RAIB

Rail Accident Investigation Branch

Rail Accident Report

Near miss between a train and a track worker at Peterborough
20 July 2018

Report 04/2019
June 2019

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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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 words such as '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, words such as '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.

Information about casualties is based on figures provided to the RAIB from various sources. Considerations of personal privacy may mean that not all of the actual effects of the event are recorded in the report. The RAIB recognises that sudden unexpected events can have both short and long term consequences for the physical and/or mental health of people who were involved, both directly and indirectly, in what happened.

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 Peterborough, 20 July 2018

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Summary

At around 10:52 hrs on 20 July 2018, a track worker, who was acting as a site lookout for another track worker who was carrying out an inspection, narrowly avoided being struck by a train near Peterborough station. The train involved had just passed through the station and was travelling at 102 mph (164 km/h) when its driver saw the lookout standing on the same line ahead. The driver immediately sounded the train's warning horn and applied the brakes. The lookout responded to the train's horn and moved out of its path about 2.5 seconds before the train reached him.

The investigation found four causal factors. The site lookout was distracted and not adequately observing his distant lookout or looking for approaching trains. He had also chosen to stand on an open line when it was not necessary to do so. The track worker carrying out the inspection, who was also the Controller of Site Safety and responsible for the safety of all the staff involved in the work, was not monitoring the unsafe actions of the lookout at the time of the incident. Lastly, the distant lookout had left his position before the train arrived because he thought he had been stood down. A distant lookout who was visible to the site lookout was from a different team and was looking out for trains coming in the opposite direction.

The investigation also found that the way in which the work was planned defaulted to using the least preferred safe system of work in the hierarchy within Network Rail's company standard for managing the safety of people at work on or near the line. Further, the current rules for communication when lookouts are used are impractical, leading to a disregard for the rules and the use of unofficial and uncontrolled practices. These two factors were the underlying causes of the incident.

The RAIB has made five recommendations addressed to Network Rail relating to the following areas:

- a rule change so that site lookouts default to standing in a position of safety unless this is not practicable to implement the safe system of work;
- investigating the common but unofficial use of flag signals by lookouts to communicate, finding ways to improve and control this communication, implementing changes and monitoring the effectiveness of the changes that are made;
- clarifying to track workers the actions they should take when more than one group wants to work with lookouts in the same place;
- continuing the ongoing work of the Network Rail route involved to reduce the use of lookouts for cyclic maintenance tasks; and
- reducing the number of cyclic maintenance tasks that are undertaken using lookouts across all of Network Rail's infrastructure.

The investigation also identified three learning points about the importance of early use of the train's horn by drivers to give an urgent warning, which probably averted an accident in this case; the briefing of lookouts on where to stand while carrying out their duties; and staff responsible for the safety of the work group not becoming distracted by the work activities to the extent that they are no longer observing the group.

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 explained in appendix A. Sources of evidence used in the investigation are listed in appendix B.

3 Throughout this report, southbound towards London King's Cross is referred to as the 'up' direction and northbound away from London King's Cross is referred to as the 'down' direction.

The incident

Summary of the incident

4 At around 10:52 hrs on 20 July 2018, a track worker who was acting as a lookout[1] for another track worker, narrowly avoided being struck by a passenger train just south of Peterborough station (figure 1).

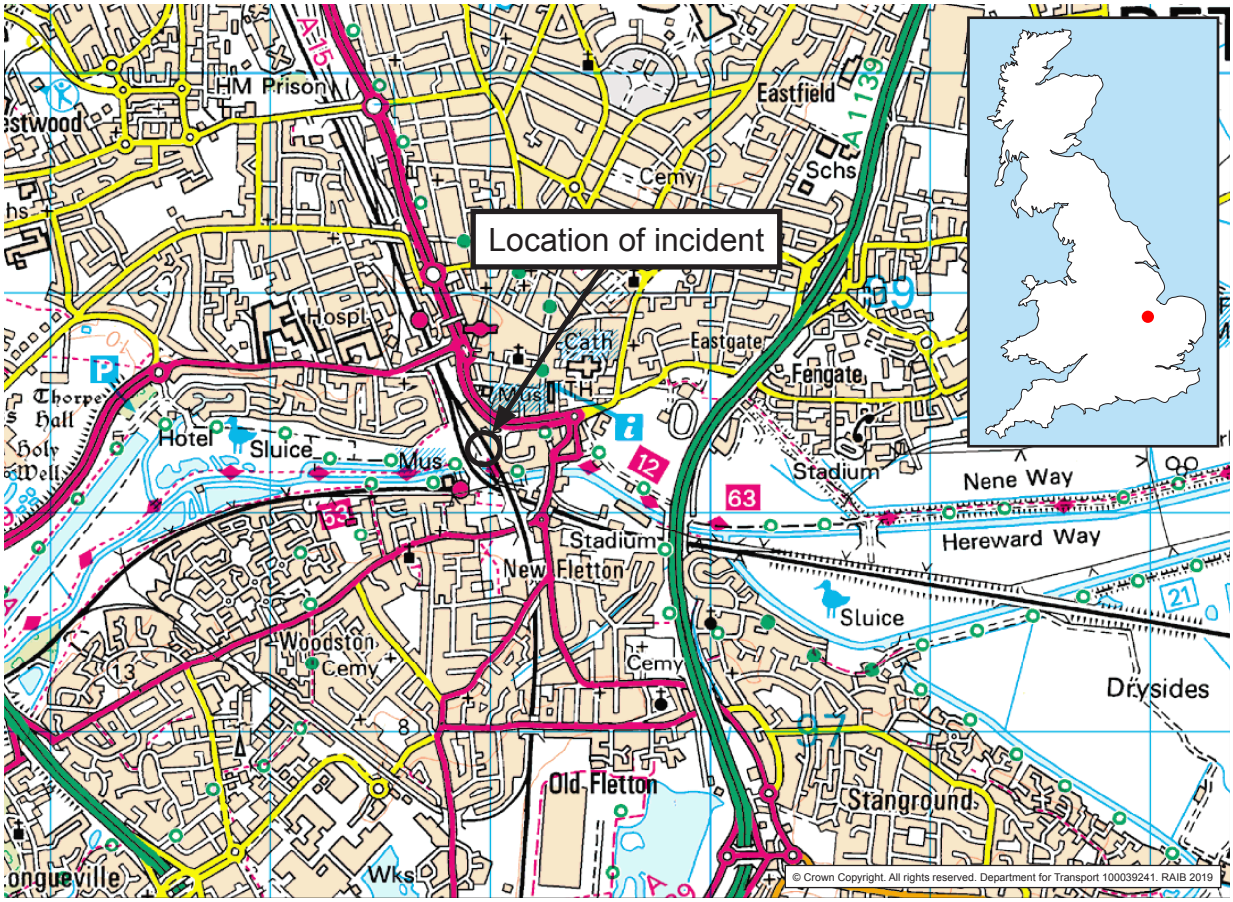

Figure 1: Extract from Ordnance Survey map showing location of the incident

5 The southbound train was approaching along the up fast line at 102 mph (164 km/h) and had just passed through the station when the driver saw the track worker standing on the same line. The driver sounded the train's warning horn and applied the brakes. The track worker moved out of the path of the approaching train about 2.5 seconds before it reached him.

6 No one was injured, but the driver was shaken by the incident. After making an emergency stop, the driver reported the incident to the signaller. A short time later, the driver was able to continue the journey to London King's Cross. The track workers reported the incident to their manager and then went to Peterborough maintenance depot.

[1] A person who is certified as competent to watch for approaching trains and to give a warning to others using a whistle or horn, or by touch.

Context

Location

7 The incident happened at 76 miles 7 chains[2] from London King's Cross station (figure 2). This location is on the East Coast Main Line (ECML) and is part of Network Rail's London North Eastern and East Midlands (LNE&EM) Route[3].

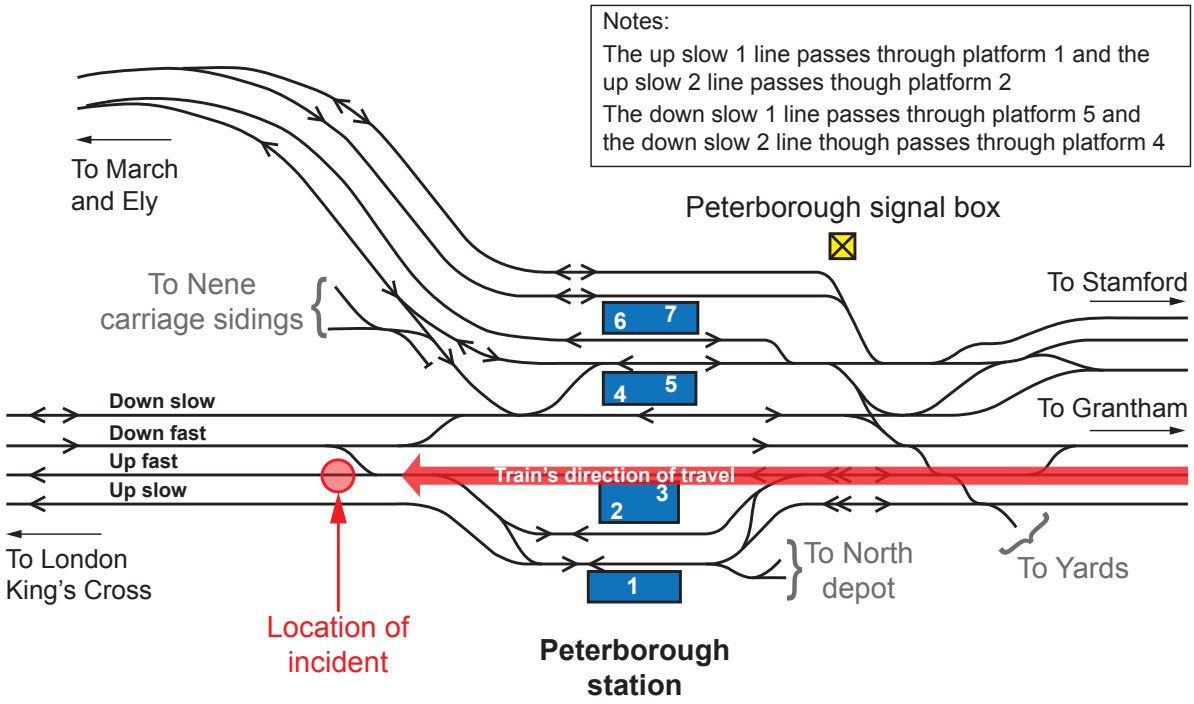

Figure 2: Schematic of track layout at Peterborough station

8 The track workers were working on the up slow and up fast lines (figure 2). The up fast line passes through platform 3 and has a maximum permitted speed of 105 mph (169 km/h). The up slow line passes through platform 1 and has a maximum permitted speed of 50 mph (80 km/h).

9 The approach on both lines is initially straight, leading into a left-hand curve (in the train's direction of travel) of about 2000 metres radius. This curve starts towards the southern end of the platforms and ends as the track straightens out after passing under the road bridge for Thorpe Road (figure 3).

10 Signalling in the area is controlled from Peterborough signal box. Most lines through the station, including the up fast line through platform 3, are electrified with 25kV AC overhead line equipment.

Organisations involved

11 Network Rail owns, operates and maintains the infrastructure. It employed all of the track workers involved in this incident.

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[2] A unit of length equal to 66 feet or 22 yards (20 metres).

[3] A name for part of Network Rail's organisation which manages, operates and maintains the railway from London King's Cross to Berwick upon Tweed (along the ECML including a number of routes that branch off the main line to Lincolnshire, Humberside, Yorkshire, Teesside, County Durham and Northumberland) and from London St Pancras to Sheffield.

