



**Australian Government**  
**Australian Transport Safety Bureau**

ATSB TRANSPORT SAFETY INVESTIGATION REPORT  
Rail Safety Investigation 2005/003  
Final

**Shunting Accident  
Regency Park, South Australia**

02 February 2005





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Rail Occurrence Investigation

2005/003

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**Shunting Accident**

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**2 February 2005**

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**Abstract**

At approximately 1317 Central Standard Time on Wednesday 2 February 2005, a Specialised Container Transport (SCT) employee was seriously injured whilst undertaking shunting operations at the SCT Rail Yards, Regency Park, South Australia.

The investigation found that work procedures allowed a shunter to ride on the end step of a wagon while being shunted and did not require that the driver confirm that the shunter was safe and/or in a safe position before starting a shunt movement.

The report proposes eight recommendations to improve railway operational safety.

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## MEDIA RELEASE

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### ***ATSB Report on SA Shunting Accident, February 2005***

An Australian Transport Safety Bureau (ATSB) investigation report, released today, has found that work procedures in the Regency Park rail yard allowed a shunter to ride on the end-steps of a wagon while being shunted and did not require that the driver confirm that the shunter was safe and/or in a safe position before starting a shunt movement.

The dangers involved in railway shunting accidents were tragically illustrated when a railway employee was severely injured and disabled after a string of wagons ran over him. The ATSB report of the accident on 2 February 2005, cites poor work practices and weak communications protocols between the driver and the shunter that resulted in permanent and severe injuries to the shunter.

The ATSB report states that the accident occurred whilst the locomotive was pushing nine wagons. Near the conclusion of the movement, the driver of the locomotive radioed the shunter to establish his whereabouts. When the shunter failed to reply, the driver stopped the train and left the cab to look for the shunter. As the driver left the cab he saw the shunter lying face down between the tracks.

The ATSB concluded that given the location in which the shunter was found, the design of the wagon and related site evidence, that either:

- the shunter fell from the end step of the leading wagon; or
- the shunter was run over by the wagon just before, or as, he attempted to board the wagon's end step.

While the report concludes that safety actions implemented immediately following the accident are likely to have prevented a similar accident, the investigation identified further opportunities to improve railway operational safety and made eight safety recommendations.

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# THE AUSTRALIAN TRANSPORT SAFETY BUREAU

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The Australian Transport Safety Bureau (ATSB) is an operationally independent multi-modal Bureau within the Australian Government Department of Transport and Regional Services. ATSB investigations are independent of regulatory, operator or other external bodies.

The ATSB is responsible for investigating accidents and other transport safety matters involving civil aviation, marine and rail operations in Australia that fall within Commonwealth jurisdiction, as well as participating in overseas investigations involving Australian registered aircraft and ships. A primary concern is the safety of commercial transport, with particular regard to fare-paying passenger operations. Accordingly, the ATSB also conducts investigations and studies of the transport system to identify underlying factors and trends that have the potential to adversely affect safety.

The ATSB performs its functions in accordance with the provisions of the *Transport Safety Investigation Act 2003* and, where applicable, relevant international agreements. The object of a safety investigation is to determine the circumstances to prevent other similar events. The results of these determinations form the basis for safety action, including recommendations where necessary. As with equivalent overseas organisations, the ATSB has no power to implement its recommendations.

It is not the object of an investigation to determine blame or liability. However, it should be recognised that an investigation report must include factual material of sufficient weight to support the analysis and findings. That material will at times contain information reflecting on the performance of individuals and organisations, and how their actions may have contributed to the outcomes of the matter under investigation. 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.

Central to ATSB's investigation of transport safety matters is the early identification of safety issues in the transport environment. While the Bureau issues recommendations to regulatory authorities, industry, or other agencies in order to address safety issues, its preference is for organisations to make safety enhancements during the course of an investigation. The Bureau is pleased to report positive safety action in its final reports rather than make formal recommendations. Recommendations may be issued in conjunction with ATSB reports or independently. A safety issue may lead to a number of similar recommendations, each issued to a different agency.

The ATSB does not have the resources to carry out a full cost-benefit analysis of each safety recommendation. The cost of a recommendation must be balanced against its benefits to safety, and transport safety involves the whole community. Such analysis is a matter for the body to which the recommendation is addressed (for example, the relevant regulatory authority in aviation, marine or rail in consultation with the industry).

The 24-hour clock is used in this report to describe the local time of day, Central Summer Time (CSuT), as particular events occurred.

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## EXECUTIVE SUMMARY

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At approximately 1317 Central Summer Time<sup>1</sup> (CSuT) on Wednesday 2 February 2005, a Specialised Container Transport<sup>2</sup> (SCT) employee was seriously injured whilst undertaking shunting operations at the SCT Rail Yards, Regency Park, South Australia. On the day of the accident, he was directing the shunting activities of locomotive T345.

At the time of the accident, locomotive T345 was propelling<sup>3</sup> a rake of nine wagons. Towards the conclusion of this movement, approximately 1319, the driver of T345 called the shunter using his hand held radio to establish his whereabouts. When the shunter failed to respond to several radio calls, the driver decided to stop the train, leave the cab and look for the shunter. As the driver left the cab he saw the shunter lying face down, parallel to the track, within the ‘four foot’<sup>4</sup>, the right hand side of his body was partly straddled across the rail lines. The shunter had sustained serious injuries.

SCT staff and emergency services personnel reacted quickly and efficiently to the accident.

Based on the analysis of available evidence it is concluded that it is likely that either:

- the shunter fell from the end step of the leading container flat wagon CQMY 3008N, whilst locomotive T345 was propelling a rake of wagons in a northerly direction, heading out of the SCT marshalling loop; or
- the shunter was run over by CQMY 3008N just before or as the shunter attempted to board the end step.

The investigation found that work procedures in the Regency Park rail yard allowed a shunter to ride on the end step of a wagon while being shunted and did not require that the driver confirm that the shunter was safe and/or in a safe position before starting a shunt movement.

In the lead-up to and post accident, SCT was conducting a review of their shunting procedures at its various intermodal sites. This included the Regency Park site in South Australia. They have subsequently modified shunting arrangements to incorporate the use of a small ‘All Terrain’ vehicle by shunters and the riding of wagons is no longer permitted. SCT has also enhanced its radio communications on T345 by providing a fixed radio with an external speaker as well as an on board CCTV system to assist with driver peripheral vision. Although these new

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1 All times throughout this report is Central Summer Time (CSuT). However as times from various sources differ marginally, all times have been referenced to the Hasler clock roll (locomotive data logger) from T345.

2 Throughout the report, Specialised Container Transport (SCT) refers to ‘Twentieth Superpace Nominees Pty Ltd, trading as SCT Logistics.

3 ‘propelling’ - any reversing movement other than setting back at a platform after a partial overrun. (Source: Glossary for the National Codes of Practice and Dictionary of Railway Terminology)

4 ‘four foot’ – the area between the rails of a standard gauge railway. (Source: Glossary for the National Codes of Practice and Dictionary of Railway Terminology)

initiatives are likely to prevent a similar accident, the investigation has identified further opportunities to improve railway operational safety.

The ATSB recommends that SCT:

- a) develop arrangements that do not require employees to ride a locomotive/wagon whilst it is being shunted, this should be done without compromising the safety of shunt movements; or if not feasible develop a restraint mechanism/workstation to protect a shunter from falling from a locomotive/wagon whilst carrying out a shunt movement.
- b) develop procedures that ensure a driver validates the position of a shunter, before proceeding with a shunt movement, and procedures that also regularly validate the wellbeing/whereabouts of a shunter whilst undertaking shunting activities.
- c) undertake a thorough risk assessment of its shunting activities, including communication protocols. Translate this into a comprehensive safe working procedure and develop/provide an associated and accredited training program. Provide regular retraining of employees with respect to safety critical activities.
- d) remind employees of their Occupational Health and Safety (OHS) responsibilities with respect to their personal safety, which includes a requirement to regularly check/replace worn personal protective equipment (PPE) such as safety boots/shoes and compliance with prescribed safety policies.
- e) undertake/record results of regular audits of employees working practices to ensure that they are complying with documented safe working procedures and training directives.
- f) ensure mandated medical instructions/restrictions are implemented. If the intent of a medical directive cannot be fully achieved consult with the medical practitioner to ensure any proposed alternative is effective.

The ATSB recommends that the South Australian Railway Safety Regulator:

- a) Actively monitor the actions initiated by SCT in response to this investigation.
- b) Recognise that the findings of this investigation may be relevant to other organisations, and take the appropriate actions to ensure they are advised accordingly.

# 1

# INTRODUCTION

Specialised Container Transport (SCT) is one of Australia's largest private train operating companies. It provides intermodal container and van freight handling services at its shunting yards located in Melbourne, Adelaide and Perth.

At approximately 1317 on Wednesday 2 February 2005, a Specialised Container Transport employee was seriously injured whilst undertaking shunting operations at the SCT Rail Yards, (Fig. 1) Regency Park, South Australia.

**FIGURE 1. Location of SCT rail yard, Regency Park (Railways of Australia)**



Although this accident was not on the Defined Interstate Rail Network (DIRN) the South Australian Government, through the State's Railway Safety Regulator, requested that the Australian Transport Safety Bureau (ATSB) initiate an independent investigation to establish the cause of the accident. This investigation has been executed in accordance with the legal framework defined by the *Transport Safety Investigation Act 2003* (TSI Act), herein after referred to as the TSI Act.

The ATSB acknowledges the cooperation of all who participated and assisted in this investigation.

**2.1****Narrative**

This accident occurred at the SCT Rail Yards, Regency Park, South Australia. SCT has one locomotive located at its Regency Park site; a T Class, (T345) which is primarily used for shunting operations.

