



Australian Government
Australian Transport Safety Bureau

Derailment of locomotive and wagon during main line shunting

South Dynon Junction, West Melbourne, Victoria | 25 July 2013



Investigation

ATSB Transport Safety Report
Rail Occurrence Investigation
RO-2013-020
Final – 16 October 2015

Cover photo: Courtesy of the Australian Rail Track Corporation

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

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

© Commonwealth of Australia 2015



Ownership of intellectual property rights in this publication

Unless otherwise noted, copyright (and any other intellectual property rights, if any) in this publication is owned by the Commonwealth of Australia.

Creative Commons licence

With the exception of the Coat of Arms, ATSB logo, and photos and graphics in which a third party holds copyright, this publication is licensed under a Creative Commons Attribution 3.0 Australia licence.

Creative Commons Attribution 3.0 Australia Licence is a standard form license agreement that allows you to copy, distribute, transmit and adapt this publication provided that you attribute the work.

The ATSB's preference is that you attribute this publication (and any material sourced from it) using the following wording: *Source:* Australian Transport Safety Bureau

Copyright in material obtained from other agencies, private individuals or organisations, belongs to those agencies, individuals or organisations. Where you want to use their material you will need to contact them directly.

Addendum

Page	Change	Date

Safety summary

What happened

On 25 July 2013, Pacific National locomotive 8122 was undertaking shunt operations in the Melbourne Freight Terminal (MFT) and onto areas of the main line controlled by signal DYN150. During one of the shunt movements, the locomotive stopped slightly forward of signal DYN150, in a position where indication on the signal was not visible to the driver. The signalling system should have detected the locomotive still occupied the track section forward of the signal, but in this instance, the system registered the train had cleared the section. The system then allowed points 143 ahead of signal DYN150 to change position for the passage of another train.

Unaware of the change in points 143, the driver continued with shunt operations by moving the locomotive forward. A Signal Passed at Danger (SPAD) alarm was generated and displayed to the Network Control Officer (NCO) who then contacted the MFT shunt planner. Meanwhile, the driver continued forward before stopping just after the lead bogie of locomotive 8122 had run through points 143, which were now set in the incorrect position for the move being undertaken.

Unaware that the points had been run through, the driver then reversed direction for the next shunt movement. This manoeuvre resulted in the lead bogie of the locomotive diverging onto a different track, causing all wheels of the locomotive and one bogie of the first wagon coupled to the locomotive to derail. At no point in time did a conversation occur between the NCO and the locomotive driver, and almost 30 minutes passed before the NCO and the shunt planner became aware of (and confirmed) the derailment at points 143.

What the ATSB found

The ATSB found that the location of the insulated rail joints adjacent signal DYN150 were incorrect. Consequently, the track section past the signal could be detected as unoccupied, even though the locomotive (and drivers cab) was positioned past the signal.

The ATSB also found that procedures specific to shunting in and about the MFT had not been implemented in this instance. It was evident that communication in response to the preceding SPAD alarm had been ineffective – allowing shunt operations to continue and locomotive 8122 to derail. Furthermore, significant time passed before the network control officer and the MFT shunt planner became fully aware of the derailment.

What's been done as a result

The Australian Rail Track Corporation initiated actions to verify (within Victoria) the position of insulated joints relative to the respective signals and develop a prioritised remediation plan for any non-conforming arrangements.

Pacific National and the Australian Rail Track Corporation have taken action to ensure all parties adhere to the documented process for shunting in and about the MFT. In addition, Pacific National has advised their drivers and shunt planners that communication regarding any issues related to the shunting movements must occur directly between the network controller and the locomotive driver.

Safety message

Rail transport operators must ensure that local communication practices are not substituted for, or do not influence required communication protocols in an emergency.

Contents

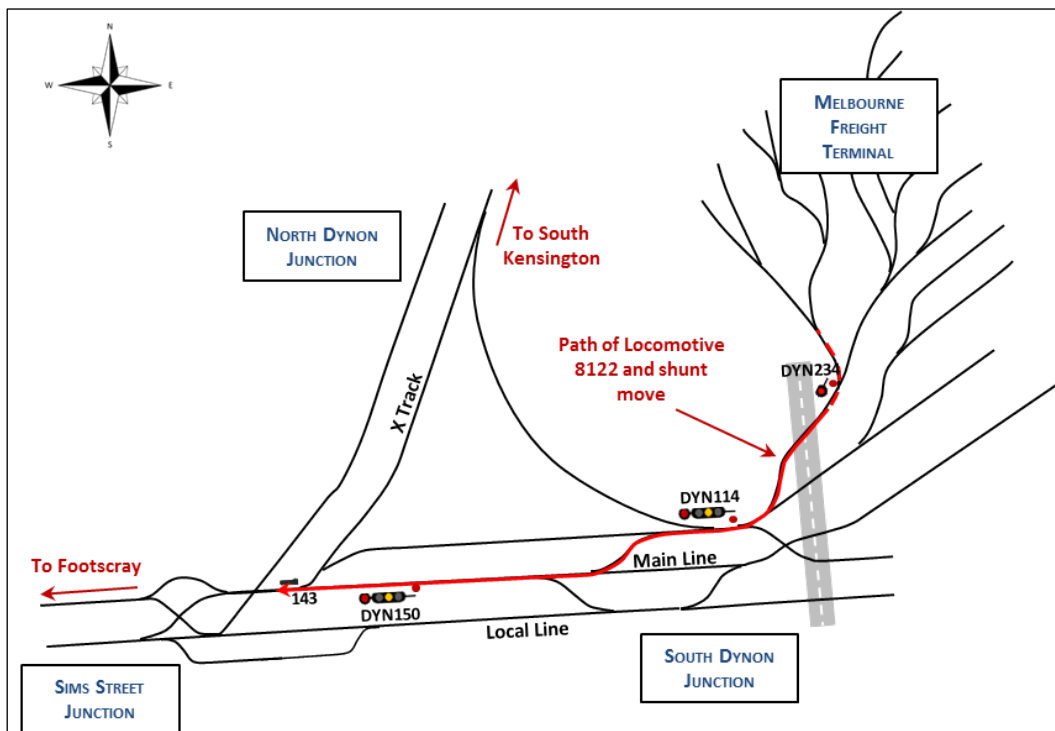
The occurrence	3
Context	6
Location	6
Train and train crew	7
Freight terminal operations	7
Operational rules	8
Operational procedures	9
Safety analysis	11
Track infrastructure	11
Track circuits	12
Existing risk controls	12
Incident response and communication	13
Signal passed at danger	13
Findings	15
Contributing factors	15
Other factors that increased risk	15
Other findings	15
Safety issues and actions	16
Additional safety action	17
General details	18
Occurrence details	18
Train details	18
Sources and submissions	19
Sources of information	19
References	19
Submissions	19
Australian Transport Safety Bureau	20
Purpose of safety investigations	20
Developing safety action	20

