Rail Accident Investigation Branch

Rail Accident Report

Buffer stop collision at London Bridge station
13 December 2024

Report 09/2025
v2 January 2026

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.

Any enquiries about this publication should be sent to:

RAIB
The Wharf
Stores Road
Derby UK
DE21 4BA

Email: enquiries@raib.gov.uk
Telephone: 01332 253 300
Website: www.raib.gov.uk

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

Version	***Date***	***Location of change(s)***	***Description of change***
v1.0	17 December 2025	n/a	Initial issue
v2.0	22 January 2026	Various	Figure 5 and various speeds amended. Footnote 1 added

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.

This page is intentionally left blank

Buffer stop collision at London Bridge station, 13 December 2024

Contents

Summary

At around 15:45 on Friday 13 December 2024, a passenger train operated by Southern Railway struck the buffer stop on arrival in platform 12 at London Bridge station at a speed of around 5 mph (8 km/h). There were no reported injuries to the driver or to the passengers on the train and there was very minor damage caused to the train and railway infrastructure.

The train had been travelling at around 14 mph (22.5 km/h) when it entered the platform and its speed gradually reduced as it progressed towards the buffer stop. When the train was around 2.5 metres from the buffer stop and travelling at a speed of approximately 6 mph (9.7 km/h) the driver made an emergency brake application. Despite this, there was insufficient distance remaining to prevent the collision.

The accident occurred because the driver of the train did not apply the brakes in time on approach to the buffer stops, almost certainly because they experienced a microsleep, due to fatigue. There are several factors that may have contributed to the driver’s fatigue. Two probable causal factors in the accident were that the base duty roster was constructed in a way that increased the risk of fatigue and that the driver had also worked many of their rostered rest days in the period up to the accident, further increasing the risk of fatigue. A possible causal factor was that the driver had less than their normal amount of sleep the night before the accident.

A further causal factor was that none of the engineered protection systems fitted to the train intervened to prevent the collision. The Train Protection and Warning System fitted on approach to the buffer stops did not automatically apply the train’s brakes because the train was travelling below the set intervention speed. Other safety systems fitted on board the train could not detect the short loss of driver alertness that occurred.

A probable underlying factor to the accident was that the management of fatigue risk by Govia Thameslink Railway, the company operating the Southern Railway franchise, was not sufficiently effective and that it had not adopted some elements of industry good practice in fatigue risk management. A second underlying factor was that there are no safety systems currently fitted to mainline trains which can detect and mitigate short losses in driver alertness.

As part of its investigation, RAIB observed that the actual hours that staff work were not considered in the management of Govia Thameslink Railway safety-critical staff with medical conditions when external advice was being sought as to their fitness for work.

RAIB has made two recommendations as a result of this investigation, one addressed to Govia Thameslink Railway to improve its fatigue management process and to follow industry best practice. The other is addressed to the Rail Safety and Standards Board, in consultation with the rail industry, to provide guidance when seeking external advice about medical conditions and working hours that may increase the risk of fatigue in safety-critical staff.

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 around 15:45 on 13 December 2024, a passenger train operated by Southern Railway (referred to as Southern throughout the remainder of this report) struck the buffer stop on arrival in platform 12 at London Bridge station (figure 1). The train was travelling at 14 mph (22.5 km/h) when it entered the platform and its speed gradually reduced as it progressed towards the buffer stop. When the train was about 2.5 metres from the buffer stop and travelling at a speed of approximately 6 mph (9.7 km/h), the driver made an emergency brake application. Despite this, there was insufficient distance remaining to prevent a collision. The train collided with the buffer stop (figure 2) travelling at a speed of around 5 mph (8 km/h)[1].

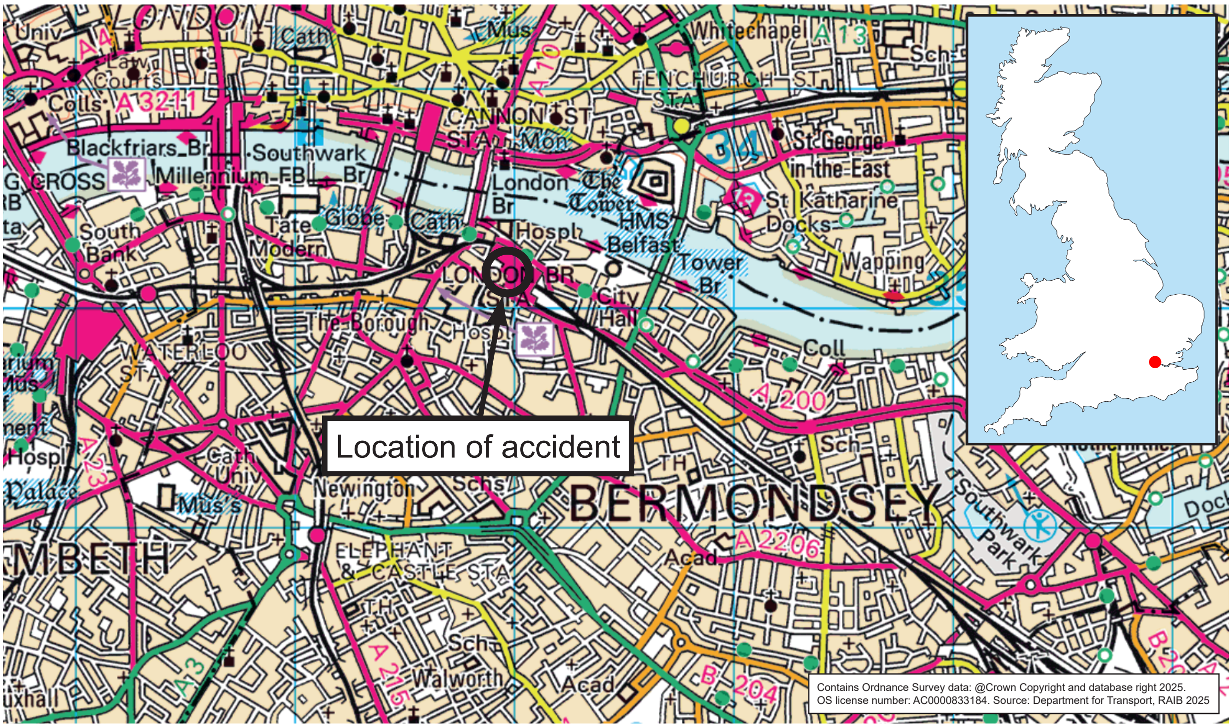

Figure 1: Extract from Ordnance Survey map showing the location of the accident at London Bridge station.

4 There were no reported injuries to the driver or to the passengers on the train.

5 There was minor damage to the buffer stop and to the signalling equipment. Repairs were made and the platform reopened later the same day.

[1] The speed and time resolution of OTDR data can lead to small discrepancies at very low speeds. For this reason, the collision speed was derived by cross-referencing OTDR data from different vehicles within the train and comparing this against the available CCTV evidence.

Figure 2: View of train 2F40 after it collided with the buffer stop at platform 12.

Context

Location

6 The accident occurred at London Bridge station in Southwark, south-east London. The mainline railway station has 15 platforms which are linked by a street level concourse. The platforms are in two groups, with platforms 1 to 9 being through platforms used by trains operating to and from Charing Cross/Cannon Street and Blackfriars/Thameslink tunnel, and platforms 10 to 15 being terminus platforms with buffer stops (figure 3). London Bridge also allows passengers to connect to the London Underground via a collocated underground station.