In accordance with SCT shunting practice, the train is operated by crew of at least two employees, comprising a driver and shunter. The driver operates the locomotive; the shunter directs all ground activities. Ground activities include the setting of points, coupling/uncoupling of wagons and providing directions to the driver, particularly where propelling movements are involved, as the end of the train may not be visible to the driver. During shunting activities, the driver and shunter communicate using a combination of hand signals and/or hand held radios where line of sight is not available; most communication is undertaken by radio.

On the day of the accident, Wednesday 2 February 2005, the weather was cold, wet and windy. The driver and shunter booked on duties at 0600 but did not start shunting activities until approximately 1224; they were due to conclude their shift at 1400. Shunting lasted for approximately one hour before the accident occurred.

At approximately 1317, unbeknown to the driver, the shunter was seriously injured whilst directing a shunt movement at the southern end of the SCT yard. Towards the conclusion of this movement, approximately 1319, the driver of T345 called the shunter using his hand held radio to establish the shunter's whereabouts. When the shunter failed to respond to several radio calls, the driver decided to leave the cab and look for the shunter. As the driver left the cab he saw the shunter lying face down, parallel and within the 'four foot' of the track, the right hand side of his body was partly straddled across the rail lines. The shunter had sustained serious injuries.

The driver immediately contacted SCT's rail - administration clerk and requested the attendance of emergency services personnel. The driver provided first aid; this was followed by backup support from the rail - administration clerk. Ambulance services arrived at 1333 followed by police at 1339. After being stabilised, the shunter was transported to the Royal Adelaide Hospital to undergo emergency surgery.

Based on medical advice, the shunter was not initially interviewed. He was however interviewed on 10 February 2005, one year after the accident, when he well enough to do so. During this interview, it was established that he had no recollection of the accident. There were no eyewitnesses to the accident.

**2.2****Location**

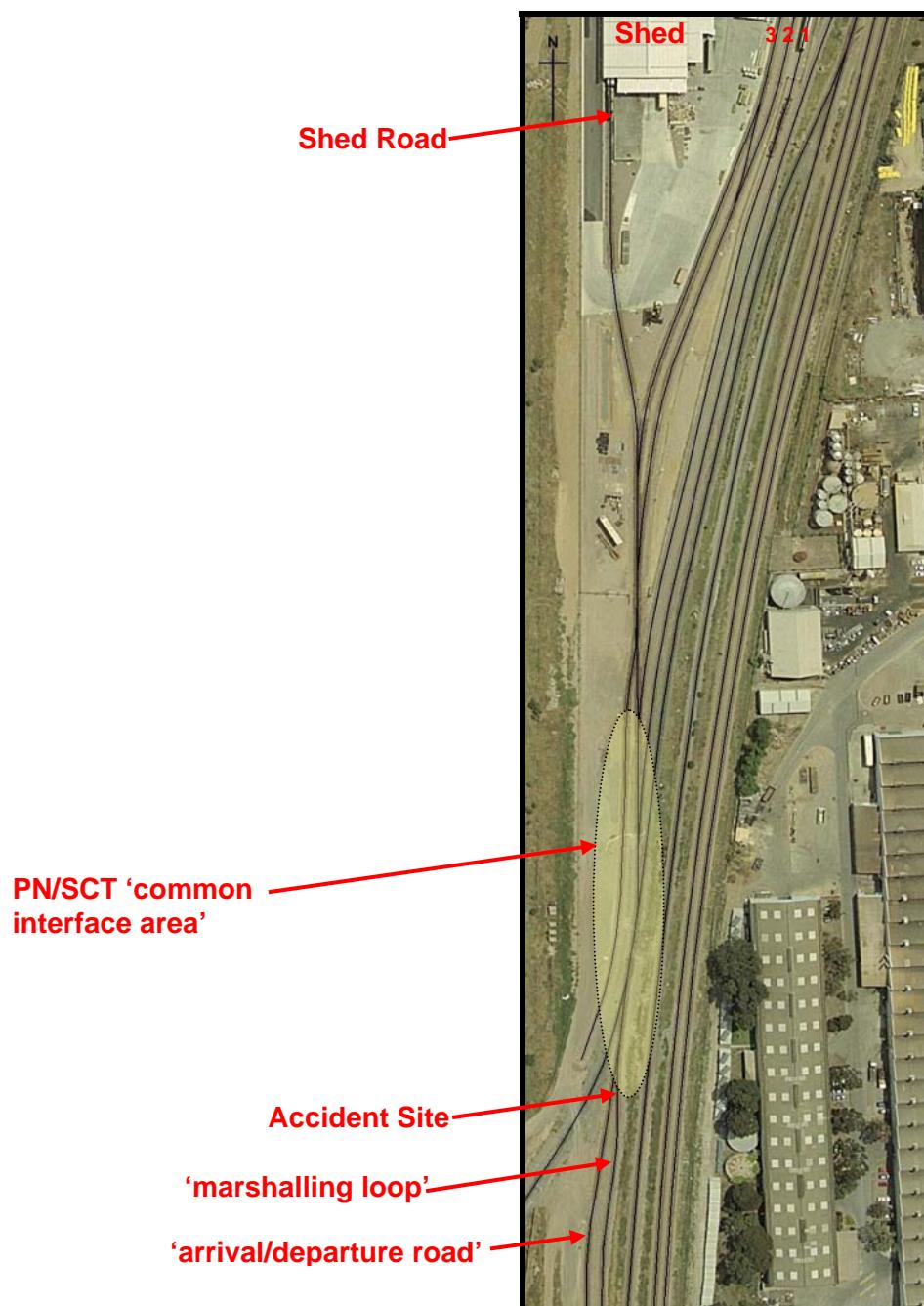
SCT provides an intermodal container and van freight handling service at shunting yards located in Melbourne, Adelaide and Perth. Its most recent facility was established at the Rail Yard, Regency Park, South Australia in August 2001.

The Regency Park site is located approximately 8.8 km north of the Adelaide CBD. It is bounded to the north by Grand Junction Road and to the east by the DIRN.

The SCT yard accesses the DIRN and the Pacific National (PN) Intermodal Yard through a 'common interface area' belonging to the Australian Rail Track Corporation (ARTC).

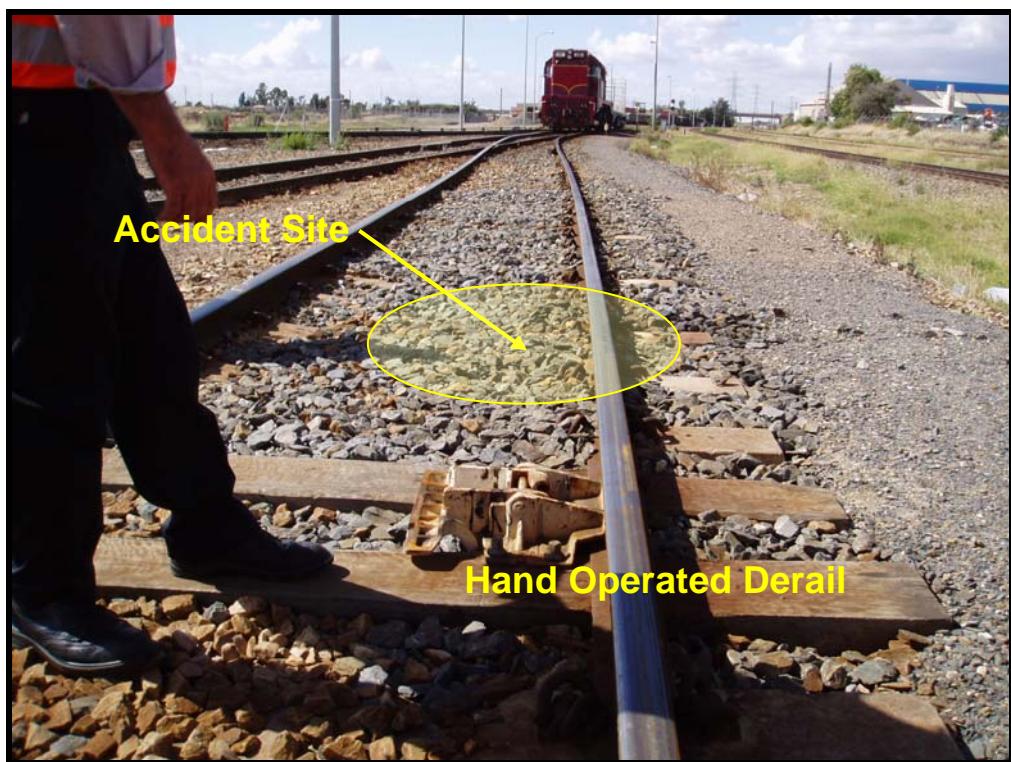
The SCT site comprises a fenced compound housing an administration block/loading shed surrounded by a concrete apron and three shunting roads. (Fig. 2) The shunting roads, viewed west to east, are called Shed Road, 3 Road and 2 Road respectively. External to the fenced compound and located to the east of 2 Road is 1 Road. South of the SCT compound is the 'common interface area' and further south again is an 'arrival/departure road' (Through Road) and 'marshalling loop'.

**FIGURE 2. SCT rail yard, Regency Park**  
(SA DEH Environmental & Geographic Information, see Appendixes, Fig 15 for large scale view)



Due to the length of trains and the constraints of the overall yard layout, SCT shunting operations work through the PN/SCT ‘common interface area’ before gaining access to a 500 metre long ‘marshalling loop’. The entrance to the ‘arrival/departure road’ and the ‘marshalling loop’ is protected by hand operated derails. (Fig. 3)

**FIGURE 3. Locomotive T345 at entrance to ‘marshalling loop’**



Documented interface procedures exist between PN and SCT, these facilitate safe train operations through the ‘common interface area’. However, these procedures do not lay down any shunting practices applicable to SCT employees. This is achieved with a ‘SCT Islington Rail Awareness Manual’ and associated instructor training.

