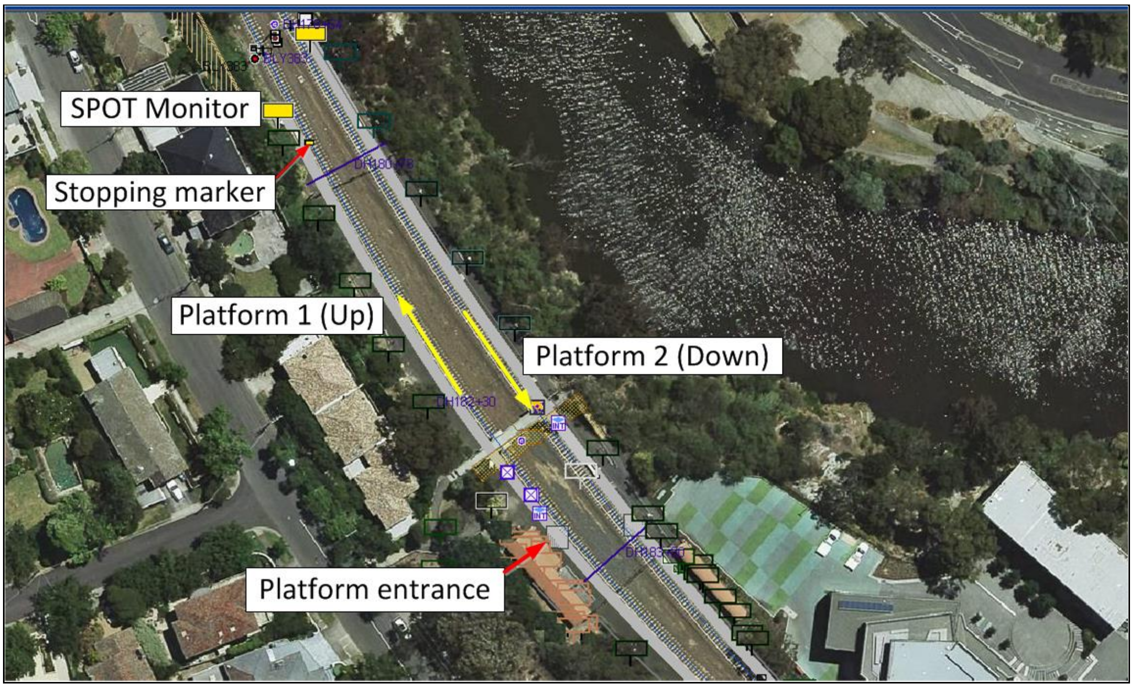
Single Person Operations Television (SPOT) monitors were located about 1.3 m from the end of the platform. The 6-car stopping marker was about 6.0 m before the SPOT monitors. The passenger entrance to the platform was about 93 m from the Up end of the platform.

---

[4] Platform on track heading towards Melbourne.

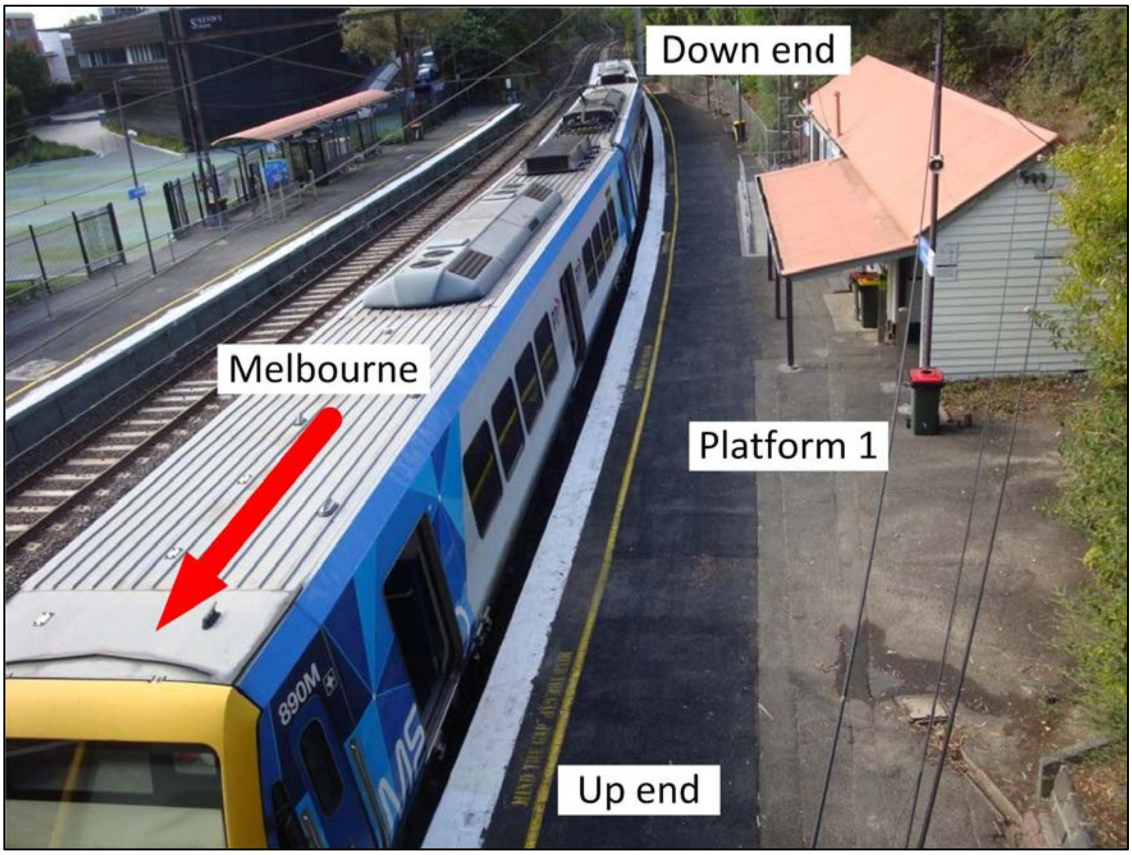
[5] Platform on track heading away from Melbourne.

