RAIB

Rail Accident Investigation Branch

Rail Accident Report

Near miss between a train and a track worker at Shawford
24 June 2016

Report 05/2017
March 2017

This investigation was carried out in accordance with:

- the Railway Safety Directive 2004/49/EC;
- the Railways and Transport Safety Act 2003; and
- the Railways (Accident Investigation and Reporting) Regulations 2005.

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This report is published by the Rail Accident Investigation Branch, Department for Transport.

Preface

The purpose of a Rail Accident Investigation Branch (RAIB) investigation is to improve railway safety by preventing future railway accidents or by mitigating their consequences. It is not the purpose of such an investigation to establish blame or liability. Accordingly, it is inappropriate that RAIB reports should be used to assign fault or blame, or determine liability, since neither the investigation nor the reporting process has been undertaken for that purpose.

The RAIB's findings are based on its own evaluation of the evidence that was available at the time of the investigation and are intended to explain what happened, and why, in a fair and unbiased manner.

Where the RAIB has described a factor as being linked to cause and the term is unqualified, this means that the RAIB has satisfied itself that the evidence supports both the presence of the factor and its direct relevance to the causation of the accident. However, where the RAIB is less confident about the existence of a factor, or its role in the causation of the accident, the RAIB will qualify its findings by use of the words 'probable' or 'possible', as appropriate. Where there is more than one potential explanation the RAIB may describe one factor as being 'more' or 'less' likely than the other.

In some cases factors are described as 'underlying'. Such factors are also relevant to the causation of the accident but are associated with the underlying management arrangements or organisational issues (such as working culture). Where necessary, the words 'probable' or 'possible' can also be used to qualify 'underlying factor'.

Use of the word 'probable' means that, although it is considered highly likely that the factor applied, some small element of uncertainty remains. Use of the word 'possible' means that, although there is some evidence that supports this factor, there remains a more significant degree of uncertainty.

An 'observation' is a safety issue discovered as part of the investigation that is not considered to be causal or underlying to the event being investigated, but does deserve scrutiny because of a perceived potential for safety learning.

The above terms are intended to assist readers' interpretation of the report, and to provide suitable explanations where uncertainty remains. The report should therefore be interpreted as the view of the RAIB, expressed with the sole purpose of improving railway safety.

The RAIB's investigation (including its scope, methods, conclusions and recommendations) is independent of any inquest or fatal accident inquiry, and all other investigations, including those carried out by the safety authority, police or railway industry.

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Near miss between a train and a track worker at Shawford, 24 June 2016

Contents

Summary

At 12:22 hrs on 24 June 2016, a train travelling at about 85 mph (137 km/h) narrowly missed striking a track worker near Shawford station, Hampshire. The track worker and a controller of site safety (COSS) had gone onto the railway to locate a reported rail defect. The track worker was not injured but was badly shaken by the incident. After making an emergency stop, the train driver reported the incident and was fit to continue his journey.

The immediate cause was that the track worker had become distracted while he was standing on a line on which trains were running. This happened because there was a breakdown in safety discipline and vigilance when the COSS and track worker went onto the railway. Firstly, they did not implement the required safe system of work for going onto the railway at Shawford. Secondly, the track worker crossed the railway without the permission of the COSS. Thirdly, the track worker was distracted and stopped on an open line when crossing back. The RAIB found a similar breakdown in safety discipline and vigilance when it investigated a fatal accident at Newark North Gate (report 01/2015). It is probable that the track worker's alertness and decision making were affected by fatigue, because he had slept in his car all week to avoid making long journeys to and from home each day. A possible underlying factor was that the rail testing and lubrication section within the Network Rail delivery unit involved was not resilient to any loss of resources or sudden increase in workload. Although not causal to the incident, the RAIB also observed that the way in which the section carried out safe system of work planning for its staff was not compliant with Network Rail's processes, and neither the COSS nor the track worker reported their involvement in the incident at the time.

In addition to a previous recommendation and learning point from the Newark North Gate accident, which also address the key issue of the breakdown in safety discipline and vigilance in this incident, the RAIB has made three new recommendations, addressed to Network Rail. The first relates to the management of fatigue for staff needing to make long journeys before and after a shift. The second relates to making the rail testing and lubrication section of the delivery unit more able to accommodate a short-term loss of resource and peaks in workload. The third recommendation calls for Network Rail to consider the reasons why its management arrangements on Wessex Route did not detect and rectify the non-compliances with the processes for managing the safety of people working on or near the line. The investigation also identified six learning points about: reminding staff of the importance of following existing rules and procedures; how the early use of the train's horn by drivers to give an urgent warning can avert an accident if track workers on their line do not acknowledge the first horn warning; and the timely reporting of operational incidents.

Introduction

Key definitions

1 Metric units are used in this report, except when it is normal railway practice to give speeds and locations in imperial units. Where appropriate the equivalent metric value is also given.

2 The report contains abbreviations and technical terms (shown in *italics* the first time they appear in the report). These are explained in appendices A and B. Sources of evidence used in the investigation are listed in appendix C.

The incident

Summary of the incident

3 At 12:22 hrs on 24 June 2016, a train narrowly missed striking a track worker near Shawford station in Hampshire (figure 1). The track worker and a *controller of site safety* (COSS) had gone onto the railway to locate a reported rail defect.

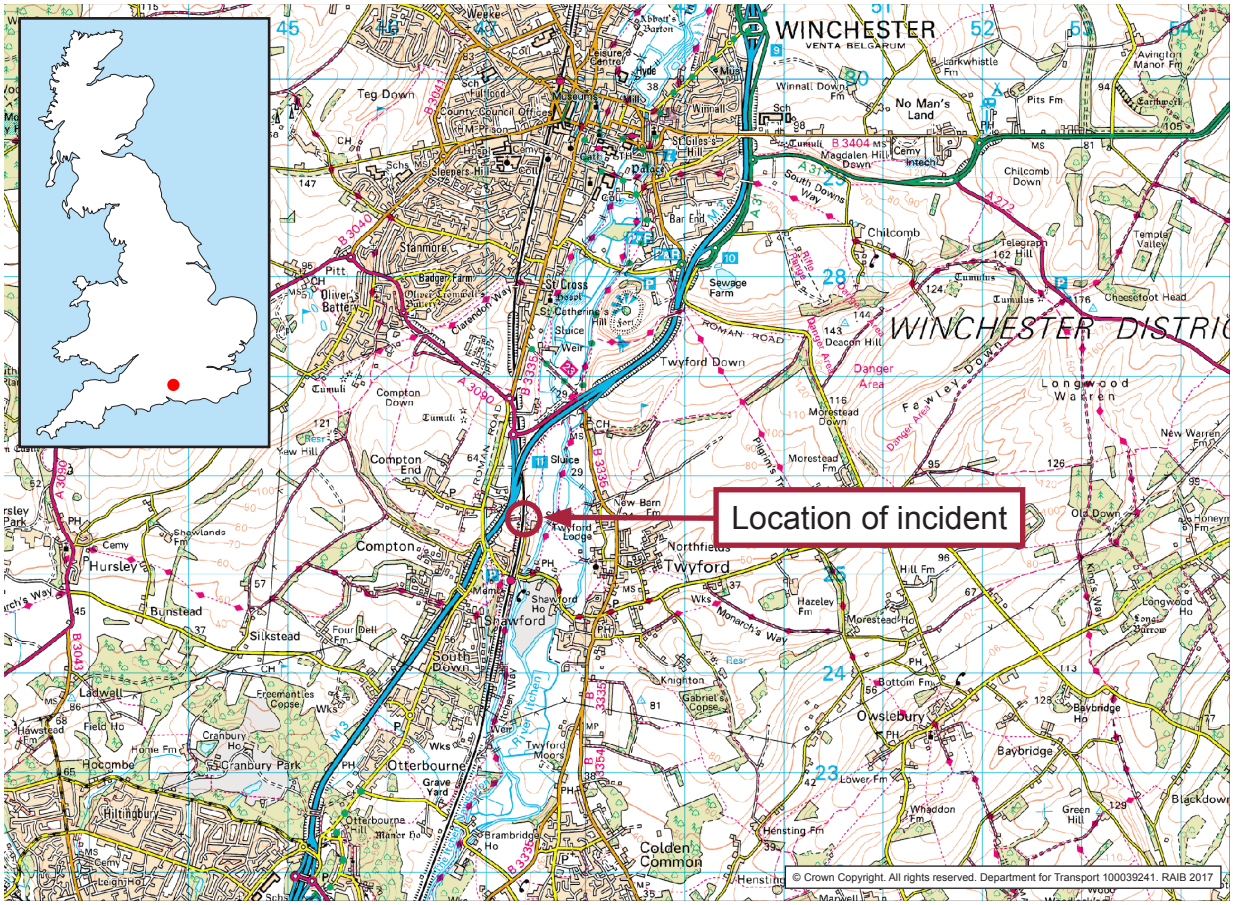

Figure 1: Extract from Ordnance Survey map showing location of incident

4 The track worker was not injured but was badly shaken by the incident. After making an emergency stop, the train driver reported the incident to the signaller and was fit to continue his journey.

Context

Location

5 The incident occurred to the north of Shawford station on the *down fast* line between Winchester and Eastleigh (figure 2), at about 69 miles 440 yards (from a zero datum at London Waterloo station). The line is part of Network Rail's *Wessex Route* and at this location the railway comprises three tracks: the *up main*, down fast and down *slow* lines (figure 3).

