RAIB

Rail Accident Investigation Branch

Rail Accident Report

Track worker struck by a train near Surbiton station, south-west London
9 February 2021

Report 05/2022
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This investigation was carried out in accordance with:

- the Railway Safety Directive 2004/49/EC
- the Railways and Transport Safety Act 2003
- 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.

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

Any information about casualties is based on figures provided to 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. 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.

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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Track worker struck by a train near Surbiton station, south-west London, 9 February 2021

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Summary

At around 11:35 hrs on Tuesday 9 February 2021, a passenger train travelling at 76 mph (122 km/h) struck and fatally injured a track worker who was walking in a crossover line between two through lines near Surbiton station, south west London. He was one of four track workers involved in undertaking inspections at the location.

The accident happened because the track worker, who was the Controller of Site Safety and involved in carrying out the track inspections, was unaware of his position relative to the train. He was unaware of his position probably because he had become distracted, either due to teaching an assistant or by undertaking an actual inspection. Once distracted, it is likely his deviation towards the line on which the train was travelling was exacerbated by the layout of the rails at the junction. The train driver sounded the train's warning horn twice during the train's approach but neither of the other two people working with the controller of site safety recalled hearing it.

RAIB's investigation found that:

- The inspection was planned to be completed while trains were running with a safe system of work in place that used unassisted lookouts. This was the least safe type of system of work which could be implemented when working on track, but its ongoing use had not been challenged in the years before the accident.
- Network Rail had a programme in place to eliminate unassisted lookout working but this had not yet led to changes to the safe systems of work at the depot where the controller of site safety worked.
- Safety of people working on or near railway lines relies on the controller of site safety implementing and managing a safe system of work, however where they are also responsible for carrying out the work, they are at increased risk of becoming distracted. This can, and has, led to staff being struck by trains or being involved in near misses.

RAIB has made three recommendations. Two recommendations are addressed to Network Rail. The first of these relates to maintaining members of work groups working on or near the line within designated safe limits, when some or all lines remain open to traffic. The second recommendation relates to understanding the nature and reasons behind rule and behavioural non-compliances observed by RAIB during its investigation. A recommendation has also been made to Rail Delivery Group to work with the wider rail industry to improve the judgement of train drivers on whether track workers are in a dangerous position and to reinforce the use of the train horn to deliver urgent warnings.

RAIB identified five learning points. These relate to: train drivers sounding an urgent warning to track workers where there is doubt whether they have moved clear of the line the train is travelling on; track workers looking to confirm on which line a train is travelling when hearing a train warning horn; track workers having quick access to emergency contact details; those creating patrol diagrams and similar having a correct understanding of the distances of positions of safety from open running lines; and planners and others involved in preparing safe systems of work consulting related patrol diagrams to check for inconsistencies between them.

Introduction

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. The term ‘London side’ refers to locations north east of Surbiton station and the term ‘country side’ refers to locations south west of Surbiton station.

2 The report contains abbreviations. These are explained in appendix A. Sources of evidence used in the investigation are listed in appendix B.

The accident

Summary of the accident

3 At around 11:35 hrs on Tuesday 9 February 2021, a track worker was struck and fatally injured by a passenger train near Surbiton station, south west London (figure 1). The train, which was travelling from London Waterloo to Salisbury, was running at around 76 mph (122 km/h) on the down fast line (figure 2) when it struck the track worker.

4 The track worker was one of a group of four staff who were involved in a planned weekly inspection of components forming the railway lines in the Surbiton area. The track worker was walking in between the up fast and down fast lines, in a line known as a crossover (see paragraph 7), with his back to the approaching train when he was struck.

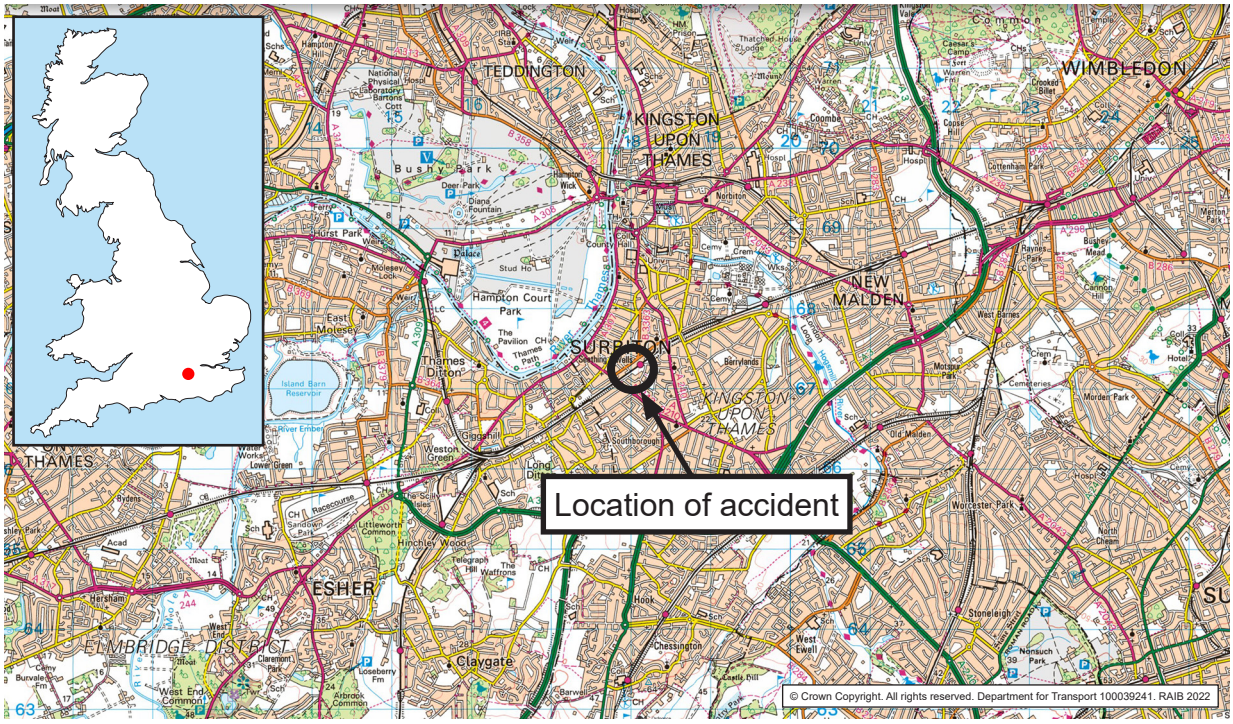

Figure 1: Extract from Ordnance Survey map showing location of accident

Context

Location

5 The railway passing through Surbiton runs from north east to south west and is used by trains travelling between London and locations on the south coast and in the west of England. The lines are therefore very busy and carry both frequent suburban and long-distance train services; different types of service have different station stopping patterns.

6 The accident occurred approximately 365 metres to the country side of Surbiton station. Here, there are five railway lines: the up slow and up fast lines carrying trains heading towards London, the down fast and down slow lines carrying trains heading away from London, and the down Hampton Court line carrying trains heading both to and from Hampton Court (figure 2). The maximum permitted speed on the up and down fast and slow lines is 80 mph (129 km/h) and the maximum permitted speed on the down Hampton Court line is 35 mph (56 km/h) in both directions.

7 Starting around 250 metres on the country side of Surbiton station, all five railway lines are interconnected by crossovers (figure 3). Crossovers connect lines together so that trains can move between them. They consist of a set of switches (moveable rails) at each end and a crossing (an assembly of track components used to support and guide train wheels where two running rails cross each other), together known as switches and crossings (S&C) (figures 3 and 4), which are connected by a section of plain line. The crossovers that are relevant to the accident are those that connect the up slow line to the up fast line, and the up fast line to the down fast line (figure 2).

8 While normally only used by trains heading towards London, the up slow and up fast lines can also be used by trains heading away from London from Surbiton station platforms 1 and 2 to reach the down fast, down slow or down Hampton Court lines. These train movements do not occur frequently and are limited to a maximum speed of 30 mph (48 km/h), both while moving in the down direction and when traversing the crossovers.

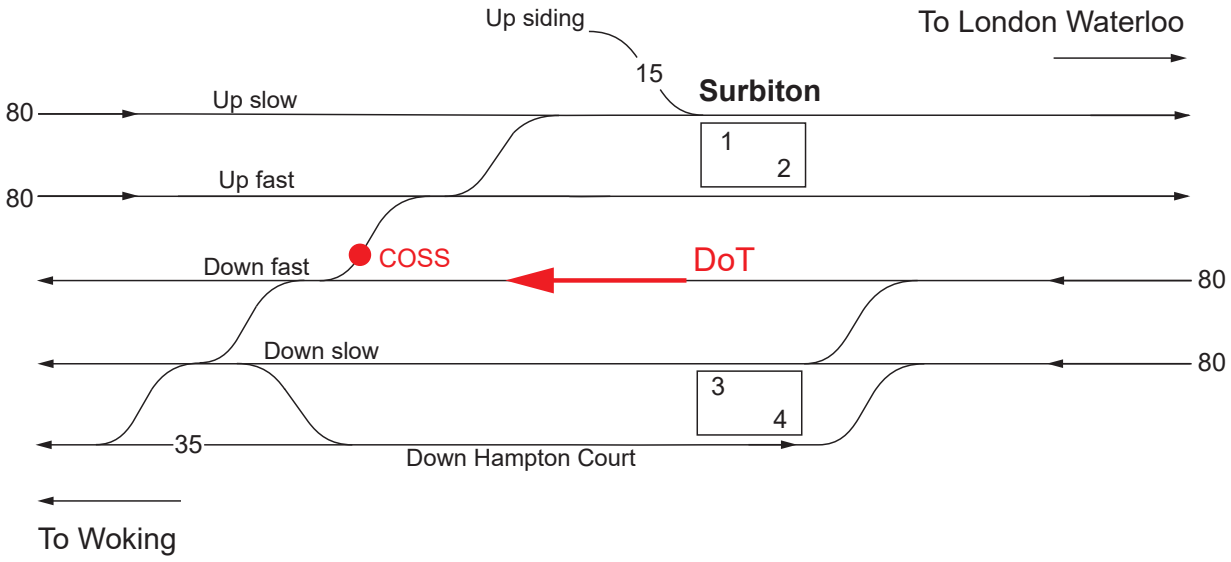

Figure 2: Track layout (not to scale and not all features shown)

Figure 3: Example of four of the crossover lines (shown by dashed lines, with the crossover where the accident occurred shown with red dashed lines) on the country side of Surbiton station. Line 1 is the up slow, line 2 is the up fast, line 3 is the down fast, line 4 is the down slow and line 5 is the Down Hampton Court. The approximate position of the COSS is shown by the yellow circle (image courtesy of Network Rail).

Figure 4: One end of a crossover, with the crossing ringed

Track inspections at Surbiton

9 The cyclical inspection of the crossovers in the Surbiton area was planned to be undertaken every Tuesday. On the country side of Surbiton station, these inspections were undertaken on the up slow and up fast lines first, walking away from Surbiton station before crossing the lines and inspecting the crossovers on the down Hampton Court, down slow and down fast lines while walking back towards Surbiton station. A number of inspections at a location can be grouped together. When this is the case, they are referred to as a patrol.

10 The purpose of the inspections is to identify defects which, if uncorrected, could affect the safe or reliable operation of the railway before the next inspection. Defects which an inspection would look to identify include damage to the switch blades, missing bolts or fastenings, damage to sleepers, railhead damage (such as rolling contact fatigue) and cracks in the crossings.

Organisations involved

11 Network Rail owns and manages the railway infrastructure at Surbiton. Network Rail's Wessex route, part of the Southern region, operates and maintains the infrastructure at Surbiton. Wessex route is sub-divided into the Wessex inner and Wessex outer delivery units. The planning and delivery of track inspection and track maintenance at Surbiton is carried out by the Woking track section, a part of Wessex inner route.