## 2.3 The accident

On the day of the accident, Wednesday 2 February 2005, the driver and shunter booked on duty at 0600. Shunting was scheduled as usual, but may not have had the normal time constraints because a derailment on the DIRN, between Perth and Adelaide, had delayed some freight services. The weather was cold, wet and windy.

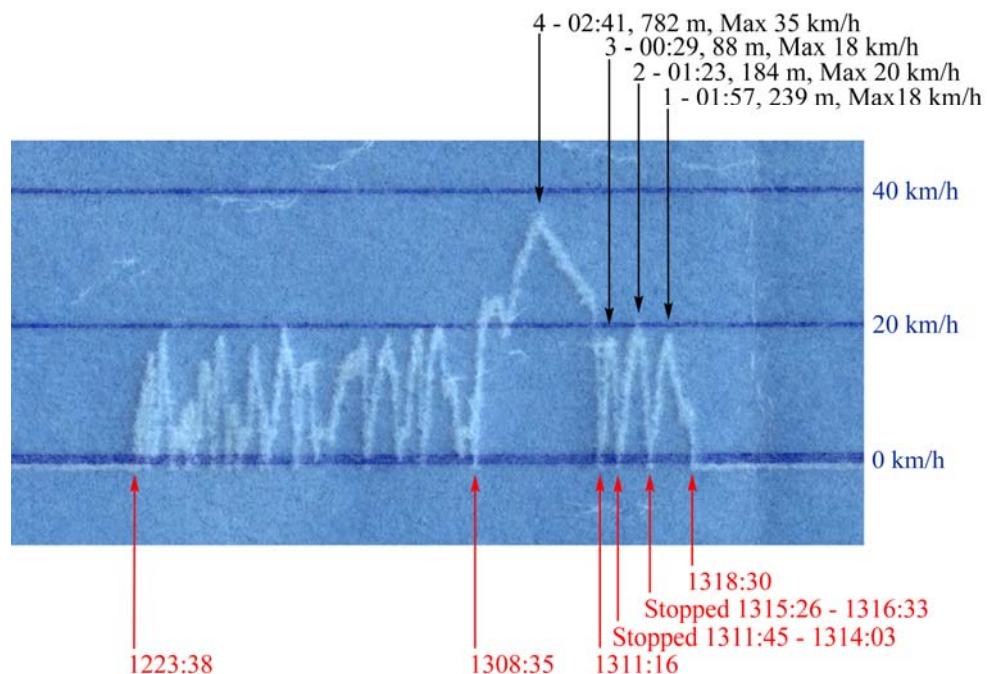
Shunting activities commenced at approximately 1224, a time that appears to coincide with an improvement in weather conditions. However, the occasional passing shower continued through to approximately 1248. There was a need to finalise the marshalling of wagons prior to the conclusion of the driver’s and shunter’s shift at 1400.

**FIGURE 4. T345, Locomotive involved in accident.**



The first recorded movement of T345 was at 1223:38, this was followed by a series of shunt movements into and out of No 3 Road, No 2 Road and the Shed Road.

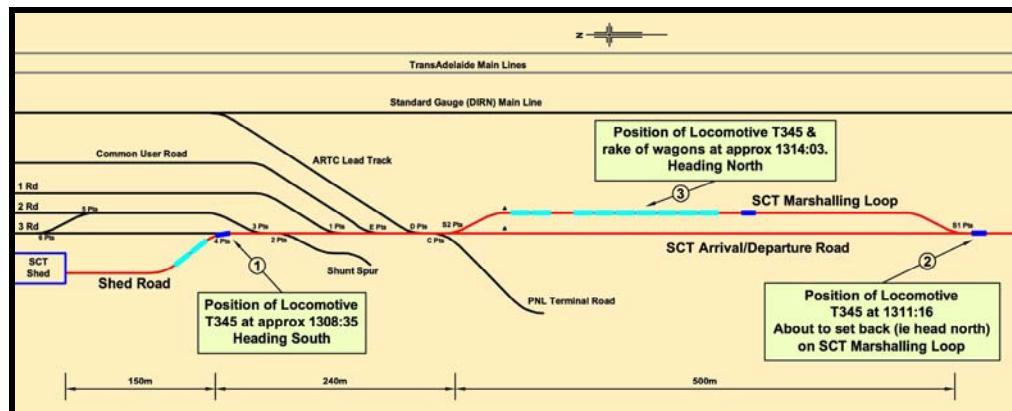
**FIGURE 5. T345, Hasler recorder data (locomotive data logger).**



At 1305:19, T345 started hauling<sup>5</sup> a rake of wagons out of the Shed Road; it moved in a southerly direction making a series of short stops, within the SCT yard, to split the rake.

At 1308:35, the shunter uncoupled the last two remaining wagons. The shunter then joined the driver in the cab before T345 headed south, (Fig. 6) through the PN/SCT common interface area. It proceeded along the 'arrival/departure road' where it travelled to the far end of the loop, clear of points, S1.

**FIGURE 6. Sequence of shunt movements (See Appendixes, Fig. 15 for large scale plan)**



T345 came to a stop at 1311:16, the shunter dismounted from the locomotive and set points S1 for the 'marshalling loop'. He rejoined the locomotive, riding the side steps as it proceeded northwards along the 'marshalling loop' before stopping short of a rake of seven wagons at 1311:45. The shunter dismounted from the side steps and coupled the wagons to the locomotive. The train now comprised seven wagons, furthest from locomotive were two covered box vans ABFY 2510R, ABFY 3130L and then a further five container flat wagons VQCY 532M, VQCY 916Y, CQBY 2013G, CQBY 2015, and CQBY 2028N closer in. The shunter continued to walk northwards in-between the 'SCT marshalling loop' and the 'SCT arrival/departure road' to couple the two remaining container flat wagons CQMY 3008N and CQMY 3014X, this was done at 1315:26. The shunter then crossed the 'SCT marshalling loop' in front of CQMY 3008N to embark on the end step and ride the wagon back towards the SCT Shed. The driver's view of the right hand side (RHS) of the furthest wagon in the rake, CQMY 3008N, was now hidden from view by the two covered box vans ABFY 2510R and ABFY 3130L (Fig. 7) as was the shunter.

The shunter was now near/adjacent the hand operated derail when he and the driver communicated using the hand held radios. A short dialogue transpired regarding the position of the derail, that is, whether it was sitting on the rail or off. Based on the interview with the driver it appears that there may have been some confusion regarding its position and the shunter's subsequent communications. The driver powered the locomotive and proceeded to propel the rake of wagons northwards into the SCT yard. (Fig. 8)

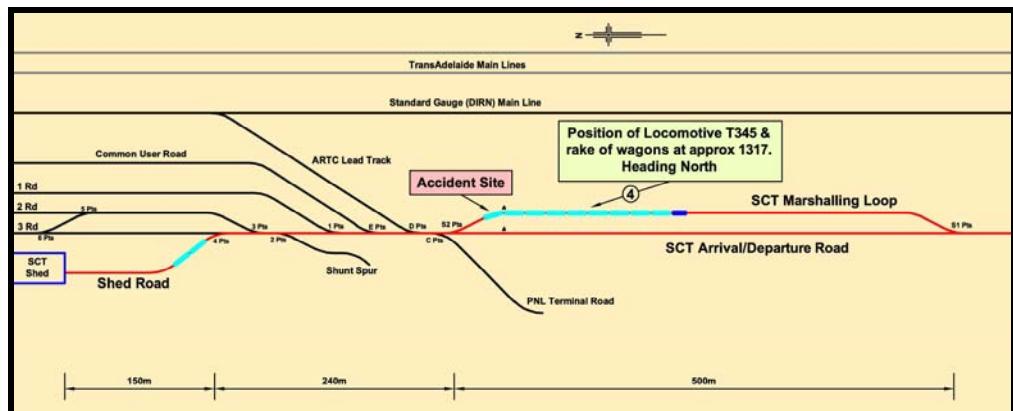
<sup>5</sup> 'hauling' - to move rail traffic using motive power source at the leading end. (Source: Glossary for the National Codes of Practice and Dictionary of Railway Terminology)

**FIGURE 7. T345 – Driver's view of CQMY 3008N, looking north and as seen while undertaking a propelling move.**



At approximately 1317, (Fig. 8, 17 & 19) unbeknown to the driver, whilst undertaking this final shunt move, CQMY 3008N and all remaining wagons including the locomotive ran over the shunter. During this entire move, the shunter would have been hidden from the driver by the box van.