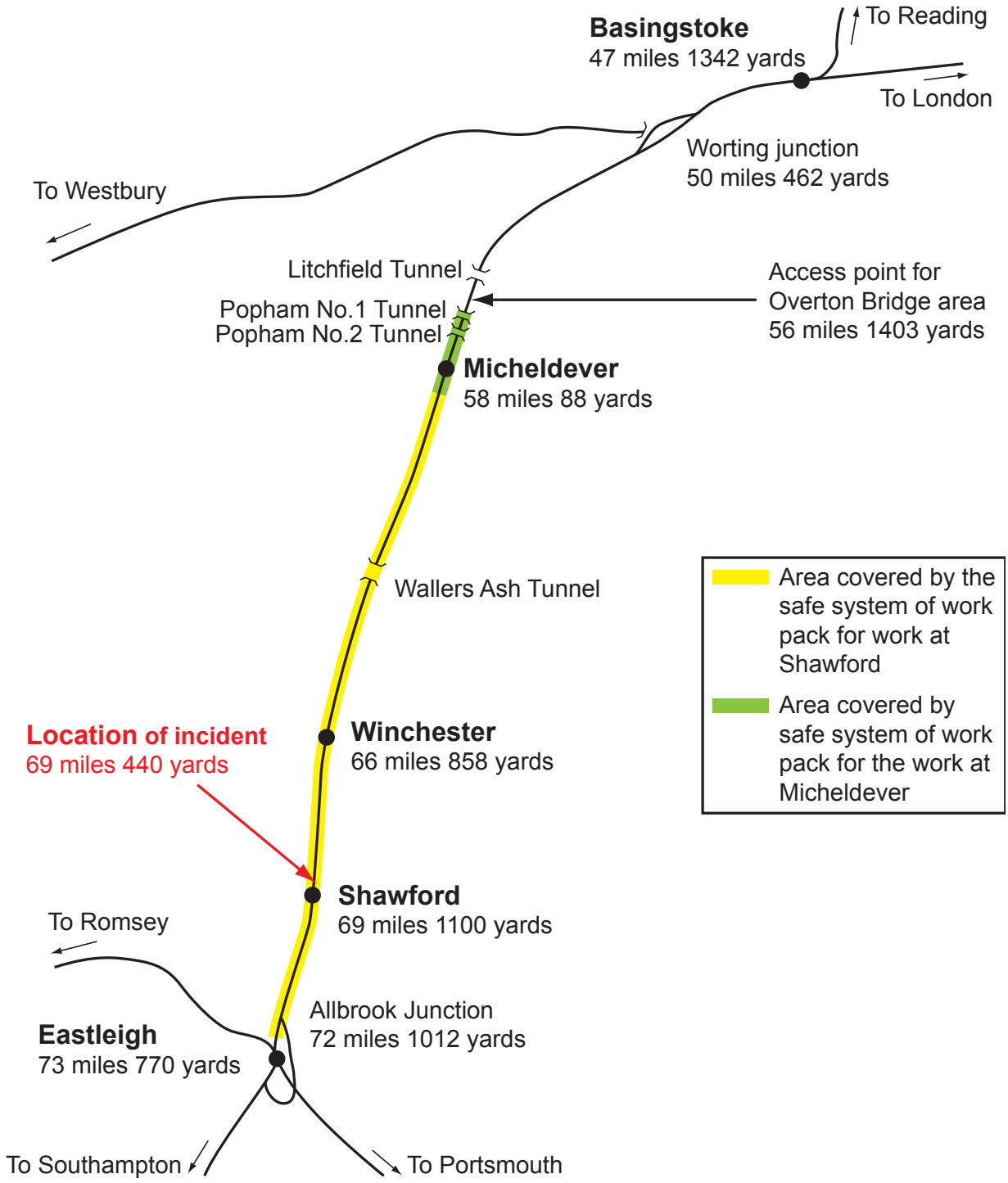

Figure 2: Overview of the key locations

6 The permitted speed on the up main and down fast lines is 100 mph (161 km/h) for *high speed trains* and specific classes of *electric multiple unit* (EMU)[1] and 90 mph (145 km/h) for all other types of train. On the down slow line, the permitted speed for all trains is 50 mph (80 km/h).

[1] These are class 442, 444 and 450 EMUs.

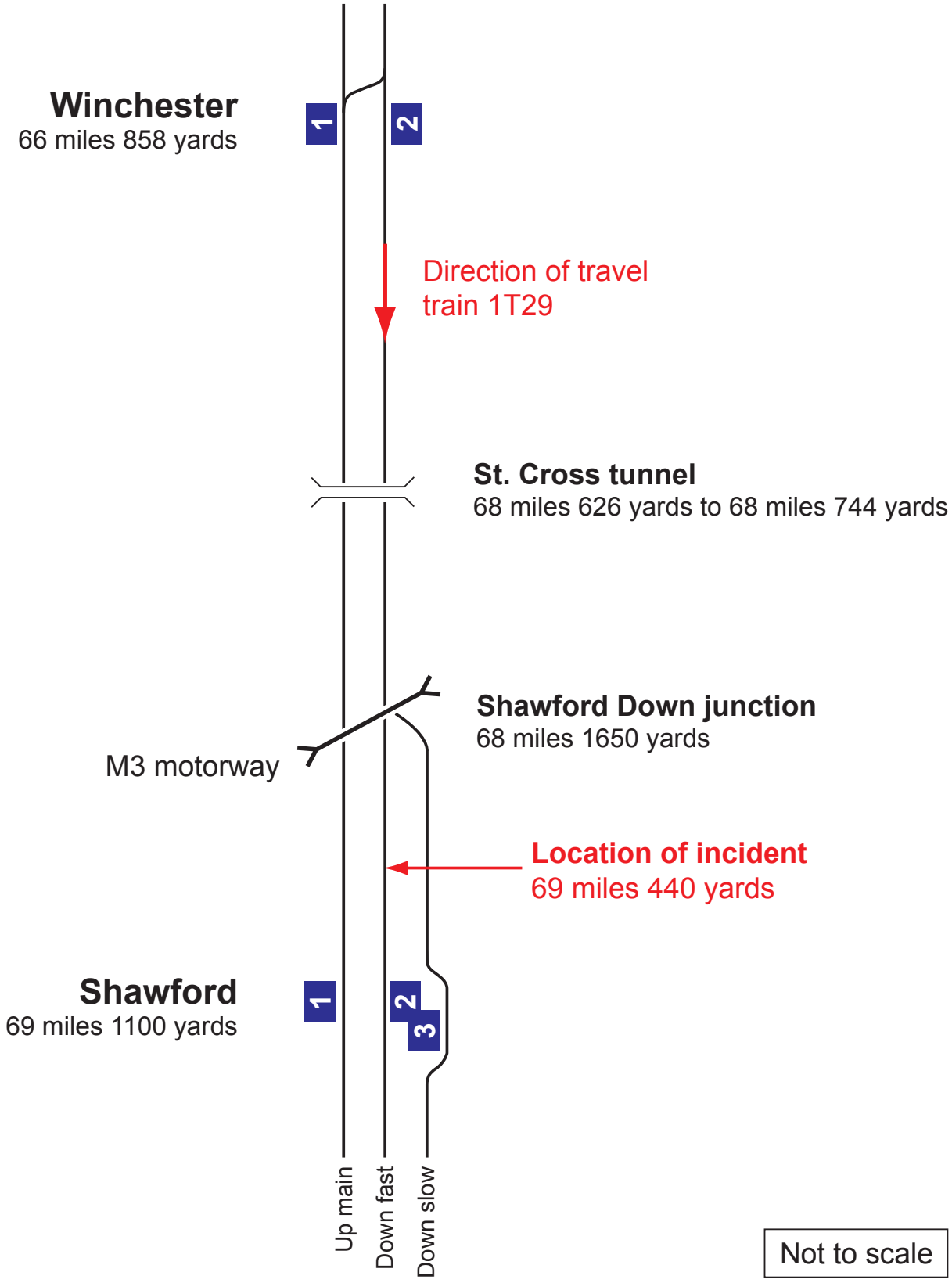

Figure 3: The track layout at Shawford

7 The incident occurred on a right-hand curve (in the train's direction of travel) of about 2600 metres radius (figure 4) and on a falling gradient of 1 in 258 (0.39%). Signalling in the area is controlled from the Eastleigh Area signalling centre. *Third rail electrification* is present throughout.

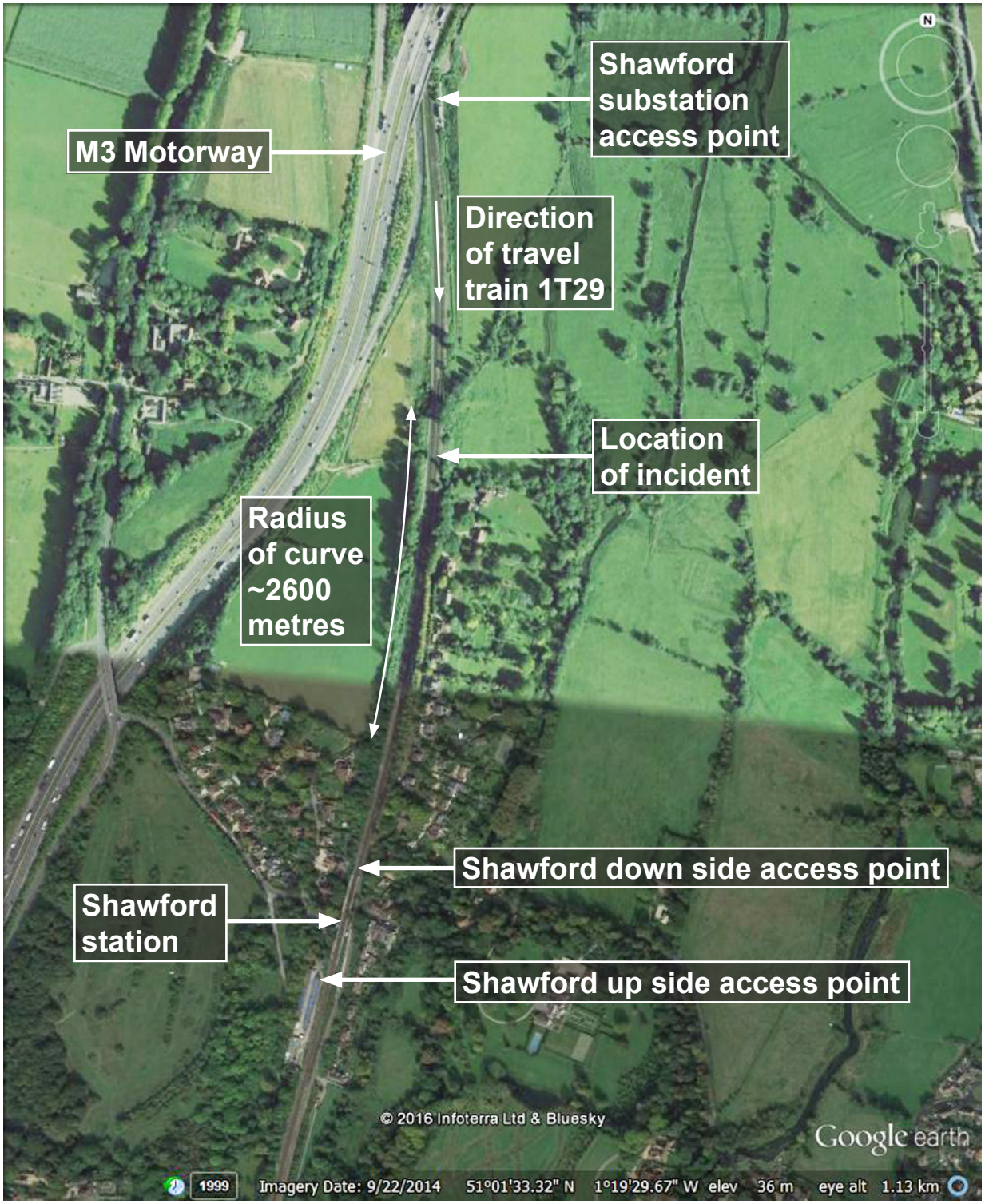

Figure 4: Google Earth view of incident site

Organisations involved

8 Network Rail owns, operates and maintains the infrastructure. It employed the track worker and the COSS.

9 South West Trains was the operator of the train and it employed the driver. Both Network Rail and South West Trains freely co-operated with the investigation.

