RAIB

Rail Accident Investigation Branch

Rail Accident Report

Passenger train collision with a road vehicle at Redcar level crossing, Redcar and Cleveland 1 May 2024

Report 05/2025
April 2025

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.

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

Passenger train collision with a road vehicle at Redcar level crossing, Redcar and Cleveland, 1 May 2024

Contents

Summary

At around 09:25 on 1 May 2024, a passenger train travelling between Saltburn and Nunthorpe struck a car on Redcar level crossing, which is situated in the unitary authority of Redcar and Cleveland. The collision took place with the train travelling at 23 mph (37 km/h). The car driver was injured in the collision and significant damage was caused to the car. There were no reported injuries to the passengers and staff on the train.

The investigation found that the signaller had opened Redcar level crossing to road traffic following the passage of a previous train to allow road traffic to clear. The signaller then forgot that the crossing was open and tried to set the route for the passenger train into Redcar Central station but was unable to clear the protecting signal to allow the train to proceed. This was because the interlocking in the signalling system had detected that the crossing was open. Unable to get the signal to clear, the signaller authorised the train to pass the signal at danger. In the absence of the crossing gates being closed or the road traffic signals being activated, the car driver drove onto the crossing where the collision occurred.

RAIB found that the normal sequence of actions used by the signaller to set the route for the train to enter Redcar Central station was disrupted, probably causing them to forget that Redcar level crossing was open to road traffic. This disruption included a telephone call and a perceived fault with the signalling panel. RAIB also found that the visual and procedural cues available to the signaller of the status of Redcar level crossing, which may have alerted them that it remained open, were either not used or were not effective.

The investigation also found that the train driver did not approach the level crossing at a speed that would have allowed them to stop the train before it collided with the car. The train driver was also unable to see that the crossing gates were open to road traffic due to their unusual design. RAIB additionally identified that there were no engineered controls fitted to the level crossing that would have automatically activated the wig-wag lights when the train approached.

An underlying factor to the accident was that Network Rail's processes for managing signaller competence had not effectively addressed the signaller's previous operational incidents. RAIB also found that no ergonomic assessment of the layout of controls at Redcar signal box had been carried out, and that this was a possible underlying factor.

RAIB has made one recommendation to Network Rail. This deals with reviewing the ergonomic risks associated with the operation of the signals and level crossings at Redcar signal box.

Three learning points have also been identified, relating to the need to comply with the rules associated with trains being authorised to pass signals at danger. These relate to signallers checking that the route is clear, to train drivers driving at caution at controlled level crossings, and to signallers specifying the locations of controlled level crossings to train drivers.

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 09:25 on 1 May 2024, a passenger train travelling between Saltburn and Nunthorpe struck a car on Redcar level crossing in the unitary authority of Redcar and Cleveland. The collision took place at 23 mph (37 km/h). As a result of the accident, the car driver suffered broken ribs and bruising. Their car was reported to have been damaged beyond economic repair.

4 Redcar level crossing is fitted with road traffic light signals (referred to as 'wig-wags') and sliding gates on both sides of the railway. The gates, when fully extended, cross the whole width of the road.

5 Before the collision occurred, the driver of the train had been authorised by the signaller to pass a signal which was showing a red (danger) aspect. The signal involved protected two level crossings, including Redcar. However, the signal was showing a red aspect because the crossing gates at Redcar were open.

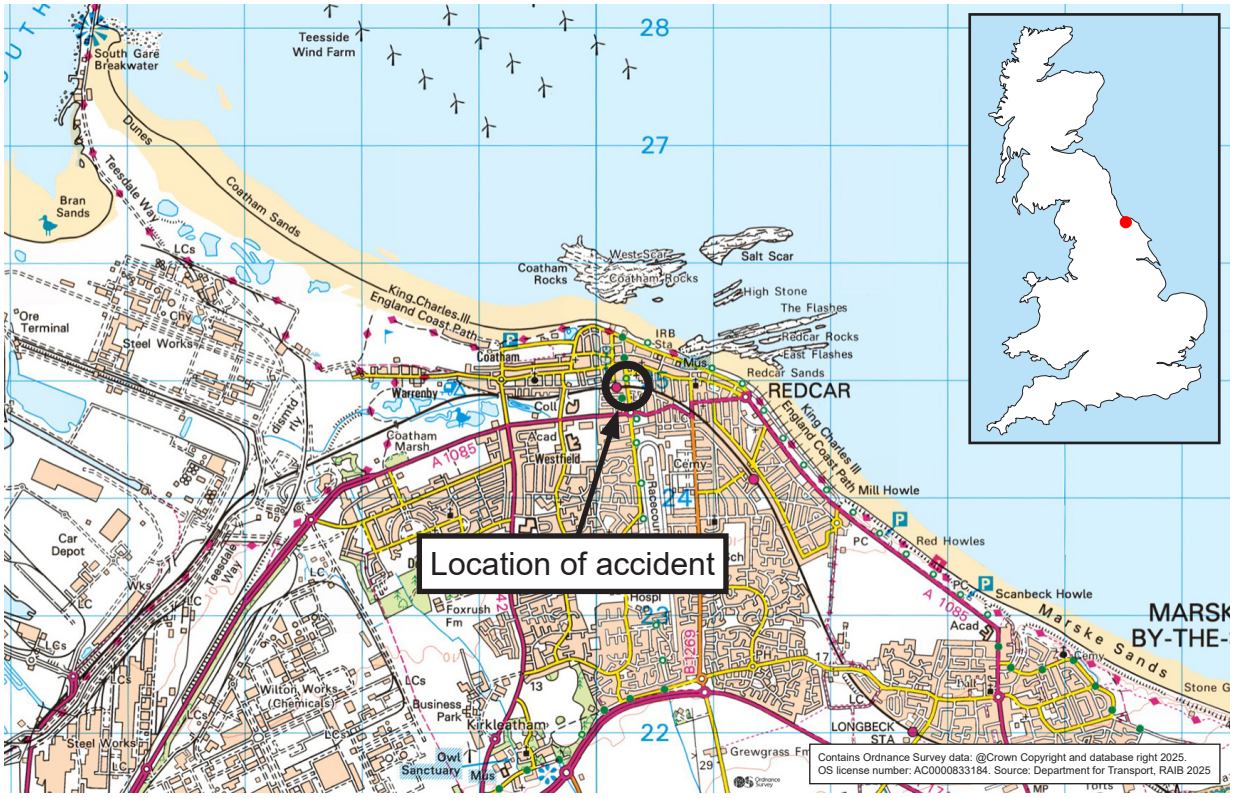

Figure 1: Extract from Ordnance Survey map showing location of accident.

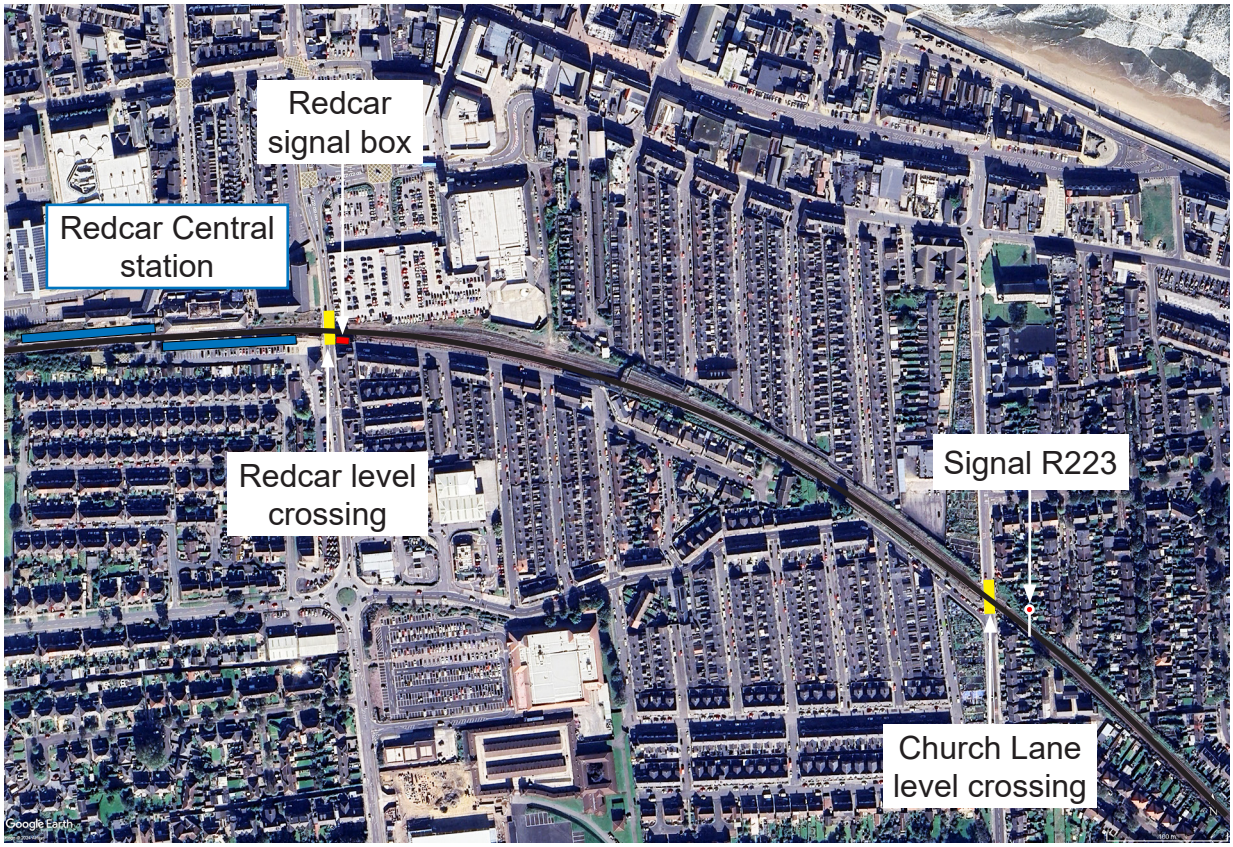

Figure 2: Overview of the locations of level crossings and the signal box at Redcar (courtesy of Google with RAIB annotations).