**Figure 3 – Heyington Railway Station platform configuration**




Source: PASS Assets Public Transport Victoria – Annotations by the Chief Investigator, Transport Safety (Vic)

**Figure 4 – Platform 1 of Heyington Railway Station (3–car set at platform)**




Source: Chief Investigator, Transport Safety (Vic)

### *Sighting of platform from front of train*

Platform 1 at Heyington Railway Station is a concave platform and the driver is unable to view the platform in its entirety along the length of the train using the train mirrors (Figure 5). This platform was equipped with four CCTV cameras that displayed sectors of the platform on four SPOT monitors. The SPOT monitors are located on the platform such that the driver is able to view the four monitors when stopped at the 6-car stopping marker. SPOT Monitor cameras were located to show the view along the train/platform length, on curved platforms rather than individual doors.

**Figure 5 – Sighting of platform from front of train**


Source: Chief Investigator, Transport Safety (Vic)

## The train

The X'Trapolis EMU is operated as a 3 or 6-car set. TD 2100 was a 6-car set and consisted of 102M-1351T-101M-162M-1381T-161M passenger cars[6]. The car body modules were designed and constructed in France and assembled at Alstom Australia, in Ballarat, Victoria. The M cars are 24.46 m in length, 4210 mm in height and 3046 mm in width. The nominal floor height of the car is 1190 mm above top of the rail. Each car has three entrances, located at the front, middle and rear of the cars. The EMU is capable of a maximum speed of 130 km/h.

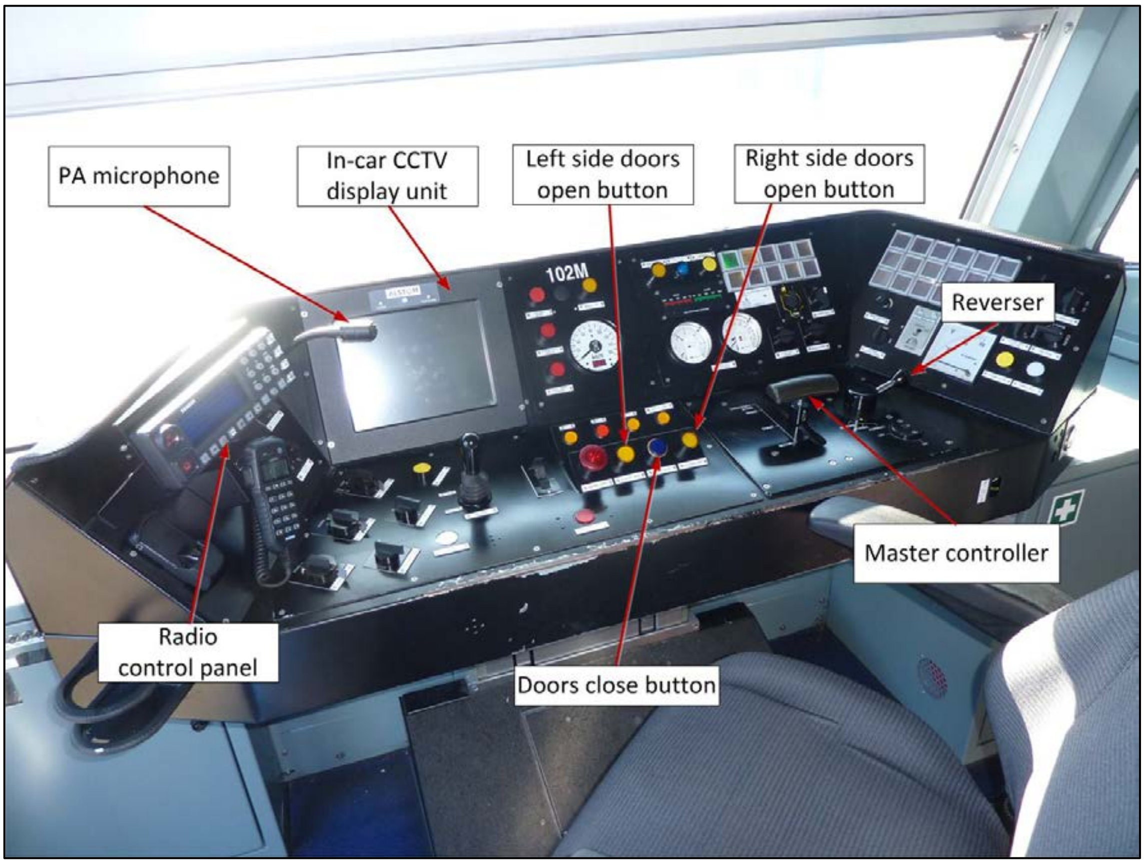
### *Traction and brake control*

The Master controller is operated by moving the handle back and forth between four positions– motor, coast, brake and emergency brake. The reverser is a three positon switch that can be moved to forward, neutral and reverse positions. In order to get forward traction, the Reverser must be moved to the forward position and the Master controller moved from the brake to the

[6] The letter M denotes a motor car unit and the letter T denotes a trailer car unit.

motor position. The position of the Master controller between the coast and motor positions dictates the tractive effort.

**Figure 6 – Driver control console of X'Trapolis EMU**




Source: Chief Investigator, Transport Safety (Vic)

## *Door operation*

The driving cab at each end of the EMU contains the equipment and devices to enable the driver to operate and monitor the train doors. Located on the driver's control console are two yellow pushbuttons that open the left and right hand side doors respectively and a blue pushbutton that closes doors on both sides (Figure 6). Further, each carriage door has a passenger operated door open button (Figure 7). All of these pushbuttons incorporate indicator lamps that illuminate and extinguish according to their activation status.

When the train doors are closed and locked the blue pushbutton lamp is illuminated, displaying a steady light. The two yellow pushbutton lamps on the console are not illuminated, nor are the pushbutton lamps on both the inside and outside of the passenger car doors.

According to the platform location the driver will apply the appropriate side 'door opening authorisation' by pushing the yellow pushbutton, which will then display a steady light. When the train speed drops below three km/h, the door opening system is activated. The blue pushbutton lamp flashes three times and turns off to indicate that doors may be operated by passengers. The passenger car door control units (DCU) located at the carriage doors emit a beep for 1.5 seconds and the passenger operated door pushbutton indicator lamp (Figure 7) illuminates in green, to indicate that passengers may now open the door. When the door pushbutton is activated by passengers entering or exiting the carriage, the DCU is activated and the passenger operated door pushbutton lamp illuminates red and the doors open.

