



Office of Transport Safety Investigations

RAIL SAFETY INVESTIGATION REPORT

RUNAWAY OF ROLLING STOCK

ENFIELD YARD

3 MAY 2011



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Established on 1 January 2004 by the Transport Administration Act 1988, and confirmed by amending legislation as an independent statutory office on 1 July 2005, OTSI is responsible for determining the causes and contributing factors of accidents and to make recommendations for the implementation of remedial safety action to prevent recurrence. Importantly, however, OTSI does not confine itself to the consideration of just those matters that caused or contributed to a particular accident; it also seeks to identify any transport safety matters which, if left unaddressed, might contribute to other accidents.

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GLOSSARY OF TERMS

Blocking Facility	A facility or device used by a Qualified Worker to prevent the operation of points or signalling equipment.
FAID (Fatigue Audit Interdyne)	A computerised model that calculates a fatigue score which is compared with the fatigue expected to be induced by working a particular pattern of work. The principal use of FAID is to assist in the management of shiftwork, scheduling and fatigue risk.
Fouled	Partially or completely blocking a railway line.
Network Procedures	Procedures issued by RailCorp for the safe conduct of work on the RailCorp network. (To be read in conjunction with Network Rules)
Network Rules	Rules issued by RailCorp to mandate the requirements for safe operation on the RailCorp network. (To be read in conjunction with Network Procedures)
Points	A crossing comprising of two matching half sets of points together with associated components. A set of points permits rail traffic to change from one track to another. Points are nominally referred to as left or right hand denoting the turnout direction as viewed from the toe end.
Qualified Worker	A worker certified as competent to carry out the relevant task.
Rake	A string of wagons or other rolling stock.
Signaller	A Qualified Worker who works points, signals and other signalling equipment to manage routes for safe and efficient transit of rail traffic.
Stabled	Parked.
Track Circuit	An electric circuit where current is carried through the rails and used to detect the presence of trains. Track circuits are used in the operation and control of points and signalling equipment.
Train Controller	A Qualified Worker who authorises, and may issue, occupancies and proceed authorities, and who manages train paths to ensure safe and efficient transit of rail traffic in the RailCorp Network.
Triple Valve	A valve in the air brake system that allows air, under pressure, to enter the brake cylinder, so applying the brake to a wheel or venting the air from the cylinder so allowing the brakes to release as required.
'Up and Down' directions	Trains travelling towards Sydney are referred to as Up trains. Movements in this direction are referred to as being in the Up direction. Trains travelling away from Sydney are referred to as Down trains. Movements in this direction are referred to as being in the Down direction.

EXECUTIVE SUMMARY

On Tuesday 3 May 2011 at approximately 12:45pm, a Pacific National Terminal Operator was changing brake blocks on a rake of 28 loaded aggregate wagons stabled in North Road No.1 in Enfield Yard. When he released the air pressure in the braking system on a wagon in the centre of the rake in order to change a brake block, the remaining brakes applied to the rake did not hold the rake on the prevailing grade and it began to run away.

The Terminal Operator's attempt to stop the rake by applying hand brakes on two wagons as they passed was not successful. The rake ran away through the yard and entered South Road No.1 colliding with another stabled rake consisting of 15 empty fuel tanker wagons and three flat bed wagons (located at the opposite end). The force of the collision caused the tanker bogie closest to the point of collision to derail.

The combined rakes continued, with two of the tankers derailing and slewing across the track, carrying away two shunting signals and an overhead wiring portal stanchion. The two rakes came to rest approximately 460 metres from the point of collision with the derailed tankers foul of the Up and Down Main lines. The rake of aggregate wagons ran away for a total of 1085 metres.

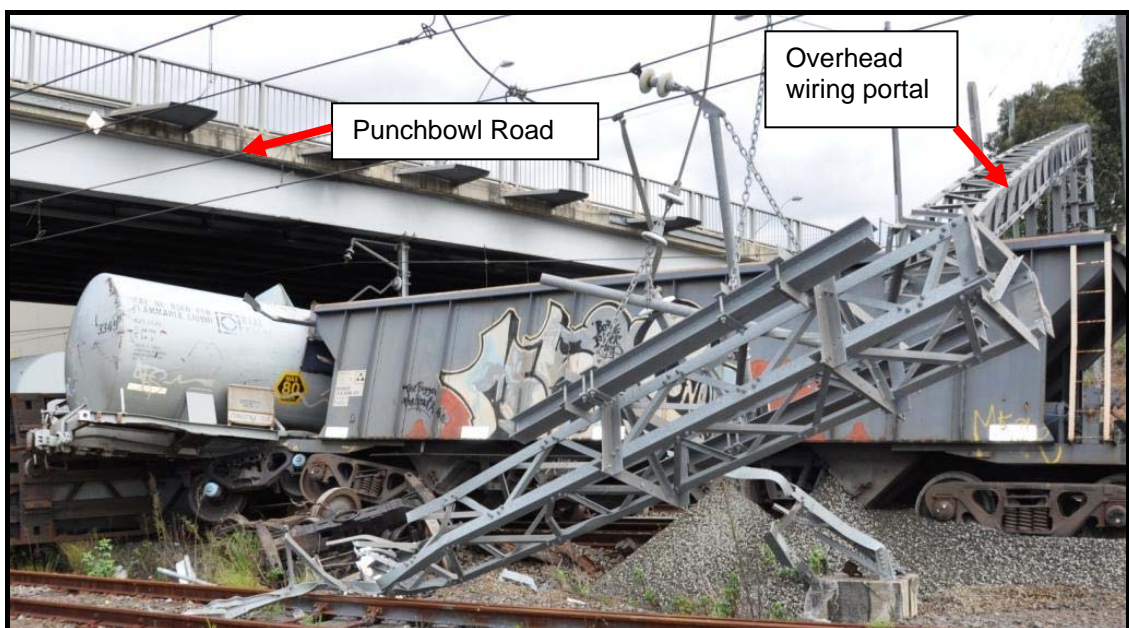
The investigation established that too few handbrakes had been applied to the rake in order to hold it on the prevailing grade. Pacific National's maintenance regime and training of terminal operators was not adequate for the effective maintenance of brakes on rolling stock that did not have slack adjusters. Also, Pacific National did not comply with the Safety Interface Plan and Management Agreement with RailCorp in regard to controlling the risk of runaways. Further, Pacific National did not comply with its own procedures for risk assessments to test the efficacy of its minimum requirement for handbrake application at Enfield Yard.

In the interests of enhancing safety, the investigation has identified a number of safety issues for improvement including Pacific National's non-conformance with its own procedures for undertaking risk assessments, and gaps in training and procedures in relation to brake maintenance. Details of all the Findings and Recommendations are contained in Parts 3 and 4 respectively.

PART 1 THE INCIDENT

Incident Synopsis

- 1.1 At approximately 12:45pm on 3 May 2011, a rake of 28 wagons ran away from North Road No.1 in Enfield Yard during maintenance activities. The rake was owned by Pacific National and loaded with aggregate (11 RHGF type wagons loaded with stone chips and 17 NPZH type wagons loaded with sand) and making up the consist of Pacific National train 9134. The rake travelled in an uncontrolled manner through the yard before colliding with a rake of 15 empty fuel tanker wagons stabled in South Road No.1. Three flat bed wagons were also attached to the tankers, at the opposite end to that at which the collision occurred. The force of the collision caused the tanker bogie at the point of collision to derail.
- 1.2 The two rakes continued with the derailed bogie travelling about 428 metres, before it struck No. 120 points. This caused the other bogie on that tanker and both bogies of the tanker immediately in advance to derail. The tankers slewed across the track carrying away two shunting signals and an overhead wiring portal stanchion before coming to rest approximately 460 metres from the point of collision. The slewed tankers were foul of the Up and Down Main lines. The rake of aggregate wagons ran away for a total of 1085 metres.