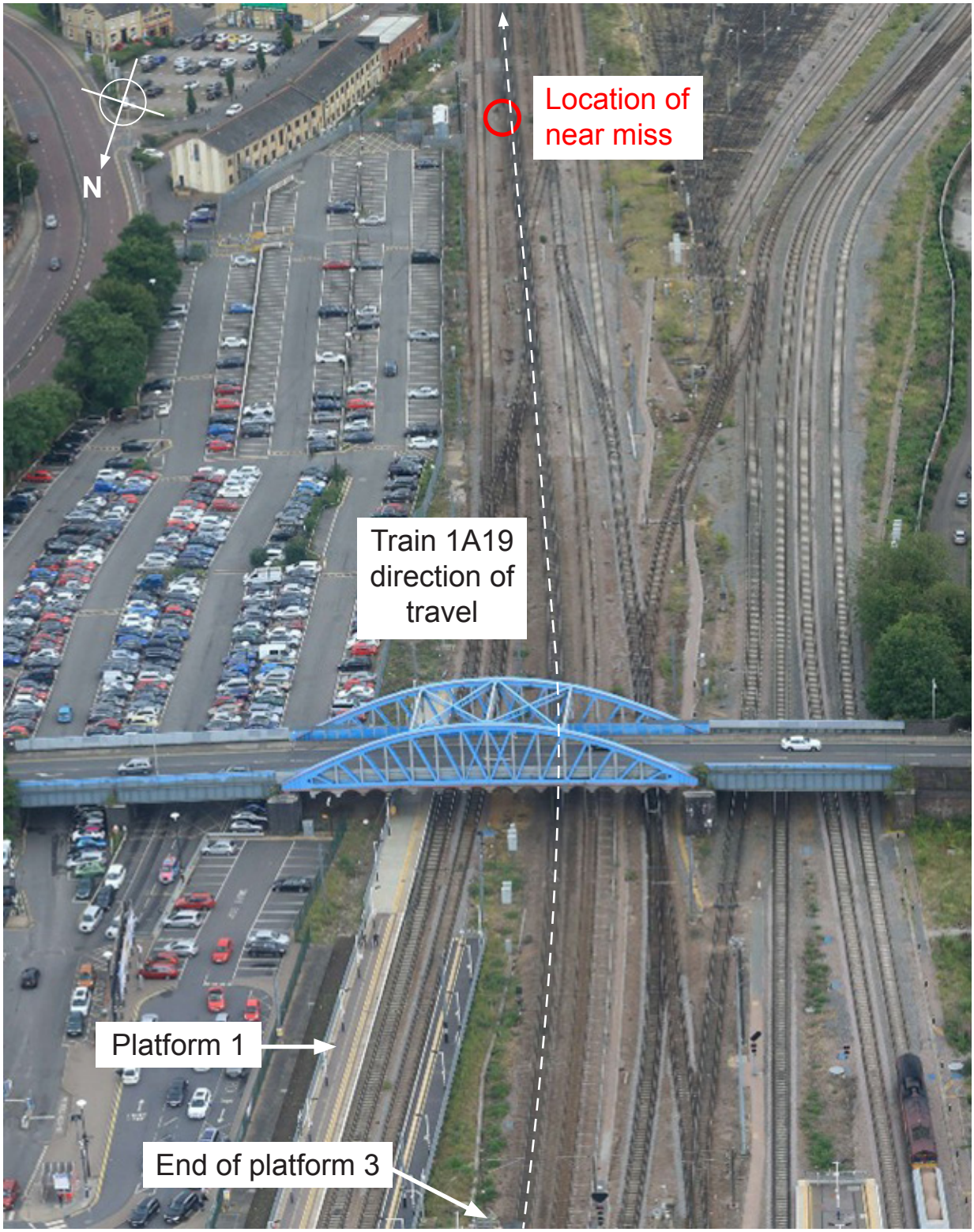

Figure 3: Aerial view of the site of the incident showing key features (courtesy of Network Rail)

12 London North Eastern Railway was the operator of the train and it employed the train driver. Both Network Rail and London North Eastern Railway freely co-operated with the investigation.

Train involved

13 The train, reporting number[4] 1A19, was the 09:16 hrs service from Leeds to London King's Cross. It comprised a driving van trailer[5] (known as a DVT) leading at the front of the train, nine coaches and a class 90 electric locomotive at the rear of the train.

Staff involved

14 The track workers were members of a lubrication team which comprised three people. This team is responsible for inspecting and maintaining lubricators[6] and is part of the rail testing and lubrication section based at Network Rail's Peterborough depot. This section is part of the Peterborough delivery unit within the LNE&EM Route's maintenance organisation.

15 The lubrication team leader was the controller of site safety[7] (COSS) for the work that day. He had ten years' experience working in railway maintenance and had moved into the lubrication team three years previously as an operative. He became a team leader about one year before the incident.

16 Track worker A, who narrowly missed being struck by the train, was an operative whose role that day was to assist with the work and to be a site lookout when required by the team leader. As site lookout, he was positioned at the site of work to warn the team leader when a train approached or when he was given a warning by the distant lookout (paragraph 17). He had two and half years' experience of working on the railway, mostly as an operative in a track maintenance team working south of Peterborough on the EMCL. He had moved into the lubrication team in June, about four weeks before the incident. He was not familiar with working in complex areas like Peterborough station, and this was only the second time that he had worked as a site lookout at this location.

17 Track worker B was an operative and his role was to be either a site or a distant lookout as required by the team leader. As distant lookout, he was positioned some distance away to give additional warning of approaching trains to track worker A, when track worker A as the site lookout would not otherwise be able to give sufficient warning to the team leader (usually in cases where the track is curved or obstructions are present). He had 17 years' experience working as an operative in different maintenance teams based at the depot. He had been on secondment to the lubrication team for the previous 17 months to carry out lookout duties.

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[4] An alphanumeric code, known as the 'train reporting number', is allocated to every train operating on Network Rail's infrastructure.

[5] A driving van trailer (DVT) is a purpose-built vehicle with a driving cab that allows a driver to operate a locomotive attached to the opposite end of a train. Locomotive hauled trains operating with a DVT remove the need for a locomotive to be attached to the leading end of the train when reversing.

[6] A device for delivering a measured quantity of lubricant (generally grease) onto the running edge of a rail in order to reduce the friction between the rail and flange of a rail wheel on curved track to reduce noise and wear.

[7] A person who is certified as competent to implement a safe system of work at a site of work on a railway line.

18 It was the first time that track worker A had worked as site lookout with track worker B acting as his distant lookout. Their role was to work together to warn the team leader when a train approached. This required track worker B, as the distant lookout, to wave a flag from side to side above the head to provide the additional warning to track worker A, the site lookout. Once track worker A saw this flag signal, he would warn the team leader.

19 On the day of the incident, there were two other Network Rail maintenance teams working near the station. One was a rail testing team and the other was a track maintenance team. Both of these teams were also using site and distant lookouts while working on the track.

External circumstances

20 It was daylight at the time of the incident and visibility was good. The local weather, based on closed circuit television (CCTV) footage and data from four local weather stations all located less than 3.5 miles (5.6 km) away, was dry. It was partly cloudy with no direct sunlight and temperatures were between 24 and 25°C. Weather observations from a station located about 9 miles (14.5 km) away, indicated light winds that morning up to 5.5 mph (9 km/h).

21 There was some background noise from the railway station and from traffic on nearby roads.

The sequence of events

Events preceding the incident

22 On Friday 20 July, the lubrication team members all arrived at Peterborough depot by 07:30 hrs. The COSS had already collected the paperwork, including details of the safe system of work[8] to be used, the previous day. After finishing their checks and preparations for the planned work, the team left the depot in a van at about 08:15 hrs to travel to the location of the first task of the day, which was to inspect a lubricator situated about three miles north of Peterborough station.

23 Once there, the team leader gave a safety briefing to the others as part of his COSS duties, which covered the work to be done and the safe system of work to be used. The safe system of work at this location required only one site lookout, so track worker B was appointed to do this. This left track worker A available to work alongside the team leader to carry out the inspection.

24 After completing their inspection, the team left at about 09:45 hrs and headed south back towards the station. On the way, they stopped off near Peterborough signal box. Here, track worker B was again appointed to be the site lookout while the team leader showed track worker A a lubricator which was of a different type to the one they had just inspected. This was a very short visit lasting about five minutes.

25 The team then went to Peterborough station's main entrance. Once there, and while sitting in the van, the team leader gave another COSS briefing to track worker B as he was now going to be the distant lookout for the next inspection. After being briefed, track worker B left the van and walked through the station, over the footbridge and to the south end of platforms 4 and 5, along the path shown by the yellow dashed line in figures 4 and 5. He went through the gate at the end of the platform and onto an authorised walkway (figure 5). Part way along this walkway was his nominated place to stand and carry out his distant lookout duties, safe from train movements. From here he could see to the north for trains that were approaching in the up direction and also see and be seen from the south, where the other team members would be working.

26 When track worker B arrived at the end of platforms 4 and 5, he found another distant lookout was already standing where he planned to look out from. This was a distant lookout for a rail testing team, though he was not looking out at the time as his team had just moved to work to the north of the station. Track worker B positioned himself about 10 metres to the south of the other distant lookout (figure 6).

27 In the meantime, the team leader and track worker A had driven through the station car park to a vehicle access point at the south end. After going through the gate, the team leader gave a further COSS briefing to track worker A who was going to be the site lookout for the inspection at this location. The planned work was to carry out a routine inspection on the lubrication equipment located on both the up slow and up fast lines (figure 7).

[8] Arrangements to make sure the workers in a group, including lookouts, are not put in danger by the movement of trains when walking or working on or near the line.