6 There were no injuries to the passengers or staff on the train. The damage to the train was largely cosmetic and it was able to be driven away from the crossing after the accident. There was damage to the fencing adjacent to the level crossing, although the gates remained operational. Train services were suspended until 14:35 the same day.

Context

Location

7 The accident occurred at Redcar level crossing, which is located in the middle of Redcar and adjacent to Redcar Central station (figures 1, 2 and 3). While Network Rail's Sectional Appendix refers to the crossing as 'Redcar', the signalling diagram in Redcar signal box labels the crossing 'West Dyke', and the signallers routinely use this name.

8 Redcar level crossing is a manually controlled gate (MCG) crossing, operated by a signaller at Redcar signal box, which uses horizontal sliding gates (see paragraph 94). This signaller also controls the manually controlled barrier (MCB) level crossing at Church Lane, approximately 600 metres to the east, which is monitored via CCTV cameras.

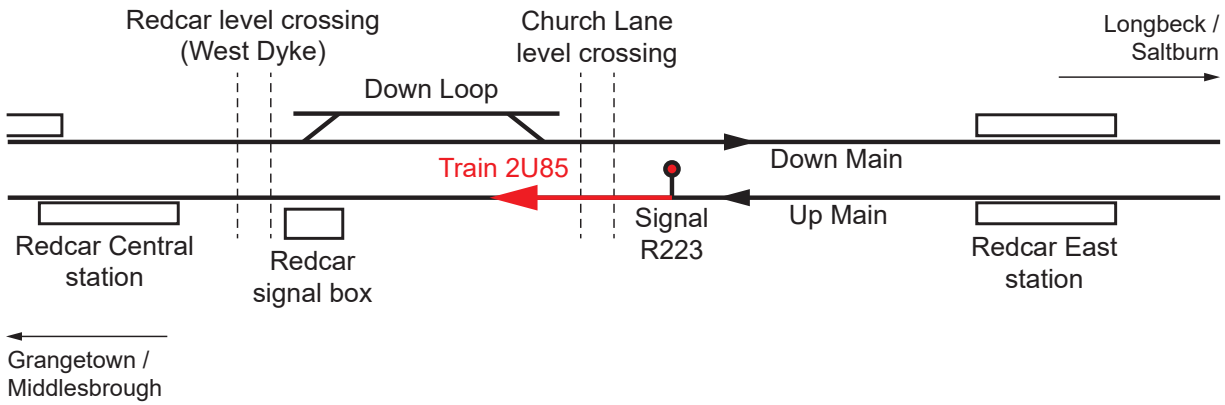

Figure 3: Track layout through Redcar.

9 Redcar level crossing is situated at 22 miles and 71 chains[1] on the line from Middlesbrough to Saltburn. This mileage is measured from a zero reference at Darlington using the pre-1978 route via Warrenby. The railway here is double track and not electrified. The section of railway between Longbeck signal box, to the east, and Redcar signal box, to the west, is controlled using the absolute block system. In simple terms, this only allows one train in each direction to enter the section of line between the two signal boxes at any one time. The operation of Redcar signal box is explained in more detail in paragraphs 37 and 42.

10 The accident happened on the Up Main line, which is used by trains heading west towards Middlesbrough. On this line, the maximum permitted speed at Redcar level crossing is 50 mph (80 km/h), increasing to 60 mph (96 km/h) immediately beyond the crossing. From Church Lane level crossing the line is on an uphill gradient of 1 in 262, but this levels off about 200 metres before Redcar level crossing.

Organisations involved

11 Network Rail owns and maintains the infrastructure in the Redcar area, which is within its North and East route. This route is part of Network Rail's Eastern region. Network Rail also employs the signaller who was operating Redcar signal box at the time of the accident.

12 Northern Trains Ltd (Northern) operated the train that was involved in the accident. It also employs the driver of that train.

13 Both Network Rail and Northern freely co-operated with the investigation.

Train involved

14 The train consisted of a class 156, two-car diesel multiple unit (number 156443). It was operating as train reporting number 2U85, the 09:08 Northern service from Saltburn to Nunthorpe, via Middlesbrough.

15 Post-accident testing of the train showed that its braking system was working normally.

[1] There are 80 chains in one mile, and one chain is approximately 20 metres.

Staff/persons involved

16 The signaller at Redcar signal box had worked as a signaller at various locations around England for 6 years. They had moved post from Cambridgeshire to Redcar signal box 15 months before the accident and this was the signaller's usual place of work.

17 The signaller had had two safety-related incidents in the 2 years leading up to the accident. One of these involved signalling a train into a section before receiving confirmation that the line was clear, while the second involved granting a line blockage incorrectly. The signaller had been put on a number of support plans to develop their competence and to improve their rule knowledge (see paragraph 110).

18 The train driver had completed driver training 15 months before the accident and successfully passed their first post-qualification reassessment a week before the accident. This training included assessment of the rules associated with passing a signal at danger. They had driven the route to Saltburn approximately 20 times in the 3 months before the accident as part of adding this to their route knowledge, and in normal service. There were no safety-related incidents identified on the driver's records.

External circumstances

19 At the time of the accident, the weather was overcast and dry with almost no wind. It was daylight, but there was no evidence that sun glare contributed to the accident, due to the cloud cover.

20 The double glazing in the signal box meant that external traffic noise was unlikely to have affected the signaller's actions.

21 The recording from the forward-facing CCTV system on the train showed that no cars crossed the level crossing as it approached. This was unusual, with witness evidence indicating that the level crossing is normally very busy with road traffic at the time of day that the accident occurred.

The sequence of events

Events preceding the accident

22 On 8 April 2024, just over 3 weeks before the accident, the signaller received an email from one of the signaller managers asking for an explanation for a 2-minute delay that a train had experienced at Redcar station. This was part of the delay attribution process that allocates the costs of delays between the train operators and Network Rail. The signaller replied, saying that the delay was related to passengers boarding and not due to signalling. This was the first and only time that the signaller had received such an email, and they stated that it drew their attention to the requirement not to unduly delay trains while undertaking signalling duties.

23 On the day of the accident, the signaller started their shift at 06:00. At 09:10, the preceding train to that involved in the accident arrived at Redcar Central station. This was train 2D11, the 08:59 Northern service from Saltburn to Bishop Auckland. As train 2D11 passed signal R223 (figure 3) the signal automatically reverted to showing a red aspect. The signaller observed the associated indicator lamps on the signalling panel flicker and go out.

24 The signaller, in the knowledge that train 2U85 was due immediately after train 2D11, left the level crossing barriers at Church Lane closed but saw through the signal box window that traffic and pedestrians were queuing at Redcar level crossing. The signaller decided to open the gates on the crossing to allow road traffic to pass.

25 At 09:11, the signaller received a bell code message from Longbeck signal box 'offering' train 2U85, effectively requesting whether the train can be signalled towards Redcar. The signaller accepted this train and, 2 minutes later, received another bell code message advising that train 2U85 was entering the section from Longbeck to Redcar.

26 At 09:14, the signaller received a telephone call from Grangetown signal box with a request for another member of staff's phone number. A minute later, the signaller called back with the requested information.

27 By this time, train 2U85 was at Longbeck station. The signaller tried to set the route for the train from signal R223 across the two level crossings and into Redcar station by using the control on the signalling panel to change the signal's aspect from red to green (proceed) (see paragraph 40). The signaller found that the red indicator lamp for signal R223 was not lit up as expected before operating the control. They were then unable to get the indication to change to show the green indicator lamp by using the control on the panel to change the signal's aspect. The signaller had, by this point, forgotten that Redcar level crossing was still open to road traffic.

28 At 09:18, the signaller called Network Rail's East Coast route control desk to report the apparent fault with signal R223 on the signalling panel. The signaller was uncertain if there was a fault on the signalling panel or with the signal itself. The signaller stated that the indicator lamps for signal R223 were blank, despite trying to set the route.

29 At 09:20, this call was interrupted by a message from the driver of train 2U85, which had stopped at signal R223. The signaller immediately called the driver back and asked what aspect the signal was showing. The driver thought that this was an unusual request but stated that the signal was showing a red aspect. The signaller said that the panel indication was blank and authorised the train driver to pass the signal.

Events during the accident

30 At 09:22, having been authorised to pass signal R223 at danger, the train driver took power and started to accelerate towards Church Lane level crossing, passing it at approximately 10 mph (16 km/h). The driver continued to accelerate up to 30 mph (48 km/h), at which point they removed power and allowed the train to coast. The driver then applied the brakes, reducing the speed to 23 mph (37 km/h), before coasting towards the level crossing and the station.

31 As soon as the train started moving, the signaller resumed the call to the route control desk to finish reporting the fault on the panel. This call continued until after the collision occurred.

32 At 09:23:07, the car entered Redcar level crossing from the south side, having turned right from the side street at Birdsall Row. The crossing gates were open, and the wig-wag lights were not activated, meaning that there was no reason for the car driver, who lived locally and was familiar with the crossing's operation, not to enter the crossing. The front right side of the car was struck by the front left side of the train as it was passing over the crossing.

Events following the accident

33 Immediately after the collision, the signaller contacted the adjacent signal boxes at Grangetown and Longbeck and arranged for all trains to be stopped. The signaller also advised the route control office and the local managers of the collision, while the emergency services were called.

34 Because the train had stopped partially in the platform, the passengers were evacuated from the train to Redcar station.

35 By 14:35, the car had been removed from the accident location, and the train was able to be driven under its own power to the depot, meaning that the line could be reopened.

36 Following the accident, both the signaller and the train driver were tested for the presence of drugs and alcohol, with all tests yielding negative results.

Background information

Redcar signal box

37 The railway at Redcar is double track, and trains arrive from and depart towards the adjacent signal boxes at Grangetown, to the west, and Longbeck, to the east. The signalling for the section between Redcar signal box and Longbeck signal box is operated using the absolute block system (paragraph 9). Signals capable of showing red aspects and green aspects control the entry and exit of trains from each block section. The line from Redcar to Grangetown signal box uses the track circuit block system. This breaks the line down into smaller sections and uses track circuits to identify the location of trains.