**FIGURE 8. Sequence of shunt movements (See Appendixes, Fig. 17 for large scale plan)**



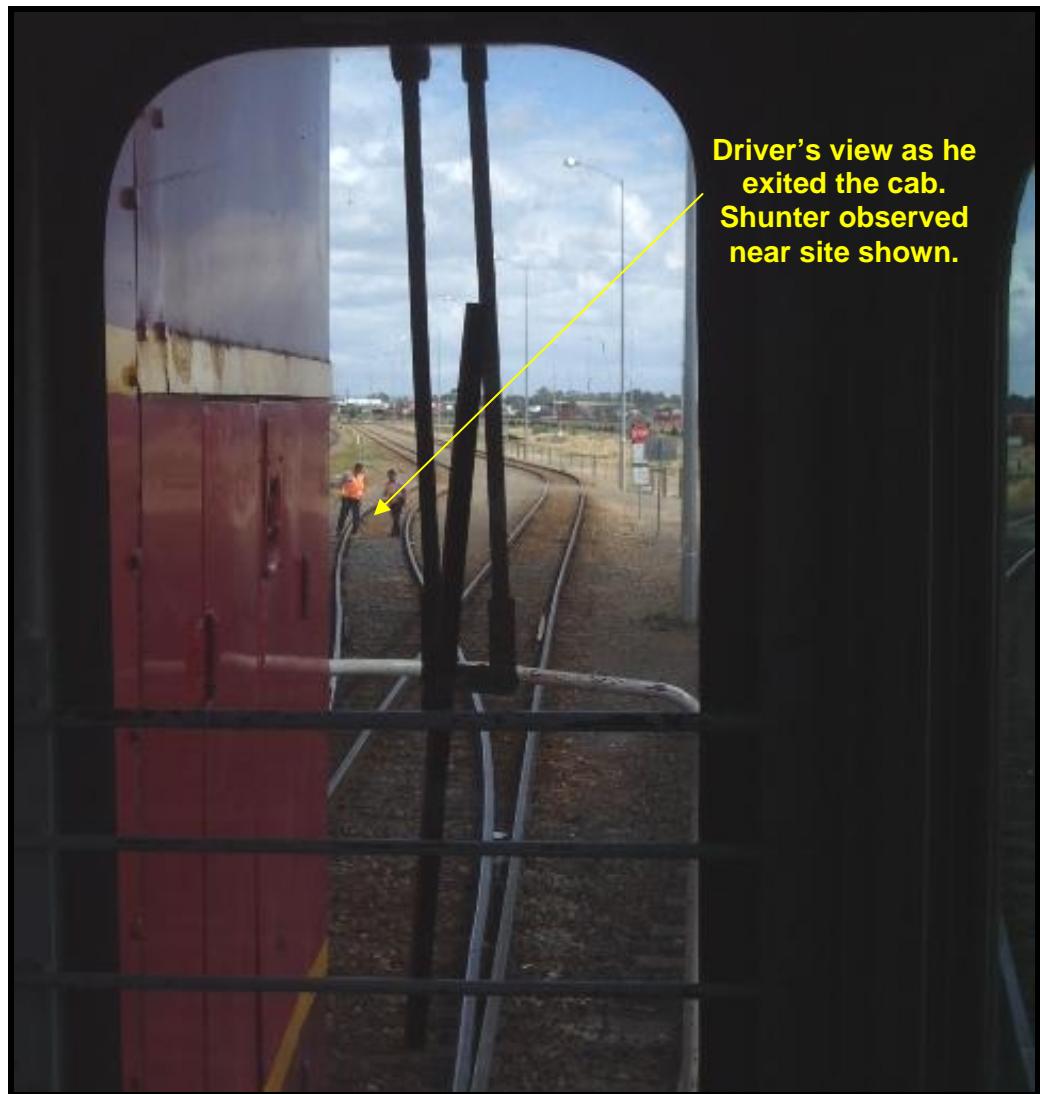
As the train proceeded northwards, the driver noticed that the train was moving too deep into the SCT yard. The driver stopped the train, at approximately 1319, (Fig. 18 & 20) and endeavoured to contact the shunter using his hand held radio for a 'situation report' and to establish the shunter's wellbeing/whereabouts.

**FIGURE 9. Container flat, CQMY 3008N – As stopped at 1318:35, looking south.**



When the shunter failed to respond to several radio calls, the driver decided to go and look for the shunter. As he exited the cab to descend the locomotive ladder, he saw the shunter on the ground just north of the hand operated derail. He rushed to the accident site. On arrival he observed that the shunter was laying face down, parallel to the track, with the right hand side of his body partly straddled across the rail lines. He had sustained serious injuries, his right arm was severed close to the shoulder, his right leg was crushed part way between the hip and knee and his left leg was crushed between the knee and ankle.

**FIGURE 10. T345 – Driver's view through cab/exit door looking south.**



The driver immediately contacted SCT's rail - administration clerk and requested the attendance of emergency services personnel. The driver provided first aid; this was followed by backup support from the rail - administration clerk. Ambulance services arrived at 1333 followed by police at 1339. After being stabilised, the shunter was transported to the Royal Adelaide Hospital to undergo emergency surgery.

## 2.4

### Personnel involved

At the time of the accident the driver had over 30 years experience in the rail industry having worked for the South Australian Railways (SAR), Australian National (AN) and National Rail (NR) before starting with SCT in 1996. He started his working life as a 'Junior Porter' but mainly worked in shunting positions since leaving the SAR. The records (summarised at Table 1.) indicate that the driver was trained/qualified to SCT requirements and that he had extensive experience as a shunt driver/shunter. Without being limited, SCT's requirements included, 'Safe Working Rules', 'SCT Yard Familiarisation', 'Interface Protocols' and locomotive driver training as appropriate.

The shunter was also appropriately trained/qualified. At the time of the accident he also had extensive experience in the rail industry. He had worked in the industry for in excess of 20 years before starting with SCT in 2002. He was trained/qualified to SCT's requirements, without being limited this included, 'Safe Working Rules', 'SCT Yard Familiarisation', 'Interface Protocols' and locomotive driver training as appropriate.

**Table 1. Driver & Shunter Details**

Details	Driver	Shunter
Gender	Male	Male
Qualifications	Shunter Driver/Shunter	Shunter Driver/Shunter
Experience	Extensive	Extensive
Trained/Re-trained	To SCT requirements	To SCT requirements
Medical Status	Fit <sup>6</sup> to National Standards	Fit to National Standards
Medical Restrictions	Yes <sup>6</sup>	No
Tests (Drug/Alcohol)	Negative	Not tested
Fatigue/Rosters	No issues identified	No issues identified

Both the driver and shunter had known each other for many years and had a well developed and amicable working relationship.

## 2.5

### Radio communications

As part of the SCT Regency Park working procedures, a driver and shunter communicate by hand signal and/or using hand held radios where line of sight communications is not available. However, radio tends to be the dominant mode of communications used at the SCT site due to the layout of the yard and shunting distances involved. The hand held radios used by SCT at their Regency Park site operate in a simple talk around/party line mode. The radios can support up to 14 channels, the SCT radios have been configured with two channels, 1 and 53. Channel 1 is used exclusively by SCT, predominately for shunting activities. Channel 53 is used for communicating with PN and ARTC when working through the 'common interface area'.

SCT also has a fixed radio located within its administration offices for the purpose of communicating with external staff and for the monitoring of voice traffic. However, voice traffic is not recorded, so it was not possible to review any conversation that may have transpired between the driver and shunter in the lead up to the accident.

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6 An examination of the driver's medical records established that he suffered from a moderate, low to mid frequency hearing loss and although authorised to undertake 'Safety Critical Work' he was required to use a headset when operating radio equipment.

## 2.6

## Environmental conditions

At the time of the accident, the temperature was estimated to be 16.8 degrees Celsius, wind speed was about 30 km/h and approximately 1.4 mm of rain had fallen since 0900 that morning. Video footage from an SCT security camera shows that the last shower of rain occurred at approximately 1248.

Weather information for the Adelaide metropolitan area was obtained from the Bureau of Meteorology, (BoM) and is as detailed at Table 2.

**Table 2. Weather details for Adelaide 2 February 2005 (Source BoM)**

Local Time	Wind Direction (degrees from true north)	Wind Speed (km/h)	Maximum Wind Gust (km/h)	Temp. (degrees Celsius)	Cumulative Rainfall (mm) from 9am
1158:59	180	24.1	35.3	18.1	0.6
1210:00	220	35.3	53.6	16.9	0.6
1230:00	200	40.7	59.4	16.7	0.6
1255:59	190	38.9	66.6	11.5	1.2
1301:00	200	35.3	66.6	12.2	1.4
1317:59	210	27.7	48.2	16.1	1.4
1330:00	210	35.3	51.8	17.4	1.4
1400:00	200	33.5	48.2	19	1.4
1401:59	200	33.5	51.8	19.5	1.4
1428:59	220	57.2	76	16.8	1.4
1431:00	210	51.8	76	14.4	1.6
1440:59	200	37.1	50	16.4	1.8
1500:00	210	42.5	53.6	17.7	1.8

## 2.7

## Train information

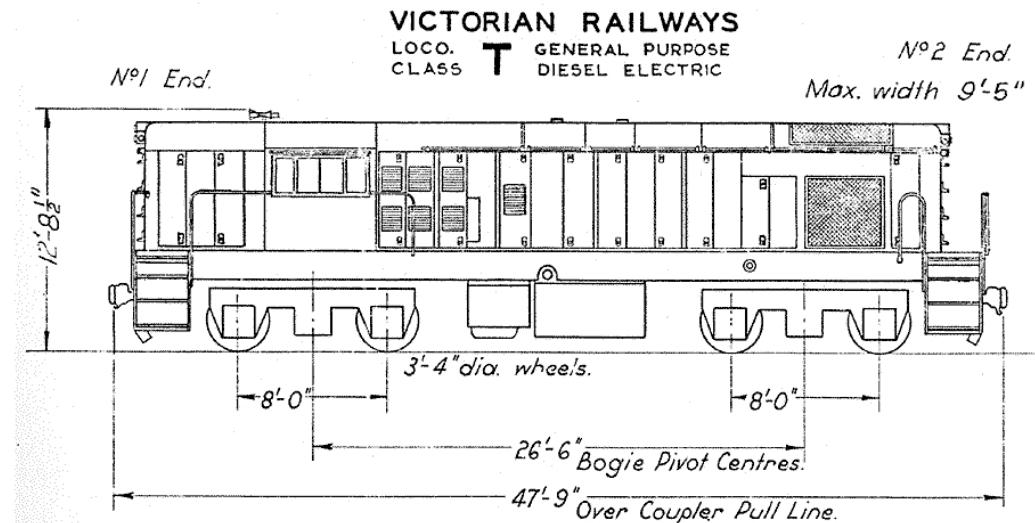
The locomotive used by SCT, a T Class, (T345) was originally purchased by the Victorian Railways and brought into service on 24 December 1956. It was primarily used for branch-line work. (Fig. 11, drawing of T Class locomotive)

It was retired from service with the Victorian railways in December 1987. Since then it has served with a number of other rail organisation before coming to SCT.