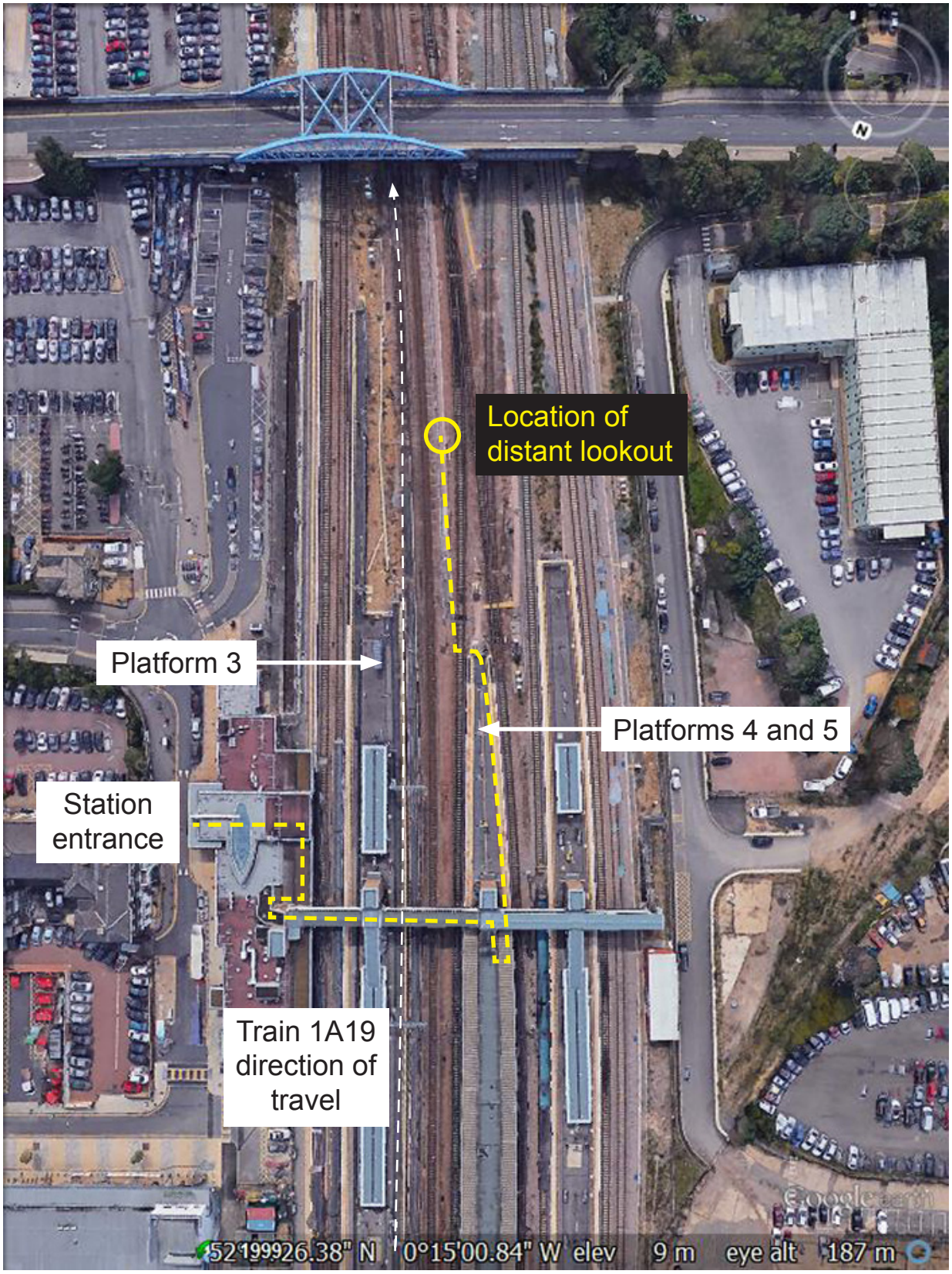


Figure 4: Aerial view of Peterborough station

Figure 5: The authorised walkway off the end of platforms 4 and 5

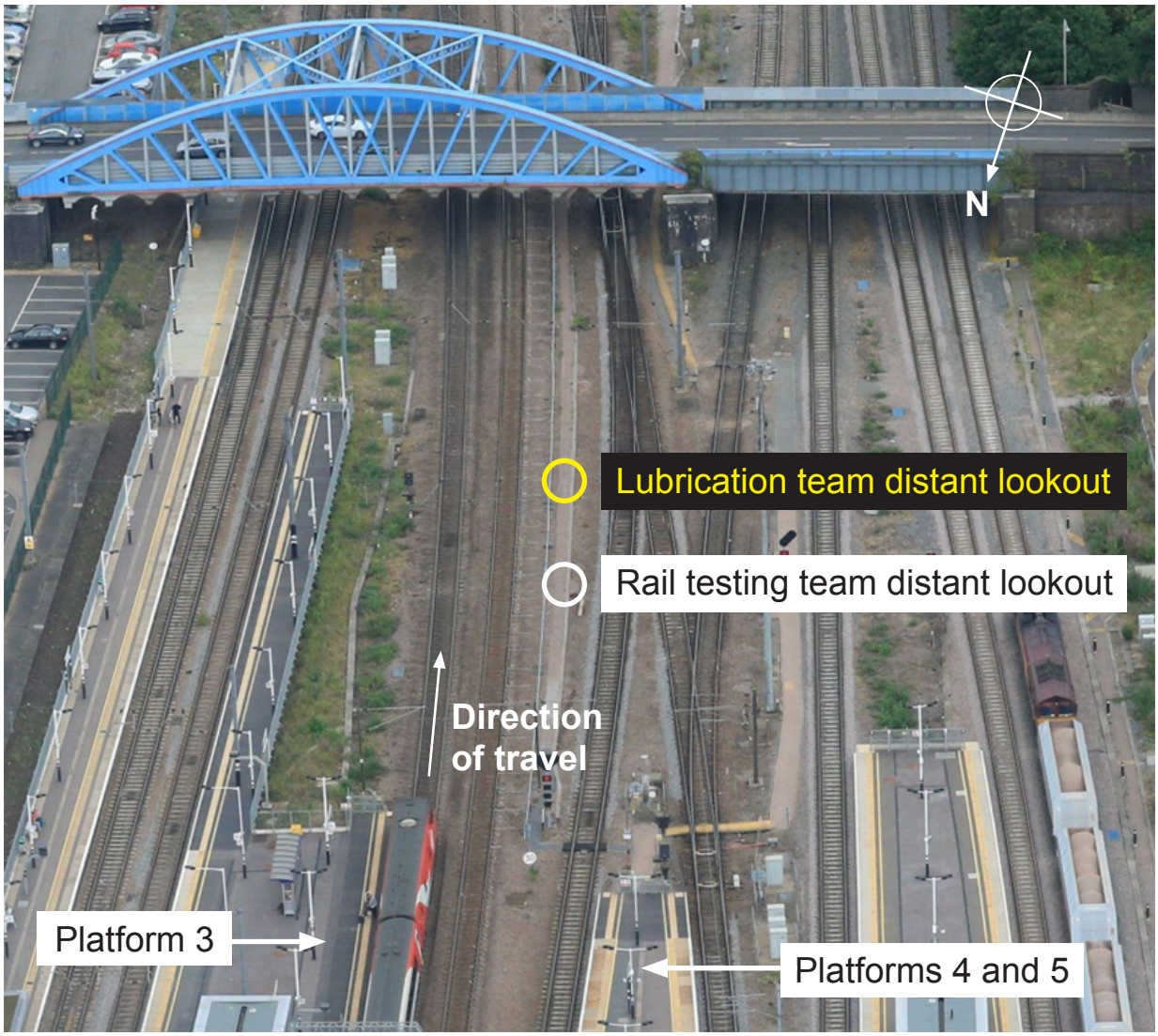


Figure 6: The locations of the distant lookouts

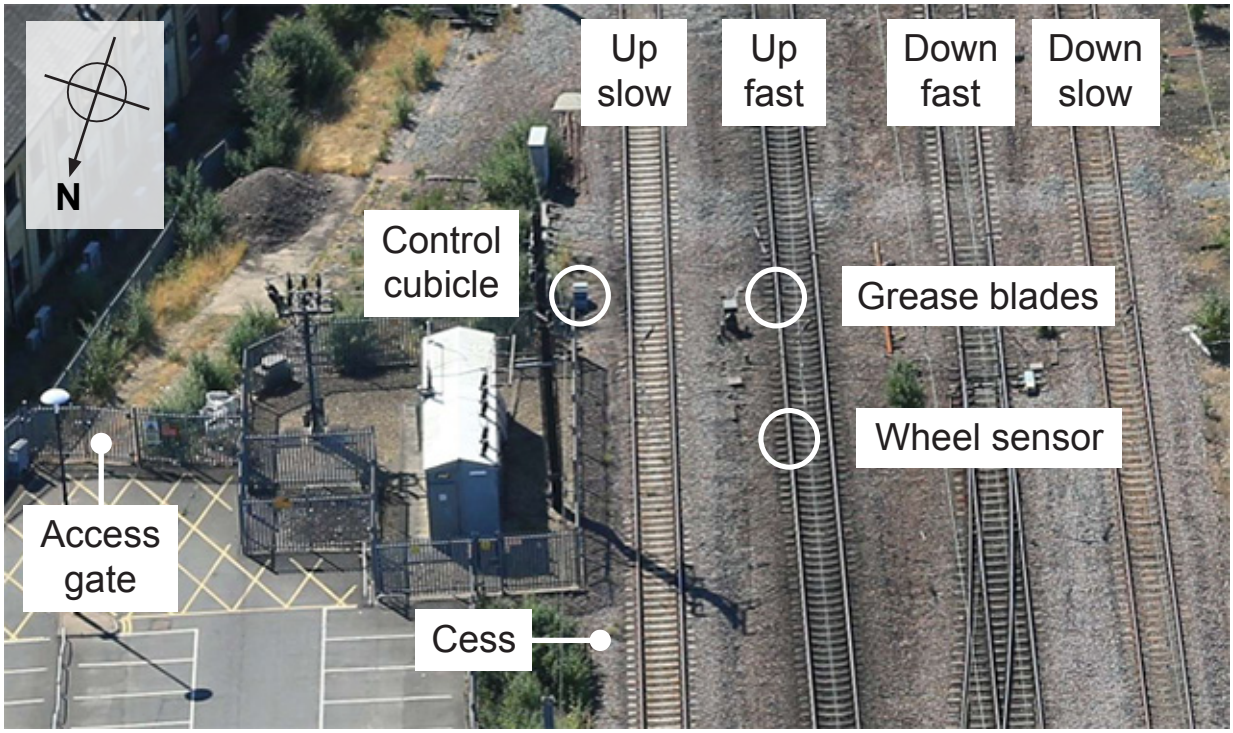


Figure 7: Location of the lubrication equipment to be inspected

28 At around 10:05 hrs, just as the team leader and track worker A were preparing to go onto the railway, they noticed there were two lookouts standing near to each other where they were expecting to see only track worker B. The team leader and track worker A agreed that track worker A would warn the team leader if either of the distant lookouts gave a warning (see paragraphs 18 and 71). The team leader then began inspecting the lubrication equipment on the up slow line while track worker A stayed nearby in the cess[9] of the up slow line.

29 After inspecting the equipment on the up slow line, the team leader moved to inspect the equipment on the up fast line. He soon found that it was not pumping out grease when commanded and began investigating the cause of the problem. While fault finding, the team leader walked to and from the blades, from where the grease is pumped out onto the rail, the train wheel sensor located on the up fast line and the control equipment cubicle located in the cess (figure 7). Track worker A followed the team leader as he moved about, including following the team leader onto the up fast line.

30 During the fault finding work and about 25 minutes before the incident, track worker B gave a warning for an approaching train by waving his lookout flag[10] above his head. Track worker B had seen a train approaching from the north on the up fast line while it was still about a mile (1.6 km) away from Peterborough station. Track worker A did not respond to this warning so track worker B continued to wave his flag. The other nearby distant lookout saw what was happening, became worried and told track worker B to keep waving his flag.

[9] The area alongside the railway. This usually provides a safe area for workers to stand when trains approach.

[10] A blue and white chequered flag.

31 Track worker A responded to track worker B's warning only when the train had reached the south end of platform 3, about 400 metres (8 seconds) away from the site of work. Its driver did not report a near miss at the site of work, as the team leader was working on the control equipment in the cess at the time, with track worker A nearby, so both were away from the up fast line. The team leader was aware that the train had arrived quicker than he had anticipated, thinking it had arrived about 10 seconds after track worker A had given him a warning. He asked track worker A about what had happened. Track worker A replied that he had responded when the distant lookout, track worker B, had given a warning. The team leader did not question this further and none of the group stopped the work to raise any concerns about how the safe system of work was functioning.

32 The team leader resumed fault finding and about 15 minutes later he concluded that the fault with the lubrication equipment was due to a problem with the control equipment in the cubicle located in the cess. He then began to reconnect the wiring he had changed while fault finding and moved back and forth frequently between the control equipment in the cess and equipment on the up fast line to do this. During this work, track worker A stopped following the team leader and remained on the up fast line even when the team leader stayed in the cess to work on the control equipment.

Events during the incident

33 At 10:48 hrs, the distant lookout for the rail testing team took a mobile phone call from his COSS telling him to return to the front of the station. He packed up his equipment and just as he was about to leave, another distant lookout, from a track maintenance team, arrived at the end of platforms 4 and 5. The track maintenance team was setting up a safe system of work to commence working at the north end of the station. The track maintenance distant lookout wanted to stand off the southern end of the platforms to give warnings to his team's site lookout for trains approaching from the south. He called his COSS to tell him that their safe system of work could not be set up because other distant lookouts were already there. The distant lookout for the rail testing team then left, telling the track maintenance distant lookout he had finished work there.

34 At about 10:50 hrs, track worker B saw a signal from track worker A that he interpreted to mean the work had finished and that he was no longer needed. Track worker B packed up his lookout equipment, told the track maintenance distant lookout that he had finished too, and left to walk back round to the front of the station to be picked up. Once the other distant lookouts had left, the track maintenance distant lookout went down onto the authorised walkway (figure 5) in readiness to provide warnings to his team. He stood in the same area as the other distant lookouts had.

35 At 10:52:04 hrs, train 1A19 entered the north end of the station, 14.7 seconds away from track worker A, who was standing on the up fast line. While the team leader was in the cess working on the control equipment, track worker B was walking back up platform 5 and the track maintenance distant lookout was now standing where track worker B had been. Figure 8 shows the final sequence of events leading up to the near miss, as seen by the forward facing camera on train 1A19.

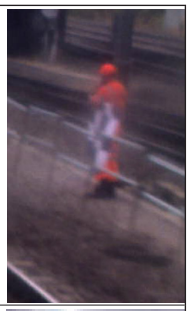
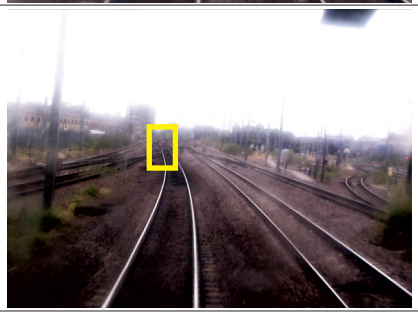
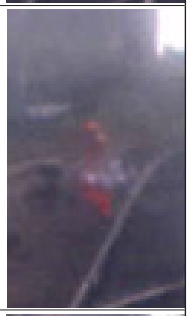
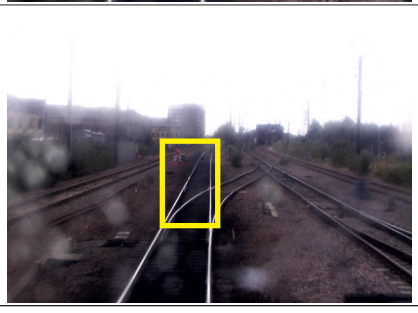
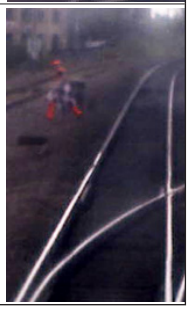
Time: 10:52:10.7 Time to track worker A: 8.8 seconds Train speed: 102 mph (164 km/h) Event: Driver started sounding train horn when she saw track worker A ahead on the up fast line. The distant lookout for the track maintenance team was standing to the right.		
Time: 10:52:13.0 Time to track worker A: 6.5 seconds Train speed: 102 mph (164 km/h) Event: As train passed under bridge, track worker A was bent over on the up fast line.		
Time: 10:52:13.7 Time to track worker A: 5.8 seconds Train speed: 102 mph (164 km/h) Event: Driver applied train's brakes just as track worker A started to straighten up.		
Time: 10:52:14.7 Time to track worker A: 4.8 seconds Train speed: 101 mph (163 km/h) Event: Track worker A started to move and wave his lookout flag.		
Time: 10:52:15.7 Time to track worker A: 3.8 seconds Train speed: 101 mph (163 km/h) Event: Driver stopped sounding train horn and track worker A stepped out of the up fast line.		
Time: 10:52:16.9 Time to track worker A: 2.6 seconds Train speed: 99 mph (159 km/h) Event: Track worker A has now moved more than 2 metres from the up fast line.		

Figure 8: The sequence of events

36 At 10:52:19.5 hrs, the train arrived at the position where track worker A had been standing on the up fast line. It was travelling at 96 mph (154 km/h).

Events following the incident

37 The train stopped at 10:52:57 hrs and the driver reported the near miss to the signaller at Peterborough signal box. After taking several minutes to recover, the driver declared to the signaller that she was fit to continue. The train then completed its journey to London King's Cross.

38 Meanwhile, the team leader who had heard the train sound its horn also noticed that it was braking. He saw the train come to a stop in the distance and decided to immediately stop work. He called his manager to explain that they might have been involved in an incident and was told to return to the depot. He did not report the incident to Route control (see paragraph 134). The team leader and track worker A departed in the van and picked up track worker B from the station. Track worker B complained to them about how long he had been waiting at the front of the station to be picked up. It was then that the team leader realised there must have been a problem with the system of work.