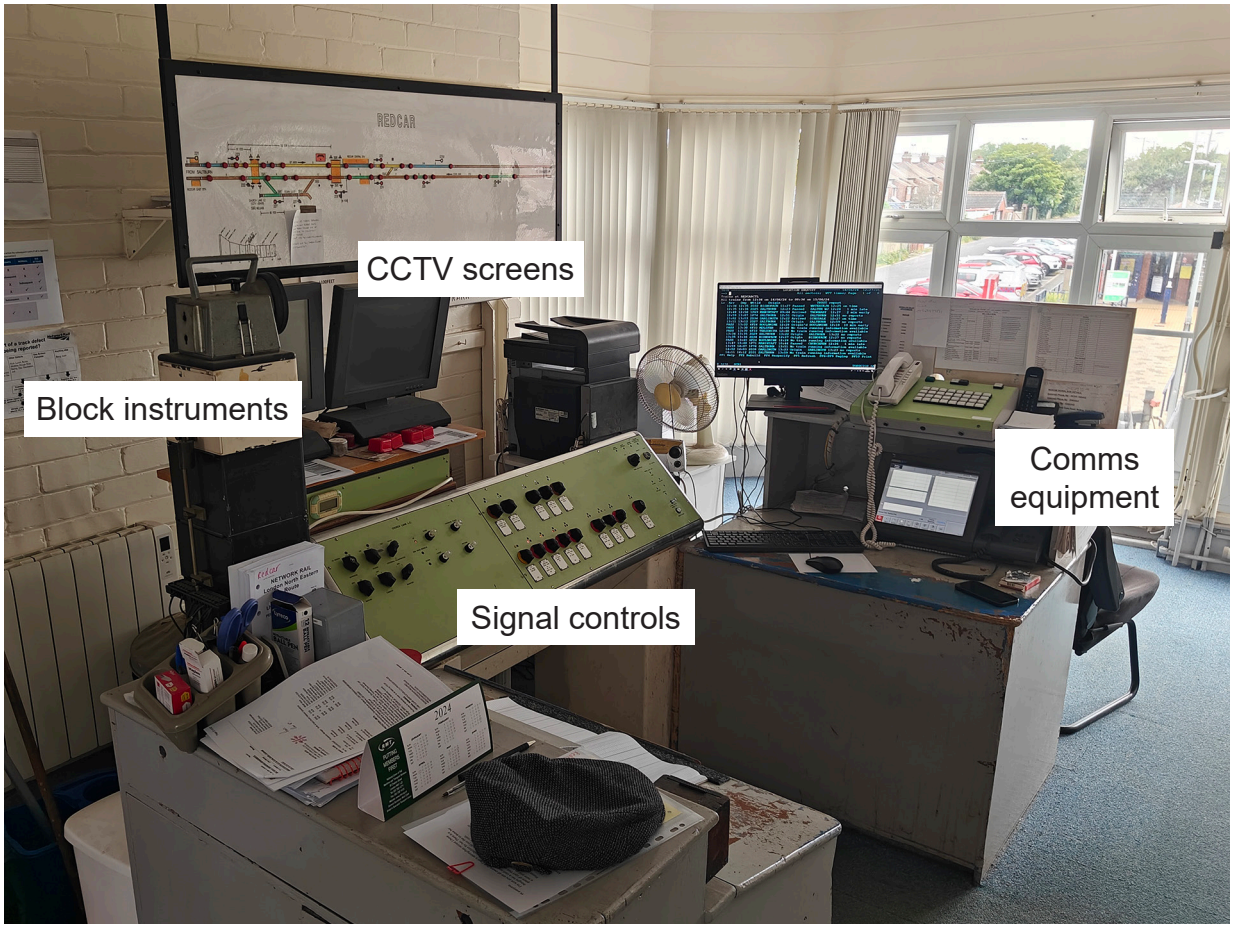

Figure 4: Signal box overview.

38 Redcar signal box controls two level crossings, both of which are situated between Redcar Central station and Redcar East station (paragraph 8, figures 2 and 3). Westbound trains, on the Up Main line, from Longbeck arrive first at Church Lane level crossing. It is about 600 metres east of Redcar signal box and is not directly visible to the signaller due to the track curvature. It is therefore monitored by the Redcar signaller using CCTV cameras and screens (figures 4 and 5). It is fitted with raising barriers and flashing wig-wag lights to manage road traffic access. The signaller has controls on the signalling panel to operate the opening and closing of the crossing and small indicator lamps to confirm that the barriers have been detected as fully raised or fully lowered.

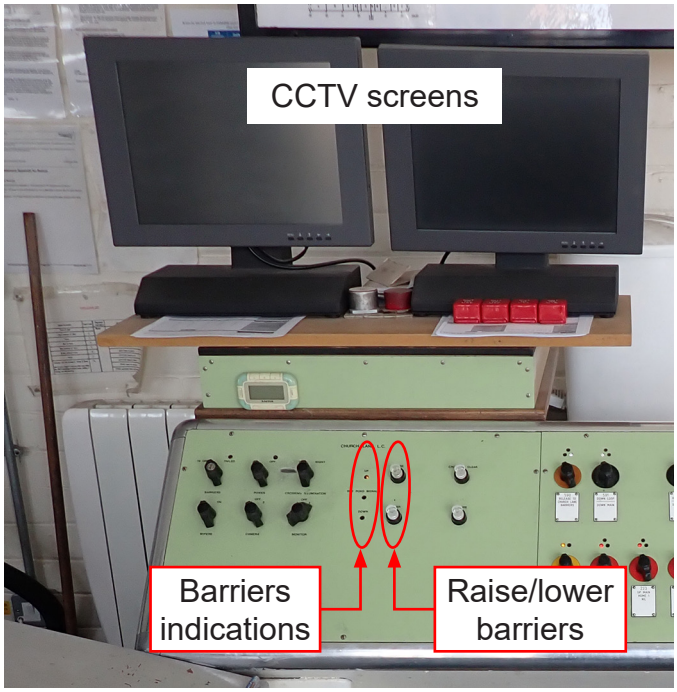

Figure 5: Church Lane level crossing controls and CCTV.

39 The second crossing which westbound trains will encounter is Redcar level crossing. This is adjacent to the signal box and is fitted with horizontally sliding gates (see paragraph 94). It is controlled by the signaller from a pedestal located by the window in the signal box, overlooking the crossing (figure 6, see paragraph 121). This crossing is not visible from the signaller's seat at the signalling panel and can only be seen by the signaller if they walk over to the end window.

Figure 6: Redcar level crossing and control pedestal.

40 Both level crossings are protected in the westbound direction by signal R223 (figures 2 and 3). This is located approximately 40 metres before Church Lane level crossing and 650 metres before Redcar level crossing. Signal R223 is controlled by a switch on the signalling panel in Redcar signal box (figure 7).

Figure 7: Signal R223 control on the Redcar signalling panel.

41 There are three indicator lamps associated with the signal control switch. One is lit green when the signal is showing a green aspect. A second is lit red when the signal is showing a red aspect. The third is lit white when a train is in the section between signal R223 and Redcar Central station. This shows that the route is 'locked', meaning that the signaller is unable to open either of the two level crossings after a train has passed signal R223 and until the train has passed both crossings. This is known as 'approach locking' (see paragraphs 131 to 133), although this protection system is not relevant to this accident as Redcar level crossing was already open when the accident occurred.

Signalling sequence

42 The normal sequence of operations when signalling a westbound train from Longbeck towards Redcar is as follows:

- First, the signaller at Longbeck sends a bell code to the Redcar signaller to offer a train in that direction. The signaller at Redcar will confirm that there are no trains in the section and, if this is the case, they will send a bell code back to Longbeck to indicate that they accept the train.
- The Redcar signaller then sets the signal section block instrument to show 'Line Clear'. A repeat of this indication is displayed to the signaller at Longbeck on a second block instrument. The Longbeck signaller is then able to clear the protecting signal to allow the train to enter the westbound section towards Redcar.
- Once the train passes Longbeck, the Longbeck signaller sends a bell code message to the Redcar signaller, who sets the block instrument to say that a train is in the section. This is visible on the Longbeck signaller's instrument.
- While the train is en route from Longbeck, the Redcar signaller can signal the train on towards Grangetown signal box if the line ahead is clear. Because the train is still about 2.5 miles (4 km) and several minutes away, it is too early to close the two level crossings to road traffic. A timer will alert the signaller to remember to close the crossings and clear signal R223.
- At this point, the signaller closes Redcar level crossing to road traffic and then closes Church Lane level crossing. Although signallers are permitted to close the crossings in any order, they normally close Redcar crossing first, as the gates operate more slowly than the lifting barriers at Church Lane due to their design.
- With the crossings confirmed as closed with no users trapped inside the gates, the signaller can then clear signal R223 to show a proceed aspect. This allows the train to cross both crossings and enter Redcar Central station. The signalling system prevents the signaller from clearing signal R223 until both level crossings are confirmed closed.
- Once the train has passed Redcar, the signaller is able to reopen both level crossings and set the block instrument to 'Normal' to await the next train to be offered. If another train is immediately offered from Longbeck, the signaller can choose to keep the crossings closed until that one has also passed. However, keeping these crossings closed can lead to delays for road traffic. The town centre location of Redcar level crossing makes it particularly susceptible to road traffic queues.

Operation of the level crossings

43 The normal sequence of operations used by this signaller when operating the level crossings is as follows:

- The first step is to set the crossing release switch on the signalling panel for Redcar to the reverse position (figure 8). This enables the operator controls at the pedestal by the window overlooking the crossing.