Train involved

10 The train, reporting number 1T29, was the 11:09 hrs service from London Waterloo to Portsmouth Harbour. It comprised three class 450 EMUs, a total of twelve vehicles, and was permitted to travel at up to 100 mph (161 km/h) on the down fast line at Shawford (paragraph 6).

Staff involved

11 The track worker and COSS were members of the rail testing and lubrication section, based at Eastleigh depot. At the time of the incident this section was part of the Eastleigh[2] *delivery unit* within Wessex Route's maintenance organisation.

12 The track worker was a rail testing team leader and had worked at Eastleigh depot for the previous six years. He had 15 years' railway experience and had been a qualified COSS for the past 13 years. The COSS was the rail testing and lubrication section supervisor and had held this post for six months. For the previous eight years he had been a rail testing team leader based at Eastleigh depot. The COSS had been qualified as a COSS for the past eight years and his last assessment of competence was in May 2016. Both the track worker and the COSS were familiar with working at this location and neither had been involved in any previous safety related incidents.

13 On the day of the incident, Network Rail had hired a contractor who was qualified to carry out the duties of a *lookout*. This contractor was allocated to work with the track worker and COSS that day but was not on the railway with them when the incident occurred.

External circumstances

14 It was daylight at the time of the incident. The local weather, based on forward facing closed circuit television (CCTV) footage from train 1T29 and data from a weather station at Southampton International Airport 5.5 miles (8.9 km) away, was dry with sunny periods and scattered clouds, and there was a moderate breeze. The sun was high in the sky and visibility was good.

15 There was some background noise from traffic on the nearby M3 motorway.

[2] In August 2016 Network Rail Wessex Route reorganised its maintenance organisation. The Clapham, Woking and Eastleigh delivery units were replaced by an Inner and an Outer delivery unit. Staff based at Eastleigh depot are now part of the Outer delivery unit.

The sequence of events

Events preceding the incident

16 During the afternoon of Thursday 23 June, the COSS checked and signed the *safe system of work* packs for the work that he and the track worker were going to do the next day. The work was to carry out rail testing at three locations: Micheldever (figure 2), the Overton Bridge area (figure 2) and Shawford. The work was originally planned for Wednesday 22 June but was rearranged to take place on the Friday instead.

17 At about 07:45 hrs on Friday 24 June, the track worker and COSS met up at Eastleigh depot and collected the pack of paperwork they needed for their work that day. This included information about the rail defects they needed to test, as well as the papers for the planned safe system of work which the COSS needed to put in place at each location when going on or near the line.

18 They left the depot at about 08:30 hrs with a contractor who was to be the lookout that day. The track worker and COSS travelled in a Network Rail van, while the contractor followed in his own car. They travelled to the first location which was near to Micheldever. Once there, the COSS completed the paperwork and gave a brief to the track worker and contractor. This brief covered all of the work they would be doing that day. The track worker and contractor then signed the safe system of work papers to record that they had received a briefing.

19 The team then proceeded to carry out rail testing at Micheldever before moving north to the Overton Bridge area (figure 2). After completing further rail testing there, they travelled to Shawford. The planned work at Shawford was to locate and verify a *suspect rail defect* on the up main line that an *ultrasonic test train* had reported overnight on 21/22 June. To verify the defect, the team planned to use ultrasonic equipment to manually test the rail, measure the size of any defects found and record the results. The team's management would then use this information to decide what further action, if any, was needed.

20 The team arrived at Shawford station car park at about 12:00 hrs and went to park both vehicles in the allocated spaces located by the access gate on the up side of the railway (figure 5). However, other cars were parked too close to these spaces, leaving insufficient space to fit in both vehicles. Consequently they drove to an alternative *access point* on the down side (figure 6), planning to park in a nearby car park for a public house (figure 6). Once there, they found it had recently changed to a pay and display car park. To avoid paying to park, they left both vehicles in the lane next to the access point while the COSS and track worker went onto the railway intending to quickly determine the exact location of the suspect rail defect. The COSS and track worker could then decide whether to find somewhere else to park in Shawford or drive to another access point to the north at Shawford substation (figure 4). The contractor remained with the vehicles so he could move them if another vehicle was unable to get past.

Figure 5: Car parking by access gate on up side at Shawford station

Events during the incident

21 As the COSS and track worker went through the down side access gate (figure 6), they agreed to stay in the down *cess* as they walked. The COSS locked the gate behind him but then became distracted by checking that no other vehicles were coming along the lane. Meanwhile the track worker set off on his own, walking north along the cess, taking with him the global positioning system (GPS) coordinates for the reported rail defect and a handheld GPS unit.

22 By the time the COSS began walking north along the cess, the track worker was about 200 metres ahead of him. As the COSS followed, he realised that he was not catching up quickly enough and thought about shouting to the track worker. However, he reported that he did not do this as he thought the track worker would not hear him due to the distance between them, the wind (paragraph 14) and the noise from the nearby motorway (paragraph 15). He was about to use his whistle to get the track worker's attention when the track worker stopped. The COSS noticed the track worker was now making small movements back and forth which indicated to him that the track worker was close to the GPS coordinates for the reported defect.

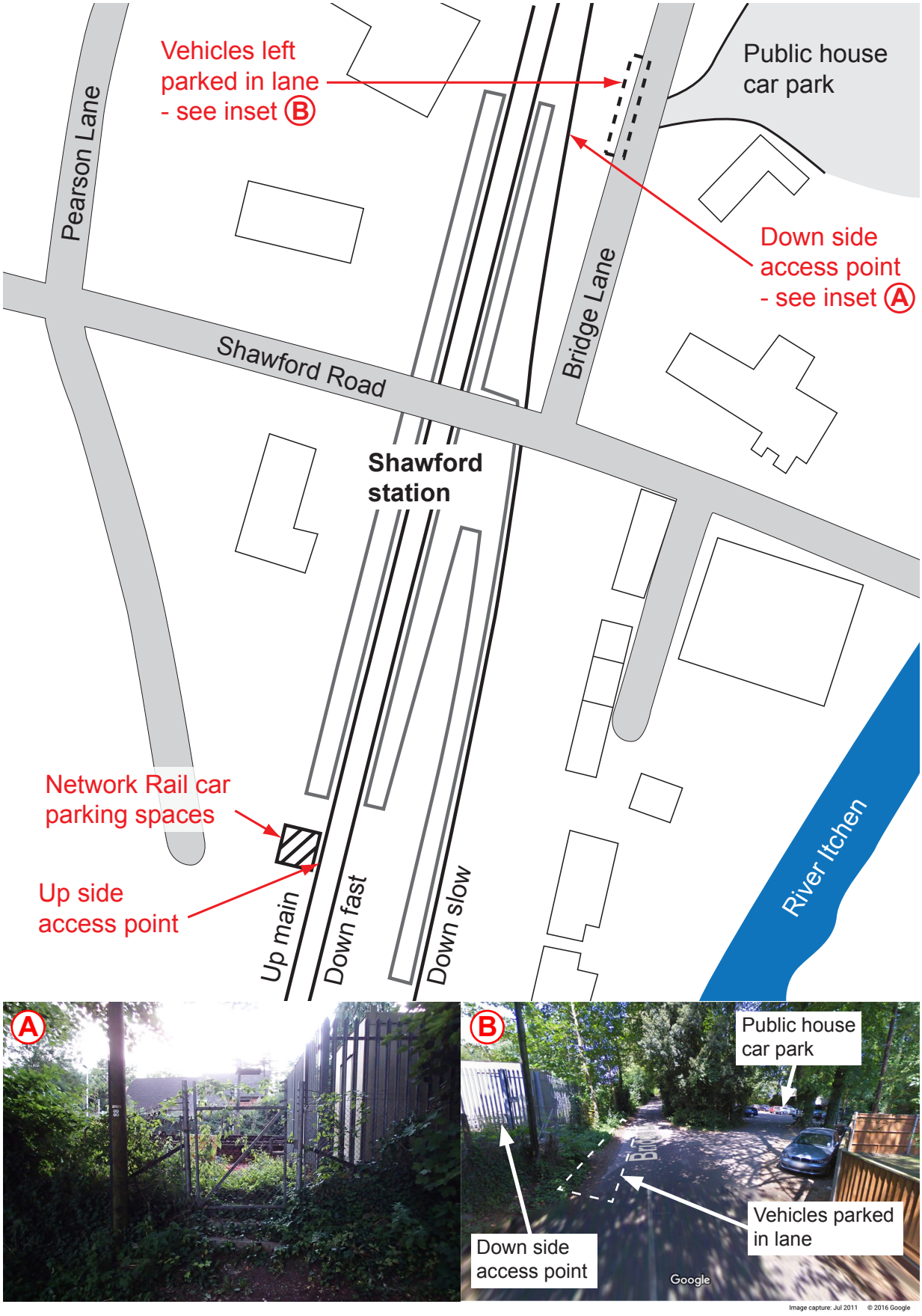

Figure 6: Access points in Shawford station area

23 As the COSS was confident that the track worker was now close to the location of the defect, he also stopped about 100 metres from the track worker. He reports that he then turned back south towards Shawford station and began planning the safe system of work needed to test the defect. This included thinking about where to place the contractor, who would be a *distant lookout* in the vicinity of Shawford station, and how to get the trolley with the ultrasonic test equipment from the access point to the location of the defect on the up main line.

24 While the COSS was looking southwards, the track worker crossed all three lines to the up cess. After attempting to get the coordinates on the handheld GPS unit to match those for the reported defect, the track worker looked for any approaching trains as he prepared to cross back. He noticed a train stopped in Shawford station on the up main line so he waited for that train to pass him. Once this train had gone, the track worker began to cross back to the down side.

25 Just as the track worker stepped into the down fast line, the handheld GPS unit beeped. The track worker stopped to look at it. At this time train 1T29 was approaching on the down fast line at about 85 mph (137 km/h). As the train passed Shawford Down junction (figure 3), the driver saw the track worker and sounded the train's horn. The track worker did not acknowledge the warning (normally done by raising an arm) or begin to move, so the driver used the train's horn to give an urgent warning (a series of short, sharp blasts) and made an *emergency brake application*.

26 The track worker heard the train's urgent warning and began to move when the train was about two seconds away. The track worker quickly stepped into the up main line, which required him to step over two live *conductor rails*. The track worker moved clear of the path of train 1T29 when it was about one second away. The COSS became aware that something was wrong from the way the train had sounded its horn and turned just in time to see the track worker very close to the front of the train.

Events following the incident

27 The driver brought train 1T29 to a stand about 100 metres before Shawford station and reported the near miss to the signaller at the Eastleigh Area signalling centre. The details of the incident were passed from the Eastleigh Area signalling centre to the Wessex Integrated Control Centre (WICC). Staff at the WICC called the Eastleigh *track maintenance engineer* and asked him to find out if any of his staff were involved.

28 After train 1T29 had passed, the track worker completed his crossing back to the down cess. The COSS walked up to the track worker and asked him about what had happened, but the track worker was too shaken to respond.