To close the doors, the driver presses the blue pushbutton on the console. An intermittent beep sounds at the DCU for three seconds to warn passengers of imminent door closure. The yellow pushbutton lamp at the control console is extinguished and the doors close while emitting an intermittent beep at the doors. When the doors are successfully closed, the beep ceases and the pushbutton lamp on the door is extinguished. The blue pushbutton lamp on the console illuminates and flashes continuously until the doors are detected closed and then displays a steady blue light.

**Figure 7 – X'Trapolis doors**


Source: Chief Investigator, Transport Safety (Vic)

### *Door operation with obstruction*

Each door is equipped with an obstacle/obstruction detection device. During the door closing sequence if an obstruction is detected, the doors will open once and then make three further attempts to close at three second intervals. If unable to close, the doors will then revert to the obstructed/open position. The blue pushbutton lamp on the driver's console will continue flashing, to indicate to the driver that a door is detected open and unlocked. The yellow pushbutton lamp stays extinguished during this sequence.

### *Traction interlocking system*

Pressing the blue pushbutton at the console initiates door closing and a 60 second time delay for traction authorisation. Detection of all doors closed and locked before the 60 seconds elapse, activates traction authorisation. Should the doors fail to close and lock after 60 seconds, the system is designed such that traction is authorised, despite the possibility that the doors have not closed. Once traction is authorised and applied the train will move. In this situation the blue pushbutton lamp will continue to flash. When the train speed exceeds three km/h and should the door obstruction be removed, the door closing mechanism activates and the doors will close, with the blue pushbutton lamp then displaying a steady blue light.

### Detection of flashing light indicators

The flash rate for the door open button on the X'Trapolis locomotive was one flash per second, with a duration of 0.5 seconds resulting in a duty cycle of 50 per cent. That is, the time the light was 'on' was equal to the time 'off.'

The Australian Standard for Ergonomics[7] recognises two acceptable flash rates, being 0.4 to 0.8 flashes per second for a slow flash rate, and 1.4 to 2.8 flashes per second for normal flash rate[8]. The X'Trapolis door open button's flash rate was therefore within the range of acceptable rates. Further, the 50 per cent duty cycle is consistent with research.[9] [10] People start to experience difficulty distinguishing a flashing light from a steady light when the flash rate reaches 30 per second, (known as the flicker-fusion frequency).[11]

### On-board passenger emergency intercom (PEI) and CCTV systems

The interior of the carriages of the train can be observed by the driver using the on-board CCTV system (Figure 7). A selector switch on the driver's control console permits the driver to select vision of each carriage. CCTV cameras are located at the front, middle and rear of each carriage. Vision of the carriage doors can be observed on the CCTV display unit on the driver's control console. CCTV vision is available to the train driver when the train is stationary or moving at up to eight km/h. Above this speed the vision automatically cuts out unless a PEI call is made.

An on-board surveillance recording function operates automatically and continuously without the need for driver intervention.

Passenger emergency contact with the train driver is available via three PEI units situated in each car; each unit consisting of a microphone, speaker, and indicator. When a PEI call button is pressed the associated camera switches to recording at the rate of eight frames per second for a two-minute period, and displays on the driver console.

## Train Driver

The train driver was qualified to drive EMUs from July 2012. His driving performance was audited regularly by MTM driver supervisors and was last audited in January 2014. No non-conformances were recorded during these audits. Medical certification for the driver was valid and current at the time of the incident. No alcohol or drugs were detected during post incident tests conducted on the driver.

## Platform departure procedures and driver training

The MTM platform departure procedure requires train drivers to ensure that a steady indication of the blue pushbutton lamp on the driver's console is observed and to check that passengers and articles are clear of the saloon doors, prior to the application of traction power and releasing the brake. Further, in the case of a door fault, a procedure outlines specific requirements that drivers are required to follow, in order to rectify the door fault or temporarily secure the door in a closed position, prior to the application of traction. Although the driver training manual includes a section 'Door Closing Obstacle' which states that a one-minute time delay is initiated when the door close pushbutton is activated, there is no specific reference to the time delay being in relation to the door open traction interlock.

---

[7] Standards Australia (1994). *Ergonomics – The human factor. A practical approach to work systems design*; Standards Association of Australia, NSW 2140. SAA HB59 – 1994.

[8] Ibid 7, P.35.

[9] Ibid 7, P.35.

[10] Sanders and McCormick (1993). *Human Factors in Engineering and Design (7th ed.).* New York: McGraw-Hill. pp 148-150.

[11] Ibid 10, pp. 150.

# Safety analysis

In this incident a young male person ran alongside the moving train in an attempt to board it and fell between the train and platform, sustaining fatal injuries. He was encouraged by passengers in the train who held the carriage doors open. Forcibly holding the train carriage doors open was both reckless and unsafe.

## Door open traction interlock

MTM operates Comeng, X'Trapolis and Siemens trains on its network. The traction interlocking systems on the Comeng and X'Trapolis trains in Melbourne are designed such that the interlocking system is deactivated automatically after a period of time. MTM advised that the train's traction interlock system was designed to deactivate to enable trains to be moved in case of door faults. In cases where door faults were identified, MTM operational procedures required the driver to manually secure the faulty doors before moving the train. In this instance the deactivation of the traction interlock permitting the movement of the train with the doors open, increased risk and was contributory to this accident.

Post incident testing found that the door open indication light on train TD 2100 functioned as designed and changed from 'flashing' to 'steady' only when the doors were closed. Although the flashing state of the indication light identified that the doors may be open it did not provide warning to the driver of the deactivation of the traction interlock control. Where the design of a safety system such as a traction interlock times out automatically, it would be prudent to have additional indications/alarms to warn a driver of a change of state in the vehicle controls, particularly during passenger boarding at a station. Further, formally documenting the operation of the traction interlock override systems in the MTM training manuals would increase driver awareness of the risks associated with these systems.