The locomotive has a fully loaded weight of 69 tonnes with an overall length of 14.5 metres (over the couplers) and a width of 2.87 metres. Maximum speed – 100 km/h.

The locomotive has an onboard ‘locomotive data logger’, a Hasler recorder, it was used for capturing time, distance and speed information.

FIGURE 11. Drawing of T Class locomotive



The remaining wagons in the rake (Table 3) comprised:

Table 3. Wagon make-up as at 1317 on 2 February 2005

Vehicle Code	Description	Brake type	Tare Mass Tonnes	Length Metres
CQMY 3008N <sup>7</sup>	Container flat	Westinghouse Triple	22.0	25.7
CQMY 3014X	Container flat	Westinghouse Triple	22.0	25.7
ABFY 2510R	Covered box van	Westinghouse Triple	30.0	23.8
ABFY 3130L	Covered box van	Westinghouse Triple	30.0	23.8
VQCY 532M	Container flat	Westinghouse Triple	20.0	20.1
VQCY 916Y	Container flat	Westinghouse Triple	20.0	20.1
CQBY 2013G	Container flat	≡ Westinghouse Triple <sup>8</sup>	19.7	19.4
CQBY 2015	Container flat	≡ Westinghouse Triple <sup>8</sup>	19.7	19.4
CQBY 2028N <sup>9</sup>	Container flat	≡ Westinghouse Triple <sup>8</sup>	19.7	19.4
TOTAL LENGTH OF WAGONS IN RAKE (meters)				197.4

<sup>7</sup> Wagon furthest from locomotive T345

<sup>8</sup> Designates that the brake system is the Chinese equivalent of Westinghouse Triple.

<sup>9</sup> Wagon closest to locomotive T345



### 3

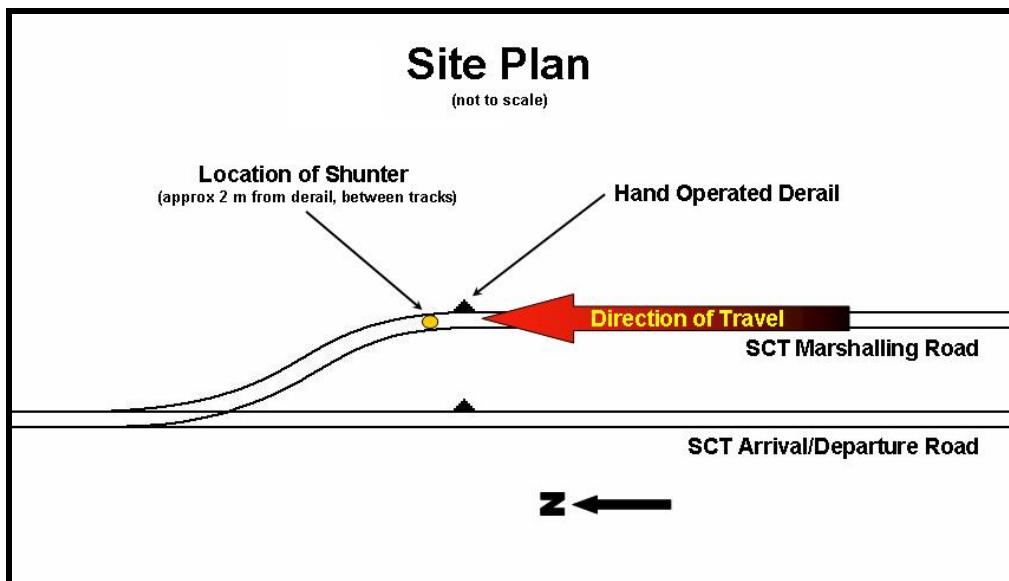
## ANALYSIS

### 3.1

#### Site overview

The shunter was found lying face down in a semi-conscious state, approximately two metres north of the hand operated derail (Fig. 12) that protects the entrance to the SCT marshalling loop. His head was facing in a northerly direction; his body was parallel to the track. His hand held radio, safety vest, set of keys and one black work boot were located within the ‘four foot’ immediately adjacent to his body. An examination of the right hand running wheels (travelling in a northerly direction) of CQMY 3008N and all remaining wagons including the locomotive showed signs of blood and fleshy tissue on most wheels, indicating that the shunter had been run over by CQMY 3008N, then the remainder of the train. This lends support to the hypothesis that shunter was in front of the end step and/or about to embark on CQMY 3008N; or that he fell, after having embarked on the end step, lost his balance and tumbled forward and in front of CQMY 3008N.

**FIGURE 12. Location of shunter at accident site**



### 3.2

#### Safety management plan

Each ‘Accredited Rail Operator’ in South Australia is required to demonstrate safe operations through the submission of a comprehensive safety management plan incorporating the identification of safety risks. This plan should then propose measures to remove or reduce those risks to levels that are as low as reasonably practicable (ALARP).

A review of SCT’s safety management plan (risk matrix) was undertaken as part of this investigation, the risk matrix failed to appropriately recognise any significant threat associated with shunting activities; in fact no direct reference was made to shunting within the risk matrix.

Better organisational recognition of the risks associated with shunting activities and the implementation of effective control measures may have mitigated the risk of this accident.

### 3.3 Work procedures

Shunting has historically been a high risk activity<sup>10</sup> and many rail authorities both in Australia and overseas now ban personnel riding on wagons as a result of unacceptably high levels of serious injury/fatality.

SCT's work procedures for shunting at Regency Park, most relevant to this accident, are shown at Table 4. (Appendixes) An examination of SCT's risk matrix, did not show 'Shunting' as a specific task and although Item 5E identifies Collision - Train/People, this reference is considered too vague. The risk matrix should clearly identify high risk processes, such as shunting, and propose strategies to mitigate high risk processes within a task.

**FIGURE 13. Illustration of shunter riding end step, (as at time of accident) facing forward holding radio. Practice now discontinued by SCT.**



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<sup>10</sup> As evidenced in the number of fatalities and serious injuries that have occurred in both Australia (three fatalities and nine serious injuries over period 2000 to 2005) and New Zealand (five fatalities over a one year period) Ref. 'Ministerial Inquiry into Tranz Rail Occupational Safety & Health' Report August 2000

At the time of this accident, SCT allowed its personnel to ride rail vehicles for the purpose of shunting; however they did recognise the danger of personnel joining a moving vehicle and instructed against this practice.

Discussions with the driver and shunter established that it was common practice for SCT shunters to ride the end step of a leading wagon when directing shunting activities, that is, undertaking the role of the shunter. It was also established that while undertaking this role, shunters would regularly stand on the end step and face forward, looking in the direction of travel, (Fig. 13) whilst undertaking a propelling move.

This coupled with the need to operate a hand held radio in one hand, meant that the remaining hand was used exclusively for gripping/support and holding any handrail.

On examining the close vertical separation of the end step and the handrail on a flat container wagon such as exists with CQMY 3008N, (Fig. 9) it is evident that the arrangement would provide limited support particularly if a shunter was facing forward, holding a radio in one hand with the other hand behind his back gripping the handrail.

On the day of the accident, the weather was cold wet and windy and it is quite probable that the end step was still wet. Had the shunter lost his footing/balance on a partially wet/slippery end step, it is reasonable to conclude that he would fall towards the track.

### 3.4

## Training and auditing

Safety policies/procedures, training and auditing are all primary defences against employees developing unsafe work practices. An examination of SCT's training and auditing documentation relating to employees engaged in 'Rail Safety Work' indicates that both employees were initially trained and qualified at an appropriate level. However, there was no recorded evidence of any re-training in safety critical shunting activities by SCT and whether the employees were regularly audited for satisfactory/safe working performance, which includes the use of recommended safety equipment and communication protocols.

Better organisational control, through an enhanced safety auditing regime and improved training, may have reduced the risk of this accident.

During the 'Directly Involved Parties (DIP)' process, SCT submitted additional information to the ATSB, a training program ('Excel' spreadsheet). This provided some evidence of repeat training, however this information was not fully reflected in the employees' personal records.

### 3.5

## Personal protective clothing

On the day of the accident, the shunter was using personal protective equipment (PPE) comprising gloves, a safety vest and safety boots. The safety vest was old and discoloured, but should have provided sufficient visual contrast. The safety boots, in particular the soles and heels were worn and coupled with the wet conditions may have provided insufficient grip as the shunter embarked onto the end step of CQMY 3008N. This may have resulted in him losing his footing and

consequently his balance. Based on the observed condition of the safety boots it is concluded that they may have been a factor that contributed to this accident.

### 3.6

### Fatigue

An examination of both the shunter's and driver's rosters revealed that fatigue is unlikely to have been a contributory factor to this accident.

### 3.7

### Medical and toxicology

SCT use the National Transport Commission (NTC) *National Standard for Health Assessment of Rail Safety Workers* hereinafter referred to as the *National Health Standard* as a basis for assessment of 'Safety Critical Workers' engaged by their company.

The investigation established that:

The shunter was medically examined on 30 July 2004 at the Work Health Clinic, Mile End, SA. His records indicate that he was 'Fit for Duty – Meets all relevant medical criteria' as prescribed by the *National Health Standard*.

It is concluded that:

He did not suffer from any known medical or psychological condition that may have contributed to the accident.

- His colour vision was normal and he had good unaided distance visual acuity.
- At the time of testing, he did suffer from a minor hearing loss in his left ear; however, this was related to a viral infection (cold) that he had at the time.
- At the time of testing, he was assessed as medically fit. His ability to communicate by radio should not have been impaired.

Based on evidential data it is believed that there were no issues that would have either directly or indirectly contributed to the accident as a result of the shunter's physical or psychological health.