29 The COSS decided to cancel the planned work and the two returned to the parked vehicles. The COSS told the contractor they had finished work for the day and the contractor left. The COSS and track worker then left Shawford, drove for about 10 minutes and then parked up to discuss what had happened. They decided they would go back to Eastleigh depot and tell their section manager. They did not report the incident to the WICC.

30 Meanwhile, the track maintenance engineer spoke to various section managers at Eastleigh depot but was unable to identify who was involved in the near miss. He did not speak to the rail testing and lubrication section manager as he had already left the office. Consequently, when the COSS and track worker got back to the depot, they could not find the section manager. They decided to leave work for the day, agreeing that the COSS would report it on Monday morning.

31 On the Monday morning, while the track maintenance engineer was making further enquiries to find out who was involved, the COSS came forward to say it had been him and the track worker.

Key facts and analysis

Identification of the immediate cause

32 **The track worker became distracted while standing on a line open to traffic.**

33 The forward facing CCTV footage recorded by train 1T29 shows that the track worker was standing in the down fast line as the train approached (figure 7). The track worker was stationary and was not looking up for approaching trains. This was because he was distracted by looking at the handheld GPS unit instead. The CCTV footage also shows the track worker did not respond at all when the train first sounded its horn. Witness evidence suggests that it would have been audible to him.

Figure 7: Forward facing CCTV image when train 1T29 was two seconds away from the track worker (courtesy of South West Trains)

34 The footage shows the track worker moved clear of train 1T29 one second before the train arrived at his position, or about 35 metres in terms of distance (figure 8). When the track worker moved, he went towards the up cess. This meant he stepped over the live conductor rail for the down fast line, over a second live conductor rail into the up main line and then moved into the up cess. The up main line that he crossed was open to traffic; however, the nearest train on this line was a freight train that was about four minutes running time away.

Figure 8: Forward facing CCTV image when train 1T29 was one second away from the track worker (courtesy of South West Trains)

35 The CCTV footage also shows there were no other members of staff close by to warn the track worker that a train was approaching. The COSS was about 100 metres away in the down cess towards Shawford station, and looking the other way.

Identification of causal factors

36 The incident occurred due to a combination of the following causal factors:

a. There was a breakdown in safety discipline and vigilance when the COSS and track worker went onto the railway at Shawford (paragraph 37); and

b. The track worker's alertness and decision making were probably affected by fatigue (paragraph 54).

Each of these factors is now considered in turn.

Site discipline

37 **There was a breakdown in safety discipline and vigilance when the COSS and track worker went onto the railway at Shawford.**

38 The safe system of work that the team was given for working on or near the line at Shawford required a lookout at the site of work and another distant lookout to provide early warning of approaching trains. The track worker should have been the site lookout, and the contractor who was waiting with the vehicles should have been the distant lookout. The COSS should have been implementing the safe system of work and carrying out the testing.

39 A breakdown in site discipline began when the COSS and track worker decided to go onto the railway to locate the reported rail defect. Witness evidence stated it was unusual for part of a team to go onto the railway just to locate the whereabouts of a defect. Normal practice would be for all of the team to go onto the railway together, with the planned safe system of work for that location in place.

40 A combination of the following three factors created the conditions for the near miss to occur:

a. A safe system of work for working at Shawford was not implemented (paragraphs 41 to 43).

b. The track worker left the down cess and crossed the tracks to the up cess without the permission of the COSS (paragraphs 44 to 47).

c. The track worker became distracted and stopped in the middle of the down fast line when crossing back to the down cess (paragraphs 48 to 53).

Each of these is now considered in turn.

No safe system of work

41 When the team arrived at Shawford station, they could not find anywhere to park both vehicles (paragraph 20). This led to the vehicles being parked in the lane by the down side access point while the COSS and track worker went to locate the reported rail defect. The COSS and track worker thought that once they knew exactly where the defect was, they could then decide which access point was the most suitable, as the defect was reported to be at 69 miles 440 yards, which was about half way between the access points at Shawford station (69 miles 1166 yards) and Shawford substation (68 miles 1672 yards).

42 The safe system of work pack provided to the team for working on or near the line at Shawford required the COSS to set up a safe system with a site lookout and a distant lookout. It was not possible to implement this way of working when only the COSS and track worker went onto the railway, as the contractor, who would have been the distant lookout, was not with them (paragraph 20).

43 While at the access gate, the COSS and track worker reached an understanding that they would both stay in the down cess while they located the defect. The COSS stated that this was his briefing to the track worker about the safe system of work they would follow. The track worker stated that rather than a formal briefing, this was a general discussion between them about what they would do after going through the access gate. This understanding between the COSS and track worker to stay in the down cess was not documented.

Crossing open lines

44 *Rule Book* Handbook 7 (GE/RT8000/HB7, 'General duties of a controller of site safety (COSS)') requires a COSS to:

> 'stay with your group so that you are able to personally observe and advise everyone until:
> - work is completed and your group is no longer on or near the line, or
> - you are replaced by another COSS or an SWL[3]'.

45 The COSS became separated from the track worker soon after they went through the access gate. The track worker had not waited for the COSS, so by the time the COSS began walking north along the cess they were about 200 metres apart (paragraphs 21 and 22). The COSS reported that he had not expected the track worker to walk that far, as he thought they would just go a short distance along the cess (up to 50 metres at most) and make an estimate of where the reported defect was by judging how the GPS signal was changing.

46 When the track worker stopped walking (paragraph 22), the COSS also stopped, turned away and focused his attention on planning the safe system of work needed to test the reported defect (paragraph 23). While he was turned away, the COSS did not see the track worker leave the down cess, cross to the up cess, and begin to cross back to the down cess. The COSS was unaware of what the track worker was doing and only realised that an incident was taking place when he heard the urgent blasts on the train's horn. When the COSS turned towards the train, he saw the track worker on the tracks very close to the front of it.

47 The COSS reported that, having worked with the track worker for about six years, he did not believe that the track worker would ever leave the cess and go onto an *open line* as he did. The track worker was also qualified as a COSS, so he too should have known there was a requirement to remain in a position of safety until the safe system of work had been established. The actions of both the COSS and track worker indicate there had been a breakdown in safety discipline and vigilance once they went onto the railway.

[3] An SWL is a Safe Work Leader.

Standing on an open line

48 While in the down cess, the track worker could not get the coordinates on the handheld GPS unit to match the coordinates he had for the reported defect. The defect was reported to be on one of the rails of the up main line so the track worker thought he might get the coordinates to match if he crossed to the up cess. After crossing all three open lines to the up cess (figure 3) he still could not get the coordinates to match up and so decided to cross back. The track worker waited for a train to pass on the up main line and once it was beyond Shawford Down junction, he began to cross back. At this point, train 1T29 was a maximum of 75 seconds away.

49 As the track worker stepped into the middle of the down fast line, the handheld GPS unit (paragraph 25) beeped. He stopped to look at the unit and noticed a low battery indication. He began thinking about that being the reason why he had been struggling to get the GPS coordinates to match. He then began to think about whether there were any spare batteries in the van. It was at that point that the track worker suddenly became aware of train 1T29 approaching at speed on the line he was standing on.

50 The track worker was so distracted that he did not notice the initial horn warning given by the train driver. It was only when he heard the subsequent urgent warning on the train's horn that he looked up and saw the train.

51 The track worker had left the down cess, crossed three open lines, and stood in the middle of an open line. The COSS qualification held by the track worker also meant he held the *individual working alone* (IWA) qualification. This allowed the track worker to carry out work alone when on or near the railway. The track worker thought that because he was effectively working on his own, he could use his IWA qualification to cross the railway. However, when working as an IWA, a safe system of work must still be planned and Rule Book Handbook 7 only permits an IWA to cross just one open line when working.

52 All workers who go on to Network Rail tracks are required to hold a *personal track safety* qualification, which is subject to recertification every two years. Both the track worker and the COSS held this qualification (which is a prerequisite to qualifying as a COSS). Personal track safety training covers how to cross the railway, which is from one safe place to another on the other side, without stopping, while continually looking out for trains.

53 The way in which the track worker acted by crossing three open lines and then standing still on an open line is further evidence there was a breakdown in safety discipline and vigilance at the time.

Track worker fatigue

54 The track worker's alertness and decision making were probably affected by fatigue.

55 Once on the railway, the track worker made several unsafe decisions. Human factors research[4] shows that a person who is fatigued is more likely to make poor decisions. The track worker's attention was focussed on the handheld GPS unit, which resulted in a loss of situational awareness; he forgot that where he was standing was an unsafe place. Human factors research[5] also shows that a person who is fatigued is more likely to become fixated on a single task, and give little or no attention to what else is going on around them. The track worker's attention was so fixed on the handheld GPS unit that he missed the first warning given by the approaching train.

56 The track worker was probably fatigued due to a lack of sleep. On the Monday morning that week he had woken early and left his home at 04:00 hrs to travel from Essex to Eastleigh. For the next four nights he had only managed to get short periods of poor quality sleep between 22:00 and 04:00 hrs each night because he was sleeping in his car in the car park at Eastleigh depot. He woke up frequently to change positions during the night and got up at 04:00 hrs, once it became light.

57 Data on the track worker's amount and quality of sleep was entered into a mathematical model[6] used to predict the probability of fatigue[7] impairment. The model predicted there was a high probability that the track worker was impaired by fatigue. The track worker stated he had felt tired at the start of the shift on the Friday morning but not so tired that he felt he was unable to work that day. It was only after the incident that he realised just how tired he was. At the start of the day he had told the COSS that he was feeling tired and was not looking forward to driving back to Essex that evening after finishing his last shift at Eastleigh depot. Consequently, the COSS had agreed to do the rail testing work to try to give the track worker less onerous duties that day.

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[4] Hockey, GRJ, Maule, AJ, Clough, PJ & Bdzola, L (2000). Effects of negative mood states on risk in everyday decision making. Cognition and Emotion, 14(6), 823-855.

[5] Sneddon, A, Mearns, K & Flin, R (2013). Stress, fatigue, situation awareness and safety in offshore drilling crews. Safety Science, 56, 80-88.

[6] Circadian's Fatigue Accident / Incident Causation Testing System (FACTS).

[7] In Office of Rail and Road (ORR) guidance, 'Managing Rail Staff Fatigue', January 2012, fatigue is considered as 'a state of perceived weariness that can result from prolonged working, heavy workload, insufficient rest and inadequate sleep'. It involves a general feeling of tiredness, resulting in a reduced ability to perform work effectively. A fatigued person will be less alert, less able to process information, will take longer to react and make decisions, and will have less interest in working compared to a person who is not fatigued. Fatigue increases the likelihood of errors and adversely affects performance (HSE booklet HSG256, 2006), especially in tasks requiring vigilance and monitoring, decision making, awareness, fast reaction time, tracking ability and memory.