The traction interlocking system on the Siemens type trains, also operated in the MTM fleet, would not allow the train to move with the doors open without driver intervention to override the interlock. Traction override systems on similar types of passenger rolling stock managed by other operators also required drivers to intervene and operate a switch if they are required to override a traction interlock. In most cases, procedures require the use of the override when there is a failure of the door closed detection equipment or electrical circuitry. Prior to operating the manual override, drivers are required to follow procedures to ensure doors are closed and locked, and to verify this action by seeking authority from a train control centre. Further, to deter unauthorised or accidental usage, the train data recorder logs the time and duration of the override selection. This type of traction interlock system improves passenger safety through the provision of an increased defence against human error.

## Factors affecting the actions of the train driver

Human performance is highly variable and subject to a number of influencing factors. Unlike services where the driver is assisted by a guard for passenger boarding and exiting the train, for driver only operations, the driver is responsible for not only the safe operation of the train but must also attend to passenger safety and security issues.

Interview evidence indicated that the driver had regularly experienced incidents of passengers forcibly holding carriage doors open during his employment at MTM. He reported that on previous occasions he had resolved this issue via an announcement instructing passengers to move away from the doors, which normally resulted in compliance. He had also experienced issues where doors were obstructed and he had been required to leave the cab to manually inspect and remove obstructions to close the doors.

The driver recalled that in this instance, he had made an announcement to passengers to move away from the door, but that the passengers holding the door open had not complied. The driver recalled that he had been about to make a call to the Metropolitan Train Control Centre (METROL)[12] to inform them of the delay, after which he intended to leave the cab to speak to the passengers face to face and close the door so that the train could depart the station. However, it was his recollection that during this time, he observed a steady light on the blue pushbutton, indicating that the door was now closed. He then applied traction power and departed Heyington Railway Station. It was not until the train arrived at Flinders Street station, that the driver was made aware of the accident.

## *Driver's mental model[13] of the door-open traction interlock*

There was no in-cab camera fitted to the train to confirm the indications displayed on the driver's console on this occasion. However, post-accident testing did not reveal any technical faults in the operation of the train's door open traction interlock and associated displays at the driver console. Based on the evidence available, the ATSB concluded that the display was functioning correctly.

During the interview, it became evident that the driver's understanding of the traction interlock was that it would not permit the train to be moved if the doors were open. He was not aware of the design feature which would, after 60 seconds, authorise traction despite the doors remaining open. The data recorder indicated (Appendix A) that the driver had moved the master controller to the 'motor' position five seconds after initiating the door close command and, as the traction interlock was active, he did not get traction. After another 25 seconds the driver applied traction again and once again the interlock prevented traction. Two minutes and six seconds after activating the door close command he applied traction for the third time and, as the interlock had now timed out, got traction. It is possible that the driver's recollection of his observation of the steady light was influenced by his mental model of the operational parameters of the interlocking system.

During the period in which the driver made the second and third attempt at applying traction, he also made the announcement to the passengers to keep the doors clear and visually checked the in-car CCTV and SPOT monitors. He stated that he attempted to observe the door that was being held open utilising the in-car CCTV, but the vision was unclear due to the group of people standing near the door. Further, the driver's vision of the platform via the SPOT monitors was unavailable as soon as the train commenced departure, preventing him from observing passengers on the platform as the train departed the station, which was the time when the youth attempted to board the moving train. The in-car CCTV also cut out as soon as the train started moving. With an inaccurate understanding of the parameters of the interlocking system's override mechanism, and with limited information to dispel his view that the train could proceed, the driver departed Heyington station.

## *Fatigue*

In the context of human performance, fatigue is a physical and psychological condition which can arise from a number of different sources, including time on task, time awake, acute and chronic sleep debt, and circadian disruption (disruption to normal 24-hour cycle of body functioning). Fatigue can have a range of influences on performance, such as decreased short-term memory,

[12] The control centre for train operations on Melbourne's metropolitan rail network.

[13] A mental model (or schema) refers to the knowledge structures stored in memory, which represent particular combinations of cues and their meanings. A person's mental model for a given situation is developed through experience but is also influenced by knowledge gained through training or briefings. Mental models assist us to recognise and assess situations and thus guide our decisions and behaviour. (Flin, R., O'Connor, P & Crichton, M. (2008). *Safety at the Sharp End. A guide to nontechnical skills*. Ashgate: Aldershot. P 26-27).

slowed reaction time, decreased work efficiency, reduced motivational drive, increased variability in work performance, and increased errors of omission.[14] Fatigue impairment has been identified as contributory in a significant number of rail accidents and incidents. Research has indicated that anything less than 5 to 6 hours sleep in 24 hours and 12 hours sleep in 48 hours is likely to lead to fatigue impaired performance.[15] [16] Based on the evidence provided to the ATSB, the driver of the train obtained about 7-8 hours of sleep in the 24 hours leading up to the occurrence (from 2355 on 21 Feb 2014) and about 16-18 hours of sleep in the 48 hours prior (from 2355 on 20 February 2014). If the driver awoke at 1000 on 22 February, his period of wakefulness at the time of the occurrence would have totalled approximately 14 hours. There was no evidence to suggest that the quality of the driver's sleep in the preceding days had been compromised. Further, the sleep opportunity periods provided while driving the afternoon shift had significant overlap with the circadian trough (around 0200 to 0600), when sleep is generally at its most restorative.

As a supplement to the above fatigue likelihood analysis, the ATSB also conducted fatigue modelling, incorporating the driver's rostered work hours, as well as his reported obtained sleep for the days leading up to the accident.[17] [18] Modelling indicated that during the latter part of the driver's shift on 22 Feb 2014, and thus at the time of the occurrence at Heyington Station, the driver's alertness was likely to have dropped to a level at which his performance was at least at mildly increased risk for fatigue impairment. The biomathematical modelling indicated that this was due mainly to time-of-day effects. Notably, it is difficult to avoid this increased fatigue risk during the early morning hours, and this prediction was understandably also a feature of the modelling for each of the shifts on 17 February 2014 and 21 February 2014, despite the driver having reported obtaining solid 8-9 hour sleep periods preceding these shifts.

Considering all of the available evidence in regard to quantity and quality of sleep obtained and reported alertness on duty, as well as the outcomes of the fatigue modelling, the driver's cognitive performance was likely to have been at a manageable level at the time of the event. The available evidence did not support a contention of fatigue impairment as contributory to this accident.