39 Once back at the depot, the lubrication team members met with their manager and gave statements to him. Network Rail suspended the team leader's COSS competency. It also suspended the lookout competencies held by track worker A and track worker B. These competencies remained suspended until January 2019 while Network Rail carried out its investigation.

Key facts and analysis

Identification of the immediate cause

40 **Track worker A was unaware of the train approaching along the line on which he was standing.**

41 When train 1A19 approached, track worker A was standing in the four foot[11] of the up fast line and he only moved clear of the path of the train about 2.5 seconds before it arrived (figure 8). Evidence from the train's forward facing CCTV and data recorder show that track worker A only became aware of the train and responded to it after the driver sounded the train's horn. Track worker A confirmed that it was the train's horn that had alerted him to its presence.

Identification of causal factors

42 The near miss occurred due to a combination of the following causal factors:

a. track worker A, in his role of site lookout, was distracted and not adequately observing the distant lookout or looking out for trains (paragraph 43);

b. track worker A stood on the up fast line when it was not necessary to do so (paragraph 49);

c. the team leader, in his role as COSS, was not observing and correcting the unsafe actions of track worker A (paragraph 58); and

d. the distant lookout visible to track worker A at the time of the incident was providing warnings for another work group and so did not give a warning to track worker A when the train approached (paragraph 67).

Each of these factors is now considered in turn.

The site lookout

Looking out for trains

43 **Track worker A, in his role of site lookout, was distracted and not adequately observing the distant lookout or looking out for trains.**

44 When train 1A19 approached, the CCTV footage shows track worker A was on the up fast line. He was bent over and looking down. He was not looking towards any distant lookout or trains approaching on either his line or the up slow line.

[11] The space between the two rails of a railway line.

45 The Rule Book, Handbook 3 (GE/RT8000/HB3 issue 3, 'Duties of the lookout and site warden'[12]) states that 'While you are acting as a lookout you must:

- make sure your mobile phone is switched off
- stay alert and carefully watch for approaching trains
- give the warning and then tell the COSS or SWL[13] if you can no longer give an adequate warning or your view becomes blocked.

You must not:

- take part in the actual work
- carry out any other duties
- allow yourself to be distracted'.

46 Track worker A was not aware of the approaching train, until it sounded its horn. He stated to the RAIB that the reason he was bent over at the time was that he had dropped a bunch of keys and was picking them up.

47 It is possible that track worker A was also distracted by the work that was taking place. Being new to the team he was keen to learn about the lubrication equipment and at the locations visited earlier that day, the team leader had been explaining what he was doing. It is possible that track worker A had continued watching what the team leader was doing while he was fault finding the lubrication equipment at this location.

48 There is evidence that track worker A was distracted earlier. In the minutes before the incident, track worker A had neither noticed when the rail testing distant lookout departed, leaving just one distant lookout, nor when track worker B left his position and was replaced by the track maintenance distant lookout (paragraph 34). Additionally, about 25 minutes earlier, track worker A had been slow to respond to the warning given by track worker B for the previous train (paragraphs 30 and 31) which showed he had not been focused on looking for warnings given by his distant lookout.

Position while looking out

49 **Track worker A stood on the up fast line when it was not necessary to do so.**

50 Before going onto the track to inspect the lubrication equipment on the up slow and up fast lines, the team leader gave a COSS briefing to track worker A. This included briefing track worker A on information about the safe system of work they were going to use, such as telling track worker A that he would be the site lookout, that track worker B was the distant lookout and where he was located, and the lines they would be working on.

[12] A member of staff appointed to warn staff working near tracks that are open to traffic if they move outside their safe working area.

[13] Safe Work Leader - a role introduced by Network Rail during 2015 as part of its Planning and Delivery of Safe Work programme. Among other things, the role replaced the COSS as the person responsible for safety at the site of work. Only parts of Network Rail's organisation adopted the SWL role.

51 Rule Book Handbook 7 (GE/RT8000/HB7 issue 5, 'General duties of a controller of site safety (COSS)') requires a COSS to place any distant or intermediate[14] lookouts in a position of safety. It is not a requirement for site lookouts to be in a position of safety while they are looking out, because a COSS might need a site lookout to be close to others working on the track to give a warning by touch or to achieve the required sighting. Rule Book Handbook 3 does require the COSS to tell the site lookout where to stand while looking out. However, the team leader did not tell track worker A where he should stand while looking out as part of his COSS briefing and track worker A did not question this.

52 When the work started, track worker A initially stayed in a position of safety in the cess and looked out from there while the team leader inspected the lubrication equipment on the up slow line. Once this part of the inspection was complete, the team leader began inspecting the equipment on the up fast line. The team leader made frequent movements between the control cubicle located in the cess and the equipment on the up fast line, comprising the wheel sensor and grease blades located 15 metres apart (figure 7).

53 The team leader had not specifically told track worker A to stay in one place so track worker A decided to follow him while he moved around fault finding (paragraph 29). Track worker A reported that he did this because he did not want to have to shout at the team leader to give a warning when a train approached. Rule Book Handbook 3 and Handbook 7 both state that the COSS must choose a method of warning for the lookout that will best suit the type of work and the location. The choice is to give a warning using either a horn or whistle, or by touch. Rule Book Handbook 7 states that the COSS can, if necessary, also get the lookout to shout a warning. The lookout training course requires a warning to be given using a horn or whistle rather than shout a warning. In his COSS briefing, the team leader did not give track worker A any specific advice on what method to use to give a warning to him.

54 Track worker A reported that he also stayed close to the team leader because the team leader was telling him about what he was doing. At the two sites they had visited previously, they had worked together on the lubrication equipment and the team leader had told track worker A what he was doing and explained how the equipment worked. The team leader however reported that he had not continued to coach track worker A at the incident location, and that his conversations with track worker A were limited to telling him when he was about to move to work on equipment on one of the lines, and to tell him that the work would take longer than planned as there was a fault.

55 After a while, track worker A had stopped following the team leader and decided to remain on the up fast line. He explained that he did this because he expected the team leader to return there after a short time. Track worker A was comfortable standing on lines open to train movements. When he had worked in a track maintenance team, he would often find himself on an open line because that was where he needed to be to work. He reported to the RAIB that he believed he was more vigilant when looking out if he was positioned in a place where he was exposed to the same level of risk as those he was there to warn, even if this was on an open line.

[14] An additional lookout placed between the site and distant lookouts to achieve the warning time required by the safe system of work.

56 Track worker A also reported that he thought standing on the up fast line gave him a better view of his distant lookout. Figure 9 shows that the difference in the angle for sighting the distant lookout from the up fast line and from the cess is very slight. The increased personal risk is, however, significant.

Figure 9: Sighting of the distant lookout by the site lookout

57 Other Network Rail staff who were familiar with carrying out site lookout duties at this location, reported to the RAIB that they did not stand on the up fast line. They indicated that they could see a distant lookout just as well from the cess or from the space between the up fast and slow lines. Figure 10 shows that the latter is just wide enough for a site lookout to stand between the up slow and up fast lines and still be in a position of safety.

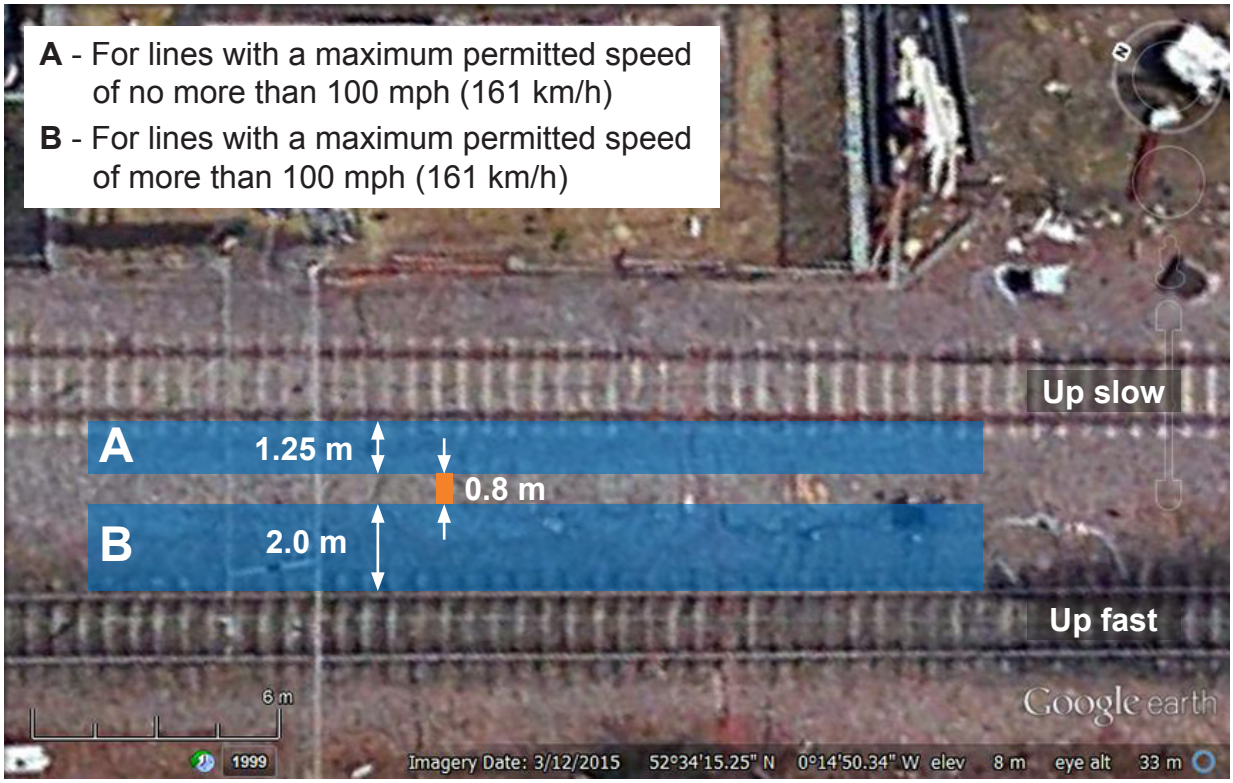


Figure 10: The space between the up slow and up fast lines

The COSS

58 **The team leader, in his role as COSS, was not observing and correcting the unsafe actions of track worker A.**

COSS responsibilities

59 The team leader, as COSS, was responsible for implementing and maintaining a safe system of work using a site and a distant lookout. The Rule Book (Handbook 7), required him to 'stay with the group to personally observe and advise everyone'. The team leader was also responsible for carrying out the task, a planned inspection of the lubrication equipment.

60 The COSS briefing given by the team leader was incomplete because it did not tell track worker A where to stand when looking out or the method of warning to use. Once the team leader and track worker A went to go onto the track, they could see two distant lookouts and so they agreed that they would respond to warnings given by either distant lookout. The team leader did not find out who the other distant lookout was, who their COSS was, where they were working or what they were doing (see paragraph 82).

61 Once the safe system of work was implemented, the team leader did not adequately observe what track worker A was doing. He allowed track worker A to follow him about and later he did not tell track worker A to move clear of the up fast line when he did not need to be there. The team leader also took no action to review the safe system of work or the actions of either lookout when track worker A was slow to respond to the warning given by track worker B for the previous train (paragraphs 30 and 31). The team leader was aware that the train had arrived only a short time after track worker A had given him a warning for it. Although he enquired as to what had happened, he did not challenge track worker A's explanation. When told that track worker A had responded when the distant lookout had waved, he made no attempt to speak to track worker B about this. He also allowed track worker A to hold his lookout flag out all of the time (see paragraphs 72 and 74).

62 When the team leader found the equipment on the up fast line was faulty, the nature of the work changed from inspection of the equipment to fault finding. Once fault finding, the team leader reported he became more and more focussed on the task as he found fault finding to be one of the most interesting and rewarding parts of his job. However, this was to the detriment of his COSS duties which still required him to monitor the safe system of work at the same time.

Workload of the COSS

63 The lubrication team was a three person team comprising a team leader and two operatives. The team leader was the only person who could be the COSS as only he held this competency. He was also the only person who held the required competencies to work on the lubrication equipment. No one was available to assist the team leader with the work at this site because both operatives, track worker A and track worker B, were required to be lookouts to implement the safe system of work.

64 In larger maintenance teams, when required, one person can be dedicated to leading the task while another is dedicated to COSS duties. In smaller teams, the likelihood of the COSS carrying out both the COSS duties and the work is greater. The views of Network Rail staff on fulfilling both roles at the same time vary. Some staff refuse to do both at the same time, others will do both but only if they believe that they can manage the workload it entails, and some will always do both to get the work done, often because there is no one else to assist. The team leader fell into this last category and, being the senior person in a small team of three, he was used to both doing the work and being the COSS.

65 Network Rail company standard NR/L2/OHS/019, 'Safety of people at work on or near the line' required the responsible manager to make the necessary resources (including equipment, people and time) available to allow the safe system of work to be implemented as planned. NR/L2/OHS/019 is silent on whether the COSS can also be involved in the delivery of the work. As the rail testing and lubrication section operates with small teams, its manager often scheduled work that required one person to be the COSS and also do the work.