Photograph 1: View of runaway damage (part)

Organisations Involved

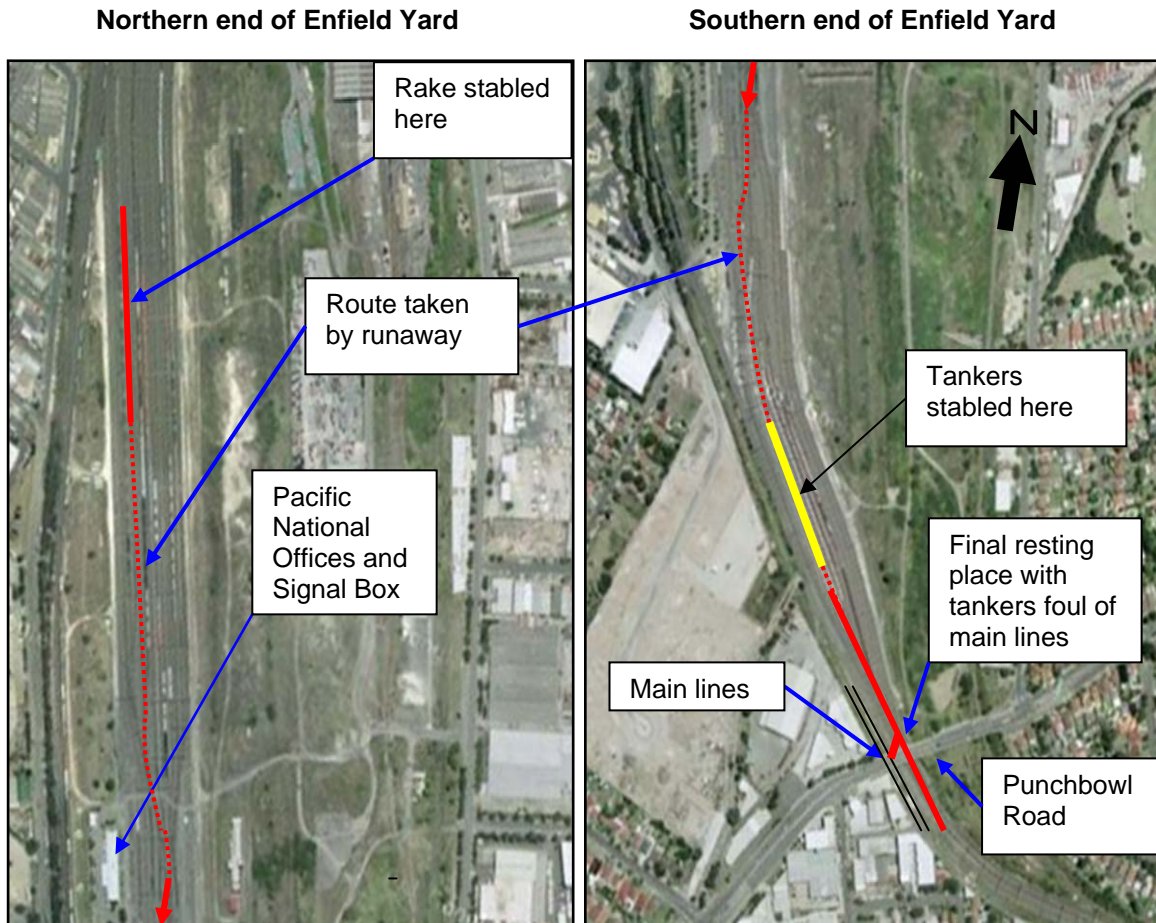
- 1.3 Pacific National is the operator of Enfield Yard and authorises train movements into and within the yard. A shift supervisor is on duty to manage and authorise these movements.¹ The Pacific National Enfield Shift Supervisor authorises all movements on track circuited areas through the RailCorp signaller, and in non-track circuited areas directly with terminal operators or train crew.
- 1.4 RailCorp owns and maintains the yard, excepting the wagon repair road, and employs a signaller who operates signalling equipment to allow movements into and within the yard in consultation with the Pacific National Enfield Shift Supervisor. RailCorp owns, maintains and operates the main lines that run past and give access to Enfield Yard. Train control is managed by a train controller located within the RailCorp Rail Management Centre (RMC) located at Central Station.
- 1.5 The operation of the yard is regulated by a Management Agreement between Pacific National and RailCorp and there is also a Safety Interface Plan in force.

Location

- 1.6 Enfield Yard was originally developed as a railway freight yard in 1916. It is located between the Sydney suburbs of Greenacre and Belfield about 15km from Sydney's CBD. The yard is approximately 0.5km in width and 2km in length, extending from the Hume Highway to the North to just beyond Punchbowl Road to the South. During 1996-97 the yard was reconstructed and the current layout dates from this period.
- 1.7 The yard is aligned north-north-west (the 'North' end) to south-south-east (the 'South' end) with a falling grade towards the South end of, predominantly, 1 in 100. The original design of the yard utilised the falling grade for 'gravitational' shunting to place wagons, individually or in groups, into different roads (depending on destination), to make up trains. In later times, as rail freight moved away from general freight with multiple destinations to containerised and bulk traffic, this type of shunting became less used and today is not employed at all at Enfield Yard.

¹ RailCorp Safety Interface Plan for Enfield Yard, version 0.2, July 2009, section 8.1 (c).

- 1.8 The signals within the yard are controlled from Enfield Signal Box which is located within the Pacific National offices in the yard. However, some areas within the yard are neither track circuited nor signalled which means that the signaller has no visibility, on his mimic board², of the location of rail traffic or rolling stock in those areas.
- 1.9 Overhead wiring (1500V) is in place over much of the yard, including the incident site, but is generally little used. At the time of the incident, the 1500V power supply to the yard was isolated (turned off) across the whole yard and had been since 12 October 2010 to facilitate the construction of a major road bridge across the middle of the yard.
- 1.10 Double main lines run past to the West of the yard. The main line does not have any passenger services scheduled on it.

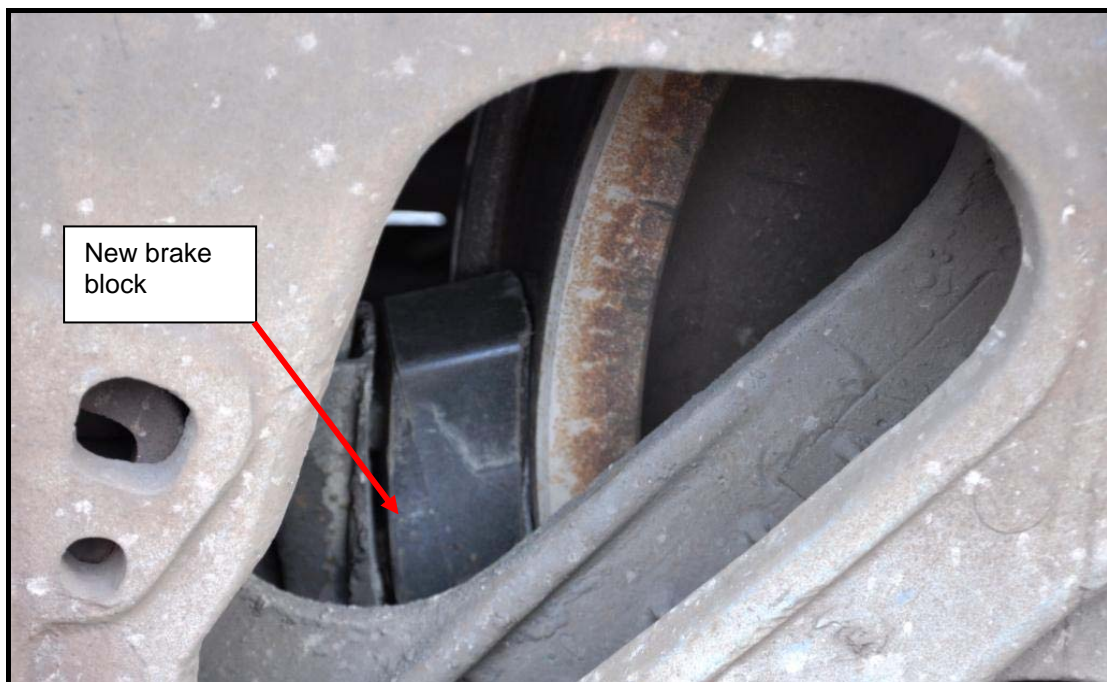


Photograph 2 : Contiguous aerial views of Enfield Yard

² Mimic Board: A display at the signaller's work station showing the state of signalling equipment and position of rolling stock.