12 Network Rail employed the staff at Woking track section responsible for operating, inspecting and maintaining the infrastructure.

13 South Western Railway operated the train involved and employed its driver.

Train involved

14 The train involved in the accident, reporting number 1L29, was the 11:20 hrs service from London Waterloo to Salisbury. It comprised two three-car, class 159 diesel multiple units.

15 South Western Railway examined the train following the accident and found no defects associated with its warning horn, lights or brakes. RAIB found no evidence that the condition of the train contributed to the accident.

Staff involved

16 Tyler Byrne, the track worker who was struck, was 30 years-old. He was a permanent employee of Network Rail, having been recruited in 2015. He originally worked at Feltham, moving to the Woking track section in 2017.

17 As well as being certified as competent in Personal Track Safety, he was certified as competent to perform various safety-critical roles including Controller of Site Safety (COSS) - a person who is certified as competent to establish and maintain a safe system of work on site, Protection Controller, Engineering Supervisor, and Lookout. He qualified as a COSS in November 2016.

18 On the day of the accident, the track worker was carrying out the crossover inspections during the patrol. He was also the Person in Charge (PIC) for the work. This role required him to have overall accountability for supervising and overseeing safe implementation of the work. A PIC is required to ensure that planned controls are suitable and put in place to keep people safe from trains, the work activity and other site risks. Consequently, the PIC must be certified as competent to act as a COSS. Although the PIC and COSS roles may be undertaken by different people, on the day of the accident the track worker was undertaking both roles, a normal occurrence for this type of work. The track worker is referred to as the COSS throughout the rest of this report.

19 The COSS was familiar with both the work and the location, as he had completed the Surbiton patrol on many previous occasions.

20 On the day of the accident the COSS was accompanied by:

- A patroller's assistant. When provided, a patroller's assistant helps to carry equipment and to assist with maintenance during a patrol. The assistant who was accompanying the COSS on the day of the accident had been working for Network Rail for two years, based at Woking track section. He was competent to perform lookout duties and undertake plain line maintenance. He had previously undertaken the patrol as a site lookout and had worked with the COSS on many previous occasions.
- A site lookout. The duties of a site lookout are to warn the others in the work group when a train is approaching that could put them in danger. The COSS tells the site lookout on which lines they must look for approaching trains (see paragraphs 52 and 53). The site lookout who was accompanying the COSS on the day of the accident had worked for Network Rail for two years and was based at Woking track section. He qualified as a site lookout in November 2020[1] and had undertaken this patrol as site lookout on two previous occasions, both in January 2021. Neither of these previous patrols was with the COSS involved in the accident.
- A distant lookout. A distant lookout is provided when the site lookout cannot see trains early enough (that is, they have inadequate 'sighting distance') to warn the group in enough time for them to stop work, clear the line and reach a position of safety. Typically, sighting distances are affected by track curvature, bridges and stations. The distant lookout who was accompanying the COSS on the day of the accident had worked for Network Rail for one year and three months and was based at Woking track section. Before that he had worked on the railway for four years with a contracting organisation. At the time of the accident, he was not located with the COSS, as his duties required him to be located away from the group.

21 At the time of the accident, the train driver had 18 years' experience of driving trains, and frequently drove class 159 trains through the Surbiton area.

[1] Network Rail guidance 'Lookout / Site Warden Workplace Support Post Training Development Workbook' states newly qualified lookouts should have access to support as they gain experience in the role (see paragraph 132).

External circumstances

22 It was a cold morning with a temperature of around 0°C and wind speeds of around 12 mph (19 km/h). Forward-facing CCTV (FFCCTV) images from train 1L29 showed light snow on the ground, though this was not deep enough to cover the sleepers. Although the sky was overcast, visibility was good. There was no work taking place on or near the railway at the location of the accident that could have reduced the group's ability to hear train warning horns.

The sequence of events

Events preceding the accident

23 On the morning of 9 February 2021, the COSS arrived at the Woking track maintenance depot sometime around 07:30 hrs. This was his first day back at work after a three-week period of sickness absence. He was met by a supervisor who had a face-to-face conversation with him. The supervisor was satisfied from this that the COSS was fit to return to work and the COSS then received the safe work packs (SWPs) relating to the day's planned activities.

24 The COSS met with the other members of the work group and discussed the day's work with them. This involved crossover inspections at Berrylands, Hampton Court and either side of Surbiton station. At around 08:00 hrs, the COSS and patroller's assistant shared a vehicle to drive to Berrylands while the site lookout and distant lookout each drove there in separate vehicles.

25 After patrolling Berrylands and Hampton Court, the group met at a Network Rail access site near to Surbiton station, at around 10:55 hrs. The COSS briefed the group on the two patrols to be undertaken. The first was inspecting crossovers on the down fast, down slow and down Hampton Court lines on the London side of the station, and then inspecting crossovers on all lines on the country side of the station (paragraph 9).

26 After the first patrol was completed, the COSS, site lookout and patroller's assistant returned to Surbiton station ready to inspect the crossovers in the station and to the country side of it. The distant lookout travelled by car to an access point further along the down side of the railway and stood in the down cess (the cess is an area adjacent to the tracks which may provide a safe place to stand clear of passing trains). The COSS had positioned the distant lookout there so that he could warn the group of any trains travelling along the up slow and up fast lines. A distant lookout was required because the track curvature limited the site lookout's view, and consequently reduced the warning time he would be able to give the COSS and patroller's assistant.

27 The COSS first inspected a set of S&C leading from the up slow line into a siding in Surbiton platform 1. Subsequently, the group walked to and inspected the crossover between the up slow and up fast lines at the country end of the station.

Events during the accident

28 The group then walked to, and inspected the crossover between the up fast and down fast lines. Train 1L29 was coasting through Surbiton station when its driver first became aware of workers on the tracks ahead. The train's on-train data recorder (OTDR) indicates that the driver sounded the train's warning horn when it was around 416 metres (12 seconds running time) from the group and travelling at around 78 mph (126 km/h).

29 During the inspection of the crossovers, the COSS was helping develop the knowledge of the patroller's assistant by pointing out key features and components of the S&C to him.

30 Evidence suggests that by this time the inspection was complete, and the group were intending to walk further away from the station, ready to cross over the lines to begin the inspection of the crossovers connecting the down Hampton Court, down slow and down fast lines, as they then walked back towards Surbiton station.

31 However, the COSS had stepped out of the four-foot[2] (the space between the running rails) of the up fast line and was walking in the crossover between the up fast and down fast lines. Witness evidence suggests that the COSS would not normally have chosen to walk in the crossover but would instead usually remain within the four-foot of the up fast line. The patroller's assistant was also walking to the left of the up fast line, in the space between the up fast and down fast, known as the ten-foot, while the site lookout remained in the four-foot of the up fast line. FFCCTV from train 1L29 shows the group walking along the track and not looking back towards the approaching train (figure 5).

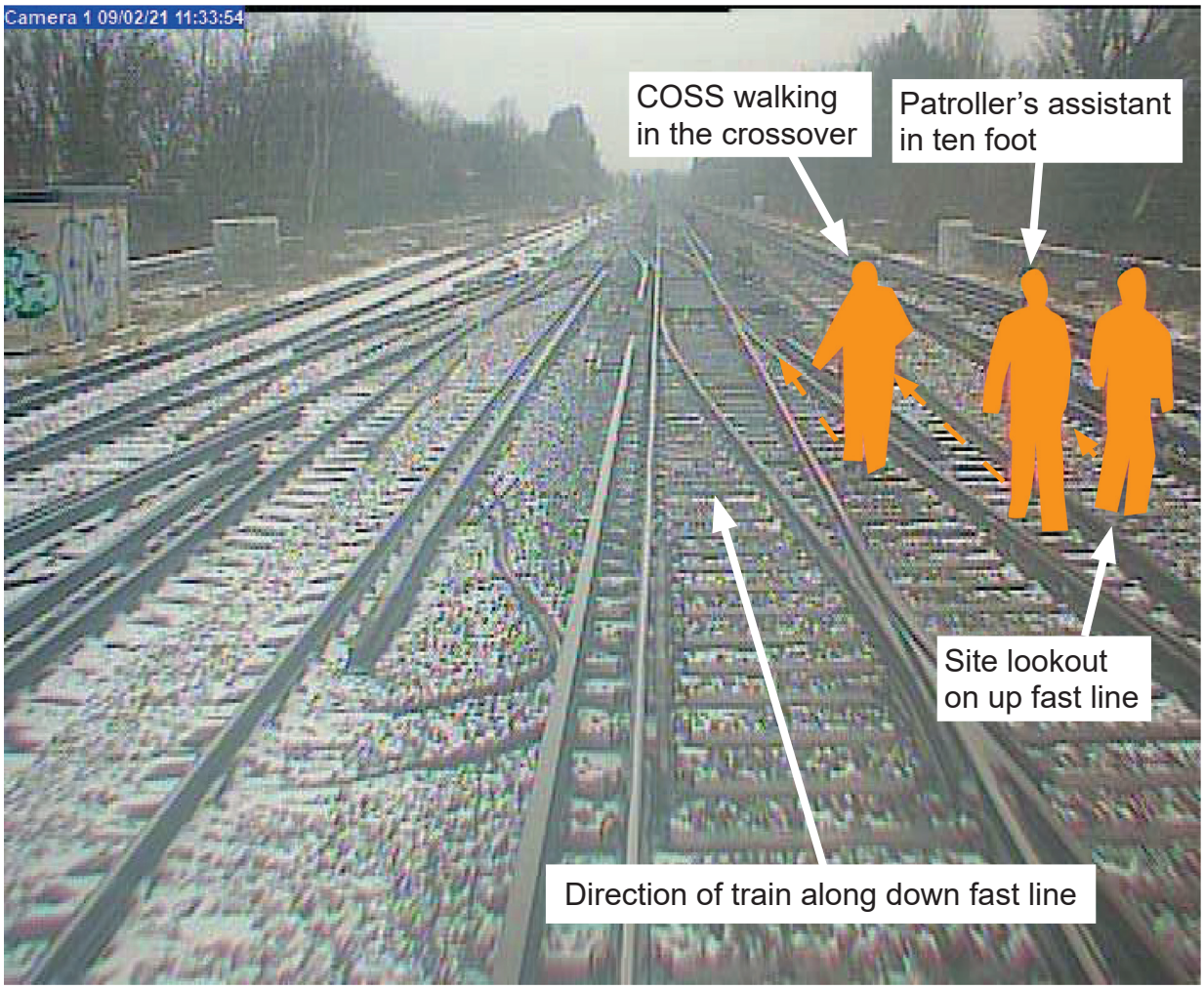

Figure 5: FFCCTV image from train 1L29 showing positions of the group just before the accident. The group have their backs to the approaching train (image courtesy of South Western Railway).

[2] The terminology used when describing railway lines includes: four-foot, to describe the distance between a pair of rails; six-foot, to describe the space between a pair of railway lines; and ten-foot, to describe a wider space often provided between pairs of lines, where there are three lines or more. The ten-foot may provide a position of safety from passing trains but did not do so at the location of the accident. Four-foot, six-foot and ten-foot are terms and not exact measurements.

32 As the train got closer to the group, the driver saw that one of them was close to the down fast line on which his train was travelling. OTDR data shows that the driver sounded the train's warning horn again while the train was around 143 metres (four seconds) from the group and travelling at around 77 mph (124 km/h). The driver stated that, while one of the workers appeared to be close to the train, he did not believe the worker was in the train's swept path[3] and therefore did not believe that he was at risk of being struck.