The occurrence

On 25 July 2013, the shunt planner at the Melbourne Freight Terminal (MFT) requested the driver of Pacific National locomotive 8122 and a shunter¹, to marshal² wagons within the terminal. To achieve the desired order of wagons, the locomotive required access beyond the terminal limits and onto the main line.

At about 1715³, at the request of the MFT shunt planner, the Australian Rail Track Corporation Network Control Officer (NCO) set a route onto the main line for locomotive 8122. About five minutes later, locomotive 8122 hauled a rake of six wagons from the MFT onto the main line and in the direction of Sims Street Junction (Figure 1). At about 1721, the locomotive passed signal DYN150 which was displaying a ‘medium speed warning’ aspect⁴. The locomotive continued beyond the signal for about 200 m before the shunter told the driver to stop.

Figure 1: Track layout Sims Street Junction showing path of locomotive 8122



Source: ARTC annotated by ATSB.

About the same time, though still some distance away, train 9794 was approaching from Footscray intending to travel towards North Dynon Junction via points 143. Although the NCO selected the required route for train 9794, the signal interlocking system⁵ prevented the route from setting, due to locomotive 8122 occupying a track section that was also part of that route. The signal interlocking system stored the selected route until such time that all the required track sections were clear.

At about 1724, the driver of locomotive 8122 received a further direction from the shunter to propel⁶ back toward the MFT. The locomotive pushed the attached wagons until they were in the

¹ A qualified worker who directs train movements for amalgamation, division or altering train consists.

² To arrange the order of vehicles in a train's consist.

³ The 24-hour clock is used in this report to describe the local time of day, Eastern Standard Time (EST).

⁴ Aspect showing yellow signal below a red signal permitting the driver to proceed at a medium speed.

⁵ Interaction of equipment controlling points and/or signals designed so that no conflicting movements can be signalled.

⁶ Movement where the locomotive is pushing the wagons and the driver is not driving from the leading vehicle in the train.

required position and the shunter again told the driver to stop. This placed the locomotive adjacent to signal DYN150.

The driver recalled that part of the locomotive (including the driver's cab) was forward of the signal. A rail vehicle placed in this position should register in the signalling system as occupying the track section ahead of the signal. In this instance however, the system registered the track section as clear and the original route set for locomotive 8122 from signal DYN150 completed.

As the route from DYN150 was no longer active, the system then commenced to set the stored route for train 9794 from Footscray. This included the operation of points 143 from the normal position (main line through South Dynon Junction), to the reverse position ('X' track through North Dynon Junction).

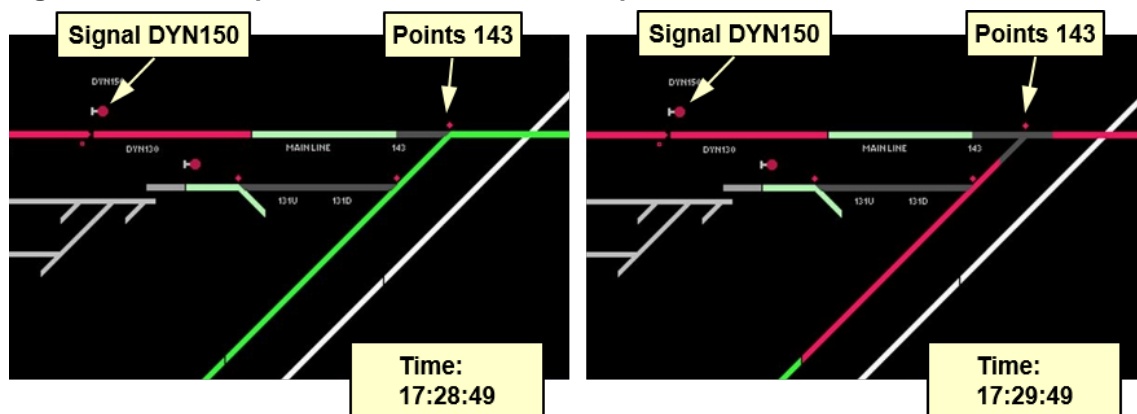
At about 1729, unaware of the change in the setting at points 143, the driver of locomotive 8122 continued the marshalling movements under the direction of the shunter. As the locomotive moved forward in another hauling move, the track circuitry detected occupancy of the section ahead of signal DYN150. This indicated on the Phoenix control system (Figure 2, Left), which provided the NCO with real time monitoring and control of field equipment. The Phoenix system recorded the track occupancy as an unauthorised movement past signal DYN150 and generated a Signal Passed at Danger (SPAD) alarm for attention by the NCO.

