RAIB

Rail Accident Investigation Branch

Rail Accident Report

Member of staff struck by a train at St Philips Marsh depot, Bristol 26 September 2023

Report 08/2024
July 2024

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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Member of staff struck by a train at St Philips Marsh depot, Bristol, 26 September 2023

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Summary

At about 13:03 hrs on 26 September 2023, a member of Great Western Railway (GWR) staff responsible for shunting trains at St Philips Marsh depot, Bristol, was struck by a train that was exiting the depot's main shed building. The train was travelling at 10 mph (16 km/h) at the time of the accident. After hearing the train strike something, the driver applied the brakes and stopped the train. Others working nearby saw that the shunter was lying next to the train and went to help them. The shunter, who had sustained serious injuries, was treated by paramedics and then taken to hospital.

After exiting the main shed building via a roller shutter door, the shunter had walked into the path of a train which its driver then started to move and accelerate much quicker than the shunter expected. The shunter took this route to get to a level crossing that ran across the end of the shed building. RAIB found that the shunter did this as they wanted to check that no one was approaching the level crossing from a blind corner. The shunter regularly used the area between the main shed building and the level crossing as a walking route, so was used to being there. However, by using this route the shunter had to walk close to or foul of the train's path. The shunter was also unaware that the train had started to move and did not realise it was catching up with them. They had expected to reach the level crossing before the train, but the train exceeded the speed limit of 5 mph (8 km/h). The driver did not observe the shunter walking ahead of the train so did not take any appropriate actions in response.

An underlying factor was that GWR had not effectively controlled the risk of a shunter being struck by a train outside of a shed building. Another underlying factor was that GWR's assurance processes had not identified that train movements within the depot were exceeding the speed limit.

Following the accident, GWR updated its risk assessment and introduced new control measures to specifically manage the risks to staff associated with trains moving outside the main shed building. GWR also addressed the deficiencies found with its assurance processes for monitoring if drivers were complying with the speed limits on its depots.

As a result of the investigation, RAIB has made two recommendations. Both are addressed to GWR. The first is to review the personal track safety training and assessment it provides for shunters, so that they receive an appropriate level of information and assessment about working and walking on depots. The second is to identify the places on its depots where its staff might be required to walk foul of a train's path when using a walking route or walkway, and then manage the risk of its staff being struck by a train in these locations.

RAIB has also identified four learning points. The first is to remind staff who work and walk on depots and in sidings of the personal track safety requirement to look out for approaching trains at least every 5 seconds when walking on the railway. The second is to remind drivers of the importance of complying with all speed limits on depots and in sidings. The third highlights the importance of drivers and shunters coming to a clear understanding about a train movement. The fourth is for staff who work in safety-critical roles to remember to declare to their employer if they have taken any medication that might have the potential to impact on their performance.

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.

2 The report contains abbreviations and acronyms, which 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 about 13:03 hrs on 26 September 2023, a member of staff responsible for shunting trains at St Philips Marsh depot, Bristol, was struck by a train that was exiting the depot's main shed building (figures 1 and 2). The train was travelling at 10 mph (16 km/h) at the time. After hearing the train strike something, the driver applied the brakes and stopped the train.

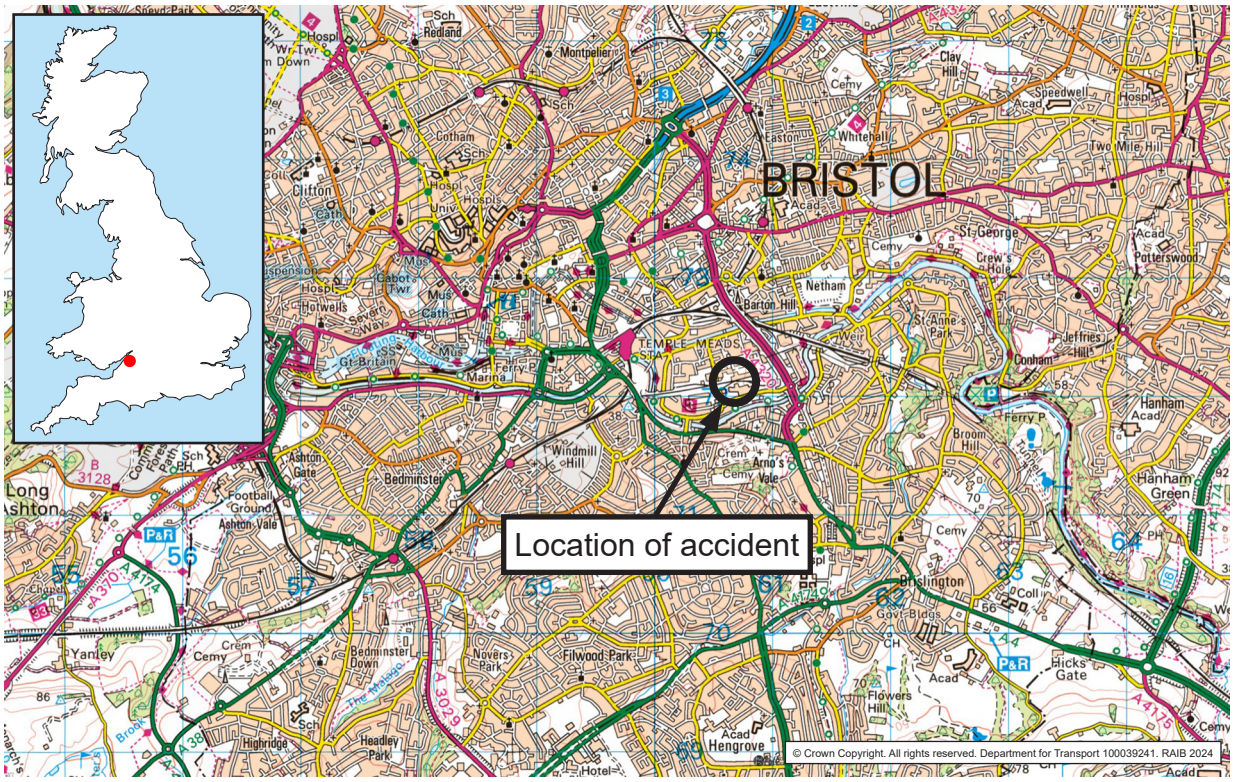

Figure 1: Extract from Ordnance Survey map showing the location of the accident at St Philips Marsh depot, Bristol.

4 Contractors working nearby saw the member of staff, a shunter, lying next to the train and went to help them. The shunter had sustained serious injuries to their ankle, as well as injuries to their knuckle, elbow, shoulder and head. Staff trained in first aid were called and attended to the shunter until paramedics arrived, who then treated the shunter and took them to hospital. The depot was closed to incoming and outgoing train movements until about 19:30 hrs while the initial investigations into the accident took place.

Context

Location

5 St Philips Marsh depot is in Bristol. It provides a train maintenance, servicing and cleaning facility for class 158, 165 and 166 diesel multiple units operated by Great Western Railway (GWR). It comprises three shed buildings and three sets of sidings (figure 3).

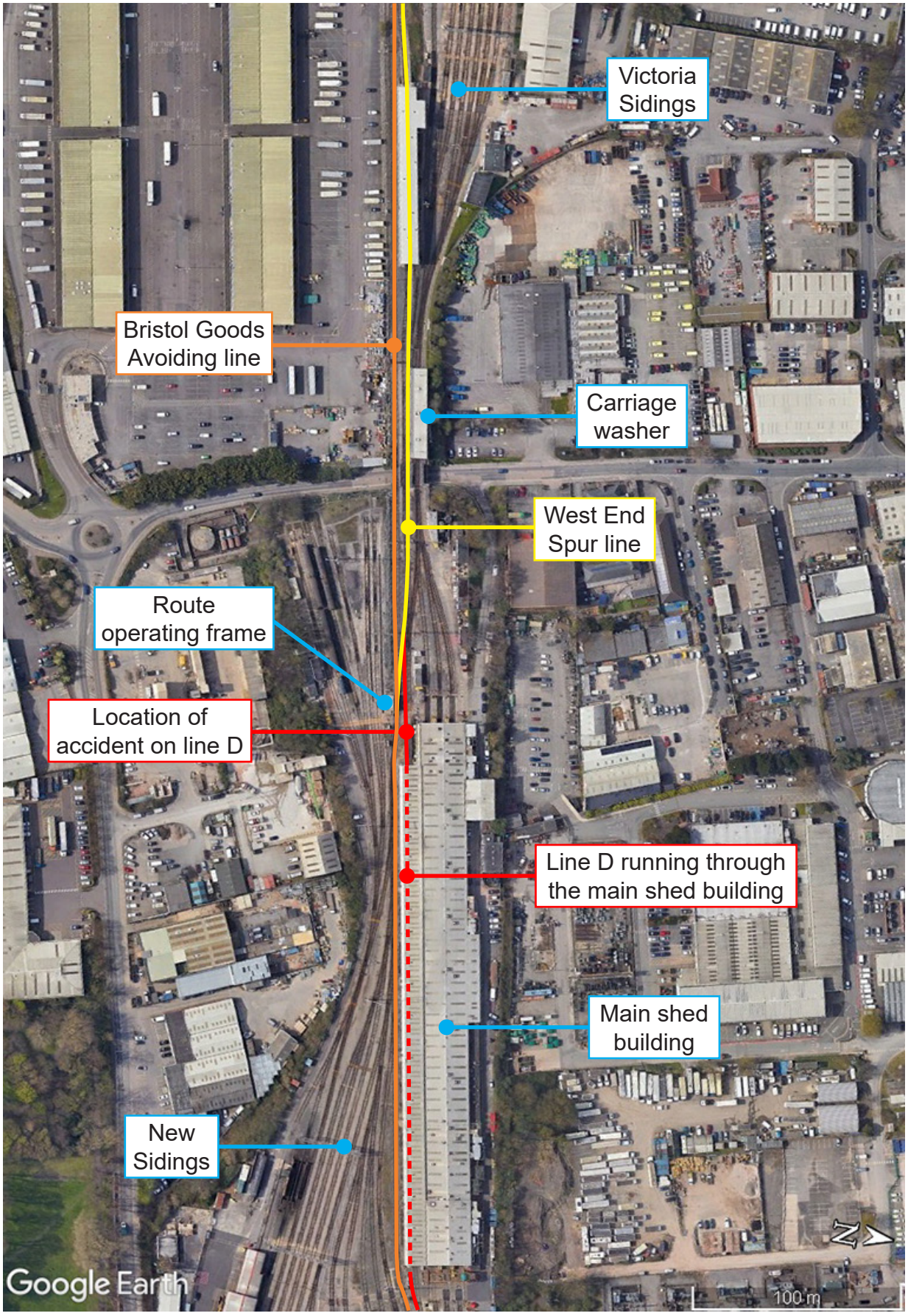

Figure 2: Overview of the location where the accident happened (courtesy of Google with RAIB annotations).

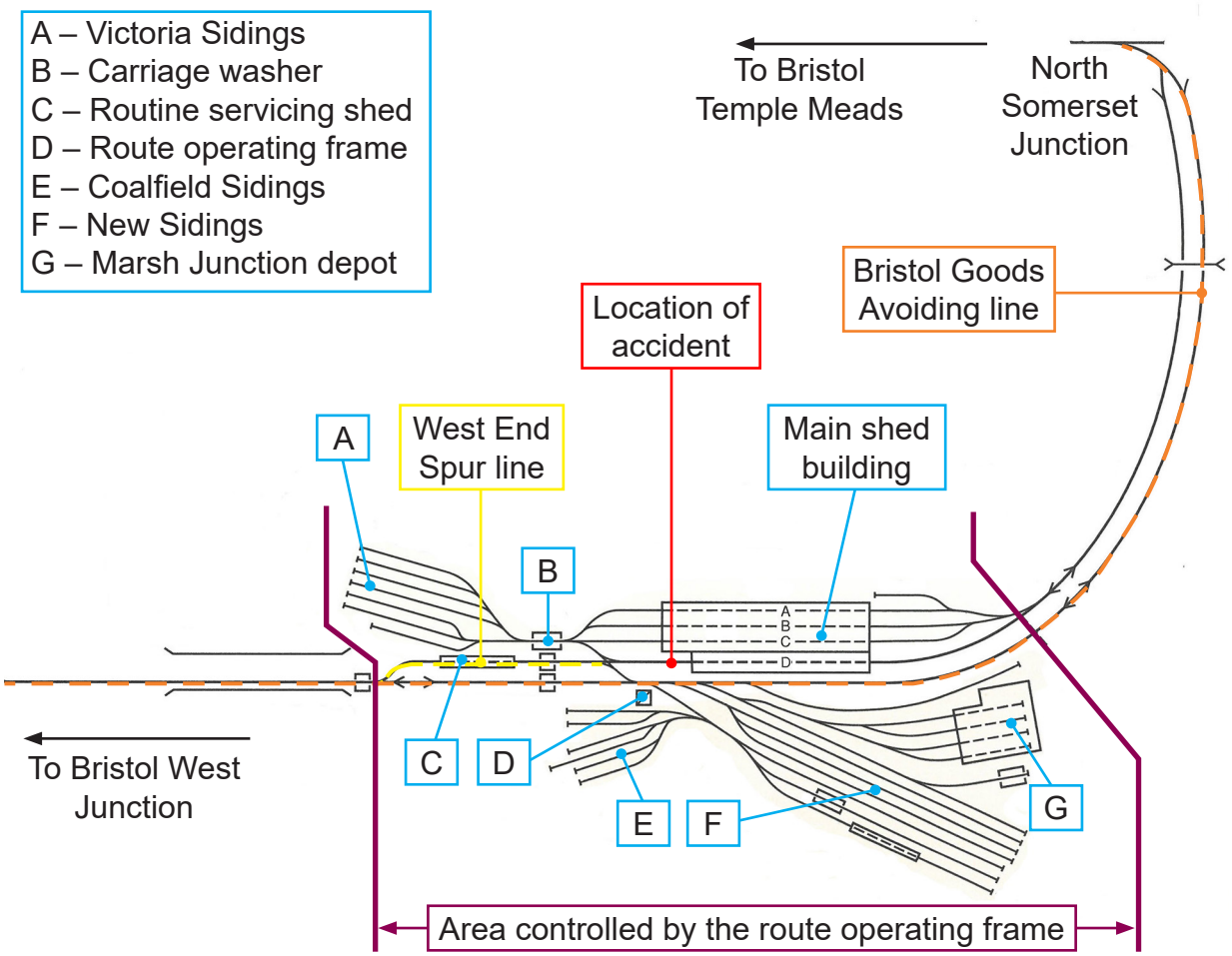

Figure 3: Depot layout.

6 A bi-directional single running line runs through the depot, between North Somerset Junction and Bristol West Junction (figure 3). This is called the Bristol Goods Avoiding line from North Somerset Junction as far as the west end boundary of the depot, where its name changes to the Up/Down Through Goods line to Bristol West Junction. This line is 1.1 miles (1.8 km) long between the two junctions and has a speed limit of 10 mph (16 km/h). All the lines leading off this running line, to either a shed building or a siding within the depot, have a speed limit of 5 mph (8 km/h). Any trains moving inside the shed buildings are required to travel at extreme caution, which is defined in local instructions as a speed well below 5 mph (8 km/h).

7 The running line, shed buildings and sidings throughout the depot are generally level, although there is a falling gradient on the line leading into Victoria Sidings (figure 3).

8 Train movements within the depot are controlled either by a shunter or by signals which are operated from a small signalling panel, called the route operating frame (figure 4). The route operating frame is worked by a route frame operator, who is more commonly called the mini panel operator (MPO). The role of the MPO is to manage the train movements onto, within and off the depot. The depot signalling interfaces at both ends of the depot (figure 3) with signalling controlled by Network Rail's Bristol workstation signaller, who is located at Thames Valley Signalling Centre, in Didcot.

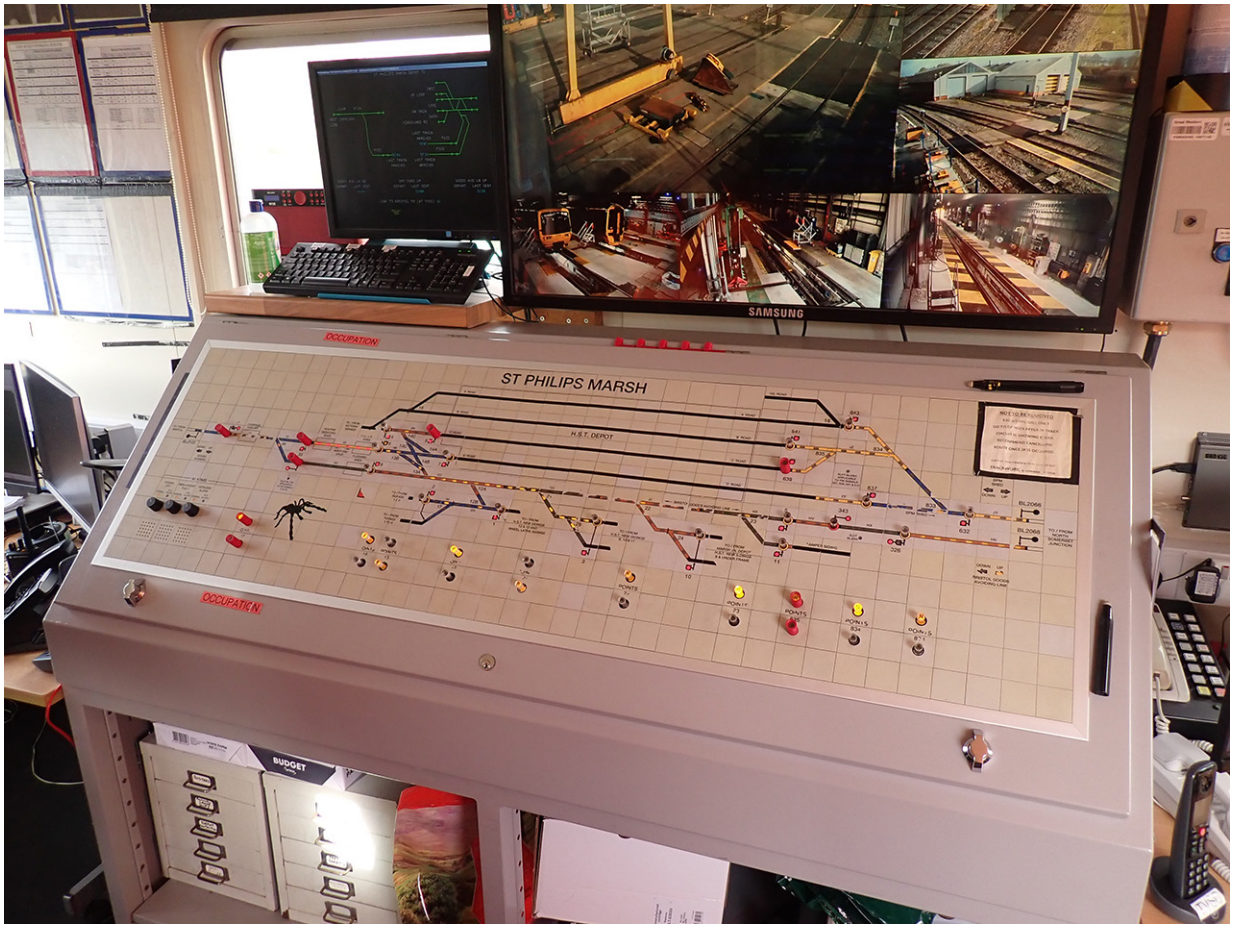

Figure 4: The route operating frame.

