



**Australian Government**

**Australian Transport Safety Bureau**

# Non-operation of level crossing protection

Colac, Victoria on 22 September 2018

**ATSB Transport Safety Report**  
Rail Occurrence Investigation  
RO-2018-015  
FINAL – 8 October 2019

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.

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#### **Addendum**

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# Safety summary

## What happened

On 21 September 2018, overnight track maintenance works being conducted in the Colac area had necessitated the isolation of the protection equipment at eight level crossings. On completion of the track work, equipment was to be reinstated and the operation of crossing protection equipment tested.

With the completion of the maintenance work, the track was returned to service and train services resumed on the morning of 22 September. However, the driver of a train transiting the area noticed that the level crossing protection equipment at the Hart Street level crossing was not operating. He stopped his train but was unable to prevent it from occupying the crossing. There was no road traffic at the time.

## What the ATSB found

The ATSB found that V/Line did not have a documented detailed process for inhibiting and then reinstating level crossing protection equipment. The Signal Maintenance Technician (SMT) undertaking these activities partially restored the Hart Street level crossing equipment before attending to other tasks. He subsequently forgot to return to that crossing to complete its reinstatement and testing, and the track was returned to service with the protection at the Hart Street crossing not operational.

It was also concluded that, for the scope of works on this night, the allocation of a non-rail electrician to support the SMT was very likely of less assistance to the SMT than had a rail-qualified technician been provided.

## What has been done as a result

V/Line has developed new procedures related to the task of inhibiting and reinstating level crossing equipment and conducted training for relevant employees in these procedures.

In addition, V/Line has reviewed its resourcing of complex and time critical tasks involving inhibiting and reinstating level crossing equipment.

## Safety message

When isolating safety equipment, it is important to have formal procedures that require the recording of the equipment's isolation, reinstatement and testing, in order to validate that restoration work is completed before rail services resume.

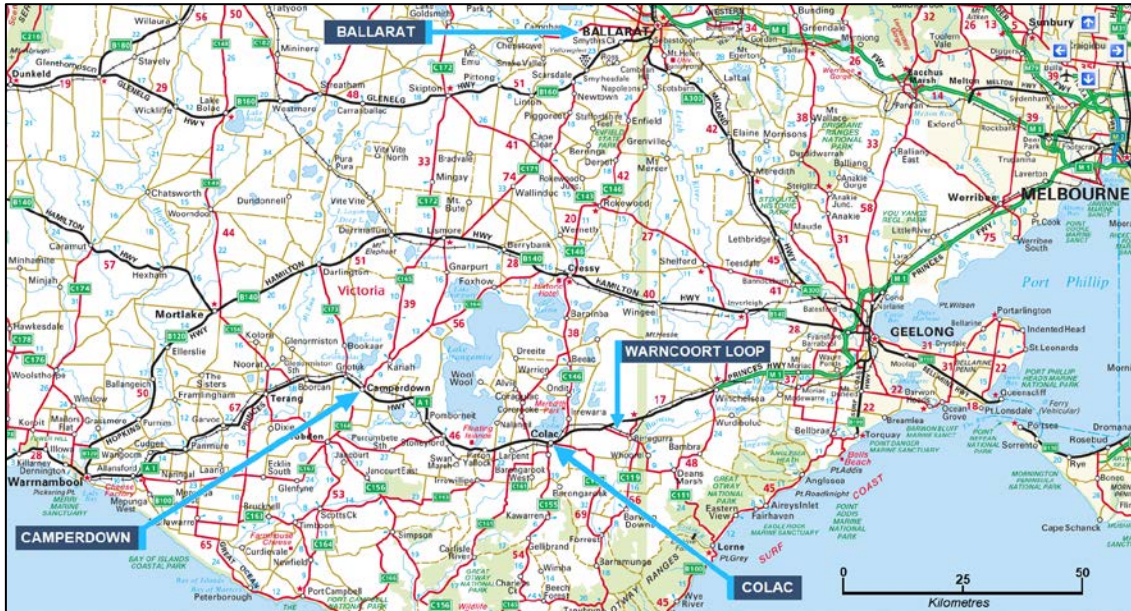
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# The occurrence

On the night of 21 September 2018, overnight track maintenance works were being conducted in the Colac area. To enable these works, an ‘absolute occupation’<sup>1</sup> applied overnight between Warncoort Loop and Camperdown (Figure 1).