7 Trains operated by Southern only operate into platforms 10 to 15. Services from London Bridge operate towards south-east London, East Sussex, Kent and the south coast. The maximum permitted speed for trains entering and leaving London Bridge station is 20 mph (32 km/h).

Organisations involved

8 Govia Thameslink Railway (GTR) is a rail franchise which owns four train operating companies: Southern, Thameslink, Great Northern and Gatwick Express. The train involved in the accident was operated by Southern, which also employs the driver.

9 Network Rail owns and maintains the infrastructure at London Bridge station.

10 Network Rail and GTR freely co-operated with the investigation.

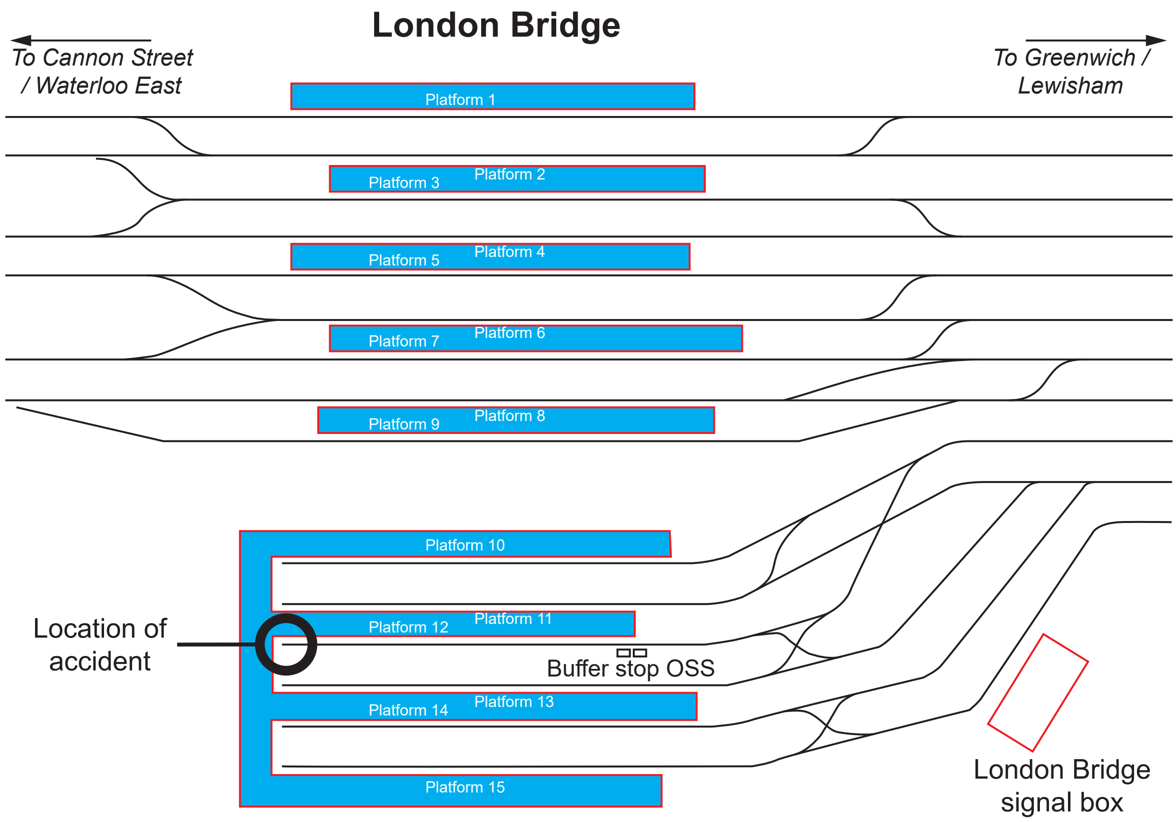

Figure 3: Simplified diagram of London Bridge station platform layout, showing platforms 1 to 15, highlighting the area of the buffer stops in platform 12, where the accident occurred.

Train involved

11 The train involved was a class 377 electric multiple unit. It was formed of two four-car units coupled together, units 377426 and 377462. It was operating as train reporting number 2F40, the 14:50 service from London Victoria to London Bridge, via Crystal Palace.

12 The train was fitted with an on-train data recorder (OTDR) and both forward-facing CCTV and internal CCTV systems.

13 Post-accident testing of the train found no faults with the train's braking or safety systems. RAIB found no evidence to suggest that the condition of the train contributed to the accident.

Railway systems involved

14 Class 377 trains are fitted with a driver's safety device (DSD) and a driver vigilance device (DVD), as well as the Automatic Warning System (AWS) and Train Protection and Warning System (TPWS).

15 The DSD system is intended to stop the train by making an emergency brake application, should the driver become incapacitated. The driver must maintain downward pressure on a foot pedal. If this is released for more than 6 seconds, the driver will receive an audible warning. If they do not respond to this warning, the emergency brake will apply.

16 The DVD system is intended to stop the train by making an emergency brake application should the driver stop making control inputs or stop periodically releasing and depressing the DSD pedal. An alarm sounds to prompt the driver to release the DSD pedal if no driving control input has been registered for 60 seconds. Failing to respond to the alarm will again result in the emergency brake being applied.

17 AWS provides an audible and visual warning to a driver on the approach to certain infrastructure features, such as signals and selected speed restriction changes. When receiving the warning, a driver must acknowledge this by pressing a reset button within 2.7 seconds. If the reset button is not pressed and released during this time, the train brakes are applied automatically.

18 TPWS equipment is provided at the terminal platforms at London Bridge. This is designed to reduce the consequence of a train overspeeding on approach to the buffers. TPWS applies the brakes on a train if it passes the fixed overspeed sensor system (OSS) above a designated set speed. For platform 12 at London Bridge, the OSS is located 55 metres from the buffer stop. The set speed at that point is 12.5 mph (20 km/h). If a train is travelling faster than this when it passes the sensors, TPWS will intervene by applying the train's brakes. As TPWS is only designed to reduce the consequences of an undesirable event, it will not necessarily prevent a collision with buffer stops. TPWS does not have a constant speed monitoring function so cannot intervene once the front of the train (which houses the TPWS receiver) has passed the sensor at a compliant speed.

19 Platform 12 at London Bridge station is fitted with buffer stops of a sliding design, which absorb energy by moving along the rails when struck, slowed by friction blocks (figure 4).

Figure 4: On the right, in their normal position the buffer stops of platform 12 at London Bridge station (courtesy of Network Rail).

Staff involved

20 The driver joined Southern in 2019 as a new train driver and is based at Norwood depot. Their competence, traction and route knowledge assessments were up to date.

External circumstances

21 The weather was cold and dry, and the railhead was not contaminated. There is no evidence that external circumstances played any part in the accident.

The sequence of events

Events preceding the accident

22 The driver had worked on each of the four days before the Friday of the accident, two of which were designated rest days, with their last day off being Sunday 8 December. On the day of the accident, the driver was rostered to book on for duty at 13:43 and to book off at 21:58. The night before, the driver had gone to sleep at around 00:30 and woke up around 07:30, which was less than their preferred amount of sleep before working a shift. They left home around 13:00 for the journey to work.

23 On arrival at Norwood depot, the driver booked on for duty and while doing so experienced some problems printing an updated diagram that had been issued. A diagram lists the trains to be worked for a driver that day and other information such as when and where breaks will be taken. Because the printer was not working, the driver needed assistance to print a copy of the diagram. This delay resulted in the driver needing to hurry to reach the platform in time to take over the train they were booked to work, and they arrived at the train with little time to spare before departing.