33 Neither the patroller's assistant nor the site lookout recalled hearing the train's warning horn on either of the two occasions when it was sounded. Around one second before the accident, FFCCTV images from train 1L29 captured a lowering movement of the left arm of the COSS, but it cannot be determined if this was an acknowledgment of the second use of the train's warning horn. FFCCTV images show no reaction from the group, suggesting none of the group were aware of the danger from the approaching train.

34 As the train passed the group, the driver heard a noise, which he stated he thought was the train striking a tool associated with the work group. Consequently, the driver applied the emergency brake and the train stopped 32 seconds later, after travelling around 637 metres from the point of collision.

Events following the accident

35 The COSS's injuries were instantly fatal and unsurvivable. After the accident, the patroller's assistant and site lookout were both in a state of shock. Neither of them had access to the phone number of the signaller to report what had happened, because this was contained within the safe work pack, which remained with the COSS. The patroller's assistant therefore called Woking track section and reported the accident to a colleague there, who immediately called the signaller to report the accident.

36 Around the same time, and as soon as train 1L29 had stopped, its driver called the signaller to report the noise he had heard and that it may have been caused by the train striking a tool being carried by the group.

37 This call was interrupted by an emergency call from the driver of train 2J25 that was just departing from Surbiton platform 4, on the down Hampton Court line, when the accident happened. The driver of this train told the signaller that a track worker had been hit by a train. The signaller stopped all trains approaching the area and called the emergency services.

[3] The swept path, or swept envelope, represents the area and volume of space that a rail vehicle can occupy in traversing a particular section of track.

Background information

Working on or near the line

38 Network Rail company standard NR/L2/OHS/019 issue 10 dated 5 December 2020 'Safety of people at work on or near the line' (known as standard 019) defines the processes used to control risks to workers. This includes the risk of being struck by trains, while working or walking on or near the line,[4] through the implementation of safe systems of work (SSoW) which are developed and issued as part of SWPs. Standard 019 defines these terms as:

- SSoW: This is a method of working that includes arrangements so that those who are to walk or work on or near the line are not put in danger, for example, by:
  - passing trains
  - entry to and exit from railway infrastructure
  - walking on or near the line
  - walking to or from a site of work
  - carrying out work.
- SWP: This is a pack of information used by a person in charge that provides the safety arrangements, including the SSoW for the work to be undertaken on site. SWPs must include, as a minimum:
  - site and task risk information and control measures
  - details on the protection or warning arrangements
  - details of the signalling arrangements, track layout and access and egress to the sites of work
  - emergency arrangements, such as the name and contact details of the local signaller and nearest hospital.

39 Standard 019 defines the key roles that are involved in the development of SSoW and SWP.[5] These are:

- Planner: This is the person who is responsible for planning the work in accordance with the requirements of the responsible manager. The planner must be competent in safe system of work planning. They must have sufficient task and site risk knowledge and experience. Where they do not have this, they must seek the assistance of those that do, for example a COSS. The planner produces the SWP for the person in charge to verify.[6]

[4] On or near the line is defined as within 3 metres (10') of a line where there is no permanent fence or structure between staff and the line or on the line itself; or on a station platform when carrying out engineering or technical work within 1.25 metres (around 4') of the platform edge.

[5] The SSoW and SWP planning process is discussed in detail in RAIB's Margam report (see paragraph 41).

[6] A review of the SWP to confirm the details in it are accurate, appropriate and fit for purpose for the work to be undertaken.

- COSS: Network Rail defines a COSS as '*A person who is certified as competent to enable activities to be carried out by a group of persons on Network Rail railway infrastructure in accordance with the requirements of the Rule Book GE/RT8000*'.[7] Further explanation of the role of the COSS is provided at paragraph 52.
- Person in Charge: This is the person with overall accountability for supervising and overseeing the work who is also involved in its planning. This person must hold COSS competence to make sure planned controls are put in place to keep people safe from trains, activity and site risks. The person in charge may appoint someone else to act as COSS, provided that person is suitably qualified. The person in charge is also responsible for verifying the SWP produced by the planner.
- Responsible manager: This person decides how work is to be prioritised, planned and delivered, and is accountable for the preparation of the SWP, although they may delegate responsibility for the preparation of the SWP to the planner. The responsible manager authorises or rejects the SWPs that have been prepared by the planner and verified by the person in charge.

  SWPs for cyclical maintenance tasks,[8] such as the inspections being undertaken on the day of the accident, can be verified and authorised for a period of 12 months, where SSoW apply to lines that are blocked to train movements, or for six months where SSoW apply to lines remaining open to train movements.

  The responsible manager is also required to monitor SWP compliance by reviewing at least 10% of completed and implemented SWPs, or a minimum of 50 SWPs where more than 500 SWPs are produced per period (4 weeks). Additionally, the responsible manager must review all SWPs that have been returned with highlighted errors/amendments.

40 Standard 019 lists seven types of SSoW for consideration when developing a SWP. These are listed in a hierarchy with those at the top considered safer than the ones lower down. When planning work, the aim is to select the highest possible type of SSoW from the hierarchy. The types of SSoW available for consideration are:

- Safeguarded, where every line at the work location is blocked to train movements (except for slow speed movements of engineering trains and machines).
- Fenced, where only the line(s) where the work is being undertaken are blocked but a fence or barrier is used to separate them from train movements on adjacent lines.
- Separated, where only the line(s) where the work is being undertaken are blocked and there is at least two metres between them and an adjacent line open to train movements. A site warden is appointed to warn anyone who moves beyond the safe working limit towards any open adjacent line.

[7] Railway handbooks are part of GERT 8000 The Rule Book and are published by RSSB at www.rssb.co.uk.

[8] An inspection or maintenance task which is performed at a regular frequency, as specified in Network Rail standards as opposed to one-off tasks.

- Warning systems (permanent), where the line being worked on is not blocked to train movements, but staff are warned about approaching trains by permanently installed equipment.
- Warning systems (human activated equipment), where the line being worked on is not blocked to train movements, but a lookout uses portable equipment to warn staff of approaching trains.
- Warning systems (portable), where the line being worked on is not blocked to train movements, but portable equipment is temporarily installed on the line to warn staff of approaching trains.
- Lookout warning, where the line being worked on is not blocked to train movements and staff are warned of approaching trains by a lookout, known as 'unassisted lookout'.

  Standard 019 also requires 'in the line monitoring' where managers, including responsible managers and supervisors, observe the implementation and management of SSoW on-site to identify unsafe actions and behaviours.

Network Rail's track worker safety (TWS) programme

41 Between April 2018 and March 2019, Office of Rail and Road[9] (ORR) decided to address concerns it had regarding the safety of track workers by undertaking a programme of inspections across every Network Rail route (this was done as part of its 2018/2019 inspection plan). The results of that work provided the evidence ORR felt it needed to support the issuing of Improvement Notices on Network Rail. On 8 July 2019, while not as a direct result of the fatal accident to two track workers at Margam (RAIB report 11/2020), the ORR served two improvement notices (IN/TW/20190708/1 and 2) on Network Rail. An improvement notice is issued when the ORR believes it is necessary to order organisations to make improvements.

42 In its letter accompanying the improvement notices to Network Rail, ORR explained that, despite Network Rail's commitment to reducing risk to track workers, improvements to safe systems of work and developments in warning and protection systems, ORR continued to be concerned at the number and frequency of deaths and injuries and near misses involving track workers.

43 ORR had concluded that Network Rail had reached the limits of protection that could be provided by improving safe systems of work, and it now needed to focus on moving to having work carried out in possessions and line blockages (where, except for slow speed movements relating to the work being undertaken, the normal running of trains is suspended). The objective of the improvement notices was to significantly reduce the amount of working with unassisted lookouts as far as is reasonably practicable by:

- Identifying track access opportunities under existing possessions and line blockages taken for other work and matching them with requirements to access the track to undertake work
- Using technological means of providing warning when line blockages are not possible.

[9] ORR is the independent safety authority for Britain's railways. Its main activities include the oversight of the industry's safety performance, the enforcement of health and safety law in the railway industry, and the provision of advice.

44 The improvement notices served on Network Rail originally had a proposed compliance date of 7 July 2021. Subsequently Network Rail obtained agreement with ORR for a later compliance date of 31 July 2022, based on the following justifications:

- Network Rail believed there was insufficient time to effectively plan the changes that were needed to comply with the notices into the December 2020 timetable, because of the lead time needed for system-wide changes
- Network Rail needed more time to implement an improved safe access planning tool, to develop an improved signaller workload tool and to engage with relevant trade unions and adapt working practices.

45 In October 2019 Network Rail's Track Worker Safety Task Force issued assurance directive STF/AD/001 'Delivering safe and effective railway maintenance' to all the company's routes. The purpose of the directive was to define the activities that needed to be delivered to comply with the requirements of the ORR improvement notices. The directive required the 13 routes to deliver a full programme of activities (referred to as the 'track worker safety programme' in this report) to ensure compliance with the improvement notices by the deadline of 31 July 2022.

46 Wessex route began its track worker safety programme in April 2020 after it had recruited the staff necessary to oversee its delivery. It set itself a target date of April 2022 to eliminate unassisted lookout working (ULW). Prior to 2020, there were no specific initiatives in Wessex route focused on reducing ULW.

Track inspection

47 Network Rail ensures that its track is safe for the passage of trains by implementing the requirements of company standard NR/L2/TRK/001 'Inspection and Maintenance of Permanent Way'. Module 2 of this standard, 'Track Inspection' issue 7 dated 5 September 2015, deals with the planning and undertaking of track inspections, including the planning and inspection of S&C, including crossovers. Different inspections are undertaken by patrollers, section managers and track maintenance engineers[10] (TMEs). Those undertaken by patrollers, as in the case of the accident at Surbiton, are known as basic visual inspections (BVIs, and referred to as 'inspections' in this report).

48 Module 2 of standard NR/L2/TRK/001 includes requirements that:

- *'Inspections shall be undertaken on foot, walking within the length of the sleepers'* (that is to say, in the four-foot)'
- *'The track is inspected during daylight"*
- '*Where practicable, the opportunity should be taken to observe the track while trains are running.'*

Standard NR/L2/TRK/001 permits the TME to seek the approval of the route asset manager if, following assessment, an alternative way of working is necessary, for example, not inspecting the track during daylight. At the time of the accident, no assessment had been undertaken or approval sought to deviate from the existing practice of inspecting the track during daylight by walking within the four-foot of the crossovers at Surbiton.

[10] A Track Maintenance Engineer's (TME) responsibilities include the planning and delivery of work activities and inspection regimes related to the track asset, undertaking technical inspections and monitoring of the track, and undertaking compliance activities in line with Network Rails' assurance procedures.

49 To visually represent a particular inspection patrol, standard NR/L2/TRK/001 requires that the TME produces an inspection diagram, known as a patrol diagram. These must include:

- Which tracks are being inspected in the patrol
- Adjacent tracks not included in the patrol
- The route to be followed by the patroller to inspect all the tracks and components covered by the patrol.

The patrol diagram for the inspections at Surbiton was updated in 2018 when Network Rail's plain line pattern recognition train[11] (PLPR) began to inspect plain line track components in the area. It needed to be updated because the PLPR effectively took over some patrolling work, but it is not able to fully inspect crossovers. An updated Surbiton patrol diagram revised to only show the inspection of the crossovers was issued as version 1 in August 2018, and revised to issue 2 in December 2019 (see paragraphs 70 and 71).