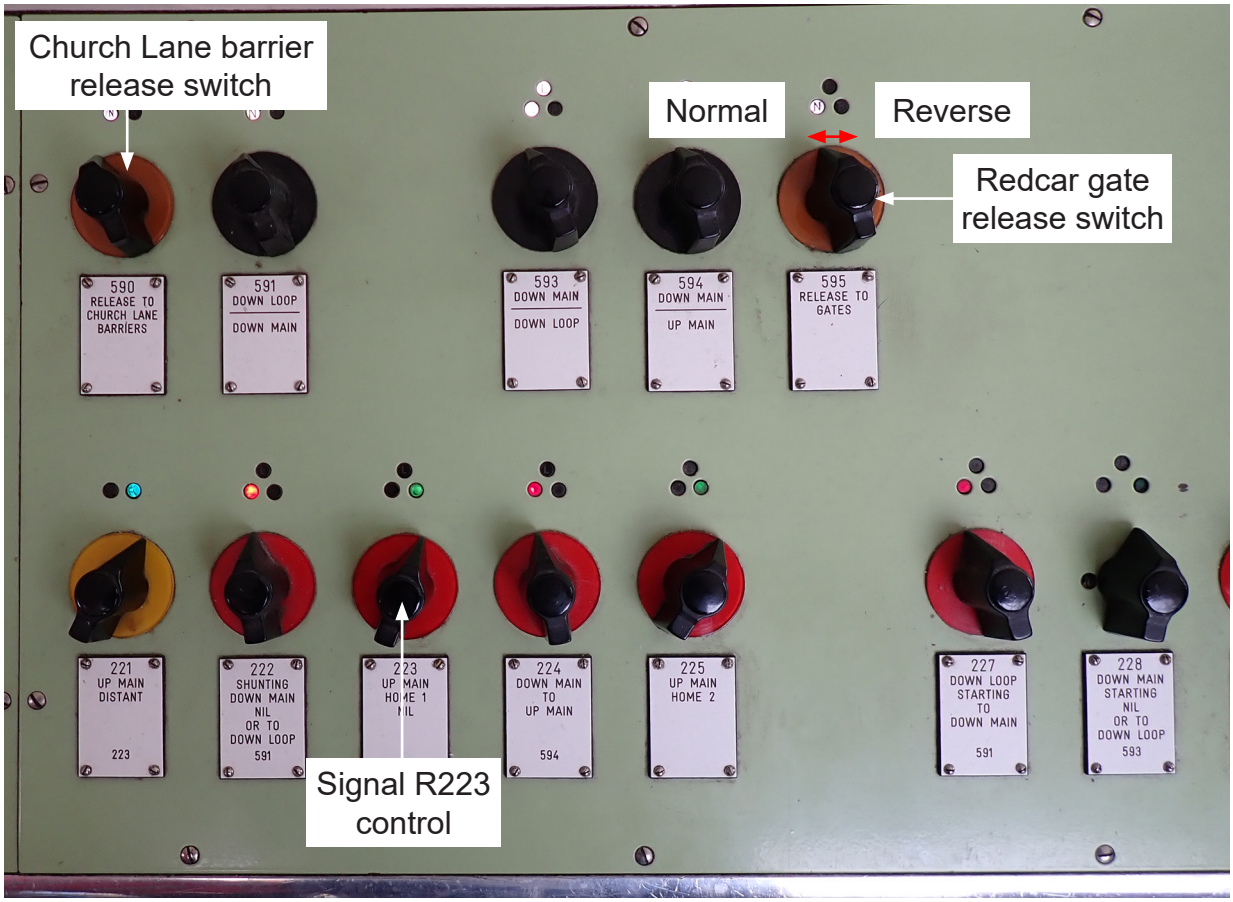

Figure 8: Signalling controls, showing crossing releases and signal R223.

- The signaller gets up from the seat at the signalling panel and walks over to the crossing pedestal (figure 9). They then operate the close control (labelled 'Normal' on the pedestal) and keep it pressed while watching the crossing for pedestrians and vehicles. The wig-wag lights and an audible alarm activate for 7 seconds before the gates then start to move across, and fully close off, the road. The signaller holds the close button pressed until the gates have fully closed and the crossing is confirmed to be clear of pedestrians and vehicles. The audible alarm ceases to sound once the gates are closed, although the wig-wag lights remain active until the road is reopened.
- The signaller then returns to the signalling panel and resets the Redcar release switch to the normal position, before selecting the Church Lane release switch to the reverse position.
- The signaller turns on the CCTV screen for Church Lane and initiates the crossing close sequence for this crossing while monitoring the CCTV image for obstructions. Once the crossing is closed and confirmed to be clear of pedestrians and vehicles, the signaller normally leaves the CCTV screen on and returns the Church Lane release switch to the normal position. The signaller can then signal trains past the now-closed level crossings by clearing signal R223.
- Once trains have passed, the signaller will reopen the crossings, normally starting with Church Lane.

Figure 9: Redcar level crossing gates controls at the pedestal.

Analysis

Identification of the immediate cause

44 The train entered the level crossing, at the same time as the car, while the crossing was open to road traffic.

45 At the time of the accident, Redcar level crossing was not closed to road traffic. The wig-wag lights and audible alarm had therefore not operated, and the gates had not closed the road. The car approached and entered the crossing while it was in this open state.

46 Before entering the crossing, the car driver, who was very familiar with it (paragraph 32), noted that there was no queueing traffic, which they found to be very unusual. The driver saw that the wig-wag lights were not flashing, and that the level crossing gate was open to the road.

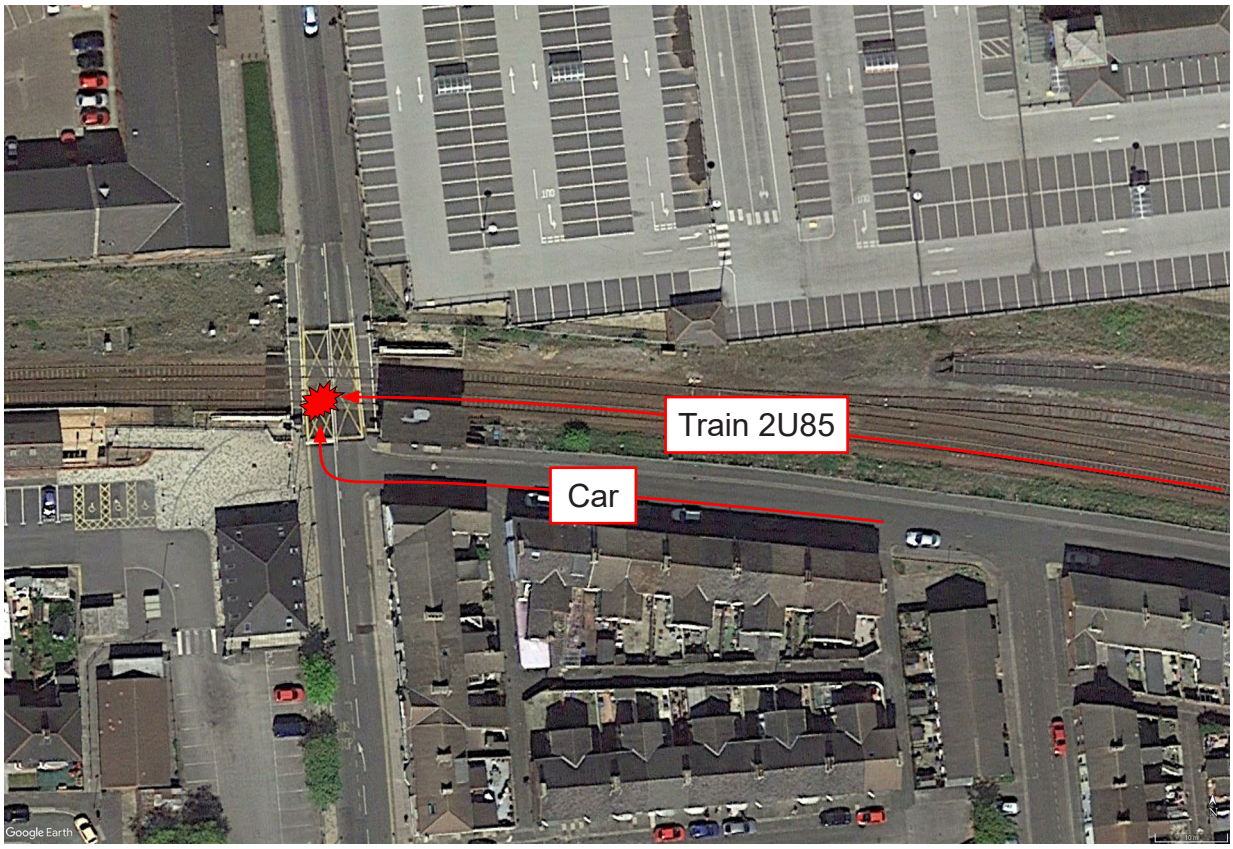

Figure 10: Direction of approach for the car and the train (courtesy of Google with RAIB annotations).

47 As soon as the car started to cross the track, it was struck by the train approaching from the right-hand side. Road users are not required to look for approaching trains at this type of level crossing, as they should be prevented from entering the crossing by the flashing wig-wags and gates. However, even if the car driver had looked to their right, they would have had no sight of the train before entering the level crossing because their view would have been blocked by the signal box, which is located on the right-hand southern corner of the crossing (from the perspective of the car driver).

Identification of causal factors

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

a. The signaller authorised the train driver to pass the signal that was protecting the level crossing while it was showing a red aspect, having forgotten that the level crossing was open to road traffic (paragraph 49).

b. While approaching Redcar level crossing, the train driver drove at too high a speed to be able to stop on identifying an emerging hazard (paragraph 75).

c. There were no engineering controls fitted to the level crossing to automatically operate the road traffic signals if a train approached while the crossing was not closed to road traffic (paragraph 96).

Each of these factors is now considered in turn.

Actions of the signaller

49 The signaller authorised the train driver to pass the signal that was protecting the level crossing while it was showing a red aspect, having forgotten that the level crossing was open to road traffic.

50 This causal factor arose because:

- The signaller's normal sequence of actions, required to set the route for train 2U85 to enter Redcar Central station, was disrupted, probably causing them to forget that Redcar level crossing was open to road traffic (paragraph 51).
- The visual and procedural cues available to remind the signaller of the status of Redcar level crossing, which may have alerted them that Redcar level crossing remained open, were either not used or not effective (paragraph 64).

Identification of the fault while signalling train 2U85

51 The signaller's normal sequence of actions, required to set the route for train 2U85 to enter Redcar Central station, was disrupted, probably causing them to forget that Redcar level crossing was open to road traffic.

52 When the preceding train, 2D11, passed signal R223, it automatically changed from showing a green aspect to a red aspect. This should have caused the green indicator lamp on the signalling panel associated with signal R223 to go out and for the red indicator lamp to illuminate. However, post-accident testing found that the bulb in the red indicator lamp had failed, while the other lamps were still operational.