58 The track worker was sleeping in his car to avoid travelling from Essex to Eastleigh and back every day. He had decided to move to Essex at the start of 2016, and in April he was offered, and accepted, a rail testing team leader role at a depot in Kent. He asked the Eastleigh *rail management engineer* at the start of May if he could be released by the end of May as this matched the date when the rental agreement for his accommodation near to Eastleigh ended. As this was an internal transfer, there was no formal notice period. The rail management engineer agreed to this date, subject to the section manager also agreeing to it upon his return to work. However, upon his return, the section manager told the track worker he could not be released until 24 June (the day of the incident). This left a three week period when the track worker was living in Essex but working in Eastleigh, with nowhere to stay near to Eastleigh.

59 The section manager told the track worker he could travel each day from Essex as it would only be for three weeks. This commute was a round trip of about 250 miles (402 km) each day and required the track worker to leave home at 04:00 hrs, work his day shift from 07:45 to 15:15 hrs, and return home by about 19:00 hrs. The track worker was off work as a result of illness for the first week, had travelled back to Essex once during the second week, and decided not to travel at all during the final week.

60 Network Rail's company standard for the management of fatigue is NR/L2/ERG/003 'Management of fatigue: Control of working hours for staff undertaking safety critical work'. Its purpose is to reduce the risks associated with working patterns, shift work and excessive working hours. NR/L2/ERG/003 only considers the impact of travelling time for shifts that are longer than 8 hours but the track worker was only working shifts that were 7.5 hours long. It also requires the risks associated with working additional hours or short notice shift changes to be assessed, with consideration given to issues such as length and quality of rest period, travel arrangements and the impact on the next rest period. It notes that commutes of more than one hour have an impact on fatigue and that driving at peak periods is more tiring. It lists possible mitigations such as providing a full rest period before the next shift or considering lodging turns for staff travelling more than two hours. However, none of this was applicable to the track worker as he was not working any additional hours nor was his shift changed at short notice.

61 Network Rail guidance note NR/GN/INI/001 'Guidance on the management of door to door work and travel time' states that door to door time (defined as the combined total of work time and travel time from and to a place of rest) should not be planned to exceed 14 hours. The track worker's average door to door time from home to work and back home was about 14 to 15 hours. The scope of NR/GN/INI/001 is limited to staff working for Infrastructure Investment (now called Infrastructure Projects), so it was not applicable to the track worker as he was working within Network Rail's maintenance organisation. There was no similar requirement for staff working within Network Rail's maintenance organisation although Network Rail is working to address this (paragraph 112).

62 The section manager had not changed the track worker's shifts to take account of the effects of travelling and he had not offered any assistance such as providing lodging. The track worker had considered staying in local hotels but decided they were too costly. He did not ask the section manager, or anyone else, for any assistance with lodging as he thought it very unlikely that he would get any help. As a result, he slept in his car. No one else at the depot knew that the track worker was doing this.

Identification of underlying factors

63 **The rail testing team based at Eastleigh depot was not resilient to any loss of resources or any sudden increase in workload. This was a possible underlying factor.**

64 The rail testing and lubrication section based within Eastleigh delivery unit was staffed and organised as shown in figure 9. The rail testing staff within the section were split into teams based at Eastleigh and Yeovil depots. They were responsible for routine ultrasonic inspections of rails, inspecting sites where the rails have *rolling contact fatigue*, verifying suspect rail defects reported by ultrasonic test trains and supporting other maintenance work carried out by the track maintenance and welding teams.

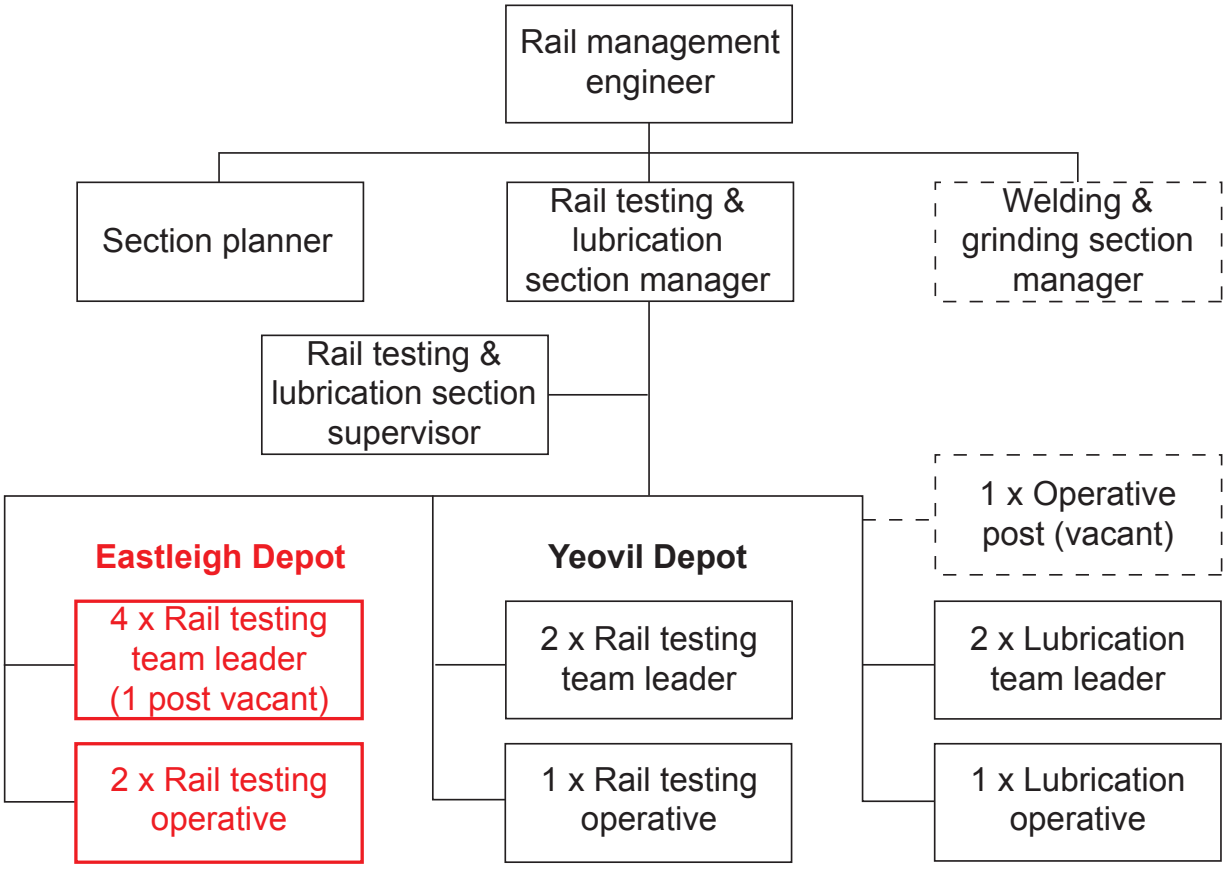

Figure 9: Organisation chart for the rail testing and lubrication section based within Eastleigh delivery unit (prior to its reorganisation in August 2016)

65 Figure 9 shows that in the rail testing team based at Eastleigh depot, there were four team leader posts, one of which was vacant (see paragraph 67), and two operative posts. During the week of the incident, two team leaders were available; one of these was the track worker who worked day shifts. The other team leader and both operatives were on annual leave. To create a day shift team of three people to do Friday's work, the section manager asked the section supervisor to work with the track worker and hired in a contractor to be a lookout. The shortage of resources that week, and over previous weeks, was the reason the section manager had not agreed to releasing the track worker at the end of May (paragraph 58).

66 Contractors were hired in, usually to be lookouts, to cover for shortfalls in resources when staff were unavailable. Some staff within the section had been off work for long periods due to illness. If the section did not maintain its resource levels using contractors, it struggled to deliver its workload. This would result in work going into *backlog*. This section has had work in backlog for several years and in 2016 it had the highest level of backlog within the delivery unit. The delivery unit's senior management team, comprising the *infrastructure maintenance delivery manager* and *infrastructure maintenance engineer* (from now on referred to as the senior management team), regularly authorised the hiring of contractors to help prevent the backlog from increasing further.

67 To provide the section manager with additional support to manage the section's backlog, at the start of 2016, the senior management team authorised the filling of the then vacant section supervisor post within the rail testing and lubrication section. This was an optional post that had been vacant since April 2010 when the maintenance organisation was last reorganised. In February 2016, it was filled by the COSS, who was promoted from a rail testing team leader role. While this change helped the section to better manage its workload, it reduced the rail testing resources. The delivery unit then attempted to recruit a replacement rail testing team leader but was unsuccessful. The post was offered to two candidates, but both declined to take it. It was still vacant when the incident happened.

68 The amount of backlog in the section was also affected by variations in the amount of work it had to deliver. In November 2015, the senior management team commissioned a project to identify the key issues that were affecting the section's workload. This identified the biggest cause of backlog as peaks in workload generated by ultrasonic test trains. There were two reasons for this:

a. multiple runs by an ultrasonic test train within the same week would generate a large number of suspect defects for the section to verify within a mandated timescale; and

b. missed or partial runs by an ultrasonic test train would require the section to risk assess the unrecorded track and then carry out any mitigation work that was required, such as manual testing.

69 For logistical reasons, an ultrasonic test train is planned to operate in a particular area for about one week at a time. Its planners attempt to spread out the test runs during that week across different delivery units, but this is not always possible. This can result in rail testing and lubrication sections, such as the one in Eastleigh delivery unit, being overwhelmed by the number of suspect rail defects it needs to verify when the ultrasonic test train runs in its area.

70 Between 17 and 24 June 2016, an ultrasonic test train undertook 25 test runs on 6 different days in the area covered by the Eastleigh delivery unit. These runs reported 272 suspect rail defects which the section was required, by Network Rail company standards, to verify within timescales ranging from 12 hours to 56 days[8]. Planning and delivering this work is disruptive to the already planned work, particularly when a suspect rail defect requiring verification within 12 hours is reported. As the ultrasonic test trains tend to run at night (due to their low maximum recording speed of 30 mph (48 km/h)), defects requiring action in a short timescale must be verified during the following day shift. Consequently, that day's work must be re-planned at very short notice. An example of this was the work that was taking place at Shawford on 24 June, which was originally planned for 22 June. This work was re-planned when a suspect rail defect with a 12 hour timescale for verification was recorded overnight on 21/22 June.

71 Planned ultrasonic test train runs can be cancelled or parts of a run missed out for many reasons. A common example occurs when a run clashes with overnight engineering work so that the line the train is planned to run over is closed to traffic. Runs were also cancelled or shortened in 2015 and 2016 due to an industrial dispute between the operator of these trains and its drivers. Runs that are cancelled are re-planned whenever possible. When a run must happen in order for the track to remain compliant with the recording requirements in Network Rail's company standards, it is given priority over any proposed engineering work. However, if any track is not recorded within the required timescale, the section manager must assess the risk arising from rails not being ultrasonically tested in time and plan any mitigation work. This often includes manually testing rails in higher risk places, such as locations where there are clusters of known rail defects or where the rails are known to have rolling contact fatigue.