Figure 1: Location diagram



Source: Melways (used with permission). Annotated by Chief Investigator, Transport Safety (Vic).

Due to the likelihood of these works causing damage to track assets, the active protection equipment at eight railway level crossings (RLXs) were required to be placed out-of-service<sup>2</sup> and the associated electrical connections disconnected and cables removed clear of the track.

## Level crossing inhibition

A Signal Maintenance Technician (SMT) was engaged to inhibit and later reinstate the crossing protection equipment. To complete the inhibiting task for each crossing, it was necessary to isolate control equipment at the crossing, and to travel to the extremities of the level crossing approach circuits to disconnect cabling.

For the five crossings closest to Colac Railway Station, the SMT initially requested the issue of five Permits To Foul the Line (PTFL)<sup>3</sup> together (No’s 1-5) issued between 2216 and 2226 (Figure 2). This was so he could quickly isolate the protection equipment at these proximal crossings and remove their track connections to allow the track works to proceed.

The SMT then received a call to attend the Colac-Ballarad Road RLX (about 6 km by road from Colac Railway Station). He drove to the location, obtained PTFLs 8 and 9 (issued between 2239 and 2241) for the Colac-Ballarad Road and the nearby Flaxmill Road crossings, and completed the inhibition of these two crossings.

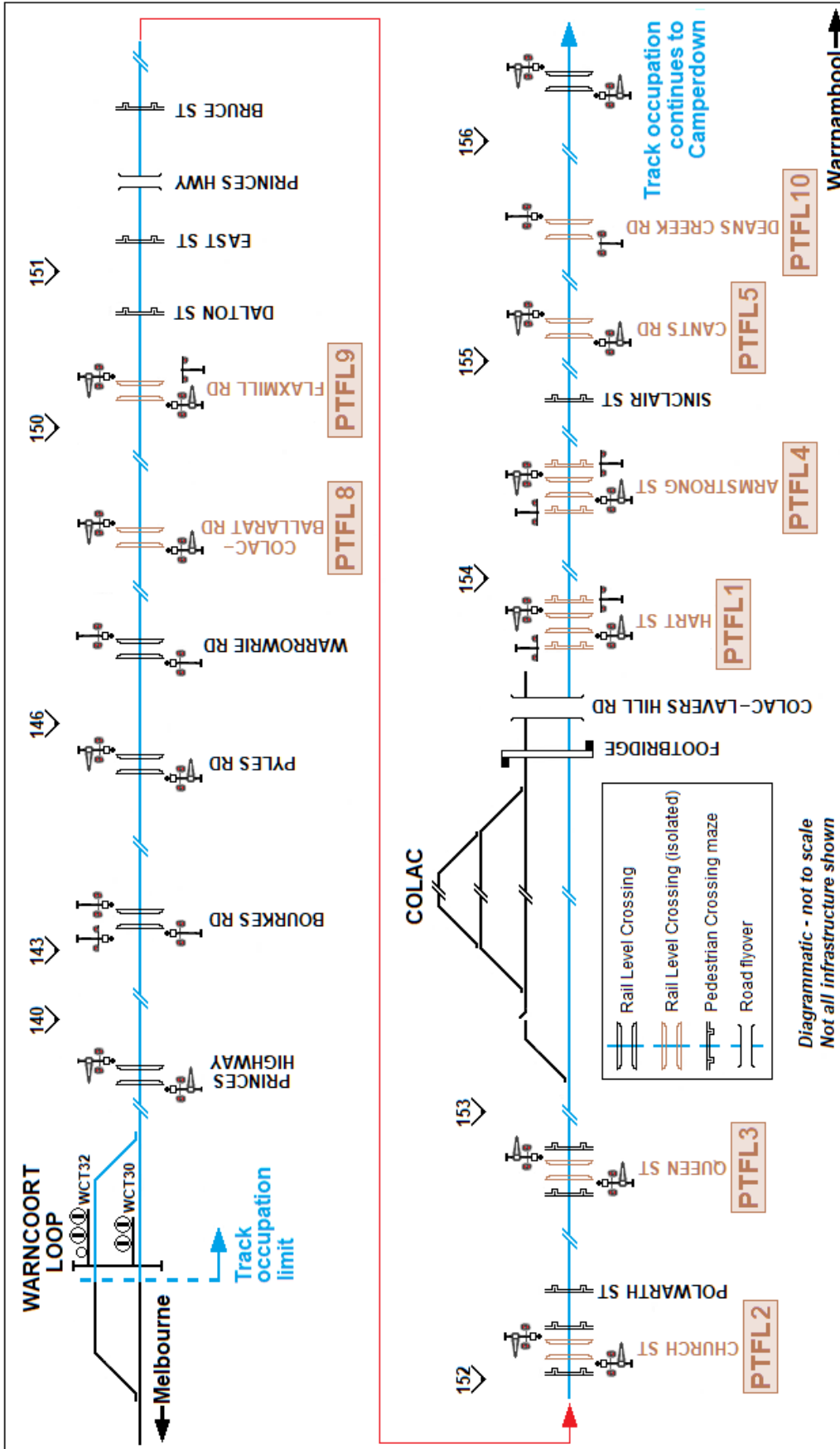
Returning to Colac, the technician completed the inhibition activity on the five RLXs nearby to Colac Station.