24 The driver operated the 14:03 service from Norwood Junction to Victoria which was uneventful. They did, however, feel warm from the earlier rushing and so they removed some layers of clothing and adjusted the cab temperature to make it cooler. During a 15-minute stop at Victoria, the driver changed ends and then departed for London Bridge at 14:50.

25 On the journey from Victoria to London Bridge the driver stated that they began to feel cold and so they adjusted the cab ventilation and added another layer of clothing.

26 At around 15:19 the train stopped at Crystal Palace station. The driver recalled beginning to feel tired, recognising the need to focus and remain alert. Fifteen minutes later, at New Cross Gate station, the last station before London Bridge, the driver stated that they got up and moved around to help them to maintain alertness. On the journey towards London Bridge, they opened the cab window with the same aim. Although aware that they were feeling tired, the driver felt able to continue the journey.

Events during the accident

27 As the driver approached London Bridge station, they reduced the speed of the train. The OTDR shows that the recorded speed of the train when entering the platform was around 14 mph (22.5 km/h). This was compliant with the speed of 15 mph (24 km/h) or less which drivers are trained to observe when entering platforms.

28 The train passed over the TPWS sensor for the buffer stop at around 8 mph (12.9 km/h). This was both below the set speed of 12.5 mph (20 km/h) and within the speed range of 6 mph to 8 mph (9.7 km/h to 12.9 km/h) that drivers are trained to adhere to at this point.

29 After focusing on controlling the train's speed for the buffer stop TPWS sensor, the driver did not remember anything further until they became aware that the train had hit the buffer stop. However, OTDR data shows that, after passing the TPWS sensor, the driver made several brake applications. At 15:44:24 they made a brake step 1 application for just over a second. At 15:44:32, about 1 second before the collision, there was a 0.1 second application of brake step 1, a 0.5 second application of full-service braking, followed by an emergency brake application. This remained applied until the train was stationary, after the collision (figure 5).

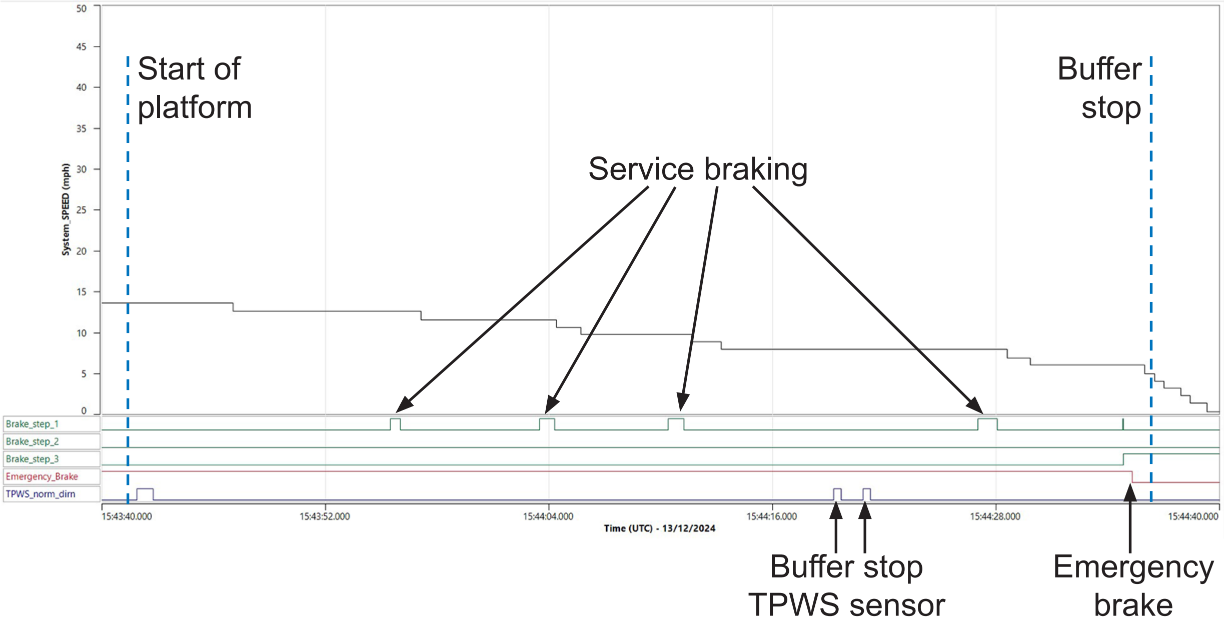

Figure 5: Train data showing driver control actions before the collision.

Events following the accident

30 The train came to a stand having pushed the buffer stops around 3 metres from their installed position. The buffer stops operated as intended and reached three of the five available friction blocks that are designed to help slow a train to a stop (figure 6).

31 The driver contacted the signaller to report the accident. Passengers were able to leave the train normally and there were no reported injuries. British Transport Police officers, who were already on duty on the station, attended the scene immediately.

32 The train departed from the station at 20:45 and was taken to Selhurst depot for testing and examination. The platform was returned to service at 23:51.

Figure 6: Buffer stops at London bridge platform 12 after the collision.

Analysis

Identification of the immediate cause

33 The train entered the platform at the correct speed but was not brought to a stand before reaching the buffer stops.

34 Evidence from CCTV images shows the train colliding with the buffer stops and the OTDR shows that the final brake application was too late to avoid the collision.

35 There was no evidence of any loss of adhesion between wheel and rail and no suggestion from the driver that the train's brakes were in any way defective. Subsequent testing of the train's brakes by GTR found that they were working normally.

Identification of causal factors

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

a. On approach to the buffer stops, the driver almost certainly experienced a microsleep as a result of fatigue (paragraph 37).

b. None of the engineered protection systems fitted to the train intervened to prevent the collision. This is a probable causal factor (paragraph 79).

Each of these factors is now considered in turn.

Microsleep

37 On approach to the buffer stops, the driver almost certainly experienced a microsleep as a result of fatigue.

38 The driver stated that they believed they had fallen asleep just before the collision. The driver also stated that they felt tired on the day of the accident and had not had as much sleep as they would normally try to have before a working day. RAIB identified that the roster worked by the driver in the weeks before the accident, and the number of rest days worked by the driver, made them susceptible to fatigue and to experiencing a microsleep. The driver's account of fatigue, and their actions on approach to the buffer stops, are consistent with being fatigued.

39 The Office of Rail and Road (ORR, the health, safety and economic regulator for railways in Great Britain) has issued a guidance document called 'Managing rail staff fatigue - Guidance for companies in the rail industry'.[2] Fatigue is defined in this document as '*a state of reduced mental or physical capability resulting from sleep loss or extended wakefulness, disruption to circadian rhythms (the 'internal body clock'), workload (mental and/or physical activity) and/or prolonged working that can impair alertness and the ability to perform safely and/or effectively.'*

[2] 'Managing rail staff fatigue', Office of Rail and Road August 2024 updated January 2025 (accessed October 2025).

40 At the time of the accident, the driver was being treated for a condition using prescription medication. The driver had declared this to their employer and had been assessed by the occupational health department at GTR, which had sought, received and acted on external medical advice. GTR concluded that the driver was fit to work and RAIB found no evidence to suggest that the driver's medical condition or the medication they were taking were factors in the accident.

41 A microsleep is a temporary sleep episode that lasts for 15 seconds or less. During a microsleep the brain involuntarily goes to sleep, and people may awake from it suddenly with a jolt. Microsleeps are characterised by a person briefly closing their eyes and experiencing a lapse in attention. A person may not realise that it has occurred and have no memory of what they have experienced. During a microsleep, the brain may not process external information such as sound or visual cues, but not all brain activity is deactivated, as it is in regular sleep.