72 Rail testing staff aim to comply with the requirement to check and sign off safe system of work packs at least one shift in advance of the work, in accordance with Network Rail company standard NR/L2/OHS/019 'Safety of People Working On or Near the Line'. However, the frequent re-planning of work means they can carry out a different set of tasks when they come into work the next day, particularly the day after an ultrasonic test train run. Often, the safe system of work packs for some of these tasks will be produced, checked and signed for on the day, which NR/L2/OHS/019 only permits if the COSS is replaced at short notice due to illness, or if the responsible manager authorises it due to exceptional circumstances. NR/L2/OHS/019 states that these occasions shall be kept to a minimum, but staff reported that this was commonplace at Eastleigh depot.

73 The frequent re-planning of work also placed a considerable amount of pressure on the rail testing and lubrication section's management. Short notice work, such as getting suspect rail defects verified within a 12 hour deadline, had to be fitted in around the routine inspection work. These routine inspections must take place within a required timescale and if a compliance deadline cannot be met, the section's management must get approval for a deviation or temporary non-compliance. To achieve this, they have to plan a date for when the inspection will happen and also show how the risk of not doing the inspection will be mitigated in the interim.

[8] The timescale in which a suspect rail defect must be verified is determined by the priority given to the defect by the ultrasonic test train and the track category of the line. The track category is determined by the permitted speed for trains running over the line and the tonnage passing over it.

74 The ongoing pressure that the rail testing and lubrication section's management was under had caused some of its staff to be off work with stress during 2016. The difficulties in managing the section became worse in August 2016 following the reorganisation of the maintenance organisation on Wessex Route. When the section at Eastleigh became the rail testing and lubrication section for the new Outer delivery unit, it gained more rail assets to test. Although the three rail testing staff who had previously tested these assets also joined the new section, they became unavailable due to illness as soon as the reorganisation had taken place. This meant the new section had more assets to test but did not have the resources to test them. Network Rail has subsequently taken action to address this resource shortfall (paragraph 110).

Factors affecting the severity of consequences

75 **The driver's prompt use of the train horn to provide an urgent warning gave the track worker just enough time to move out of the train's path.**

76 Train 1T29 was permitted to travel at up to 100 mph (161 km/h) on the down fast line at Shawford (paragraph 6). When it approached the track worker, it was travelling at about 85 mph (137 km/h) (paragraph 25) because this is about the highest speed that this class of EMU (paragraph 10) can reach after stopping at Winchester station.

77 Just after passing over Shawford Down junction, the driver saw the track worker and sounded the train's horn. At this point the driver was not sure exactly which line the track worker was standing on due to the track's curvature (figure 4). As the train got closer, the driver realised the track worker was standing on his line so he gave an urgent warning on the train's horn (paragraph 25) and made an emergency brake application. It was this urgent warning that caught the track worker's attention (paragraph 26) and gave the track worker just enough time to move clear.

Observations

Non-compliant safe system of work planning

78 **The way in which the rail testing and lubrication section carried out safe system of work planning was not compliant with the processes set out in NR/L2/OHS/019.**

79 NR/L2/OHS/019 states its purpose is to control the risks to staff from train movements by requiring effective planning of on-track activities and establishing a hierarchy of protection and warning methods. This Network Rail company standard was first issued in April 2002 and its introduction established the requirement that all work being carried out on or near the line would be subject to risk assessment. The findings of this risk assessment should then be taken into account within a safe system of work. The safe system of work would also take into account a hierarchy of protection and warning methods, so that the safest

method of protection would be used whenever possible, rather than defaulting to a safe system of work using lookouts.

80 Two cyclic safe system of work packs were issued to the COSS that day. A cyclic safe system of work pack is intended to be used for a routine activity so it can be reviewed once and then used again and again where the same task is carried out at the same location. However, these cyclic packs were instead being used for one-off tasks to verify reported suspect rail defects at different locations. This meant each one-off task was not subject to its own risk assessment when the safe system of work for carrying it out was produced.

81 The pack for the first series of tasks that day at Micheldever (paragraphs 18 to 19) called for the COSS to implement a safe system of work using the installed *train operated warning system* to provide a warning of approaching trains, rather than using lookouts. When the team then moved to carry out the second series of tasks in the Overton Bridge area, the COSS set up a safe system of work using a site lookout; the available sighting distance meant he did not need to use a distant lookout to achieve the required warning time for approaching trains. Network Rail was unable to provide a safe system of work pack for the work carried out that day at this location.

82 The pack for the work at Shawford called for the COSS to implement a safe system of work using a site lookout and a distant lookout. Although it was written for a cyclic task, it was being used for a one-off task. Additionally, this pack contained the following anomalies and errors:

- It covered a 15 mile (24 km) section of railway from 58 miles 264 yards to 73 miles 440 yards. Although the permitted line speeds remained the same on the up and down lines throughout, the available sighting distances varied so the number of distant lookouts needed also varied.
- It stated the nominated access point was at 52 miles 924 yards, which was 5 miles 1100 yards outside of the area it covered.
- It was incorrectly dated for the 22 June rather than 24 June (the date when the work was originally planned to take place, rather than the date when it happened).

83 The verification and checking process for the production, checking and issuing of the safe system of work pack (as described in NR/L2/OHS/019) did not find the errors or anomalies in it. No one had amended the date on the pack and this particular pack had been issued 14 times in the past without any of the other anomalies being reported back to the section planner. After the incident, Network Rail checked other packs issued to staff in the section and found many contained similar errors.

84 The cyclic safe system of work packs used that day were part of a series that the section planner and section manager had set up on the planning system about three years ago to cover all of the Eastleigh depot area. The section's management team then used these packs as required, by picking the pack that covered the mileage where the planned work was, printing it out and issuing it to their staff. These packs were used for whatever task was planned. The section's management team had set up this way of working because the section planner had been off work for long periods due to illness. Otherwise when the section planner was absent, no safe system of work packs could be issued, so no work could take place. Using cyclic packs in this way meant the section did not consider the hierarchy of protection and warning methods when it planned its work as it always defaulted to using the same safe system of work at any location within the mileage covered by the pack.

85 Staff in the rail testing and lubrication section defaulted to using a safe system of work with lookouts in many locations between Basingstoke and Eastleigh during the daytime. Staff stated that they did not attempt to plan or request a *line blockage* during the day as it was very unlikely that their request would be accepted due to the frequent train service. As they believed it was not possible to get a line blockage, staff did not use any of the safe systems of work for working on a line closed to traffic. This meant about 80 to 90% of the work carried out by the rail testing staff at Eastleigh depot was on lines with trains still running, using a safe system of work with lookouts. In contrast, the rail testing staff within the same section but based at Yeovil depot, who work primarily on the line between Basingstoke and Yeovil, could get line blockages during the day so less than half of their work took place using lookouts.

86 The section planner had received two weeks training about the planning process during his six years in this role. He had not had any practical training on how to use the computer system that Network Rail uses for planning, producing and issuing safe system of work packs. Consequently, his lack of knowledge limited his use of the computer system to only producing cyclic packs for all of the work he planned for the rail testing and lubrication section.

87 The way in which the rail testing and lubrication section was planning, producing and issuing safe systems of work to its staff meant it was not complying with the processes in NR/L2/OHS/019, and therefore not correctly managing the safety of staff working on the track. Staff took the view that as long as a pack was issued to them, it covered the required mileage, was signed by the staff it was given to, and then handed back in at the end of the shift, then that was all that was needed. Staff were able to adopt this way of working without being challenged. It was only after the incident that Network Rail identified the level of non-compliance to NR/L2/OHS/019 within the rail testing and lubrication section. While work is ongoing with Network Rail to improve the managerial supervision and audit checking for planning safe systems of work (paragraphs 104 to 106), the existing management arrangements on Wessex Route (eg its assurance regime, audits, monitoring and supervision, etc) should have been capable of identifying this level of non-compliance prior to the incident.

Reporting of the near miss

88 **The COSS and track worker did not report the near miss at the time so no one knew who was involved for the next three days.**

89 After the near miss, the COSS was unsure as to exactly what had happened and the track worker was too shaken to provide an explanation. They decided to leave Shawford and drive back to their depot to report the incident to the section manager (paragraph 29). Staff working in the Eastleigh delivery unit have received a briefing telling them that they should report all operational incidents, including near misses, to WICC straight away and then tell their line manager. Staff at WICC were aware of the incident as the driver had reported it (paragraph 27), and so they sent a *mobile operations manager* to Shawford to find out who was involved and what had happened. However, when the mobile operations manager arrived, he did not find anyone there as the COSS and track worker had already left for the day.

90 The COSS and track worker did not report the incident when they got back to Eastleigh depot as their section manager had already left work for the day. They did not call the section manager or report the incident to anyone else. Consequently, Network Rail did not have the opportunity to carry out a 'for cause' drugs and alcohol test on the track worker and COSS as described in Railway Group Standard GE/RT8070 'Testing Railway Safety Critical Workers for Drugs and Alcohol'. While there is no evidence to suggest that either was under the influence of drugs or alcohol, the correct process was not followed.

Previous occurrences of a similar character

91 Within a three week period in June 2016, in addition to the incident at Shawford, there were two other serious incidents involving track workers who were nearly struck by trains on Wessex Route. One occurred near Basingstoke on 14 June when two track workers were standing in the path of an approaching train. The track workers did not have a safe system of work in place as they were in a location where it was necessary to take a line blockage to work, and no line blockage had been granted by the signaller. The other incident occurred at Nine Elms, London, on 28 June when two track workers moved into the path of an approaching train. They were walking along the tracks to get back to an access point but did not have a safe system of work in place to do this.

92 The RAIB class investigation report into track worker safety (to be published in 2017) identified 71 incidents that occurred during 2015 in which track workers working outside a possession on Network Rail infrastructure were at risk of being struck by a moving train. The RAIB selected 10 incidents that were representative of those occurring during 2015 and its analysis of them drew out 12 common causal factors. Those applicable to this incident are:

- the COSS became preoccupied with the task and was no longer effectively maintaining the safe system of work (paragraphs 44 to 47);
- the COSS had not implemented the SSOW as planned because circumstances on site were different from those envisaged by the plan (paragraphs 41 to 42); and

- an unofficial method of working was agreed on site, creating the potential for confusion about the arrangements for maintaining safety (paragraph 43).

93 The RAIB has undertaken previous relevant investigations into track worker accidents and incidents. Factors common to this incident are:

- a breakdown in site safety discipline and vigilance at the work site as staff did not comply with the requirements of the Rule Book:
  - staff focused on a task were standing too close to an open line and not looking out for approaching trains;
  - staff did not use their knowledge and experience to ensure their own safety; and
  - staff responsible for monitoring what others were doing were not close by or present.
- staff were working on or near the line without a safe system of work in place, they did not adhere to the safe system of work that was in place, or the safe system of work that they were using was inadequate or inappropriate;
- the work was planned at short notice and the hierarchy in NR/L2/OHS/019 was not followed; and
- the experience and/or knowledge of the person planning the safe system of work was inadequate.