Meanwhile, the locomotive was moving toward points 143, which were now incorrectly set for this movement. At about 1730, the locomotive ran through⁷ the points. Shortly after trailing the points, the shunter again told the driver to stop the shunt movement.

At about the same time, the NCO responding to the SPAD alarm phoned the MFT shunt planner. A conversation commenced about what the driver of the shunt movement was doing in passing signal DYN150 without authorisation.

As locomotive 8122 ran through the points, the signalling system lost detection of the point orientation. This, in conjunction with the new track occupancy, caused the cancellation of the route from Footscray. The Phoenix system reflected this change (Figure 2, Right), but it went unnoticed by the NCO.

Figure 2: Screen captures from Phoenix control panel



The left-hand image shows the Phoenix control panel screen immediately after the signalling system detected locomotive 8122 occupying the track section ahead of Signal DYN150. The right-hand image shows the Phoenix control panel screen immediately after the signalling system loses detection of the points 143 orientation. Source: ARTC annotation by ATSB

The locomotive stopped while straddling the points 143, with the lead bogie on the facing side of points 143 and the rear bogie on the trailing side. The shunter again told the driver to change direction and propel back towards the MFT. This manoeuvre caused the lead bogie of the locomotive to diverge onto the 'X' track (towards North Dynon Junction), while the locomotive's

⁷ A movement through trailing points set in the wrong position. Damage to the point mechanism and switch rail usually results.

rear bogie and wagons continued along the main line towards the MFT. The driver realised what was happening and applied the brake, but could not stop the train before derailing the locomotive and the lead bogie of the first coupled wagon.

At about the same time, the MFT shunt planner interrupted his phone conversation with the NCO and issued an instruction to the driver by UHF radio to stop the train. The MFT shunt planner did not wait for a response from the driver, but confirmed with the NCO that he had told the driver to stop. Neither the shunt planner nor the NCO was aware that the locomotive had derailed.

The NCO, the shunt planner and other representatives of the operator continued with a series of phone conversations about the SPAD and their intention to authorise the locomotive to push back behind signal DYN150. None considered the possibility of a derailment. Almost 30 minutes passed before the NCO and the shunt planner became aware of (and confirmed) that locomotive 8122 and a wagon had derailed at points 143.

The NCO then arranged for protection of the track and an inspection of the damage to the infrastructure. At 1515 on 26 July, the locomotive and the lead wagon were recovered and the track restored for traffic.

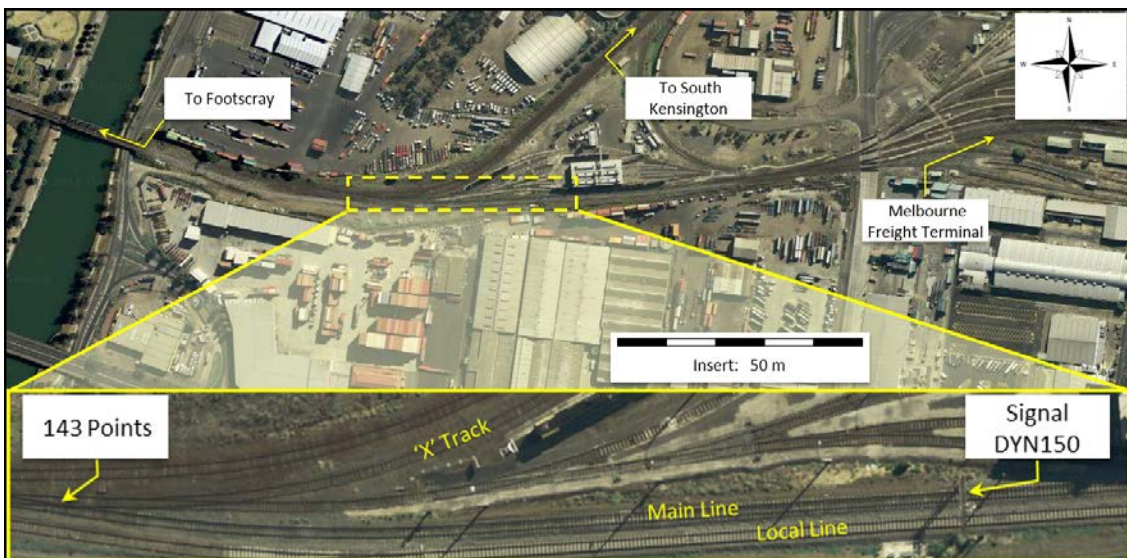
Context

Location

The Dynon area was a freight hub in Melbourne, Victoria with freight terminals servicing the Port of Melbourne, Appleton Dock, and Swanson Dock. The track from Footscray approached from the west; entering the Dynon area at Sims Street Junction, where a track branched to North Dynon Junction then on towards South Kensington. The main rail line continued east towards South Dynon Junction and the MFT.