42 Microsleeps are often caused by fatigue but can occur at any time. They are more likely to occur when someone is sleep deprived but may even occur after only a single night of restricted sleep. They are also more likely to occur during repetitive and monotonous tasks. Some research has also demonstrated that they are more likely to happen in the afternoon due to natural circadian rhythm.[3]

43 Evidence from the OTDR and CCTV shows that there were approximately 16 seconds between the train passing over the TPWS sensor and colliding with the buffer stop. Although the driver made brake applications during this period, such automatic behaviour can occur during a microsleep. Evidence from the driver's account supports the occurrence of a microsleep episode as they attempted to maintain a level of alertness before arriving at London Bridge station, and there was a short period where they experienced a lapse in attention and were unable to recall what had happened afterwards.

During the journey

44 The driver stated that they had taken actions to remain alert during the journey as they had begun to feel tired. They had switched on the air conditioning fan in the cab. Data from the train shows that this occurred at Forest Hill station at 15:28, 16 minutes before the accident occurred. The driver also mentioned other measures they took such as opening the window and moving around the cab. Countermeasures similar to these are often used when feeling tired driving a car and are assumed to help combat fatigue, although none will have a substantive or long-lasting effect (Reyner & Horne, 1997[4]). The driver's actions, however, demonstrate their awareness that they were feeling tired, and that they took steps to remedy this.

[3] Moller H J and others, 'Simulator performance, microsleep episodes, and subjective sleepiness: normative data using convergent methodologies to assess driver drowsiness', Journal of Psychosomatic Research: volume 61, issue 3, pages 335 to 342 (September 2006).

[4] Reyner LA and Horne JA, 'Evaluation of ''in-car'' countermeasures to sleepiness: cold air and radio', Sleep: volume 21, issue 1, pages 46 to 51 (January 1998).

45 The driver did not contact Southern control to report feeling tired as they believed that they would be able to safely continue the journey. They stated that had they felt they could not do so, they would have reported this. Research by RoSPA[5] (The Royal Society for the Prevention of Accidents) has shown that generally people are able to detect when they are feeling sleepy but may underestimate the level of fatigue or the risk associated with it. This, alongside a strong desire to reach a destination can act as a barrier to reporting fatigue. Train drivers are aware that declaring themselves unfit for duty has the potential to cause major disruption to operations. The approaches to London Bridge are very busy and this could encourage a driver to take steps to reach their destination, which is relatively close, rather than causing delays if their train could not continue.

46 The driver had experienced an incident a year earlier at London Bridge station where the TPWS had applied the train's brakes as a result of the train passing the OSS on the platform slightly faster than the set speed. As a result of this previous incident, the driver was focused on passing the TPWS sensor at the correct speed. Having done this on the day of the accident, it is possible that the driver then relaxed and experienced an associated reduction in alertness as the demands of the driving task also reduced.

47 The driver's fatigue was caused by a combination of the following:

a. The base roster was constructed in a way that increased the risk of the driver becoming fatigued. This is a probable causal factor (paragraph 48).

b. The driver had worked a number of rest days in the period up to the day of the accident which further increased the risk of fatigue. This is a probable causal factor (paragraph 69).

c. The driver had less than their normal amount of sleep the night before the accident. This is a possible causal factor (paragraph 75).

Each of these factors is now considered in turn.

Design of the base roster

48 The base roster was constructed in a way that increased the risk of the driver becoming fatigued. This is a probable causal factor.

49 To meet the national railway timetable, train operating companies allocate drivers to train services using rosters. To allow cover for short-term changes to the timetable, such as those caused by driver holidays, sickness and training, extra drivers are available to cover the required shifts to operate the required train service. These extra drivers are often referred to as 'spare turns'. The base roster includes rest days between sets of rostered days and sometimes, if there is a shortfall of drivers, those on rest days may be asked if they want to volunteer to work instead.

50 RAIB's analysis of GTR's train driver base roster for Norwood depot found that it did not include some areas of published good practice in fatigue management. Consequently, the shifts worked by the driver of train 2F40 increased the risk of fatigue.

[5] 'Driver fatigue and road collisions', RoSPA March 2024 (accessed on 15 October 2025).

51 For drivers based at Norwood depot, GTR's long-term planning department issues a set of diagrams twice a year. Each diagram must comply with a set of rules, governing issues like maximum duty length and the scheduling of breaks. From these diagrams a base roster is constructed using a third-party software package.

52 The base roster is evaluated for fatigue risk using an assessment tool called the FRI (fatigue risk index) developed as part of a programme of research for the Health & Safety Executive (HSE). The tool is a mathematical model that uses shift timings and an estimation of rest and workload. The FRI produces two numerical outputs for a given roster pattern. These are a fatigue index and a risk index. The fatigue score represents the probability that a person is experiencing a high level of fatigue. The risk score represents the relative risk of a fatigue-related event. Its output is a prediction which should not be used solely for establishing a threshold for determining whether a roster is acceptable in terms of fatigue.

53 At GTR a fatigue score is calculated for each roster. The scores are managed when creating the roster to keep them below a defined threshold score.

54 The roster is also designed to comply with the 'Hidden limits.' This is an informal term often used by the railway industry when referring to the working time limits that were introduced following the public inquiry into the Clapham Junction rail accident in December 1988, led by Lord Justice Hidden.[6] The public inquiry found that one of the causes of the accident was that workers' performance had probably been affected by fatigue. These limits have been used extensively in the rail industry to manage fatigue by defining permissible work and rest periods. However, they have subsequently been superseded by a risk-based approach to determine working hours and avoid fatigue (see paragraph 61).

55 The Hidden limits included the following requirements:

- no more than 12 hours work per turn of duty
- no more than 13 shifts in 14 consecutive days
- a minimum of 12 hours rest between duties
- a maximum 72-hour working week.

56 Other legal regulations have subsequently been introduced to limit working hours since the Clapham Junction investigation report was published. These include The Working Time Regulations 1998, The Management of Health and Safety at Work Regulations 1999 and The Railways and Other Guided Transport Systems Regulations 2006.

57 Therefore, in addition to the Hidden limits, the base roster at GTR is constructed to meet these legal requirements by ensuring that drivers have:

- no more than 7 continuous days' work
- a minimum of 12 hours rest between duties.

58 Once base rosters are constructed, they are then sent to local union representatives who check them against local agreements. This check will also consider fatigue risk.

[6] The investigation report is available at https://www.railwaysarchive.co.uk/docsummary.php?docID=36.

59 Following this, GTR's short-term planning department produces short-term planning (STP) diagrams which take into account any subsequent changes to the timetable, for example, due to engineering works or major public events. These STP diagrams are then sent to the resource managers and to the roster clerks who will allocate each diagram to individual drivers using a different third-party software system. This software will flag up any breaches of the Hidden limits, but it does not produce an altered FRI score. Changes to weekly rosters are posted at depots 1 week in advance, and any changes to daily rosters are posted 2 working days in advance of the relevant shifts.

60 Appearance sheets are used to communicate to drivers the shifts they have been allocated and to show the amendments to the base roster (including changed diagrams and any overtime). These sheets are then sent to the resource managers who then deal with STP diagrams that have no allocated driver because of, for example, sickness, annual leave or training commitments. If any diagrams remain uncovered the work will be offered for rest day working. The only check made by resource managers for fatigue risk at this point is against the Hidden limits (figure 7).