Summary of conclusions

Immediate cause

94 The track worker became distracted while standing on a line open to traffic (paragraph 32).

Causal factors

95 The causal factors were:

a. There was a breakdown in safety discipline and vigilance when the COSS and track worker went onto the railway at Shawford (paragraph 37, see also Newark North Gate recommendation 1 (paragraph 100)). This resulted in:

i. A safe system of work for working at Shawford not being implemented (paragraphs 41 to 43, see also Newark North Gate recommendation 2 (paragraph 104), **Learning points 1 and 2**).

ii. The track worker leaving the down cess and crossing the tracks to the up cess without the permission of the COSS (paragraphs 44 to 47, **Learning point 3**).

iii. The track worker becoming distracted and stopping in the middle of the down fast line when crossing back to the down cess (paragraphs 48 to 53, **Learning point 4**).

b. The track worker's alertness and decision making were probably affected by fatigue (paragraph 54, see also paragraph 112, **Recommendation 1**).

Underlying factor

96 A possible underlying factor was that the rail testing team based at Eastleigh depot was not resilient to any loss of resources or any sudden increase in workload (paragraph 63, **Recommendation 2**).

Factors affecting the severity of consequences

97 A factor that affected the consequence was the driver's prompt use of the train horn to provide an urgent warning which gave the track worker just enough time to move out of the train's path (paragraph 75, **Learning point 5**).

Additional observations

98 Although not linked to the incident on 24 June 2016, the RAIB observes that:

a. The way in which the rail testing and lubrication section carried out safe system of work planning was not compliant with the processes set out in Network Rail standard NR/L2/OHS/019 (paragraph 78, see also Newark North Gate recommendation 2 (paragraph 104), **Recommendation 3**).

b. The COSS and the track worker did not report the near miss at the time so no one knew who was involved for the next three days (paragraph 88, **Learning point 6**).

Previous RAIB recommendations relevant to this investigation

99 The following recommendations, which were made by the RAIB as a result of a previous investigation, have relevance to this investigation.

Recommendations that are currently being implemented

Fatal accident involving a track worker, near Newark North Gate station, 22 January 2014, Recommendation 1

100 The recommendation below in this report (RAIB report 01/2015) addressed one of the factors identified in this investigation (the breakdown in safety discipline and vigilance when the COSS and track worker went on or near the line (paragraph 37)). So as to avoid duplication, it is not remade in this report. The recommendation and its current status is as follows.

Recommendation 1

The intent of this recommendation is that Network Rail improves work site safety discipline and vigilance, especially for teams doing cyclical or repetitive tasks with which they are familiar.

Network Rail should:

a) systematically brief and where appropriate rebrief its COSS/Safe Work Leaders that they must be on site at all times, even when working with experienced staff, and that they must provide a full site based safety briefing once the safe system of work has been verified by them as being appropriate for the conditions at the time of the work;

b) rebrief its lookouts about not leaving the position of safety until the COSS has given permission;

c) actively monitor the degree to which work site discipline is being maintained, and take appropriate corrective action if any issues are found; and

d) investigate how best to maintain vigilance and safety discipline for cyclical and repetitive tasks and implement any practicable measures into its working procedures.

101 In response to parts a and b of this recommendation, Network Rail produced briefings for staff who carry out the duties of a COSS/SWL and the duties of a lookout. Network Rail reported to ORR that these briefings had been delivered to its staff by 30 November 2015 so these parts of the recommendation were complete. For part c, Network Rail reported it would review and develop the requirements for work site inspections by supervisory and management grades, including guidance on the frequency of visits and what to do when issues are found. It would also implement a method of ensuring that regular assurance inspections take place, with the frequency of visits based on a risk profile for the task and the safe system of work being used. Network Rail reported to ORR that this work was complete by 30 November 2015.

102 ORR has asked Network Rail to provide further information to evidence what work has taken place to implement parts a, b and c of this recommendation. As ORR has not yet received this information, it considers the implementation of these parts of the recommendation is ongoing.

103 Network Rail is implementing part d of this recommendation as part of its work to implement Newark Northgate recommendation 2. This work is ongoing with a planned completion date of 30 April 2017. See paragraphs 105 to 106 for the actions Network Rail has taken to implement recommendation 2.

Fatal accident involving a track worker, near Newark Northgate station, 22 January 2014, Recommendation 2

104 The recommendation below in this report (RAIB report 01/2015) addressed another factor identified in this investigation (the safe system of work was not implemented when the COSS and track worker went onto the railway at Shawford (paragraphs 41 to 43)) and the first observation (safe system of work planning not compliant with NR/L2/OHS/019 (paragraph 78)). So as to avoid duplication, it is not remade in this report. The recommendation and its current status is as follows.

Recommendation 2

The intent of this recommendation is to improve the implementation of Network Rail's procedures for planning safe systems of work, so that the hierarchy of risk is used in the intended way.

Network Rail should:

a) introduce sufficient managerial supervision and audit checking to confirm that the standards governing the safety of track workers are being correctly implemented by its delivery units in the planning of safe systems of work (SSOW), particularly in those areas where staff regularly work on lines that are still open to traffic.

b) take steps to strengthen any weaknesses it finds, including the re-training of staff involved in planning safe systems of work.

105 In July 2015, Network Rail reported that this recommendation would be implemented as part of its work to deliver the *Planning and Delivery of Safe Work* (PDSW) initiative. Following receipt of Network Rail's response, the ORR stated it considered good planning to be as much an essential feature under the current system as it will be under PDSW. ORR therefore wrote to Network Rail in August 2015 asking it for evidence of improvements in its planning process and managerial auditing of planning under the existing arrangements in NR/L2/OHS/019, as the introduction of PDSW was likely to be some time away.

106 Network Rail has since reviewed its plans to implement the PDSW initiative and decided to temporarily suspend its introduction. However, Network Rail has continued to carry out some work related to the PDSW initiative including a review of its standards related to staff working on or near the line. This review identified issues with the assurance processes in standard NR/L2/OHS/019. It also identified that the hierarchy of safe systems of work being used required updating. Subsequently, Network Rail revised standard NR/L2/OHS/019 and published it in January 2017, with a compliance date of 3 July 2017. Having reviewed the information received from Network Rail, the ORR has concluded that Network Rail is taking action to implement this recommendation, so it considers the implementation of the recommendation as ongoing.

Actions reported as already taken or in progress relevant to this report

107 In July 2016, Wessex Route briefed all of its track workers following three near miss incidents within three weeks during June 2016 (paragraph 91). The briefing was given to all Network Rail employees who worked on Wessex Route infrastructure. It was also given to staff who managed Network Rail or contractors' staff working on Wessex Route infrastructure. The briefing reminded staff that when going on or near the line they should always have a safe system of work pack that covers the site of work, have a COSS briefing before starting work, follow the instructions given by the COSS and ask questions if they do not understand. Staff holding the COSS competency were reminded to always set up the method of protection needed to protect the safety of the staff under their control. All staff were reminded to never cut corners.

108 The three near miss incidents also prompted further work on Wessex Route. Network Rail reported that this work has included elements to:

- maintain the profile and importance of the information given in the near miss briefing;
- improve the workforce's understanding of the planning process including better management supervision through periodic safety inspections;
- improve risk and behavioural awareness within the workforce; and
- introduce new technology to improve track worker safety.

109 After the incident at Shawford, the delivery unit's workforce health and safety and environment advisor reviewed many of the safe system of work packs that the rail testing and lubrication section planner had issued. He found that many of the packs issued for rail testing contained errors or were issued as cyclic packs when the work was not a cyclic task. Consequently, the section planner was suspended from planning, producing and issuing safe system of work packs until he had received further training. All of the cyclical packs were deleted and staff briefed to check the new packs issued to them before using them. The delivery unit's senior management team has since increased its planning resources. A second planner has temporarily joined the rail testing and lubrication section and an additional planner, reporting directly to the senior management team, has been recruited. This planner is used across all of the sections within the delivery unit to provide cover when section planners are unavailable and to assist with peaks in planning workload. The delivery unit has also brought in a person who is an experienced signaller to assist with planning line blockages.

110 In September 2016, the delivery unit's senior management authorised funding to employ two contract rail testers and six contract lookouts for an eight week period within the section. This was to provide the rail testing and lubrication section with sufficient resources to get its backlog under control and give time for the section's management to plan a way forward in managing its workload. The use of these contractors has continued while the senior management team work to resolve the section's shortfall in resources following the creation of the Outer delivery unit (paragraph 74). Since February 2017, for one week out of every four, the delivery unit's senior management team has also employed a contract rail tester and lookouts to mitigate the spikes in workload generated by ultrasonic test trains.

111 The rail testing and lubrication section's management, with the support of the delivery unit's senior management, is working towards carrying out the majority of the section's work within planned possessions or line blockages from the start of 2017. This is to significantly reduce the amount of work that is carried out while trains are running, using lookout protection.

112 Network Rail is revising its standards for the management of fatigue. NR/L2/ERG/003 is to be revised and renumbered NR/L3/STE/003 and guidance document NR/GN/INI/001 is to be withdrawn. The revised standard, which will apply to all Network Rail employees, includes a requirement that door to door time shall not be planned to exceed a maximum of 14 hours. It also proposes that while there is no maximum travel time within the 14 hour limit, managers shall minimise travel time as far as reasonably practicable, and in cases where travel time cannot be minimised below two hours (in total), working time shall be adjusted so the 14 hours door to door time limit is not exceeded. Network Rail has not yet published the revised standard, NR/L3/STE/003, as work to assess the impact of these changes on its staff and operations is ongoing.

Recommendations and learning points

Recommendations

113 The following recommendations are made[9]:

1 *The intent of this recommendation is to increase awareness that lengthy travelling times before and after a work shift can cause staff to be fatigued, which in turn can reduce alertness and increase the risk of those staff making unsafe decisions while carrying out safety critical work.*

As part of its management of fatigue for staff undertaking safety critical work, Network Rail should continue its work to implement a process to require its managers who are directly responsible for staff working on or near the line to consider:

- the fatigue that regular long journeys, both before and after a shift, can cause, so that staff are not required to commute long distances to their place of work; and
- the actions that can be taken to reduce the amount of time staff spend travelling, where necessary, such as revised working times or providing lodging near to the work where appropriate (paragraph 95b).

2 *The intent of this recommendation is to improve the resilience of the rail testing and lubrication section within Eastleigh (now Wessex Outer) delivery unit to loss of resources and sudden increases in workload so that such situations do not compromise safety.*

Network Rail should:

a. Carry out a review to identify improvements in how the Eastleigh (now Wessex Outer) rail testing and lubrication section manages rail defects so that it is more tolerant of changes to staff resourcing and peaks in workload. The review should include consideration of:

- the resourcing levels needed within the section to manage and deliver its work bank arising from planned inspections and likely volumes of work arising to support maintenance activities;

continued

[9] Those identified in the recommendations have a general and ongoing obligation to comply with health and safety legislation, and need to take these recommendations into account in ensuring the safety of their employees and others.