53 The signaller was aware that the green indicator lamp (figure 7) was lit as train 2D11 approached the signal. Their perception was that the lamps flickered and went out as that train passed it. It is very likely that the green indicator lamp actually went out as intended as the train passed the signal, and that the red indicator lamp became lit momentarily before going out as it failed. The signaller was unable to recall if the white indicator lamp lit after the train passed, but the circuitry for this lamp suggests that it would have been lit while the train was between signal R223 and Redcar Central station (paragraph 41).

54 Once train 2D11 was in the station, the signaller reset the block equipment and was immediately offered train 2U85 by the Longbeck signaller. The signaller accepted this train, and after operating the crossing release switch (paragraph 43), they walked over to the pedestal and opened Redcar level crossing due to the build-up of traffic (paragraph 24). At that time, the CCTV display for Church Lane remained switched on from the previous train and was showing it as closed. Opening the crossing to allow a build-up of road traffic to ease was common practice amongst signallers who worked at Redcar, although not something that was required by local operating rules, such as the signal box special instructions.

55 After receiving the bell code from the Longbeck signaller, indicating that train 2U85 was entering section, the Redcar signaller answered a telephone call from the Grangetown signaller requesting contact details for a member of track maintenance staff. The signaller immediately called back after locating the requested details. This call was on a fixed telephone which had a corded handset, meaning that the signaller needed to be close to the signalling panel to use it.

56 After this call, with train 2U85 approaching, the signaller tried to clear signal R223 to allow the train into Redcar Central station. However, the green and red panel indicator lamps remained unlit, thus giving the signaller no indication of what aspect the signal was showing. The lamps remained unlit while the signaller tried to change the signal to show green. This was because the signalling system interlocking detected that Redcar level crossing was still open to road traffic and prevented the signal aspect from changing to show green. By this point, the signaller had forgotten that they had opened Redcar level crossing to road traffic a few minutes earlier.

57 At 09:18, the signaller called the route control office in York to report the unlit indicator lamps. Although this was made on a different telephone, which was cordless, the signaller remained at the signalling panel during this call.

58 Two minutes into this call, the signaller received a notification on the GSM-R (Global System for Mobile Communications-Railway) radio from the driver of train 2U85. The signaller put the cordless telephone aside, but with the call still connected to the control office, while calling the train driver back using the GSM-R system. The signaller, still without any indications on the signalling panel, asked the train driver what aspect signal R223 was showing. The train driver reported the signal as showing a red aspect (paragraph 29).

59 The signaller believed that the signal would not clear due to a fault, rather than due to the intended function of the interlocking. Based on this, and their awareness of the requirement not to unduly delay trains (paragraph 22), the signaller authorised the driver of train 2U85 to pass signal R223 at danger.

60 Humans are constantly assessing the situation they are in, taking in new information from the environment, and using existing knowledge and prior experiences to make decisions. The ‘working memory’ holds the information used for cognitive function. In dynamic situations that are evolving and changing quickly a person relies heavily on their working memory to process information. Working memory has a limited capacity and, if the situation is stressful, or unfamiliar, or the person is focused on one particular task, then the ability to process new information becomes diminished.

61 This is supported by Cooper et al[2] who identified that as situations become more demanding, skilled performance as an output decreases. The ability to maintain awareness of a situation, as one of the main precursors to decision-making, can degrade with stress and be affected by interruptions and distractions, and can impose a heavy load on the working memory, specifically when dealing with out-of-course situations.

62 In this instance, the signaller's normal routine of operating the level crossings was disrupted, firstly by the call from Grangetown, and then by the lamps not operating as expected. Their routine was then further disrupted by responding to the call from the train while trying to identify and report this fault.

63 This was the signaller's first shift after having had 4 days off work; there was no evidence that fatigue or any out-of-work distractions played a part in the accident.

Signaller's awareness of Redcar level crossing status

64 The visual and procedural cues available to remind the signaller of the status of Redcar level crossing, which may have alerted them that Redcar level crossing remained open, were either not used or not effective.

The signal box window

65 The signaller was unable to see Redcar level crossing from the signalling panel and would have needed to move from the panel to view it from the signal box window. This is because, unlike with a lifting barrier (as fitted at Church Lane), the sliding gates are not visible from the signalling panel when they are open to road traffic. However, the earlier need to use the fixed telephone to call the Grangetown signaller means that the Redcar signaller would have needed to move away from the window after train 2U85 entered section (paragraph 55). Once by the panel, they probably would have naturally stayed close to the panel to set the route.

66 The signaller could see that Church Lane level crossing was closed to road traffic via the CCTV screens situated above the panel. As this is generally the second crossing to be closed for trains entering the section to Redcar, this may have supported a belief in the signaller that Redcar level crossing was closed.

Visual indicators

67 With the crossing open to road traffic, the interlocking would normally have ensured that the red indicator lamp on the panel associated with signal R223 would have stayed lit, giving the signaller a positive indication that the signal would not clear. However, with the bulb failed in the red indicator lamp (paragraph 52) and with no indication to say whether a lamp was faulty, the signaller had no indications at all for this signal. It is possible that, had the red indicator lamp been lit, the signaller would have realised that the interlocking was preventing them from clearing the signal, and this may have caused them to check further the status of the crossing.

[2] Cooper, S., Porter, J. & Peach, L. (2014) Measuring situation awareness in emergency setting: a systematic review of tools and outcomes. Open Access Emergency Medicine, 1-7, DOI: 10.2147/OAEM.S53679.

68 There are small indicator lamps associated with the crossing release switch (paragraph 43 and figure 11). Of these, the 'N' indicator lamp (which tells the signaller that the gates are not locked after being closed to road traffic) could have alerted the signaller that the crossing was open. Witness evidence shows that the signaller did not observe the status of these lamps. This is because these indications are small and are intended to indicate the status of the interlocking rather than whether the crossing is closed. As a result, they are not routinely checked during signalling operations to determine the status of Redcar level crossing and are not included on the route cards (see paragraph 72).

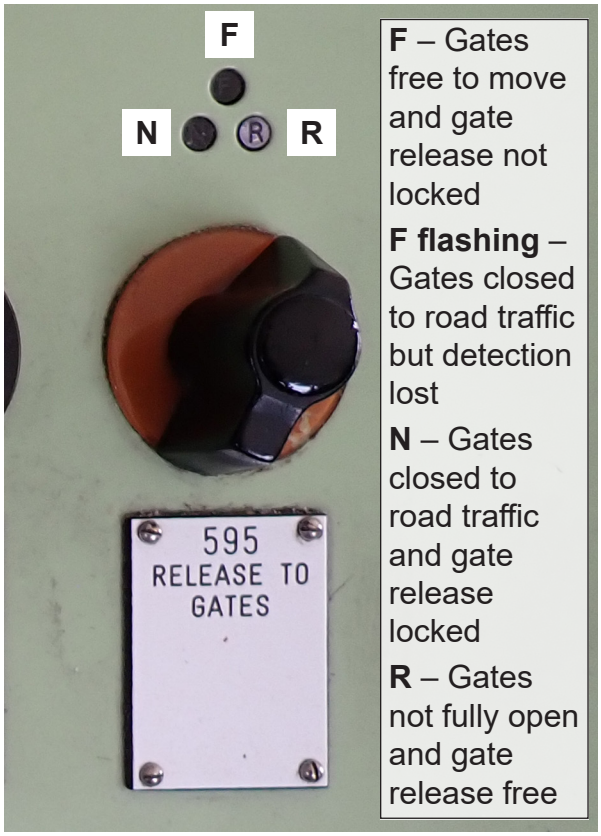

Figure 11: Crossing release indications.

Authorising a train to pass a signal at danger

69 The process of authorising train 2U85 to pass signal R223 at danger, to allow it to proceed towards Redcar Central station, is defined in Module S5 of GERT8000 the Rule Book, 'Passing a signal at danger or an end of authority (EoA) without a movement authority (MA)', issue 11 dated December 2023.

70 Section 2.1 of module S5 requires signallers to make sure that the line is safe before authorising a train to pass a signal at danger. It states:

'You must make sure:

- *the portion of line concerned is clear and safe for the movement as required by the train signalling regulations*
- *the barriers or gates at any controlled level crossings are closed to road traffic'.*

71 The signaller did not comply with this rule as they did not check that Redcar level crossing was closed before authorising train 2U85 to pass signal R223.

72 The signaller had access to a set of route cards, which set out the conditions that need to be met for all the possible train movements. These are intended to be used in the event of equipment failures but can be referenced at any time for routine train movements, if required. For a train movement from signal R223 to Redcar station, the route card specified that both Church Lane and Redcar level crossings must be closed to road traffic and that the associated crossing release switches must be reset to their normal positions.

73 The signaller did not use the route cards when setting the route for train 2U85. The signaller had previously used the route cards as an aide-memoire when authorising unusual train movements, such as putting a train into the down loop at Redcar (figure 3). However, because the movement of train 2U85 on the day of the accident required the same actions and checks as almost every passing train, the signaller did not consider that they needed to use the route card to set the route.

74 With train 2U85 approaching the level crossing, the signaller resumed the call to the control office to complete reporting of the panel fault. The collision with the car occurred while this call was in progress. Had the signaller taken the time to consider the situation with the panel fault, they might have been able to better understand what was happening.

Actions of the train driver

75 While approaching Redcar level crossing, the train driver drove at too high a speed to be able to stop on identifying an emerging hazard.

76 After being authorised to pass signal R223 by the signaller, the driver of train 2U85 applied power. When the train reached Church Lane crossing, it was travelling at approximately 10 mph (16 km/h) and accelerating. Church Lane level crossing had remained closed to road traffic following the passage of the previous train (paragraph 24). This crossing is fitted with conventional lifting boom barriers, which means that the barriers would be visible in the raised position if it had not been closed to road traffic.

77 The train continued to accelerate to a speed of 30 mph (48 km/h), at which point the driver removed power and allowed the train to coast. Approximately 130 metres before reaching Redcar level crossing, the driver applied the brakes to reduce the speed a little in preparation for arrival at the station. Approximately 70 metres from the crossing, the driver released the brakes to allow the train to coast at 23 mph (37 km/h) towards the station. The driver expected the next action to be applying the brakes to stop in the station platform and was not expecting there to be a potential hazard at the level crossing.