Toxicology testing was not performed on the shunter due to the seriousness of his injuries. Also, based on medical advice, the shunter was not interviewed<sup>11</sup> due to the traumatic nature of his injuries and his psychological health. However, all available evidence would suggest that alcohol and/or drugs was not an issue.

The driver was medically examined on 20 August 2004 at the Work Health Clinic, Mile End, SA. His records indicate that he was 'Fit for Duty Subject to Job Modification – Does not meet all medical criteria, .....'. His medical records show that he suffers from a moderate, low to mid frequency hearing loss; he was fit for duty in all other respects.

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<sup>11</sup> The shunter was interviewed on 10 Feb 05, one year after the accident, when the ATSB received formal notification that he well enough to do so. During the interview with the shunter it was established that he had no recollection of any of the events either in the immediate lead-up to, or post accident.

It is concluded that:

- He did not suffer from any known psychological condition that may have contributed to the accident.
- His colour vision was normal and he had good unaided distance visual acuity.
- His medical records did show that he was 'Required to use a headset for radio communication'.

Based on evidential data it is apparent that the driver suffered from a moderate, low to mid frequency hearing loss. There was no evidence to suggest he was wearing a headset at the time of the accident. It would appear that SCT did not ensure that the driver used the headset as prescribed. The absence of the head set increased the risk of miscommunication.

Toxicology testing was performed on the driver, the results were negative.

### 3.8

## Radio communications

A radio site survey (channel 1) was jointly conducted by the ATSB and SA Workplace Services using the shunter's hand held radio (Fig. 14) to establish whether any potential problems may have existed with the radio and/or radio coverage within the SCT yard area. No deficiencies were identified, as relates to the technical aspects of the radio/radio system.

**FIGURE 14. Hand held radio, Serial No 672TDL4017 used by shunter on 2 February 2005**



An examination of SCT's work procedures established that SCT was aware of the importance of effective communications and the very important need to pass accurate and unambiguous information.

Based on the driver's interview and his statement to the SA Police it is evident that some form of miscommunication had arisen between the driver and shunter regarding the position of the hand operated derail and subsequent communications. This occurred just prior to the accident in which the shunter was injured.

It was noted that SCT's communication procedures recommend that radio operators should:

'Exchange messages clearly without ambiguity using "OVER" at the end of each transmission.'

SCT procedures further prescribe:

'If the Locomotive operator is uncertain of the Signal person command or direction, a stop signal is to apply until signal has been re-established.'

There was some level of miscommunication between the driver and shunter just prior to executing the propelling movement in which the shunter was injured. This may have been exacerbated in the non use of a radio headset by the driver. The shunter had either not mounted the end step of CQMY 3008N, or had just embarked onto the end step of CQMY 3008N at the time the driver started propelling the rake of wagons. Available evidence would indicate that the shunter lost his balance and tumbled forward in front of the rake of wagons before being run over.

Had the driver observed the radio procedures requiring the train to remain where it was in the absence of a definite instruction from the shunter, the dynamics for the accident would have been removed.

It was also noted that SCT does not prescribe that a driver must regularly communicate with a shunter to establish their wellbeing/whereabouts. Had such a procedure been in place the driver may have responded more quickly to this accident.

## **3.9 Environmental factors**

Based on BoM information and video evidence it is concluded that the weather in the vicinity of the SCT Yard at Regency Park was cold, wet and windy. It is likely that the track and the end step of CQMY 3008N were wet and slippery and may have been factors that contributed to this accident.

## **3.10 Train performance**

An examination of the general condition of locomotive T345 and the nine wagons in the rake through visual inspections of the running gear components; including bogies, braking system, and mechanical structure did not identify any issues that would have had any direct or indirect causal effect on the accident.

Following an examination of T345's maintenance records, the SCT security video and the Hasler tape, it is concluded that the locomotive was performing normally on the day of the accident; braking performance is not considered a factor that may have contributed to the accident.

The driver had restricted visibility from the cab, but the procedures allowed for radio communications where the driver and shunter were not in sight of each other.

### **3.11**

## **Chart log and video evidence**

An examination of SCT's security video<sup>12</sup> and the locomotive chart log was used in reconstructing the sequence of events leading up to the accident. A review of the chart log (Fig. 5) shows that T345 had been driven at speeds significantly in excess of that prescribed in SCT's operating procedures. Although this is not considered a factor in this accident it is concluded that robust auditing of prescribed safety practices may have been an effective mechanism in reinforcing a culture that promotes safety.

### **3.12**

## **Track and site layout**

A physical examination of the site established that SCT has set up a number of quarry rubble pathways adjacent to its rail lines. These pathways can be used by shunters and other personnel who may wish to walk alongside or adjacent to trains during shunt movements. The layout of the SCT yard and distances that shunting operations may work over can extend up to 1 km. It is unreasonable to expect that employees will walk these distances and if not provided with alternative means of conveyance, will certainly result in employees riding on wagons/locomotives, particularly if not prohibited by the employer.

An examination of the track established that there were no deficiencies or defects that either directly or indirectly contributed to the accident.

### **3.13**

## **Emergency response**

The emergency response to this accident was effective and efficient. The total time that elapsed from when the driver of T345 stopped, (1319) and identified that an accident had occurred, contacted SCT's rail - administration clerk to request the attendance of emergency services and the subsequent arrival of SA Ambulance services (1333) was 14 minutes. After being stabilised, the shunter was transported directly to the Royal Adelaide Hospital to undergo emergency surgery. The driver and Rail – administration clerk should be commended for their quick and effective response to this emergency.

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<sup>12</sup> The SCT video surveillance cameras were too distant from the accident site to provide specific detail regarding the nature of the accident and there were no witnesses to this accident



At approximately 1317 on Wednesday 2 February 2005, a Specialised Container Transport employee was seriously injured whilst undertaking shunting operations at the SCT Rail Yards, Regency Park, South Australia.

Although this accident was not on the DIRN the South Australian Government through the State's Rail Safety Regulator requested that the ATSB initiate an independent investigation to establish the causal factors.

As a result of its investigation, the ATSB makes the following observations detailing the most likely sequence of events giving rise to the accident, the factors believed to have contributed to the accident, and other factors of interest identified through analysis.

### 4.1

#### The accident

Given the locality, that is the position in which the shunter was found, the location of the end step, and the evidence of blood on the wheels of the wagons and locomotive, it is likely that either:

- the shunter fell from the end step of the leading container flat wagon CQMY 3008N, whilst locomotive T345 was propelling a rake of wagons in a northerly direction, heading out of the SCT marshalling loop; or
- the shunter was run over by CQMY 3008N just before or as he attempted to board the end step.

### 4.2

#### Contributing factors

The number of unsafe acts and deficient local conditions that may have contributed to the accident include:

- a) the driver was uncertain of the directions given by the shunter and did not challenge those directions before he started the final propelling movement.
- b) safe working procedures did not require that the driver validate the shunter was safe/in a safe position before starting a shunt movement.
- c) the height of the handrail/hold, relative to the end step does not provide an optimum grip on the handrail.
- d) due to the need to use the hand held radio, the shunter did not have both hands free to hold the end step handrail to provide balance and support.
- e) the design of the end step on CQMY 3008N did not facilitate a safe riding position.
- f) despite the expanded metal construction used on the end step, the surface of the step most probably was wet, and combined with the worn footwear of the shunter, would have been potentially slippery.

- g) the weather was cold, wet and windy, the end step of CQMY 3008N was probably wet and slippery.
- h) the personal protective equipment, (PPE) in particular the soles/heels of the shunter's safety boots were found to be in a poor condition and probably would not have provided adequate grip.
- i) the SCT Safety Management Plan (risk matrix) did not adequately identify the level of risk associated with the practice of riding on the end step of wagons and SCT did not develop mature strategies to mitigate that risk.
- j) SCT allowed its shunters to ride on wagons whilst being shunted.
- k) SCT did not audit employees for safe shunting practices, including the auditing for appropriate communication protocol.
- l) the lack of adequate training documentation and associated training to instruct employees in safe shunting procedures.
- m) the lack of safety auditing to validate employees were complying with identified safe working practices.
- n) SCT did not impose mandated medical requirements as specified in the driver's medical records and/or the driver did not use a head set as prescribed.

## 4.3 Findings

Based on available evidence including the position of the shunter's body on the track and the nature of his injuries, it is concluded that:

- a) the shunter was run over by the leading right hand wheel of the container flat wagon CQMY 3008N, either:
  - after he fell from the end step; or
  - as he attempted to board the end step
 during the period when train T345 started its propelling move heading north out of the SCT marshalling loop.
- b) the shunter was run over by the entire train, right hand running wheels. (travelling in a northerly direction)
- c) the injured shunter commonly would ride the end step of a wagon facing forward. He would hold the hand held radio in one hand and use his second hand, (behind his back) to hold the wagon's handrail for support.
- d) normally, SCT drivers and shunters communicate by hand signal and/or using hand held radios. No technical deficiencies were identified with the hand held radios or SCT's radio system.
- e) the SCT radio procedures do not prescribe a requirement that a driver should regularly check on a shunter's wellbeing/whereabouts.

- f) there was no documented evidence in the respective employees' records of a regular audit for satisfactory/safe working performance, including the use of appropriate/recommended SCT communication protocols.
- g) the driver/shunter was trained to SCT safety requirements; however, there was no documented evidence in the respective employees' records of an ongoing re-training program.
- h) fatigue due to rostered work-shifts is unlikely to have been a contributory factor.
- i) the shunter was medically and psychologically fit.
- j) toxicology testing was not performed on the shunter due to serious nature of his injuries.
- k) the driver was psychologically fit. He suffered from a moderate, low to mid frequency hearing loss. There was no evidence to indicate that he was using a radio headset at the time of the accident as prescribed in his medical records.
- l) toxicology testing was performed on the driver, the results were negative.
- m) the locomotive was functioning normally on the day of the accident; braking performance is not considered a factor.
- n) on the day of the accident, T345 had been driven at speeds in excess of that prescribed in SCT's operating procedures. Although not considered a factor in this accident, robust auditing of safety practices, including allowable train speed limits, may have been an effective mechanism in promoting a focus on safety.
- o) there was no deficiency or defect identified with the track.
- p) the emergency response to this accident was effective and efficient.