The derailment occurred at points 143, situated at the 4.429 km mark⁸ at the eastern end of Sims Street Junction. The distance from the points to signal DYN150 was about 177 metres. The connection between the 'X track' to South Kensington and the main line towards the MFT occurs at points 143 (Figure 3).

Figure 3: View of South Dynon Junction track layout including the main line, 'X' track and points 143



Source: Google Earth, annotated by ATSB.

Network control

The Australian Rail Track Corporation (ARTC) managed the main line, 'X track' and associated signalling infrastructure involved in the derailment. The signalling infrastructure incorporated track circuits for rail vehicle detection and remotely controlling line-side signals and point machines.

The Phoenix control system, located at the Mile End control centre in South Australia, provided the remote control functionality. The system was a non-vital centralised traffic control system^{9 10} monitored and operated by the NCO. The system also provided status indications for the signalling equipment supporting the monitoring and management of train movements in real time.

⁸ Track km from the point of derailment to Southern Cross Station

⁹ Signalling equipment and circuits are considered non-vital where a failure to function correctly would not cause an unsafe signalling system condition. Non-vital equipment and circuits do not affect the safe operation of the signalling system.

¹⁰ Centralised traffic control (CTC) is a system of remotely controlling the points and signals at a number of interlocked stations, junctions and crossing loops in automatic signalling areas, from a centralised control room or signal box.

Train and train crew

Train information

The locomotive involved in the occurrence was an 81-class diesel electric with an overall length of about 21.2 m. The shunt movements involved the remarshalling of six (multiple-platform) wagons with a combined overall consist length of about 660 m. There was no evidence that any mechanical defects were affecting the locomotive's operation.

The locomotive 8122 was fitted with a *Hasler data logger*, an electro-mechanical strip chart recorder. The logger recorded data such as time, speed, throttle position, vigilance control and brake pipe pressure, on a waxed paper tape.

Locomotive data loggers provide essential evidence in verifying the sequence of events during an investigation. In this case, the tape recovered from locomotive 8122 was damaged and in very poor condition when provided to the ATSB. The damage to the tape was near the data critical to the derailment sequence and prevented the accurate examination and analysis of events. Consequently, the data logger information could not verify the position of locomotive 8122 relative to signal DYN150 before it moved off and ran through points 143.

Train crew

The driver of locomotive 8122 had worked in the rail industry for about 8 years and had been qualified as a driver for 5 years. The driver's route competency included a number of main line routes and local areas – including the MFT. The driver was familiar with the shunting operations at the MFT.

There was no evidence to suggest impairment of the driver's performance from fatigue or other factors. Similarly, the driver's health assessment records met the required National Standard for Health of Rail Safety Workers. Following the derailment, the driver underwent a routine drug and alcohol-screening test, which returned a negative result. There was no evidence to suggest that any medical or physiological factors affected the driver's performance leading up to or during the derailment.

Freight terminal operations

There were four Pacific National facilities managed at this locality. These included the Melbourne Freight Terminal (MFT), the Melbourne Operations Terminal, the Locomotive Provisioning Centre and the Wagon Maintenance Centre. The facilities all had direct rail connections to the ARTC network.

The MFT contained multiple shunt roads used to load, unload and marshal wagons. The shunt roads within the terminal were not long enough to wholly accommodate the average train length, and as such, longer trains required shunting out of the MFT and onto the main line.

A shunt planner located in the terminal 'tower' coordinated shunt movements within the MFT. A shunter was also positioned on the ground (usually towards the rear of the train consist). The shunter operated the yard points and directed the locomotive driver on where to position the train for the coupling of wagons on the required shunt roads. Where a shunt movement was required to exit the terminal and move onto the main line, the shunt planner contacted the NCO to facilitate the clearing of the relevant main line signals.

Communication

The means of communication between the MFT shunt planner and the NCO was by way of landline telephone. The MFT shunt planner also had an Ultra High Frequency (UHF) base radio for communication with the terminal shunters and the locomotive drivers.

The locomotive 8122 was fitted with the AWARE¹¹ train radio system, providing the driver with direct voice communication to the relevant train control, the MFT shunt planner, and the shunter on the ground. Prior to obtaining access onto the ARTC track, the driver had logged access to the system using the prescribed code. The radio communication system was serviceable at the time of the derailment.

Operational rules

Section 12 of the *ARTC Code of Practice for the Victorian Main Line Network (TA20)* documents the rules for shunting of freight wagons on the ARTC main line, including the Dynon area. While generally under the instruction of a shunter, a train driver must also comply with the network's fixed signals. That is, it is not permissible to shunt vehicles past a signal displaying a stop (red) indication, even if the shunter directs the movement.

If there is a requirement for a shunt movement to pass a signal, a route must be authorised by the NCO. A route is defined as 'a section of track between one signal and the next, along which an authorised movement is to be made'¹².

Railway signalling systems usually facilitate single direction train movements from one signal to the next, so it is not normal practice for trains to change direction or divert from the original authorised route. *Short shunting* is a term commonly used to describe a diversion from an authorised route. The ARTC rules provide further clarification regarding the term *short shunting*:

'Short Shunting' is defined as a train movement whereby the train does not complete the full signalled route, in order to take an alternative route at a midway point.

Signalling in track circuited areas is generally designed directionally, so that when the rear of a train clears the fouling point, a cross movement can be performed behind that train, even though the rear of that train may not have cleared the opposing Fixed Signal.