<sup>1</sup> The temporary possession by track maintenance forces of a defined section of a rail network in order to carry out on-track works. Train movements through the defined section during the term of the occupation are prohibited.

<sup>2</sup> V/Line variously refers to this process as ‘inhibition’, ‘isolation’ or ‘disarrangement’.

<sup>3</sup> These permits are issued by the Track Force Protection Coordinator (TFPC). See also ‘Permit To Foul the Line’, p 6.

Figure 2: Diagram showing the area of works on 21 September, including RLXs



Source: Chief Investigator, Transport Safety (Vic)

Receiving advice of rapid progress, the SMT requested PTF10 (issued at 0126), then drove to and inhibited the Deans Creek Road RLX (approximately 3.5 km by road from Colac Railway Station).

All eight level crossings were now inhibited.

## Level crossing reinstatement

Knowing the Tamper & Regulator Gang had completed work at the Colac-Ballararat Road and Flaxmill Road RLX locations, the SMT returned there (a total distance of about 11 km by road to attend both RLXs), reinstated the in-track equipment, and surveyed<sup>4</sup> the two crossings. PTFs 8 and 9 (for these crossings) were not returned at that point but were returned later, during the call to the Track Force Protection Coordinator (TFPC) in which PTF 2 was also returned.

Moving to the Church Street RLX (a further 2.5 km of travel) the SMT reinstated its on-track equipment, surveyed it, and returned PTF 2 (together with PTF 8 and 9) between 0518 and 0519. Following this, he reinstated the equipment for the Queen Street RLX (1 km distant by road) and surveyed it as well. However, he could not return the PTF at this time as the track machines were returning to the Colac yard and were occupying the crossing for a period.

The SMT then reinstated the in-track equipment for Hart Street (1.5 km distant) and went to the location case (the level crossing equipment control box) intending to return the control equipment to operation. However, due to overlapping track circuits<sup>5</sup> not yet being reconnected, the full restoration of the Hart Street crossing protection was not completed at that point in time. The technician then went to undertake other tasks, and subsequently did not return to Hart Street to complete its reinstatement.

By this time, the Tie Renewal Gang had completed their work and returned to the Colac yard, and the SMT commenced to reinstate in-track equipment and survey the remaining RLXs at Deans Creek Road, Cants Road and Armstrong Street.

The SMT then called the TFPC and returned the remaining five PTFs between 0625 and 0626, including that for Hart Street. He believed he had been to each RLX, reinstated and tested each, and confirmed this belief with the assisting electrician. With this, the SMT considered his work for the shift completed.

