RAIB

Rail Accident Investigation Branch

Rail Accident Report

Two track workers struck by a wagon being propelled by a rail crane at Port Glasgow, Inverclyde
15 March 2025

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This investigation was carried out in accordance with:

- the Railway Safety Directive 2004/49/EC
- the Railways and Transport Safety Act 2003
- the Railways (Accident Investigation and Reporting) Regulations 2005.

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Preface

The purpose of a Rail Accident Investigation Branch (RAIB) investigation is to improve railway safety by preventing future railway accidents or by mitigating their consequences. It is not the purpose of such an investigation to establish blame or liability. Accordingly, it is inappropriate that RAIB reports should be used to assign fault or blame, or determine liability, since neither the investigation nor the reporting process has been undertaken for that purpose.

RAIB's findings are based on its own evaluation of the evidence that was available at the time of the investigation and are intended to explain what happened, and why, in a fair and unbiased manner.

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

In some cases factors are described as 'underlying'. Such factors are also relevant to the causation of the accident or incident but are associated with the underlying management arrangements or organisational issues (such as working culture). Where necessary, words such as 'probable' or 'possible' can also be used to qualify 'underlying factor'.

Use of the word 'probable' means that, although it is considered highly likely that the factor applied, some small element of uncertainty remains. Use of the word 'possible' means that, although there is some evidence that supports this factor, there remains a more significant degree of uncertainty.

An 'observation' is a safety issue discovered as part of the investigation that is not considered to be causal or underlying to the accident or incident being investigated, but does deserve scrutiny because of a perceived potential for safety learning.

The above terms are intended to assist readers' interpretation of the report, and to provide suitable explanations where uncertainty remains. The report should therefore be interpreted as the view of RAIB, expressed with the sole purpose of improving railway safety.

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

RAIB's investigation (including its scope, methods, conclusions and recommendations) is independent of any inquest or fatal accident inquiry, and all other investigations, including those carried out by the safety authority, police or railway industry.

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Two track workers struck by a wagon being propelled by a rail crane at Port Glasgow, Inverclyde, 15 March 2025

Contents

Summary

At around 20:30 on 15 March 2025, a wagon, which was being propelled by a rail-mounted crane within an engineering possession, struck two track workers near to Port Glasgow station. The propelling crane, along with two others, was being used as part of the renewal of a section of track within the possession. One track worker became trapped between the wagon and the lifting beam of one of the other cranes and was seriously injured. The second track worker was also trapped under the wagon and suffered minor injuries.

The investigation found that one of the other cranes had lowered a section of track, that was to be used in the renewal, onto the track ahead of the propelling crane and wagon that was moving to collect it. The two track workers were standing on the track close to the track panel discussing where it was supposed to have been set down. The member of staff controlling the propelling crane issued a stop command over the radio that was not received by the crane's driver, and the staff on the track did not recognise that the crane had not stopped.

RAIB found that the operator of the propelling crane was unable to see in the direction of travel and was reliant on radioed instructions from the member of staff controlling the movement on the ground.

RAIB also found that there was no lighting on the leading end of the wagon being propelled by the rail crane that could have alerted the staff to its approach, despite the railway Rule Book requiring this.

A possible underlying factor identified that Network Rail's requirements for the use of duplex communications systems and the use of product-approved equipment were not being complied with, and that Network Rail had no effective assurance processes to check on compliance. A second, possible underlying factor was that operational rules applicable to the rail cranes were not recognised as being relevant to these machines and so were not being applied.

RAIB has made one recommendation to Swietelsky Construction. This deals with reviewing the communications equipment and protocols used when controlling movements of its rail cranes, in relation to Network Rail's standards. This recommendation is also highlighted to other similar operators of rail cranes.

RAIB has also made two recommendations to Network Rail. One deals with reviewing its standards relating to the use of radio communications for controlling movements of on-track machines, while the second relates to reviewing its assurance processes for monitoring compliance with such requirements.