Before the Incident

- 1.11 The 28 aggregate wagons arrived in the early hours of Saturday 1 May 2011 having been loaded previously at Dunmore Quarry, near Kiama in the Illawarra region of New South Wales. The wagons were stabled in North Road No.1 within Enfield Yard. The rake was positioned by a Pacific National train crew while a Pacific National Terminal Operator detached the locomotives, applying hand brakes to consecutive wagons at the Southern or 'downslope' end of the rake to secure it. The rake was scheduled to remain at this location until Wednesday 4 May. It was unusual for the loaded rake to be stabled in Enfield Yard for this extended period but wet weather had caused the suspension of the service by the customer.
- 1.12 The same Terminal Operator carried out some routine maintenance activities on the rake between the time it was stabled and the time of the incident, fitting it in with other work. He began at the 'downslope' end and worked up the Eastern side of the rake. The Terminal Operator examined the brakes and replaced brake blocks as required (*Photo 3*). This included brake blocks on three of the wagons with handbrakes applied. In order to change these, the Terminal Operator had to release the hand brake, replace the brake block(s) and then re-apply the hand brake. No additional compensating handbrake was applied to another wagon prior to a handbrake being released.

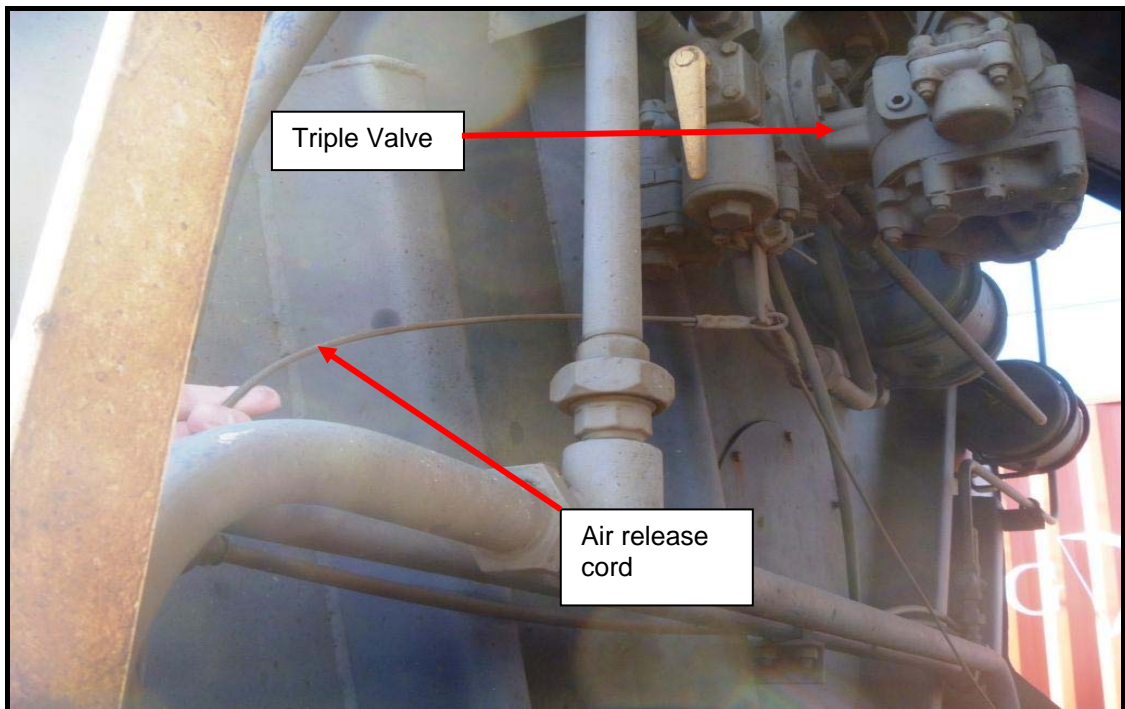


Photograph 3: New brake block fitted on one of the NPZH wagons

- 1.13 On Tuesday 3 May, the same Terminal Operator commenced duty at 12 Noon and walked towards the rake in North Road No.1. As he proceeded he examined one side of another train, replacing one brake block. He then recommenced maintenance activities at the point where he had left off on the Sunday. He completed the eastern side and moved around the 'top of slope' end to the Western side of the rake.

The Incident

- 1.14 The Terminal Operator worked down the Western side of the rake replacing brake blocks as required (one brake block on each of four different wagons) until he came to wagon NPZH35652C just before 12:45pm. The Terminal Operator identified that the first wheel that he came to needed to have its brake block changed. He also noticed that the air brakes were still applied on this wagon as the brake cylinders were still charged with air.³
- 1.15 The Terminal Operator walked to the downslope end of the wagon and pulled the release cable attached to the triple valve to vent the air from the brake system (see *Photograph 4*).



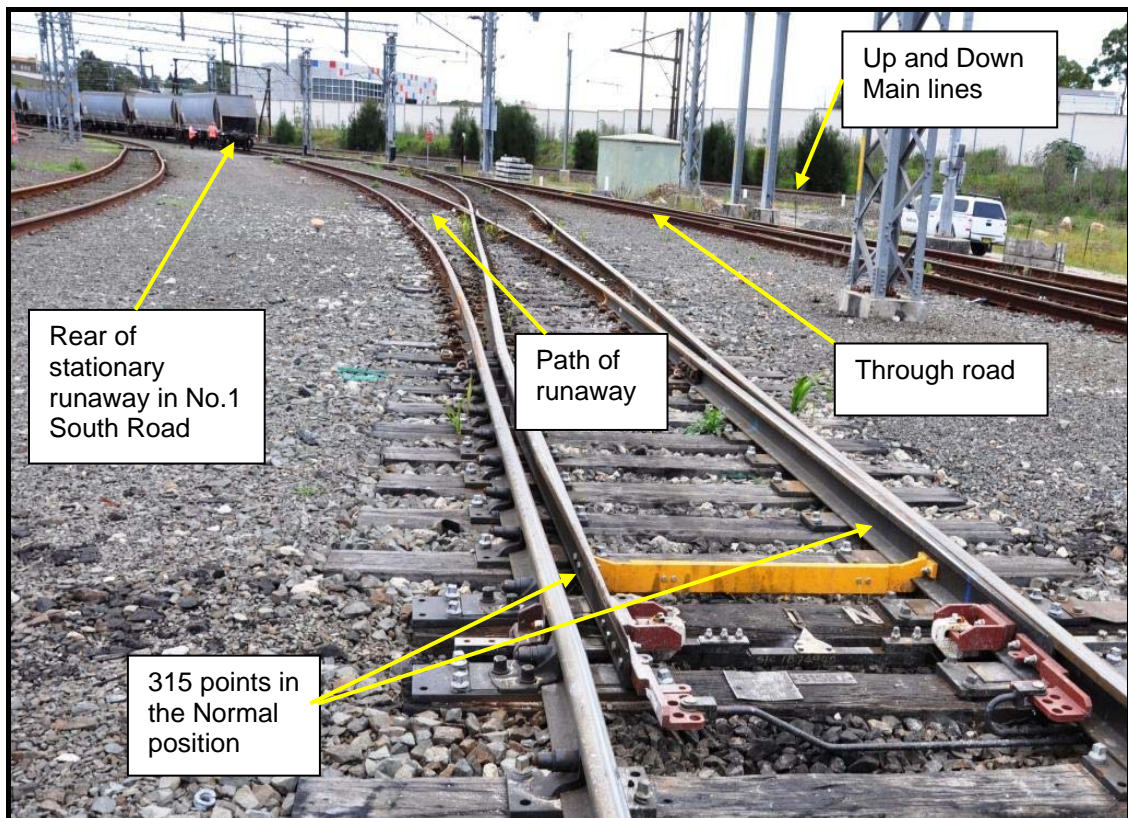
Photograph 4: Auto valve and release cable