50 Table 1 in standard NR/L2/TRK/001 module 2 sets out the minimum frequency of inspections. For the crossovers between the up slow, up fast, down fast, down slow and down Hampton Court lines the minimum inspection frequency was one inspection per two weeks. However, the inspection was undertaken weekly to align with the weekly inspection required for the S&C leading into the up siding from the up slow line at platform 1 at Surbiton station, which was a different design. There was also a desire to monitor the condition of all the crossings in the area to identify any cracks that might otherwise have not been seen until the next two weekly inspection; Network Rail reported that some crossings in the area had been affected by cracks during the preceding years.

Network Rail's assurance processes

51 Network Rail's management assurance processes are set out in company standard NR/L2/ASR/036, and are intended to provide assurance, at every level of the organisation, that risk management systems are operating as intended. Network Rail has three levels of assurance:

- Level 1: 'Local (route) management controls' including compliance monitoring, inspections, management reviews and self-assurance
- Level 2: 'Corporate oversight' including engineering verification, deep dive reviews, and functional and management system audits, conducted by persons independent from those with the responsibility for implementing the risk controls
- Level 3: 'Independent challenge and assurance of risk control policies' consisting of audits undertaken by Network Rail's internal audit team with the findings reported to the Network Rail board. These audits can also be informed by activities undertaken by external bodies such as ORR.

The level 1 assurance activities are primarily focused on ensuring compliance with rules and procedures, and include observing how work is done by undertaking site visits to observe that safe systems of work are being correctly implemented and followed, and that safe working behaviours are shown.

[11] Plain line pattern recognition is a train-based technology for carrying out visual inspections of plain line track using cameras to capture images of track components while running. Software is then used to process the captured images to recognise the track components and identify any associated defects which are then output into a report.

Duties and responsibilities

52 The duties of the COSS are defined in the Rule Book, Handbook HB7 'General duties of a controller of site safety (COSS)' issue 7 dated September 2020. These duties include:

- Before allowing their group to walk to the site of work or to start work, the COSS must have:
  - set up the safe system of work so that nobody in the group will be put in danger by a passing train
  - tested the safe system of work to make sure it is adequate
  - briefed everyone in the group about the hazards at the location and the safe system of work for the task to be undertaken. The COSS must make sure everyone in the group understands this safety briefing.
- When using a SSoW involving lookouts the COSS is required to make sure each lookout knows the direction and lines that need to be watched for approaching trains, and must position site lookouts so that:
  - any approaching train can clearly be seen
  - the required warning time is available (using distant and intermediate lookouts if necessary)
  - the warning will be received by everyone in the group (if necessary, using more than one site lookout).
- The COSS must also tell the site lookout:
  - where to stand
  - from which direction and on which lines trains will approach
  - who to give the warning to, and how to give the warning (whether by whistle, horn, touch and if necessary by shouting)
  - where the position of safety is.

53 The duties of a lookout are defined in the Rule Book, Handbook HB3 'Duties of the lookout and site warden' issue 3 dated September 2014. The rules include requirements that a site lookout must:

- Stay at their post until the COSS tells them that they are no longer needed to act as lookout
- Give the warning and then tell the COSS if they can no longer give an adequate warning or their view becomes blocked
- Immediately give the warning when they see a train approaching on the lines concerned, or the distant or intermediate lookout waves their chequered flag
- Give a series of short sharp blasts on the whistle or horn or repeat the touch warning if anyone does not immediately acknowledge their warning and move to the position of safety.

54 The role of patroller's assistant is not formally recognised by Network Rail, but when on or near the line a person acting as patroller's assistant must follow the rules for personal track safety and the rules contained in the Rule Book, Handbook HB1 'General duties and track safety for track workers' issue 5.1 dated December 2020. In essence:

- They must follow all instructions given by the COSS and must not go on or near the line until the COSS has given them a safety briefing about the hazards at the location and the safe system of work that has been set up so that they will not be put in danger by approaching trains. If they do not understand any part of the safety briefing, they must ask the COSS to repeat or clarify any points as necessary.
- When working using lookout SSoW and the lookout gives the warning, they must immediately stop any work, acknowledge the warning, and move to the position of safety. They must not leave the position of safety until instructed by the COSS.

Analysis

Identification of the immediate cause

55 The COSS was in the swept path of the approaching train.

56 FFCCTV images from train 1L29 show that the COSS was close to the line on which the train was travelling. The rules contained in handbook 1 (paragraph 54) define a position of safety as being at least 1.25 metres (four feet) from the nearest line on which a train can approach where the maximum permitted speed of trains is 100 mph (161 km/h) or less; the maximum permitted speed of approaching trains along the down fast line is 80 mph (129 km/h).

Identification of causal factors

57 The accident occurred due to a combination of the following causal factors:

a. The COSS had moved into an unsafe position relative to the down fast line (paragraph 58).

b. The COSS did not take action to move out of the approaching train's path (paragraph 74).

c. The patrol was undertaken while the lines were open to train movements (paragraph 104).

Each of these factors is now considered in turn.

Factors influencing the actions of the COSS

58 The COSS had moved into an unsafe position relative to the down fast line.

59 Although it is not possible to know with certainty why the COSS was in an unsafe position relative to the down fast line, it was probably because of a combination of the following factors:

a. The COSS had probably entered the crossover after becoming distracted from his primary safety critical role, either because he was teaching his assistant about S&C inspection, or by carrying out the inspection (paragraph 60).

b. The layout of the rails at the junction probably meant the COSS did not realise he was walking in the crossover, and possibly also caused him to unintentionally move further towards the down fast line (paragraph 65).

c. The design of the patrol required the group to walk along the up fast line to reach a position where they would cross to the down cess and commence the patrol of the down lines (paragraph 69).

Each of these factors is now considered in turn.

Distraction

60 The COSS had probably entered the crossover after becoming distracted from his primary safety critical role either because he was teaching his assistant about S&C inspection or by carrying out the inspection.

61 Witnesses indicated that the COSS's normal practice was to inspect the crossover by leaning over from the four-foot of the up fast line, only stepping over the rails to go into the crossover if he specifically saw something that required closer inspection. In these circumstances the COSS would ask the site lookout to look for trains approaching along the down fast line.

62 RAIB considers it most likely that the COSS stepped into an unsafe position relative to the down fast line after becoming distracted while teaching his assistant about S&C inspection. The patroller's assistant stated that just before the accident, the COSS had been pointing out crossing components to him at the switches at the start of the crossover from the up fast to down fast line. The patroller's assistant stated that he had asked the COSS about crossing components because he was trying to gain more knowledge about them, to be ready for a Network Rail course that he was due to take in the near future.

63 The possibility cannot be totally discounted that the COSS intentionally stepped into the crossover because he saw something which he considered required closer inspection, for example a crack in the crossing (paragraph 50), and then became distracted. Although no cracks were found when the patrol was completed two days after the accident, in the end of the crossover nearest to the station one or two clips (used to secure the rails to each sleeper) were found loose, and another had fallen from its housing. However, the site lookout stated he was not asked on this occasion to look for trains on the down fast, which would have been normal practice for this COSS had he wished to move to carry out a closer inspection of a component. Furthermore, the movements of the COSS immediately before the accident, as evidenced by the FFCCTV images, did not suggest that he had knowingly put himself at additional risk.

64 Neither the patroller's assistant, site lookout or distant lookout had any concerns about the actions of the COSS on the day of the accident. Family and friends said the COSS was fit and well and looking forward to returning to work. This suggests that it is unlikely the COSS was preoccupied with work-related or personal issues on the morning of the accident or that his previous sickness (paragraph 23) had any impact on his actions that day. The post-mortem found no indication of any disease or presence of substances, including alcohol or drugs, that might have contributed to him becoming distracted or losing awareness of his position on the track.

Layout of the rails

65 The layout of the rails at the junction probably meant the COSS did not realise he was walking in the crossover and possibly also caused him to unintentionally move further towards the down fast line.

66 Evidence suggests that immediately prior to the accident the COSS was not 'teaching' the patroller's assistant or carrying out inspection work, but that he nevertheless continued to walk in the crossover. RAIB considers that the number of and layout of rails at the location probably made it difficult for him to appreciate his exact location. It is also possible that the COSS may have mistakenly thought he was walking in the crossover between the up slow and up fast lines, or thought he was walking in the four-foot of the up fast line.

67 Witness evidence supports the possibility that it can be confusing to know exactly where you are when in junction areas, because of the number of rails and S&C and their proximity to each other. A witness with many years of experience of working in the Surbiton area stated that:

> '*The layout of the ladder [crossovers] means that you can just step over one bit of rail, and you end up stepping into a different direction. It's especially easy at Surbiton because the ladder is so compact – squashed together*'.

68 At the time of the accident, the patroller's assistant was walking in the space between the up fast line and the up fast to down fast crossover, but he believed he was walking in the up fast line (figure 5). It is possible that he too had become distracted when talking with the COSS and did not realise his exact location because of the number and layout of the rails where they were walking. It is also possible that the presence of the extra person (the patroller's assistant) restricted the walking space as the patrol progressed and, in combination with distraction and the layout of the rails, possibly meant that the COSS and the patroller's assistant walked further to the left than would normally be the case.

The patrol

69 The design of the patrol required the group to walk along the up fast line to reach a position where they would cross to the down cess and commence the patrol of the down lines.

70 Once the inspection of the crossovers on the up side[12] of the railway was complete, issue 2 of the patrol diagram, dated December 2019 (figure 6) required the group to walk in single file in the up fast line to reach the point where they were to cross to the down side of the railway ('walking' is shown on the patrol diagram as a blue dashed arrow and 'inspecting' is shown as a red dashed arrow). However, only the site lookout was walking in the up fast line.

[12] Up and down sides of the railway generally describe the direction of trains on adjacent lines. At Surbiton, up side refers to the side of the railway where trains travel along the up slow and up fast lines; the down side refers to the side of the railway where trains travel along the down Hampton Court, down slow and down fast lines.

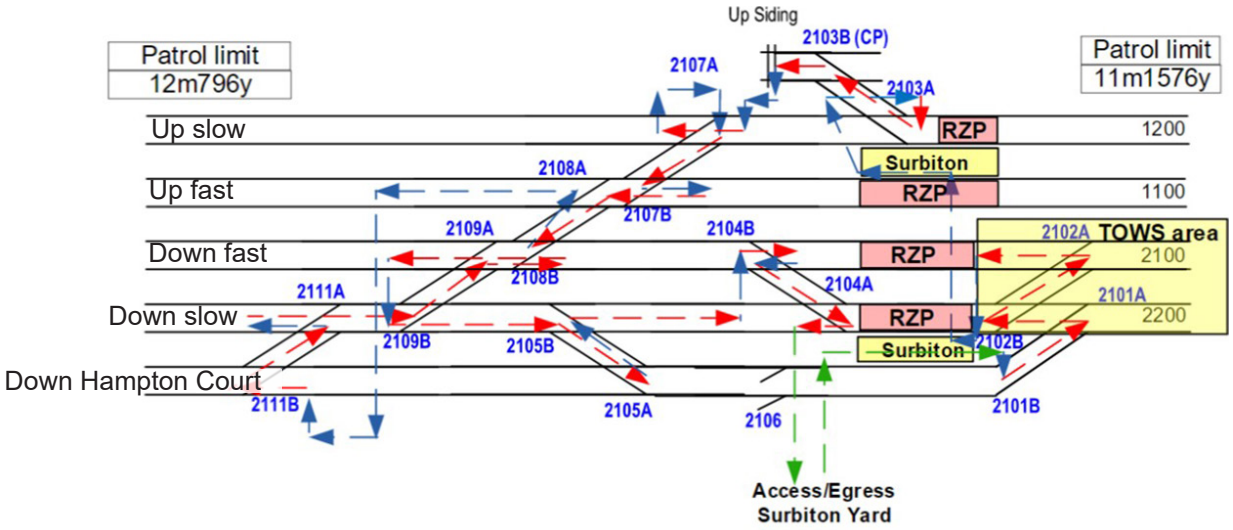

Figure 6: The patrol diagram for the Surbiton area

71 Issue 1 of the patrol diagram had shown that, after inspection of the up fast to down fast crossover, the group were to return to the up cess and walk back to Surbiton station to use the station footbridge to get to the down side of the railway. Once on the down side, the group were then required to walk in the down cess to reach the point where the inspection of the crossovers on the down lines could commence. However, it was identified by the TME that staff were not walking back to the station because of the time taken to complete the patrol, and so he revised the patrol diagram to issue 2, which now required the group to walk in the up fast line to reach the point where they would cross to the down side of the railway. This reflected how staff were actually walking during the patrol and a belief that it is safer not to walk with backs to traffic.