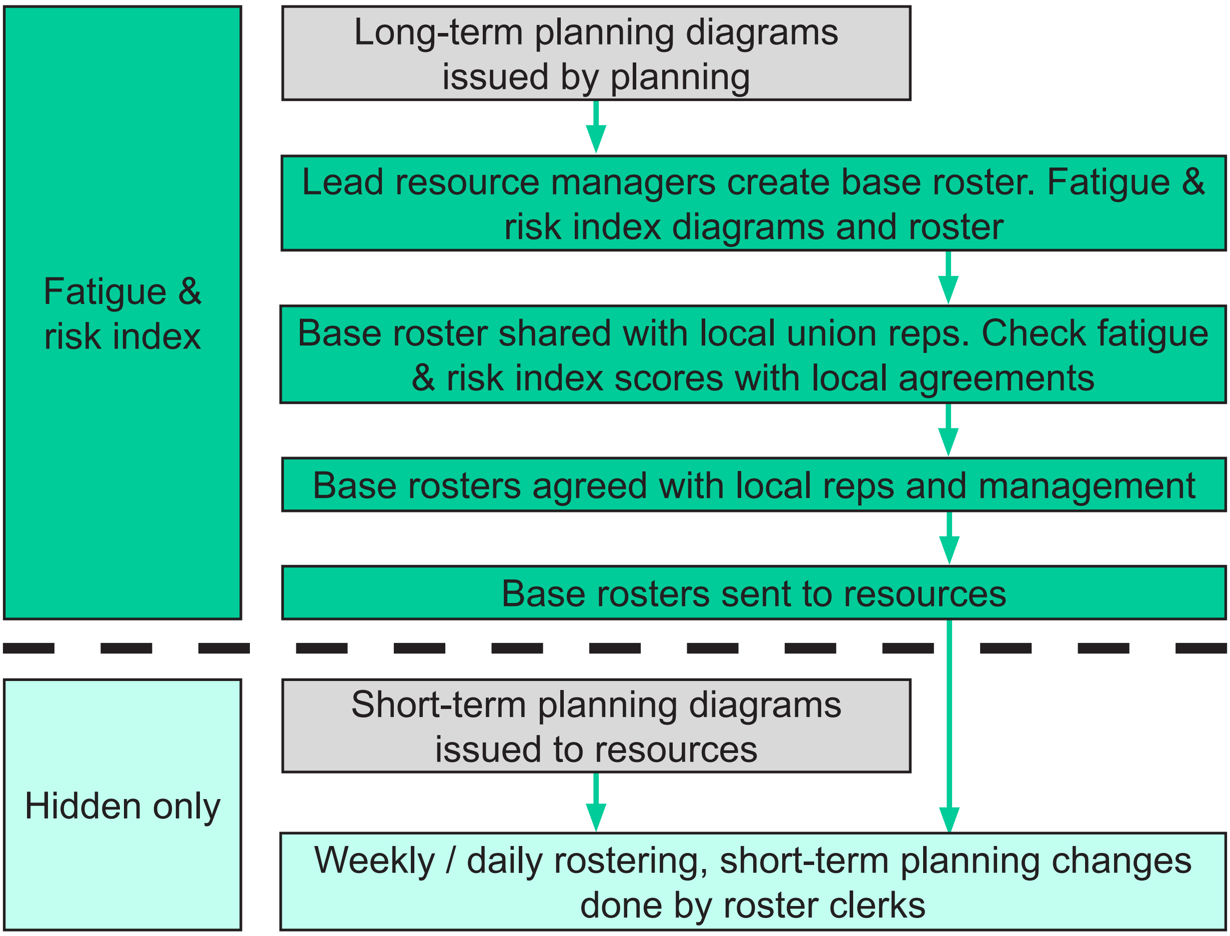

Figure 7: Diagram showing the rostering process in place at GTR at the time of the accident.

Fatigue risk assessment of the roster

61 In August 2024, ORR issued an updated version of its guidance document 'Managing rail staff fatigue - Guidance for companies in the rail industry', which was originally issued in 2012 (paragraph 39). This guidance provides advice and information about fatigue and reflects significant elements of the required legislation and legal obligations for the duty holders in the rail industry. It also sets out the necessary components of a fatigue risk management system (FRMS).

62 Although GTR makes various checks on rosters for fatigue risk, reliance on the FRI as a fatigue assessment tool for the base roster is not in line with good practice issued by ORR. ORR's guidance is clear on the limitations of fatigue assessment tools such as the FRI, and states that they should be used with caution and as part of a wider FRMS. The limitations of fatigue risk tools and the bio-mathematical models which underpin them, and the need to consider their output among other information, were also outlined in the 2012 version of this guidance.

63 The reliance on Hidden limits to manage fatigue is also contrary to good practice. ORR guidance notes that it is still possible to produce a fatiguing roster while observing these limits and that knowledge of fatigue risk management has developed since they were established. ORR guidance states: *'It is important to recognise that these limits were based on what was thought to be operationally achievable at the time, rather than on sound fatigue management science'*. This was also stated in the 2012 version of the guidance. It is also of note that Railway Group Standard, GH/RT 4004, 'Changes in Working Hours – safety critical work', issue 1 dated August 1996, which incorporated the Hidden limits, was withdrawn in 2007.

64 Although checks are made to identify working patterns that may possibly cause fatigue when designing the base roster, subsequent changes that are then incorporated into the roster are subject to fewer checks of this nature, as they are only checked to see if they are compliant with Hidden limits. This increases the likelihood that the final roster produced will not adequately manage the risk of fatigue for a driver.

65 ORR issued a document called 'Good Practice guidelines – fatigue factors',[7] in December 2021. These guidelines contained a set of factors that identify working patterns that may increase the risk of fatigue in the rail industry and were later included in the 2024 guidance (paragraph 39). These factors are not prescriptive limits but indicate a potential increase in the likelihood of fatigue occurring. Fatiguing factors should be kept to a minimum in a roster and a high number of fatiguing factors highlights the need to assess and control the potential fatigue risk.

66 RAIB analysed the driver's roster for the month before the accident. The analysis identified six of the fatiguing factors listed within the ORR document. These were:

- early starts (05:00 – 07:00)
- very early starts (before 05:00)
- less than 2 days off after a block of early starts
- more than 12 consecutive day shifts

[7] 'Good Practice guidelines – fatigue factors', Office of Rail and Road December 2021 (accessed October 2025).

- more than 55 hours worked in a 7-day period
- successive shift start times varying more than 2 hours.

67 Two shifts that the driver worked at the beginning of the week of the accident had backward rotating shift patterns. This means that each of the shifts was started earlier than the last one and this backwards rotation may contribute towards fatigue.

68 The processes used by GTR when constructing and managing drivers' rosters did not identify all these fatiguing factors. As a consequence, the rostering process did not effectively assess and control the risk of fatigue which probably led to the driver being sufficiently fatigued to experience a microsleep.

Rest day working

69 The driver had worked a number of rest days in the period up to the day of the accident which further increased the risk of fatigue. This is a probable causal factor.

70 RAIB's review of the shifts worked by the driver found they had worked many of their rostered rest days. It is probable that working rest days resulted in a significantly increased risk of fatigue. This risk would also depend on the quality of rest experienced by an individual in the days before, during and after a rest day worked.

71 In the 22 days preceding the accident the driver was rostered to have 12 rest days. The driver worked 9 of these, leaving them with 3 actual rest days in that 22-day period. In November, the driver was rostered 8 rest days and worked 6 of them, while in October they were rostered for 10 rest days and again worked 6 of them. Overall, in the 3 months before the accident, the driver had taken 10 rest days, an average of less than one a week.