³ When a rake is detached from its locomotive(s) the air brakes are applied but, over time, the air pressure tends to bleed off and the air brakes release. However, the air pressure had not bled off on this wagon and so the brake blocks were still applying pressure to the wheel treads.

- 1.16 This action caused the brakes to release, as intended. As the brakes released, the rake began to move. There are two possible mechanisms which could have caused this to occur: the wagon together with the 13 wagons upslope moving under gravity and abutting the stationary wagons downslope may have caused the rake to runaway; alternatively, the portion of the rake downslope of wagon NPZH35652C may have been held stationary by the combination of the air brakes and hand brakes applied on this wagon, and ran away as soon as the air brakes released. The investigation was not able to determine which hypothesis was correct. The fact remains that, despite the applied handbrakes, the rake began to move downhill.
- 1.17 On observing the whole rake move about three metres, the Terminal Operator realised that there was a problem and called the Shift Manager on his hand held radio saying; *“one north is on the move”*.
- 1.18 The Terminal Operator also applied the handbrakes to the wagon he was working on and the first one immediately upslope, as they moved off.
- 1.19 Despite the Terminal Operator's actions, the rake continued to accelerate and he was therefore unable to apply further handbrakes. The Terminal Operator called the Shift Manager again (an estimated 10 seconds after the first call) and stated; *“we have a runaway”*.
- 1.20 The Terminal Operator stated that the Shift Manager set off the ‘runaway alarm’.⁴ The Terminal Operator could not hear it because of his proximity to the runaway that was still passing his location, but he could see the flashing lights.
- 1.21 The Terminal Operator made the following broadcast over the open channel WB radio frequency; *“Anyone on WB in Enfield Yard; runaway here (pause) run off”*.
- 1.22 The runaway continued to accelerate under the effect of gravity and exited North Road No.1 passing onto an area of the yard where rail traffic can be routed from and towards various different roads. The runaway continued to No. 315 points, which were in the Normal position, causing the runaway to be

⁴ Runaway Alarm - Enfield Goods Yard has an alarm comprised of flashing lights and a siren that can be manually operated to warn workers in the yard of a runaway.

directed towards South Road No.1 in which a rake of 15 empty fuel tankers and three flatbed wagons was stabled (see *Photograph 5*).

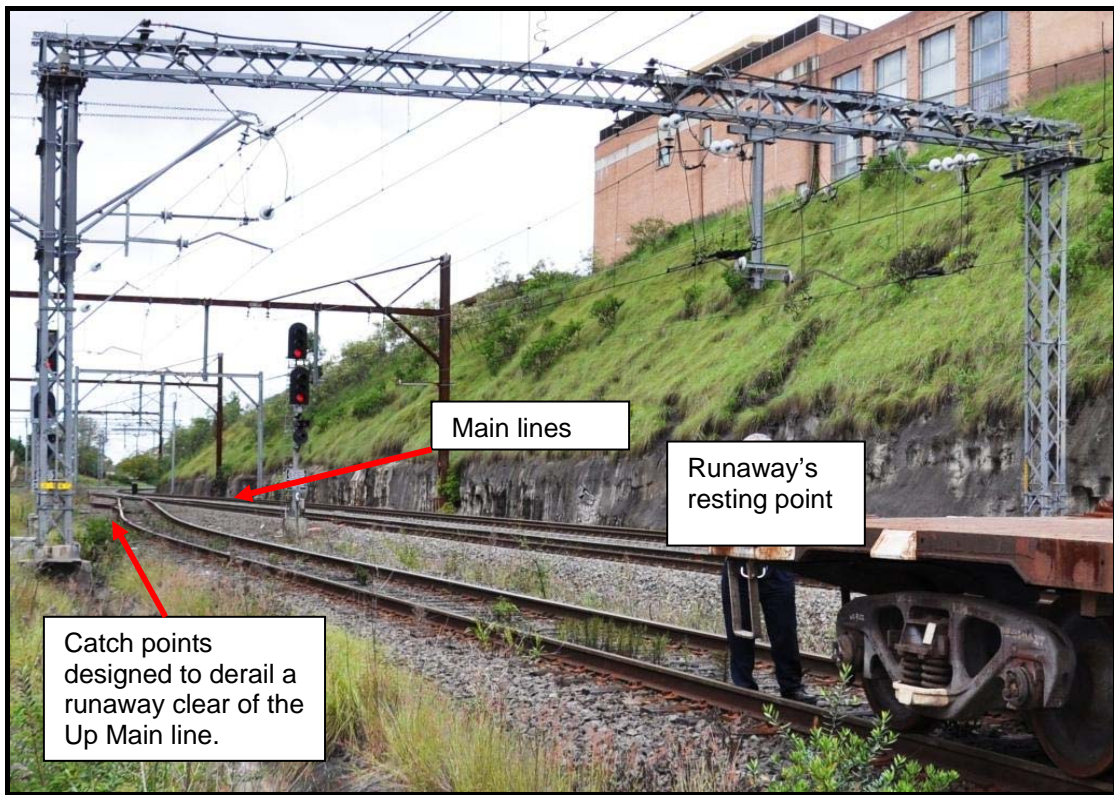


Photograph 5: View looking South towards the runaway at 315 points

- 1.23 The northern most tanker was located at 14.763km⁵ and the runaway wagons collided with it, having travelled approximately 630 metres at this point.
- 1.24 The force of the collision lifted the bogie of the first tanker clear of the rail head. All four wheels fell back landing to the right hand side of the rails in the direction of travel.
- 1.25 The two rakes, consisting of three empty flat beds (leading), 13 empty fuel tankers and the 28 loaded wagons, continued, with the rearmost bogie of the rearmost tanker in a derailed state.
- 1.26 After travelling 428 metres, the derailed bogie struck No. 120 points which caused the other bogie on that tanker and both bogies of the tanker immediately in advance to derail all wheels. The tankers slewed across the track and carried away two shunting signals and an overhead wiring portal stanchion.

⁵ Distance measured by rail from a point at Sydney's Central Station.

1.27 The rolling stock came to a stand with the leading flat bed at 14.080km (see *Photograph 6*). The runaway had travelled in excess of 1000 metres.



Photograph 6: Runaway came to rest towards the South end of the yard

1.28 The derailed tankers were slewed across Through Road No.1 and straddled the Up Main line intermittently activating the track circuits which alerted the signaller to the probability that the Up Main line was fouled. The tankers were also foul of the Down Main line. There was no rail traffic approaching the area at the time.