RAIB has highlighted three learning points relating to staff compliance with the requirement to only start work when they have been briefed by a COSS, requirements for lighting on wagons in possessions and the application of safety-critical communication procedures.

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 20:30 on 15 March 2025, a wagon, which was being propelled by a rail-mounted crane within an engineering possession, struck two track workers near to Port Glasgow station. This crane, along with two others, was being used as part of the renewal of a section of track within the possession.

4 One track worker became trapped between the wagon and the lifting beam of one of the other cranes and was seriously injured. A second track worker suffered minor injuries.

Context

Location

5 The accident occurred at 121 miles and 12 chains on the down line between Port Glasgow station and Wemyss Bay Junction, which is used by trains heading west from Glasgow towards Gourock and Wemyss Bay (figures 1, 2 and 3). This mileage is referenced from a zero at Carlisle station via Carstairs and Larkfield Junction.

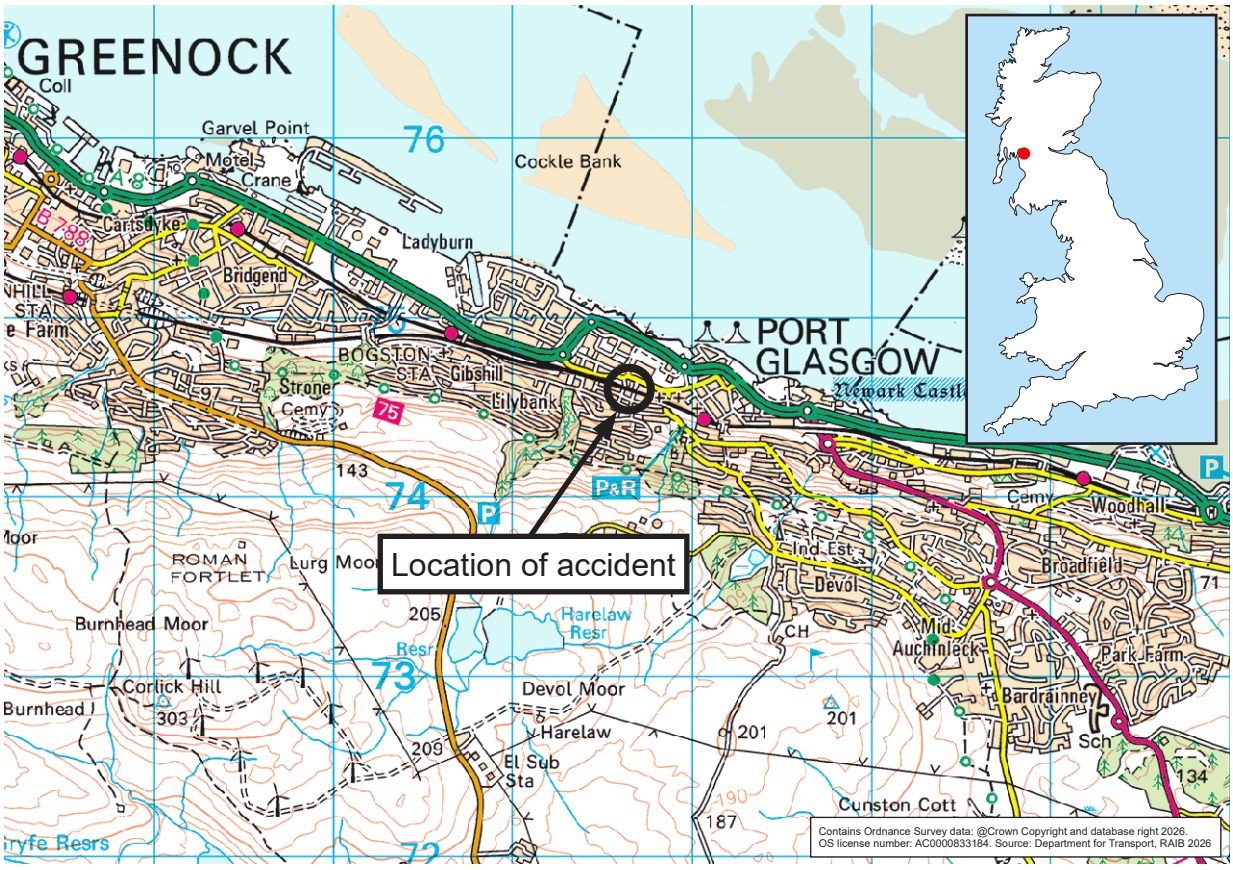

Figure 1: Extract from Ordnance Survey map showing location of accident at Port Glasgow.

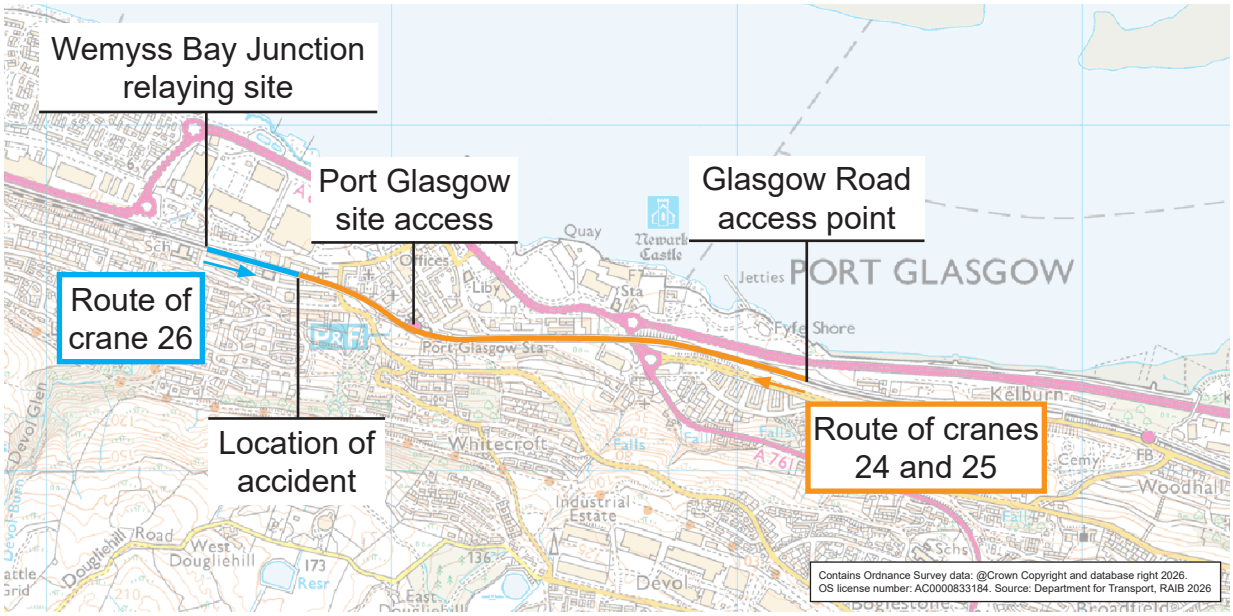

Figure 2: Overview of site/incident showing geographical relationship of main features.