A shunting movement must complete the full signalled movement prior to reversing the direction of the train in order to take an alternative route.

'Short Shunting' is not permitted.

A shunting movement may reverse direction within a set route, provided the integrity of the route is not compromised (i.e.: the route is not altered whilst the train is in between the controlling Signals).

In this instance, the authority of the controlling Signaller must first be obtained.

It is clear from the rule that diverting from the authorised route is short shunting and thus not permitted at any time. However, the rule also provides clarification regarding the permitted reversal of direction within an authorised route. That is, as there is no alteration to the route and only a reversal of direction, the movement is not classified as short shunting and is permitted so long as authority is provided.

In this case, the shunting operation undertaken by locomotive 8122 required a series of movements involving various shunt roads in the MFT and movement out onto the ARTC mainline via signal DYN150. The methodologies employed were accepted and commonly-practiced procedures for shunting at the MFT. At the time when locomotive 8122 needed to pass signal DYN150, the shunt planner requested authority from the NCO for shunt operations to move out past the signal. The NCO provided authority by setting a route between signal DYN150 and signal MGL57 (local line at Footscray).

When signal DYN150 cleared, shunt operations continued within the route set between signals DYN150 and MGL57. In conjunction with the instructions given by the shunter located on the

¹¹ Australia Wide Augmented Radio Environment System, a touch screen communications system. An AWARE screen is provided for both the driver and observer (co-driver) positions in the locomotive cab.

¹² Rail Industry Safety and Standards Board (2010), Glossary of Rail Terminology – Guideline.

ground in the MFT, the driver of locomotive 8122 followed the signalled route onto the main line. At no stage did the driver communicate directly with the NCO.

As noted previously, shunt movements were permitted to reverse direction so long as the route (between the two signals) could not be altered; that is, while the tracks between the signals remained occupied. If the entire train and locomotive had moved back behind the signal (clear of the track circuits), movements within the route would be considered complete and the driver would again need to abide by the relevant signal indication. Should the shunting operation need further forward movement and occupancy of the track ahead of the signal, authority from the NCO would once again be required.

These actions were all consistent with the ARTC rules. Authority was obtained to shunt within the route set between signals DYN150 and MGL57; including reversal of direction as was common practise at the MFT. There was no intention by the NCO to compromise (or alter) the route set between signal DYN150 and signal MGL57.

Operational procedures

ARTC *Standing Train Notices* provide notice of temporary or permanent alterations to the ARTC network. In October 2009, the ARTC issued notice (1983/2009), providing instructions related to shunting movements at the MFT. The notice stated:

As part of shunting operations at the Pacific National Melbourne Freight Terminal, a train or locomotive movement may need to shunt onto the ARTC main line outside either end of the terminal within specified limits.

PN must clearly outline the limits and moves required for the planned shunt to the ARTC Melbourne Metro Train Controller.

Before clearing the relevant signal for the shunt movement, the Train Controller must:

- * Block relevant motor operated points that the movement is to traverse as required.

The Train Controller must maintain point blocking until the train or loco has completed the shunt and PN has advised that the movement is completely behind a controlled signal.

Point blocking is a facility used to prevent the operation of the points. The procedure defined in the notice provided an additional control measure to ensure the integrity of the authorised route and prevent short shunting. That is, all points that may provide an opportunity to alter the route are prevented from operating.

In this case, the PN shunt planner requested authority from the NCO for shunt operations to move out past signal DYN150. The NCO provided that authority by setting a route between signal DYN150 and signal MGL57 (local line at Footscray), but did not block points 143.

The investigation found that the driver of locomotive 8122 initially passed signal DYN150, which was displaying a proceed indication, with the intention of conducting a number of shunt movements. Shunting included reversing direction and pushing back towards the MFT. Recorded signal data indicated that during the shunt movement, the track section ahead of DYN150 registered being clear of any occupancy. This condition implied that locomotive 8122 had moved back behind DYN150. As the signal interlocking system now registered the route from DYN150 as complete, the system automatically operated points 143 to set the stored route for train 9794 from Footscray.

From the driver's recollection, the locomotive had pushed back to a point where it was adjacent signal DYN150, but had not returned behind DYN150 at any time during shunting. As such, there was no trigger for the driver to notify the NCO before moving forward. When again requested by the shunter to move forward, the driver continued shunting as though the route from DYN150 was still available for shunt operations.

As the signalling system had previously registered the route from DYN150 had cleared, the subsequent occupation of the tracks beyond the (red) signal resulted in the NCO receiving a SPAD alarm.

Safety analysis

From the ATSB's investigations and examination of recorded signalling data, it was evident that there had been a disparity between the driver's observations and the indications displayed on the Phoenix signalling system, with respect to the relative position of locomotive 8122 and signal DYN150.

The following analysis examines the possibility that the integrity of the route set from DYN150 (for shunting) was compromised, resulting in the NCO receiving a SPAD alarm, the operation of points 143, and the subsequent derailment of locomotive 8122. The actions taken in response to the SPAD alarm and subsequent derailment are also examined.

Track infrastructure

The signalling system relied on track circuits to detect the location of rail vehicles. In simple terms, a track circuit uses the rails as electrical conductors to allow a power supply to energise a relay. Rail vehicle wheels and axles electrically short-circuit the two rails, which prevents energising of the relay, thereby detecting the presence of the rail vehicle. Insulated rail joints¹³ (IRJs) provide electrical isolation between consecutive track circuits while maintaining the structural integrity of the rail for train movements.