66 When this work was planned, it was seen simply as an inspection and did not consider the possible need to carry out fault finding in the event of a problem being found. The team leader placed an expectation on himself to try to immediately fix problems or, at least, understand what was wrong so the parts needed to effect a repair could be ordered if a future visit was needed. When the nature of the work changed from routine inspection to fault finding, the team leader did not review the suitability of the safe system of work or his ability to monitor the safe system of work while he was fault finding.

The distant lookout

67 **The distant lookout visible to track worker A at the time of the incident was providing warnings for another work group and so did not give a warning to track worker A when the train approached.**

68 This causal factor arose due to a combination of the following:

a) track worker B, who was the distant lookout for the lubrication team, had left his position prior to the arrival of train 1A19, because he thought he had been stood down (paragraph 69); and

b) the distant lookout visible to track worker A was from a different maintenance team and was looking out for trains approaching from the opposite direction (paragraph 78).

Each of these is now considered in turn.

The position of track worker B

69 **Track worker B, who was the distant lookout for the lubrication team, had left his position prior to the arrival of train 1A19, because he thought he had been stood down.**

70 This situation arose because of a breakdown in the communication between track worker A (the site lookout) and track worker B (the distant lookout). Lookouts are not permitted to have their mobile phone switched on (paragraph 45) but as track workers A and B were required to see each other when performing lookout duties, they used their lookout flags to communicate. Although prohibited by the rules, the RAIB found instances when a COSS and lookout were using mobile phones to communicate (see paragraph 106).

71 Only one lookout flag signal is described in the Rule Book (Handbook 3), to be used by the distant lookout to give a warning for an approaching train. A distant lookout waves the lookout flag from side to side above the head as shown in figure 11. When a site lookout sees this, he/she should warn the group at the site of work. Once everyone in the group has acknowledged the lookout's warning (by raising one arm above their head) and moved to a position of safety, the site lookout should return the same flag signal to acknowledge the distant lookout's warning. Both lookouts should then stop waving their lookout flags.

72 Both track workers A and B were also using two unofficial flag signals that day to communicate. Neither flag signal is in the Rule Book nor included in the training given to lookouts.

73 The first unofficial flag signal is used by lookouts to communicate that it is 'all clear', meaning that no trains are approaching, so that work can start or resume. The RAIB found that some distant lookouts hold their lookout flag out briefly and then, once acknowledged by the site lookout, both lookouts gather their flag up and hold it in against the flag pole. Other site and distant lookouts were found to hold the flag out all the time, either to the side or across their body, to give a continuous all clear signal to each other (figure 12).

Figure 11: Lookout flag signal to give a warning

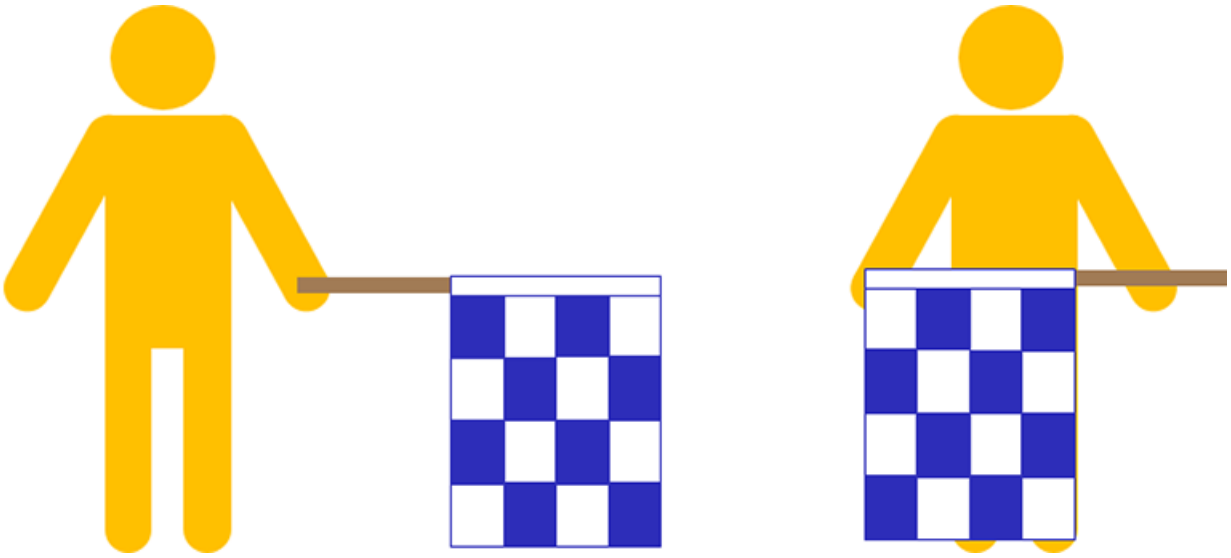


Figure 12: Unofficial lookout flag signals used to communicate 'all clear'

74 Before the team leader and track worker A went onto the track south of Peterborough station, track worker B, as the distant lookout, held his flag out briefly to give an all clear at the start of the work. Track worker A acknowledged this by holding his flag out but then kept his flag held out. He did this because on previous occasions when he had worked with the track maintenance team based at Peterborough depot, he had seen that their lookouts hold their flags out all of the time to give an 'all clear' signal. A previous manager there had instructed the track maintenance team to do this and the practice had continued. Track worker A had assumed that as the lubrication team was based at the same depot as this track maintenance team, both teams followed the same practice. Therefore, he held his flag out all the time as he thought that this would fit in with common practice in his new team. However, the lookouts in the rail testing and lubrication section did not follow this practice because they only held their flags out briefly to give an 'all clear' signal.

75 A second unofficial flag signal is used by lookouts to communicate that work is complete so they can stand down the safe system of work and leave their post. When the safe system of work can be stood down, the COSS tells the site lookout who then waves their lookout flag low across their knees. This is known as an 'under wave' (figure 13). When a distant lookout sees an under wave flag signal, he acknowledges by doing the same. Both lookouts then stop waving and know they can stop looking out for trains and leave their position.

Figure 13: Unofficial lookout flag signal used to communicate that work is complete

76 On the day of the incident, track worker B believed he saw an under wave, albeit 'flimsy', from track worker A. Track worker B reported that he gave an under wave in response, packed up and left his position. However, just before this happened, track worker A had been moving about a lot as he was following the team leader around (paragraphs 53 and 54). Track worker A was still holding the flag out across his body while he did this as the COSS had not told him to do otherwise. It is probable that track worker B mistook a movement by track worker A and his flag as the under wave signal. By that time, track worker B was expecting the inspection to end soon as it had already gone on for much longer than planned; the timing of the apparent under wave fitted in with his expectation.

77 When track worker B returned the under wave signal, he reported that he could see both the team leader and track worker A in the cess, further confirming in his own mind that the work had finished. As he was leaving, track worker B did not look back so he did not see that track worker A had gone back onto the up fast line. Track worker A did not see track worker B leave his position or that his place had soon been taken by the track maintenance team distant lookout (paragraph 48).

Track maintenance team distant lookout

78 **The distant lookout visible to track worker A was from a different maintenance team and was looking out for trains approaching from the opposite direction.**

79 Just before the incident, track worker A could see someone standing where he was expecting to see his distant lookout. He therefore assumed that this person was track worker B. Because the visible distant lookout was not giving a warning at the time train 1A19 was approaching the site of work, track worker A stated that he thought he had time to pick up the keys he had just dropped (paragraph 46).

80 The distant lookout that track worker A could see was not track worker B but was the distant lookout from a track maintenance team, there to give warnings for a team working to the north of the station. He was looking out for trains approaching from the south in the down direction. At this time, no one was giving warnings to track worker A for trains approaching in the up direction from the north.

81 The walkway off the end of platforms 4 and 5 is a popular place for distant lookouts to stand (figure 5). It gives good sighting of trains approaching from the north for work taking place to the south of the station. Similarly, it gives good sighting of trains approaching from the south for work taking place to the north of the station. That morning, three maintenance teams with lookouts from Network Rail's Peterborough depot, were working around the station, and each wanted to place its distant lookout at that location.

82 The investigation found that there were no controls in place to manage clashes between different work groups wanting to use lookouts in the same location. The RAIB found no rule, guidance or training to cover this scenario and none of Network Rail's company standards prevent a COSS from setting up a safe system of work with lookouts when another work group is already using lookouts at the same location. At present, the management of this situation relies on the COSS from each work group speaking to each other to come to an agreement on how best to proceed. If the work is compatible, the groups might share lookouts. More often, one group will wait until the other has finished its work or will move to work elsewhere.

83 Each maintenance section has a section planner who is responsible for planning the safe systems of work and who will hold an applicable competence within Network Rail's competence management system. The section planners on LNE&EM Route have access to information that allows them to identify potential clashes between workgroups when planning work in engineering possessions[15] or line blockages[16]. However, there are no similar information sources that allow section planners or managers to easily identify potential clashes for work planned using lookouts. The planning system used to prepare and issue safe system of work packs[17] does not automatically identify any such clashes. The section planners on LNE&EM Route do not communicate with their counterparts about what work is being planned using lookouts. Consequently, each section planner plans all their work using lookouts in isolation, with no knowledge of what other work is planned to take place using lookouts and whether it could cause a clash.

84 A section planner can search on the planning system to see if a safe system of work pack covering a specified mileage has already been issued, but doing this is time consuming. Even if a potential clash is identified, it is difficult for the section planner to predict when another team will be working there. Teams working with lookouts are often given a number of safe system of work packs at the start of the day and have the flexibility to decide the order of where to go and when, as each pack is usually valid for any time between 08:00 and 16:00 hrs. There is also no guarantee that the team will actually go to a location on the planned day. Teams working with lookouts can change their plans at short notice, for example if a previous job takes longer than expected, or if they are diverted to respond to a defect.

85 It is difficult to predict a clash between teams using lookouts. Witnesses indicated that clashes between two teams wanting to work with lookouts in the same place are not uncommon and it is possible to find three teams with lookouts all wanting to be in the same place at the same time.

Identification of underlying factors

Planned work using lookouts

86 **The planning of routine inspection work by the rail testing and lubrication section at Peterborough depot had defaulted to using the least preferred 'safe system of work' in the hierarchy defined within Network Rail's company standard NR/L2/OHS/019.**

87 Network Rail company standard NR/L2/OHS/019 describes the use of a safe system of work with lookout warning as the 'last resort'. That morning, three Network Rail maintenance teams were all using lookouts for planned work around Peterborough station, two of which were from the rail testing and lubrication section. NR/L2/OHS/019 describes a hierarchy of safe systems of work that should be considered when planning any work. This is shown in table 1.

[15] A section of railway line which is under exclusive occupation of an engineer for maintenance or repairs.

[16] A section of railway line on which trains are prevented from moving, by placing or maintaining signals at danger.

[17] A pack of information used by the COSS that provides details of the site of work, the work to be done and the planned safe system of work, in accordance with Network Rail company standard NR/L2/OHS/019 and the Rule Book GE/RT8000.

	Safe system of work	Type	Description
1	Safeguarded site of work	Protection	Where every line at the site of work has been blocked to normal train movements. This was formerly known as 'Safeguarded Green Zone'. Examples include engineering possession or line blockages where all lines are blocked.
2	Fenced site of work	Protection	Where there is a suitable barrier between the site of work and any line open to the normal movement of trains or moving vehicles. This was formerly known as 'Fenced Green Zone'. Examples include demarcation such as using types of fencing as described in the Rule Book.
3	Separated site of work	Protection	Where there is a distance of at least 2 metres (6 feet 6 inches) between the nearest running rail of an open line and the site of work, and a site warden has been appointed to maintain the safe limits of the protected area. There is an identifiable limit to the site of work. Alternatively, where there are two people in the group, a site warden does not need to be appointed. Neither member of the group is to go any closer than 2 metres (6 feet 6 inches) to the nearest running rail of the open line. There is an identifiable limit to the site of work These were formerly known as 'Separated Green Zones'. Examples include simple line blockages, line blockage with detonators, line blockage with signal disconnection, using lock out devices.
4	Warning systems – Permanent	Warning	Where there is permanently installed equipment which will provide a warning, to give sufficient time to allow everyone involved to reach a position of safety at least ten seconds before any train arrives at the site of work. Examples include the Train Operated Warning System (TOWS) and Automatic Track Warning System (ATWS).
5	Warning systems – human activated equipment	Warning	Where portable equipment can be deployed and activated by a lookout in order to provide a warning, to give sufficient time to allow everyone involved to reach a position of safety at least ten seconds before any train arrives at the site of work. This was formerly known as 'Red Zone' with warning from LOWS. The only example is the Lookout Operated Warning System (LOWS).
6	Warning systems – Portable	Warning	Where portable equipment can be installed which will provide a warning, to give sufficient time to allow everyone involved to reach a position of safety at least ten seconds before any train arrives at the site of work. Examples include the Automatic Track Warning System (ATWS) and Semi-Automatic Track Warning System (SATWS).
7	Lookout warning	Warning	Where one or more lookouts are positioned to provide enough warning to allow everyone involved to reach a position of safety at least ten seconds before any train or vehicle arrives at the site of work. Alternatively where a COSS is working alone and looking out for him/herself. This was formerly known as Red Zone. Examples include site lookout and multiple lookouts.