72 ORR guidance (paragraph 39) states that rest day working should be kept to a minimum to ensure that planned recovery time achieves its objective and staff return to work refreshed. The guidance also recognises that: *'Some individuals may be keen to maximise their earnings by working as much overtime as possible, with potentially dangerous consequences in terms of fatigue.'* ORR notes that any proposed changes to work patterns should be risk assessed to check that they take into account good fatigue management practices.

73 Although on the day of the accident the driver was not working a rest day, in the weeks leading up to the accident there had been a need for rest day working at Norwood depot due to unanticipated uncovered work. Although there are generally no resource issues at the depot and there are often 'spare' drivers available, the rules governing how these spare drivers may be used to cover unallocated work turns may limit their usability. Spare drivers, for example, may not have the requisite route or traction knowledge to cover specific diagrams or a nominal signing-on time which can only be varied by a limited amount.

74 Before rest day working is allocated to a driver, the only check made by the resource managers is compliance with the Hidden limits. No checks are made to see if the rest day work being allocated increases the risk of fatigue for the driver concerned.

The driver's sleep routine

75 The driver had less than their normal amount of sleep the night before the accident. This is a possible causal factor.

76 The most probable reasons for the driver being fatigued relate to the base roster they were working (paragraph 48) and the number of rest days they worked in the weeks before the accident (paragraph 69). However, it is also possible that the amount of sleep they had the night before the accident contributed to the fatigue they experienced.

77 The night before the accident, the driver stated that they had not had the quantity of sleep that they usually have when working. They had gone to bed at around 23:30 and fallen asleep at around 00:30, getting up at around 07:30. Normally, the driver had around 8 hours sleep a night and with an early afternoon start time for work, would get up at around 09:00. However, due to unexpected changes in childcare arrangements at home, the driver needed to be up earlier on the day of the accident.

78 Fatigue can be caused by a reduction in sleep quality or quantity. The extent to which sleep loss causes fatigue varies among individuals and can depend on overall health, daily activities and typical sleep patterns. Research (Innes, Poudel & Jones, 2013[8]) has found that when their regular pattern of sleep is disrupted or restricted, people with consistent sleep patterns and efficient sleep may be more prone to microsleeps than other people.

Engineered systems on the train

79 None of the engineered protection systems fitted to the train intervened to prevent the collision.

80 The train was fitted with safety systems designed to stop the train by triggering an emergency brake application. All these systems were found to be operating as designed after the accident. However, as the conditions for them to intervene were not met, they did not prevent the collision. This was because:

a. The driver maintained pressure on the foot pedal during the approach to the buffers. The DSD system requires the pressure to be released from the DSD foot pedal for 6 seconds before it activates (paragraph 15).

b. The time between the driver's last driving control input and the train reaching the buffer stop was around 10 seconds, less than the intervention time of the DVD (paragraphs 16 and 29).

c. The train was travelling at around 8 mph (12.9 km/h) when it passed over the TPWS OSS. This was under the set speed of 12.5 mph (20 km/h), so TPWS did not intervene (paragraphs 18 and 28).

---

[8] Innes C R H, Poudel G R and Jones R D, 'Efficient and regular patterns of nighttime sleep are related to increased vulnerability to microsleeps following a single night of sleep restriction', Chronobiology International: volume 30, issue 9, pages 1187 to 1196 (2013).

Identification of underlying factors

Management of fatigue

81 GTR's management of fatigue risk was not sufficiently effective and did not incorporate some elements of rail industry good practice. This is a probable underlying factor.

82 At the time of the accident, some of the elements of fatigue risk management at GTR did not reflect good practice. This included the use of the FRI tool to design working rosters (paragraph 62) and a reliance on the Hidden limits (paragraph 63). In addition, 'fatiguing factors' were not considered at any point in the roster design (paragraph 68). Where changes needed to be made to a base roster, the final rosters which resulted had only received very basic fatigue checks (paragraph 60). Rest day working was also only checked for compliance with the Hidden limits with no checks being made to see if this increased the risk of fatigue (paragraph 74).

83 In addition to ORR's guidance on managing rail staff fatigue (paragraph 39), the Rail Safety and Standards Board (RSSB, a not-for-profit body whose members are the companies making up the railway industry) also provides research and guidance in the area of fatigue risk management (appendix C). RSSB's guidance supports the use of ORR's fatiguing factors in the design of rosters and the move away from the use of the Hidden limits. It also suggests developing a mechanism for reviewing fatigue risk associated with actual working hours rather than on planned hours alone.[9]

84 GTR's FRMS does not include a policy or a process for authorising and risk assessing overtime and rest day working to minimise the risk from fatigue. GTR's current fatigue standard, GTR/H&SMS/4.15 20/11/2017 states that: '*Although it is recognised that rest day working is an individual choice, employees must ensure that they self manage their fatigue levels when rest day working.'* This leaves decisions about rest day working fatigue risk to individuals and does not provide any management control of increased risk of fatigue, although the company does undertake some random checks of the numbers of rest days worked. Employees may not be best placed to fulfil this expectation and manage this risk objectively, particularly as it may conflict with a natural desire to maximise earnings (paragraph 72).

85 Although rest day working is a common feature of staffing arrangements on the operational railway it is important that it is monitored and assessed for fatigue. If a significant amount of rest day working take place, then fatigue risks are likely to be higher if the risk is not controlled.

[9] '9 things you consider for your fatigue risk management plan', RSSB (2020).

Driver alertness monitoring

86 Safety systems currently fitted to trains operating on the mainline railway are not able to detect and mitigate short losses of driver alertness.

87 The current safety systems fitted to mainline trains (paragraphs 14 to 16) are not able to detect short losses of driver awareness. Existing driver safety devices are fitted to mitigate a temporary loss of control of a train due to driver incapacitation, while existing driver vigilance systems measure the frequency of actions taken by drivers, monitoring only their functioning, and not their level of alertness. Often these systems can be responded to in an automatic manner and are not adequate for predicting overall deterioration in performance. The existing systems fitted to trains, including the one involved in this accident, are compliant with the standards that were in force at the time of their introduction into service.

88 The current standard for these systems is the National Technical Specification Notice 'Operation and Traffic Management (OPE)', issue 2,[10] dated May 2025, and its predecessor document issued in 2021. Both state that the on board monitoring shall automatically stop the train when a lack of driver activity is detected. The means to do this is detailed in clause 4.3.9.3.1 of National Technical Specification Notice 'Rolling Stock – Locomotive & Passenger (LOC & PAS)', issue 2 dated May 2025. This requires that '*the driver's cabs shall be equipped with a means to monitor a driver's activity, and to automatically stop the train when a lack of driver's activity is detected'.* This is done by monitoring the driver's actions when the train is moving. If there is no driver action over a defined period of time then a warning is provided, and an emergency brake application made if there is no response to the warning.

89 New train specifications usually refer to RSSB's 'Key Train Requirements' document. This is designed to assist those responsible for setting specifications for new build and refurbished trains. This document is currently at version 7, dated July 2023.

90 For trains built to the current version of 'Key Train Requirements', there is a requirement for them to have passive provision in the cab for an attention/alertness monitoring system. This would be items on the driving control desk, a power supply, a feed into the OTDR, a seat vibration device, and/or communication with the control centre. There is no requirement for such an attention/alertness monitoring system to be fitted.

91 Modern vigilance monitoring devices can identify when a driver's level of attention is significantly decreased. An intervention occurs a set threshold is reached. Devices may use metrics such as eye closure, head position and gaze to establish a loss of attention.