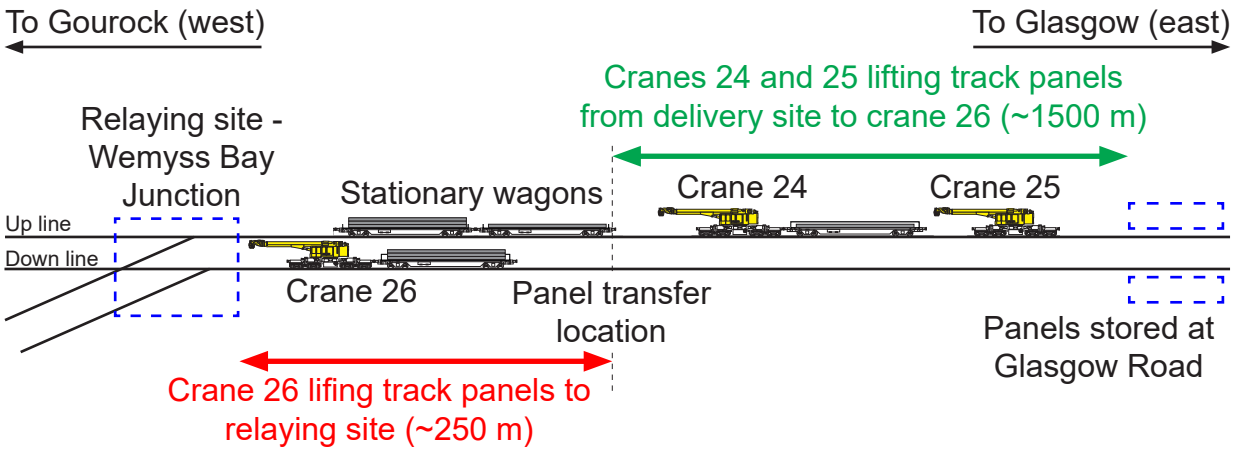

Figure 3: Track layout, showing crane movements on 15 March 2025.

6 At the time of the accident, the track at Wemyss Bay Junction was being relaid. This meant that the line was under an engineering possession from Paisley St James station, in the east, to Greenock station, on the Gourock branch, and Drumfrochar station, on the Wemyss Bay branch. An engineering possession is a stretch of railway that has been closed to normal rail traffic to allow maintenance, or other work, to take place. Within this possession, trains were only permitted to move at a maximum speed of 5 mph (8 km/h), including at the site of the accident.

7 The railway at this location is on a structure that raises it above street level (figure 4). The line is electrified using 25 kV AC overhead lines, but these were de-energised and isolated as part of the protection for the engineering works. The signalling is normally controlled from the Paisley workstation at the West of Scotland signalling centre but, as the line was under possession, train movements were being controlled by possession staff.

Figure 4: Raised structure at the accident location.

Organisations involved

8 Network Rail owns and maintains the infrastructure at this location, which lies in its Scotland's Railway region.

9 The track renewal work was being managed by the Rail Systems Alliance Scotland (RSAS). This is a joint venture consisting of the client, Network Rail, the design agent, Arcadis, and the principal contractor, Babcock Rail Ltd.

10 RSAS contracted out the supply of rail cranes to another joint venture, Swietelsky Babcock Rail. This consisted of Swietelsky Construction Company Ltd and Babcock Rail Ltd (referred to as Swietelsky Construction and Babcock Rail in the rest of this report).

11 Swietelsky Construction was the operator of the three rail cranes in the possession. It owned crane 26 and had shared ownership of cranes 24 and 25 with Babcock Rail. It was also the employer of five of the six staff operating and controlling the cranes.

12 Vital Rail, part of Morson Group Ltd, was the employer of the sixth member of staff working with the rail cranes. They were subcontracted by Babcock Rail to provide a member of staff to act as a 'slinger', assisting with the lifting activities.

13 All the above parties freely co-operated with the investigation.

Vehicles involved

14 Three rail cranes were involved in the work at Wemyss Bay Junction. All of these were Kirow KRC250UK 25-tonne capacity cranes. Two of these were built in 2006 and were numbered DRK 81624 and DRK 81625 (figure 5). At the time of the accident, these two cranes were moving track panels from an access point, where they had been delivered to the site, to a transfer location, where the accident happened.

Figure 5: Crane 25, pictured at Doncaster. Crane 24 is of the same type.

15 The third rail crane was built in 2015 and was of a similar design to the other two, with the addition of an extendable counterweight that made its lifting capability more flexible. This crane was numbered DRK 81626 (figure 6). This crane was collecting track panels that had been brought to the transfer point by the other two cranes and transporting them to the relaying site at Wemyss Bay Junction (figure 3).