72 Normally, when work has been completed, everyone should return to the cess to walk to the next work location or exit from the railway. Handbook 7 'General duties of a controller of site safety (COSS)' issue 7 dated September 2020 contains a rule that states that, when using lookouts as part of a SSoW, no more than two open lines can be crossed to reach the position of safety. Therefore, the method of crossing the lines shown on issue 2 of the patrol diagram, requiring three open lines to be crossed, was not compliant with Handbook 7.

73 This non-compliance arose due to a misinterpretation of the rule in Handbook 7 when the patrol diagrams were amended by the TME in post in December 2019, following the introduction of the PLPR train (paragraph 49). The non-compliance was identified during a review of the patrol diagrams. This was undertaken by a different TME, seconded to Woking track section in January 2021, who was more familiar with the rule. He also identified the same problem with another patrol diagram for a different location. The TME raised the issue with the infrastructure maintenance delivery manager for Wessex Inner route towards the end of January 2021, but due to the short period of time between identifying the non-compliance and the day of the accident, the patrol diagrams and SSoW had not been revised before the accident occurred.

Awareness of the approaching train

74 The COSS did not take action to move out of the approaching train's path.

75 FFCCTV images from train 1L29 show that the COSS did not appear to be aware of the danger from the approaching train. Data from the train's OTDR shows that the train's horn was sounded twice during the train's approach. On both occasions the train, approaching along the down fast line, would have been visible from the COSS's position, had he turned in that direction.

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

a. The site lookout did not provide a warning to the COSS because he was not looking out for trains travelling on the down fast line (paragraph 77).

b. The COSS did not move out of the path of the train when the driver sounded its warning horn (paragraph 86).

Each of these factors is now considered in turn.

Site lookout warning

77 The site lookout did not provide a warning to the COSS because he was not looking out for trains travelling on the down fast line.

78 The SSoW issued to the COSS covered the patrol of the up fast and up slow and down fast, down slow and down Hampton Court lines. The patrol itself was planned to be undertaken in two halves; firstly, to inspect the crossovers on the up lines, then cross the tracks to commence the inspection of the crossovers on the down lines.

79 The SSoW provided for a site lookout and distant lookout during these patrols. The distant lookout was needed when patrolling along the up lines to give sufficient warning to the site lookout of trains approaching along the up slow and up fast lines, because track curvature restricted sighting of trains.

80 The site lookout, in addition to observing the distant lookout, was also needed because trains could approach along the up slow and up fast lines in the down direction from platforms 1 or 2 at Surbiton station, to access the down lines.

81 The stated intent of those who prepared the patrol diagram (figure 6) was for a COSS to walk halfway into the crossover from the up fast, stopping before they reached the limit of the safe distance from the down fast (1.25 metres), and to do the reverse when patrolling along the down fast line, thereby satisfying the requirements of standard NR/L2/TRK/001 to walk within the length of the sleepers (paragraph 48). However, when preparing the diagram, the TME wrongly believed there was sufficient separation between the up fast and down fast lines for the inspection of the crossover to be done in this way, and that there was therefore no need for there to be warning of trains approaching on the adjacent down fast line. It is unclear why the patrol diagram did not graphically show that patrollers were expected to stop halfway but instead showed a red dashed line (meaning 'inspecting') through the full length of the crossover (paragraph 70, figure 6).

82 In contrast, the planner preparing the SSoW was briefed that patrollers would inspect the crossover by viewing it from the four-foot of the up fast and then the down fast lines. This was how patrollers inspected the crossover in practice, even though no derogation had been sought against the requirement in standard NR/L2/TRK/001 to walk within the length of the sleepers. This meant that no warning was required for trains approaching along the adjacent lines (e.g. no warning of trains approaching along the down fast line when inspecting the crossover from the up fast four-foot).

83 Although not covered by the SSoW, there was evidence that some COSSs, if they saw something needing closer inspection in the crossover, would ask the site lookout to look out for trains approaching along the down fast line while the COSS stepped into the crossover. In order to get adequate sighting distance to provide enough time for a group to reach the position of safety in the up cess, the site lookout would need to stand in the up fast. The rules allow a site lookout to stand in any location to gain better visibility of approaching trains providing they do not need to cross more than two open lines to reach the position of safety, Therefore the site look out would be allowed to stand in the up fast. The site lookout on the day of the accident could not recall being told to look in both directions when briefed by the COSS before starting the patrols at Surbiton, or during the patrol on the countryside of Surbiton station. As a result, he stated that he was only looking out, towards the distant lookout, for trains approaching along the up slow and up fast lines.

84 The discrepancies between the patrol diagram, its intent and normal practice had not been identified either by staff working with the SSoW, or by those responsible for applying the assurance regime. The ineffectiveness of Network Rail's assurance processes (paragraph 51) was identified in RAIB's investigation into the accident involving two track workers at Margam (paragraph 41).

85 If the discrepancy had been identified, it is probable that the patrol diagram would have been revisited and a derogation sought to permit the patrollers to continue patrolling by looking into the crossover, as was permitted following the accident. However, it is also possible that the SSoW would have been revisited and additional resources, such as another distant lookout, provided to warn of trains approaching during inspection of the crossover.

The train's warning horn

86 The COSS did not move out of the path of the train when the driver sounded its warning horn.

87 FFCCTV images from train 1L29 show that the COSS seemed unaware of the danger from the approaching train. Data from the train's OTDR recorded the two-tone warning being sounded on two occasions during the train's approach.

88 It is not known for certain why the COSS did not react to the train's warning horn, but possible explanations are that:

a. the COSS may not have heard the warning horn sounded by the approaching train (paragraph 89); or

b. the COSS may have heard the warning horn but believed no action was necessary because neither he, nor the patroller's assistant, nor the site lookout were in danger (paragraph 95); and/or

c. The driver of the train was not aware that the COSS was in danger of being struck by the train and therefore had not sounded an urgent warning (paragraph 100).

Each of these factors is now considered in turn.

Hearing the train's warning horn

89 The COSS may not have heard the warning horn sounded by the approaching train.

90 Neither the patroller's assistant nor the site lookout could recall hearing the train's warning horn before the accident. Although the evidence suggests that immediately prior to the accident the COSS was not 'teaching' (paragraph 62) the patroller's assistant, it is possible the COSS's attention had not yet refocused on his primary safety-critical role of ensuring his own and the group's safety. It is also possible that the patroller's assistant's attention had also not yet refocused following the 'teaching'. The site lookout had his back to the approaching train and his attention was focused on looking ahead towards the distant lookout.

91 Railway group standard GM/RT2131 'Audibility and Visibility of Trains' describes the requirements for train warning horns. The standard requires that:

- An approaching train needs to be clearly audible and recognisable as a train to members of the public and trackside staff (that is, it should not be similar to warnings given by devices used in road transport, factories or other common warning equipment).
- The warning horn of an approaching train needs to be audible for a distance of at least 400 metres along the track. This condition is considered adequately fulfilled if the warning horn sound pressure levels specified are achieved. For trains designed to operate up to 100 mph (161 km/h), such as the train involved in the accident, the required sound pressure levels are a minimum of 86 dB(C) and a maximum of 94 dB(C) at 25 metres.

When tested by South Western Railway after the accident, the train's warning horn was found to have sound pressure levels of around 97 dB(C) at a distance of 25 metres,[13] 3 dB(C) above the maximum of 94 dB(C).

92 The train's OTDR recorded that the driver sounded the warning horn in a high tone-low tone[14] combination twice on approach to the group:[15]

- The first time was when the train was around 416 metres and 12 seconds from the work group, travelling at around 78 mph (126 km/h); OTDR recorded that the horn was sounded for a total of 1.5 seconds during a 2 second period.

[13] Railway Group Standard GM/RT2131 requires Measurement of the sound pressure at the fixed distance of 25 metres.

[14] Tone refers to the highness or lowness (pitch) of a sound.

[15] Testing showed that the train's OTDR may have recorded shorter soundings of the warning horn than were actually made. This was because the microswitches used to record the operation of the warning horn in the OTDR are located towards the ends of the range of travel of the valve which is operated by the driver to sound the warning horn.

- The second time was when the train was around 143 metres and 4 seconds from the group, travelling at around 77 mph (124 km/h). The OTDR recorded that the horn was sounded for a total of 0.4 seconds during an 0.8 second period.

From the up fast line and crossover (where the COSS was located), sighting of trains approaching along the down fast line is around 1,150 metres, and so the train would have been visible to the COSS on both occasions that the warning horn was sounded.

93 Subjective audibility tests[16] found horns to be 'clearly audible' when they were 7 dB or higher above ambient noise, and that sound pressure levels reduce by about 10 dB to 12 dB per doubling of distance from the source. The train's warning horn was first sounded when the train was between 416 metres and 367 metres from the group, and so the sound pressure levels reaching the group would have been around 50 dB, and therefore would only have been 'clearly audible' if the ambient noise was below 43 dB.

94 The ambient noise levels present when the train's warning horn was first sounded are not known. However, RSSB study T1205 says that as a very rough approximation, a sound level of at least 60 dB or 65 dB is needed for a horn to be described as clearly audible. This study was in relation to two rural settings but around the time of the accident there is no evidence that local noise, such as trains passing the group, other workers or road noise would have affected the group's ability to hear. Even normal conversation taking place at a distance of 1 metre can generate 60 to 70 dB. Therefore, it is possible that the first sounding of the warning horn, reaching the group at about 50 dB, would not have been heard by them (paragraph 92). The second sounding of the warning horn is discussed in paragraphs 96 and 97.

The COSS's perception of risk

95 The COSS may have heard the warning horn but believed no action was necessary because neither he, nor the patroller's assistant, nor the site lookout were in danger.

96 An image from the train's FFCCTV a few seconds before the accident captures the COSS's left arm appearing to lower towards his side. OTDR data recorded that the second warning horn of 0.4 seconds duration sounded around four seconds before the COSS was struck. While it is possible that the arm movement was unrelated to the warning horn, it is also possible that the COSS was lowering his arm after having acknowledged the second warning. If this was the case, then the COSS took no action which indicated that he understood that the warning meant that he was not at risk of being struck by the approaching train and FFCCTV shows that none of the group appear to turn to look in the direction of the approaching train.

[16] RSSB study T1205 'Relationship between train horn test measurements and perceived sound levels on the track', 2021.

97 The COSS may have wrongly assumed the driver was making them aware of his presence, but that he was not in danger. It is not uncommon for train drivers to make a short sounding of the warning horn as a courtesy when nearing track workers. It is also possible that the COSS, having been distracted and then misled by the layout of the rails, did not realise that he was close to the down fast line and was in a position of danger in respect of the approaching train. The COSS may also have thought the warning horn was from the train about to depart from Surbiton platform 4, from which the train could not reach the work group.