Organisation involved

9 GWR is the operator of both the depot infrastructure and the train. It is also the employer of the driver and shunter who were involved in the accident. GWR freely co-operated with the investigation.

Train involved

10 The train involved in the accident was a two-car class 158 diesel multiple unit, number 158771 (figure 5). It had arrived onto the depot earlier that morning from Bristol Temple Meads station.

11 At the time of the accident, the unit was moving out of the main shed building along line D (figure 2). Its initial destination was the West End Spur line, where it was to stop behind PM6 signal, then reverse direction to go to the New Sidings (figure 6).

Figure 5: Unit 158771, where it stopped after the accident.

Staff involved

12 The driver had over 49 years' experience of working on the railway. They were based at Bristol throughout their career with British Rail, and, more recently after privatisation, with the Greater Western railway passenger franchises that operated trains from London to South West England and South Wales. The driver operated mainline trains up until April 2008, after which they worked as a depot driver based at St Philips Marsh depot. Their role as a depot driver required them to shunt trains within the depot and to take trains between the depot and Bristol Temple Meads station. They had no recent previous incidents on record, and no issues were noted with how they drove trains during their more recent competence assessments covering the past 5 years.

13 The shunter had started working at the depot in January 2020 in a general engineering grade before moving to a shunter role at the start of March 2022. The shunter completed their training in March 2022 and then underwent a period of mentoring until they passed their final assessment in November 2022, after which they could work on their own. They had no previous incidents on record, and no issues were noted with their performance during their post qualification assessments in 2023.

External circumstances

14 The accident happened during daylight. The forward-facing closed-circuit television (CCTV) footage from the train showed the weather was dry, partly cloudy, with sunny periods. Local weather stations, located between 0.55 miles (0.88 km) and 0.75 miles (1.18 km) away, recorded data showing the air temperature was about 18°C. At the time of the accident the sun was overhead, so its position was not a factor.

15 RAIB has not identified any external factors that influenced this accident.

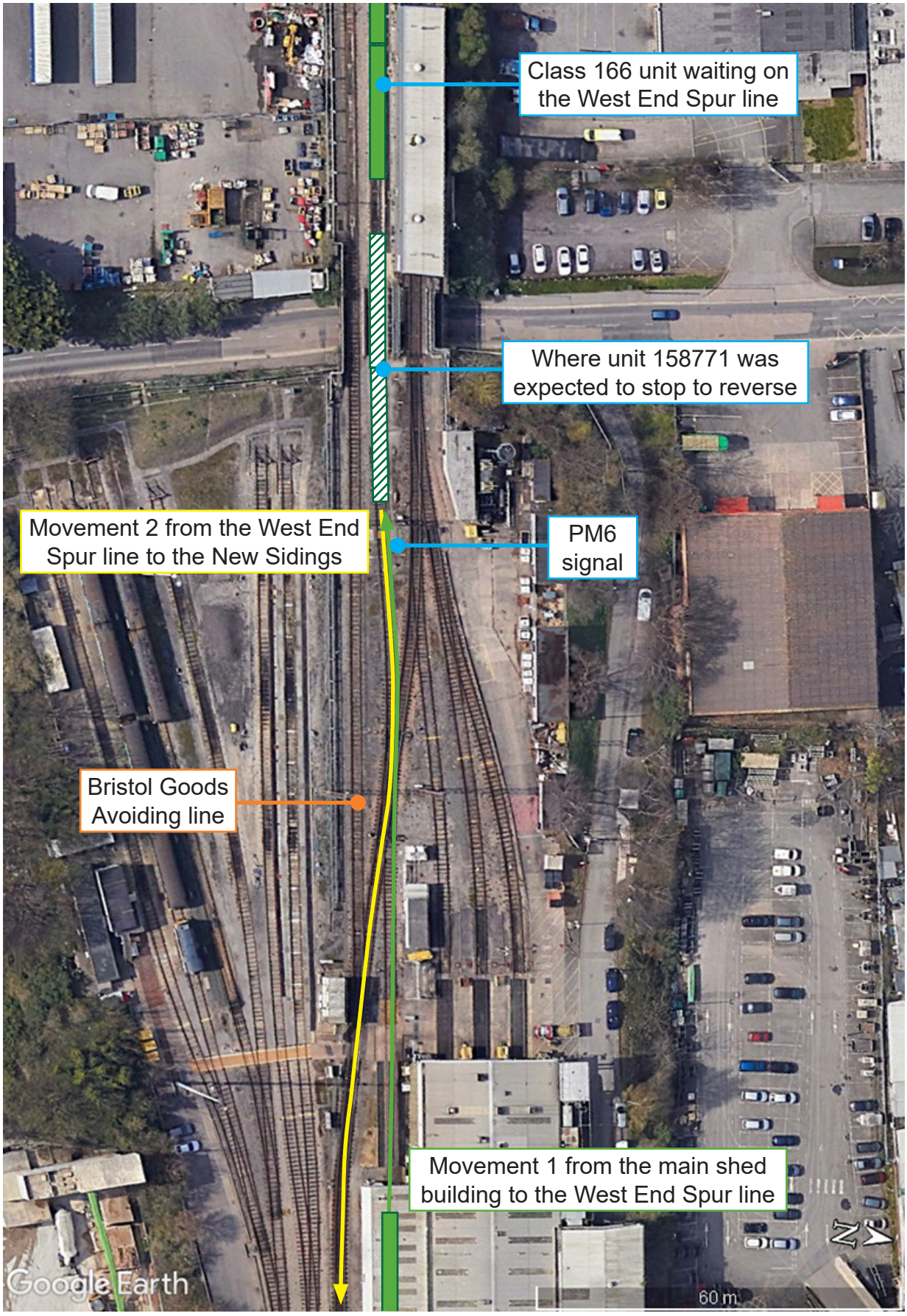

Figure 6: The planned route for the unit (courtesy of Google with RAIB annotations).

The sequence of events

Events preceding the accident

16 The shunter started their shift at 06:30 hrs on 26 September 2023 and spent the morning carrying out shunting movements as required by the MPO.

17 At 08:45 hrs, unit 158771 departed from Bristol Temple Meads station to go to St Philips Marsh depot. At about 08:49 hrs, it passed North Somerset Junction and moved onto the depot infrastructure controlled by the MPO, travelling along the Bristol Goods Avoiding line. Between 08:54 hrs and 09:02 hrs, the unit moved onto the West End Spur line, then reversed direction and moved into the main shed building along line D. It was left there for maintenance activities to take place.

18 At about 12:55 hrs, the MPO contacted the shunter via radio and asked them to go to the main shed building as they were required to shunt two trains. The first shunt was to move unit 158771 out of the main shed building so it could then be taken to the New Sidings. The second was to shunt a class 166 unit that was waiting on the West End Spur line, after recently arriving onto the depot, into the main shed building in place of unit 158771. The MPO then called the drivers mess room and asked for two drivers, with one driver needed to move unit 158771 and the second driver needed to move the class 166 unit. The driver who left the mess room to go to unit 158771, who was involved in the accident, had just arrived at the depot, as they were due to start their shift at 13:00 hrs.

19 The forward-facing CCTV footage recorded by unit 158771 shows that, shortly afterwards, the shunter traversed the level crossing over the Bristol Goods Avoiding line as they walked to the main shed building from the shunters' mess room. The shunter then made their way from the level crossing along the line D track and into the main shed building.

20 After arriving at the unit, the shunter began to carry out checks to confirm that it was safe to move. This included checking that nothing was still connected to the train or hanging down from it. The shunter also went into the leading cab and started the train's engines. This was so that the air compressor on the unit could run to replenish the unit's air supplies.

21 Once they had completed their checks around the outside of the train, the shunter stopped in front of it and contacted the MPO by radio to say their train checks were complete. In response, the MPO set the route from PM7 signal, which is at the exit of the main shed building on line D, to the West End Spur line (figure 7). The signal then changed to display a proceed aspect.

22 About a minute before the train moved, its forward-facing CCTV shows three contractors in orange high-visibility clothing, who were working on the adjacent line C, walking onto the level crossing at the end of the main shed building (figure 8). After stopping on the level crossing to hold a brief conversation, two of the contractors continue, while the third turns around and goes back, walking over and then clear of the track for line D. While this was happening, the driver arrived at the train.

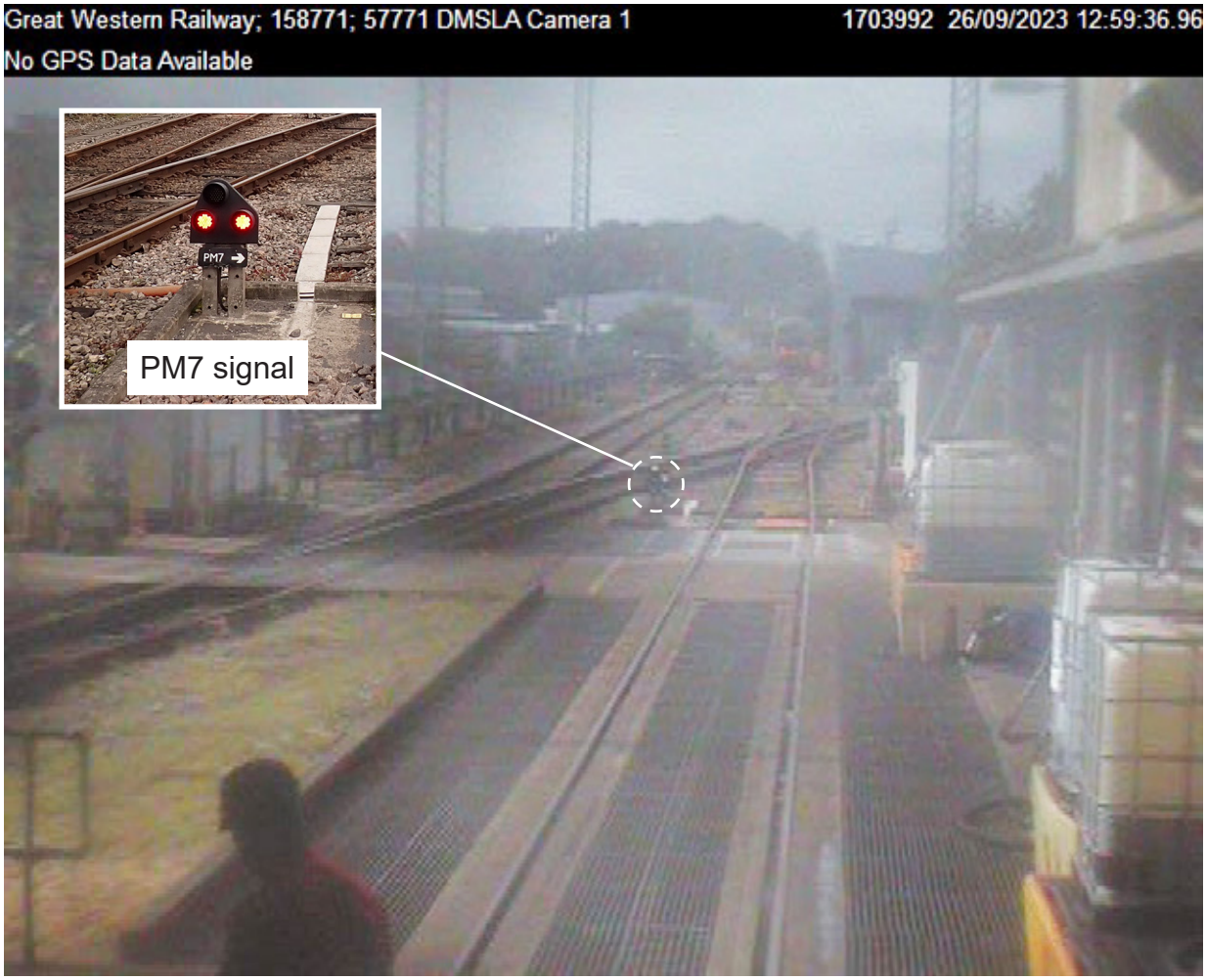

Figure 7: Forward-facing CCTV image of PM7 signal displaying a proceed aspect (courtesy of Great Western Railway) and a close-up view of PM7 signal but displaying a stop aspect.

23 The driver boarded the train and went into the cab. About 10 seconds later, the driver closed the train's external doors. During this time, the shunter had moved to the front left-hand side of the train. While there, the shunter gave verbal authority to the driver, who was at the cab window, that the movement out of the main shed building could begin.

24 About 15 seconds before the train began to move, the on-train data recorder (OTDR) shows traction interlock was gained, which meant all the train's external doors were now detected as closed and the train could be moved under traction when demanded by the driver. About 3 seconds later, the OTDR shows the driver released the train's brakes.

25 About 6 seconds before the train began to move, the driver pulled the traction handle away from its 'off' position. Within the next second, the driver pulled it further backwards to notch six (the traction handle has eight positions, referred to as notches, which range from its off position through to a maximum of notch seven). As the driver did this, the forward-facing CCTV shows the shunter had begun walking towards the roller shutter door to exit the main shed building. About 3 seconds before the train began to move, the shunter passed through the roller shutter door to go outside, walking ahead of the train, on the left-hand side of the line D track.

Figure 8: Forward-facing CCTV image of the contractors on the level crossing (courtesy of Great Western Railway).

Events during the accident

26 Just as the train started to move, the shunter began to walk diagonally to the right, so they were now foul of the train's path. The shunter continued walking diagonally, until they passed over the right-hand rail, at which point they then began walking parallel to the right-hand rail, but still foul of the train's path. During this time the driver was unaware of where the shunter was.

27 About 8 seconds after the train had started to move, the driver moved the traction handle to its off position. At this point the train was travelling at 10 mph (16 km/h) and was quickly catching up with the shunter who was still walking parallel to the track on its right-hand side. About 1 second later, while nearing the end of the main shed building for lines A to C, the shunter was walking alongside two intermediate bulk containers that were next to the right-hand side of the track (figure 9).

Figure 9: The intermediate bulk containers.

28 Within the next second, the train caught up with the shunter while travelling at 10 mph (16 km/h). The shunter realised the train was behind them just before it struck them on the elbow. This knocked the shunter over and as they fell, they threw themselves forward to avoid going underneath the train. It is unknown if the shunter's ankle injury was caused by the action of throwing themselves forward or whether their ankle was struck by the train. Witness evidence indicates that the shunter's high-visibility vest then caught on the side of the train, causing the shunter to be dragged a short distance alongside the train, until the vest's hook and loop fastenings gave way. The shunter came to rest on the concrete apron for the level crossing, lying next to the train.

Events following the accident

29 After hearing the train strike something, the driver applied the train's brakes about 1 second later. The train stopped 6 seconds after the brakes were applied.

30 Members of a group of contractors, who were working nearby on the adjacent line C, saw the shunter fall to the ground next to the train and went to them. They raised the alarm and soon after staff trained in first aid arrived to attend to the shunter. An ambulance was called and all movements onto the depot were stopped until about 19:30 hrs. After receiving treatment from paramedics, the shunter left the depot in an ambulance at about 14:13 hrs to go to hospital. The next day the shunter underwent surgery for the injuries to their ankle.

Analysis

Identification of the immediate cause

31 The shunter walked into the path of a train which its driver then started to move and accelerate much quicker than the shunter expected.

32 The forward-facing CCTV footage recorded by the train shows the shunter exited the main shed building through the roller shutter door and began walking to the level crossing and that the route they took placed them in the path of the train (paragraphs 25 to 27). The shunter wanted to get to the level crossing to check that no one was approaching it from the right-hand side, as the end of the main shed building for lines A to C created a blind corner on that side (figure 10). Figure 10 shows that a 'Stop, Look, Listen' board is positioned on the approach to the level crossing on this side to warn users to look for trains before they cross line D. However, the shunter wanted to be at the level crossing as they knew that a group of contractors was working nearby (paragraph 22), so they could warn anyone who moved towards lines D that a train was about to pass.

33 While walking to the level crossing, the shunter did not look back at the train, so did not see that it was accelerating and starting to catch up with them. The shunter had walked this way to the level crossing before. Based on their previous experience, they expected to get to the level crossing well before the train did. However, as the shunter walked parallel with the track, the train's speed had increased to a maximum of 11 mph (18 km/h) and was 10 mph (16 km/h) just as the train caught up with the shunter (paragraph 27). At this time, the shunter was walking next to two intermediate bulk containers (figure 9) which reduced the clearance between the train and containers to between 0.45 and 0.65 metres, leaving the shunter with nowhere to go to once they became aware that the train was behind them immediately before being struck.

Identification of causal factors

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

a. After exiting the shed via the roller shutter for line D, the shunter walked foul of the train's path when going to the level crossing (paragraph 35).

b. The train exceeded the speed limit after the shunter had given the train's driver permission to move (paragraph 70).

c. The driver did not observe the shunter walking ahead of the train and hence did not take any appropriate actions in response (paragraph 86).

Each of these factors is now considered in turn.