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

a. The train driver did not drive at caution when approaching Redcar level crossing, after being authorised to pass the protecting signal at danger, as required by the Rule Book (paragraph 79). This is a possible factor.

b. The signaller did not instruct the train driver to approach the level crossing at caution, as required by the Rule Book (paragraph 88).

c. The train driver was unable to see that the road traffic gates were still open as the train approached the level crossing (paragraph 93).

Each of these factors is now considered in turn.

Driving at caution

79 The train driver did not drive at caution when approaching Redcar level crossing, after being authorised to pass the protecting signal at danger, as required by the Rule Book. This is a possible causal factor.

80 Module S5 of the Rule Book (paragraph 69) sets out rules for drivers of trains who are authorised to pass signals at danger. Section 4.2 relates to train speeds after passing a signal at danger, and this states:

'… you must proceed at caution, even if the line appears to be clear'.

81 Section 4.3 relates to level crossings specifically and states:

'You must approach at caution and check it is safe before passing over any … controlled level crossing'.

82 The term 'proceeding at caution' is defined in Rule Book Module TW1, 'Preparation and movement of trains', issue 19 dated December 2023, which states:

'If instructed to proceed at caution, you must, as well as not exceeding any specified speed, proceed at a speed which takes account of conditions (such as the distance you can see to be clear), that will allow you to stop the train short of any train, vehicle or other obstruction, or the end of your movement authority'.

83 The train driver stated that they initially drove at caution after being authorised to pass the protecting signal at danger, and the train passed Church Lane level crossing at approximately 10 mph (16 km/h) (paragraph 76). They were able to see that the crossing was clear with the barriers closed to road traffic. The train driver then increased the train's speed and approached Redcar level crossing at 23 mph (37 km/h) (paragraph 77). The driver could see that there was no obstruction on the level crossing. However, the design of the level crossing gates meant that the train driver could not see from a distance if they were closed to road traffic (see paragraph 94).

84 In these circumstances, to check that the crossing was safe the train would have needed to be travelling at a very low speed, possibly as low as walking pace. This meant that the way that the driver drove the train as it approached the crossing on 1 May 2024 was not in compliance with the requirements of the Rule Book. Had these requirements been met, then it is possible that the train would have been travelling at a low enough speed for the accident to have been avoided, or for the speed of impact to have been substantially reduced.

85 The train driver stated that they were aware of the need to drive at caution when approaching controlled level crossings after being authorised to pass a signal at danger, and that they did so for Church Lane level crossing. However, they also stated that they were aware that Redcar level crossing was adjacent to the signal box, with the signaller viewing it through the window while operating it. The train driver was aware of historic reliability issues with the level crossing gates, although they had not experienced any of those themself. The train driver expected the signaller to draw the crossing to their attention if there was any doubt about it being closed to road traffic. The signaller had not done so (see paragraph 92). As a result, the train driver was focused on preparing to stop the train in the station platform and was not driving at caution while approaching Redcar level crossing.

86 The train driver had been in that role for approximately 17 months, having completed their training in December 2022. Since then, they had successfully completed their first routine reassessment of competence in April 2024. The driver had completed the route knowledge training for the route to Saltburn, via Redcar, in March 2024, with further route knowledge consolidation completed in March 2024. The train driver had been trained in the rules associated with module S5 of the Rule Book and had successfully passed the associated assessments.

87 On the day of the accident, the train driver had started their shift at 06:36. This was their second working day after two rest days, and there was no evidence of either shift-related fatigue or out-of-work concerns.

Instructions from the signaller

88 The signaller did not instruct the train driver to approach the level crossing at caution, as required by the Rule Book.

89 While the train was stopped at signal R223, the signaller determined the aspect being shown and authorised the train driver to pass the signal at danger (paragraph 29). During this process, the signaller stated that Church Lane crossing was clear and authorised the train driver to pass the signal and to pass over Church Lane crossing if it was safe to do so. The train driver repeated back that he had authority to pass the signal at danger and to pass the crossing if it was safe to do so.

90 Module S5 of the Rule Book (paragraph 69) also sets out rules for signallers who are authorising trains to pass signals at danger. Section 3.1 states:

> *'You must tell the driver … how far the movement can proceed'*

and:

> *'You must instruct the driver to approach at caution and check it is safe before passing over any … controlled level crossing'.*

91 During the call with the train driver, the signaller did not explicitly state how far the train movement could proceed, but the driver correctly assumed that this would be to the next signal, beyond Redcar Central station.

92 Although the signaller did instruct the train driver to check if it was safe before passing Church Lane level crossing, they gave no similar instruction relating to Redcar level crossing. This was not in compliance with section 3.1 of module S5. The absence of this explicit instruction led the train driver to assume that there was no problem at Redcar level crossing, and hence to not drive more slowly to check the status of the gates (paragraph 85).

Visibility of the gates

93 The train driver was unable to see that the road traffic gates were still open as the train approached the level crossing.

94 The level crossing gates at Redcar are of a unique design on Network Rail's infrastructure. They each consist of a horizontally extending, cantilevered gate (figure 12) that is motor-driven and operated from the pedestal in Redcar signal box (figures 6 and 9). These gates were installed in 2016 and replaced a set of wooden, motor-driven, swung gates. These swung gates had suffered from a history of unreliable operation, partly down to the wind that tends to blow in from the sea at Redcar. Network Rail was unable to replace them with conventional lifting boom barriers because the position of the signal box did not allow sufficient space for the necessary equipment. Unlike Church Lane level crossing barriers, those at Redcar do not rise into the air and so are not visible from a distance when they are open to road traffic (figure 13).

95 On the day of the accident, after the signaller had reopened the barriers to allow traffic to ease, there was no road traffic passing across the crossing while train 2U85 approached. This meant that the train driver was provided with no visual clue from crossing road traffic that the gates, and therefore the road, were still open, which would have prompted the driver to brake. This was also the reason that the car driver was able to immediately exit the side road and enter the crossing (paragraph 32).

Figure 12: View of Redcar level crossing from the operator's pedestal.

Figure 13: View of Redcar level crossing with the gates open to road traffic.

Protection at the level crossing

96 There were no engineering controls fitted to the level crossing to automatically operate the road traffic signals if a train approached while the crossing was not closed to road traffic.

97 The signalling controls at Redcar level crossing date from the early 1970s when the signal box was upgraded from a traditional lever frame to the current 'individual function switch' (IFS) panel. The pedestal control for the level crossing gates, along with the associated signalling equipment, was also installed at that time.

98 When the level crossing controls were installed, there was no requirement in railway standards for the wig-wag lights at MCG crossings to be provided with overrun protection. Overrun protection is intended to automatically activate the wig-wag lights in the event of a train approaching the crossing with the gates not being closed to road traffic. This situation could occur, for example, if a train passes a protecting signal at danger. In this case, the activation of the wig-wag lights would have almost certainly caused the road user not to enter the crossing.

99 The provision of overrun protection is mandated in current Network Rail standards for the design of other types of manually controlled crossings, such as manually controlled barrier (MCB) crossings. However, the current relevant standard for MCG crossings, NR/L2/SIG/11201/Mod X20, 'Signalling Design: Level Crossings: Manned Gated Crossings', issue 1 dated September 2011, does not have such a requirement. This is because MCG is no longer a crossing type permitted to be newly installed on Network Rail infrastructure.

100 Network Rail's standards are not generally applicable retrospectively to existing level crossings. However, there is a requirement to carry out an assessment of the reasonability of bringing a crossing in line with current standards when any alterations are being made.

101 Section 2.2 of NR/L2/SIG/11201/Mod X01, 'Signalling Design: Level Crossings: General', issue 1 dated 3 September 2011, states:

> *'When any alteration is considered at a level crossing it shall be considered whether the alteration provides a reasonable opportunity to bring parts or all of the crossing up to full compliance with this standard … [but] smaller alterations need not trigger a full upgrade. The assessment of reasonability to undertake works shall be by documenting the costs of the additional works to update the crossing set against the realistic safety and operational benefits of the works. The results and recommendations shall be considered by the project and sponsor arranging the original alteration work'.*

102 When the gates were renewed in 2016 (paragraph 94) Network Rail carried out such an assessment, which considered plans to completely renew the signalling in 2022. The intention of these plans was to move control of the level crossings to a remote signalling centre, with CCTV monitoring at Redcar similar to that then in use at Church Lane. The signal box at Redcar could then be demolished, thus allowing space for conventional lifting boom type barriers to be fitted.

103 The assessment concluded that the associated cost and expected 6-year life of the new gates meant that the work associated with upgrading the level crossing controls to include overrun protection in the interim period was not reasonable. As a result, the new gates were connected to the existing signalling controls and pedestal, with no changes being made to the associated interlocking and signalling controls.

104 Since 2016, the railway line to Saltburn has been removed from Network Rail's re-signalling plans, and life extension work at Redcar signal box is planned to take place in 2026. This means that part of the basis for the decision not to add overrun protection no longer exists.

Special inspection notice for crossing overrun protection

105 In November 2023, Network Rail issued a special inspection notice, NR/SIN/217, 'Inspection of Signal Overrun Protection Effectiveness at Level Crossings', issue 1. This notice was issued in response to two incidents. The first involved a near miss when a train was authorised by the signaller to pass a signal at danger at Magdalen Road, Cambridgeshire, on 9 August 2017 (RAIB safety digest 14/2017, see paragraph 126). The second involved a signal passed at danger (SPAD) that occurred at Woodnesborough, Kent, on 26 September 2023. RAIB did not investigate this incident, but reviewed Network Rail's internal report into it. Both incidents involved trains entering level crossings with the barriers open to road traffic and in the absence of effective overrun protection.

106 The scope of NR/SIN/217 was to review all manually controlled crossings, and all automatic and user worked crossings that were fitted with road lights that would require overrun protection under current standards. The intention of the review was to check at each location whether overrun protection was fitted. It also required a check of whether the effectiveness of such protection, where installed, complied with current standards.

107 NR/SIN/217 then required Network Rail to assess the risk at every crossing that was identified as having protection below that required by the current standards. This would form the basis for the development of a plan to address the crossings posing the highest risks by prioritising improvement work at those crossings.