At the completion of the night's work, the track occupation was cancelled by the TFPC. This enabled the recommencement of train services between Melbourne and Warrnambool.

The first train to transit the area was a Warrnambool-to-Melbourne service. Its driver did not report any fault with the RLX. The second service was running from Melbourne to Warrnambool and had departed Colac Railway Station at about 0930. Its locomotive driver noticed that the flashing lights for the Hart Street level crossing were not operating. He made an Emergency brake application but was unable to prevent the locomotive from occupying the crossing. There was no road traffic at the time. The locomotive driver inspected the rail head and train consist wheels for contamination, identifying no issues, and the service was permitted to continue.

Subsequent inspection of the Hart Street RLX active protection revealed that the level crossing protection had not operated because it was still inhibited.

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<sup>4</sup> The survey process follows reinstatement of an RLX, and involves [1] testing the track circuit to ensure it operates the RLX equipment as intended, and [2] checking that on-board parameters (e.g. track voltage setup values) of the HXP-3 RLX control unit have not changed as a result of the system having been inhibited.

<sup>5</sup> Some of the RLXs in Colac were sufficiently close to each other that the approach/departure track circuits of one overlapped those of another.

# Context

## Infrastructure works

The track and associated infrastructure, including the level crossing protection systems, is owned by the Victorian Rail Track Corporation (VicTrack) and managed by V/Line Corporation (V/Line). V/Line is responsible for track and signalling maintenance.

The maintenance work on 21-22 September was part of a tie<sup>6</sup> renewal project, being carried out by V/Line between September and December 2018, to replace sleepers on the Melbourne-to-Warrnambool line.

## Resourcing

This project was the first to be undertaken since the inception of a new method for allocating staff to track maintenance projects. The resourcing and support function of projects such as this became the direct responsibility of the corporate Project Delivery team. Previously, local<sup>7</sup> signal maintenance technicians supported projects within their area. From the time of this project, there was greater scope to draw technicians from other regions.

At the commencement of these works, maintenance technicians were not readily available (due to the effects of insufficient staff numbers and annual leave requirements). Thus, for signal maintenance technical support, the Warrnambool tie renewal project required that a technician be drawn from other assignments. The Signal Maintenance Technician (SMT) allocated to support this project was based in Ballarat.

## The track maintenance work groups

There were four separate work groups operating within the track occupation:

- The Electrical Assets group; a Signal Maintenance Technician and assistant, responsible for removing on-track equipment and for functionally inhibiting any active Railway Level Crossing (RLX) protection prior to the works, and for reinstating it following completion.
- The Tie Discharge Gang; engaged in unloading and laying out the new sleepers. They worked ahead of the Tie Renewal Gang.
- The Tie Renewal Gang; consisting of more than 40 personnel and about 12 on-track machines to insert the replacement sleepers
- The Tamper & Regulator Gang; followed the Tie Renewal Gang with personnel and on-track machinery to restore the track and ballast state in preparation for the resumption of rail traffic.

## Supervisor of the four workgroups

The overall on-site workgroup supervisor for the area under the Absolute Occupation was a V/Line Assistant Track Maintenance Supervisor. He had about 30 years' rail experience.

## Signal Maintenance Technician

### Qualification and experience

The maintenance technician on this shift was a qualified electrician and Signal Maintenance Technician with around 4.5 years' experience in the rail industry. He had been involved in V/Line projects since May 2018.

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<sup>6</sup> In this context, 'tie' is an alternative term for a railway sleeper

<sup>7</sup> Personnel assigned to operate only within and throughout a particular region.



### ***Technician's roster and sleep***

On the Monday prior to the incident, the SMT worked a 10-hour dayshift, then had 26.5 hours off duty. Commencing 1900 on the Tuesday evening, he was then rostered on for 12-hour night-shifts. He worked these night-shifts on the Tuesday, Wednesday and Thursday nights with 12 hours off duty, and reportedly about 6 hours' sleep, between each shift. He was rostered to work another 12-hour shift on the night of the incident.