Figure 6: Crane 26, pictured at Doncaster.

16 For the purposes of this report, the cranes will be referred to as cranes 24, 25 and 26 respectively. The crane that was propelling the wagons which struck the track workers was crane 26 (DRK 81626).

17 Two of the cranes, 24 and 26, each had their eastern ends coupled to a flatbed 'salmon' type wagon. These wagons are used for carrying track panels for use during the relaying. Crane 25 was not coupled to a wagon. At the time of the accident, the wagon coupled to crane 24 had one track panel loaded on it (figure 7), while the wagon coupled to crane 26 had three track panels, as shown on a similar wagon in figure 8.

Figure 7: The salmon wagon coupled to crane 24, with one track panel loaded (courtesy of British Transport Police).

Figure 8: A salmon wagon with three track panels loaded (courtesy of British Transport Police).

18 Operation of a rail crane always requires at least two people. The crane operator sits in the cab, operating the controls for lifting and movement. The crane controller is situated on the ground close to the crane and is responsible for overseeing the safety of the crane in its operating environment. The crane controller also provides instructions to the crane operator when the crane is moving and when it is undertaking lifting activities.

Staff involved

19 The operator of crane 26 had over 38 years' experience of working on the railway, with 25 of those years working with Kirow cranes.

20 The crane controller for crane 26 had over 22 years' experience of working on the railway, with 18 of those years working with Kirow cranes, including the planning of associated lifts and work.

21 The operator of crane 24 had over 14 years' experience of working on the railway, with 10 of those years working with Kirow cranes.

22 The operator of crane 25 had over 14 years' experience of working on the railway, with 11 of those years working with Kirow cranes.

23 The crane controller for both cranes 24 and 25 had 2 years' experience of working with Kirow cranes. They were acting as crane controller for the two cranes, because both were planned to work and travel together. They had been fully qualified as a Kirow crane controller for 6 months.

24 The slinger, who was working primarily with crane 24, had 5 years' experience of working on the railway. Although they were subcontracted staff, they only worked with the Kirow cranes alongside Swietelsky Construction staff.

25 None of the staff detailed above had any previous safety incidents on record.

External circumstances

26 The weather at the time of the accident was dry and clear, with the temperature about 3°C. It was dark, with very little external lighting other than the glow from street lighting on the adjacent roads. There was some lighting from the ends of each of the rail cranes, and staff had head torches mounted on their safety helmets. No additional site lighting had been provided at the location of the accident. Lighting is discussed at paragraph 92.

27 No other external circumstances are likely to have affected the accident. The only significant noise in the vicinity of the accident came from the engines of the three rail cranes. No other powered equipment was being used in the immediate vicinity.

The sequence of events

Events preceding the accident

28 The six staff associated with the three rail cranes travelled from their homes in north-west England and north Wales to a hotel at Glasgow Airport, about 15 minutes from the work site, on the morning of Friday 14 March 2025. This allowed them to check in and rest before the start of the first shift that night.

29 The staff arrived at Port Glasgow station around midnight. On arrival, they signed in with, and were briefed on site safety by, the site access controller at 00:10 on Saturday 15 March. They then travelled to Langbank station, about 4 miles (6.5 km) east of Port Glasgow, where the cranes had already entered the possession. The six staff then moved the cranes to an access point at Glasgow Road, about 0.7 miles (1.1 km) east of Port Glasgow. Here they used two of the cranes to position track panels that had been delivered to site, ready for later lifting and transport to the relaying site at Wemyss Bay Junction. All the work on this shift took place at the access point, with no one working at the transfer location where the accident happened.

30 At 07:50, the shift ended and the staff returned to Port Glasgow station where they formally signed out of the site. They then returned to their hotel for rest before the next shift.

31 At 19:45 on the Saturday evening, the staff signed in again at Port Glasgow station, and received another site safety briefing. Four of the staff were then driven to cranes 24 and 25, which were still located at the Glasgow Road access point. The other two staff walked along the track from Port Glasgow station to the relaying site at Wemyss Bay Junction, where crane 26 was located, after being moved there during the day shift.