---

[14] Battelle Memorial Institute (1998). *An Overview of the scientific literature concerning fatigue, sleep, and the circadian cycle.* Report prepared for the Office of the Chief Scientific and Technical Advisor for Human Factors, US Federal Aviation Administration.

[15] Dawson, D. & McCulloch, K. (2005). Managing fatigue: It's about sleep. *Sleep Medicine Reviews, 9,* 365-380.

[16] Thomas, MJW. & Ferguson, SA. (2010). Prior sleep, prior wake, and crew performance during normal flight operations. *Aviation, Space, and Environmental Medicine, 81 (7),* 665-670.

[17] This modelling was conducted using the Fatigue Avoidance Scheduling Tool (FAST). FAST is a bio-mathematical model, underpinned by the Sleep, Activity, Fatigue and Task Effectiveness (SAFTE) model which asserts that (a) a circadian process influences both performance and sleep regulation, and (b) sleep regulation is dependent on hours of sleep, hours of wakefulness, current sleep debt, the circadian process, and fragmentation (awakenings during a period of sleep). The normative dataset for FAST is made up of rail industry workers.

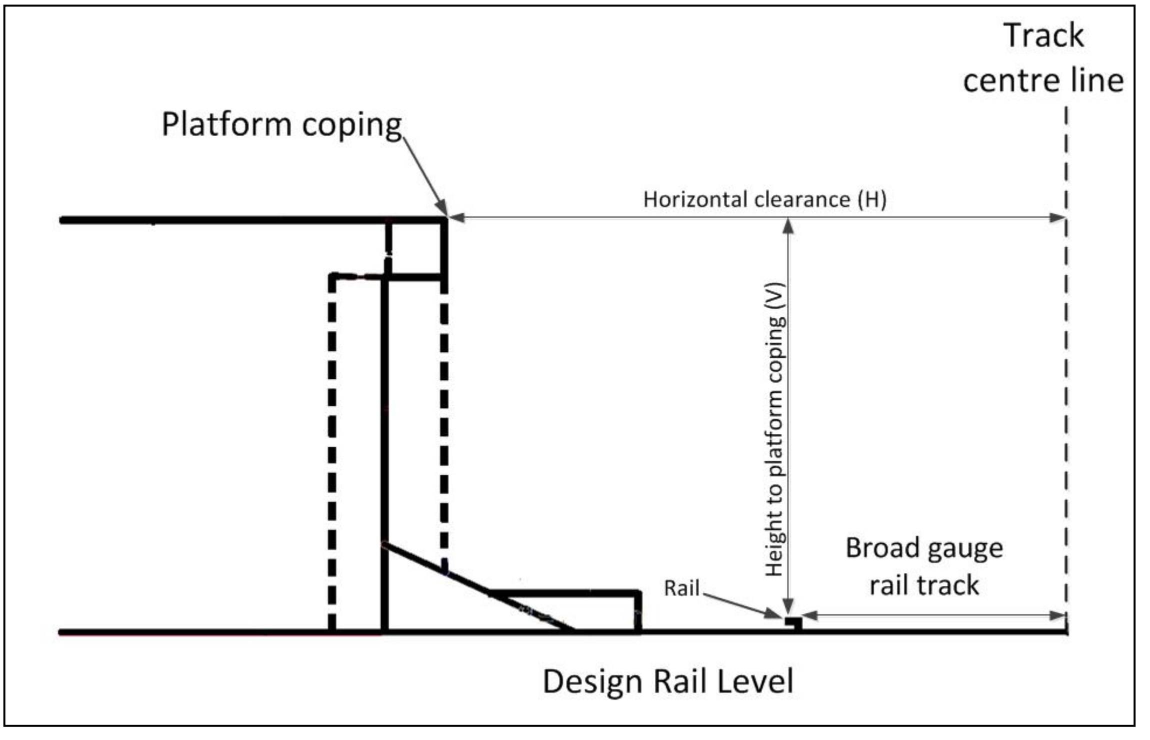
[18] Biomathematical models are typically based on averaged fatigue data from a limited range of individuals. Results of biomathematical fatigue modelling should therefore be interpreted with caution when being used to estimate individual performance. No model has the capacity to fully account for individual differences in sleep and/or performance. (Civil Aviation Safety Authority, (2014). *Biomathematical Fatigue Models Guidance Document.* Available from: http://casa.gov.au/wcmswr/_assets/main/aoc/fatigue/fatigue_modelling.pdf.

## Platform-train interface

The Victorian Rail Industry Operators Group[19] (VRIOG) standards apply to the upgrading and maintenance of structures and facilities of the metropolitan railway stations. Public Transport Victoria (PTV)[20] requires transport operators to comply with the Victorian Rail Industry Operators Group[21] (VRIOG) Standards for the maintenance and upgrade of rail infrastructure.

The VRIOG standard *VRIOGS 001 - Structure Gauge Envelopes* issued in June 2012 specifies the minimum clearances required to safely separate rolling stock from trackside infrastructure. The standard specifies the horizontal distance from the track centre line to the platform edge (H) and the vertical height from the design rail level to the top of the platform edge (V) [Figure 8]. For existing track infrastructure the standard specifies a horizontal distance of 1550 mm with a construction tolerance of +10 mm and vertical height of 1043 mm for tangent track.[22]

**Figure 8 – Horizontal and vertical clearances between platform and track**




**Source: VRIOGS 001, modified by Chief Investigator, Transport Safety (Vic)**

Where a platform is curved, extra horizontal clearance is required to allow for:

- the end throw of rolling stock
- the dynamic effects such as car body roll
- body displacement due to lateral deflection of suspension and wheel flange wear.

Further, track centre misalignment, gauge variations and rail wear are other factors that have to be allowed for during platform design and installation.

---

[19] Victorian Rail Industry Operators Group consists of Public Transport Victoria, Vic Track, MTM, Yarra Trams, V/Line and the Australian Rail Track Corporation.

[20] PTV is the statutory authority responsible for providing and coordinating public transport in Victoria.

[21] Victorian Rail Industry Operators Group consists of Public Transport Victoria, Vic Track, MTM, Yarra Trams, V/Line and the Australian Rail Track Corporation.