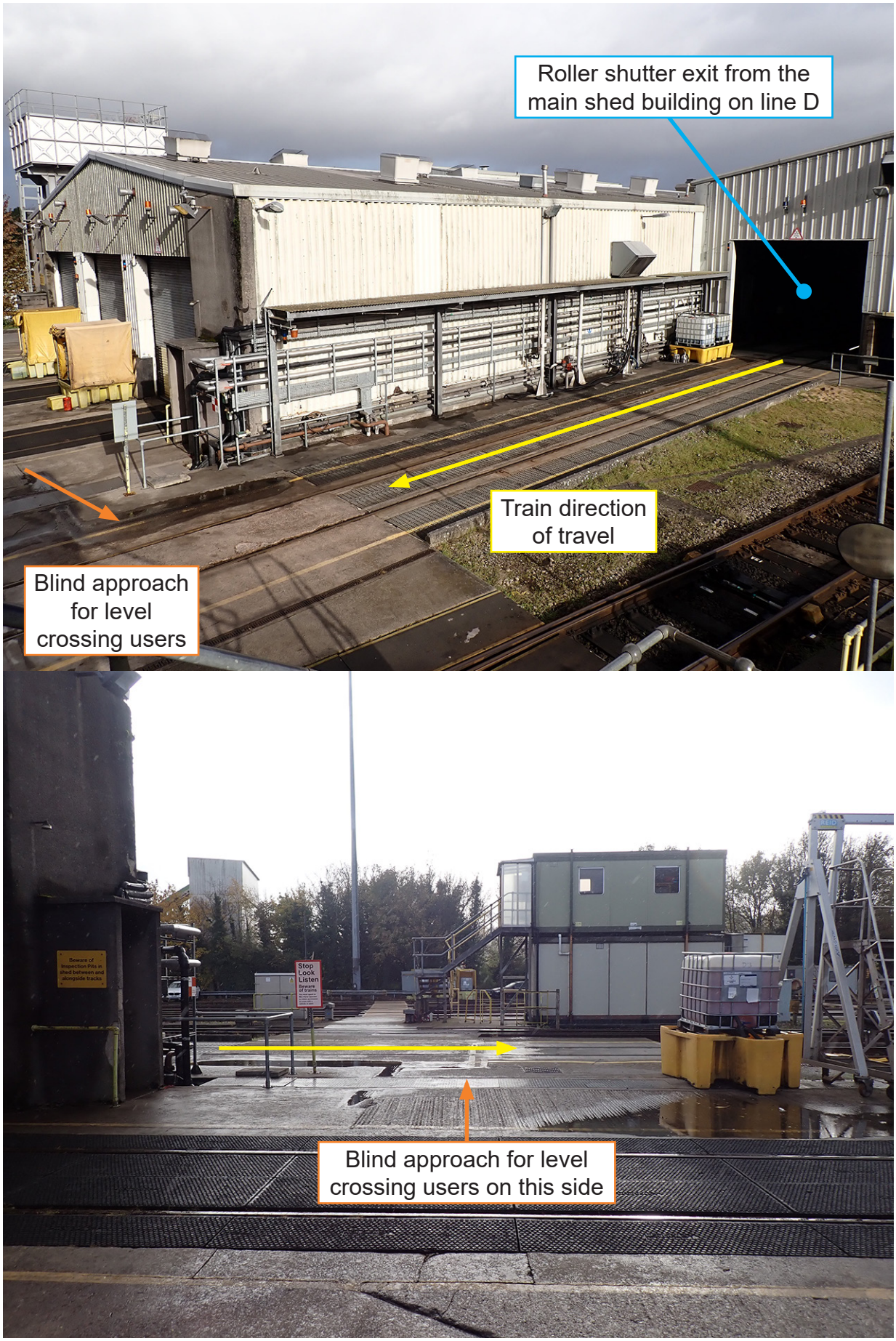

Figure 10: The blind corner at the end of the main shed building.

Walking routes and walkways on the depot

35 After exiting the shed via the roller shutter for line D, the shunter walked foul of the train's path when going to the level crossing.

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

a. The shunter wanted to check that no one was approaching the level crossing (paragraph 37).

b. The shunter used the area between the exit of the main shed building on line D and the level crossing as a walking route to reach the level crossing (paragraph 45).

c. The route taken by the shunter to the level crossing meant they had to walk close to or foul of the path of the train (paragraph 58).

d. The shunter was unaware that the moving train was catching up with them (paragraph 62).

Each of these factors is now considered in turn.

Level crossing checks

37 The shunter wanted to check that no one was approaching the level crossing.

38 The shunter wanted to get to the level crossing to stop any contractors, who might be approaching it from the blind side (figure 10), from walking out in front of the train that was about to pass. The shunter was aware that contractors were working nearby on line C, as part of a programme of work to install a new depot protection system (paragraph 22).

39 It was not a routine activity for the shunter to check for people approaching the level crossing from the side with very limited visibility when a train was moving out of the main shed building on line D. It was something that the shunter had been taught to do during their mentoring period when gaining their shunter competency, but was only to be carried out when they knew external parties were working on the depot. Outside of such times, the shunter expected that the staff permanently based on the depot would be aware that trains could approach from that direction.

40 The shunter believed that the depot drivers would be aware that walking up to the level crossing to check for potential users was something that the shunters sometimes did. However, the driver stated that they were unaware that shunters did this and could not remember ever seeing a shunter do it.

41 The need for shunters to check for users approaching the level crossing on its blind side was not something that the depot management had foreseen. This meant that when and how this check was done was ad hoc, with the depot CCTV showing different shunters adopting different practices. If the check was not being carried out when a train exited the main shed building on line D, shunters often stayed in the shed or by the roller shutter door. Every so often, when a shunter did carry out the check, they usually walked up to the crossing and waved the train out of the shed from there, although the shunter's role in controlling the movement had already ended by now. It had ended when the shunter gave verbal authority to the driver to start the movement out of the shed building (paragraph 23).

42 All shunters are required to follow the GWR professional shunting handbook. The handbook states it is designed to improve operational safety and performance and lists seven principles that shunters should apply during their work. One principle is to be risk aware by recognising and pre-empting operational risk throughout the railway. This is achieved by using professional judgement to perceive situations where risk is likely or present, then applying personal strategies to avoid incidents and accidents. More generally, throughout the handbook, it guides shunters to be proactive and anticipate risk. This aligns with the decision of the shunter to go to the level crossing to make sure the contractors were not about to cross in front of the train.

43 Another principle in the handbook is about accountability, with shunters being responsible for their actions and decisions. It also talks about personal safety, and, while this section does tell shunters to take care of their own health and safety and that of others, it is very general in nature.

44 As well as calling for compliance with the requirements of Railway Group Standard GERT8000[1] (more commonly referred to as the Rule Book), the shunting section in the handbook includes some specific requirements that cover shunting activities. These state that shunters must not walk alongside a moving train and that shunters should not cross a railway line unless there is at least 15 metres separation from the nearest vehicle on that line (the shunter was about 15 metres from the unit when they began to cross the track). The handbook does not mention anything about not walking ahead of a train that is about to move or one that has started to move. Similarly, there is no such requirement in Rule Book Module GERT8000-SS2, 'Shunting', issue 5.2 dated August 2021,[2] which covers shunting activities, or in the depot operating instructions for St Philips Marsh depot.

Walking route

45 The shunter used the area between the exit of the main shed building on line D and the level crossing as a walking route to reach the level crossing.

46 The shunter was used to walking in the area between the level crossing and the roller shutter door for the line D entrance into the main shed building. They had arrived that way earlier when they walked from their mess room to the unit to prepare it for its movement (figure 11). This way to the main shed building is shown as an authorised walking route on the general depot map (figure 12). It is also shown as one on the authorised walking routes map for the depot (figure 13). A copy of this map is used in the site induction presentation given to contractors working on the depot, indicating that this way into the main shed building is an authorised walking route.

[1] Railway Group Standard GERT8000, known as the Rule Book, describes the duties and responsibilities of staff, and the regulations in force, to ensure the safe operation of the railway. Copies of Railway Group Standards, Rail Industry Guidance Notes, and Rail Industry Standards can be obtained from the Rail Safety and Standards Board (RSSB) at www.rssb.co.uk.

[2] This issue was in force at the time of the accident.

Figure 11: Forward-facing CCTV image of the shunter walking along line D to get to the main shed building (courtesy of Great Western Railway).

47 GWR advised that, while this area was shown as an authorised walking route on its authorised walking route map, and repeated in the site induction, this was an error. It considered that only the area covered by the concrete apron for the level crossing, running across the end of the main shed building, is actually an authorised walking route. The driver held a similar view that this area was not an authorised walking route, which meant they did not expect anyone to be there when they were moving a train.

48 Depot engineering staff usually exit the main shed building at that end via a pedestrian door next to the roller shutter door for line C (figure 14). There is also a pedestrian exit next to the roller shutter door for line D (figure 14), which depot engineering staff could use, although management at the depot considered its use to be limited to that of a fire exit. The fence outside this pedestrian exit stops anyone coming through the door from going towards the adjacent Bristol Goods Avoiding line, but this also directs them towards the track for line D, which they can walk along to reach the crossing.

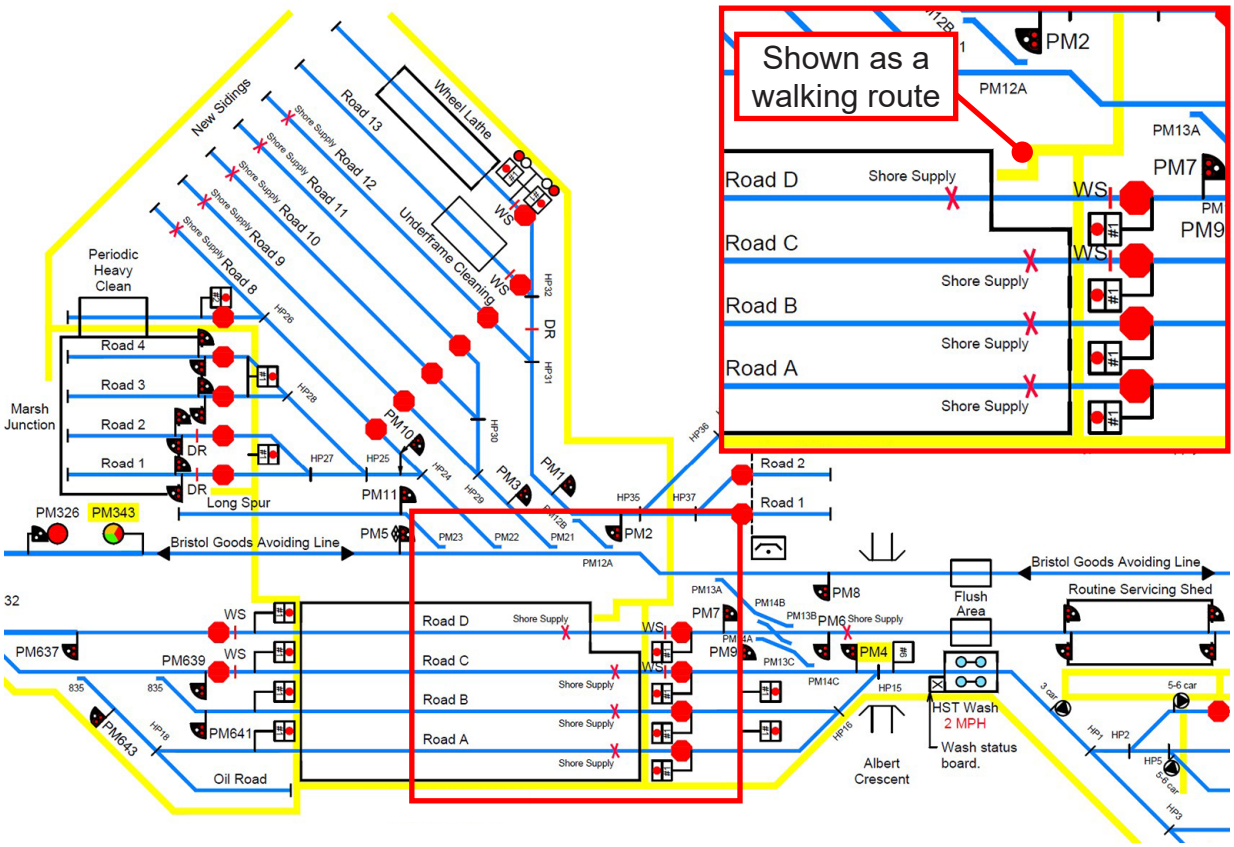

Figure 12: The depot map with the walking routes shown in yellow.

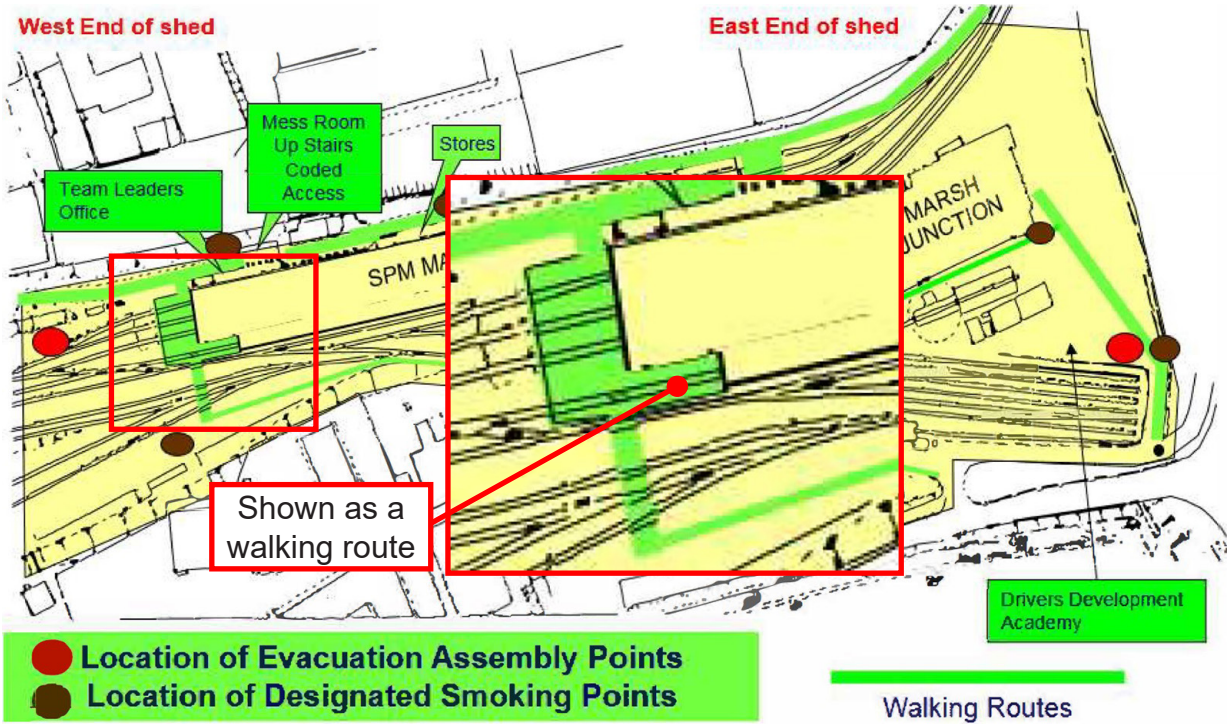

Figure 13: The authorised walking route map for St Philips Marsh depot with the authorised walking routes shown in green.

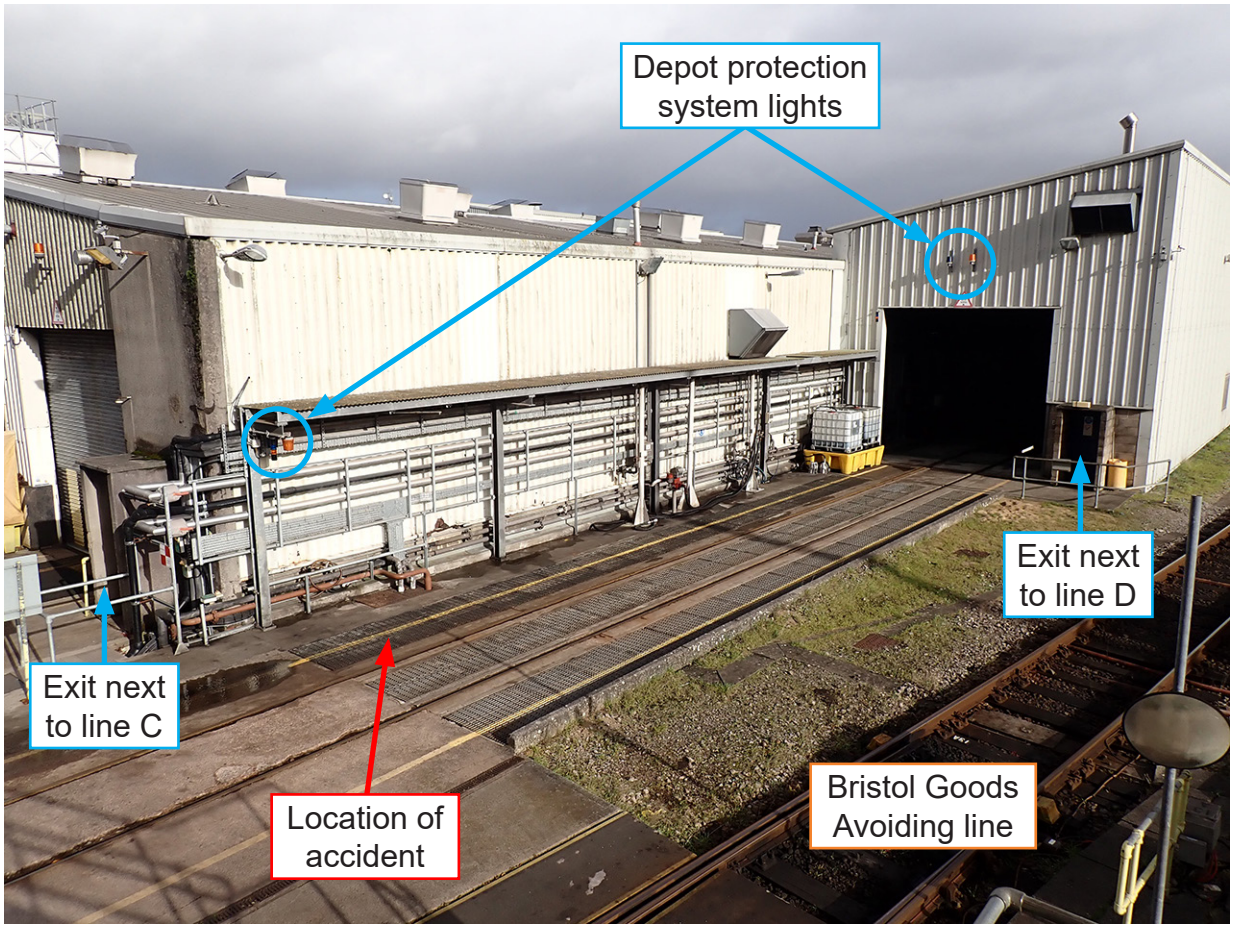

Figure 14: The pedestrian exits at the end of the main shed building (photograph taken after all but one of the intermediate bulk containers have been relocated).

49 Managers at the depot considered the outside area between the main shed building and level crossing along line D to be a walkway, rather than an authorised walking route. This meant that only staff in certain roles with specific competencies, like the shunter, could use it to access the main shed building. Depot management also considered this area to be an extension of line D as it ran through the main shed building, meaning that depot engineering staff could go into this area and work within it, provided they were working under the depot protection system that covered line D through the building. Figure 14 shows how the depot protection system extended to this area, with warning lights fitted to the outside of the main shed building.

50 The shunter also considered this area to be an outside extension of line D. They had worked in this area in their previous role (paragraph 13) under the depot protection system. In their current role, the shunter classed it as a walkway which they could use to get between the crossing and main shed building without the need to use the depot protection system. This was because they held a personal track safety (PTS) competency.

51 The purpose of PTS is to provide staff with an awareness of the rules and practices relating to their safety when on or about railway tracks. PTS holders are required to be trained and then pass an assessment of their knowledge every 2 years. As is usual for train operating companies, GWR has its own version of the PTS competency for its staff that need to go on or near railway lines. This closely follows Rule Book Module GERT8000-G1[3] which covers general safety responsibilities and personal track safety for non-trackworkers, such as drivers and shunters.