32 At 20:11, cranes 24 and 25, along with the four staff, started to transit along the up line towards Port Glasgow station (figure 3). Each crane was carrying a track panel ahead of it, suspended from a lifting beam on its boom.

33 At 20:26, crane 26, along with its two staff, started to transit along the down line towards Port Glasgow station, with the unloaded boom trailing, while propelling the loaded salmon wagon ahead of it.

34 At 20:26:57, cranes 24 and 25 arrived on the up line at the intended transfer location (figure 3), where the track panels would be set down, ready to be picked up by crane 26 for transfer to the relaying site. Under the guidance of the slinger, who was positioned alongside crane 24, the operator of crane 24 shunted its position slightly before slewing its boom to position its track panel over the adjacent down line.

35 At 20:27:49, crane 24 had lowered its track panel onto the down line, as evidenced by the crane's data recorder, which recorded the boom load reducing. The slinger left the lifting beam and track panel attached to the crane in case it had to be moved and walked to the west end of the track panel to meet the controller of crane 26, who was approaching on foot on the down line. They met and both stood on the track of the down line, discussing the placement of the track panel.

Events during the accident

36 Crane 26 and the coupled wagon approached the intended transfer location on the down line from the direction of Wemyss Bay (from the west). The operator in the cab of crane 24 saw the end of the salmon wagon, which was coupled to crane 26, appear past a pair of wagons that were stabled ahead of them on the up line (closer to Wemyss Bay Junction). At this point, the salmon wagon was very close to the track panel that crane 24 had lowered onto the down line, and to the crane 26 controller and the slinger who were standing just to the west of it, between the track panel and the approaching wagon. The operator of crane 24 started to blast their horn repeatedly to alert the two staff members to the danger.

37 The controller of crane 26 and the slinger heard the horn sounding but were struck by the end of the salmon wagon before they could react. The wagon then continued and struck crane 24's lifting beam, which was still attached to the track panel. The controller of crane 26 was forced under the wagon into a gap adjacent to the lifting beam, between the wagon's bogie and the track panel. The slinger was in a similar position on the other side of the lifting beam, but had their right arm trapped between the wagon's brake rigging and the lifting beam.

38 The operator of crane 26 felt a bump from the collision and immediately stopped the crane from moving. The operator of crane 24 immediately jumped down from their crane and ran to help the trapped staff, with the assistance of the other staff at site.

Events following the accident

39 Emergency services attended and gained safe access to the site under the supervision of possession control staff. The fire service, with assistance from the crane team staff, removed two track panels from the top of the salmon wagon involved in the collision, to allow it to be jacked up to release the slinger's arm. The slinger was then taken to hospital. Their injuries included crush damage to the soft tissue of one arm, requiring extensive skin grafts.

40 The controller of crane 26 suffered a minor knee injury.

41 There was minimal damage to the wagon and the lifting beam, and no damage to the track or infrastructure. The accident delayed the planned track renewal work, resulting in a delay of 1 day, with the railway reopening on 20 March 2025.

Background information

On-track plant and on-track machines

42 During maintenance and construction activities, railway contractors use a variety of rail-mounted vehicles to undertake work. These are used to carry out lifting activities, transport materials, dig holes and undertake other work activities, often using a variety of types of attachment.

43 Many of these are adapted from road vehicles and are fitted with deployable rail wheels which allow them to run along the railway. These vehicles are normally transported to site by road and are then driven onto the track where the work is to take place. They are designed to only be used on the track within an engineering possession. Such rail vehicles are referred to as on-track plant (OTP).

44 Some other vehicles are also specifically designed to operate on the railway within a possession but, unlike OTP, can also be transported to site on the operational railway, either under their own power, or as part of a train. Such rail vehicles are referred to as on-track machines (OTM). Rail cranes, such as those involved in this accident, are classified as OTM.