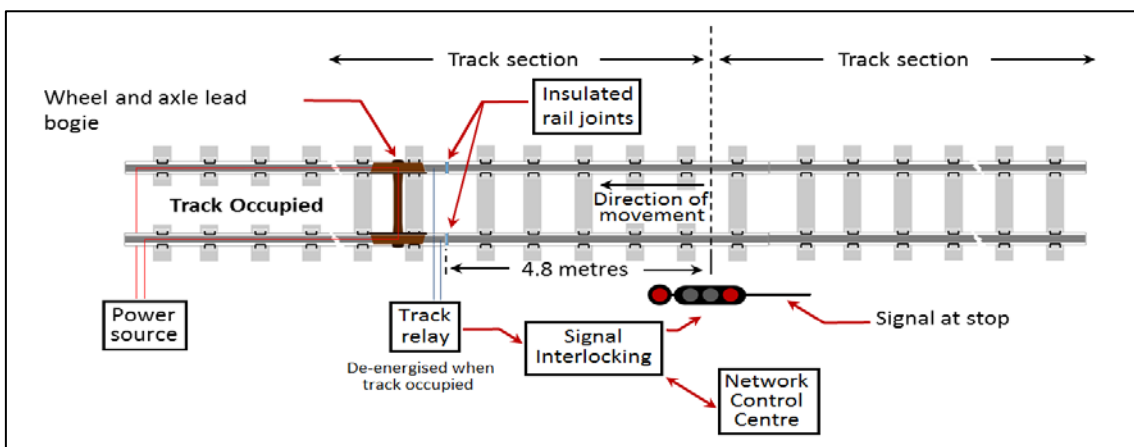
To ensure the position of a rail vehicle is detected accurately with respect to the position of fixed line-side signals, it is essential that the IRJs are appropriately located – usually immediately adjacent the signal.

In this case, an examination of the track infrastructure for signal DYN150 found the IRJs were located about 4.8 m ahead of the signal's physical position (Figure 4). This was non-compliant with the ARTC procedure¹⁴, which specified the following requirement:

Ideally the insulated rail joints shall be located directly in line with signal to which they apply and no more than 2 m past the signal.

ARTC inspection records from January 2009 listed the position of the signal relative to the IRJ as being correct. There was no record of any significant changes to the infrastructure associated with signal DYN150 between the 2009 inspection and the derailment. The ARTC had no record of the reasons or considerations behind the installation of the IRJs 4.8 m past signal DYN150.

Figure 4: Schematic of rail vehicle axle, track circuit and signal displaying stop indication



Source: ATSB.

¹³ A rail joint manufactured from components and assembled such that the joined rails are electrically insulated from each other.

¹⁴ ARTC Engineering (Signalling) Procedure ESC-07-01 Installation of Trackside Equipment

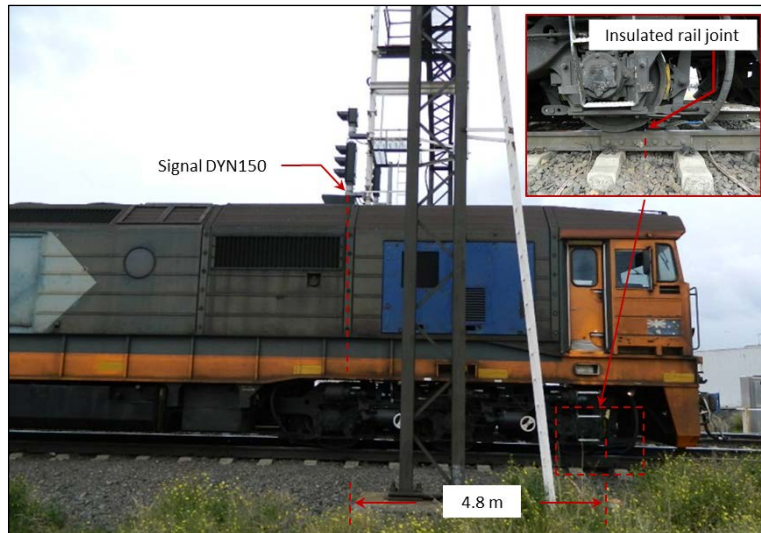
Track circuits

Track circuits do not detect a transition of occupancy until the lead wheelset of a rail vehicle has traversed the IRJs. If the IRJs are positioned ahead of a signal, the front of a rail vehicle may already be past the signal before its lead wheelset crosses the IRJs. Conversely, a movement in the opposite direction will be detected clear of the track circuit even though the rear of the train still occupies the track ahead of the signal.

Following this incident, an exemplar locomotive was placed adjacent to signal DYN150, in a position where the lead wheels of the front bogie were immediately behind the IRJs (Figure 5) and not detected by the track circuit located ahead of the signal. The position was consistent with the driver’s recollection of locomotive 8122 before it moved towards points 143 and subsequently derailed. In this position, it was evident that a driver in the locomotive cab would not be able to observe the aspect of signal DYN150.

In this case, the driver recalled pushing the shunt movement back into the MFT and stopping (under instruction of the shunter) in a position similar to that illustrated in Figure 5. The locomotive had not moved behind the signal and consequently the driver had no reason to believe he did not still have authority to continue shunt operations beyond signal DYN150. Had the locomotive been behind the signal, the driver may have observed the signal and been prompted to request a further authority to pass the signal for the next shunting move.