108 NR/SIN/217 required the review of all relevant level crossings on Network Rail infrastructure to be completed by 31 July 2024, 3 months after the accident at Redcar. It was initially briefed out to the signalling teams in each of Network Rail's routes on 19 December 2023. North and East route, which is responsible for the line to Saltburn, met to identify the relevant level crossings on 11 January 2024. Reviews were then undertaken at monthly intervals, with Redcar first being reviewed in detail on 12 June 2024, around 6 weeks after the accident. For context, the North and East route initially reviewed 161 level crossings, with 102 identified as requiring action to meet current standards, and 36 of those as having no overrun protection. Due to the high volume of crossings to be reviewed, Network Rail's Eastern region, which includes North and East route, was granted a temporary variation to extend the completion date of NR/SIN/217 to 28 March 2025.

109 Since completing the NR/SIN/217 reviews, Network Rail has identified the forthcoming life extension works for the signalling at Redcar as an opportunity to assess and plan upgrades to the level crossing controls to potentially incorporate overrun protection.

Identification of underlying factors

Management of the signaller's competence

110 Network Rail's processes for managing signaller competence had not effectively addressed issues identified relating to the signaller's competency during previous operational incidents.

111 Network Rail signaller competence is managed in line with national operating procedures (NOPs). These include NOP 2.06, 'Signaller competence assessment and development' and NOP 2.14, 'Additional monitoring of employees and support'. These procedures form the basis by which signallers' line managers, usually local operations managers (LOMs), manage the ongoing competence of signallers and how they deal with any apparent deficiencies in that competence.

112 The signaller at Redcar had moved to that post in February 2023 after moving from a similar post at Stonea in Cambridgeshire. While at Stonea, the signaller had been under a support plan (see paragraph 114) as a result of not passing routine knowledge reassessments. This plan ended in April 2022. In September 2022, the signaller was placed on another support plan after an incident in which they authorised a train to pass a signal at danger without having confirmed that the line was clear. Because the signaller did not demonstrate the required standard during further rules knowledge tests, this plan continued until just before they left Stonea in January 2023.

113 The signaller undertook the required training for Redcar signal box from February 2023 and started duties there on 6 April 2023. On 8 June 2023, the signaller was put on another support plan for not fully complying with the required standards for communication. After identifying that the signaller had previously been on support plans after not passing knowledge tests, the LOM responsible for the signaller enhanced the support plan to include additional monitoring of performance.

114 Support plans are intended to address a development need. NOP 2.06 states that they:

> *'… may involve learning more about a process or rule, practising activities that haven't been undertaken for a while, getting more experience, spending time with other team members or functions or attending a training course'.*

Network Rail provides additional guidance on its intranet as to how LOMs can use the procedures and structure support plans.

115 The signaller was placed on a formal performance improvement plan in June 2023, due to unauthorised absences, and this was closed off in September 2023. A second formal improvement plan was triggered in October 2023 due to the signaller's compliance with communications standards not improving, and this was due to continue until January 2024.

116 After the second improvement plan, the signaller was found to have granted a line block to maintenance staff incorrectly on 12 Oct 2023. As a result, they were stood down from duties to retrain on rules knowledge. The signaller remained off duty, refreshing their rules knowledge, until 10 January 2024, by which time they had passed the rules assessments. No further incidents were recorded involving this signaller until the accident on 1 May 2024.

117 Therefore, before the accident, the signaller had had a number of operating incidents and other issues that required competence support and led to repeated requirements for monitoring, retraining and refreshing. Network Rail managers appear to have followed the applicable processes and recorded the relevant information and the signaller's knowledge appears to have been refreshed successfully multiple times.

118 However, Network Rail's processes do not clearly define triggers for escalating sub-standard performance, deficient knowledge or signallers making errors, either over a prolonged period or over multiple instances. The processes leave line managers (such as LOMs) to judge how best to escalate prolonged or repeated issues, either by additional support, improvement plans or disciplinary actions. Line managers also have to take account of the availability of staff and resource if proactive action to remove signallers from duty is made.

119 Network Rail is undertaking a long-standing review of the processes defining how signaller competence and support plans are managed, which includes a review of both NOP 2.06 and NOP 2.14 (see paragraph 141).

Layout of the signalling and level crossing controls

120 No ergonomic assessment of the layout of the signalling and level crossing controls at Redcar signal box had been carried out. This is a possible underlying factor.

121 The controls for Church Lane level crossing, including the CCTV display, are located at the signalling panel (figure 5 and paragraph 38). The controls for Redcar level crossing are located away from the signalling panel at the end of the signal box, meaning that the signaller has to walk across the box floor to reach them every time they are operated, or the crossing status needs to be checked (figure 14 and paragraph 39).This allows a signaller to have a clear view of the road and pavement while operating the Redcar level crossing controls.

122 The Redcar signaller was therefore in a situation where information about the level crossings that they were operating came from two different locations in the signal box. The signaller has to walk between these locations routinely to complete the sequence necessary for the passage of each train. The design of the crossing gates also means that their position cannot be seen from the seat at the signalling panel. Although there are small indications associated with the level crossing release switch, these are not routinely checked when signalling trains (paragraph 68). In the case of this accident, the lack of visibility of both crossings when setting the route meant that the signaller did not have an effective reminder that the Redcar level crossing was still open, after they were interrupted while setting the route for train 2U85.

123 The requirements for ergonomic assessment within Network Rail are defined in its standard NR/L2/ERG/24020, 'Engineering Assurance Arrangements for Ergonomics Within Design and Development Projects', issue 3 dated December 2011. This standard only requires ergonomic assessment to be undertaken when there are changes made to infrastructure, systems or equipment where these have ergonomic implications.

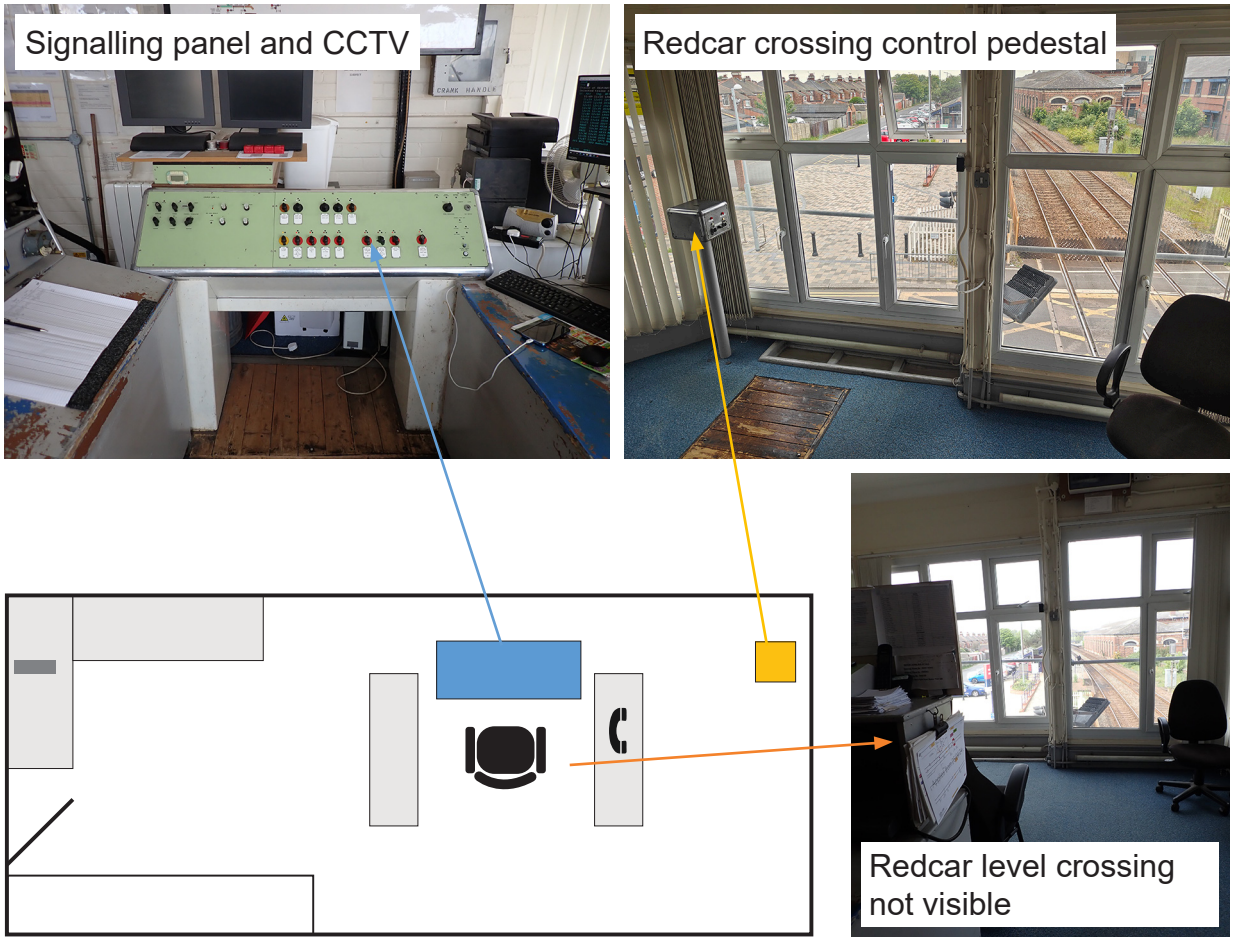

Figure 14: Layout of the signal box.

124 No ergonomic assessment of the signal box at Redcar was found in Network Rail's records. This is because there had been no operational or design changes made to the signal box, or to the level crossing, that were significant enough to require such an assessment since the introduction of the ergonomic standard. For example, the upgrade of the Redcar level crossing gates in 2016 was assessed to have had no ergonomic effect on the operation of the signal box. This was because the level crossing controls remained the same and the signal supervision of the gates remained unchanged.

125 An increase in rail traffic through Redcar in 2022 also did not trigger an ergonomic assessment, as there were no operational changes. However, this would have had the effect of requiring more frequent closure of the crossing and a resulting increase in the amount of road traffic being required to wait at the crossing. The additional signaller workload was recognised and assessed, but no changes to the operation of the signal box were considered necessary.