As a result of its investigation, the ATSB makes the following recommendations with the intention of improving railway operational safety. Rather than provide prescriptive solutions, these recommendations are designed to guide interested parties on the issues that need to be considered. Recommendations are directed to those agencies that should be best placed to action the safety enhancements intended by the recommendations, and are not necessarily reflective of deficiencies within those agencies.

**5.1****Actions taken**

SCT has conducted a review of their shunting procedures at the Regency Park site in South Australia, and subsequently modified its shunting arrangements. The amended procedures incorporate the use of a small 'All Terrain' vehicle. The riding of wagons is no longer permitted. SCT has also enhanced its radio communications on T345 by providing a fixed radio with external speaker as well as an on board CCTV system to assist with driver peripheral vision.

**5.2****Recommendations****RR20060001**

The ATSB recommends that SCT:

- develop arrangements that do not require employees to ride a locomotive/wagon whilst it is being shunted, this should be done without compromising the safety of shunt movements; or if not feasible develop a restraint mechanism/workstation to protect a shunter from falling from a locomotive/wagon whilst carrying out a shunt movement.

**RR20060002**

The ATSB recommends that SCT:

- develop procedures that ensure a driver validates the position of a shunter, before starting a shunt movement and also regularly validates the wellbeing/whereabouts of a shunter whilst undertaking shunting activities.

**RR20060003**

The ATSB recommends that SCT:

- undertake a thorough risk assessment of its shunting activities. Translate this risk assessment into a comprehensive safe working procedure and develop/provide an associated and accredited training program. Provide regular retraining of employees with respect to safety critical activities.

**RR20060004**

The ATSB recommends that SCT:

- remind employees of their Occupational Health and Safety (OHS) responsibilities with respect to their personal safety, which includes a requirement to regularly check/replace worn personal protective equipment (PPE) such as safety boots/shoes and compliance with prescribed safety policies.

**RR20060005**

The ATSB recommends that SCT:

- undertake/record results of regular audits of employees working practices to ensure that they are complying with documented safe working procedures and training directives.

**RR20060006**

The ATSB recommends that SCT:

- ensure mandated medical instructions/restrictions are implemented. If the intent of a medical directive cannot be fully achieved consult with the medical practitioner to ensure any proposed alternative is effective.

**RR20060007**

The ATSB recommends that the South Australian Railway Safety Regulator:

- Actively monitor the actions initiated by SCT in response to this investigation.

**RR20060008**

The ATSB recommends that the South Australian Railway Safety Regulator:

- Recognise that the findings of this investigation may be relevant to other organisations, and take the appropriate actions to ensure they are advised accordingly.

Section 26(1) of the Transport Safety Investigation Act 2003, states that the Executive Director may provide a draft report, on a confidential basis, to any person whom the Executive Director considers appropriate, for the purposes of:

- a) Allowing the person to make submissions to the Executive Director about the draft; or
- b) Giving the person advance notice of the likely form of the published report.

The final draft of this report was provided for comment to the following directly involved parties:

- a) Specialised Container Transport (SCT)
- b) Driver of SCT locomotive T345
- c) Shunter injured by locomotive T345
- d) South Australian Railway Safety Regulator.

A number of comments and observations on the draft report were received from directly involved parties. Their remarks have been considered by the ATSB investigation team and some have been incorporated into the body of this report where appropriate.



## 7.1

## Extract of SCT work procedures

Table 4. Extract of SCT working procedures, relevant to accident

Reference	Details and Relevant Clause(s)
PROCEDURE: PRO-026	Islington Interfacing (Pacific National and SCT Procedure)
	Relevant Clause(s)
	Nil
WORK INSTRUCTION WI 016	Shunting Work Instruction Islington South Australia
	Relevant Clause(s)
	<b>4.1. Rail Siding Preliminary Check prior to operating</b>
	<ul style="list-style-type: none"> <li>Verify that hand held radios and locomotive radio are on channel 1 and fully operational - and that additional batteries are on charge.</li> </ul>
	<b>4.2. Shunting Locomotive</b>
	<ul style="list-style-type: none"> <li>Locomotive must not be operated at a speed greater than 10 km per hour within shunting area.</li> </ul>
	<b>4.3. Shunting Guidelines</b>
	<ul style="list-style-type: none"> <li>Only trained personnel are permitted to operate Locomotive whilst accompanied by a trained shunter (Signal Person).</li> <li>If the Locomotive operator is uncertain of the Signal person command or direction, a stop signal is to apply until signal has been re-established.</li> <li>When coupling or uncoupling wagons Signal person must be in a position which is visible to coupling and ensure alignment is correct. Under no circumstances is the shunter to go between the wagons whilst they are in motion. If the alignment of the couplers is not true the shunted is to give the command "Stop" and advise locomotive operator he is going between wagons. The locomotive operator is to ensure that consist is secure and is not permitted to proceed with movement of same until directed by same shunter.</li> </ul>
VOL 1	SCT ISLINGTON RAIL AWARENESS MANUAL
	SCT RAIL ORGANISATIONAL CHART
	Relevant Clause(s)
	Nil

**Table 4. Extract of SCT working procedures, relevant to accident (Cont'd)**

Reference	Details and Relevant Clause(s)
VOL 2	SCT ISLINGTON RAIL AWARENESS MANUAL INTRODUCTION
	Relevant Clause(s)
	<p><b>BASIC TRAINING - A FEW "MUST DO'S"</b></p> <p>There are a few to observe when working in rail yards:</p> <ul style="list-style-type: none"><li>• Always look and listen for rail movements.</li><li>• Always be aware of your footing.</li><li>• Always be aware of your grip on a handrail.</li><li>• Never turn your back on a moving rail vehicle.</li><li>• Never walk backwards in a rail yard.</li><li>• Never commit your weight to a step or handrail without testing them first.</li><li>• Never stand between the couplings of two vehicles.</li><li>• Never stand or balance on a rail.</li></ul> <p><b>SAFETY MUST COME FIRST</b></p> <ul style="list-style-type: none"><li>• At ALL times when shunting, the paramount consideration is SAFETY.</li></ul> <p><b>GETTING ON - GETTING OFF</b></p> <p>It is a good and safe policy to avoid riding on vehicles, but if it is absolutely necessary (as in the need to 'ride' a handbrake) do it in safety.</p> <p>Be certain that:</p> <ul style="list-style-type: none"><li>• You can see the driver (and be seen by the driver).</li><li>• If you have to get off in a hurry, you have an escape route.</li><li>• You won't get trapped between a platform or fence, and the vehicle.</li></ul> <p>If you have no choice but to get off a moving vehicle <b>IN AN EMERGENCY</b>.</p> <ul style="list-style-type: none"><li>• DO NOT JUMP.</li><li>• First LOOK where you are going to land.</li><li>• Keep a grip on the handrail, then STEP DOWN with your OUTSIDE FOOT making contact with the ground first.</li><li>• Only when you are balanced, release your grip on the vehicle.</li><li>• NEVER try to get off a moving vehicle in the opposite direction to which it is moving. To try to go the other way, will see you flat on your back and possibly under the wheels.</li></ul>

**Table 4. Extract of SCT working procedures, relevant to accident (Cont'd)**

Reference	Details and Relevant Clause(s)
VOL 2 (Cont'd)	SCT ISLINGTON RAIL AWARENESS MANUAL INTRODCTION
	Relevant Clause(s)
	GETTING ON – GETTING OFF  If you get on a vehicle, be sure of what you are doing. Make sure the vehicle is stationary. As previously stated: <ul style="list-style-type: none"><li>• Always <b>be sure of your footing</b> on a step.</li><li>• Always <b>be sure of your grip</b> on a handrail.</li></ul>
	COMMUNICATION PROTOCOLS  General Safety <ul style="list-style-type: none"><li>c) Make transmissions so they be understood, be brief and related to the task at hand.</li><li>f) Use standard radio terms when operating with radios.</li></ul> Testing communications equipment  Communications equipment provided for railway operations (for example radios on trains, in terminals and yards, or used for track work) shall be tested and checked for their intended operation before use.
	Transmitting and Receiving messages  Exchange messages-clearly without ambiguity using “OVER” at the end of each transmission.
	Standard Radio Terms (See Appendixes)
VOL 3	SCT ISLINGTON RAIL AWARENESS MANUAL HEALTH & SAFETY
	Relevant Clause(s)
	Nil
VOL 4	SCT ISLINGTON RAIL AWARENESS MANUAL SHUNTING INSTRUCTIONS FOR ISLINGTON
	Relevant Clause(s)
	<b>4.3. Shunting Guidelines</b> <ul style="list-style-type: none"><li>• If the Locomotive operator is uncertain of the Signal person command or direction, a stop signal is to apply until signal has been re-established.</li></ul>

## 7.2

## SCT standard radio terminology

**Table 5. SCT standard radio terminology**

Term	Meaning
Receiving -	I (called party) acknowledge your call, proceed with message
Message Received -	I have received your message and I understand it.
Over -	I have finished speaking and I am waiting for a reply.
Out -	My transmission has been completed.
Correct -	You are correct, or what you have transmitted is correct.
Negative -	No, or permission is <u>not</u> granted, or there is an error in your read back.
Stand By -	Wait, I will be back soon.
Say Again -	Please repeat your last message.
Speak Slower -	Speak more slowly, it is hard to understand you.
Roger -	All your last message is received and understood.
Loud and Clear -	Your signal is strong, every word is understood.
Emergency -	This is an emergency situation.