Initial Incident Response

1.29 Two separate but interconnected responses occurred as a result of the incident.

1.30 Pacific National's response was as follows:

- The Terminal Operator, using separate channels on his hand-held radio, informed the Enfield Shift Supervisor and the Signaller, followed by a broadcast call in an attempt to warn anyone in the yard (who was listening on the open channel radio) of the runaway.
- The Shift Supervisor set off the 'runaway alarm'.

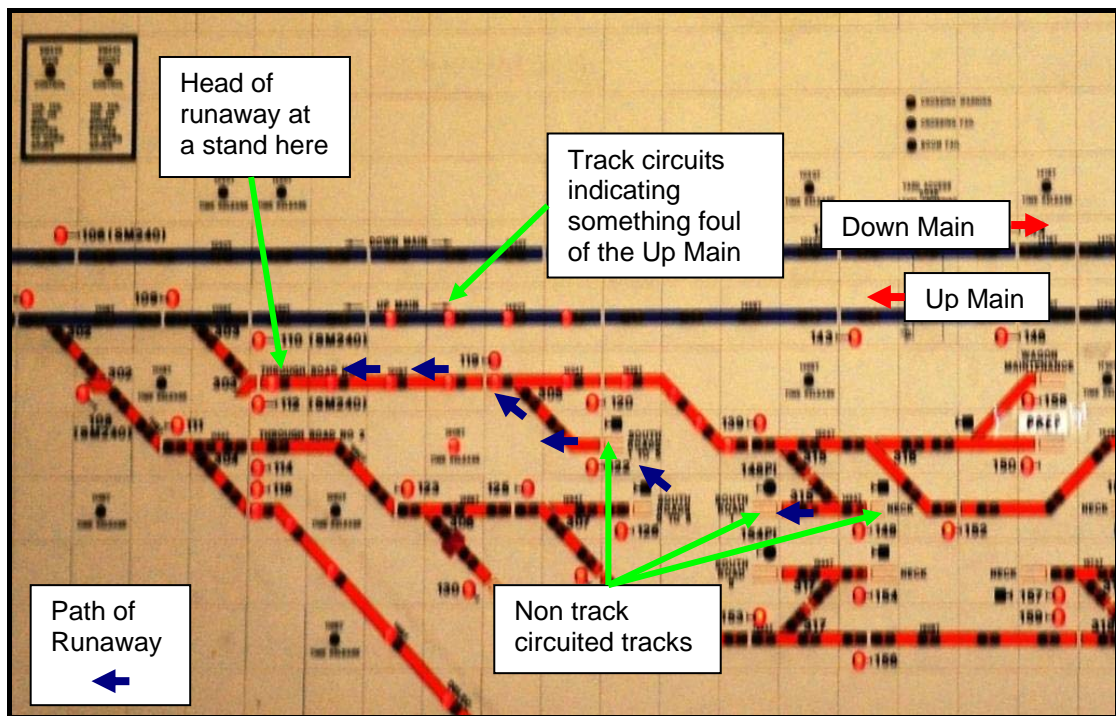
- Pacific National staff, including the Terminal Operator, proceeded to the then stationary runaway to determine its location and condition.
- On arrival at the derailment site some minutes later, the Terminal Operator determined that both Up and Down Main lines were fouled. The Terminal Operator was the first Qualified Worker to become aware of this.
- The Terminal Operator immediately contacted the Signaller by two-way radio and made him aware of this fact.

1.31 RailCorp's response was as follows:

- The Enfield Signaller was alerted to the runaway and could see it passing his location en route to the southern end of the yard.
- As the runaway moved through the yard various track circuits indicated its progress to the Signaller (except in those areas which were not track circuited). However, the Signaller was unable to take any action to mitigate the effects of the runaway. He was aware that no rail traffic was in the vicinity of the incident site or closely approaching it, and so assessed that no immediate action was required to protect it.
- At 12:44pm, the Signaller reported the incident to the Train Controller who was operating the Goods Board in the RMC. The Train Controller alerted RailCorp response personnel.
- The Signaller was aware of the approach of an empty coal train (CA69) and, in conjunction with the Area Controller (signaller) operating the Bankstown Panel of the Sydenham Signalling Complex, arranged to halt it in the vicinity of Canterbury (4km away).

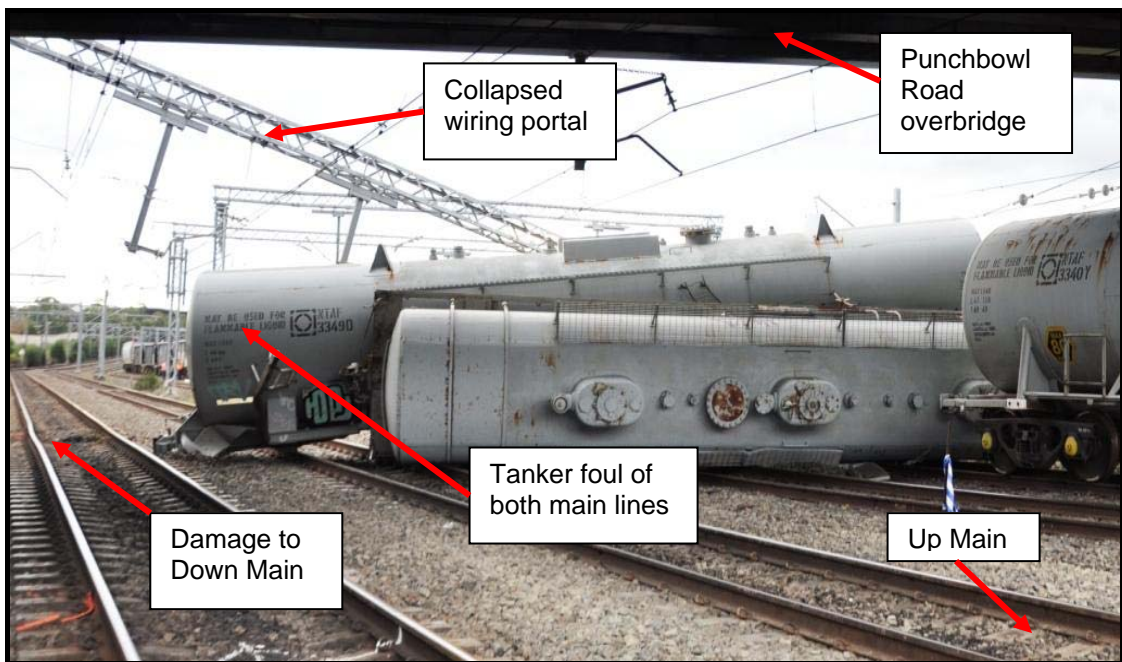
Subsequent Incident Response and Management

1.32 The Signaller indicated to the Train Controller that the exact circumstances of the derailment were not clear and neither was the current location of the derailed wagons; the Down Main line appeared to have something foul of it as his display was indicating that something was occupying a section of track (see *Photograph 7*). At this time, the Terminal Operator had not yet informed the Signaller that both main lines were blocked.



Photograph 7: Enfield Signaller's mimic board

- 1.33 At 12:49pm the Signaller informed the Train Controller of his opinion that the Down Main line would be clear and available for traffic. However, the Train Controller wanted more information before allowing trains to run. The closest approaching train on the Down Main line was Pacific National empty coal service CA69 which was approximately 4km from the site of the incident. The Train Controller instructed the Area Controller operating the Campsie panel at Sydenham to “*put blocks on in case it's a derailment*” (i.e., place and keep a signal at Stop to prevent the train from approaching the incident site).
- 1.34 At 12:56:14pm, the Train Controller received an assurance from the Enfield Signaller; “*we are definitely clear of the Down Main*”. The Train Controller asked the Area Controller at Sydenham to “*take the block off and get CA69 going*” (i.e., advance the train towards the incident site). This assurance was based on the Signaller's mimic board display without verification from personnel at the incident site. However, during the three-way conversation between the Train Controller, the Area Controller and the Signaller at 12:57:45pm, the Enfield Signaller interjected: “*I have now been told the stanchion (overhead wiring portal) is down over both tracks ... so the whole thing is blocked*” (see Photograph 8). At this point the Train Controller rescinded his earlier instruction to advance CA69.