Figure 5: Exemplar locomotive near signal DYN150 and IRJ’s



Source: Pacific National with annotation by ATSB.

While there was insufficient evidence to discount the possibility that locomotive 8122 actually had pushed back behind signal DYN150, it was clear that the infrastructure configuration could permit a scenario whereby a locomotive driver may remain unaware that the expected route from signal DYN150 had not been maintained during shunt movements.

Existing risk controls

Regardless of the stopping point of the locomotive (either adjacent the signal or completely behind), the signalling system detected the track beyond signal DYN150 as clear. This released the route and allowed operation of points 143, which altered the route that had been set between signal DYN150 and signal MGL57 (for the shunting).

The ARTC had recognised the potential for this scenario and issued Standing Train Notice 1983/2009 to provide specific additional protection. That is, even if the route set between signal DYN150 and signal MGL57 became unoccupied, the integrity of the route could not be compromised (or altered) until the NCO had verified that the train or loco had returned completely behind signal DYN150.

All parties have responsibilities under Standing Train Notice 1983/2009, PN to communicate the planned shunt and the ARTC to apply blocking facilities to the relevant points. In this instance

however, the driver, shunt planner and Network Control Officer had not implemented these procedures.

There is no clear reason why neither party initiated the requirements of the notice in this case, nor was there any evidence to suggest the lapse was a common occurrence. Both the ARTC and PN have initiated action to reinforce the requirement for relevant personnel to implement the instructions of Standing Train Notice 1983/2009 when shunting at the MFT (refer to *Safety issues and actions* section below).

Incident response and communication

To mitigate further risk following the development of this occurrence, two key events required an effective and timely response. The first was the SPAD alarm generated by the signalling system indicating a limit of authority overrun, and the second was the actual derailment of locomotive 8122 at points 143.

Signal passed at danger

The ARTC *Code of Practice for the Defined Interstate Rail Network, Operations and Safeworking, Issue 2* (ARTC Annotated Version May 2002) documented the required action by the NCO when responding to a SPAD alarm. The code required the NCO to promptly react to emergencies or unusual circumstances and to protect the train that had overrun and any other train that may come into conflict. The code's intent was for the NCO to promptly stop the train that had overrun its limit of authority and to stop any other movements that were at risk.

In this case, in response to the SPAD alarm, the NCO contacted the MFT shunt planner, rather than the driver of locomotive 8122, and a conversation began regarding the SPAD at DYN150. The driver was unaware of the SPAD alarm and did not recall receiving any instruction from either the NCO or the MFT shunt planner to stop the train.

Analysis of network voice recordings indicated that the shunt planner (during his conversation with the NCO) made a short call to the driver by UHF radio and used the phrase 'red light'. This phrase was identical to the normal expression used by the shunter when directing a driver to stop, before making further directions to complete a particular shunt movement. The shunt planner's 'red light' phrase did not alert the driver to the significance of the message and there was no follow up by the shunt planner to confirm that the driver had received and understood the communication.

The absence of direct communication between the driver and the NCO meant that the driver remained unaware of the SPAD alarm. The adopted process failed to ensure protection (in this case against derailment) for the train identified by the signalling system as having exceeded its authority.

Derailment of locomotive 8122

Without receiving clear instructions to the contrary and unbeknown to the NCO and MFT shunt planner, the driver of locomotive 8122 continued shunt operations that led to the derailment at points 143.

The ARTC *Code of Practice for the Victorian Main Line Network* documented the action required by a locomotive driver in response to an emergency scenario (such as a derailment). Drivers were required to advise the NCO by radio that a derailment had occurred and that the safe operation of the line was affected. Contrary to this however, the driver said that his first action in this case was to contact the MFT shunt planner, before relaying the information to other Pacific National representatives. The driver did not directly contact the NCO and there was no recorded evidence verifying discussions between the driver and the shunt planner. Examination of the train control voice logs indicated that almost 30 minutes passed before all parties became aware of (and confirmed) that locomotive 8122 and a wagon had derailed at points 143.

Communication

Typically, a driver would request an authority to enter the main line from a shunting yard or terminal directly from the NCO. This establishes a direct line of communication between the driver and the NCO.

The process for obtaining an authority in and about the MFT differed because of the type and frequency of train movements undertaken. For operational reasons, the shunt planner (rather than the driver) would contact the NCO to request an authority to enter the main line. This process inherently limited direct communication between the locomotive driver and the NCO – including on this occasion, the more urgent communications related to the SPAD alarm.

While communicating through a third party (the MFT shunt planner) may have been suitable for managing routine shunt operations at this location, it was evident that communication in response to the SPAD alarm was ineffective, as shunt operations continued and locomotive 8122 subsequently derailed. Furthermore, significant time passed before the NCO and the MFT shunt planner became fully aware of the derailment.

The investigation found that although communication systems and protocols were in place, the NCO and the train driver did not directly communicate following the SPAD alarm or the subsequent derailment. Had this communication occurred, it was possible that there would have been sufficient time to stop the train before the arrival at the points, or at least alert the driver and prevent the subsequent reverse manoeuvre that produced the derailment. Similarly, had the driver immediately reported the derailment directly to the NCO, actions could have been taken much earlier to ensure the protection of this and other train movements in the vicinity.