## 7.3

## Aerial photographs

Fig. 15 - aerial view of SCT Yard showing placement of infrastructure.

Fig. 19 & 20 - aerial view of SCT Yard showing the position of T345/wagons for the shunt movement just prior to and post accident.

**Table 6. drawing legend**

Drawing Legend:		
1)	Derail (HO)	<b>Hand Operated Derail</b> , a specially shaped block that is manually placed over one rail of a siding to protect main line traffic from any runaway vehicles or unauthorised moves.
2)	Pts	<b>Points</b> , a track component that provides a path for a wheel to transfer from one track to another and usually consists of a section of bent and planned rail (known as the switch rail) and its connecting parts.
3)	S/L	<b>Spring Lever</b> , a trailable spring activated device used to set the position of a set of points for the turnout or straight ahead road.
4)	S/S	<b>Switchstand</b> , a lockable spring loaded switch lever with a signal indication for the manual operation of points.
5)	Sig	<b>Signal</b> , a mechanical or electrically operated device that indicates to train drivers when they must stop or may proceed.



FIGURE 15 and 16. Site layout SCT yard and P.N./SCT interface area, showing position of infrastructure and position(s) of T345 and rake of wagons at 1308:35 through to 1314:03.

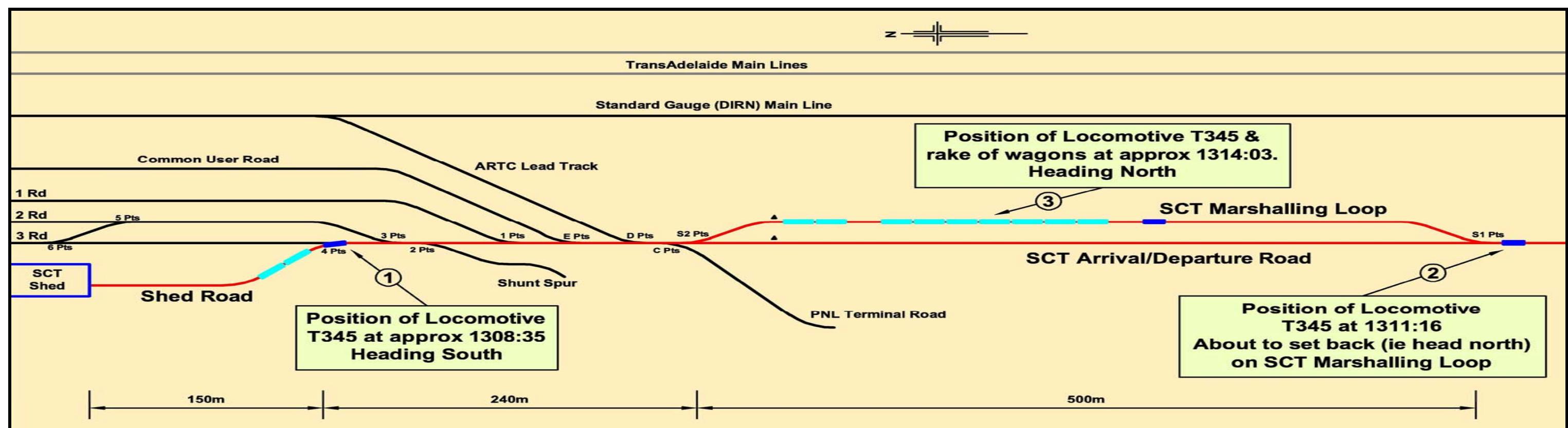
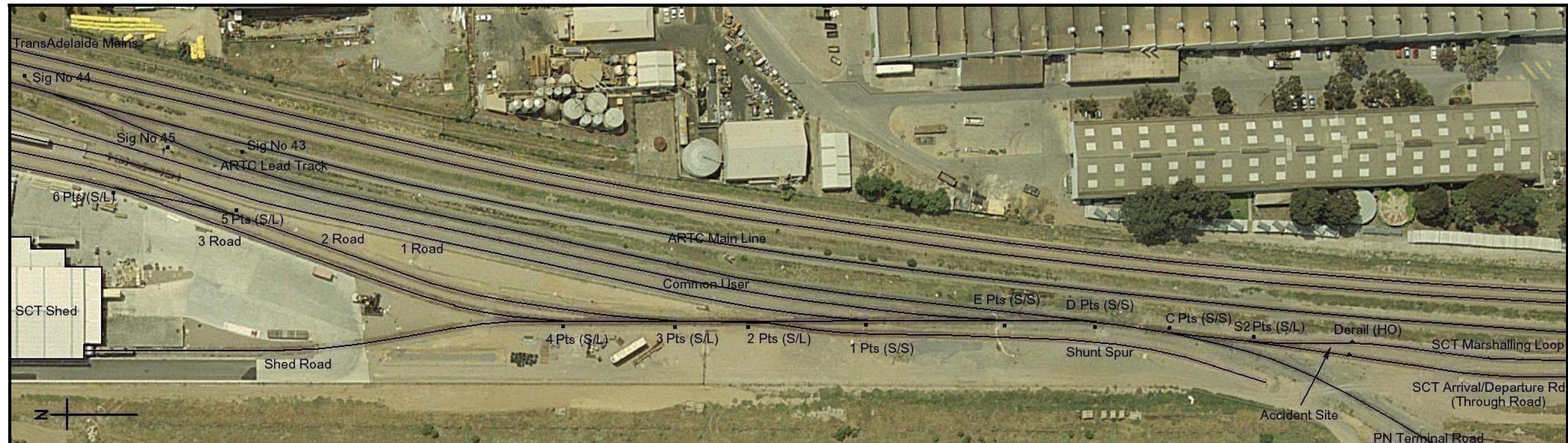


FIGURE 17 & 18. Site layout SCT yard showing position of T345 and rake of wagons at 1317 and 1319.

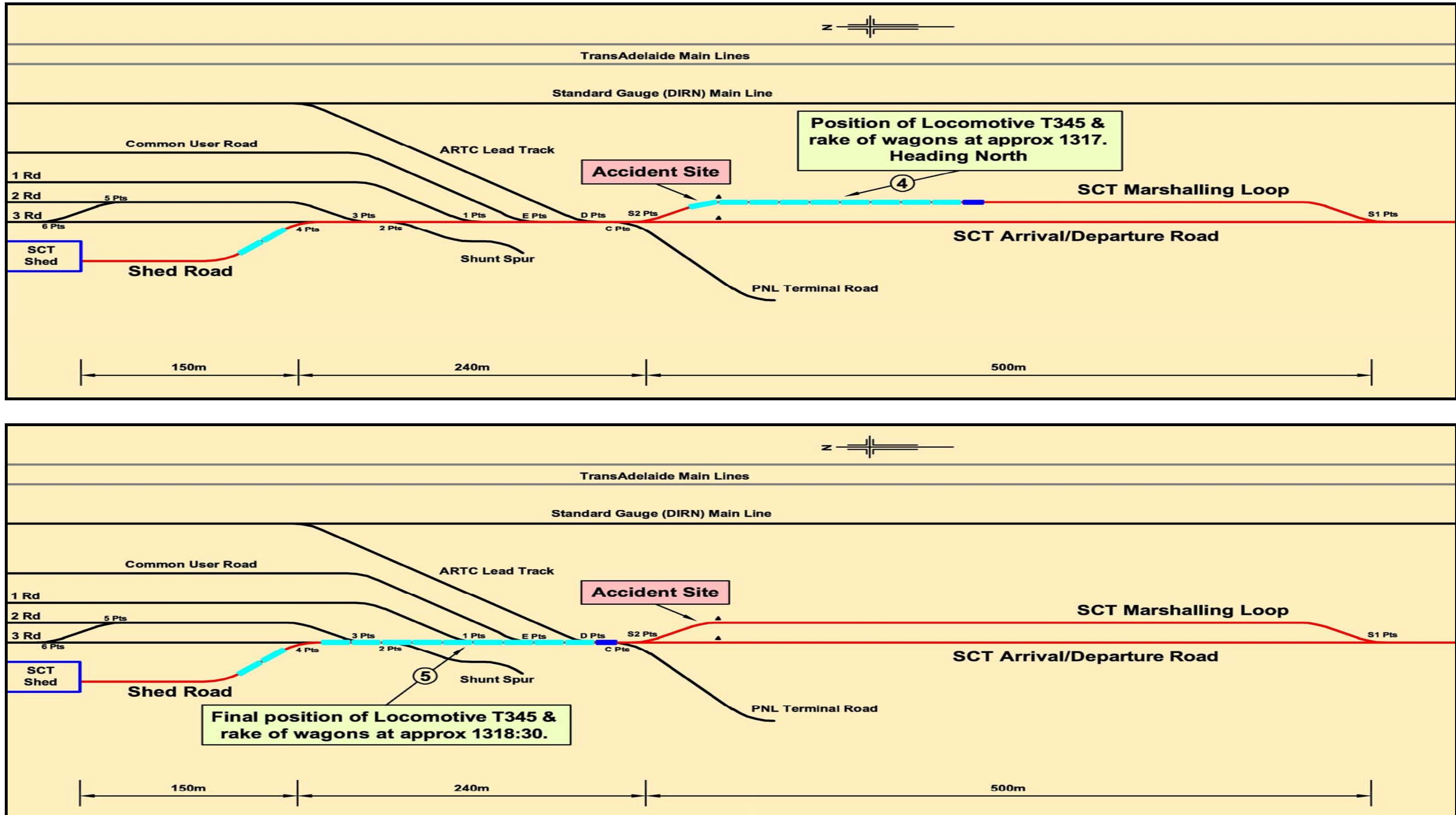


FIGURE 19 & 20. Site layout SCT yard showing position of T345 and rake of wagons at 1317 and 1319.



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