Photograph 8: View in a northerly direction, under Punchbowl Road overbridge

- 1.35 At 1:00:17pm the Train Controller received an assurance from the Electrical Operations Control in Sydney that the area of the incident had a power outage (i.e., electrical supply had been disconnected) so no immediate action was required to make the area electrically safe.
- 1.36 Pacific National's Depot Manager directed that the Shift Supervisor breath test the Terminal Operator. This was done with a 'negative' result obtained. No testing for the presence of other drugs was conducted.
- 1.37 At 2:40pm, nearly two hours after the incident and 50 minutes after the arrival of the RailCorp Network Operations Superintendent, Fire and Rescue NSW was requested to attend to inspect the damaged fuel tankers. At 3:15 pm they declared the wagons as being safe for recovery work to commence.
- 1.38 Diversionary routes were established to allow rail traffic trapped and/or delayed by the incident to recommence their journeys. This involved bringing disused crossovers back into use to allow goods trains to travel between the Goods line and the Bankstown line at Campsie. Recovery operations then commenced to re-rail the wagons, remove aggregate spillage and debris, and repair damaged infrastructure.
- 1.39 An error was made during the management of rail traffic past the incident site which caused Down services to encroach the limits of Track Work Authorities on the Up track. This error was detected and rectified and is not considered to have been safety critical.

- 1.40 Pacific National issued instructions that all handbrakes must be applied when stabling these aggregate trains, if loaded, within Enfield Yard until the incident had been investigated.

Rolling Stock and Maintenance

- 1.41 The rake of aggregate wagons was made up of 11 RHGF type and 17 NPZH wagons. It measured 490 metres in length with a total mass of 2576 tonnes. It was one of two rakes of wagons engaged in transporting aggregate from Dunmore Quarry to Botany via Enfield Yard. NPZH type wagons, in common with most current freight rolling stock, have slack adjusters which allow the brake rigging to be adjusted during brake block replacement (see *Photograph 9*).



Photograph 9: Brake slack adjuster on NPZH type wagon

- 1.42 However, RHGF type wagons do not have slack adjusters and the brakes require manual adjustment during brake block replacement. The RHGF type wagons were at the Southern (downslope) end of the rake and it was therefore a number of these wagons that had their handbrakes applied to hold the rake on the grade.

- 1.43 Terminal operators' duties include inspecting and changing brake blocks as required. However, they are not trained to make brake adjustments on rolling stock which does not have slack adjusters. This means that brake adjustments are only performed during maintenance which occurs at 75,000km intervals. Pacific National has calculated that each brake block would have been changed up to 15 times during this period, which could extend to 18 months.
- 1.44 Brakes (both air and hand application) are subjected to testing to enable the Net Brake Ratio (NBR) to be calculated, to prove that they meet minimum operational requirements. The testing procedure is set out in RailCorp's Rolling Stock Engineering Procedure EPR 005 *Measurement of Wagon Brake Block Forces*. The braking force applied to the wheels of a vehicle is measured and this is divided by the vehicle's mass giving a NBR expressed as a percentage. This test is only required before new rolling stock is introduced into service or when modifications are carried out. The last such test on RHGF type wagons was carried out after modifications in June 2000. The hand brake NBR was calculated as being 14%. RailCorp's Engineering Standard – Rolling Stock RSU 441 *Braking performance* specifies a minimum handbrake NBR of 13% when using high friction composite brake blocks, the type fitted to RHGF type wagons.
- 1.45 After the incident, Pacific National carried out tests to establish the (handbrake) NBR on four bogies belonging to three of the wagons which had had their handbrakes applied. A total of 20 individual hand brake tests were conducted. These tests resulted in an average NBR of 12.2% with six tests returning figures of 4% or less.
- 1.46 The wagon from which the Terminal Operator released the air brakes, precipitating the runaway, was identified as being overdue for routine maintenance, but by less than 5000km. This is not regarded as being a factor in this incident and is catered for in Pacific National maintenance procedures. Maintenance records were reviewed for all 27 aggregate wagons and no other defects were identified as being likely to have contributed to the runaway.
- 1.47 Another difference between the two wagon types, of relevance to this incident, was the location of the handbrake. The NPZH wagon's hand brakes are located on the side of the wagon and could therefore be accessed by the

Terminal Operator as the rake started to run away (see *Photograph 10*). In contrast, the handbrake wheel on the RHGF wagons can only be accessed by stepping between the wagons.



Photograph 10 : Hand brake locations

- 1.48 The empty tanker stock that was struck was made up of 13 empty fuel wagons belonging variously to Inland Petroleum and Caltex. There were also three empty flat top wagons attached to the tankers at the opposite end to that at which the collision occurred. None of these wagons were in current use and had been stored, out of service, at this location for some time.

Employee Information

- 1.49 The Terminal Operator had 35 years experience in the rail industry and had commenced employment in 1976. He had worked at Enfield Yard since that time, with only short absences to work at other locations. His Certificate of Competency and medical assessments were appropriate and current.

Fatigue

- 1.50 An examination of the Terminal Operator's timesheets indicated that he had worked on six of the seven days preceding the runaway with shift lengths of

up to 12 hours. The majority of these shifts, or a component of them, were overtime.

- 1.51 When he stabled train 9134, just after midnight on the Friday night, he was 11 hours into a 12 hour shift, this being his fourth consecutive 12 hour shift. He was rostered off on Saturday 30 April having finished his last shift at 2:00am.
- 1.52 The Terminal Operator commenced his next shift at 12 Noon on Sunday 1 May finishing at 9:00pm. The following day he again commenced at Noon and completed a 12 hour shift, then retiring to bed at about 3:00am on the morning of Tuesday 3 May.
- 1.53 Pacific National utilises the Fatigue Audit InterDyne (FAID) to help monitor and manage the fatigue of workers. The FAID score calculated from the hours worked by the Terminal Operator in the period leading up to the incident indicated a highest score (or numerical representation) of 65 (an indication of a possible “moderate level of fatigue”).
- 1.54 On the day of the incident the Terminal Operator commenced duty at Noon and the incident occurred some 40 minutes later.
- 1.55 The Terminal Operator stated that in his experience this shift pattern was “*normal*” and reported that he did not feel fatigued.
- 1.56 It was concluded there was insufficient evidence to suggest that fatigue could be considered to have contributed to this incident to a significant degree.

Environmental Conditions

- 1.57 The weather around the time of the collision was dry and cloudy. The temperature recorded at the Canterbury weather station, approximately 4 kilometres away, was 18°C at 12:30pm, with a 13 km/h north-easterly wind. The weather conditions did not contribute to the incident.
- 1.58 There was a falling grade in the yard, predominantly 1 in 100, both at the point of, and over the course of, the runaway path. While the presence of such a grade in a rail yard is not unusual, this incident would not have occurred if there hadn't been a grade.

PART 2 ANALYSIS

Introduction

2.1 To establish the causal and contributing factors of the incident, OTSI examined the following:

- a. voice logs for the Train Controller's workstation at the RMC and for the Area Controllers' adjacent to Enfield signal box⁶ - the Bankstown panel at Sydenham and the Lidcombe panel at Strathfield;
- b. voice logs for WB radio at Enfield Yard;
- c. signalling logs before, during and after the incident;
- d. track diagrams, signalling and track circuit plans;
- e. Pacific National plans and procedures;
- f. RailCorp network rules and procedures;
- g. RailCorp Train Operating Conditions (TOC) manual;
- h. audit and investigation reports provided by ITSR;
- i. audit and investigation reports provided by Pacific National;
- j. Bureau of Meteorology records; and
- k. the Terminal Operator's medical and training and assessment records.