[10] https://www.gov.uk/government/publications/ntsn-operation-and-traffic-management.

92 In 2014, RSSB published knowledge search report S184, titled 'Driver alertness monitoring systems'. This evaluated existing and emerging vigilance device technology, including facial monitoring systems. These typically use a sensor focused on the subject's face to identify signs like eyelid movement, that may indicate drowsiness. The report identified concerns with the intrusiveness and reliability of this technology. It also raised concerns about the suitability of other types of technology used in road vehicles for the rail environment. ORR guidance (paragraph 39) states that this type of technology, if introduced, should always supplement wider organisational fatigue controls, not replace them.

93 Following the tram accident at Sandilands, Croydon, in 2016 (RAIB report 18/2017), London Trams fitted the Guardian system to its fleet of trams. This system measures percentage of eye closure, face expression, head position and gaze direction. When it detects that attention has decreased below set parameters an event is recorded. This triggers an alert to the driver (an audible warning and seat vibration). The event is then uploaded for external analysis and on-call managers are alerted, who can then respond appropriately. ORR has informed RAIB that it is aware at the time of this report (December 2025) of an ongoing trial of a wearable device in the tram sector which is intended to proactively detect the onset of fatigue.

94 RAIB has investigated two relevant accidents where the safety systems did not detect and mitigate against a loss of driver alertness when approaching buffer stops:

- RAIB's investigation into a buffer stop collision that occurred at Kirkby, 13 March 2021 (RAIB report 07/2022), found that the driver was distracted from the driving task by their mobile phone and by a bag falling on the cab floor. The train struck the buffer stop at around 29 mph (47 km/h). Similarly to this accident, none of the engineered systems were activated to apply the brakes as the conditions for their interventions were not met. The collision caused significant damage to the infrastructure.
- At Enfield Town, on 12 October 2021 (RAIB report 13/2022), a train hit the buffer stop at 7.7 mph (12 km/h) due to the driver losing awareness of the driving task. RAIB's investigation found that the driver was fatigued at the time and post-incident testing produced a positive result for recreational drugs. Again, none of the engineered systems applied the train's brakes, as the conditions for their interventions were not met. The accident caused a minor leg injury to one passenger, who also reported suffering the effects of traumatic shock, while another reported that they were also suffering from traumatic shock. The buffer stop was destroyed in the collision.

Observation

Medical fitness and working hours

95 Actual working hours were not considered in the management of GTR safety-critical staff with medical conditions.

96 RAIB observed that the consultant medical professional used by GTR based their decision on the driver's fitness to work on the assumption that the driver worked a 'normal' working week without significant overtime or rest day working. In this case, the consultant believed that GTR's occupational health department would manage any additional fatigue risk arising from working additional hours. However, this was not explicitly considered by the occupational health practitioner or by other line managers at GTR.

97 Fitness-to-work decisions result in an outcome where someone is either fit or unfit (with or without workplace adjustments). It is often treated as a binary problem where employees are either considered fit to work as many hours as the rostering system allows, or not at all. This may result in actual working hours not being considered in fitness for duty of safety-critical staff.

98 The medical fitness requirements for train drivers are set out in The Train Driving Licences and Certificates Regulations 2010[11] which require train drivers to meet a standard of medical and psychological fitness.

99 Since the accident, in March 2025, Rail Industry Standard RIS-3789 TOM, 'Medical Fitness Assessment' has been issued. This single standard replaces previous standards:

- RIS-3451-TOM, 'Medical fitness standards for train drivers', issue 1 dated 2016
- RIS-3452-TOM, 'Fitness standards for workers involved in train movements', issue 1 dated 2016
- guidance GOGN 3655, 'Guidance on medical fitness standards', issue 2 dated 2014.

RIS-3789 TOM sets out requirements and guidance for medical fitness assessments for the rail industry and includes fatigue guidance. It does not, however, give specific guidance on how to manage the potential effects of fatigue combined with a medical condition.

100 Medical and occupational health specialists may be provided with background information about the role and tasks undertaken by safety-critical workers before making decisions about fitness to work. However, this means that there is no specific requirement in standards to consider actual hours worked or the potential for additional hours to be worked. A more holistic and risk-based approach, with greater co-ordination between all those involved, that takes into consideration individual health and working patterns, would enable better fatigue management for people with medical conditions.

101 This is supported by RSSB's 2025 report T1324, 'Managing the risk associated with medical impairment in safety critical occupations'. This recommends providing a risk-based approach when managing incapacitation or impairment for safety-critical workers. It highlights the need for collaboration to make reasoned and evidence-based decisions allowing risk control measures to be put in place.

[11] https://www.legislation.gov.uk/uksi/2010/724/contents.

Previous occurrences of a similar character

102 As well as the accidents discussed in paragraph 94, RAIB has previously investigated other accidents and incidents involving driver fatigue. These include:

- A collision between two freight trains that occurred at Loversall Carr Junction, Doncaster, 5 July 2022 (RAIB report 08/2023). In this accident, a freight train passed a signal at danger and collided with the rear of a stationary freight train ahead of it. The driver experienced a loss of awareness of the driving task, probably due to the effects of fatigue and low workload. The driver's working pattern and an undiagnosed sleep condition also contributed to their fatigue. RAIB found that a probable underlying factor to the accident was that the operating company's management systems did not detect that the driver was at risk of fatigue.
- In 2017, a collision with the buffer stops at Kings Cross station (RAIB safety digest 15/2017) resulted in minor injuries to four passengers. The accident occurred because the driver was suffering from fatigue and experienced a microsleep in the last few seconds of the approach to the buffer stop. RAIB's safety digest highlighted the importance of effective and comprehensive fatigue risk management.
- In 2021, RAIB investigated a near miss between a rail grinding train and an empty passenger train at Sileby Junction (RAIB report 06/2022). RAIB found that the driver did not control the speed of their train, probably due to fatigue. A probable underlying factor to the incident was that the operating company's fatigue risk management processes did not prevent the driver from being affected by fatigue.

Summary of conclusions

Immediate cause

103 The train entered the platform at the correct speed but was not brought to a stand before reaching the buffer stops (paragraph 33).

Causal factors

104 The causal factors were:

a. On approach to the buffer stops, the driver almost certainly experienced a microsleep as a result of fatigue (paragraph 37), **Learning point 1**. This causal factor arose due to a combination of the following:

   i. The base roster was constructed in a way that increased the risk of the driver becoming fatigued. This is a probable causal factor (paragraph 48), **Recommendation 1**.

   ii. The driver had worked a number of rest days in the period up to the day of the accident which further increased the risk of fatigue. This is a probable causal factor (paragraph 69), **Recommendation 1**.

   iii. The driver had less than their normal amount of sleep the night before the accident. This is a possible causal factor (paragraph 75), **Recommendation 1**, **Learning point 1**.

b. None of the engineered protection systems fitted to the train intervened to prevent the collision (paragraph 79), action already taken, paragraph 112.

Underlying factors

105 The underlying factors were:

a. GTR's management of fatigue risk was not sufficiently effective and did not incorporate some elements of rail industry good practice. This is a probable underlying factor (paragraph 81), **Recommendation 1**.

b. Safety systems currently fitted to trains operating on the mainline railway are not able to detect and mitigate short losses of driver alertness (paragraph 86), action already taken, paragraph 112.

Additional observation

106 Although not linked to the accident on 13 December 2024, RAIB observes that:

a. Actual working hours were not considered in the management of GTR safety-critical staff with medical conditions (paragraph 95), **Recommendation 2**.