52 The PTS training given by GWR to its shunters followed an engineering training procedure rather than an operational training procedure, as this role fell within its engineering function. This procedure stated its purpose was to provide candidates with an understanding of PTS for when working on or off depots. The procedure also explained that one of the main objectives of PTS was to ensure candidates were aware of safe walking when on the railway. However, the training course stated that PTS was '*to keep persons safe from being struck or crushed by moving trains on the mainline, which is to a standard defined by Network Rail'*. Accordingly, the course material stated its aim was about being competent in walking on or near the line when away from a depot environment. This meant that the course content for safe walking when on or near the track was much more focused on what to do when out in a mainline railway environment, rather than when on a depot.

53 The engineering training for PTS did mention that authorised walking routes, if available, should be used when walking around the railway. These are designated pedestrian routes that provide staff with a safe way of going to and from a location on railway infrastructure. These authorised walking routes can follow a combination of public paths and roads, private paths and roads on railway land, plus purpose-built paths running alongside and across the railway. As they provide a safe way to get to a location, staff using them are not required to hold a PTS competency. However, anyone using an authorised walking route should have received information about using it beforehand, such as through a site induction. There was no reference in the PTS training material about where to find information on authorised walking routes. GWR stated that it expected its staff would know that this information was available on its company intranet.

54 The PTS competency allows its holders to walk on the railway away from an authorised walking route. However, there was very little information in the PTS training material about what to do in these situations, apart from a requirement to look up at least every 5 seconds when walking on the railway. The shunter was aware of this requirement but did not look back towards the train at any point when walking to the level crossing.

55 In line with the course content, the assessment questions for the engineering PTS training were also focused on knowledge associated with being on the operational mainline railway. There were no questions about going on the track or using the authorised walking routes within a depot environment.

[3] GERT8000-G1, 'General safety responsibilities and personal track safety for non-trackworkers', issue 9.1 dated November 2022.

56 Staff within GWR's operations function, which includes its train drivers, receive a different PTS training course. Their course includes much more information about walking within depots and using authorised walking routes. The training material was updated sometime in 2020 or 2021 to include more information for drivers about working and walking on depots. This was partly in response to a recommendation made by RAIB following the fatal accident at Tyseley depot (RAIB report 09/2020, see paragraph 129), and partly because GWR's PTS standard was updated following a planned review.

57 The assessment for the operations version of the PTS competency also includes questions about how to stay safe when on depots. These cover the requirements for crossing the track in front of trains, the common hazards when walking within and across the front of maintenance buildings, and where information on authorised walking routes can be found. Consequently, GWR provided much more information about working and walking on depots to its drivers than to its shunters. Its drivers are also assessed on their knowledge of this topic, whereas its shunters are not.

Shunter foul of the train's path

58 The route taken by the shunter to the level crossing meant they had to walk close to or foul of the path of the train.

59 Yellow lines are painted on the ground between the main shed building and the level crossing, on both sides of the track, to denote the safe area clear of the path of a train. At the time of the accident, these yellow lines were faded but still visible on the concrete sections of the walkway. The yellow lines should have continued onto the metal drainage grids running most of the distance to the level crossing, but GWR believed these lines had not been painted (figure 15).

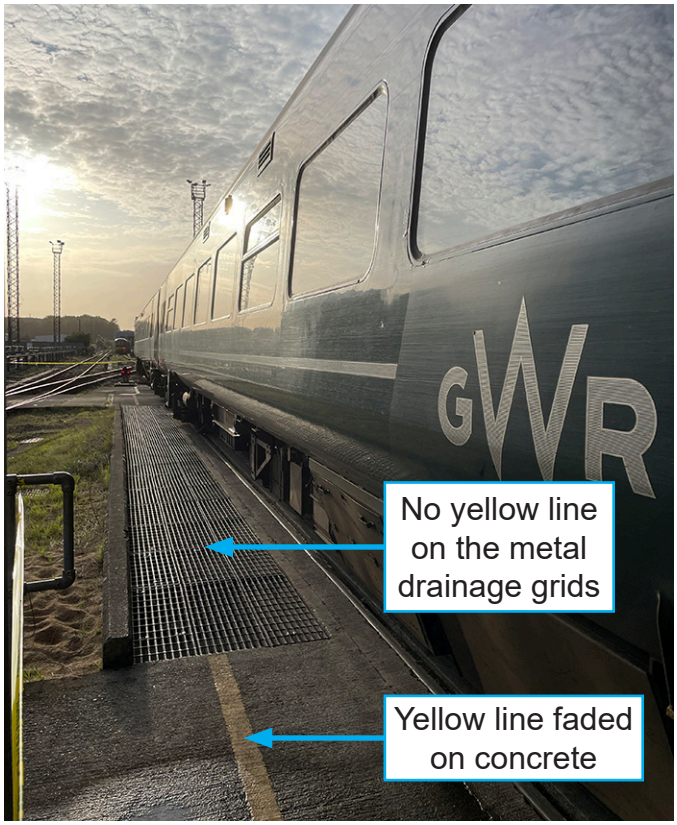

Figure 15: The faded yellow lines along the walkway.

60 The yellow lines are positioned 1 metre from the nearest running rail on each side. This is less than the minimum of 1.25 metres that PTS competency holders must be from a running line to be in a position of safety when a train is passing (for a railway line with a permissible speed of 100 mph (160 km/h) or less). On the left-hand side in the direction of travel, the raised kerb edging means the strip of walkway that the shunter could walk along on this side was limited to 0.45 metres wide (figure 16). Further to the left, the ground is unpaved and uneven, presenting a potential tripping hazard if walked on. This area is also adjacent to the Bristol Goods Avoiding line running through the depot.

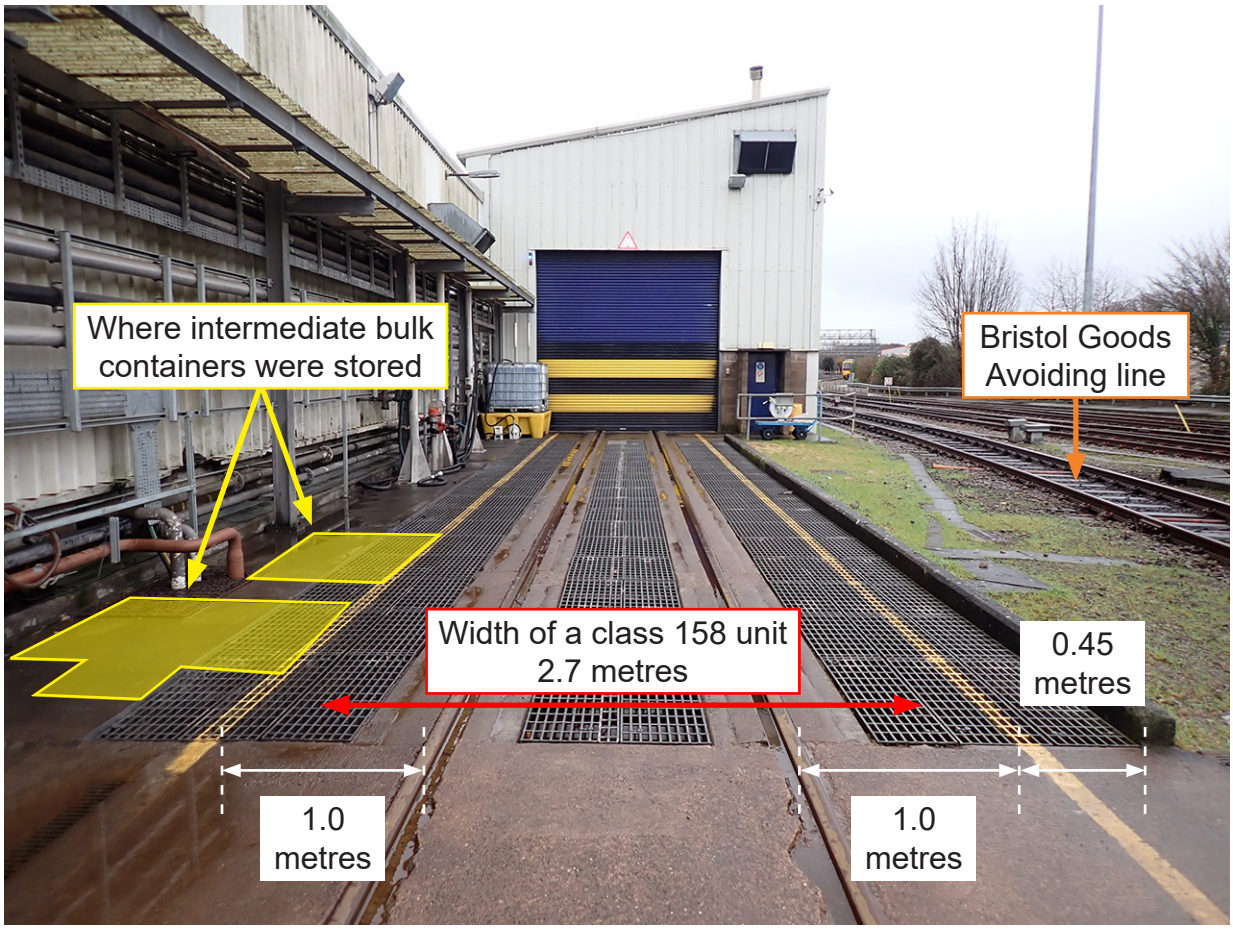

Figure 16: The layout of the yellow lines along the walkway (photograph taken after the lines have been repainted).

61 In places on the right-hand side in the direction of travel, the space to the outside of the yellow line was restricted at the time of the accident by five intermediate bulk containers that were used to store liquids (figure 9). This limited the available space (paragraph 33) and the shunter was walking next to two of these containers when they were struck. Therefore, the shunter had very little space on either side of the walkway in which to walk to the level crossing without being foul, or very close to being foul, of the train's path.

Awareness of the train

62 The shunter was unaware that the moving train was catching up with them.

63 The shunter did not hear the train start to move behind them, and only became aware of the train as it caught up with them. By then it was too late to move out of its way, as the shunter was in a place with a limited amount of space (paragraph 33).

64 The forward-facing CCTV footage from the train showed the shunter did not look back as they walked to the level crossing. The shunter was aware from their PTS training of the need to look for trains at least every 5 seconds when walking on the railway (paragraph 54). However, the shunter explained that they expected to reach the level crossing before the train did, as this was something that they had done before, so they felt no need to look back. It is also possible that the shunter did not look back as they were walking along a familiar depot walkway, rather than on or near a mainline railway, where trains can approach at much higher speeds.

65 The shunter believed that their walking pace meant they would reach the level crossing before the train did. Analysis of the CCTV footage shows the shunter was walking at an average speed of about 2.7 mph (1.2 m/s). When the train began moving, the shunter had about 16 metres further to walk to get to the level crossing and be clear of the train, which at their average walking pace would have taken 13.3 seconds.

66 The train needed to travel about 30 metres to reach the level crossing. Data recorded by the OTDR shows the train travelled at an average speed of 6.3 mph (2.8 m/s) from the start of the movement to the collision occurring, which meant that it caught up with the shunter before they reached the crossing (see paragraphs 70 to 85). If the train had moved at an average speed of 3 mph (1.3 m/s), which RAIB found from OTDR data was a typical speed for a train movement within a shed building, the shunter would have been at the level crossing about 9 seconds before the train. At an average speed of 5 mph (2.2 m/s), the speed limit for the lines leading away from the main shed building (paragraph 6), the shunter would have arrived at the level crossing just before the train.

67 The shunter did not hear the train when it started to move, which also meant they did not look back towards it. The train's horn was not sounded when the train started to move because there was no requirement for the driver to do this when setting off out of the main shed building. Rule Book Module SS2 only requires trains to sound a warning when entering a shed or building.

68 The depot operating instructions includes a section which covers environmental considerations at the depot, including noise. This section provides an authorisation, which is permitted by Rule Book Module SS2, not to sound the horn when entering a shed building, subject to two conditions being met. One is that the driver stops the movement at the entrance and only proceeds when authorised and it is safe to do so. The other condition is that the depot protection must be operating.

69 The section of the depot operating instructions on environmental considerations does state that '*drivers must use the warning horn as described in the Rule Book*' but also explains that '*unnecessary sounding of the warning horn is to be avoided*'. As the driver did not see the shunter walking ahead of the train, they did not sound the horn to warn them (see paragraph 86).

Train speeds on the depot

70 The train exceeded the speed limit after the shunter had given the train's driver permission to move.

71 The sectional appendix[4] shows that the railway lines leading off the Bristol Goods Avoiding line, which go into and out of the shed buildings and sidings at the depot, have a speed limit of 5 mph (8 km/h).

72 Rule Book Module SS2 does not specify a speed for shunt movements. This level of detail is instead found in the section of the depot operating instructions which covers speed limits on the depot. This states that all rail vehicle movements must be carried out at caution subject to a maximum speed of 5 mph (8 km/h) and be able to stop short of any train, vehicle or obstruction.

73 The depot operating instructions also state when further restrictions are to be applied. These include a requirement that drivers must proceed at extreme caution, when entering, leaving and moving within shed buildings. It states these movements must be at a speed below 5 mph (8 km/h) that is appropriate to the prevailing risk. These restrictions also require a shunter to be in position at the entrance of the shed building who must control the movement and ensure the safety of staff in the vicinity. GWR clarified to RAIB that this only applies to trains entering a shed building.

74 GWR stated there is no prescribed speed limit once a train is inside a shed building. However, GWR explained that it expected that movements into, within and out of shed buildings would be carried out at '*extreme caution*', so much slower than 5 mph (8 km/h). The depot map (figure 12) included an annotation that stated that the maximum speed inside a shed building should be 3 mph (5 km/h) but GWR explained that this was not an official instruction.

75 RAIB found no instructions or guidance on exactly when the expected speed limit changed from '*extreme caution*' to 5 mph (8 km/h) during a movement out of a shed building. The driver was unsure about when the speed limit changed but their understanding was that most drivers increased their speed once the front cab of their train was outside the shed building. The shunter's view, based on their experience, was that trains would accelerate to 5 mph (8 km/h) once the front end was outside. Managers from GWR's operations function also agreed that the speed limit changed when the front cab exited the building. The rationale for this was the depot protection system was in operation which meant everyone inside the shed building should be clear of the train and know that it was moving by this time.

76 During this accident, the OTDR recorded that the train was travelling at greater than 3 mph (5 km/h) within 2 seconds of the train starting to move. After 4 seconds, the train was recorded at a speed of 6 mph (10 km/h), when the front cab was still inside the shed building. The train's rate of acceleration, which was in response to the driver moving the traction handle to notch six, meant it caught up with the shunter about 9.5 seconds after it started to move. The train reached a maximum speed of 11 mph (18 km/h), which was recorded for 0.5 seconds over a distance of 3 metres, shortly before it struck the shunter. At this time, the rear part of the leading vehicle was still inside the main shed building.

[4] An operating publication produced by Network Rail that includes details of running lines, permissible speeds, and local instructions.

77 When assessing driver compliance with speed limits on its depots, GWR defines a driver as speeding when the train speed is 3 mph (5 km/h) or more above the permissible speed (this increases to 4 mph (6 km/h) or more for movements on main running lines). This means GWR classifies a train as speeding in the shed buildings or sidings in the depot when its speed reaches 8 mph (13 km/h). This margin over the permissible speed is to allow for some differences in the readability of the speedometer, which can vary depending on the driver's height and viewing position. It also allows for any minor differences in the speed displayed by the speedometer and speed as recorded by the OTDR.

78 GWR told RAIB that it believed that drivers should be able to read the speedometer accurately enough to know when their train was moving at 5 mph (8 km/h). The speedometer fitted to unit 158771 had major markings in 10 mph (16 km/h) increments, along with minor markings at intermediate 5 mph (8 km/h) increments (figure 17). Maintenance staff tested the speedometer in the leading cab after the accident, in 10 mph increments from 0 to 100 mph, and no fault was found with the readings it displayed.

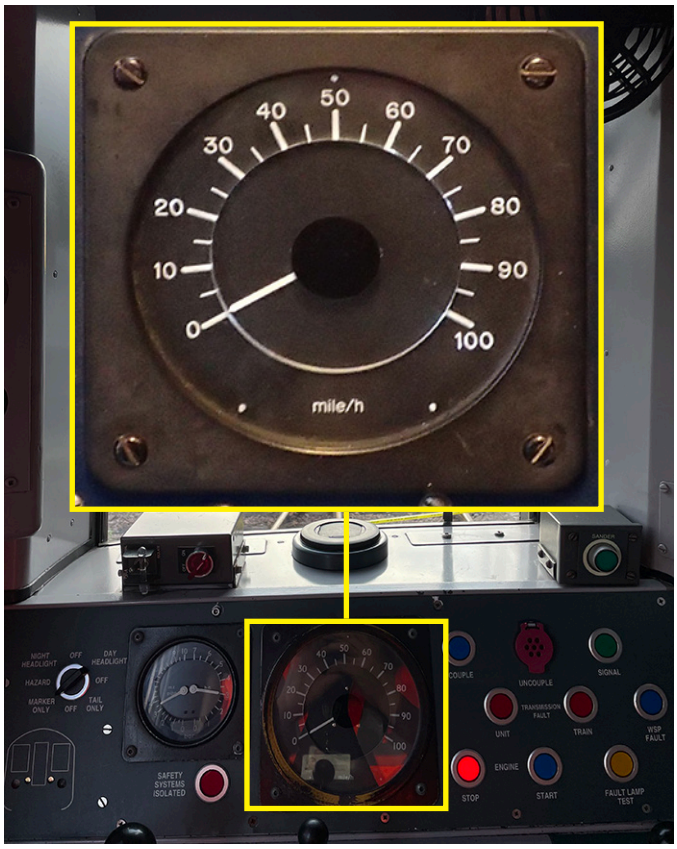

Figure 17: The speedometer in the leading cab of unit 158771.

79 The driver stated that they did not know they were travelling as fast as they were. The driver knew what the permissible speed was and stated that they would try to keep to 5 mph (8 km/h) as much as they could but explained that they found this was difficult to do when starting a movement out of a shed building. After starting a movement, to know when to move the traction handle to off and start coasting, the driver stated that they tended to judge their speed by observation just as much as they did by looking at the reading displayed on the speedometer. The driver acknowledged they must have misjudged their speed when leaving the shed building, which they explained was due to their focus being on the level crossing ahead of them, although they did not observe the shunter walking ahead of the train when looking ahead (see paragraph 86). The driver was also aware that the contractors were working nearby so was watching out in case one of them walked out from the blind side of the crossing.