In addition, an interview was conducted with the Terminal Operator and notes were taken from discussions with other workers present at the time of the incident, notably the Signaller.

Previous Incidents

2.2 Pacific National identified five runaways that had occurred over the last five years due to handbrake failure. None of the incidents occurred at Enfield Yard and none were directly comparable to this incident.

⁶ Enfield signal box audio was not recorded.

Anticipation and Management of Risk

2.3 The Safety Interface Plan (SIP) between RailCorp and Pacific National included an annexure entitled “*Risk Assessment*”, the “*specific hazard event*” of a “*collision between trains*” with the cause “*Rolling stock runaways*”. Nine “*existing controls*” were listed, four of which were preventative while five were mitigative.

2.4 The preventative controls were listed as follows:

- wagon preventative maintenance system (control did not prevent the incident);
- train pre-departure checklist, including brake and coupling inspections (control not relevant to this incident);
- operator-specific procedures for attaching, detaching and stabling rolling stock (control did not prevent the incident); and
- trespass exclusion measures (control not relevant to this incident).

2.5 The mitigative controls were as follows:

- derailleurs on the wagon maintenance sidings (control not relevant to this incident);
- catchpoints at the northern and southern ends of the yard to the Enfield Goods Main line (had the runaway not derailed, the catchpoints at the southern end would probably have prevented it reaching the main line);
- siding lock out facilities in yard (control not relevant to this incident);
- runaway sirens in yard (these were activated and operated as designed); and
- emergency response plan (this is designated as being RailCorp’s responsibility; there were some inadequacies in RailCorp’s response).

2.6 Section 8.12 of the SIP *Storage of rollingstock on the RailCorp track* states in part:

“(b) ensure that rolling stock is not left unattended unless appropriately stabled and protected in accordance with RailCorp Network Rules and Network Procedures.”

RailCorp Network Rule NTR 404 *Using brakes* states:

“Before detaching a locomotive from a train, the Train Crew must secure the train against movement in accordance with the requirements specified in the TOC manual.”

The Management Agreement for Enfield Yard between Pacific National and RailCorp (which commenced on 01 June 2009) also specifies that the TOC manual be utilised. The TOC manual specifies, for a 1:100 grade, that “3 in 10 (30%)” of handbrakes be applied. In the case of the rake of 28 aggregate wagons, nine handbrakes were required to be applied to comply with this instruction.

2.7 Section 8.12 of the SIP also includes the passage “(d) assess the risks related to storage of their rolling stock.” Pacific National had not carried out a risk assessment as required under this section.

2.8 Pacific National’s Integrated Safety Management System document Generic Procedure 006.10-R02 *Securing Trains With Park Brakes* states its purpose to be:

“To provide information for Terminal Operations staff and locomotive train crews in relation to the minimum number of wagon park brakes (hand brakes) that must be applied to safely hold trains on various grades of track.

This procedure applies to all Pacific National trains and wagons and must be used where Pacific National trains and wagons need to be secured on main line sections, yards or terminals or terminals and sidings with unprotected connection to main lines. For certain yards, terminals and sidings this standard may be varied to reflect additional site-specific protection in accordance with the process below and site-specific risk assessment.”

2.9 Schedule 2 of Procedure 006.10-R02 sets out a table for various grade ranges and numbers of wagons (and lists certain “typical” yards). It specifies the minimum number of handbrakes to be applied for each combination. In the case of the incident rake, at its stabled location in Enfield Yard, the number of handbrakes specified was four. Beneath the table the following is noted:

“Site conditions may require an assessment for additional protection. If location is not referred (sic) in the above table a local site risk assessment is to be conducted.”

Enfield Yard is not referred to in the table. Pacific National had not carried out a risk assessment at the yard as required under this procedure.

- 2.10 Pacific National had undertaken “Rail Safety and HSE” (Health Safety & Environment) Audits at Enfield in 2008 and 2009 that identified issues surrounding Interface Coordination Plans (e.g., the RailCorp SIP) risk assessments, sign offs, distribution and review and audit. There is no evidence that any corrective actions were taken to address the issues identified. Indeed, the SIP supplied to OTSI by Pacific National was a draft copy in contrast to the ‘final’ version supplied by RailCorp.

Incident Analysis

- 2.11 The Terminal Operator stated that he applied seven hand brakes at the time of the initial stabling of the rake. This represented 25% of the 28 wagons, less than the 30% specified in the RailCorp TOC manual. Subsequent to the incident it was determined that a maximum of five hand brakes (or 18%) had been applied. However, even this lower figure exceeds the Pacific National Procedure GPR-006-10 *Securing Trains with Park Brakes* (Table 2) which directs that within a yard with a gradient of “1:200 to 1:100 grade (average over length of rake)” with 20-60 wagons, four park brakes (handbrakes) are to be applied. The Terminal Operator could not account for the discrepancy in the number of handbrakes applied being the difference between the seven he stated he applied at time of stabling and the five which were found to be applied after the rake ran away. As the two wagons (in addition to the five that did have handbrakes) had not had any new brake blocks fitted, the possibility that the Terminal Operator had wound off the handbrakes to facilitate maintenance, and had not reapplied them, can therefore be discounted. The discrepancy can only be explained in one of two ways: a person or persons unknown released two handbrakes at some time between the rake being stabled and secured by the Terminal Operator, or they had never been applied.
- 2.12 When a train is stabled and a handbrake is applied, the airbrakes are already forcing the brake blocks against the wheel tread. The application of the

handbrakes holds the brake rigging (mechanical linkages) and brake blocks in this position as the air brakes tend to leak off and release over time. When the handbrakes are released to facilitate maintenance, then reapplied, the force of the hand application does not match that applied by the air brakes. This results in a reduction in the braking effort of the handbrake. However, the Net Brake Ratio (NBR) is calculated by applying the handbrake without air and, had the NBR been satisfactory on these wagons, the reapplication of the handbrakes by the Terminal Operator would have resulted in adequate braking force being applied on each wagon.

- 2.13 Routine maintenance between preventative maintenance cycles on RHGF wagons was not adequate to maintain NBR at or above the minimum required level.
- 2.14 The Terminal Operators at Enfield Yard were not trained to complete brake adjustments on rolling stock that was not fitted with slack adjusters.
- 2.15 The Terminal Operator released the air brakes on wagon NZPH35652C, located in the middle of the rake, so that he could replace a worn brake block. While this was normal practice, this action precipitated the movement of the whole rake. It is noted however, that over time as the air brakes leaked off, the handbrakes applied to the rake may have been inadequate to hold the train on the grade and a runaway could have occurred without the maintenance intervention by the Terminal Operator.
- 2.16 The Terminal Operator responded by attempting to arrest the rake's motion by applying two additional handbrakes and also by reporting the runaway directly to his shift manager, the Signaller and, by a general broadcast call, to others working in the yard.
- 2.17 Pacific National did not comply with its own procedures or the requirements of the Safety Interface Plan in relation to risk assessing its stabling procedures and, in particular; handbrake application.
- 2.18 Pacific National did not comply with the Safety Interface Plan or the Management Agreement and used a lesser number of handbrakes to secure stabled rolling stock than required by the TOC Manual.
- 2.19 There was a contradiction in the SIP. A preventative control for the risk of 'runaway' was allocated to the operator ("*Operator-specific procedures for*

attaching, detaching and stabling rollingstock”) but the SIP also directed that RailCorp Network Rules and Procedures and, by extension, the RailCorp TOC Manual be complied with. The TOC Manual specified more stringent requirements for the application of handbrakes than Pacific National’s procedures.