Findings

From the evidence available, the following findings are made with respect to the derailment of locomotive 8122 at South Dynon Junction, West Melbourne, Victoria, on 25 July 2013. 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 driver, shunt planner and Network Control Officer did not implement the procedures documented in ARTC Standing Train Notice 1983/2009.
- **The placement of the insulated rail joints adjacent to signal DYN150 was not in accordance with the ARTC engineering procedure ESC-07-01. [Safety issue]**
- The Network Control Officer did not contact the driver of locomotive 8122 following receipt of the SPAD alarm.
- The driver of locomotive 8122 was unaware that points 143 were set incorrectly for the passage of the locomotive.
- **The practice of using a third party (the shunt planner) to facilitate communication between Network Control Officers and train drivers at the Melbourne Freight Terminal prevented an effective response to the emergency. [Safety issue]**

Other factors that increased risk

- The driver of locomotive 8122 did not immediately report the derailment to the Network Control Officer.

Other findings

- The data log tape from locomotive 8122 was damaged and in very poor condition when provided to the ATSB, so could not be used to verify the sequence of events.

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.

Where relevant, safety issues and actions will be updated on the ATSB website as information comes to hand. The initial public version of these safety issues and actions are in PDF on the ATSB website.

The insulated rail joints were incorrectly placed

Number:	RO-2013-020-SI-01
Issue owner:	Australian Rail Track Corporation
Operation affected:	Network Infrastructure
Who it affects:	Network Control

Safety issue description:

The placement of the insulated rail joints adjacent to signal DYN150 was not in accordance with the ARTC engineering procedure ESC-07-01.

Proactive safety action taken by Australian Rail Track Corporation

Action number: RO-2013-020-NSA-097

Within Victoria, the Australian Rail Track Corporation initiated a survey to measure and record the position of insulated joints relative to the position of the signal to which they refer. Sites where the maximum specified distance was exceeded were entered into a risk-based and prioritised remediation plan.

Current status of the safety issue

Issue status: Adequately addressed

Justification: The ATSB is satisfied that the action taken by the ARTC addresses this safety issue.

Communication protocols at the Melbourne Freight Terminal

Number:	RO-2013-020-SI-02
Issue owner:	Pacific National
Operation affected:	Rail: Operations Control
Who it affects:	Network Control

Safety issue description:

The practice of using a third party (the shunt planner) to facilitate communication between Network Control Officers and train drivers at the Melbourne Freight Terminal prevented an effective response to the emergency.

Proactive safety action taken by Pacific National

Action number: RO-2013-020-NSA-098

Pacific National has formally communicated the requirements of ARTC Train Notice 1983 - *Shunting for Train and Locomotive Movements at Melbourne Freight Terminal* to all Melbourne Freight Terminal (MFT) Shunt Planners, through the issue of Local Safety Notice LSN-Melb-13/01 - *Short Shunting Movements between Opposing Fixed Signals*. The notice reiterates the following:

- All communications with ARTC Network Controllers are to be undertaken in accordance with ARTC Train Notice 1983;
- All MFT Shunt Planners are to contact the ARTC Network Controllers to request access and nominate departure signals for shunting movements entering the ARTC network from the MFT; and
- Once the shunting movement has entered the ARTC network the Network Controller is to contact the Locomotive Driver directly regarding any issues or to provide further instructions in relation to the shunting movements.

To ensure the protocols are followed as required, Pacific National has formally advised ARTC of its requirements for communications between MFT and the ARTC Network Controller.

Current status of the safety issue

Issue status: Adequately addressed

Justification: The ATSB is satisfied that the action taken by Pacific National addresses this 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

Proactive safety action taken by the Australian Rail Track Corporation

The ARTC has issued a Network Control Centre Notice (Notice number 021, issued 16/9/2015), drawing attention to the requirements of Standing Train Notice 1983/2009 and that all Network Controllers are to adhere to the instructions regarding the blocking of points over which a shunt is to traverse at the MFT.

General details

Occurrence details

Date and time:	25 July 2013 – 1730 EST	
Occurrence category:	Accident	
Primary occurrence type:	Derailment	
Location:	4.429 km from Southern Cross Station, Melbourne, Victoria	
	Latitude: 37°48'17.25"S	Longitude: 144°54'42.05"E

Train details

Train operator:	Pacific National	
Locomotive	8122	
Wagons	6	
Type of operation:	Freight - shunting	
Persons on board:	Crew –	1
Injuries:	Crew –	Nil
Damage:	Minor	

Sources and submissions

Sources of information

The sources of information during the investigation included:

- Pacific National Pty Ltd
- The Australian Rail Track Corporation
- The driver of locomotive 8122

References

- Rail Industry Safety and Standards Board (2010), Glossary of Rail Terminology – Guideline.
- Code of Practice for the Defined Interstate Rail Network, Operations and Safeworking, Issue 2 – ARTC Annotated Version May 2002
- ARTC Code of Practice for the Victorian Main Line Operations Issue 1, Revision 2, 07 August 2011

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 the Office of the National Rail Safety Regulator, Pacific National, the Australian Rail Track Corporation, and the driver of locomotive 8122.

Submissions were received from all parties. These were reviewed and where considered appropriate, the text of the report was 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 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 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

Enquiries 1800 020 616

Notifications 1800 011 034

REPCON 1800 011 034

Web www.atsb.gov.au

Twitter @ATSBinfo

Email atsbinfo@atsb.gov.au

Investigation

ATSB Transport Safety Report Rail Occurrence Investigation

Derailment of locomotive and wagon during main line shunting
South Dynon Junction, West Melbourne, Victoria, 25 July 2013

RO-2013-020

Final – 16 October 2015