80 The driver explained that, based on their experience, they needed to apply a high traction notch (up to notch five or six) to get a class 158 unit to move and that this then made it harder to drive these units at slow speed. The driver described these units as being 'sluggish' in traction notch one and how they often would not move in a low traction notch, so the driver tended to select a higher traction notch when starting a movement. The OTDR recorded that the traction handle was moved from its off position to notch one and then through to notch six in less than a second, suggesting that the driver had decided to select a high traction notch to move the train.

81 OTDR data recorded by another class 158 unit that the driver had driven on the depot 4 days before, shows a very similar driving style. This data shows the unit was initially driven using traction notch three to set off, before accelerating up to a maximum speed of 7 mph (11 km/h) and then stopping (based on the previous movements this most likely placed the unit on the West End Spur line before PM6 signal). When the driver continued the movement about 2.5 minutes later, they initially selected traction notch six to accelerate quickly to 8 mph (13 km/h) before coasting. The first 130 metres of this movement was on the West End Spur line, so travelling at 8 mph (13 km/h) on this line met GWR's definition of speeding (paragraph 77). The train then continued at 8 mph (13 km/h) onto the Bristol Goods Avoiding line, which was below the permissible speed for this line (paragraph 6).

82 Once on the Bristol Goods Avoiding line, the driver then moved this unit twice, both times only for a short distance, before making a third movement to depart the depot and take the unit to Bristol Temple Meads station. When starting each of these movements, the driver initially selected traction notch five. This indicates that the driver appears to have developed a driving style for this type of unit where they used a high traction notch, so accelerated quickly, before then selecting a lower traction notch, coasting or braking, even when only moving short distances. This driving style, using traction notch five or six to accelerate quickly, was the same as seen when the accident happened.

83 Although there was no evidence that the driver was directly under any pressure from anyone to move the unit, they were conscious that a driver colleague was waiting to move the other unit into the shed building (paragraph 18). This meant the driver wanted to complete their train movement, to be out of the way of this other movement. The MPO had also tasked the driver, with the message passed via the shunter once the driver had got to the train, to prepare the unit so that it would be ready to go into service later that day. The driver was to do this once they had taken the unit to the New Sidings, and this meant the driver also wanted to get to the sidings to complete this task. It is possible that this desire to complete the movement may also have contributed to their decision to quickly accelerate the train.

84 GWR stated that it considered the way the class 158 unit was driven was not consistent with best practice for train handling. For starting movements on a main running line from a stand, the view of staff from within its operations function was that the movement should start in traction notch three at most. For slow speed movements on a depot, GWR expected its drivers to only use traction notches one or two. This would mean the unit's rate of acceleration is much less, and, in turn, the train's speed is easier to control.

85 This view expressed by the staff in GWR's operations function aligned with the professional driving technique as described in its fleet driver manual for class 158 units. The manual, dated 2007, was used as a basis for training GWR's drivers on how to handle class 158 units. It stated that, when starting away, drivers should select traction notch one or two depending on engine response and gradient, or greater only if absolutely necessary. Only once the train starts to move should traction notch three then be selected by the driver. The driver's competency records show they were passed as competent to drive class 158 units in 2013. Their training and ongoing assessments were based on the manual so they would have been familiar with its contents. However, their experience of driving these units meant they would select a much higher traction notch when starting away (paragraph 80).

Visibility of the shunter

86 The driver did not observe the shunter walking ahead of the train and hence did not take any appropriate actions in response.

87 Sightlines from the driving position in the cab of a class 158 unit are more restricted to the right (in the direction of travel). This is because the cab is set on the left-hand side with the width of the windscreen limited by the gangway end (figure 5), which allows staff and passengers to move between units when two or more units with gangway ends are coupled together. The gangway end curtain extends from the centre at the front, which further reduces the field of view to the right (figure 5). RAIB measured that when a person is 8 metres or less from the front of the unit, standing in the cess on the right-hand side of the unit in the direction of travel, they are no longer visible from the driving position (figure 18). A person is partially visible between 8 and 10 metres away, and fully visible once more than 10 metres away (figure 18). RAIB also measured that when a person is closer than 4 metres from the front of the unit, they are not visible from the driving position. This occurs even when the person is standing directly in front of the unit on the driver's side, as they are hidden by the cab desk.

Figure 18: View from the driving position on a class 158 unit.

88 When the driver moved the traction handle away from the off position, the shunter was inside the shed building, on the left-hand side, not far from the front of the train. It is likely that at this time only the upper half of the shunter would have been visible to the driver. When the driver completed moving the traction handle to notch six about 0.8 seconds later, the shunter had started moving, on the left-hand side, towards the open roller shutter door. As the shunter had now moved further away from the front of the train, directly ahead of it on the driver's side, a greater part of them would have been visible to the driver.

89 After the driver had demanded traction, the train did not move for about 4 seconds. The class 158 unit is fitted with an engine under each vehicle that drives both axles on the inner bogie via a two-speed hydrokinetic transmission. This converts the mechanical energy provided by the engine into the kinetic energy of a fluid. It takes time to do this, which the GWR operations team stated is normal. The fleet driver manual for class 158 units (paragraph 85) notes that when the transmission is fully engaged the engine speed falls, which is when the brakes should be released. During the time taken for the unit's transmission to respond to the driver's traction demand, the shunter had walked out of the roller shutter door, so was about 9 metres from the front of the train.

90 The position of the shunter, as they walked from the roller shutter door towards the level crossing, is shown in a series of figures in appendix C. These figures also show the relative position of the train and the driver's likely view of the shunter. It can be seen from these figures that during the first 4 seconds, after the driver had demanded traction at 13:01:01 hrs to the train starting to move at 13:01:05 hrs, the shunter was in a position that was visible to the driver. During the first 5 seconds of the train's movement, from 13:01:05 to 13:01:10 hrs, the shunter was still in a position that was visible to the driver, albeit they were now towards the right-hand side of the windscreen. Between 13:01:10 to 13:01:13 hrs, the front cab exited the main shed building and the train's speed increased to 10 mph (16 km/h), at which point the driver had moved the traction handle to the off position. During this time, the position of the shunter in the driver's view would have moved both lower down and further to the right-hand side of the windscreen. It is likely that the shunter was no longer visible to the driver by 13:01:12 hrs and the train caught up with the shunter and struck them about 2.5 seconds after this.

91 This analysis shows that, after the driver demanded traction in notch six, the driver had an uninterrupted view of the shunter for 9 seconds. However, the driver stated that they were unaware of where the shunter was throughout the movement out of the main shed building. The driver explained that their attention was focused further ahead on the level crossing during the movement (paragraph 79).

92 Once the driver had authority from the shunter to begin the movement, the shunter's role in the movement ended. That meant there was no requirement for the driver to look for the shunter to receive hand signals on when to start or stop. The driver also did not expect to see the shunter as they thought they might have gone to check the position of a set of hand points. This was the normal thing for a shunter to do when a train was going from the shed building onto the line towards the carriage washer (figure 3). This was because the driver expected to go towards the carriage washer and set back behind PM4 signal. However, the train was routed to go to the West End Spur line and set back behind PM6 signal instead. There was space for it to stop between PM6 signal and the class 166 unit that was waiting to move into the main shed building. As the driver had seen the other train waiting on the West End Spur line, they had assumed they were going towards the carriage washer. However, this route was blocked to train movements due to the contractors working on the new depot protection system. As well as possibly explaining why the driver was unaware of the shunter, this also shows the driver and shunter had not come to a clear understanding about the details for the train movement.

93 The driver also noted that the train was ready to move as soon as they arrived and got into the cab. The driver explained that they would normally start the engines and carry out their checks while they waited for the air compressor to replenish the train's air supplies. However, as the shunter had already started the unit's engines (paragraph 20), this meant the driver did not go through their usual routine to orientate themselves to the driving task, and it is possible that their attention was focused on checking the cab desk gauges and indications when the train first started moving. Subsequently, the driver would not have observed the shunter when they were walking directly ahead of the train. If the point at which the driver had completed these checks and then started focusing their attention ahead towards the level crossing had coincided with when the front of the train had exited the shed building, it is likely that the driver would not have observed the shunter. By this time in the movement, the shunter was in a position that was much less visible to the driver (paragraph 90).

94 Although the short amount of time between arriving at the train and it being ready to move off may have resulted in the driver being less focused on their surroundings before setting off, shunters on the depot had been trained to start the engines on units since March 2018. GWR had introduced this practice to reduce the amount of time drivers spent waiting for trains to be ready to move, particularly the class 165 and 166 units which are known by GWR to lose air quite quickly once the engines are shut down. The shunter was trained and passed out as competent to carry out this activity in May 2022 as part of their training. The shunter said starting the engines on a unit was something that they routinely did.

95 As this practice had been in place for about 5 years, it is likely that the driver had experienced arriving at a train with its engines already running many times before. One of the driver's practical assessments that took place in 2021 recorded how the driver had gone to move a class 158 unit that already had its engines running.

96 RAIB also considered a number of other potential reasons for the driver not observing the shunter including fatigue and distraction due to personal issues or mobile phone usage. However, no evidence gathered by RAIB during its investigation indicated these factors were present.

97 The driver was screened for drugs and alcohol after the accident and declared ahead of their test that, about 15 hours before, they had taken an over-the-counter medicine that contained a 10 mg dosage of codeine. The driver had taken this medication in the past outside of work and had never suffered any side effects. As they had felt fit for duty that day, the driver had not declared taking this medication to GWR before starting their shift. RAIB found that occupational advice for employees taking medication that contained codeine varied. One occupational health provider recommended an eight-hour period of restriction from safety-critical duties after taking the medication. This amount of time had already passed. Another provider recommended that the driver should be accompanied at all times when carrying out safety-critical duties during the following 48 hours. They could then be permitted to resume duties if they had not experienced any side effects during this time. Due to the medication's relatively small dosage, the time passed since the driver had taken it, and the driver reporting no side effects, RAIB considers it highly unlikely to have played a part in the accident.

Identification of underlying factors

Risk controls for train movements

98 GWR had not effectively controlled the risk of a shunter being struck by a train movement outside of a shed on its depot infrastructure.

99 When RAIB first asked GWR about how it had assessed the risk of a shunter being struck by a train, it provided its depot protection risk assessment for St Philips Marsh depot, reference SMS-1875-21, issue 7a. The only hazard in this risk assessment relevant to this accident related to a person being struck by a train while working on a vehicle or infrastructure. Consequently, many of the identified risk controls were focused on the correct use of the depot protection system, which provided an audible warning to warn anyone nearby when a movement was taking place. It also warned staff when a movement was going to take place by flashing orange lights above the affected line. At other times when no train movements were taking place, the lights above a line would be a steady blue.

100 Some of the other control measures listed in the risk assessment for this hazard were more relevant to this accident. They included a requirement that movements were controlled by competent shunters in accordance with the depot operating instructions, that high-visibility clothing should be worn and that train movements should be carried out at low speeds of less than 5 mph (8 km/h).

101 GWR scored this hazard as 3 for likelihood (on a scale of 1 being rare to 5 being regular) and 4 for severity (also on a scale of 1 being negligible to 5 being severe), giving a risk score of 12. This meant GWR considered these activities to be high risk with further action required. The risk assessment then identified further actions that were required to control the risk. These included briefings on the depot protection procedure, assurance activities to check adherence to the depot protection procedures including daily checks, plus checks that the depot operating instructions were being complied with. These extra actions changed the hazard scores to 2 for likelihood and 4 for severity, giving a residual risk score of 8. This meant the hazard was now classified by GWR as a medium risk which it could tolerate. In addition, GWR had to continue to monitor these risks to ensure they did not increase over time, due to changes in the task or environment.

102 While this risk assessment was detailed and controlled the risk to engineering staff who might be working on a train in the main shed building, its scope did not extend to a person being struck by a train during a shunting movement into or out of a shed building. Therefore, GWR had not assessed or controlled the specific risk to shunters in these circumstances, when a train was permitted to move.

103 GWR subsequently provided RAIB with a risk assessment for generic shunting tasks, reference SPM SH 01, which was dated December 2008 and last reviewed in January 2020. There were three hazards in this risk assessment that were relevant to this accident which were:

- hazard 1, moving vehicles, which was marked as relevant to GWR staff, contractors and visitors
- hazard 5, run over by a vehicle, which was marked as only being relevant to shunters
- hazard 10, vehicle speed, which was marked as only being relevant to shunters.

104 There were various control measures recorded for each of these hazards. Control measures common to all three hazards included compliance with procedures for the competence of shunters, compliance with depot speed limit and following Rule Book Module SS2. Most relevant to this accident was hazard 5, which included further control measures such as procedures for the competency management of staff undertaking operational duties, walking routes, high-visibility clothing, and limited clearance signage. With these control measures in place, this hazard was scored 1 for likelihood and 3 for severity, giving an inherent risk score of 3.

105 This risk score meant the hazard was assessed by GWR as being low risk, so no further controls were required. Unlike the depot protection risk assessment, this assessment considered that no activity had a severity rating of greater than 3, which GWR defined as moderate. This equated to an injury resulting in a broken or fractured major bone, which matched what happened in this accident. However, under slightly different circumstances this and other similar accidents could result in one of the higher severity categories of 4 (major, resulting in amputation or permanent disability) or 5 (severe, resulting in a fatality).

106 The effectiveness of GWR's control measures for this hazard, in the context of this accident, was considered by RAIB as shown in table 1.

GWR control measure	RAIB analysis of effectiveness based on evidence gathered in this investigation
Procedures for the competence of shunters.	None of the training, mentoring or assessment for shunters specifically referred to not walking ahead of a moving train or a train that was about to move (paragraph 35).
Procedures which cover the competency management of staff undertaking operational duties.	The shunter's competency management assessments did not identify any issues with how the shunter worked or any unsafe practices such as walking ahead of moving trains (paragraph 13). The checks carried out for speed compliance under the driver's competency management assessments also did not identify any issues (paragraph 12).
Rule Book Module SS2.	There were no specific rules in Rule Book Module SS2 about not crossing in front of stationary trains or not walking ahead of, or keeping clear of, moving trains.
Depot speed limit.	This would have been effective, but the speed limit was not complied with (paragraph 70) and this was not detected (see paragraph 109).
Walking routes.	Where the shunter walked was not an authorised walking route, although various GWR documents showed it as such (paragraph 46). It was considered by GWR to be a walkway, so could be used by PTS holders such as the shunter. However, the driver did not know this and so was not expecting anyone to be there when a train was moving (paragraph 47).
High-visibility clothing.	Appropriate high-visibility clothing was worn by the shunter (figure 11), but they were still not seen by the driver (paragraph 86).
Limited clearance signage.	Signage was in place at either end of the walkway to indicate that it was a limited clearance area (figure 19), so a PTS competency holder would know there was no position of safety (paragraph 60) on that side of the track for the length of the structure. The intermediate bulk containers stored on that side further limited the available space on the side where the shunter was struck (figure 9).

Table 1: Effectiveness of the control measures for the hazard of being run over by a vehicle.

Figure 19: The limited clearance signage at each end of the walkway.

107 After the accident, GWR updated its depot protection risk assessment to issue 7b, to explicitly cover the risk of a shunter being struck by a moving train. A new hazard for persons in control of movements, a shunter, being struck by a train was added. The proposed control measures for the new hazard were:

- Shunters are trained and assessed as competent to Rule Book Module SS2, the GWR Appendix to the Rule Book, the depot operating instructions and PTS.
- Train movements are carried out at low speed, less than 5 mph (8 km/h).
- A clear understanding of the movement is required between the driver and shunter before any movement takes place.

108 The resultant risk was scored as 5, based on a severity of 5 and likelihood of 1. In terms of the control measures, RAIB notes that none of the documents listed in relation to shunter competency specifically cover the use of walking routes or walkways, or require a shunter not to walk ahead of a moving train or one that is about to move. Compliance with a low speed limit of less than 5 mph (8 km/h) is likely to have been effective, but it was common practice for trains to accelerate to 5 mph (8 km/h) once the leading cab had exited the main shed building (paragraph 75). A clearer understanding between the shunter and driver, with the driver being aware that the shunter was walking ahead to the level crossing, is likely to have prevented this accident.

Assurance for compliance with speed limits

109 GWR's assurance processes had not identified that train movements within the depot were exceeding the defined speed limits.

110 The driver was classified as a depot driver under GWR's competency management system. This meant they were subject to the following schedule of assessments over a three-year cycle:

- three practical assessments each year by a driver manager (nine during a three-year cycle)
- one unobtrusive assessment each year, carried out by a driver manager but without the driver's knowledge (three during a three-year cycle)
- one simulator-based assessment during the three-year cycle, which was for assessing the driver's competency for the more unusual or out-of-course scenarios that would not normally be seen during the other assessments (such as emergencies or failures).

111 The driver's knowledge of the different classes of diesel multiple unit that they were competent to drive was covered in each three-year cycle by the driver manager planning a practical assessment that covered each one. The driver's last assessment that included driving a class 158 unit was on 7 August 2022. This assessment recorded that the driver adhered to the depot speed limits, but no information was recorded about what traction notch was used by the driver when starting the movement.

112 The driver's knowledge of the routes that they were competent to drive over was limited to within the depot and the two routes between the depot and Bristol Temple Meads station (figure 3). This made it straightforward for driver managers to observe the driver working trains over these routes during the practical assessments.

113 GWR uses an electronic system to manage the competence of its operational staff such as drivers. Records on this system showed that all the driver's assessments were up to date. There were no significant issues recorded for any of the criteria used for the driver's assessments.

114 The criteria followed by the driver managers when carrying out unobtrusive assessments for mainline drivers would typically require them to download the OTDR for a journey and review the driver's performance over a continuous one-hour period of driving. However, records shows that unobtrusive assessments carried out by the driver managers for depot drivers tended to be visual only and did not include reviewing OTDR downloads. Notes recorded by the driver managers for these assessments show that driver managers would usually judge the train's speed from observations on the ground or they would travel in the rear cab and look at the speedometer.

115 GWR reported that it was difficult to do an OTDR download review for a depot driver as typically they would drive many different units during a shift, requiring multiple downloads to be taken. Also, each unit tended to only be driven for short distances and a small amount of time. GWR also found that drivers were not always entering their personal identification number into the OTDR interface when making short movements, which made it difficult to identify which drivers had carried out which movements.

116 GWR also acknowledged it was difficult for driver managers, who are based elsewhere, to get onto a depot to carry out an unobtrusive assessment for a depot driver without the driver being aware that they were there. This was because driver managers had to abide by the usual depot rules, such as signing in. Witness evidence suggests that drivers would normally be aware when a driver manager was on the depot.

117 To address this issue with the unobtrusive assessment of depot drivers, GWR required its driver manager teams to undertake random OTDR downloads from a mixture of unit classes at each of its maintenance depots on at least four occasions per year. A driver manager should then analyse these OTDR downloads to assess the general level of compliance at the depot across a random selection of depot drivers. If any areas for concern were identified, then the driver manager team was required to arrange for specific monitoring to take place as appropriate. However, RAIB found that these random downloads had not been taking place at St Philips Marsh depot.