98 Witness evidence suggests that on many occasions train drivers sound the warning horn even though they do not pose a threat to the workgroup. This is particularly the case where the train driver is unable to determine the exact location of the work group because of track curvature or limited sighting due to lineside infrastructure. Overuse of the warning horn can lead to habitual acknowledgement by track workers without the actual position of the train, and its potential danger to them, being understood. RAIB's investigation into a fatal accident to a track worker at Whitehall West junction, Leeds, on 2 December 2009 (RAIB report 15/2010) also identified this issue. This led to an article being published in March 2011 in Red Alert, a railway industry publication.

99 Overuse of the warning horn can also lead to track workers becoming desensitised to it. This, and the short duration of the second sounding of it four seconds before the accident, may explain why neither the patroller's assistant nor the site lookout could recall hearing it, and are seen on the FFCCTV not reacting to it.

The train driver's perception of risk

100 The driver of the train was not aware that the COSS was in danger of being struck by the train and therefore had not sounded an urgent warning.

101 Rule Book module TW1 'Preparation and movement of trains' issue 15.1 dated December 2020 (in force at the time of the accident) includes rules relating to the use of the train warning horn. The rules state that drivers:

- Must only use the horn as much as is necessary to give an effective warning or to make sure safe working takes place.
- Must sound the horn to warn anyone who is on or near the line on which they are travelling.
- Give a series of short, urgent danger warnings to anyone who is on or dangerously near the line who does not:
  - acknowledge the warning by raising one arm above the head, or
  - appear to move clear out of the way of the train.

102 The driver stated he was aware that on getting closer to the workers, one of them was near the running rail of the up fast line, and he believed the person was taking a risk being that close to his train. However, the driver did not believe the COSS was in the swept path of the train and he did not think he was going to strike them. For this reason, the driver did not sound any urgent danger warnings.

103 Although a SSoW should not rely on a train driver sounding the warning horn to warn group members that a train is approaching, a review of previous RAIB investigations has found that not sounding the urgent warning and/or misjudging the proximity of track worker has featured on several occasions. Examples include:

- Track worker struck by a train and seriously injured on Grosvenor Bridge, London Victoria on 13 November 2007 (RAIB report 19/2009), when the driver did not register the danger immediately before the accident and did not sound a further warning or repeated urgent warning.
- A fatal accident to a track worker at Whitehall West junction on 2 December 2009 (RAIB report 15/2010), when the trainee driver believed that the lookout who was struck appeared to be no closer to the track than the track workers the train had just passed.
- A track worker struck by a train and seriously injured at Stoats Nest Junction on 12 June 2011 (RAIB report 16/2012), when the driver believed that the track workers were aware of their proximity to the running line, and that they were clear of it.
- A track worker struck and seriously injured at West Drayton on 22 March 2013 (RAIB bulletin 05/2013), when the driver was aware that the lookout had not acknowledged the approaching train but did not sound an urgent warning because the lookout appeared to be clear of the line.
- A fatal accident to a track worker struck by a train near Roade on 08 April 2020 (RAIB report 03/2021), when the track worker's clear acknowledgement meant that the driver did not perceive his presence on the line ahead as an emergency until it was too late, although on this occasion the lack of an urgent danger warning did not make any material difference.

Working on open lines

104 The patrol was undertaken while the lines were open to train movements.

105 At the time of the accident all five lines at the location were open to train movements. During this time the group had to access and exit the railway, inspect the crossovers, and walk along the lines between the inspections.

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

a. The least safe type of SSoW was chosen for the patrol, without any attempt to achieve a safer level (paragraph 107).

b. Prior to the accident, implementation of the TWS programme had not led to changes to the cyclical patrols at Woking track section (paragraph 115).

Each of these factors is now considered in turn.

The SSoW

107 The least safe type of SSoW was chosen for the patrol, without any attempt to plan a safer level.

108 In cases where work needs to be undertaken with people on or near the line, standard 019 requires that the safest type of SSoW from the hierarchy of possible options is chosen (paragraph 40). However, the patrol which was being undertaken when the accident occurred was planned and undertaken using unassisted lookout SSoW, the least safe type in the hierarchy of SSoW. Standard 019 is clear that this method shall be regarded as the last resort, and only used if other methods are not viable.

109 Having not attempted to secure a line blockage for the patrol, the alternative SSoW within the hierarchy involved various ways of providing a warning of approaching trains (paragraph 40). Of these systems, permanent automatic warning systems were not installed at the location of the accident, and portable lookout-operated warning systems were not yet in use at the depot. This meant that, although these methods of warning were considered safer methods of working, neither could be used for the patrol.

110 There was a long-term acceptance among the staff at Woking depot responsible for planning and designing the patrols and SSoW, that obtaining line blockages during the day, sufficient to undertake the inspections, would not be possible. This was based on local knowledge and experience, which was that while line blockages (where the signaller stops trains from running on one or more lines) were possible during the day on the lines through Surbiton, they were of short duration because of the frequency of train services, and so were incompatible with the time needed to carry out the inspections.

111 This lack of opportunities to access the track using line blockages is not uncommon, and was identified in RAIB's investigation into the Margam accident (paragraph 41). As a result of its Margam investigation, RAIB made a recommendation to Network Rail, in consultation with the Department for Transport, relevant transport authorities, ORR and other railway stakeholders, to explore ways of reducing the risk to staff who work on or near the track by creating more opportunity for safe access to the track when trains are not running (see paragraph 150).

112 The need to carry out inspections during the day was a consequence of the requirements of standard NR/L2/TRK/001 (paragraph 47) that the track is inspected during daylight, and, where practicable, the opportunity is taken to observe the track under traffic (while trains are running). Although standard NR/L2/TRK/001 permits variations to these requirements, when supported by assessment by the TME and with the agreement of the Regional Head of Engineering (Track), Woking track section had not considered it necessary to apply for such a variation, because:

- The TME wished to comply with standard NR/L2/TRK/001, in particular the requirement to inspect during the day, to see and hear how the track, including the S&C, performed while trains were running over it.

- Witness evidence was that it was believed to be unusual, '*an alien thing to do'*, to patrol and inspect at night, changing decades of established working practice.[17]

113 There was also a belief that SSoW using unassisted lookouts, and the SSoW for the Surbiton patrol in particular, were safe if implemented properly. Witness evidence was that the factors that had caused the accident at Margam (paragraph 41), which occurred during open line working, were not considered by staff to be applicable to Woking track section.

114 RAIB notes that none of the other types of warning SSoW would have prevented an accident where a person unintentionally, and unknowingly, steps beyond the safe agreed working limits where onto adjacent lines that are open to trains. These systems would often be set up to only warn of trains approaching along lines within the defined safe working limits. At the accident location, this would have been limited to the up slow and up fast lines.

Wessex route TWS programme

115 Prior to the accident, implementation of the TWS programme had not led to changes to the cyclical patrols at Woking track section.

116 Although Wessex route was progressing with its TWS programme, with an intended elimination of unassisted lookout working date of April 2022 (three months before the ORR improvement notice compliance date of 31 July 2022), it had not taken effective action to reduce levels of unassisted lookout working by the time the accident occurred. It had also yet to examine how the cyclical patrols and inspections at Woking track section that currently used unassisted lookouts could be done using other protection methods.

117 Wessex's approach to implementing the TWS programme was to only implement changes on the ground once:

- all related issues had been 'ironed out'
- risk transfer had been identified and, where considered credible, avoided
- preparations had been structured to minimise disruption to working practices and train services.

While this approach has benefits, it also meant that little material change had been made at the time of the accident.

118 During 2020, Network Rail's Safety Task Force (paragraph 45) had raised concerns about the slow rate of reduction of ULW within a number of routes within Southern region, North West and Central region and Anglia route (figure 7).[18] It engaged with senior management within these routes in an attempt to drive the TWS programme forward and reduce levels of unassisted lookout working.

119 Towards the end of 2020, Network Rail's Safety Task Force reported that other routes within these regions had begun to show improvement, but Wessex route had yet to do so. At the end of January 2021, the Safety Task Force reported that the level of ULW within Wessex route had remained static since July 2019.

[17] Network Rail stated to RAIB that patrolling and inspecting during the night was normal practice on some other routes.

[18] Scotland route had already eliminated ULW and so has a zero score.

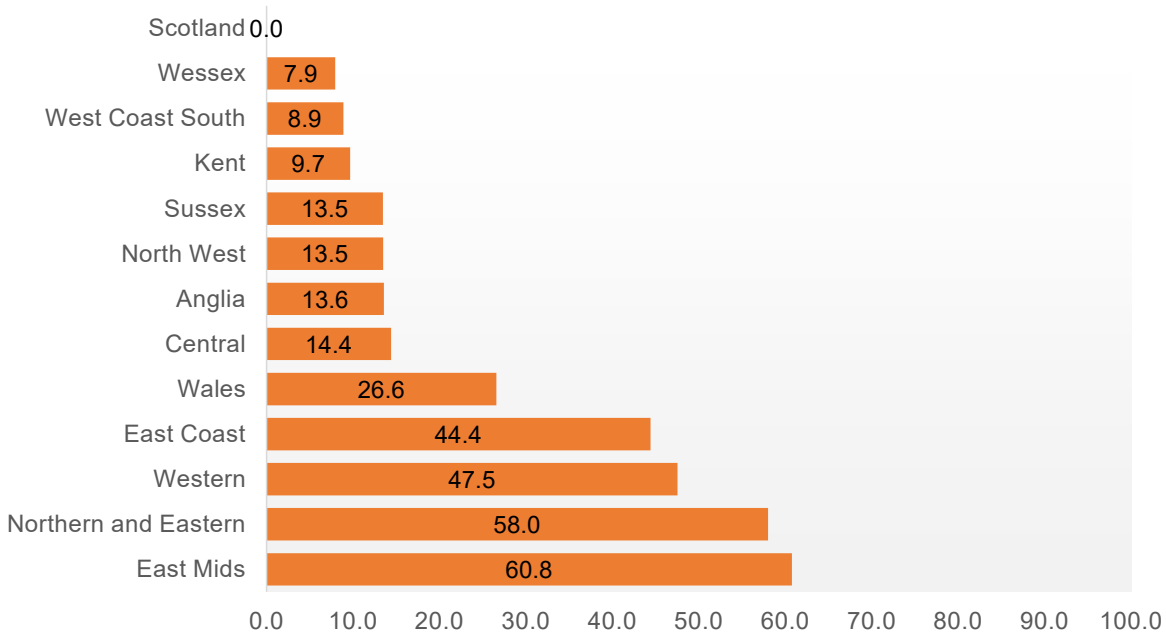

Figure 7: Data showing % reduction in baseline ULW hours to September 2020 (baseline is 1 April 2019)

120 Data from April 2020, when Wessex route began its TWS programme, until the last period before the accident (January 2021), indicates that Wessex was slower at reducing levels of ULW within Southern Region than both the Kent and Sussex routes (figure 8). Despite this, Wessex route reported that it still believed it would have achieved compliance with its intended date to eliminate the practice of April 2022. During this period, data provided by Network Rail showed that Woking track section had only reduced ULW hours by about 2% and that it still accounted for around 40% of all SSoWs used at Woking track section. Data provided by Network Rail also showed that Woking track section was among the worst performing track sections in the Wessex Inner area in this respect. Following the accident, Wessex route introduced an accelerated TWS programme that significantly reduced levels of unassisted lookout working (see paragraph 153) and Woking track section achieved zero hours of ULW in April 2021.

Region	ULW hours 04/20	ULW hours 01/21	% hours diff.	ULW MSTs 04/20	ULW MSTs 01/21	% MSTs diff.
Wessex	1723	1560	9.5	1395	1321	5.3
Kent	1853	1532	17.3	1464	1278	12.7
Sussex	1836	1448	21.1	1999	1534	23.3

Figure 8: Data showing % reduction (shown in red boxes) in baseline unassisted lookout working (ULW) hours and maintenance scheduled tasks using unassisted lookout working (MSTs) from April 2020 to January 2021

121 In addition to the general approach taken by Wessex route, anecdotal evidence from managers in the Wessex Inner route suggests that its TWS programme progress may have been influenced by a focus on reducing the number of temporary speed restrictions (TSRs) during 2020, and that this had possibly diverted some management effort away from the TWS programme.