[22] VRIOGS 001, section 8, (K) b).

For curved track, the VRIOG Standard[23] requires that an additional *standard clearance* be added to the horizontal clearance stipulated for tangent track (1550 mm). The curve radius of Platform 1 of Heyington railway station was 380 m, and the applicable increase to the required clearance is 135 mm[24] giving a required standard horizontal clearance of 1685 mm.

The standard also provides an equation[25] for deriving an *absolute minimum clearance*. The applicable increase to the required clearance using this method is 85 mm. This gives a total minimum required horizontal clearance of 1635mm.

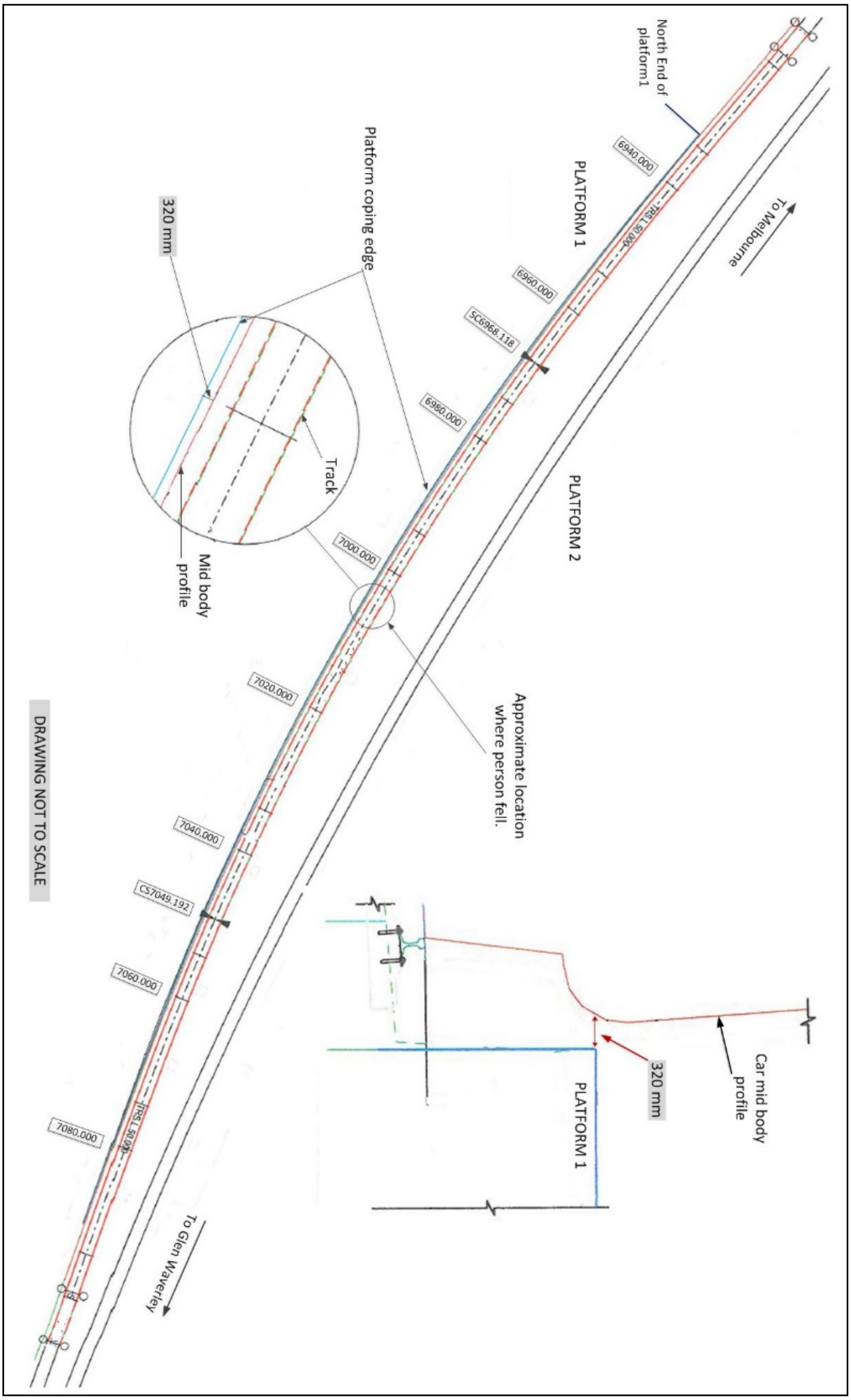
The VRIOG Standard only specifies the minimum clearance required and does not specify a maximum clearance between a platform and the train as its purpose is to ensure a clear operating envelope is provided for rolling stock on the network.

At the absolute minimum horizontal clearance required by the VRIOG Standard (1635 mm) and a construction tolerance (+10 mm), a gap of 297 mm would exist between the X'Trapolis car mid-body and the platform. At the standard horizontal clearance required by the VRIOG standard (1685 mm) and the construction tolerance, a gap of 347 mm would exist between the mid-body and the platform. The largest measured gap between platform 1 and the X'Trapolis car mid-body was about 390 mm at the station entrance. The gap in the area that the person fell between the platform and train was about 320 mm. This gap lies between the two gaps (297 mm and 347 mm) derived using the *absolute minimum clearance* and the *standard clearance*.

From 2013, the *Structures and Facilities Standard* developed by MTM defined the requirements for the design and construction of stations for the suburban metropolitan railway. This standard required that all new platforms be either tangent or convex with a radius of not less than 1000 m. The standard did not provide for the construction of concave platforms. For existing platform renewal, MTM developed a 'design practice note' (DPN) effective from January 2014. This document provides guidelines on the permissible construction tolerances applicable to platform renewal works.

[23] In VRIOGS 001, section 4.2.
[24] VRIOGS 001, section 4.2 (l).
[25] VRIOGS 001, section 11.1.