Table 1: The hierarchy of safe system of work in NR/L2/OHS/019, Issue 9

88 The section manager had produced and issued the safe system of work packs for the lubrication team's planned inspections earlier that week because he did not have a section planner working for him at the time (see paragraph 113). He used safe system of work packs that had already been set up on the computerised planning system for these cyclic tasks. As a result, whenever the lubrication equipment to the south of Peterborough station was inspected, the lubrication team defaulted to doing this work using a safe system of work with lookouts (item 7 in table 1).

Equipment warning safe systems of work

89 The section manager did not have the option to choose to use a permanent warning system (item 4 in table 1) for this inspection as no such system is installed at this location. It was also impractical for him to choose a portable warning system (item 6 in table 1) as the time required to plan, install and remove the portable warning system was disproportionate to the inspection that needed to be done.

90 The section manager could have chosen to use a lookout activated warning system (item 5 in table 1) but many of the Network Rail maintenance teams based at Peterborough depot were reluctant to use their lookout operated warning system (LOWS) equipment due to past reliability issues.

91 LOWS equipment comprises a control unit that is located at the site of work and supervised by a LOWS controller, along with up to four lookouts who are equipped with lookout operated transmitter units. The system is designed so that when a train approaches, a lookout operates switches on the transmitter unit to send a warning. When the warning is received by the control unit, it gives a visual and audible warning using flashing lights and a warning sound. The workers at the site of work then have sufficient time to move clear of the track and into a designated position of safety.

92 LOWS incorporates safety functions to ensure a warning is given at the site of work if potentially unsafe conditions occur. These include:

- the transmitter unit is tilted for a specified amount of time, which may be because the lookout has fallen or collapsed;
- the lookout fails to operate the vigilance switch mounted on the transmitter unit;
- only one of the two switches to give a warning is activated on the transmitter unit;
- the radio signal from any connected transmitter unit is interrupted for a specified time; and
- the system self-detects that a warning might have been missed.

93 For any of these conditions, the visual and audible site warning is triggered on the control unit and continues until acknowledged and cancelled by the LOWS controller. The system then needs to be reset before it becomes operational again.

94 Track worker A was familiar with using LOWS and competent to use it. He had used it when working in his previous track maintenance team (paragraph 16). LOWS had not been used by the maintenance teams who work in the Peterborough station area for about five years. Some maintenance teams had used LOWS in the past but found it to be unreliable as the signal between the transmitter and control units would be lost, causing a failsafe warning to be given. The teams found that sometimes LOWS would work at a specific location, but not at others. Even after mapping out the places where LOWS worked, the teams still found it was sometimes unreliable at these locations. Consequently, LOWS fell out of use and whenever work was planned by the maintenance teams in the Peterborough station area, it was not considered as an alternative to using multiple lookouts.

Safe and effective working project

95 LNE&EM Route is gradually increasing the amount of work that its maintenance teams carry out using the protection safe systems of work (items 1 to 3 in table 1). This change is being delivered by its Safe and Effective Working (S&EW) project. Some maintenance sections have engaged with the S&EW project much more than others. The Peterborough depot rail testing and lubrication section had only had limited interaction with the S&EW project before this incident occurred.

96 LNE&EM Route started the S&EW project after a track worker fatality at Newark[18]. The project is supported by the Route's senior management and has had a full time team of seven staff since around the start of 2018. The project coves eight maintenance delivery units, encompassing 104 sections, which equates to more than 700 individual maintenance teams. Its primary focus is on planning and delivering the Route's known maintenance workload as Network Rail knows how often it needs to inspect and carry out routine maintenance tasks on its assets. These are called maintenance scheduled tasks and are often referred to as MSTs. The project has identified that from the 400,000 MSTs that the maintenance teams undertake annually, they generate about 700,000 maintenance activities that must be carried out each year on LNE&EM Route.

97 When a maintenance section engages with the S&EW project, phase 1 is to take the section's known maintenance activities and align as much of this work as possible into engineering possessions. It does this by looking at the access opportunities available in the agreed strategy for pre-programmed cyclical engineering possessions. This process also takes into account the number of night shifts that the section's maintenance staff can be rostered to work in accordance with their employment terms and conditions. The project has found that its phase 1 work has helped to protect the engineering possessions that are available and the impact on maintenance of any proposed changes to the length of engineering possessions can be assessed. The S&EW project has also found that phase 1 has promoted collaborative working between maintenance sections.

[18] Fatal accident involving a track worker at Newark North Gate station, 22 January 2014, RAIB report 01/2015.

98 Phase 2 of the S&EW project uses Signal Box Special Instructions[19] (SBSIs) to deliver further cyclic tasks. The project has added pre-planned line blockages to the SBSIs in the Route's signal boxes. These are built around gaps in the working timetable to identify times when access between trains is possible. The project is creating about 1720 SBSIs across 198 signaller locations[20]. These SBSIs deliver about 245,000 annual maintenance activities, generated from about 140,000 MSTs, in planned line blockages. Each SBSI has a unique reference and follows a standard format. It provides information about where the line is to be blocked from and to, along with other information, such as the access points to use and nearby welfare facilities.

99 The project has created the SBSIs in cooperation with both the maintenance and operations functions within LNE&EM Route. This work has also included the creation of a line blockage register. The register is based on signaller workload assessments for every hour during the day and shows how many line blockages a signaller can reasonably manage at any one time. This tool aims to avoid the situation where a signaller refuses to give a line blockage due to workload. As well as the SBSIs, the register is kept up to date with any other planned line blockages.

100 The S&EW project is monitoring the amount of work taking place using protection safe systems of work and reports it has seen a steady increase in this type of working by the four maintenance delivery units that cover the southern end of the ECML from London King's Cross to Doncaster (figure 14). Data obtained by the project also shows that the rail testing and lubrication section within the Peterborough delivery unit is the section that carries out the least proportion of work using protection safe systems of work (figure 15).

101 At the time of the incident, the Peterborough rail testing and lubrication section was carrying out about 70% of its work using a warning safe system of work, primarily using lookouts rather than equipment (figure 15). A large proportion of this section's work is responding to suspected rail defects within a specified timescale, so this rail testing work often cannot be planned into engineering possessions or line blockages. However, this is not the case for the work of the lubrication team, as almost all of its work consists of cyclic inspections.

102 Network Rail's Scotland Route does not currently allow work to be done on lines open to traffic with a lookout warning safe system of work (item 7 in table 1). For working on an open line on Scotland Route, work must be carried out using an equipment warning safe system of work (items 4 to 6 in table 1).

[19] Network Rail instructions that may exist in a specific signal box that are only applicable to that box and are supplementary to the Rule Book.

[20] Where a signaller is provided to control or supervise an area of railway using a signalling control system (ranging from a mechanical signal box to a workstation with display screens). In large signal boxes there will be multiple signaller locations, with each signaller responsible for a specific area.

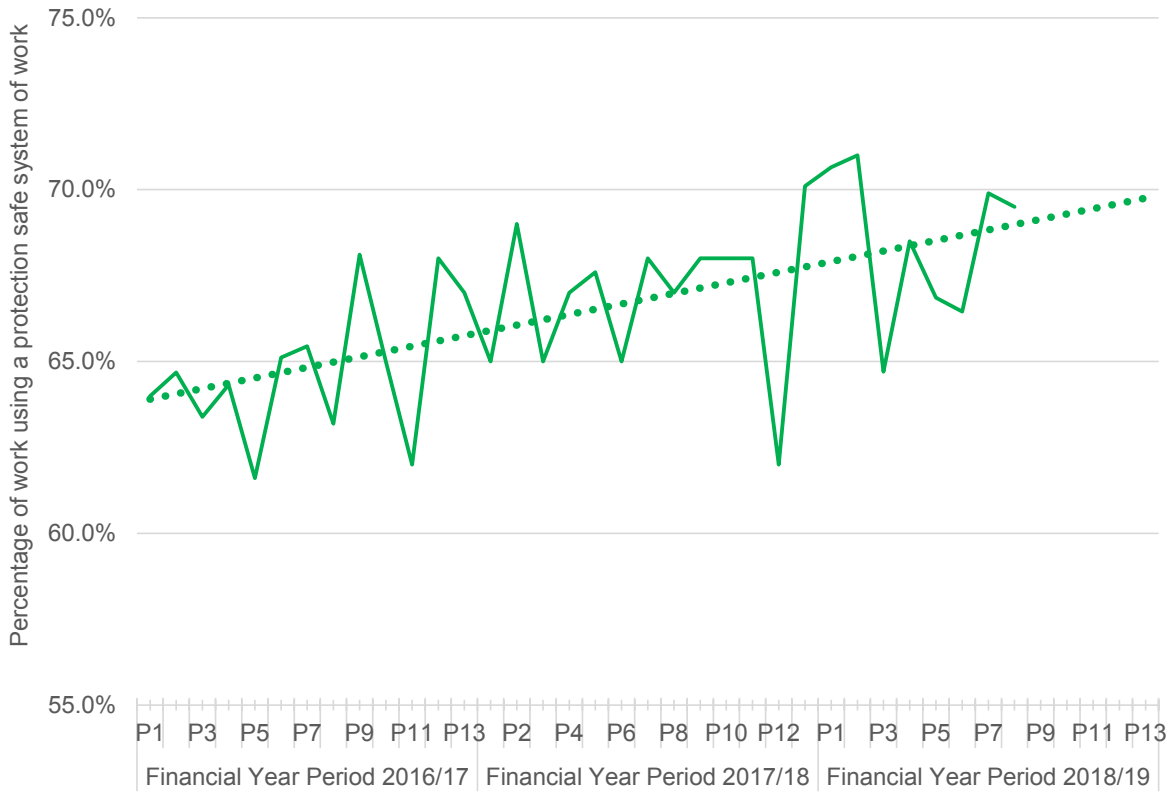


Figure 14: Graph showing the increase in the amount of work carried out using protection safe systems of work by the four maintenance delivery units that cover the southern end of the ECML from London King's Cross to Doncaster

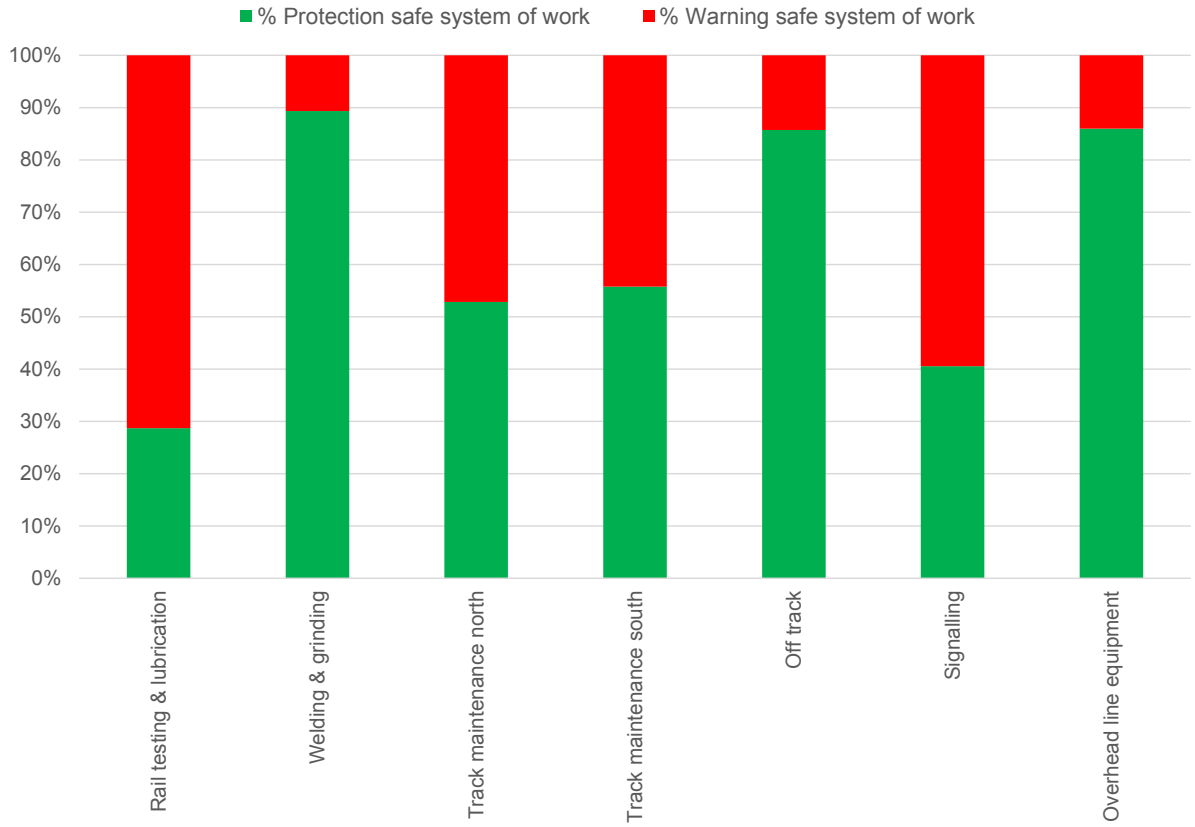


Figure 15: Graph showing the amount of work carried out using protection safe systems of work by each maintenance section within Peterborough delivery unit

103 The S&EW project is unlikely to ever eliminate the need for some working using lookouts. This is because the project (phases 1 and 2) can only accommodate maintenance work arising from the need to respond to or repair defects when it aligns with pre-programmed cyclical engineering possessions. However, in places where there are many assets to maintain and high levels of work arising, the project has attempted to increase the frequencies of the location's pre-programmed cyclical engineering possessions. In addition, some working using lookouts might need to continue as the available engineering possessions will not accommodate all of LNE&EM Route's 700,000 annual maintenance activities. Problems can also be encountered in some places when attempting to use SBSIs as these are dependent upon the density and reliability of the train service.