Identification of underlying factors

The ability of the COSS to monitor safety

122 When a COSS is involved in the work being undertaken, they may become distracted from their primary role of ensuring the SSOW is implemented correctly. This potentially reduces levels of safety, particularly when working within warning types of SSoW. This was a probable underlying factor.

123 The available evidence indicates that the COSS was walking in the crossover because he had become distracted (paragraph 62). Once distracted, the COSS appears to have moved closer to the down fast line while being unaware that he was in a dangerous position relative to it, and that he was outside the safe working limits of the SSoW.

124 When working under a warning type of SSoW, a COSS is responsible for ensuring the group does not stray outside safe limits, and for establishing an effective method of warning. This contrasts with other types of SSoW, where all lines may be blocked, or where safe working boundaries between blocked and open lines are clearly marked, either by a temporary fence or tape, or by providing a site warden who is given the dedicated task of observing safe working limits and warning anyone who is about to go beyond them. It is of note that Handbook 3 'Duties of the lookout and site warden' issue 3 dated September 2014, explicitly prohibits a site warden from taking part in any work so they can focus on observing the safe working limits.

125 When a COSS responsible for implementing a warning type of SSoW is also carrying out work, their attention is naturally divided between the work, and monitoring the safe limits and the actions of other people in the work group. Any additional tasks undertaken, such as passing on knowledge to someone within the group (paragraph 62), can further distract the COSS from their primary safety responsibilities.

126 Distraction of COSSs, in combination with other factors, has featured in previous RAIB investigations where staff have moved beyond safe working limits, including:

- Grosvenor Bridge (RAIB report 19/2009) where the COSS moved away from a line under lookout protection and towards an adjacent open line, where he was then struck by an approaching train.
- Bulwell (RAIB report 20/2013) where the COSS's awareness of his position with respect to the line may have been reduced because he was working alone and needed to concentrate on some elements of a lineside vegetation inspection.
- Saxilby (RAIB report 21/2013) where the COSS became distracted and did not see or hear an approaching train which struck him.
- Clapham Junction (RAIB safety digest 02/2018) where track workers lost awareness of their position relative to an open line, resulting in a near miss.

127 In its investigation into the accident at Margam (paragraph 41), RAIB commissioned the Transport Safety Research Centre at Loughborough University to conduct research into the factors affecting safety behaviours of COSSs. The aim of this research was to understand the key factors that can affect safety leadership on site and included analysis of 47 RAIB investigation reports.

128 This analysis resulted in a list of 47 causal factors in track worker incidents and accidents and showed that situational awareness was the second most frequently occurring causal factor, with distraction the tenth most frequently occurring. These findings support the conclusion that a COSS's focus on safety can diminish through distraction and loss of situational awareness when they are also undertaking work.

Observations

Assurance

129 Some working practices within Woking track section were not compliant with safe working rules, behaviours and procedures, and the SWP and SSoW documentation contained errors and omissions. Network Rail's assurance processes had not identified these issues.

130 During its investigation into this accident, RAIB found evidence of non-compliant behaviour and non-compliance with processes within Woking track section. RAIB has found no evidence that any of these directly contributed to the cause of the accident. However, these non-compliances had not been identified by Network Rail's assurance processes. This issue was also identified in RAIB's Margam and Roade investigations (see paragraph 137) and were the subject of Recommendation 7 of the Margam report (see paragraph 148).

Rules and behaviours

131 Non-compliance with rules and safety behaviours included:

- Sentinel cards are used by Network Rail to identify staff, their roles and competencies, and, as part of its fatigue management system, as a means of telling when people have accessed the company's infrastructure. COSSs are required to scan the Sentinel card of everyone in their group via an app before they start work. The COSS did not always do this, and evidence indicated that he had not done it on the day of the accident. Sentinel records showed that other Woking track section COSSs were also not always scanning their own and their group's Sentinel cards.
- Prior to starting work on or near the railway, a COSS must give everyone a safety briefing that includes the SSoW for the work to be undertaken. Evidence showed that the COSS gave one safety brief covering the two SSoW at Surbiton on the morning of the accident. Witness evidence was that this was also the practice of some other COSSs.
- Some COSSs, including the COSS involved in the accident, positioned the distant lookout in the down cess when patrolling the up fast and up slow lines. This meant that when trains passed by on the down Hampton Court, down slow or down fast lines the site lookout lost visibility of the distant lookout. In this situation, the work group should return to the position of safety in the up cess. Witness evidence was that, because of the short period of time for which sight of the distant lookout was lost, it was common for track workers to remain on track during this period, contrary to relevant rules in Handbook 3 that require a lookout to give a warning, and then tell the COSS, if their view becomes blocked.

- Some COSSs additionally set up a lookout SSoW when using the permanently installed train operated warning system (TOWS) while patrolling on the London side of Surbiton station. Two different SSoW should not be used concurrently and, in this case, only the SSoW using TOWS should be used, as this was both the prescribed SSoW and higher up the hierarchy of SSoW. The reason given for using two SSoW was that TOWS gave a warning a long time before a train approached, so by using a lookout as well, the COSS could maximise the time on the track. Overlaying TOWS with lookout warning previously led to a near miss with a group of track workers at Egmanton level crossing, Nottinghamshire, on 5 October 2017 (RAIB report 11/2018).
- Before starting work on or near the line, the SSoW included a requirement for the COSS to call the signaller to find out whether there are any unusual train movements that could require modification to the SSoW. Evidence showed that the COSS on the day of the accident, and some other local COSSs, did not do this.
- When warned by the site lookout of an approaching train, the rules require that everyone must immediately go to the position of safety. FFCCTV from trains passing the group before the accident showed that they were not all moving to the position of safety when trains passed along the up fast line.

Process and procedures

132 Non-compliance with process and procedures included:

- Network Rail's procedures require that supervisory and management staff undertake assurance checks that include behavioural observations of staff when they are on or near the line, commonly known as site surveillance checks. Despite this, there is no recorded evidence that any of the behavioural issues and rule non-compliances identified by RAIB had been identified before the accident by supervisory staff or managers at the Woking track section.
- The intention of the plan for patrolling the crossover where the accident occurred was that COSSs would walk into it from either end (paragraph 81). Before the accident, it was not known at local management level at Woking track section that most COSSs were not walking into the crossover to inspect it, but were instead viewing it from the fast lines (paragraph 82).
- The SWP for the patrols on the day of the accident, and the SSoWs within it, contained errors and omissions including:
  i. Incorrect mileages, including the limits of the TOWS system.
  ii. Incorrect line speeds, and some bi-directional lines were not identified as such.
  iii. No access points specified for the patrols at Berrylands or Surbiton.
  iv. The Hazard Directory (a system maintained by Network Rail to provide staff with data on known hazards along the railway) was not up to date. For example, the areas where unassisted lookout working protection must not be used were not current.
  v. Travelling times between sites of work were not shown.

- Standard 019 requires that 10% of all issued SWPs are checked each period. These checks are intended to confirm that the SWP produced by the planner is accurate and appropriate and identify whether the SSoW has been implemented as planned. Records show that some checks were not completed or were completed late.
- After training, the site lookout should have been assigned to a mentor and issued with a logbook to record his development, but this was not done.
- Some managers were aware before the accident that a site lookout was used in addition to the TOWS SSoW, but there is no evidence that action had been taken to understand the reasons for this so that appropriate corrective action could be taken.

Drug and alcohol testing

133 Following the accident, neither the patroller's assistant, site lookout, nor train driver were tested for the presence of drugs and alcohol.

134 At the time of the accident, Rail Industry Standard RIS-8070-TOM Issue 1, December 2016 'Testing Railway Safety Critical Workers for Drugs and Alcohol' set out the measures which infrastructure managers and railway undertakings needed to take to ensure that their staff did not work under the influence of substances that could impair their performance, such as alcohol or drugs, and to comply with the relevant requirements of the Transport and Works Act 1992.[19]

135 Network Rail and South Western Railway had captured these measures in their own procedures for the testing of staff for the presence of drugs and alcohol following accidents and incidents. However, RIS-8070-TOM Issue 1 did not make testing mandatory after an incident or accident, and judgement by railway companies as to whether tests were necessary was permitted.

136 Neither organisation carried out any drugs and alcohol testing following this accident (paragraph 155). Network Rail stated that it did not test the staff involved in the accident because the manager who responded had no suspicion of inappropriate behaviour and the staff did not exhibit any signs of being under the influence of drugs or alcohol. South Western Railway stated that it did not test the driver because it believed the train had been driven in an appropriate manner.

[19] The Transport and Works Act 1992 makes it an offence for staff undertaking certain tasks on the railway to be unfit to work through alcohol or drugs. Because the alcohol limits contained in the act could still impair the performance of safety-critical tasks, the mainline railway in Great Britain has mandated stricter alcohol limits via RIS-8070-TOM. An individual found to be above these limits would be subject to disciplinary action from their employer.

Previous occurrences of a similar character

137 Before the accident at Surbiton, three accidents between November 2018 and April 2020 led to the deaths of four members of railway staff as a result of being struck by a train, while they were at work on railway lines. These occurred at:

- Stoats Nest Junction, near Croydon (RAIB report 07/2019).
- Margam, Neath, Port Talbot (RAIB report 11/2020).
- Roade, Northamptonshire (RAIB report 03/2021).

In addition, RAIB has investigated many near miss incidents where workers have had to take avoiding action to prevent being struck by an approaching train, including a near miss involving a distant lookout walking on the London side of Surbiton station on 2 November 2016 (RAIB Safety Digest 06/2017). The recommendations made by RAIB into the double-fatal accident at Margam are of particular relevance to this accident and are discussed at paragraph 143.

Summary of conclusions

Immediate cause

138 The COSS was in the swept path of the approaching train (paragraph 55).

Causal factors

139 The causal factors were:

a. The COSS had moved into an unsafe position relative to the down fast line (paragraph 58, **Recommendation 1**). Although it is not possible to know with certainty why the COSS was in an unsafe position relative to the down fast line, the following factors may have been influential:

   i. The COSS had probably entered the crossover after becoming distracted from his primary safety critical role, either because he was teaching his assistant about S&C inspection, or by carrying out the inspection (paragraph 60).

   ii. The layout of the rails at the junction probably meant the COSS did not realise he was walking in the crossover, and possibly also caused him to unintentionally move further towards the down fast line (paragraph 65).

   iii. The design of the patrol required the group to walk along the up fast line to reach a position where they would cross to the down cess and commence the patrol of the down lines (paragraph 69).

b. The COSS did not take action to move out of the approaching train's path (paragraph 74). This causal factor arose due to a combination of the following:

   i. The site lookout did not provide a warning to the COSS because he was not looking out for trains travelling on the down fast line (paragraph 77, no recommendation).

   ii. The COSS did not move out of the path of the train when the driver sounded its warning horn (paragraph 86, **Recommendations 1 and 2**).

c. The patrol was undertaken while the lines were open to train movements (paragraph 104, no recommendation).

Probable underlying factor

140 When a COSS is involved in the work being undertaken, they may become distracted from their primary role of ensuring the SSOW is implemented correctly. This potentially reduces levels of safety, particularly when working within warning types of SSoW (paragraph 122, **Recommendation 1**).

Additional observations

141 Although not linked to the accident at Surbiton on 9 February 2021, RAIB observes that some working practices within Woking track section were not compliant with safe working rules, behaviours and procedures, and the SWP and SSoW documentation contained errors and omissions. Network Rail's assurance processes had not identified these issues (paragraph 129, **Recommendation 3** and Margam Recommendation 7).