118 This requirement for random OTDR downloads at depots was introduced by GWR about 3 years ago when it created a new depot driver grade on its competency management system. This grade was primarily created for new employees who were specifically recruited to be depot drivers. Previously, depot drivers tended to be mainline drivers who were restricted to this role due to either involvement in incidents or for personal reasons. These drivers used to be assessed by following the same process as when they had driven trains on the mainline. By continuing to follow the same competency requirements, these drivers could potentially return to mainline driving duties at some point in the future. Consequently, driver managers were randomly downloading and analysing OTDR records for these depot drivers as part of their assessment schedule until about 2020.

119 However, when it introduced its new depot driver grade, GWR decided that all of its depot drivers would have their competency assessed the same way and that only visual unobtrusive assessments would be carried out for this grade. As this meant none of its depot drivers would be subject to individual assessments that used OTDR downloads, GWR instead introduced a requirement to carry out a random selection of four OTDR download checks at each depot every year.

120 After the accident, it was found that some driver manager teams were doing the random OTDR download checks at the depots they covered, but other teams were not, including the team that covered the depot drivers at St Philips Marsh depot. GWR stated that it believed that this new requirement was not briefed out very well, so its application had been inconsistent. This was then missed by GWR's assurance activities.

121 The depot management at St Philips Marsh depot also carried out compliance checks every 2 weeks that followed a pro-forma checklist. These checks included an item to observe the speed of train movements, but these observations were limited as they relied on the judgement of the person carrying out the check to assess a train's speed. There was also an item on the checklist to review random OTDR downloads. While engineering staff at the depot have the equipment to download a train's OTDR, this item was marked as not applicable on every completed checklist because the depot management did not have the skills needed to analyse an OTDR download.

122 In summary, no one from either GWR's operations or engineering functions was checking random OTDR downloads to confirm that depot drivers at St Philips Marsh depot were complying with speed limits.

123 When the OTDR for unit 158771 was downloaded after the accident, RAIB found that it included data recorded for journeys going back to 11 September 2023. GWR provided information that showed where this unit had been throughout this time. From this, RAIB identified three other occasions when this unit had been on St Philips Marsh depot overnight. The OTDR data for the unit's movements onto, within and off the depot during these visits was analysed.

124 RAIB found that on each of the three nights, the unit made seven movements. Out of this total of 21 movements, 6 speeding events were identified. This was 29% of the total, with at least one speeding event each night. The OTDR recorded two movements that took place at 10 mph (16 km/h) instead of 5 mph (8 km/h) when the unit went from line D of the main shed building into Victoria Sidings. One movement out of Victoria Sidings was recorded at 10 mph (16 km/h) instead of 5 mph (8 km/h) before the unit stopped. When the next movement started, the unit travelled into the New Sidings at 9 mph (14 km/h), again above the 5 mph (8 km/h) limit. There was another movement at 8 mph (13 km/h) on the West End Spur line. There was also one movement recorded within the main shed building along line D which took place at 6 mph (10 km/h), instead of the required speed of much slower than 5 mph (8 km/h).

125 RAIB's analysis of the OTDR from unit 158771 showed that the unit was much more likely to travel at 5 mph (8 km/h) when traction notch three or below was selected when setting off. When traction notch four or above was selected, the unit accelerated at a greater rate and then tended to travel at a speed of between 7 mph (11 km/h) and 10 mph (16 km/h). This matched the data recorded by the OTDR on another class 158 unit that the driver had moved within the depot on 22 September 2023 (paragraph 81).

126 The OTDR data recorded by these class 158 units shows that some drivers were regularly selecting traction notch five or above when starting a movement with this type of unit on the depot, so accelerated quickly. This made these drivers prone to exceeding the 5 mph (8 km/h) speed limit by the time they stopped demanding traction and began to coast. Had GWR been carrying out random OTDR downloads and analysing the data, it might have identified train handling issues with some of its drivers and taken corrective actions.

Previous occurrences of a similar character

127 GWR provided details of four incidents that had happened at St Philips Marsh depot in the past 5 years. These were two collisions, a derailment and a train that passed a red signal and damaged a set of points. None of these incidents involved a train that was travelling faster than the permissible speed on the depot. GWR had no records of any other incidents on the depot that involved trains speeding, nor any other incidents or accidents that involved a member of its staff being struck by a train on the depot. There were no reported near miss incidents involving a shunter. Only one incident was found that involved a shunter, which had happened in 2018, when a shunter alighted from a moving train at the depot.

128 RAIB identified two previous investigations that were relevant to this accident. Both involved a member of staff being struck by a train in a siding or yard. The first accident happened in September 2018, when a freight train that was entering Dollands Moor freight yard collided with a shunter who was sat stationary on a small petrol-powered buggy on a level crossing (RAIB report 05/2019). The train driver was unaware of the buggy until shortly before the accident and was unable to avoid a collision. The shunter on the buggy attempted to jump clear but suffered life-changing injuries. RAIB's investigation identified that the safety management of work activities within the Dollands Moor yard was inadequate.

129 The second accident happened in December 2019, when a driver became trapped between two trains in the yard at Tyseley maintenance depot, Birmingham, and was fatally injured (RAIB report 09/2020). The driver passed between two closely spaced trains when one of the trains moved as part of a coupling operation. The driver had not used a safe route when walking within the yard, and almost certainly did not expect that the trains would move when passing between them. Another driver, who was the one attempting to couple the trains, was unaware that anyone else was nearby. The depot operator had not adequately considered the risks faced by drivers on the depot.

130 While neither of these accidents directly related to a train that was speeding, they both involved a member of staff being in an unsafe position when a train was moving in a yard or siding and the lack of a sufficient and adequate assessment of the associated risks.

Summary of conclusions

Immediate cause

131 The shunter walked into the path of a train which its driver then started to move and accelerate much quicker than the shunter expected (paragraph 31).

Causal factors

132 The causal factors were:

a. After exiting the shed via the roller shutter for line D, the shunter walked foul of the train's path when going to the level crossing (paragraph 35, **Recommendation 1**). This causal factor arose due to a combination of the following:

   i. The shunter wanted to check that no one was approaching the level crossing (paragraph 37, action already taken (see paragraph 140) and **Learning point 1**).

   ii. The shunter used the area between the exit of the main shed building on line D and the level crossing as a walking route to reach the level crossing (paragraph 45, action already taken (see paragraph 139) and **Recommendation 2**).

   iii. The route taken by the shunter to the level crossing meant they had to walk close to or foul of the path of the train (paragraph 58, action already taken (see paragraph 139) and **Recommendation 2**).

   iv. The shunter was unaware that the moving train was catching up with them (paragraph 62, **Recommendation 1** and **Learning point 1**).

b. The train exceeded the speed limit after the shunter had given the train's driver permission to move (paragraph 70, action already taken (see paragraph 141) and **Learning point 2**).

c. The driver did not observe the shunter walking ahead of the train and hence did not take any appropriate actions in response (paragraph 86, action already taken (see paragraph 140), **Recommendation 2** and **Learning points 3 and 4**).

Underlying factors

133 The underlying factors were:

a. GWR had not effectively controlled the risk of a shunter being struck by a train movement outside of a shed on its depot infrastructure (paragraph 98, action already taken (see paragraphs 139 and 140) and **Recommendation 2**).

b. GWR's assurance processes had not identified that train movements within the depot were exceeding the defined speed limits (paragraph 109, action already taken (see paragraph 141) and **Learning point 2**).

Previous RAIB recommendation relevant to this investigation

134 The following recommendation, which was made by RAIB as a result of a previous investigation, has relevance to this investigation.

Accident at Tyseley depot, 14 December 2019, RAIB report 09/2020, Recommendation 1

135 This recommendation reads as follows:

> *Recommendation 1*
>
> *The intent of this recommendation is that West Midlands Trains reduces the risk to train drivers and other staff when walking and working in depots, yards and sidings, including those working across functions within WMT or for other companies.*
>
> *As part of its ongoing revision of risk assessments at Tyseley depot, West Midlands Trains should identify hazards and assess the risk to train drivers and other persons when they are walking and working in depots, yards and sidings for which it is responsible. The output from this assessment should be used to ensure that suitable measures are in place to mitigate risks and that any measures adopted will be appropriate for staff working for other functions within West Midlands Trains and for persons working for other duty holders.*
>
> *West Midlands Trains should also develop and implement processes to ensure that risk assessments are reviewed whenever significant changes are made in depot operations, such as following timetable changes.*
>
> *This recommendation may also apply to other duty holders who are responsible for depots, yards and sidings.*

136 This recommendation was implemented by West Midlands Trains by carrying out a risk assessment for Tyseley depot, including the risks to drivers and other persons walking in the depot. Subsequently, actions were planned and taken because of this risk assessment. These actions also included regular reviews of the risk assessment. The information and lessons learned from this work, which related to depot safety, were shared with other train operating companies through a depot safety group that was facilitated by the Rail Delivery Group (a membership organisation comprising the train operating companies in Great Britain).

137 The recommendation noted that it may also be applied to other duty holders responsible for depots, yards and sidings. GWR was aware of the accident at Tyseley and had made some changes to its ways of working in response to this recommendation. It introduced a requirement for staff to allow a minimum of 15 metres separation from nearby stationary rail vehicles when crossing a railway track (paragraph 44). GWR also added content to its PTS training for operations staff, as part of a planned review, to reduce the risk of a similar accident happening to one of its drivers when walking and working on a depot. However, similar changes were not made to the PTS training given to its engineering staff, such as shunters.

138 While this recommendation related to an investigation that was primarily focused on drivers, it was written so that it was also applicable to other persons that were walking and working in depots. The Bristol St Philips Marsh depot investigation has reinforced the need to identify, assess and control the risk to staff, such as shunters, who regularly walk and work on depots.

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

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

139 GWR has further updated its depot protection risk assessment as part of its work to introduce a new depot protection system at St Philips Marsh depot. These changes have introduced new control measures to specifically manage the risks associated with trains moving out of the main shed building on line D (paragraph 98). The risk assessment now has a specific entry explaining that the area where the shunter was struck is not an authorised walking route and that staff must hold a PTS competency to be in this area, unless the depot protection is set so that no train movements can take place along line D.

140 As a further risk control measure, GWR has formalised the arrangements for the shunter to check the level crossing is clear when a train is leaving the main shed building on line D. Shunters are now required to actively control every train movement on the outside section of line between the roller shutter door and level crossing. This means that trains can now only travel through this area when it is safe to do so, under the direct supervision of a shunter throughout. All shunters and drivers have been briefed on the process.

141 GWR has addressed the deficiencies found with its driver manager teams not carrying out the required random OTDR downloads on its depots (paragraph 109). It has briefed its driver manager teams on the need to do this and has also increased the frequency of these random OTDR downloads at each depot from four each year to one every 4 weeks. GWR's senior management now monitor that these OTDR downloads are being taken and reviewed.

Other reported actions

142 GWR has repainted the yellow lines along the length of the walkway between the roller shutter door and level crossing (figure 20). It has also moved all but one of the intermediate bulk containers that were stored on the side of the walkway where the shunter was struck, so there is now space to walk or stand and not be foul of a train's path. One of the intermediate bulk containers, next to the roller shutter door, could not easily be moved as it is part of an oil recovery system, so plans to move it are ongoing.

143 GWR is considering what options exist to widen the walkway on the opposite side to where the shunter was struck, so there is space to walk on that side without being close to, or foul of, the train's path.

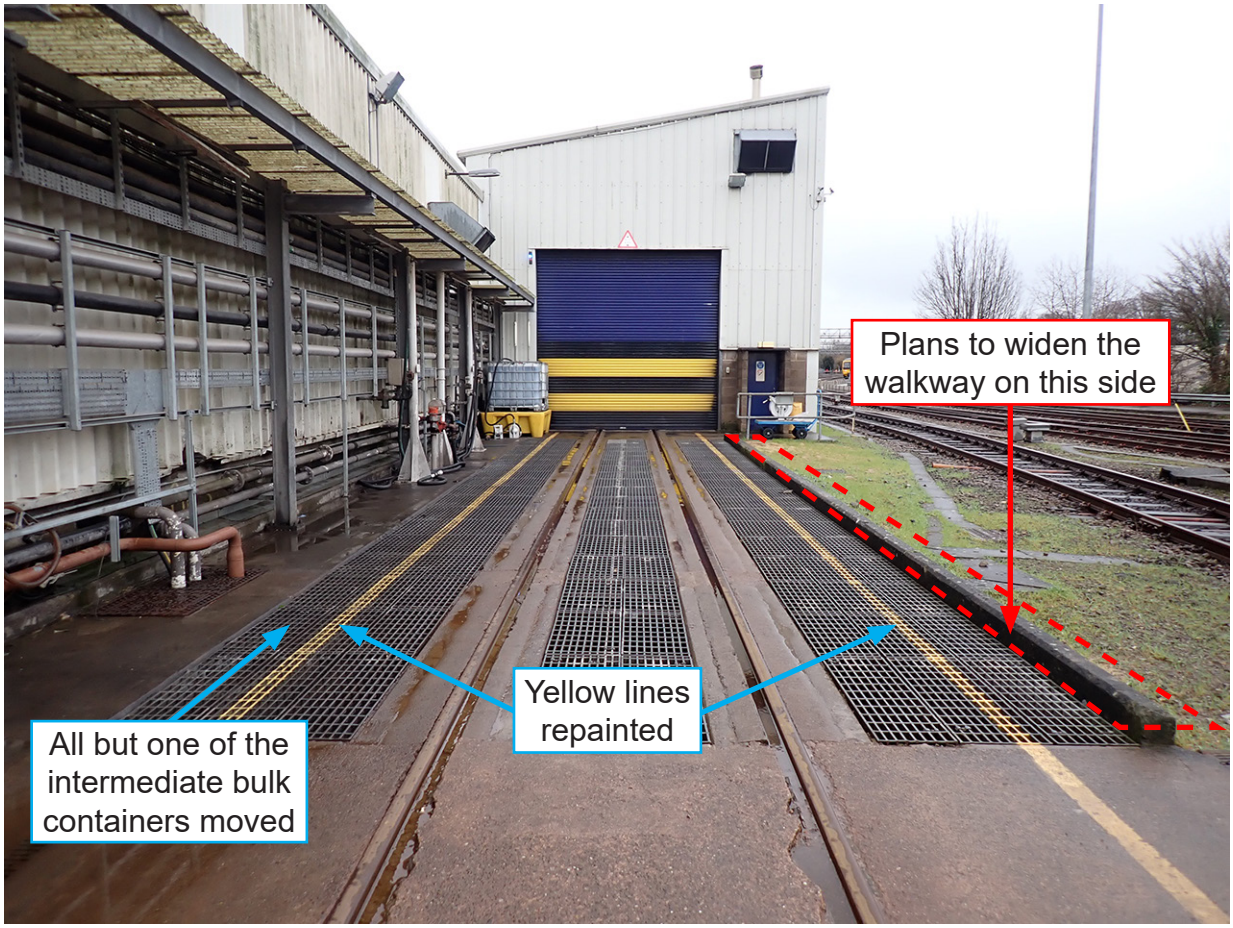

Figure 20: The areas next to the walkway after the accident.

Recommendations and learning points

Recommendations

144 The following recommendations are made:[5]

1 *The intent of this recommendation is to reduce the risk of staff at Great Western Railway, who hold a personal track safety competency, from being struck by a train when working and walking in its depots.*

Great Western Railway should review the training and assessment it provides for shunters and other staff from its engineering function for gaining or recertifying their personal track safety competency, to ensure that these staff receive an appropriate level of information and assessment about working and walking on depots. This review should specifically consider the training and assessment already provided to Great Western Railway staff working in its operations function who hold personal track safety competency (paragraphs 132a and 132a.iv).

This recommendation may also apply to other duty holders who are responsible for shunters working in depots, yards and sidings.

2 *The intent of this recommendation is to manage the risk of staff being struck by a train when using authorised walking routes and walkways on depots.*

Great Western Railway should review the authorised walking routes and walkways on all its depots where staff that hold a personal track safety competency can walk, and identify the places where staff using such walking routes or walkways might be required to walk foul of a train's path. Using the results of this review, Great Western Railway should:

a. assess the risk to staff who might walk in these areas, with specific reference to the hazard of being struck by a train

b. understand the factors that might affect the level of risk in these locations, for example, where there is limited clearance or where the types of rolling stock that use the depot have differing fields of view from the driving position

[5] 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.

c. identify what controls can be put in place to reduce this risk to a level that is as low as is reasonably practicable

d. implement the identified control measures, including appropriate briefing or training to the staff affected (paragraphs 132a.ii, 132a.iii, 132c and 133a).

Learning points

145 RAIB has identified the following important learning points:[6]

1 Staff who work and walk on depots and in sidings, such as shunters, are reminded of the personal track safety requirement to look out for trains that could be approaching from any direction at least every 5 seconds when walking on the railway, particularly when they know that a train is about to move (paragraphs 132a.i and 132a.iv).

2 Train drivers are reminded of the importance of complying with all speed limits on depots and in sidings, as being struck by a train can cause serious, life-changing or fatal injuries to staff, even at relatively slow speeds. Particular care may be needed when accelerating at the start of a movement not to exceed a low speed limit (paragraphs 132b and 133b).

3 The events at Bristol St Philips Marsh depot highlight the importance of train drivers and shunters reaching a clear understanding about a train movement, particularly when information is exchanged during a face-to-face conversation which might be less formal in nature. This may, for example, include the shunter taking the lead to tell the train driver where they will be when the train movement starts, so the driver knows the shunter's location and can observe them if required (paragraph 132c).

4 Staff who work in safety-critical roles are reminded of the importance of remembering to declare to their employer if they have taken any medication that might have the potential to impact their performance, especially before they carry out any safety-critical duties. This means the potential effects of the medication can be checked by the employer and any precautions deemed necessary can be taken (paragraph 132c).

[6] '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

CCTV	Closed-circuit television
GWR	Great Western Railway
MPO	Mini panel operator
OTDR	On-train data recorder
PTS	Personal track safety
RAIB	Rail Accident Investigation Branch
RSSB	Rail Safety and Standards Board

Appendix B - Investigation details

RAIB used the following sources of evidence in this investigation:

- information provided by witnesses
- information taken from the OTDR on two class 158 units
- CCTV recordings taken from the train
- site photographs and measurements
- weather reports and observations at the site
- rosters showing the hours worked by the staff involved
- training and competence management records for the staff involved
- training materials for GWR's PTS courses and depot induction
- documentation from GWR covering its competence management system, assurance activities, risk assessments, and its rules, instructions and procedures for operations on the depot
- information about previous incidents on depots operated by GWR
- maintenance and post incident testing records for unit 158771
- train running information from railway operations systems
- maps and aerial views of the depot
- a review of previous RAIB investigations that had relevance to this accident.