**Figure 9 – Schematic showing clearance between platform and train**




**Source: Metro Trains Melbourne with annotations by Chief Investigator, Transport Safety (Vic)**

# Findings

The following findings are made with respect to the incident involving a young male person, who sustained fatal injuries when attempting to board the Glen Waverley train to Flinders Street Station. 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

- An individual attempted to board the moving train and fell between the train and the platform.
- The train doors were held open by a group of passengers.
- **As designed, the traction interlock automatically deactivated after a period of time. This allowed traction to be applied and the train to depart with the carriage doors open. (Safety Issue)**
- **Due to the curvature of the track, a wide gap existed between the platform and train at the Heyington Railway Station. There are several stations on the Melbourne metropolitan rail network where wide gaps exist between platforms and trains due to track curvature. These gaps pose a risk to passengers. (Safety Issue)**

## Other factors that increased risk

- **The train door open/close indicator on the driver's control console was inadequate as a warning device once the traction interlock had deactivated. (Safety Issue)**
- **The existing standards stipulated minimum clearances between trains and platforms but did not consider the effect of the resulting gaps with respect to safe accessibility. (Safety Issue)**

# 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.

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 repeated separately on the ATSB website to facilitate monitoring by interested parties. Where relevant the safety issues and actions will be updated on the ATSB website as information comes to hand.

## The train could be moved with the carriage doors open

| | |
|---|---|
| Number: | RO-2014-005-SI-01 |
| Issue owner: | Metro Trains Melbourne |
| Type of operation: | Passenger |
| Who it affects: | Train passengers |

### *Safety issue description:*

As designed, the traction interlock automatically deactivated after a period of time. This allowed traction to be applied and the train to depart with the carriage doors open.

***Proactive safety action taken by:*** Metro Trains Melbourne

MTM advised the ATSB that subsequent to the incident MTM has made no changes to the traction interlock system on the rolling stock, but has commenced a risk review of the traction interlock timing.

***ATSB comment in response:***

The ATSB believes that the traction interlock system in its present configuration presents a risk to passengers and suggests that MTM institute additional risk mitigation measures until the risk review is completed. Accordingly, the ATSB issues the following Safety Recommendation:

***ATSB safety recommendation to:*** Metro Trains Melbourne

Action number: RO-2014-005-SR-030

The ATSB recommends that MTM consider a modification of the traction interlock override system to incorporate additional risk mitigations.

Action status: Released

## Inadequacy of the doors open warning device

| | |
|---|---|
| Number: | RO-2014-005-SI-02 |
| Issue owner: | Metro Trains Melbourne |
| Type of operation: | Passenger |
| Who it affects: | Train passengers |

### *Safety issue description:*

The train door open/close indicator on the driver's control console was inadequate as a warning device once the traction interlock had deactivated.

ATSB safety recommendation to: Metro Trains Melbourne

Action number: RO-2014-005-SR-031

The ATSB recommends that MTM consider incorporating an additional warning device to heighten driver awareness that the train doors have not closed, if automatic deactivation is retained.

Action status: Released

## Standards for train / platform clearances

| | |
|---|---|
| Number: | RO-2014-005-SI-03 |
| Issue owner: | Metro Trains Melbourne |
| Type of operation: | Passenger |
| Who it affects: | Train passengers |

### *Safety issue description:*

The existing standards stipulated minimum clearances between trains and platforms but did not consider the effect of the resulting gaps with respect to safe accessibility.

***Proactive safety action taken by:*** Metro Trains Melbourne

Action number: RO-2014-005-NSA-032

For existing platform renewal, MTM is implementing the requirements of the 'design practice note' (DPN). This document provides guidelines on the permissible construction tolerances applicable to platform renewal works.

***Current status of the safety issue:***

Issue status: Adequately addressed

Justification: Compliance with the DPN and works plans for higher risk platforms will ensure that an optimum platform/rolling stock gap is maintained, reducing the risk to passengers, while also reducing the risk of rolling stock/platform contact.

## Train / platform clearances

| | |
|---|---|
| Number: | RO-2014-005-SI-04 |
| Issue owner: | Metro Trains Melbourne |
| Type of operation: | Passenger |
| Who it affects: | Train passengers |

### *Safety issue description:*

Due to the curvature of the track, a wide gap existed between the platform and train at the Heyington Railway Station. There are several stations on the Melbourne metropolitan rail network where wide gaps exist between platforms and trains due to track curvature. These gaps pose a risk to passengers.

***Proactive safety action taken by:*** Metro Trains Melbourne

Since the incident, Metro Trains Melbourne has realigned the track at Heyington railway station and a rubber finger coping has been installed along the entire edge of the platform face in order to minimise the gap between the train and platform. Further, LED white lighting and a barrier has been constructed at the platform entrance to deter passengers from running for the train.

MTM has also completed a survey of all the stations with curved track across the network in order to measure the platform offsets from the track. Platforms of higher risk have been identified and in the short term these stations have had ‘Mind the gap’ painted along the platforms, while also announcements are made to warn passengers of the gap. In the long term, works plans have been drawn up for these platforms in order to institute risk mitigation measures.

***ATSB comment in response:***

The ATSB accepts that the works plans drawn up to institute additional risk mitigation measures are satisfactory. However, an unacceptable risk to passengers exist until the works are completed. Accordingly, the ATSB issues the following Safety Recommendation:

ATSB safety recommendation to: Metro Trains Melbourne

Action number: RO-2014-005-SR-035

The ATSB recommends that MTM expedite their plans to introduce additional risk mitigation measures (such as instituted at Heyington Railway Station), at the platforms that have been identified as presenting higher risks from larger platform-carriage clearances.

Action status: Released

# General details

## Occurrence details

| | | |
|---|---|---|
| Date and time: | 22 February 2014 – 2325 EST | |
| Occurrence category: | Accident | |
| Primary occurrence type: | Fatal injury | |
| Location: | Heyington Railway Station, Toorak, Victoria | |
| | Latitude: 37° 50.08' S | Longitude: 145° 01.355' E |

## Train TD 2100

| | | |
|---|---|---|
| Train operator: | Metro Trains Melbourne | |
| Registration: | TD 2100 | |
| Type of operation: | Passenger | |
| Persons on board: | Crew – 01 | Passengers – Unknown |
| Injuries: | Crew – Nil | Other – 01 |
| Damage: | None | |

# Sources and submissions

## Sources of information

The sources of information during the investigation included:

- Metro Trains Melbourne
- Public Transport Victoria
- Transport Safety Victoria
- Train driver
- Witnesses.