Communication between the COSS and intermediate or distant lookouts

104 **The current rules for communication between the COSS, and his/her intermediate or distant lookouts are impractical, leading to a disregard for the rules and the use of unofficial and uncontrolled practices.**

105 The Rule Book expectation is that a COSS will always communicate with his intermediate and distant lookouts face to face. However, this can be impractical when:

- *Setting up, testing or starting to use the safe system of work.* Before allowing the work to start, the COSS first needs to be confident that it is his intermediate or distant lookout that can be seen in the distance (lookouts are often used on curves and there have been instances where a COSS has mistaken other staff for their lookout). The COSS then needs to know that the safe system of work is working as planned, with the required warning time being achieved, by testing it. This testing requires a lot of communication between the COSS and lookouts which is not practical to do face to face, because of the distances involved. Once the COSS is ready to start work, it is also impractical for the COSS to tell every lookout face to face that work is commencing.
- *Resuming work after a train has passed.* The COSS is responsible for allowing the work group back onto the track. While the COSS can make this decision based on no warning being given by the lookouts, many prefer to receive a positive indication from their lookouts that no further trains are approaching (see table 2 for the accident that happened at Redhill on 24 June 2014).
- *Resuming work if a distant lookout gives a warning but no train passes the work group.* This can happen when the distant lookout is placed before a diverging junction and the work is taking place on one of the routes beyond the junction. Although the distant lookout is required to provide a warning for all trains, some trains might take a different route. When this happens, the COSS cannot decide if the work can resume as the distant lookout might be giving the warning to indicate that there is a problem that is affecting the safe system of work. Relying on face to face to communication would be disruptive.

- *Standing down the safe system of work once the work is finished.* Face to face communications would require the COSS to first ensure his work group is in a position of safety. The COSS would then need walk out to each intermediate and distant lookout to tell them they can stand down, before then walking back to the work group. This could require the COSS to walk significant distances along the track, sometimes in both directions, taking a significant time to do so. In the meantime, the COSS is away from the work group so is not observing what the group is doing, as required by the Rule Book.

106 The investigation found that staff at Peterborough depot had adopted ways of working to overcome the above impracticalities. This included instances where rules were routinely not being followed, such as a COSS and distant lookout using mobile phones to communicate with each other when the Rule Book requires all lookouts to switch off their mobile phones (paragraph 45).

107 The investigation also found the widespread use of unofficial flag signals. The 'all clear' and 'end of work' flag signals are used by teams from the various maintenance disciplines and they have been in use for many years. The team's managers and some senior managers within Network Rail are aware of their use.

108 These unofficial flag signals, or variants of them, are believed to be in use across much of LNE&EM Route, and quite likely nationwide. The RAIB has asked Network Rail about how widespread these practices are across the different routes but Network Rail has not provided any information. Although these flag signals appear to be in widespread use by various maintenance disciplines across many depots, their unofficial status means there is no control over them. This has resulted in variations between what different teams do, which in turn can lead to confusion and misunderstandings as evidenced by this incident.

109 Working with lookouts has remained largely unchanged for many years. The Rule Book defines a number of rules that must be followed when using lookouts but it is silent on some aspects of this way of working. This absence has led to staff developing ways to overcome some of the difficulties associated with using lookouts, such as the use of unofficial flag signals. While there has been a small amount of research conducted on the use of lookouts[21], this work was primarily focused on modelling factors that influence the behaviour and affect the vigilance of lookouts. The RAIB has been unable to find any research by the UK rail industry into the factors that affect how staff set up and use the lookout warning safe system of work when out on the railway.

[21] Developing Bayesian belief networks to support risk-based decision making in railway operations, Proceedings of the 5th International Conference on Applied Human Factors and Ergonomics AHFE 2014, B Molloy, N Balfe and E Lowe, Centre for Innovative Human Systems and Network Rail.

Factors affecting the severity of consequences

110 Just after passing through platform 3, the driver saw track worker A and realised he was standing on the line on which her train was approaching. She sounded the train's horn first, which track worker A described as two aggressive blasts, and then made an emergency brake application. It was the driver's prompt use of the train's horn that caught track worker A's attention and gave him just enough time to move clear.

Observations

Non-compliance with Network Rail company standard NR/L2/OHS/019

111 **The rail testing and lubrication section at Peterborough depot was not planning its work in accordance with the latest issue of Network Rail company standard NR/L2/OHS/019.**

112 At the time of the incident, the section had been planning its work using issue 8 of NR/L2/OHS/019 (paragraph 65). However, it should have been planning its work in accordance with issue 9 of the standard, which was issued in March 2017, and required compliance from July 2017. Issue 9 introduced the role of the 'person in charge' on site and the use of safe work packs covering task risk, site risk, and operational risk (see paragraph 125).

113 The section was not complying with issue 9 of NR/L2/OHS/019 because it had not had a section planner in place for long periods. The section planner, who was responsible for both the rail testing and lubrication, and the welding and grinding sections, had initially been off work due to sickness and was then on maternity leave at the time of the incident. A replacement section planner was brought in, but she was only covering the welding and grinding section at the time of the incident while she built up her knowledge of how the section worked and the type of work that it did. This left the section manager to use the computerised planning system to issue the required packs for the rail testing and lubrication teams.

114 The section manager used safe system of work templates that had already been set on the planning system to create and issue packs. Once a task had been planned as a cyclical task and then authorised on the planning system by a responsible manager, it could be used repeatedly for six months without any further verification being required. Earlier that week the section manager had selected and printed off the already prepared packs for the lubrication team's inspection work that week. These packs were handed to the team leader on the evening before. He then checked the packs and signed them off, ready to use the next day.

115 The packs provided to the team leader included controls to manage the risks related to train movements. As these packs were not produced in accordance with the latest version of NR/L2/OHS/019, they did not require a person in charge on site to be appointed for the work and did not consider the risks related to doing the task. If the more up to date standard had been applied, it is very likely that the team leader would also have been the nominated person in charge for the inspection, and as the work scheduled for that day was planned to be a routine cyclic inspection, it would not have required any additional task controls to be put in place. Therefore the outcome would probably have been the same.

Previous occurrences of a similar character

116 Table 2 provides an overview of the 19 previous accidents and incidents, including three fatal accidents, which the RAIB has investigated since it became operational in 2005, where it was planned that the staff involved would use the lookout warning safe system of work (see item 7 in table 1). For each event, a brief description of what happened and the causes is included. Further details for each event can be found in the referenced RAIB publication.

Date	Location	Description	RAIB publication
Planned safe system of work: Lookout warning			
17/02/2007	Tinsley Green Junction	A near miss between a train and a track worker due to the poor implementation of the system of work. The COSS was inexperienced and did not take into account all of the possible ways that trains could be routed towards the site of work.	Report 43/2007
29/04/2007	Ruscombe Junction	A track worker was struck and fatally injured by a train because he continued to work and did not move to a position of safety. The track worker was given a touch and verbal warning by the site lookout so was aware of the approaching train but possibly assumed that it was not routed towards him.	Report 04/2008
29/08/2007	Leatherhead	A track worker was struck and seriously injured by a train due to a poorly implemented system of work. Factors found included inadequate warning times, poor placement of lookouts and staff not always stopping work when warned of an approaching train.	Report 19/2008
13/11/2007	Grosvenor Bridge	The COSS was struck and seriously injured by a train when he moved away from the line covered by the system of work and went onto an adjacent line. The COSS did not tell the lookout when he moved to the adjacent line. Other factors included an incomplete COSS briefing and staff not challenging the behaviour of the COSS.	Report 19/2009
23/05/2008	Kennington Junction	A track worker was struck and seriously injured by a train when he failed to move to a position of safety after being given a warning by the site lookout. Deficiencies found with the system of work included the COSS not reviewing it when it became dark and staff not moving to a position of safety when trains approached on an adjacent line.	Report 29/2009
30/03/2009	Dalston Junction	A distant lookout was struck by a train, but was not seriously injured, when he walked into the path of the train at a junction. As he walked with his back to the approaching train, he did not react to the warnings it sounded. Factors found included staff who were unfamiliar with the area, deficiencies in how the group were working with each other, and the condition of the area alongside the track causing the lookout to walk on the line.	Report 30/2009
02/12/2009	Whitehall West Junction	A distant lookout was struck and fatally injured by a train. The lookout had moved a short distance from his allocated position of safety and was standing too close to the adjacent line. He was standing with his back to the approaching train and was possibly unaware of it.	Report 15/2010

Date	Location	Description	RAIB publication
30/03/2010	Cheshunt Junction	A track worker was struck and seriously injured by a train when he failed to move to a position of safety after being given a warning by the site lookout. The track worker was not expecting the train to be routed towards where he was working. Factors found included an unsatisfactory system of work was implemented and staff did not always move to a position of safety when warned by the lookout.	Report 06/2011
02/02/2012	North Kent East Junction	A train struck equipment being carried by a lookout causing him minor injuries. A group of track workers had become distracted when the work was complete, so while they were standing in the cess, the safe system of work was not maintained. The lookout had ceased to look out for approaching trains and, although clear of the adjacent line, no one in the group was standing in a position of safety when the train approached.	Bulletin B01/2012
16/07/2012	Roydon	A near miss occurred between a train and two track workers due to the lookout being unable to give a sufficiently early warning for the approaching train. The implemented system of work was found to be inappropriate given the task and the location of the site of work.	Report 07/2013
22/03/2013	West Drayton	An intermediate lookout was struck and seriously injured by a train. The lookout was distracted and was not standing in a position of safety. He was standing with his back to the approaching train, too close to the adjacent line.	Bulletin B05/2013
12/07/2013	Poole	A track worker was struck a glancing blow by a train and suffered minor injuries. A system of work had been implemented when the group were walking to the site of work at the start of the work. The track worker was struck while walking alone to join the group at the site of work some time later. There was no lookout in place to warn him of the train approaching behind him when he stepped out of the cess to avoid an obstruction.	Bulletin B04/2013
22/01/2014	Newark North Gate	A track worker was struck and fatally injured by a train after walking out of his position of safety. He most probably moved to look for trains approaching from the opposite direction when he was struck by a train that approached from behind him. Factors found included a breakdown in safety discipline and vigilance at the site of work.	Report 01/2015

Date	Location	Description	RAIB publication
24/06/2014	Redhill	A track worker was struck and seriously injured by a train as he was walking alongside the line with his back to the approaching train. The track worker's position of safety was not adequate as there was no level place to stand clear of the adjacent line. Deficiencies were found in the planning, choice and implementation of the system of work. The investigation observed that the distant lookouts were using unofficial flag signals to indicate to the site lookout and COSS when their view of approaching trains was blocked by trains going away from the site of work. The COSS used these flag signals to decide when it was safe for the group to resume working on the track.	Report 06/2015
08/04/2016	Maesyfelin Bridge	A near miss occurred between a train and a group of track workers due to the use of an unauthorised system of work. The lookout was told to warn the group of approaching trains using hand-held radios. The planned safe system of work was not implemented by the COSS and no-one in the group challenged this.	Safety Digest D04/2016
24/06/2016	Shawford	A near miss occurred between a train and a track worker who crossed three open lines and then became distracted, while standing on the middle line, when a train approached. The track worker went onto the open lines without implementing the planned safe system of work. Factors found included a breakdown in safety discipline and vigilance at the site of work.	Report 05/2017
02/11/2016	Surbiton	A near miss occurred when a distant lookout was caught between two trains travelling in the same direction on adjacent lines. The distant lookout was unfamiliar with the area so he had walked too far and into an unsafe area. The distant lookout was briefed by the COSS when the system of work was set up but this did not adequately explain to him where his position of safety was.	Safety Digest D06/2017
21/04/2017	Between Audley End and Great Chesterford	A near miss occurred between a train and a group of track workers due to the system of work not being implemented in accordance with the rules. As the group moved along the track, the achieved warning times became inadequate. The COSS then varied the planned system of work by getting the distant lookout to give warnings to the site lookout by using a horn instead of waving a flag. The site lookout was then told to listen out for the horn while looking out for trains coming the other way. The site lookout did not hear the distant lookout's horn warning when the train approached from behind him.	Safety Digest D12/2017
22/08/2017	Between Wimbledon and Raynes Park	A distant lookout was struck a glancing blow by a train and suffered minor injuries. The system of work required the distant lookout to walk ahead of the group. While walking, with his back to the approaching train, the distant lookout moved from his position of safety so that he was too close to the adjacent line when he was struck.	Safety Digest D19/2017

Table 2: Previous accidents and incidents involving the lookout warning safe system of work

117 During the same period, table 3 shows the two previous incidents that the RAIB has investigated where it was planned that the staff involved would use an equipment warning safe system of work (items 4, 5 and 6 in table 1). Further details for each event can be found in the referenced RAIB publication.