Appendix C - The positions of the train and shunter

The following sequence of figures is based on RAIB's analysis of the forward-facing CCTV footage and OTDR. They show the derived positions of the train and the shunter relative to each other in increments of 1 second, starting from when the driver first demanded traction to move the unit at 13:01:00 hrs. The sequence then continues through to 13:01:14 hrs, which is just before the shunter was struck. The next figure is at 13:01:14.5 hrs when the shunter was struck, and then at 13:01:15.5 hrs when the driver had applied the train's brakes. Each figure also shows the expected visibility of the shunter from the driver's position at that time.

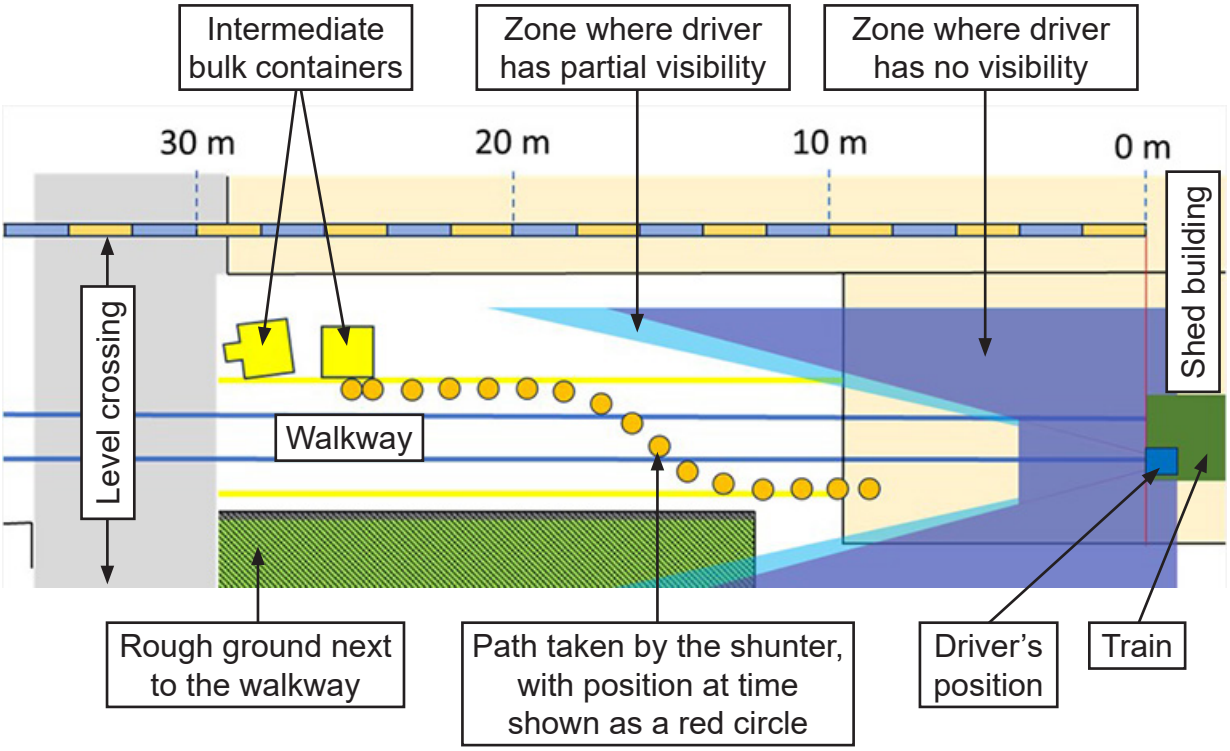

Figure C1: Explanation of the features shown on the appendix C figures.

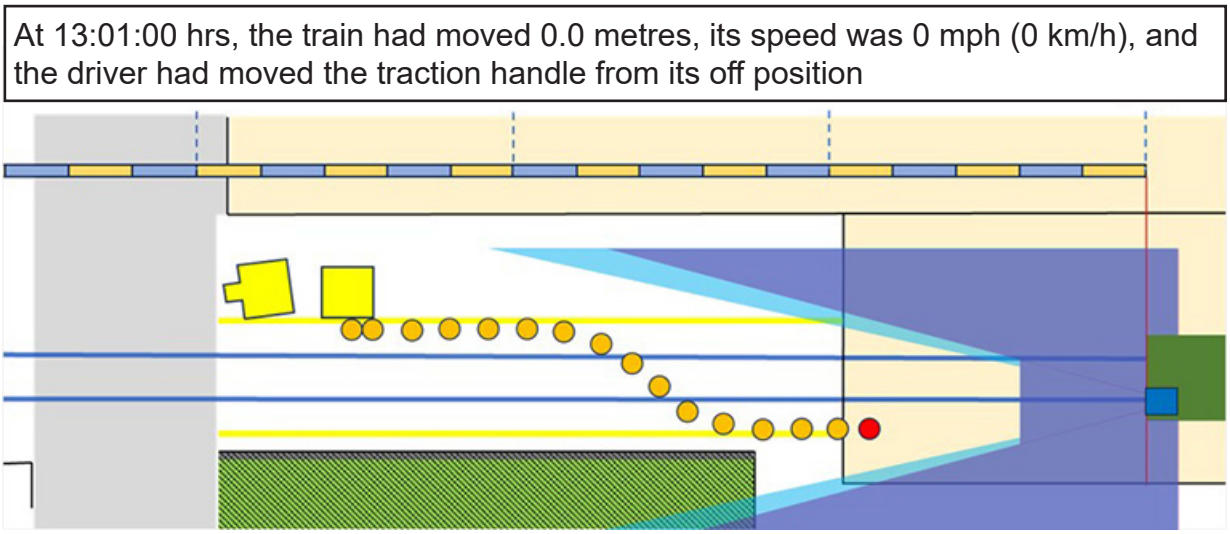

Figure C2: The position of the shunter and train at 13:01:00 hrs.

At 13:01:01 hrs, the train had moved 0.0 metres, its speed was 0 mph (0 km/h), the driver had by now moved the traction handle to notch 6, and the shunter was walking out of the main shed building through the roller shutter door

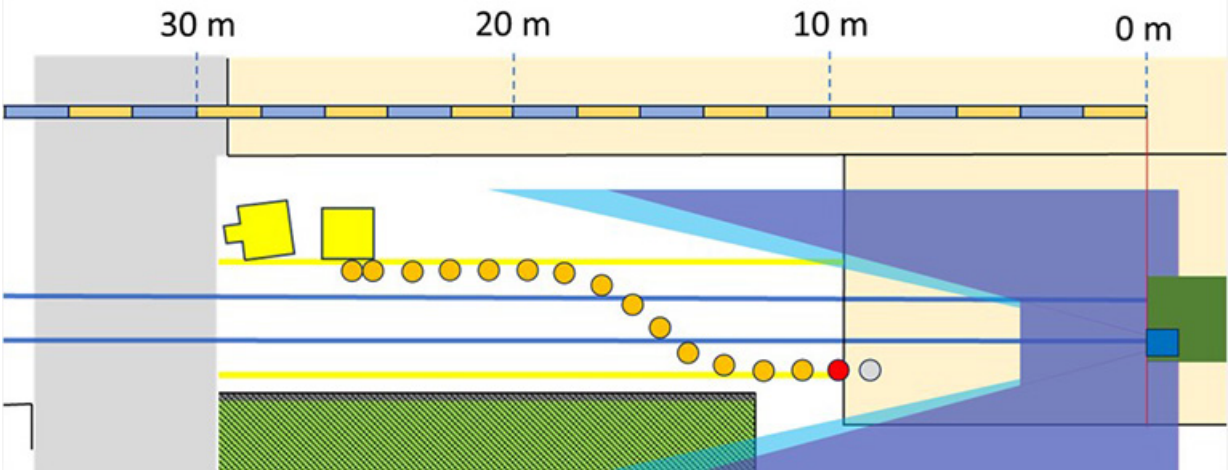

Figure C3: Shunter and train positions at 13:01:01 hrs.

At 13:01:02 hrs, the train had moved 0.0 metres and its speed was 0 mph (0 km/h)

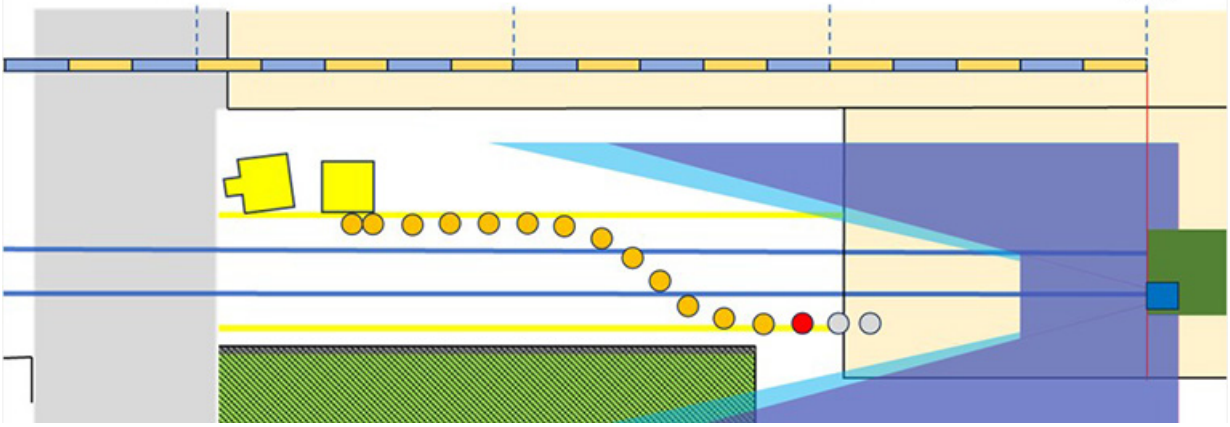

Figure C4: Shunter and train positions at 13:01:02 hrs.

At 13:01:03 hrs, the train had moved 0.0 metres and its speed was 0 mph (0 km/h)

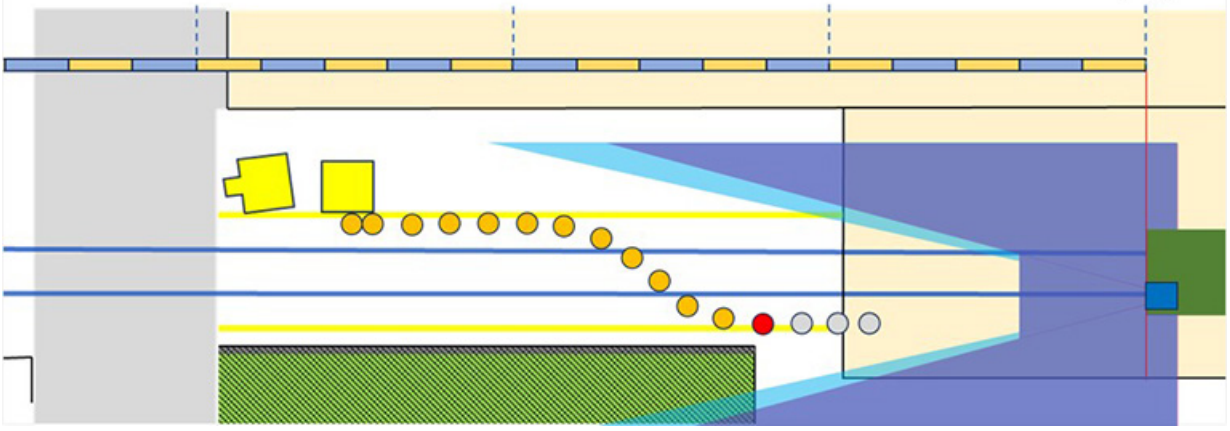

Figure C5: Shunter and train positions at 13:01:03 hrs.

At 13:01:04 hrs, the train had moved 0.0 metres, its speed was 0 mph (0 km/h), and the shunter started to move diagonally to the right

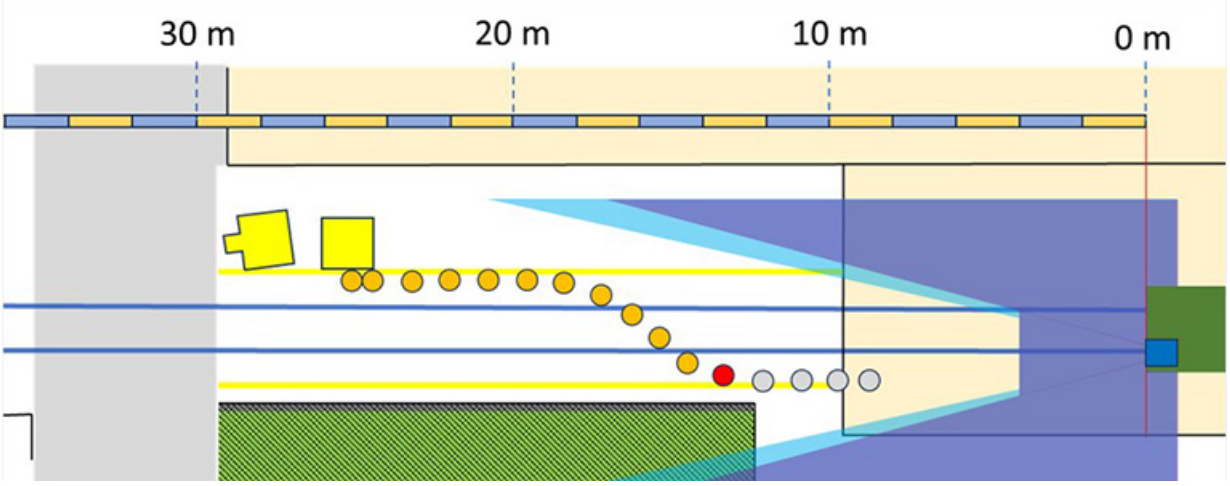

Figure C6: Shunter and train positions at 13:01:04 hrs.

At 13:01:05 hrs, the train had moved 0.0 metres, its speed was 0 mph (0 km/h), but the first sign of the train starting to move was visible on its forward-facing CCTV footage

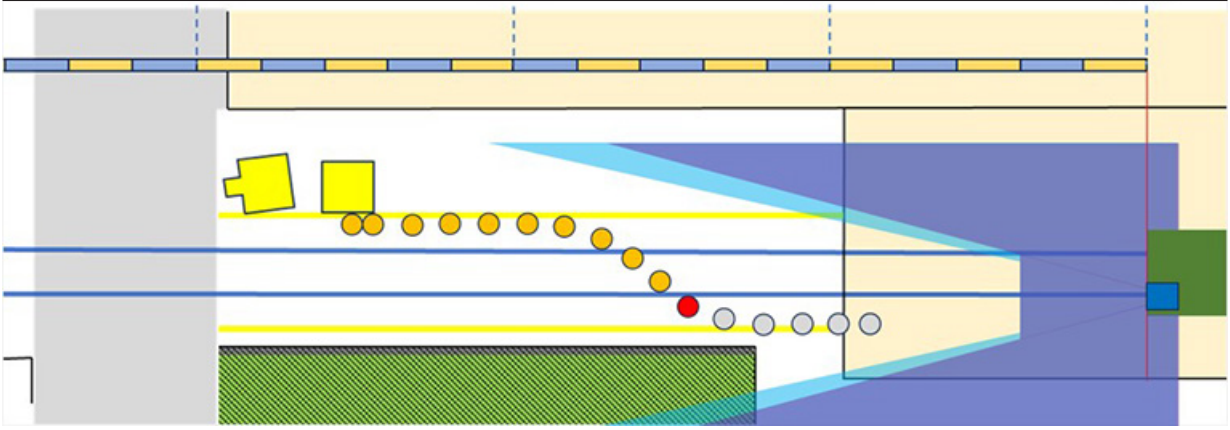

Figure C7: Shunter and train positions at 13:01:05 hrs.

At 13:01:06 hrs, the train had moved 0.0 metres, its speed was 2 mph (3 km/h), the first sign of the train starting to move was recorded by the OTDR, and the shunter was now between the running rails

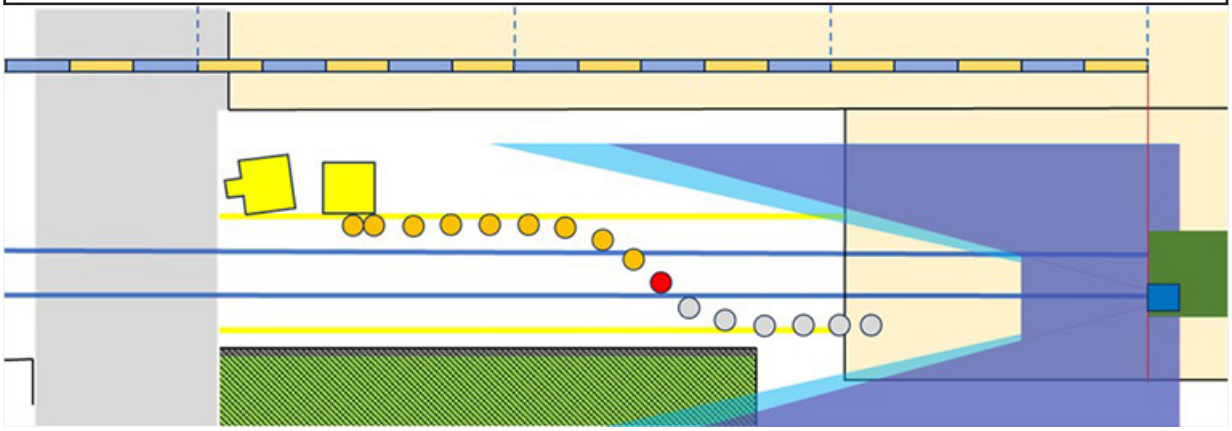

Figure C8: Shunter and train positions at 13:01:06 hrs.

At 13:01:07 hrs, the train had moved 1.6 metres and its speed was 3 mph (5 km/h)

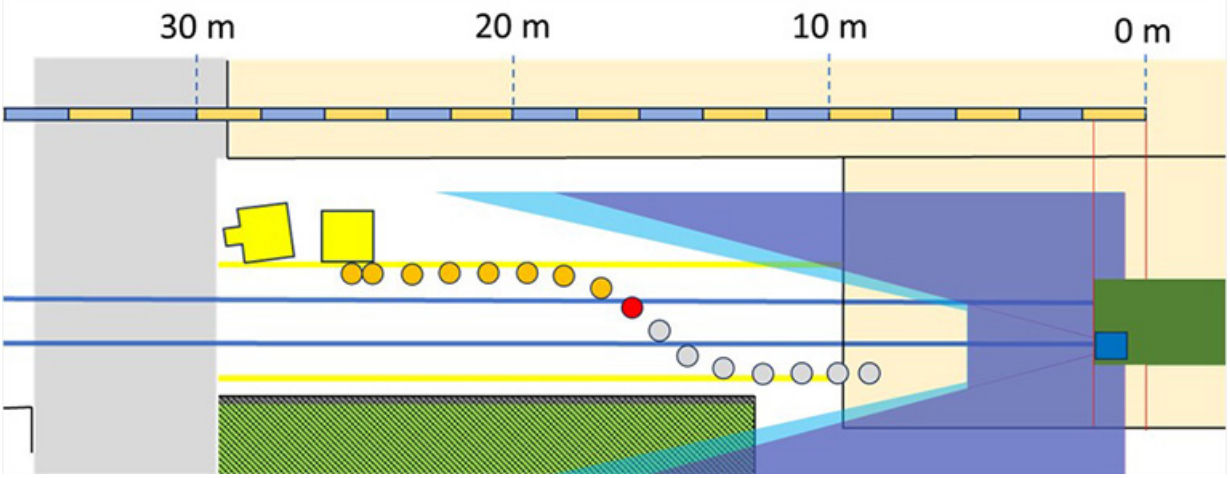

Figure C9: Shunter and train positions at 13:01:07 hrs.