Additionally, for the purposes of regulation 12(1) of the Railways (Accident Investigation and Reporting) Regulations 2005, these recommendations are addressed to the Office of Road and Rail to enable it to carry out its duties under regulation 12(2) to:

(a) ensure that recommendations are duly considered and where appropriate acted upon; and

(b) report back to RAIB details of any implementation measures, or the reasons why no implementation measures are being taken.

Copies of both the regulations and the accompanying guidance notes (paragraphs 200 to 203) can be found on RAIB's website www.gov.uk/raib.

- the impact that planned runs by ultrasonic test trains can have on the management and delivery of the section's workload when a large amount of time dependent work to verify suspect defects is generated by multiple runs taking place in short succession; and
- the impact that missed or partially completed runs by ultrasonic test trains can have on the management and delivery of the section's workload.

b. Take steps to implement any improvements from the findings of the review (paragraph 96).

This recommendation may also apply to other rail testing and lubrication sections within Network Rail.

3 *The intent of this recommendation is to reduce the risk to staff working on or near the line by improving compliance with the requirements for such working.*

Network Rail should:

a. Investigate why management arrangements within Wessex Route did not detect and/or rectify gross non-compliances within the rail testing and lubrication section at the former Eastleigh (now Wessex Outer) delivery unit with the processes for managing the safety of people working on or near the line. The investigation should include consideration of:

- why its audit and self-assurance processes did not identify the full extent of the non-compliances with planning and implementing safe systems of work found by the RAIB;
- why its monitoring and reporting processes did not trigger earlier action by senior management within the Wessex Route to resolve the way in which safe systems of work were being planned and delivered;
- how the availability of, and time pressures on, staff in roles within the work planning process affected the way in which safe systems of work packs were being produced, reviewed, signed off and used;
- whether there are other delivery units, with persistent non-compliances to processes that can affect the safety of its staff when on or near the line; and
- the effect that any other factors have had in contributing to the gross non-compliances with planning and implementing safe systems of work.

b. Based on the findings of its investigation, take action to improve the management arrangements at Route level for monitoring the performance of the delivery units, with respect to planning and implementing safe systems of work (paragraph 98a).

This recommendation may also apply to other Routes within Network Rail.

Learning points

114 The RAIB has identified the following key learning points[10]:

1 Staff who carry out the duties of a Controller of Site Safety (COSS) / Safe Work Leader (SWL) are reminded to brief the staff in their group and implement the safe system of work provided for working at a location whenever going on or near the line, even if it is just to scope the work activity that the safe system of work was intended for (paragraph 95a.i).

2 Staff are reminded that they should receive a briefing from the Controller of Site Safety (COSS) / Safe Work Leader (SWL) on the safe system of work for working at a location whenever going on or near the line, even if it is just to scope the work activity that they are there to carry out. If they are not briefed by the COSS / SWL or believe that the proposed safe system of work is inadequate, they should raise their concerns with the COSS / SWL and not go on or near the line until these have been addressed (paragraph 95a.i).

3 Staff who carry out the duties of a Controller of Site Safety (COSS) / Safe Work Leader (SWL) are reminded that Rule Book Handbook 7 (GE/RT8000/HB7) requires them to always stay with their group so that they are able to personally observe and advise everyone until work is completed and their group is no longer on or near the line (paragraph 95a.ii).

4 This incident highlights the importance of the fundamental rule that staff should watch and listen for trains at all times when crossing an open line, looking up at least every five seconds, and not allowing themselves to become distracted with other tasks or by equipment or devices they are carrying (paragraph 95a.iii).

5 For train drivers, this incident highlights how the early use of a train's horn to give an urgent warning (a series of short, sharp blasts) can avert an accident, when track workers on their line do not immediately acknowledge the initial horn warning and move to a position of safety (paragraph 97).

6 Network Rail staff are reminded that if they are involved in an operational incident, such as a near miss with a train, they must report it immediately. In the first instance staff should report the incident to Route control or the controlling signal box. Staff should then also report the incident to their line manager (paragraph 98b).

[10] 'Learning points' are intended to disseminate safety learning that is not covered by a recommendation. They are included in a report when the RAIB wishes to reinforce the importance of compliance with existing safety arrangements (where the RAIB has not identified management issues that justify a recommendation) and the consequences of failing to do so. They also record good practice and actions already taken by industry bodies that may have a wider application.

Appendices

Appendix A - Glossary of abbreviations and acronyms

CCTV	Closed circuit television
COSS	Controller of site safety
EMU	Electric multiple unit
GPS	Global positioning system
IWA	Individual working alone
PDSW	Planning and delivery of safe work
SWL	Safe work leader
WICC	Wessex Integrated Control Centre

Appendix B - Glossary of terms

All definitions marked with an asterisk, thus (*), have been taken from Ellis's British Railway Engineering Encyclopaedia © Iain Ellis. www.iainellis.com.

Access point	A designated point along a railway at which entry to railway property may be made safely. Most are pedestrian only, often with steps to track level. The remainder are vehicular and range between those that are just simple gates, to large levelled areas with level crossing surfaces permitting easy access for road rail machines. The presence of an access point does not guarantee that access to the track itself is necessarily safe at that location.*
Backlog	The name used by Network Rail's maintenance organisation for time dependent items of work, such as inspections, that have not been completed by their planned due date, but have not yet reached the date where not completing this item of work is a non-compliance to standards.
Cess	The area along the side of the railway track.
Conductor rail	An additional rail, raised above the height of the adjacent running rails as it is supported by electrical insulators, which is used to convey and enable collection of electrical traction current at track level. Conductor rail systems carry voltages of the order of 750 Volts direct current.
Controller of site safety (COSS)	A person certified as competent to implement a safe system of work at a site of work on a railway line.
Delivery unit	The name given to the part of Network Rail's organisation that is responsible for the maintenance of assets in a defined geographical area.
Distant lookout	A lookout positioned to give additional warning of approaching trains to the lookout at the site of work, in cases where the lookout at the site of work would not otherwise be able to give sufficient warning to staff.
Down	The name generally given to lines used by trains travelling in the direction away from London. In this case it is from Basingstoke towards Eastleigh.
Electric multiple unit	A multiple unit that can be driven and controlled as a single unit from the driving cab at the leading end and whose motive power is electricity supplied externally from overhead line equipment or conductor rails.*
Emergency brake application	A demanded brake application that uses a more direct and separate way than that used for normal service braking applications. This may result in quicker application of braking.

Fast	Normally describing the track or tracks with the highest permissible speed in multiple track railways. Sometimes also used to describe the most important tracks in a layout where all tracks are the same speed.*
High speed train	Various locomotive and coaching stock formations and multiple units that are permitted to run at 100 mph (160 km/h) or more (which are defined in the sectional appendices (operating publications produced by Network Rail that include details of running lines, permissible speeds and local instructions) as class 91 locomotive with mark 4 vehicles and driving van trailer, classes 158, 159, 168, 170, 171, 172, 175, 180, 220, 221, 222, 253, 254 and 373).
Individual working alone	A person certified as competent to implement a safe system of work for their own protection on a railway line.
Infrastructure maintenance delivery manager	A senior Network Rail manager who has overall responsibility for the day-to-day management of maintenance of the track, signalling, electrification and plant assets within a defined area. This includes overall responsibility for the budget for maintaining these assets.
Infrastructure maintenance engineer	A senior Network Rail manager who manages the engineering team, providing day to day support and is responsible for delivery of maintenance volumes within financial targets.
Line blockage	An arrangement where a section of line has no train movements over it and is safeguarded by the signaller.
Lookout	A member of staff whose sole responsibility is to look out for and give warning of approaching trains.
Main	The principal track on a railway.*
Mobile operations manager	A Network Rail operations manager who provides first line response to incidents.*
Open line	A line or track upon which trains are running.*
Personal track safety	The minimum training and certification required by Network Rail before being allowed on or near the line. The course introduces basic concepts of safety and emergency action.*
Planning and delivery of safe work (PDSW)	A Network Rail initiative to implement four major changes to the current arrangements for people working on or near the line: ● a new role of safe work leader (SWL); ● a permit to work system; ● a new digital map of the railway; and ● a new universal work planning process.

Rail management engineer	The Network Rail manager responsible for the delivery of rail related maintenance tasks including welding, grinding, ultrasonic rail testing and lubrication.
Rolling contact fatigue	Collective term for all rail defects directly attributable to the rolling action of a rail wheel on the rail.*
Rule Book	Railway group standard GE/RT8000, which is the publication detailing the general responsibilities of all staff engaged on the railway system, and the specific duties of certain types of staff such as train drivers and signallers.*
Safe system of work	An arrangement of precautions which ensure that workers are exposed to least possible risk. This can include COSS briefings, provision of special equipment, possessions and isolations. The latter arrangements are the responsibility of a controller of site safety (COSS).*
Safe work leader	A new competence that Network Rail is introducing. The safe work leader will have overall (task and safety) responsibility for work carried out.
Slow	A track of lesser importance than a fast line but which runs alongside a fast line. A slow line may not be slower than the fast line.*
Suspect rail defect	A feature or flaw found within the data recorded by an ultrasonic test train which indicates there may be an internal defect within a rail. The suspect rail defect is then verified by manual methods, with this work carried out by the local rail testing section using handheld or trolley mounted ultrasonic test equipment.
Third rail electrification	A general term used to cover the type of electrification that involves the supply of DC traction current to trains by means of a conductor rail laid along one side of the rails, known as the third rail.*
Track maintenance engineer	The Network Rail manager responsible for the delivery of track maintenance, and the line management of the rail management engineer, within a defined area.
Train operated warning system	A permanently installed system in which an audible warning of an approaching train is triggered automatically by the occupation of certain signal sections on the approach to the installation. The warning time is usually pre-set to a minimum of 45 seconds. The system is nearly always referred to by its initials TOWS.*
Ultrasonic test train	A train equipped with ultrasonic rail flaw detection equipment. It is capable of scanning both rails at speeds up to 30 mph with reliable results, although detailed analysis of each rail flaw still requires manual methods.*

Up	The name generally given to lines used by trains travelling in the direction towards London. In this case it is from Eastleigh towards Basingstoke.
Wessex Route	A name for the part of Network Rail's organisation which manages, operates and maintains the railway from London Waterloo to Portsmouth, Southampton, Weymouth, Salisbury and Exeter, plus the railway that links Reading and Guildford to Redhill and Gatwick Airport.

Appendix C - Investigation details

The RAIB used the following sources of evidence in this investigation:

- information provided by witnesses and at meetings with employees of the parties involved;
- closed circuit television (CCTV) recordings taken from train 1T29;
- site photographs;
- weather reports and observations at the site;
- maintenance documents including the safe system of work packs;
- records for the rail testing and lubrication section's planned and completed maintenance work;
- documents detailing the runs by ultrasonic test trains and the suspect defects that were reported;
- competency records for the staff involved in the incident;
- Network Rail company standards;
- Rule Book handbooks and other Railway Group standards;
- reports from rail industry systems showing what trains were running in the area; and
- a review of previous RAIB investigations that had relevance to this incident.

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This report is published by the Rail Accident Investigation Branch,
Department for Transport.

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