Date	Location	Description	RAIB publication
Safe system of work: Warning systems – human activated equipment			
22/09/2014	Hest Bank	A near miss occurred between a train and a group of track workers using a system of work involving LOWS equipment. The lookout did not give a warning to the group, either because he operated the wrong switch on his equipment by mistake, or because he forgot to send a warning after seeing the train and waiting to give a warning. He waited to give warnings as he was positioned on a long section of straight track so could see approaching trains a significant time before the group needed to be warned to move into a position of safety. It is probable that the lookout's vigilance had degraded after working continuously for almost two hours.	Report 08/2015
Safe system of work: Warning systems – permanent			
05/10/2017	Egmanton	A near miss between a train and a group of track workers occurred due to the COSS implementing an ad-hoc system of work. The COSS was using a lookout to give an additional warning after the TOWS system had started sounding so he could delay the team having to get off the track and thereby get more work done. However, when the train approached, both the lookout and COSS had become distracted by the work and did not see the train until it was nearly upon them. No-one in the group challenged the ad-hoc safe system of work set up by the COSS.	Report 11/2018

Table 3: Previous accidents and incidents involving an equipment warning safe system of work

Summary of conclusions

Immediate cause

118 Track worker A was unaware of the train approaching along the line on which he was standing (paragraph 40).

Causal factors

119 The causal factors were:

a. track worker A, in his role of site lookout, was distracted and not adequately observing the distant lookout or looking out for trains (paragraph 42, **Learning point 1**);

b. track worker A stood on the up fast line when it was not necessary to do so (paragraph 49, **Recommendation 1 and Learning point 2**);

c. the team leader, in his role as COSS, was not observing and correcting the unsafe actions of track worker A (paragraph 58, **Learning point 3**); and

d. the distant lookout visible to track worker A at the time of the incident was providing warnings for another work group and so did not give a warning to track worker A when the train approached (paragraph 67). This causal factor arose due to a combination of the following:

i. track worker B, who was the distant lookout for the lubrication team, had left his position prior to the arrival of train 1A19, because he thought he had been stood down (paragraph 69, **Recommendation 2**); and

ii. the distant lookout visible to track worker A was from a different maintenance team and was looking out for trains approaching from the opposite direction (paragraph 78, **Recommendation 3**).

Underlying factors

120 The underlying factors were:

a. the planning of routine inspection work by the rail testing and lubrication section at Peterborough depot had defaulted to using the least preferred 'safe system of work' in the hierarchy defined within Network Rail's company standard NR/L2/OHS/019 (paragraph 86, **Recommendations 4 and 5**); and

b. the current rules for communication between the COSS, and his/her intermediate or distant lookouts are impractical, leading to a disregard for the rules and the use of unofficial and uncontrolled practices (paragraph 104, **Recommendation 2**).

Factor affecting the severity of consequences

121 A key factor that mitigated the consequences of the incident was the driver's prompt use of the train's horn to provide a warning, which gave the track worker just enough time to move out of the train's path (paragraph 110, **Learning point 1**)

Additional observation

122 Although not linked to the incident on 20 July 2018, the RAIB observes that the rail testing and lubrication section at Peterborough depot was not planning its work in accordance with the latest issue of Network Rail company standard NR/L2/OHS/019 (paragraph 111, no recommendation as action already taken (paragraph 127)).

Previous RAIB recommendations relevant to this investigation

123 The RAIB has made many recommendations as a result of previous investigations into accidents and incidents where track workers have either been struck, or come very close to being struck, by a train. Some of these recommendations relate to issues found by this investigation, such as how the work was planned, a lack of planning resource, incomplete or inadequate pre-work briefings, or a lack of safety discipline on site, including individuals disregarding rules (for various reasons). However, the following recommendation has particular relevance to this investigation.

Fatal accident involving a track worker at Newark North Gate station, 22 January 2014, RAIB report 01/2015, Recommendation 1

124 Recommendation 1 read as follows:

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.

125 In response to part (a), Network Rail re-briefed all of its staff on updates made to Rule Book Handbook 7, with specific reference to the requirement that a COSS must stay with the group until the work is complete or replaced by another COSS. For the remaining parts of this recommendation, Network Rail made changes to NR/L2/OHS/019 and published issue 9 of the revised company standard in March 2017, with compliance required from July 2017. The changes in issue 9 of NR/L2/OHS/019 included the use of a safe work pack covering both the safe system of work and site risks, and the introduction of the person in charge role on site. The revised company standard included requirements for the authorisation, verification and final acceptance check for safe work packs for cyclical tasks to ensure they are still valid for the site when used. The revised NR/L2/OHS/019 also introduced several requirements that reinforced the need for the responsible manager to monitor and carry out assurance checks of staff at work on or near the line.

126 In April 2018, ORR reported to the RAIB that Network Rail had re-briefed staff on the duties of a COSS/SWL and taken steps to improve worksite safety discipline and vigilance as part of the publication of issue 9 of NR/L2/OHS/019. ORR stated it would be monitoring implementation of the revised company standard through its usual inspection work. ORR concluded that Network Rail had taken the recommendation into consideration and taken action to implement it.

Actions reported that address factors which otherwise would have resulted in a RAIB recommendation

127 After the incident, Network Rail allocated a section planner to cover both the rail testing and lubrication and the welding and grinding sections. The provision of this planner has meant the section is now planning all of its work in accordance with the requirements of issue 9 of NR/L2/OHS/019.

Other reported actions

128 The infrastructure maintenance engineer[22] responsible for the Peterborough delivery unit has reported to the RAIB that he is planning changes to the rail management team, which is responsible for both the rail testing and lubrication section and the welding and grinding section. The aim of the planned change is to reduce the workload of the planner and rail management team to a manageable level. At the time of the incident, the rail management team was responsible for delivering work from London King's Cross to Stoke tunnel south of Grantham (a distance of about 100 miles (161 km)). The proposed changes will leave the existing rail management team to manage the rail assets from Stoke tunnel to just south of Peterborough, with a newly created rail management team based at Hitchin being responsible for the rail assets from just south of Peterborough to London King's Cross.

129 The competencies of the staff involved were immediately suspended (paragraph 39). These were restored in January 2019 after Network Rail completed its investigation and the staff were re-briefed.

130 Shortly after the incident, the infrastructure maintenance engineer issued a special instruction to his maintenance staff prohibiting a second group from starting work using lookouts if another group is already working at that location with lookouts in place. The infrastructure maintenance engineer made this a permanent instruction from January 2019.

131 The infrastructure maintenance engineer instructed the S&EW project to look at the cyclic inspections for the lubricators in his area of responsibility (which is from Stoke tunnel south of Grantham, to Sandy) to determine how many of these inspections could be done in planned engineering possessions or using SBSIs instead (paragraphs 97 to 99). The project was told to prioritise the inspections that required multiple lookouts when a safe system of work using lookouts was used. The infrastructure maintenance engineer is expecting that after May 2019, no lubricator inspections in his area will take place using multiple lookouts.

132 Network Rail has made changes to the way that it plans work for the rail testing and lubrication section. The section manager has been tasked with creating safe work packs that cover more specific areas, rather than having more generic packs covering much larger areas. Staff who will be the COSS for these planned tasks have been instructed to work more closely with the section planner when the task is planned.

[22] A senior Network Rail manager who manages the engineering team, providing day to day support, and is responsible for the delivery of maintenance volumes and compliance with standards.

133 Network Rail is considering the viability of adding another person to the Peterborough lubrication team for some tasks. This is to allow the team leader to work on the lubrication equipment while the additional person carries out the COSS duties, such as monitoring how the implemented safe system of work is being maintained. The use of this additional person will be dependent upon an assessment of the work to be done and the workload on the COSS when the work is planned. It will also be dependent upon someone who holds the COSS competency being available.

134 For all of the maintenance staff based at Peterborough depot, Network Rail has issued notices and carried out briefings covering the need to provide thorough and complete pre-work briefings to the group, the correct reporting of incidents (the team leader called his section manager to report the incident when he should have reported it to Route control (paragraph 38)), and awareness and use of the close call and work safe procedures.

Recommendations and learning points

Recommendations

135 The following recommendations are made[23]:

1 *The intent of this recommendation is to minimise the exposure of site lookouts to the risk of being struck by moving trains.*

Network Rail should promote an amendment to the Rule Book (GE/RT8000) to require Controllers of Site Safety and Safe Work Leaders to default to placing their site lookouts in a position of safety, unless this is not practicable to implement the safe system of work, eg the site lookout needs to be positioned elsewhere to achieve unrestricted sighting of intermediate / distant lookouts or trains, give a warning by touch, or be close by to give an audible warning (paragraph 119b).

2 *The intent of this recommendation is to reduce the risk of track workers being struck by a train as result of a breakdown in the communications between a Controller of Site Safety / Safe Work Leader and site lookout at the site of work, and the intermediate and distant lookouts.*

Network Rail should:

a. investigate the common practices used by Controllers of Site Safety / Safe Work Leaders and site lookouts to communicate with intermediate / distant lookouts using flag signals to indicate 'all clear' at the start of work and after a train has passed, and 'work complete';

b. seek to understand the reasons for the unofficial systems of communication currently used and the risks that they introduce;

c. investigate ways of improving communication between those at the site of work and intermediate / distant lookouts, including the use of technology;

d. implement, across its network, an improved system of communication, based on the findings from (a), (b) and (c) above, including training of relevant staff and promoting amendments to the rule book as necessary; and

[23] 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 Rail and Road 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.

e. implement effective arrangements for the monitoring, audit and review of the improved system of communication that it puts in place (paragraphs 119d.i and 120b).

3 *The intent of this recommendation is to reduce the risk to track workers working under lookout warning, by removing the potential for confusion arising from having multiple work groups and distant lookouts in close proximity.*

Network Rail should provide guidance and training for its staff holding the Controller of Site Safety / Safe Work Leader competency, on the actions to be taken if more than one group wants to use a safe system of work with distant / intermediate lookouts that overlap at a location (paragraph 119d.ii).

4 The *intent of this recommendation is to reduce the risk to track workers on the LNE&EM route by reducing the amount of work undertaken with lookout warning by improving the planning and management of maintenance tasks to better utilise existing resources and track access opportunities.*

Network Rail should increase engagement of all maintenance sections across the London North Eastern and East Midlands Route, with the route's 'Safe and Effective Working' project, so that as many of its cyclic maintenance tasks as possible are undertaken in planned possessions or using line blockage protection systems (paragraph 120a).

5 *The intent of this recommendation is to significantly reduce the number of routine work activities that are undertaken at the lowest level of the hierarchy for safe systems of work in Network Rail company standard NR/L2/OHS/019*.

Network Rail should:

a. reduce the number of cyclic maintenance tasks that are undertaken with lookout warning by establishing improved planning processes to substantially decrease the reliance on lookout warning by enabling more pre-planned activities to take place in planned possessions, or using line blockages protection systems; and

b. implement effective arrangements for the monitoring, audit and review of these revised planning processes (paragraph 120a).

Learning points

136 The RAIB has identified the following key learning points[24]:

1 For train drivers, this incident highlights how the early use of a train's horn to give track workers that are on your line an urgent warning (which is defined in the Rule Book as a series of short blasts) can avert an accident (paragraphs 119a and 121).

2 For Controllers of Site Safety / Safe Work Leaders, this incident demonstrates the importance of briefing your site lookout on where to stand while carrying out their lookout duties and where their place of safety is (paragraph 119b).

3 For Controllers of Site Safety / Safe Work Leaders, this incident highlights the importance of not becoming distracted by the work activities to the extent that you are no longer able to 'personally observe and advise everyone in your work group' as required by the Rule Book, while on or near the line (paragraph 119c).

[24] '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

ATWS	Automatic Track Warning System
CCTV	Closed Circuit Television
COSS	Controller of Site Safety
DVT	Driving Van Trailer
ECML	East Coast Main Line
LNE&EM	London North Eastern and East Midlands
LOWS	Lookout Operated Warning System
MST	Maintenance Scheduled Task
S&EW	Safe and Effective Working
SATWS	Semi-Automatic Track Warning System
SBSI	Signal Box Special Instruction
SWL	Safe Work Leader
TOWS	Train Operated Warning System

Appendix B - Investigation details

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

- information provided by witnesses;
- information taken from the train's on-train data recorder;
- closed circuit television (CCTV) recordings taken from the train and Peterborough station;
- site photographs;
- weather reports and observations at the site;
- documentation for the planned maintenance work including the planned safe system of work;
- competency records for the Network Rail staff involved;
- the relevant Rule Book modules and Network Rail company standards;
- training course material for lookouts;
- log entries and train running information from industry information systems;
- data on the type of safe system of work being used by Network Rail's maintenance teams on LNE&EM Route;
- information about the Safe and Effective Working project; and
- a review of previous RAIB investigations that had relevance to this accident.

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