The incident occurred overnight between Friday and Saturday. The SMT reported going to bed at around 0630 on the Friday morning following his previous shift, and achieving about 6 hours' sleep. He commenced work at Wendouree (Ballarat) at about 1930 that evening and drove to Colac to commence his support work. He completed activities on site at about 0630 the following morning, before driving back home.

### ***The work***

In the week prior to the incident, the SMT had become aware that signals technical support was required for this tie renewal project and had agreed to be tasked for the project. Work for the project commenced on 4 September and was progressing west.

The level crossing inhibition task required:

- the isolation of the RLX active protection by using temporary jumper wires to connect certain system component terminals within the equipment location cases adjacent to each RLX (Figure 3)
- the disconnection of signal and track circuit bonding wires from the rails at each RLX
- the detachment and removal of any between-rails equipment.

**Figure 3: Position of a typical RLX location case (Hart St, Colac)**



Source: Chief Investigator, Transport Safety (Vic)

Following completion of work, these actions were reversed, with the addition of a test (survey) at each crossing to confirm its functionality.

V/Line did not have a formal, written procedure describing or defining this sequence of actions. SMTs learnt the processes associated with inhibition and reinstatement through on-the-job training.

### **Support resources**

The SMT had commenced his role on the project working solo but, having become aware of the scope-of-works for the Friday-night shift, requested assistance for that shift.

The SMT was informed that no qualified rail technical assistance was available, but that an assisting electrician from a contract electrical company would be supplied. The contract electrician had no previous rail-based experience but held a Track Safety Awareness qualification and was to work under the technician's direct supervision.

### **Supporting documentation**

The overlap of adjacent track circuits and unfamiliarity with the location presented a challenge to the SMT. The As-In-Service plans<sup>8</sup> for the RLXs in this region had not been updated since their track-circuited approaches had been extended from 1,000 to 1,300 m about a year earlier. Lacking an up-to-date diagram of arrangement, the SMT was required to inspect the length of each track-circuited section to identify the location of connected equipment.

## **Worksite Protection**

### **Overall protection**

The worksite protection for the four groups was managed by a Track Force Protection Coordinator (TFPC). Their role included establishing the Absolute Occupation Order, and arranging its cancellation at the completion of works. The TFPC held such an Order for the Warncoort Loop-to-Camperdown section (issued at 2209 on 21 September 2018) with Worksite Protection recorded as being in place at 2214. This TFPC was also authorised to issue Permits To Foul the Line (PTFLs).

### **Signalling workgroup supervisor**

The SMT functioned as the 'Workgroup Supervisor'<sup>9</sup> for his workgroup. He was authorised to have on-site management of an individual or group of people working under the cover of an Absolute Occupation. He was also authorised to seek and hold PTFLs.

### **Permit To Foul the Line (PTFL)**

A PTFL is a paper instrument designed to convey and record the granting of permission to occupy the track between defined geographical limits during the existence of an Absolute Occupation. Relevant portions of the process are described here.

Where the active protection equipment at a railway level crossing (RLX) is to be disconnected (or 'inhibited') or its functionality restricted, the workgroup supervisor, who, for this particular task must also be qualified as a signal maintenance technician, must first obtain a PTFL. Work at the location of the RLX cannot commence until the PTFL has been issued.

An SMT may hold multiple PTFLs for the disconnection of active level crossing protection equipment and must be in possession of a separate PTFL for each RLX during the time the active protection equipment is out-of-use at that crossing. The PTFL remains in place until normal operation of the active protection equipment has been restored.

<sup>8</sup> System diagrams depicting the individual arrangement of equipment at each RLX.

<sup>9</sup> Safeworking Circular SW 0205/2018, *Absolute Occupations – Supplementary Instructions*, 6 June 2018.

The PTFL must only be issued or cancelled by the TFPC who (at the time) is holding the Absolute Occupation. When a workgroup, including that of an SMT, has completed their work, and all staff, machinery and equipment is clear of the line, the workgroup supervisor must 'return' the PTFL to the TFPC by completing the relevant section of the form. The TFPC then cancels the PTFL. This process can be by radio communication.