At 13:01:08 hrs, the train had moved 3.2 metres, its speed was 4 mph (6 km/h), and the shunter was now on the right-hand side of the track

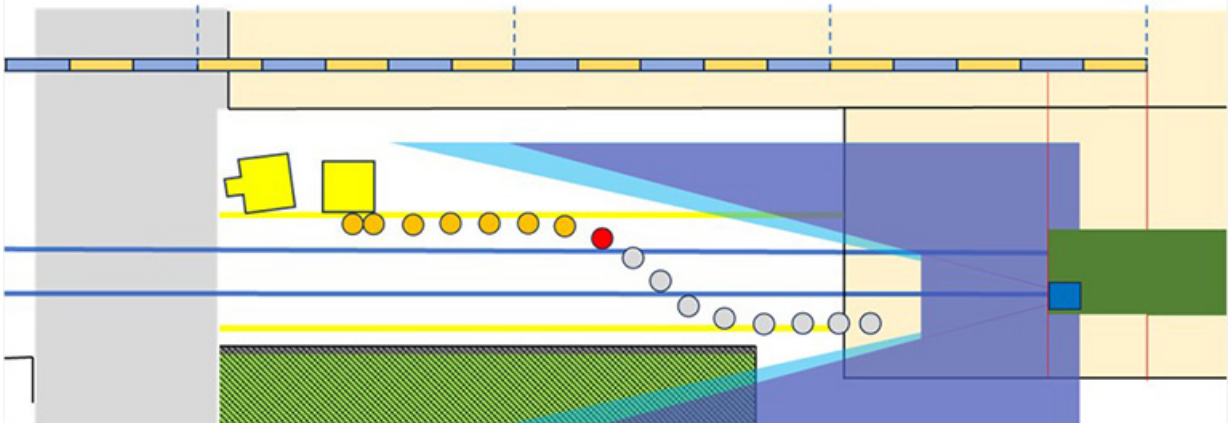

Figure C10: Shunter and train positions at 13:01:08 hrs.

At 13:01:09 hrs, the train had moved 6.4 metres and its speed was 5 mph (8 km/h)

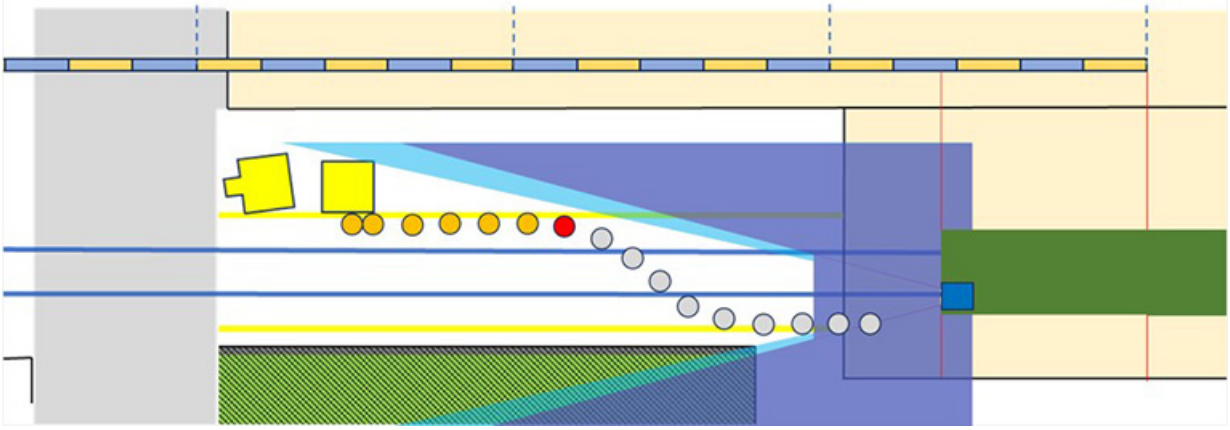

Figure C11: Shunter and train positions at 13:01:09 hrs.

At 13:01:10 hrs, the train had moved 8.0 metres, its speed was 6 mph (10 km/h), and the shunter was walking parallel with the track along its right-hand side

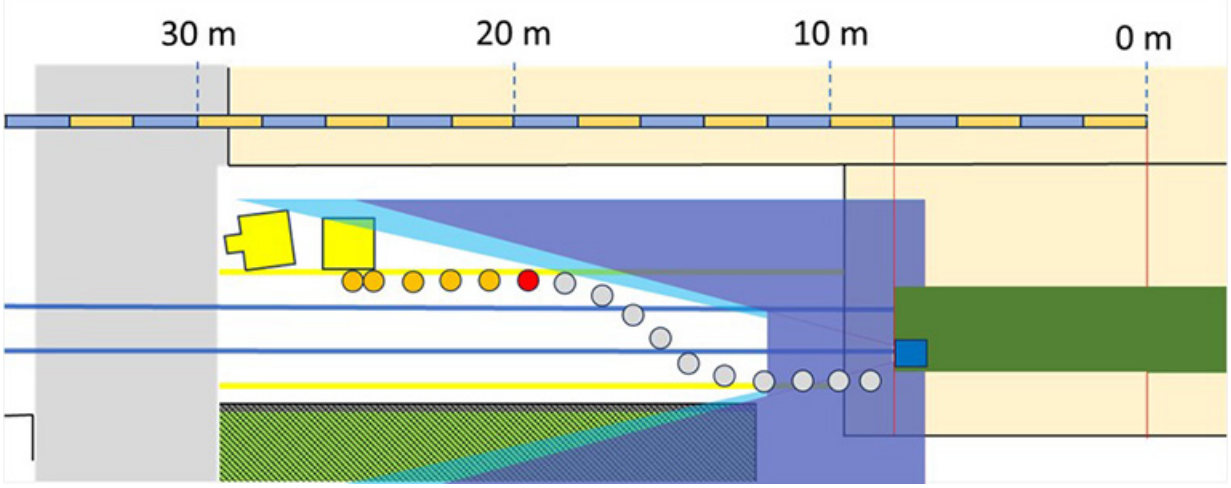

Figure C12: Shunter and train positions at 13:01:10 hrs.

At 13:01:11 hrs, the train had moved 11.3 metres, so the front cab had now exited the main shed building, its speed was 8 mph (13 km/h), and the shunter was no longer fully visible from the driver's position

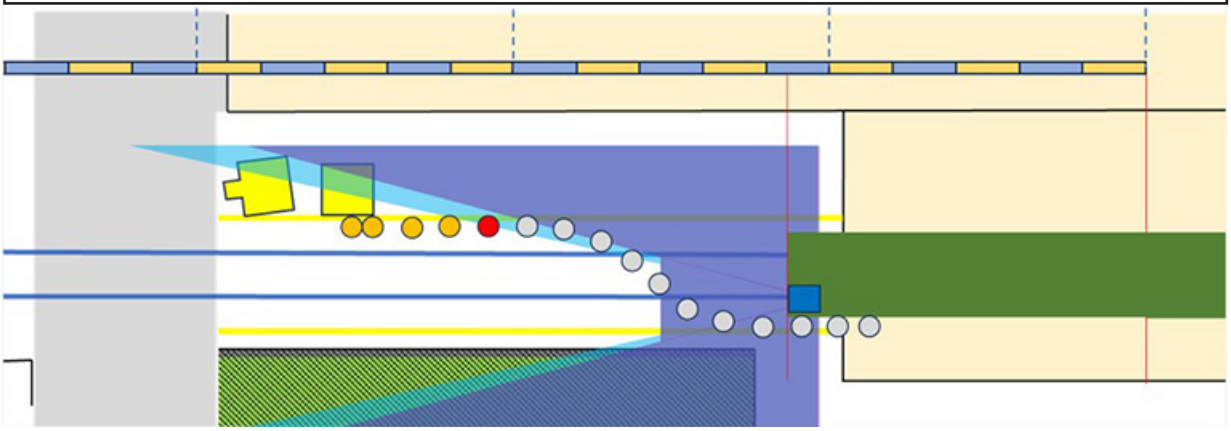

Figure C13: Shunter and train positions at 13:01:11 hrs.

At 13:01:12 hrs, the train had moved 14.5 metres, its speed was 9 mph (14 km/h), the driver had moved the traction handle to notch 5, and the shunter was now only partially visible from the driver's position

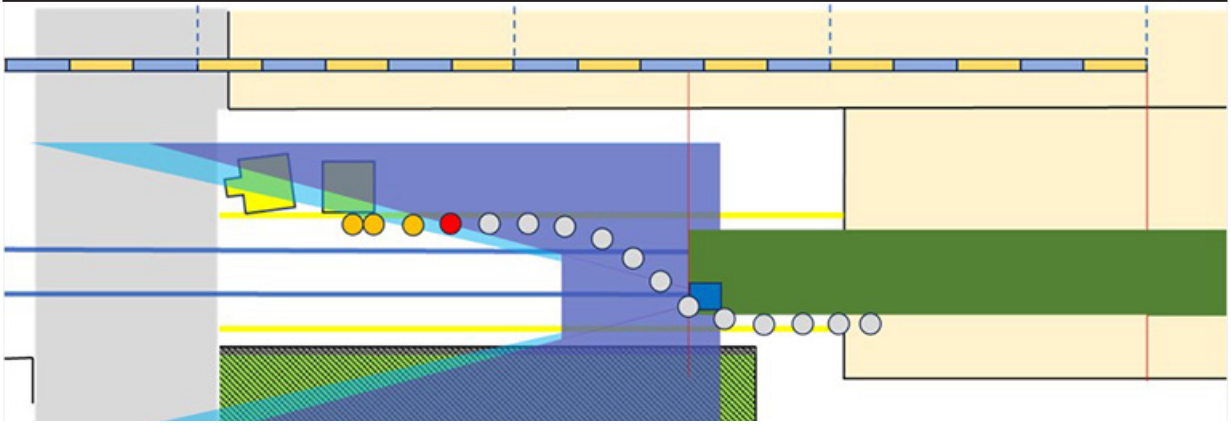

Figure C14: Shunter and train positions at 13:01:12 hrs.

At 13:01:13 hrs, the train had moved 19.3 metres, its speed was 10 mph (16 km/h), the driver had moved the traction handle to its off position, and the shunter was no longer visible from the driver's position

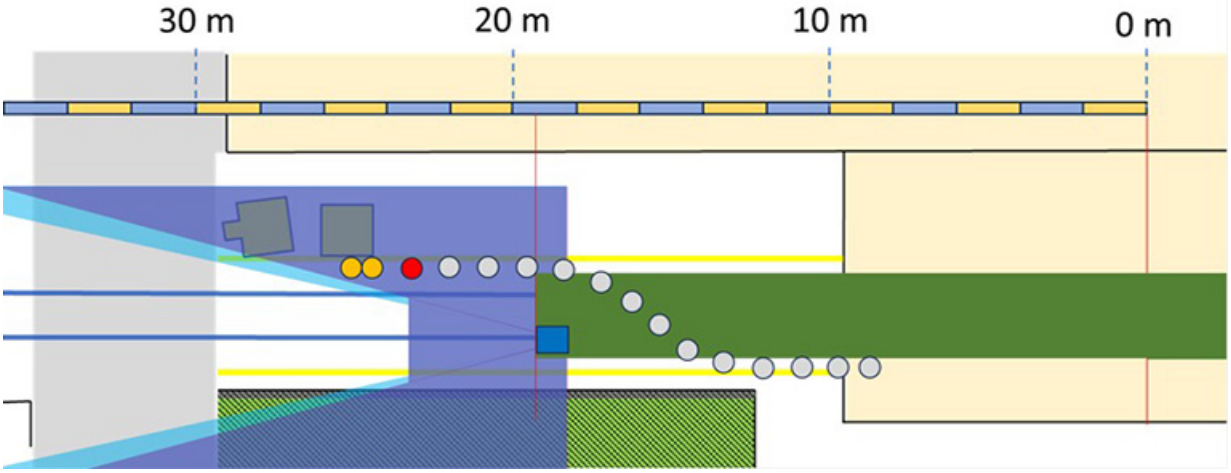

Figure C15: Shunter and train positions at 13:01:13 hrs.

At 13:01:14 hrs, the train had moved 22.5 metres and its speed had reached 11 mph (18 km/h), which was the highest speed recorded by the OTDR

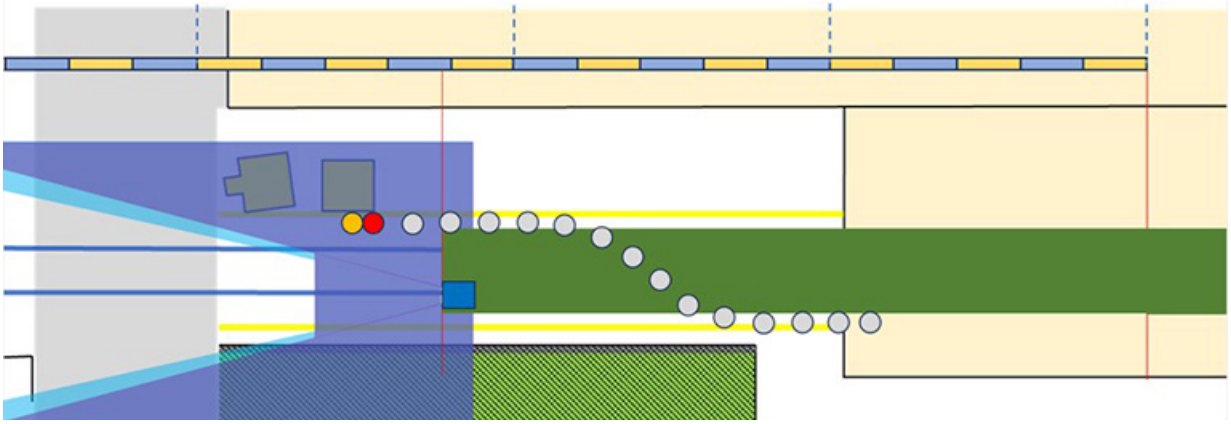

Figure C16: Shunter and train positions at 13:01:14 hrs.

At 13:01:14.5 hrs, the train had moved 25.7 metres, its speed was 10 mph (16 km/h), and it had caught up with and struck the shunter who was next to one of the intermediate bulk containers

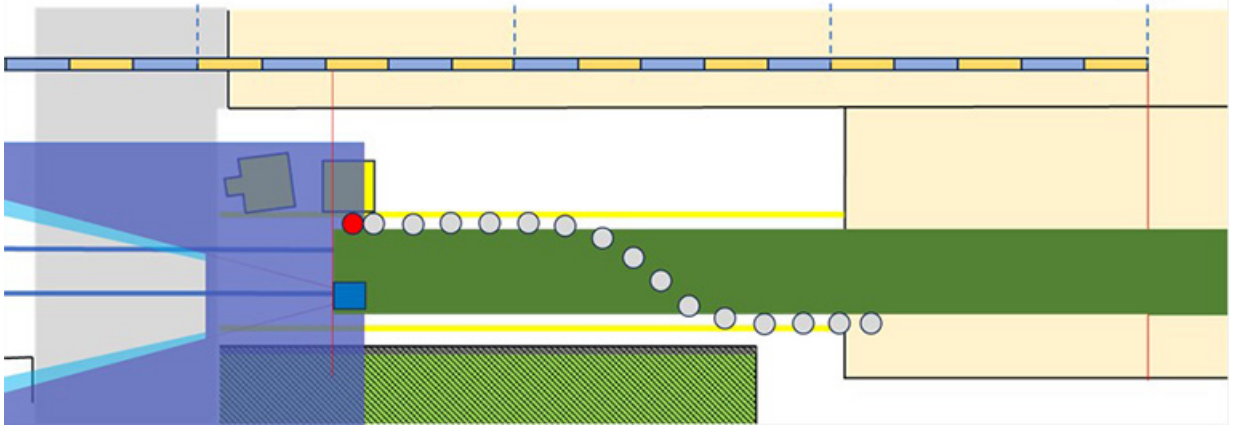

Figure C17: Shunter and train positions at 13:01:14.5 hrs.

At 13:01:15.5 hrs, the train had moved 29.8 metres, its speed was 10 mph (16 km/h), and the driver had applied the brakes

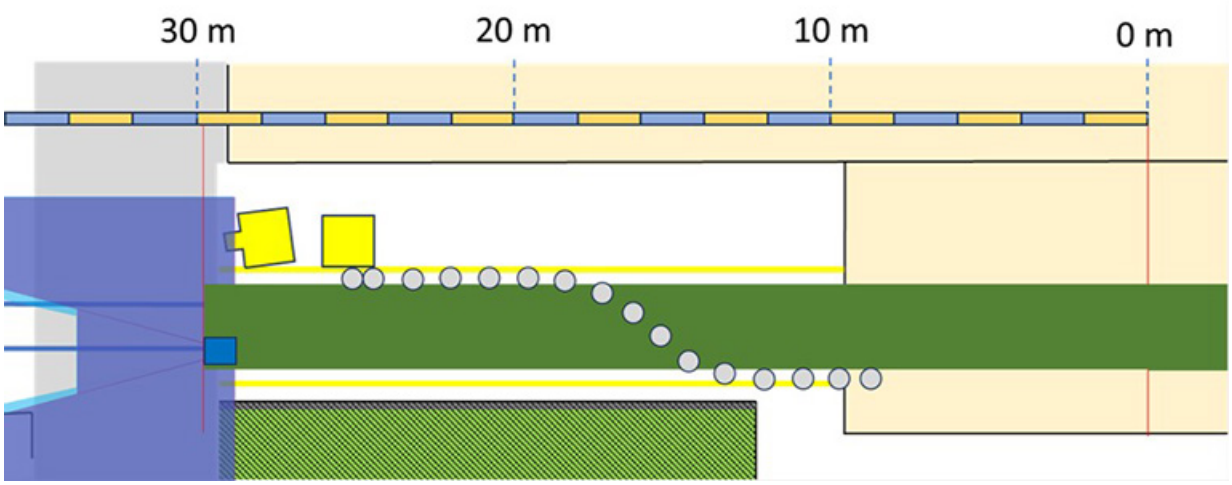

Figure C18: Train position at 13:01:15.5 hrs (the exact position of the shunter at this time is unknown).

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

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