## References

Battelle Memorial Institute (1998). *An Overview of the scientific literature concerning fatigue, sleep, and the circadian cycle.* Report prepared for the Office of the Chief Scientific and Technical Advisor for Human Factors, US Federal Aviation Administration.

Civil Aviation Safety Authority (2014) *Biomathematical Fatigue Models Guidance Document.* Available from: http://casa.gov.au/wcmswr/_assets/main/aoc/fatigue/fatigue_modelling.pdf

Dawson, D. & McCulloch, K. (2005). Managing fatigue: It's about sleep. *Sleep Medicine Reviews, 9,* 365-380.

Flin, R., O'Connor, P & Crichton, M. (2008). *Safety at the Sharp End. A guide to nontechnical skills*. Ashgate: Aldershot.

Thomas, M.J.W. & Ferguson, S.A.. (2010). Prior sleep, prior wake, and crew performance during normal flight operations. *Aviation, Space, and Environmental Medicine, 81 (7),* 665-670.

## Submissions

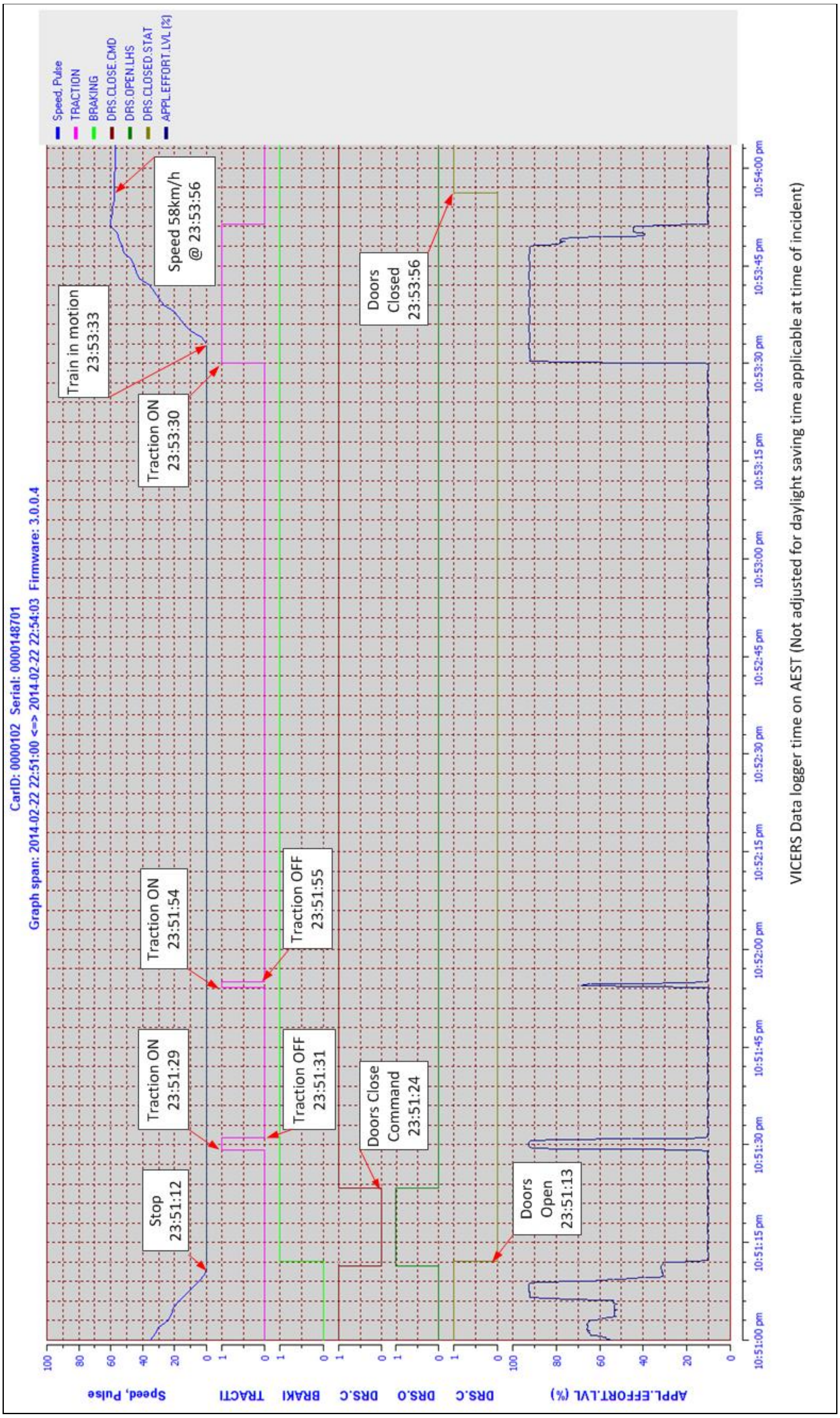
Under Part 4, Division 2 (Investigation Reports), Section 26 of the *Transport Safety Investigation Act 2003*, the ATSB may provide a draft report, on a confidential basis, to any person whom the ATSB considers appropriate. Section 26 (1) (a) of the Act allows a person receiving a draft report to make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

A draft of this report was provided to Metro Trains Melbourne, Public Transport Victoria, Transport Safety Victoria, Office of the National Rail Safety Regulator and the train driver.

Submissions were received from Metro Trains Melbourne, Public Transport Victoria, Transport Safety Victoria and the Office of the National Rail Safety Regulator. The submissions were reviewed and where considered appropriate, the text of the draft report was amended accordingly.

# Appendices

## Appendix A – VICERS Data logger analysis




**Source: Chief Investigator, Transport Safety (Vic)**

# 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 Commonwealth 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 fare-paying passenger operations.

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**

**Enquiries** 1800 020 616
**Notifications** 1800 011 034
**REPCON** 1800 011 034
**Web** www.atsb. gov.au
**Twitter** @ATSBinfo
**Email** atsbinfo@atsb.gov.au
**Facebook** atsbgovau

Investigation

**ATSB Transport Safety Report**
Rail Occurrence Investigation

Fatality at Heyington Railway Station Toorak, Victoria,
22 February 2014

RO-2014-005
Final – 27 April 2016