Previous RAIB recommendations relevant to this investigation

Recommendation that is currently being implemented

Buffer stop collision at Kirkby, Merseyside, 13 March 2021, RAIB report 07/2022, Recommendation 1

107 The above recommendation addresses the factor relating to the provision of safety systems fitted to trains, as identified in this investigation. To avoid duplication it is not remade in this report. However, shown below is a recap of its wording and an account of its current status.

Recommendation 1

The intent of this recommendation is that additional research be undertaken into systems which can detect and monitor driver alertness and awareness, and how these could be trialled in the industry.

RSSB, in consultation with relevant stakeholders and bodies representing staff, should undertake further research into how the detection and mitigation of a loss of alertness or attention in train drivers can be improved. This research should specifically consider the effectiveness of systems currently in operation and build on work already completed, such as the functional specification and proposed trials set out in the T1193 research report. It should also take into account relevant practice from other transport systems.

108 On 10 August 2023, ORR reported to RAIB that RSSB had a proposed action plan and timescale for delivery in response to this recommendation. The status of this recommendation is classified as ‘open’ as actions to address the recommendation are ongoing. The research and subsequent planned actions will potentially address the risk of identifying and mitigating a loss in driver alertness which has been identified in this investigation. As a result, there is no further recommendation made as part of this investigation (paragraph 112).

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

109 In August 2025 GTR published a revised fatigue management standard. GTR stated to RAIB that this new standard provides a foundation for the management of fatigue-related absences, fatigue reporting and roster modelling. It also references shift swaps and overtime, with GTR stating that further relevant work is planned.

110 ORR's best practice guidance for managing rail staff fatigue was first issued in 2012 and reissued in 2024 (paragraph 61). This guidance has helped to steer fatigue risk management in the rail industry towards good practice, supported by launch events intended to encourage duty holders to adopt it. However, despite this, this investigation and others undertaken by RAIB suggest that it has not been completely embedded in Britain's rail industry, with many operators still relying only on the FRI and adherence to Hidden limits to manage fatigue in their organisation.

111 Alongside the new issue of the guidance, ORR is including fatigue management as a topic when undertaking duty holder inspections during 2025 and into 2026. These will focus on many areas of fatigue risk management, including policies, training, management and supervision, measuring and reviewing performance, and incident investigation procedures. The information from the inspections will also provide data to help further understand fatigue management in the British rail industry and how this can be improved and developed.

112 A research project is also currently being undertaken by RSSB to improve understanding of train driver alertness and attention monitoring devices. This is research project IMP T1193 'Trialling technology to monitor train driver alertness and attention'. RSSB informed RAIB that it was, as of July 2025, undertaking trials of driver alertness and monitoring devices and that it will trial in-cab equipment which detects eye closure and, specifically, microsleeps.

Recommendations and learning point

Recommendations

113 The following recommendations are made:[12]

1 *The intent of this recommendation is to reduce the risk of fatigue affecting the performance of train drivers employed by Govia Thameslink Railway.*

Govia Thameslink Railway should review and improve its fatigue risk management system. This review should consider how the risk of driver fatigue should be assessed and effectively controlled, and should include specific consideration of:

- relevant law, guidance and good practice from the rail industry, and other industries that may be applicable
- the development of an appropriate fatigue policy
- the use of bio-mathematical models and their limitations
- the design of driver rosters
- the tools available to assist staff who are responsible for making short-term adjustments to base rosters (such as rest day working), and how these allow the evaluation of fatigue risk and support decisions about changes to rosters
- the monitoring and control of rest day and extended hours working to ensure that the fatigue risk remains effectively controlled
- consideration of fatigue when investigating operational incidents
- appropriate performance indicators
- briefing staff, such as drivers and those responsible for allocating overtime and rest day working, on the increased risk of fatigue from working additional hours.

Govia Thameslink Railway should develop a timebound programme for the implementation of any appropriate improvements to its fatigue risk management system identified by this review.

[12] 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.

This recommendation may apply to other transport undertakings (paragraphs 104a.i, 104a.ii, 104a.iii and 105a).

2 *The intent of this recommendation is to provide clear guidance to the rail industry in Great Britain when seeking external advice from medical specialists about medical conditions and working arrangements of safety-critical staff.*

The Rail Safety and Standards Board, in consultation with the rail industry and using relevant processes, should review and, as necessary, revise any standards and guidance relevant to the assessment of the impact of additional working hours for staff with medical conditions.

This review should consider the information that should be provided to medical specialists when advice is being sought as to the possible impacts of medical conditions and/or medication on an individual's ability to safely perform their role. Such information may include working conditions, typical shift patterns, working hours, length of working days, breaks and possible variations, such as the likelihood of rest day working and extended working hours (paragraph 106).

Learning point

114 RAIB has identified the following important learning point:[13]

1 Drivers are reminded of the importance of:

- assessing their personal level of fatigue before and during duty, and to inform their company if they have any concerns about their ability to work safely (paragraph 104a)
- effectively managing their rest periods, including getting sufficient sleep based on their preferred sleep duration, to reduce the risk of fatigue (paragraph 104a.iii).

[13] '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

Abbreviation / acronym	Term in full
AWS	Automatic Warning System
DSD	Driver's safety device
DVD	Driver's vigilance device
FRI	Fatigue risk index
FRMS	Fatigue risk management system
GTR	Govia Thameslink Railway
HSE	Health and Safety Executive
ORR	Office of Rail and Road
OSS	Overspeed sensor system
OTDR	On-train data recorder
RAIB	Rail Accident Investigation Branch
RSSB	Rail Safety and Standards Board
STP	Short-term planning
TPWS	Train Protection and Warning System

Appendix B - Investigation details

RAIB used the following sources of evidence in this investigation:

- site photographs and measurements
- CCTV footage
- data from on-train data recorders
- witness statements
- alcohol and drug test results
- medical records, information and expert medical opinion
- training, assessment and competence records
- train operator procedures
- train maintenance records
- train operating company staff rosters
- industry guidance and standards
- buffer stop risk assessment
- weather reports and observations at the site
- a review of previous RAIB investigations that had relevance to this accident.

Appendix C - RSSB guidance and information on fatigue

RSSB Document no. RS504, 'Fatigue Management – A Good Practice Guide', issue 1 dated 1 September 2012

RSSB, 'Fatigue and its Contribution to Railway Incidents', https://www.rssb.co.uk/about-rssb/key-industry-topics/fatigue-and-alertness/fatigue-and-its-contribution-to-railway-incidents, dated 10 May 2019

RSSB, 'Managing Fatigue Risk: Planning and Rostering', https://www.rssb.co.uk/about-rssb/key-industry-topics/fatigue-and-alertness/managing-fatigue-risk-planning-and-rostering, dated 23 May 2019

RSSB, 'During-shift fatigue assessment tool', https://www.rssb.co.uk/about-rssb/key-industry-topics/fatigue-and-alertness/during-shift-fatigue-assessment-tool, dated 19 May 2025

RSSB, 'Managing Fatigue Risk: The Role of Line Managers and Supervisors', https://www.rssb.co.uk/about-rssb/key-industry-topics/fatigue-and-alertness/managing-fatigue-risk-the-role-of-line-managers-and-supervisors, dated 26 May 2021

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

Any enquiries about this publication should be sent to:

RAIB
The Wharf
Stores Road
Derby UK
DE21 4BA

Email: enquiries@raib.gov.uk
Telephone: 01332 253 300
Website: www.raib.gov.uk