142 Following the accident, neither the patroller's assistant, site lookout, nor train driver were tested for the presence of drugs and alcohol (paragraphs 133 and 155, no recommendation).

Previous RAIB recommendations relevant to this investigation

143 Following the accident at Margam (paragraph 41) RAIB made 11 recommendations. Four of these recommendations are relevant to the Surbiton investigation.

Recommendation 2

144 This recommendation reads as follows:

> *Network Rail should carry out a detailed investigation at delivery units and depots of how management is monitoring and supervising section planners and staff working on or near the track, to check that safe work plans are being generated, and implemented safely on the ground. It should then use the findings to develop and implement improved procedures on monitoring and supervision, and assess and address any related staff resource requirements*

145 On 10 November 2021 ORR reported to RAIB that the status of this recommendation was 'implementation ongoing' and that:

> *'The response to this recommendation is being reconsidered in conjunction with the response to recommendation 7. Southern Region have responded with evidence to demonstrate how their existing monitoring and assurance addresses the issues which motivated the recommendation. This evidence is being evaluated. If it is accepted as suitable and sufficient then similar evidence will be sought from the other Regions with a view to demonstrating that effective monitoring and supervision is now in place and that the recommendation has been superseded by events in the field.'*

Recommendation 5

146 This recommendation reads:

> *Network Rail, in consultation with its main contractors and Trade Union representatives, should establish a permanent expert group, which comprises representatives from across the rail industry with sufficient seniority and recent front-line experience, together with external experts with relevant qualifications or background (including a behavioural scientist), to provide oversight of all track worker safety improvement programmes. Its scope, which should be formally documented, should include:*
>
> *a) providing independent advice, guidance and challenge to the Network Rail board and the SHE committee on matters related to the delivery of safety improvements (including those identified by the ORR improvement notices)*
>
> *b) checking that parallel and interdependent work streams are being properly co-ordinated*
>
> *c) monitoring the development and implementation of new or revised procedures and management processes*
>
> *d) ensuring that the need to address the impact on front-line track workers is not overlooked when implementing new technologies and work management processes*
>
> *e) checking that recommendations and lessons from accident investigations are being learned and fed into improvement processes*

f) providing a source of ongoing corporate memory and continuity of vision (particularly during times of organisational and personnel change).

147 On 10 November 2021 ORR reported to RAIB that the status of this recommendation was 'implementation ongoing' and that:

'*Although the establishment of the group largely meets the terms of the recommendation, it is not yet fully embedded to the extent that we consider the recommendation to have been implemented. Network Rail are considering how the group can effectively provide independent advice, guidance and challenge to the Network Rail board and the SHE [safety health and environment] committee. Network Rail and ORR both consider that the role of the group in providing ongoing corporate memory and continuity of vision, particularly during times of organisational and personnel change, would be applicable for some time while GB Railways was being established.'*

Recommendation 7

148 This recommendation reads:

Network Rail, in consultation with its main contractors and staff representatives, should commission a project to improve the way its management assurance system operates in areas directly affecting the safety of track workers. The review should include each of the following:

a) the identification of improved systems for collecting reliable data on how mandated processes are being applied in maintenance depots, and within track worker teams (to supplement or replace the existing Level 1 management self-assurance)

b) improved mechanisms for collating, analysing, tracking, and presenting the findings of audits, investigations and other management assurance activities.

The project should also consider ways of expanding the scope of management assurance activities to provide better intelligence on the underlying reasons for the non-compliances that are identified during audits, including consideration of the views of auditors and other relevant staff. The improved management assurance arrangements that are identified should be endorsed by the Network Rail board before implementation in accordance with a structured and validated programme for change.

This recommendation may apply to other Network Rail assurance processes.

149 On 10 November 2021 ORR reported to RAIB that the status of this recommendation was 'implementation ongoing' and that:

'*We found the Network Rail initial response somewhat unfocussed. In our various discussions it became clear that the plans were, in fact, quite targeted. It has already delivered an Assurance Policy and Manual and the programme has the endorsement of the Executive Leadership Team.*

At our most recent progress meeting we learned that the plan is progressing to time. ORR has pressed Network Rail to describe how it will ensure that any change is 'structured and validated' as required by the recommendation.

Network Rail expect to submit a closure statement once it has sufficient evidence that its management assurance systems are considered a BAU [business as usual] process.'

Recommendation 10

150 This recommendation reads:

> *Network Rail, in consultation with the Department for Transport, relevant transport authorities, ORR and other railway stakeholders, should investigate ways of optimising the balance between the need to operate train services and the need to enable safe access to the track for routine maintenance tasks. Options for consideration should include:*
>
> *a) the provision of gaps in the train service, during daylight off-peak hours, to enable timely and safe access for maintenance staff*
>
> *b) greater use of alternative routes or bidirectional lines to achieve the above*
>
> *c) increased availability and utilisation of weekend and night time possessions for cyclical maintenance tasks.*
>
> *Any reasonably practicable measures that are identified should then be implemented in accordance with a timebound plan.*

151 On 10 November 2021 ORR reported to RAIB that the status of this recommendation was 'implementation ongoing' and that:

> *'Network Rail is making considerable progress in this area. It has engaged with DfT and secured some co-operation regarding strengthened requirements to collaborate being contained in Directly Awarded Passenger Train Franchises. Network Rail will provide a summary of the clauses as part of a closure statement'* and that '*It would be inappropriate to report it as implemented until it is clearer what the structure and powers of GB Railways will be as this could have a significant impact on these matters.'*

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

152 Within a few days of the accident, Wessex route moved inspections of crossovers, that were being done while trains were running, into possessions during the night when trains were not running. To do this, derogations against the requirements of standard NR/L2/TRK/001 were approved (paragraph 48).

153 In February 2022 Network Rail advised RAIB that:

> *'Wessex has reduced the use of ULW and LOWS* [lookout operated warning system] *to a total of 287 hours at Period 10. It is anticipated that this figure will fall further following changes to patrolling patterns being implemented in the Inner area during the period.*
>
> *There are areas where agreement has not been able to be reached to provide additional access or moving to night working, the Route plan to utilise technology, increase staff numbers or utilise the recently submitted National Network Change. This Network Change, providing it is agreed, formalises a mechanism to secure the train-free access required to maintain the railway on safety grounds.*
>
> *While the programme has seen technology deployed, to further increase workforce safety a programme of additional protection is being implemented. Following successful trials, plans are in development to install geofencing base stations across Wessex (and the Southern Region). Once in use these will provide virtual barriers advising staff if they come close or breach the barrier.'*

Network Rail told RAIB that the accuracy of the geofencing virtual barrier is around 100mm and that following successful trials, it is progressing this technology through its procurement processes.

154 Network Rail also told RAIB that:

> *'In January 2021 the Southern Region undertook a qualitative assessment of 019 compliance engaging with section managers, PiC and section planners, to identify areas and themes where there were gaps and concerns. These were used to create a programme to drive this forwards, and a governance framework has been established within the Track Worker Safety Programme and within the Southern Safety Framework (known as Southern Thumbs Up).'*

155 In March 2022, RSSB updated rail industry standard RIS-8070-TOM 'Drugs and alcohol testing for safety-critical workers' to specifically include reference to testing of staff involved in accidents or incidents that are reportable to, and that may result in, an RAIB investigation (paragraph 133).

Background to RAIB's recommendations

156 ORR's improvement notices (paragraphs 41 to 45) led to the introduction of Network Rail's TWS programme (paragraph 46). The TWS programme is still being implemented across Network Rail's routes and progress is being monitored by ORR.

157 The introduction of warning technologies through implementation of the TWS programme (such as portable, automatic track warning systems, semi-automatic track warning systems and signal-controlled warning systems), while intended to improve track worker safety, will not prevent a similar accident where distraction leads to track workers moving beyond safe working limits adjacent to open lines where a warning of approaching trains is not provided.

Recommendations and learning points

Recommendations

158 The following recommendations are made:[20]

1 *The intent of this recommendation is to prevent accidents and near misses due to staff working on or near the line moving beyond safe working limits.*

Network Rail should review whether safe systems of work in which staff are working on or near the line, and where some or all lines remain open to traffic, incorporate adequate risk controls so that members of the work group remain within the designated safe limits. The review should consider including the role of appropriate technology and whether having members of the work group undertaking multiple tasks could compromise risk controls. Network Rail should implement any necessary changes identified in accordance with a timebound plan (paragraph 139a, 139b and 140).

2 *The intent of this recommendation is to support and improve the judgement of train drivers as to whether track workers are in close proximity to their train, and reinforce the necessary action to take if there is a possibility that track workers are likely to be struck.*

The Rail Delivery Group, with the support of RSSB, should identify the issues drivers face in judging the proximity of track workers to the swept path of their train. They should develop training and briefing materials to better prepare drivers to make accurate judgements as to when track workers are at risk of being struck and to react appropriately, for example by sounding the urgent warning. The Rail Delivery Group should share the resulting training and briefing material with transport undertakings (paragraph 139b).

[20] 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 www.gov.uk/raib.

3 *The intent of this recommendation is for Network Rail to understand the reasons underlying the non-compliances identified during this investigation and learn from them.*

Network Rail should review working practices at Woking track section to understand the extent and nature of any non-compliances relating to safe systems of work and their related rules, procedures, and behaviours. This review should seek to understand the underlying reasons behind any non-compliances identified and if they may apply more widely to other track sections. Network Rail should take actions to address any issues identified by this review (paragraph 141)

Learning points

159 RAIB has identified the following learning points:[21]

1 The importance of train drivers using the train horn to sound an urgent warning to alert anyone on or dangerously near to the line on which their train is approaching (paragraph 100).

2 The importance of track workers acknowledging train warning horns by raising one arm above the head and looking to confirm whether the train making the warning could put them in danger. Assuming a train warning horn does not apply can lead to near misses and accidents (paragraph 98).

3 It is good practice for someone other than the COSS to also have the contact details of the controlling signal box for use in an emergency. While these details are in the safe work pack, this may not be readily available to others if the COSS is involved in an accident and urgent help is needed (paragraph 35).

4 It is important that distances associated with positions of safety from open lines are accurately known when creating documents such as patrol diagrams (paragraph 81).

5 When SSoW are being designed or reviewed, it is important that relevant patrol diagrams are consulted so that any mismatch between the SSoW and patrol diagram can be identified and corrected (paragraph 84).

[21] 'Learning points' are intended to disseminate safety learning that is not covered by a recommendation. They are included in a report when RAIB wishes to reinforce the importance of compliance with existing safety arrangements (where 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

FFCCTV	Forward-facing closed-circuit television
COSS	Controller of site safety
ORR	Office of Rail and Road
OTDR	On-train data recorder
PIC	Person in Charge
RAIB	Rail Accident Investigation Branch
RSSB	Trading name of Rail Safety and Standards Board
S&C	Switches and crossings
SSoW	Safe system of work
SWP	Safe work pack
TME	Track maintenance engineer
TOWS	Train operated warning system
TWS	Track worker safety
ULW	Unassisted lookout working

Appendix B - Investigation details

RAIB used the following sources of evidence in this investigation:

- information provided by witnesses
- information taken from the train's on-train data recorder
- CCTV recordings taken from the train involved, other trains and Surbiton station
- site photographs and measurements
- weather reports and observations at the site
- analysis of signalling data
- audio recordings of conversations with staff at Woking signal box
- Railway standards, rules and instructions
- Network Rail company procedures and records
- safe work pack documentation
- staff competence records and training records
- medical records
- information relating to the train's warning horn and OTDR systems
- a review of previous RAIB investigations that had relevance to this accident.

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