# Safety analysis

## Error by Signal Maintenance Technician

### ***The error***

Toward the end of a busy night shift, the Signal Maintenance Technician (SMT) and his assistant had proceeded to Hart Street to complete reinstating its crossing protection. Track equipment was reconnected, but the reinstatement process for Hart Street was not finalised at that point in time because of a requirement to reinstate track circuit cabling. The SMT and his assistant then attended to other tasks, and forgot to return to the Hart Street level crossing to complete its reinstatement, and test its functionality.

### ***Workload***

The rate-of-progress achieved by other workgroups during the evening meant there was competition for the SMT's attention to have level crossings isolated or reinstated as the works progressed. To satisfy the requirements of the other work groups, the SMT was engaged in considerable to-and-fro travel throughout the work area.

### ***Fatigue***

Regularly sleeping for reduced hours can affect human performance. In one study, people reporting more than 7.5 hours of sleep had significantly less probability of falling asleep than those reporting sleep durations of less than 6 hours 45 minutes.<sup>10</sup> Other studies have confirmed that chronic sleep restriction to fewer than 6 hours per night has been shown to impair performance and to increase the tendency to involuntarily fall asleep.<sup>11</sup>

In this instance, the SMT reported that he had had around 6 hours sleep the day before this shift. The technician had switched to a night-shift roster on the Tuesday, and this was his fourth 12-hour night shift. Following the shift change, and as a result of the low sleep hours in the preceding days, it is likely that the technician's cognitive performance was less than if he'd been well rested.

## Process control

SMTs learnt the process for inhibiting and reinstating active railway level crossing (RLX) installations through on-the-job observation. They did not have the benefit of any prescribed procedure for this activity. Thus, there was no formal process available to the SMT by which the individual tasks associated with the isolation or removal of active level crossing equipment could be recorded and then be available to ensure correct and complete reinstatement.

The SMT was handling multiple Permit to Foul the Line (PTFLs) (that was permitted). However, rather than returning each permit individually at the completion of reinstatement of each RLX, the SMT in some cases delayed and then grouped their return. This included the PTFL for the Hart Street crossing, that was returned, away from the Hart Street site, at the end of the SMT's work. This method of handling the PTFLs removed another potential defence against error.

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<sup>10</sup> Banks S. Behavioral and physiological consequences of sleep restriction. *Journal of clinical sleep medicine*. 2007 Aug 15;3(05):519-28.

<sup>11</sup> Carskadon MA, Dement WC. Cumulative effects of sleep restriction on daytime sleepiness. *Psychophysiology*. 1981 Mar;18(2):107-13.

## Project resourcing

The SMT assigned to the project assessed that he would require (and he requested) assistance for Friday's overnight shift. However, V/Line could not provide a rail technician due to a lack of staffing availability, and provided instead, an electrician who was only able to carry out tasks under direct supervision. As a result, the SMT did not have the benefit of a rail-qualified associate with whom he could divide the task of inhibiting the eight level crossings. Nor was the SMT able to potentially benefit from cross-checking by a rail-experienced colleague.

Given the scope of works to be undertaken by the SMT on this night, he would have benefited from the support of an appropriately qualified rail technician.

## Out-of-date 'As-In-Service' plans for rail level crossings

System diagrams depicting the arrangement of equipment unique to each level crossing and its associated track circuitry were held within the Public Transport Victoria (PTV)<sup>12</sup> Drawing Management System. Maintaining their currency was the responsibility of V/Line. However, the on-site documentation was not up-to-date. Track circuit distances had changed over the prior year, and this information had not been transferred to the As-In-Service diagrams of the RLXs.

As a result, the SMT expended valuable time in having to identify each RLX circuit without the assistance of accurate documentation.

### ***Previous investigation***

In a previous investigation<sup>13</sup> into a 'short ring incident' incident at a Colac RLX, the Chief Investigator, Transport Safety (Vic), found that: 'As-In-Service drawings were found to be inconsistent with the actual site configuration' and that 'site working documents for field maintenance staff did not fully reflect the actual system configuration.'

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<sup>12</sup> At the time of this incident PTV was the trading name for the Public Transport Development Authority, a Victorian Government Statutory Agency responsible for providing, coordinating, and promoting public transport. As of 1 July 2019 PTV formed part of an integrated Department of Transport.