Previous occurrences of a similar character

126 On 9 August 2017, a train was involved in a near miss at Magdalen Road level crossing at Watlington in Cambridgeshire. The train had been authorised by the signaller to pass a signal at danger while the level crossing was still open to road traffic. One car passed over the crossing seconds before the train arrived, and a second had to stop before entering the crossing to avoid a collision. RAIB published a safety digest (RAIB safety digest 14/2017). This highlighted the importance of signallers ensuring that the route is safe for the passage of trains when authorising a train to pass a signal at danger. It also emphasised the importance of signallers stopping and thinking before trying to recover from an unexpected event, and of train drivers actively monitoring the safety of the line ahead after having been authorised to pass a signal at danger. Like Redcar level crossing, Magdalen Road did not have overrun protection. Network Rail's learning from this incident was part of the basis for the implementation of NR/SIN/217 (paragraph 105).

Summary of conclusions

Immediate cause

127 The train entered the level crossing, at the same time as the car, while the crossing was open to road traffic (paragraph 44).

Causal factors

128 The causal factors were:

a. The signaller authorised the train driver to pass the signal that was protecting the level crossing while it was showing a red aspect, having forgotten that the level crossing was open to road traffic (paragraph 49, **Learning point 1**). This causal factor arose due to the following:

   i. The signaller's normal sequence of actions, required to set the route for train 2U85 to enter Redcar Central station, was disrupted, probably causing them to forget that Redcar level crossing was open to road traffic (paragraph 51, **Learning point 1**).

   ii. The visual and procedural cues available to remind the signaller of the status of Redcar level crossing, which may have alerted them that Redcar level crossing remained open, were either not used or not effective (paragraph 64, **Recommendation 1** and **Learning point 1**).

b. While approaching Redcar level crossing, the train driver drove at too high a speed to be able to stop on identifying an emerging hazard (paragraph 75, **Learning point 2**). This causal factor arose due to the following:

   i. The train driver did not drive at caution when approaching Redcar level crossing, after being authorised to pass the protecting signal at danger, as required by the Rule Book (paragraph 79, **Learning point 2**). This is a possible factor.

   ii. The signaller did not instruct the train driver to approach the level crossing at caution, as required by the Rule Book (paragraph 88, **Learning point 3**).

   iii. The train driver was unable to see that the road traffic gates were still open as the train approached the level crossing (paragraph 93, **Learning point 2**).

c. There were no engineering controls fitted to the level crossing to automatically operate the road traffic signals if a train approached while the crossing was not closed to road traffic (paragraphs 96 and 140, no recommendation).

Underlying factors

129 The underlying factors were:

a. Network Rail's processes for managing signaller competence had not effectively addressed issues identified relating to the signaller's competency during previous operational incidents (paragraphs 110 and 141, no recommendation).

b. No ergonomic assessment of the layout of the signalling and level crossing controls at Redcar signal box had been carried out (paragraph 120, **Recommendation 1**). This is a possible underlying factor.

Previous RAIB recommendations relevant to this investigation

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

Previous recommendation that had the potential to address one or more factors identified in this report

Accident at Moreton-on-Lugg, 16 January 2010, RAIB report 04/2011, Recommendation 3

131 RAIB investigated the collision between a train and two cars at the level crossing at Moreton-on-Lugg, near Hereford, that occurred on 16 January 2010. This collision resulted in one fatality and serious injuries to a second person.

132 The cause of the accident was that the signaller raised the barriers in error when the train was approaching and was too close to be able to stop before reaching the level crossing. The signaller had just been involved in an absorbing telephone call that had interrupted the normal task of monitoring the passage of the train. As a result, they believed that the train had already passed over the crossing.

133 Although an engineered safeguard was provided in the form of interlocked signals, this was not sufficient to prevent the signaller mistakenly replacing the protecting signal and then raising the barriers when a train was closely approaching. Approach locking, an engineered safeguard that would have provided this protection, was not fitted when the crossing was converted to manual barrier operation in the mid-1970s. There was no plan to fit such a safeguard, and no industry requirement to formally consider the safety benefits of one.

134 Following the accident, RAIB made four recommendations to Network Rail, and one of those related to how it determines when signalling assets should be brought into line with the latest safety standards. This recommendation reads as follows:

Recommendation 3

The intention of this recommendation is to ensure that whenever signalling renewal or major maintenance work is planned, those responsible understand when it is necessary to formally evaluate the opportunity to improve compliance with the latest engineering standards.

Network Rail should develop and implement:

- *criteria for when it is necessary to formally assess the need to bring existing signalling and level crossing assets in line with latest design standards; and*
- *a process to record the findings of such assessments.*

135 The Office of Rail and Road (ORR), the safety regulator for Network Rail, reported to RAIB in 2016 that this recommendation had been ‘Closed’.

136 Network Rail's implementation of NR/SIN/217 (paragraph 105), and its 2016 assessment of the level crossing controls (paragraph 102) demonstrate that it has been implementing processes for assessing how to bring level crossings in line with current design standards.

Recommendations that are currently being implemented

Class investigation into factors affecting safety-critical human performance in signalling operations on the national network, RAIB report 03/2020, Recommendation 4

137 In the light of a number of incidents involving signaller errors, RAIB undertook a class investigation into what may affect the decisions made by signallers, recognising that they may be influenced by a variety of systemic factors. The investigation examined several different types of incidents and identified several common factors that may influence the actions of signallers.

138 RAIB made six recommendations to Network Rail, one of which related to gaining a better understanding of what knowledge is used by experienced signallers to contribute to safe and efficient performance and how this could be incorporated into training and development. This recommendation addressed one of the factors identified in this investigation (paragraph 129a). To avoid duplication, it is not remade in this report.

Recommendation 4

The intent of this recommendation is to improve the capabilities of all signallers through training that better understands the information, strategies and knowledge used by experienced signallers.

Network Rail should carry out research with the objective of better understanding what constitutes experiential knowledge of experienced signallers (both in general and specific to a location), how such knowledge contributes to safe and efficient performance, and then incorporating the findings into the training and development of all signallers. This may include, but not be limited to, training at signalling school and/or local initiatives, such as structured mentoring, simulated scenarios or operational exercises for both initial and refresher training.

139 In 2021 ORR reported that the recommendation is 'Progressing'. ORR stated that it needed more detail from Network Rail before it could form a view on the appropriateness of the plan. ORR stated that it intended to ask Network Rail what the outcome is of the milestones completed so far to inform their view.

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

140 Since the accident, Network Rail has completed the implementation of NR/SIN/217 (paragraph 105). This has identified that the crossing at Redcar would require upgrading to deliver effective overrun protection for approaching trains. Network Rail is in the process of quantifying the associated risks at all such crossings identified so that it can prioritise improvement work where the benefits will be highest. Network Rail has identified that forthcoming life extension work to the signalling at Redcar in 2025/26 gives an opportunity to incorporate upgrades to deliver the overrun protection identified under NR/SIN/217.

141 Network Rail is continuing its ongoing review of the standards and processes associated with the management of signaller competence. This work includes a review of how competence is managed after incidents involving signallers, along with updating of guidance to managers as to how these are recorded and acted on.

Other reported actions

142 Northern refreshed the train driver's rules knowledge, particularly those involving passing signals at danger and driving at caution. The lessons learned from the accident were further briefed to all Northern drivers.

143 The signaller has been subject to Network Rail disciplinary processes. The signaller has also been the subject of judicial proceedings.

144 Network Rail has revised the training material for signallers at Redcar and updated this to incorporate specific questions about use of route cards. It has also revised the signaller competence review process covering Redcar to try to increase use of simulations of out-of-course scenarios.

145 Network Rail has also revised the route cards used at Redcar signal box to improve the layout and wording and has carried out local briefings to emphasise that they must be used every time a train is authorised to pass a signal at danger.

146 Network Rail has also delivered refresher briefings to signallers emphasising the importance of not rushing during degraded working. This has included refreshing its 'Take 5' safety campaign which reminds staff of the need to take time before, during, and after, any task to think about the safety of the situation.

Recommendation and learning points

Recommendation

147 The following recommendation is made:[3]

1 *The intent of this recommendation is to reduce the risk of signallers at Redcar, and other signal boxes with similar ergonomic issues, making errors.*

Network Rail should undertake an ergonomics and human factors assessment of the signal box at Redcar, with a particular focus on how information about the status of Redcar level crossing is made available to the signaller. This assessment should take into account relevant standards and good practice and should specifically consider the equipment layout of the signal box and how this impacts the signaller's interaction with signalling equipment and their safe control of level crossings. It should also consider any changes in signaller workload and practice which are likely to be associated with changing volumes of rail and road traffic passing over the crossings.

This assessment should be used to inform an assessment of the practicability of potential future improvements to the layout of the signal box, and to consider if changes are required to operational processes. Network Rail should develop a timebound plan to implement any necessary improvements or changes identified.

Network Rail should also consider undertaking such studies at other signal boxes where information that is essential for the signalling of trains comes from multiple locations in the box (paragraphs 128a.ii and 129b).

[3] Those identified in the recommendation have a general and ongoing obligation to comply with health and safety legislation, and need to take this recommendation 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, this recommendation is 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.

Learning points

148 RAIB has identified the following important learning points:[4]

1 It is important that signallers focus on checking that the train route is clear, and particularly that level crossings have been closed, when managing out-of-course working. This includes making appropriate use of route cards to confirm that all the relevant precautions have been implemented (paragraphs 128a, 128a.i and 128a.ii).

2 It is important that train drivers approach controlled level crossings at caution after being authorised to pass a signal at danger (paragraphs 128b, 128b.i and 128b.iii).

3 It is important that signallers specify the need to drive at caution over controlled level crossings, and identify each of the relevant level crossings, when authorising a train to pass a signal at danger (paragraph 128b.ii).

[4] '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	Full term
EoA	End of authority
GSM-R	Global System for Mobile Communications - Railway
IFS	Individual function switch
LOM	Local operations manager
MA	Movement authority
MCB	Manually controlled barriers
MCG	Manually controlled gates
NOP	National operating procedure
ORR	Office of Rail and Road
RAIB	Rail Accident Investigation Branch
SPAD	Signal passed at danger

Appendix B - Investigation details

RAIB used the following sources of evidence in this investigation:

- information provided by witnesses
- information taken from the train's data recorder
- CCTV recordings taken from forward-facing cameras on the train
- dashcam footage provided by a motorist
- signalling system data recordings
- signalling design information and standards
- staff management records for the staff involved
- industry procedures and standards for drivers and signallers
- site photographs and measurements
- weather reports and observations at the site.

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