- 2.20 RailCorp, as the owner and maintainer of Enfield Yard, routinely had personnel working in and about the yard, but had not undertaken any assurance activity to ensure that Pacific National was complying with the SIP or Management Agreement as it applied to stabling of rolling stock.
- 2.21 There were no procedures specific to the maintenance activity of changing brake blocks nor had any training been provided to terminal operators. It is likely that the lack of such procedures and training resulted in the NBR of the NPZH wagons falling below the required value. Also, while not contributory to the incident, it is noted that the Terminal Operator wound off an individual wagon’s handbrake, in order to replace brake block(s), on at least three occasions, before reapplying them. This had the effect of reducing the number of handbrakes holding the rake on the grade by one wagon on each occasion.

Other Safety Matters

- 2.22 The Independent Transport Safety Regulator (ITSR) was requested to supply details of any audits or compliance visits relating to stabling or maintenance activities at Enfield, which it had undertaken since 2005. One audit was identified dated 30 October 2009; “Joint Regulators National Audit” (Legislative compliance). The audit identified a number of non-conformances relevant to the incident in the area of safety audit arrangements, risk management and safety interface coordination. However, none of the audit activities or findings was directed specifically at Pacific National’s operations at Enfield Yard. At the time of the incident there were no outstanding findings relating to the ITSR audits.
- 2.23 Shortly before this incident, on 13 April 2011, the ITSR issued Transport Safety Alert (TSA) No. 36 entitled *Effective securement with handbrakes and stopblock functionality*.⁷ The TSA highlighted recent incidents of “*handbrakes*

⁷ Details are available from ITSR’s website: <www.transportregulator.nsw.gov.au/>

not being applied as required, or not functioning as intended and suggested that rolling stock operators “reassess” six areas, including three relating to handbrakes and stopblocks which are relevant to this incident:

- the adequacy of coverage of these matters in their standards, risk registers, defect management systems and other relevant documentation;
- the adequacy of instructions for the application of handbrakes, including the requirement for the number of vehicles to be secured on different gradients; and
- the maintenance and inspection procedures which manage the possibility of defective or poorly designed handbrakes, and the defences which exist against such defects leading to adverse outcomes including, but not limited to, techniques for detecting cases where attempted handbrake applications have not resulted in braking function.

2.24 In response to the TSA and the incident at Enfield Yard, Pacific National has proposed a number of safety actions including:

- implementing a local procedure for stabling trains at Enfield Yard consistent with RailCorp’s TOC Manual;
- an engineering review of all wagon classes’ braking systems;
- establishing the current NBR of all wagon classes;
- a review of Generic Procedure 6.10 *Securing Trains with Park Brakes* to ensure clarity once the above review has been completed;
- site specific risk assessments for the stabling of rolling stock in Pacific National yards where one has not already been completed;
- reviewing and, where appropriate, amending incident management standards;
- a review of training material on changing brake blocks on wagons without slack adjusters and the training of terminal operators to carry out this task;
- developing a process for working on braking systems; including where rolling stock is loaded;
- reviewing the maintenance schedule for the wagon type (RHGF) involved in this incident; and

- developing a new drug and alcohol testing standard that will require the mandatory testing of all personnel involved in safety critical incidents.

PART 3 FINDINGS

Immediate Cause

- 3.1 The immediate cause of the incident was that, during maintenance activities, the air brakes were released on wagon NPZH35652C and the rake ran away due to the rake's remaining brakes being insufficient to hold it stationary on the prevailing grade.

Contributing Factors

- 3.2 The application of five handbrakes was insufficient to hold the rake stationary on the falling grade.
- 3.3 Pacific National did not comply with the requirements of the Safety Interface Plan with RailCorp; viz., it did not comply with the requirements to “*ensure that rolling stock is not left unattended unless appropriately stabled and protected in accordance with RailCorp Network Rules and Procedures*”.
- 3.4 Pacific National did not comply with the requirements of the Management Plan with RailCorp which specified that the requirements of the TOC Manual were to be met. The TOC Manual specified that nine wagons should have had handbrakes applied on this train.
- 3.5 Pacific National had not carried out any risk assessments to test the efficacy of its minimum requirement for handbrake application at Enfield Yard as required by its own procedures and the Safety Interface Plan.
- 3.6 There were no procedures specific to the maintenance activity of changing brake blocks especially on wagons that were not fitted with slack adjusters; nor had any training been provided to Terminal Operators in regard to the adjustment of brakes on rolling stock without slack adjusters.

Other Safety Matters

- 3.7 Although the Shift Supervisor was breath tested, no testing for the presence of other drugs was conducted, contrary to Pacific National's policy requirements for this type of incident.
- 3.8 The Safety Interface Plan in force at Enfield Yard has an inconsistency. It requires the operator to apply RailCorp Network Rules and Procedures (which, by extension, include the TOC Manual) but states that operator-specific procedures for stabling will be used. An operator's own procedures

may not be sufficient to meet the requirements contained in the TOC Manual, as was the case in this incident. [Recommendation 4.2]

- 3.9 The Enfield Signaller authorised rail traffic to resume on the Down Main line on the basis of his mimic board display without verification that the line was clear and not affected by the derailment.
- 3.10 Fire and Rescue NSW were not requested to attend in the immediate aftermath of the incident. This was despite fuel tankers being involved in the collision with one derailed and lying on its side. A RailCorp Network Operations Superintendent arrived on site at about 1:30pm but it was another 50 minutes until Fire and Rescue NSW was called. [Recommendation 4.3]
- 3.11 The Net Brake Ratio (NBR) is calculated, using a prescribed testing regime, to establish that it meets or exceeds minimum standards, before a new class of rolling stock is allowed to enter service. The same process is followed if modifications are undertaken which may affect braking performance. However, there is no requirement to test rolling stock to establish if each type continues to meet minimum NBR requirements during its service life. [Recommendation 4.5]

PART 4 RECOMMENDATIONS

To improve the safety of rail operations and prevent a recurrence of this type of incident, it is recommended that the following remedial safety actions be undertaken by the specified responsible entities.

Pacific National

- 4.1 Verify that the proposed safety actions listed in section 2.24 are completed.

RailCorp

- 4.2 Review the content of its Safety Interface Plans to identify and rectify inconsistencies in relation to the stabling of trains and rolling stock.
- 4.3 Review the adequacy of incident response procedures and training in relation to the management of potentially dangerous goods, e.g., empty fuel tankers, and implement improvements where shortfalls are identified.

ITSR

- 4.4 Utilise this investigation to identify issues that might inform future audit and compliance activities.
- 4.5 Encourage industry to consider incorporating the verification of rolling stock NBR on a regular basis by including it in routine maintenance schedules through the issue of a Transport Safety Alert (TSA) or other appropriate method.

PART 5 APPENDICES

Appendix 1: Sources and Submissions

Sources of Information

- Independent Transport Safety Regulator
- NSW Bureau of Meteorology
- Pacific National Pty Ltd
- Rail Corporation New South Wales

Submissions

The Chief investigator forwarded a copy of the Draft Report to the Directly Involved Parties (DIPs) to provide them with the opportunity to contribute to the compilation of the Final Report by verifying the factual information, scrutinising the analysis, findings and recommendations, and to submit recommendations for amendments to the Draft Report that they believed would enhance the accuracy, logic, integrity and resilience of the Investigation Report. The following DIPs were invited to make submissions on the Draft Report:

- Independent Transport Safety Regulator
- Pacific National
- RailCorp
- The Terminal Operator

Responses were received from all Directly Involved Parties except the Terminal Operator. The Chief Investigator considered all representations made by DIPs and responded to the author of each of the submissions advising which of their recommended amendments would be incorporated in the Final Report, and those that would not. Where any recommended amendment was excluded, the reasons for doing so were explained.