<sup>13</sup> CITS (Vic) Rail Safety Investigation Report № 2008/06. On 9 July 2008 a freight train occupied a level crossing at Colac with the flashing lights and warning bells operating but before the barriers had commenced to lower.

# Findings

From the evidence available, the following findings are made with respect to the non-operation of railway level crossing protection that occurred in Colac, Victoria on 22 September 2018. 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 Signal Maintenance Technician (SMT) forgot to complete the restoration of the Hart St level crossing.
- **V/Line did not have a documented detailed process for inhibiting and reinstating level crossing protection equipment. [Safety Issue]**

## Other factor that increased risk

- For the scope of works on this night, the allocation of a non-rail electrician to support the SMT was very likely of less assistance to the SMT than had a rail-qualified technician been provided.

## Other finding

- V/Line had not maintained up-to-date the system diagrams depicting the arrangement of equipment at each level crossing.

# Safety issues and actions

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

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.

## Process control

Number:	RO-2018-015-SI-01
Issue owner:	V/Line
Operation affected:	A rail passenger service
Who it affects:	Rail: Passenger - Regional

### **Safety issue description:**

V/Line did not have a documented detailed process for inhibiting and reinstating level crossing protection equipment.

### **Proactive safety action taken by V/Line**

Action number: RO-2018-015-NSA-015

V/Line has developed and issued new specific procedures related to the task of inhibiting and reinstating level crossing equipment and conducted training for relevant employees in these procedures.

### **Current status of the safety issue**

Issue status: Adequately addressed.

Justification: The ATSB is satisfied that the safety action taken by V/Line addresses the safety issue.

## Additional safety action

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.

V/Line has reviewed its resourcing levels for complex and time critical tasks involving inhibiting and reinstating level crossing equipment.

# General details

## Occurrence details

Date and time:	22 September 2018 – 0630 EST	
Occurrence category:	Incident	
Primary occurrence type:	Infrastructure Irregularity	
Location:	Colac, Vic.	
	Latitude: 38° 20.638' S	Longitude: 143° 34.826' E

## Train details

Train operator:	V/Line	
Registration:	TD8861	
Type of operation:	Rail passenger	
Persons on board:	Crew – 1	Passengers – number unknown
Injuries:	Crew – 0	Passengers – 0
Damage:	None	



# Sources and submissions

## Sources of information

The sources of information during the investigation included:

- V/Line

## References

*Level Crossing Short Warning Time, Freight Train 9251, Queen Street Colac, 9 July 2008*, Chief Investigator, Transport Safety (Vic), Rail Safety Investigation Report No 2008/06, pp 35-36.

## 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, the employees concerned and relevant agencies. Submissions were reviewed and where considered appropriate, the text of the draft report was amended accordingly.

# Australian Transport Safety Bureau

The 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 the 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.

## Terminology used in this report

**Occurrence:** accident or incident.

**Safety factor:** an event or condition that increases safety risk. In other words, it is something that, if it occurred in the future, would increase the likelihood of an occurrence, and/or the severity of the adverse consequences associated with an occurrence. Safety factors include the occurrence events (e.g. engine failure, signal passed at danger, grounding), individual actions (e.g. errors and violations), local conditions, current risk controls and organisational influences.

**Contributing factor:** a factor that, had it not occurred or existed at the time of an occurrence, then either:

- (a) the occurrence would probably not have occurred; or
- (b) the adverse consequences associated with the occurrence would probably not have occurred or have been as serious, or
- (c) another contributing factor would probably not have occurred or existed.

**Other factors that increased risk:** a safety factor identified during an occurrence investigation, which did not meet the definition of contributing factor but was still considered to be important to communicate in an investigation report in the interest of improved transport safety.

**Other findings:** any finding, other than that associated with safety factors, considered important to include in an investigation report. Such findings may resolve ambiguity or controversy, describe possible scenarios or safety factors when firm safety factor findings were not able to be made, or note events or conditions which ‘saved the day’ or played an important role in reducing the risk associated with an occurrence.