Simplex and duplex radio communications

45 When maintenance and operational staff use radio communications to talk to each other at site, there are two primary classifications of systems that are widely used.

46 The more basic of these systems is when radio communications are only able to be transmitted in one direction at a time. This normally uses back-to-back radio sets, where the user has to press a ‘push to talk’ (PTT) button to open a channel from the handset to any others on the same channel. That allows the user to speak a message into the radio that will be heard by any radios set to the same channel. While that message is being transmitted, no other user can send a message on the same channel. This system is normally referred to as simplex communication.

47 An alternative system usually used on the railway is when the radio channel is continuously open, allowing messages to be sent from any radio on the channel to all the others at any time, without having to press a button to open the channel. That allows multiple messages to be sent at the same time, although operational protocols are used to ensure that this is managed. This system is normally referred to as duplex communication.

Site safety personnel

48 Network Rail requires all staff working on or near operational railway lines to be supervised by a controller of site safety (COSS). The duties of a COSS are defined by Rule Book GERT8000 Handbook HB7, 'General duties of a controller of site safety'. At the time of the accident issue 9, dated September 2024, was applicable. A COSS is required to establish a safe system of work to protect staff from the movement of rail vehicles, and to brief all members of the group to ensure they fully understand these arrangements. Following the briefing, staff are required to sign in with the COSS, who will then implement the safe system of work. During the work, a COSS is required to be in a position to observe and advise staff to ensure that they are compliant with the briefed safe system of work.

49 Network Rail's standard NR/L2/OHS/019, 'Safety of people at work on or near the line' also defines a person-in-charge (PIC) role as the person with overall accountability for supervising and overseeing works. Issue 12, dated 2023, was in force at the time of the accident. PICs can appoint themselves to undertake the duties of the COSS or may appoint another competent person to undertake this role. In the case of the crane operations discussed in this report, it is the COSS role, with its responsibility for protection from vehicle movements, that is more relevant to the circumstances of the accident.

Analysis

Identification of the immediate cause

50 A wagon, being propelled by crane 26, approached two track workers who were standing on the line ahead.

51 The staff accounts of the sequence of events show that the controller of crane 26 and the slinger were standing in the four-foot (the space between the running rails) of the down line when a salmon wagon, propelled by crane 26 and loaded with track panels, approached them.

52 They were still standing on the line, discussing the position of the track panel that had been set down by crane 24, when they were struck by the wagon.

Identification of causal factors

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

a. Crane 26 did not stop before the wagon that it was propelling collided with the two track workers (paragraph 54).

b. The two track workers were standing between the rails of the down line, unaware that the wagon being propelled by the crane was still moving towards them (paragraph 85).

Each of these factors is now considered in turn.

Continued movement of the crane

54 Crane 26 did not stop before the wagon that it was propelling collided with the two track workers.

55 The data recorder from crane 24 shows that there were only 37 seconds between that crane placing the track panel on the down line and the wagon coupled to crane 26 colliding with the staff and the track panel (figure 9).

56 The data recorder from crane 26 did not contain sufficient data to be able to accurately record its speed at the time of collision. However, the limited data available and the assumption that it was unlikely to be travelling significantly faster than its crane controller could walk along the railway mean that it was probably travelling at about 1.7 m/s (3.5 mph or 5.6 km/h). This was consistent with the recorded average transit speed of crane 24 on the journey from Glasgow Road to the accident location.

57 This speed meant that the wagon was probably about 60 metres from the track panel when the panel was lowered (by crane 24) onto the down line. Staff accounts suggest that the controller of crane 26 was walking about 40 metres ahead of the moving wagon, so was probably less than 20 metres from the track panel when they saw it being lowered. At that point, witness evidence indicated that the controller of crane 26 instructed the operator of crane 26 to stop, using the radio. The controller of crane 26 then shouted to the slinger that the panel was in the wrong place and walked forward to them to discuss where the track panel was supposed to be.

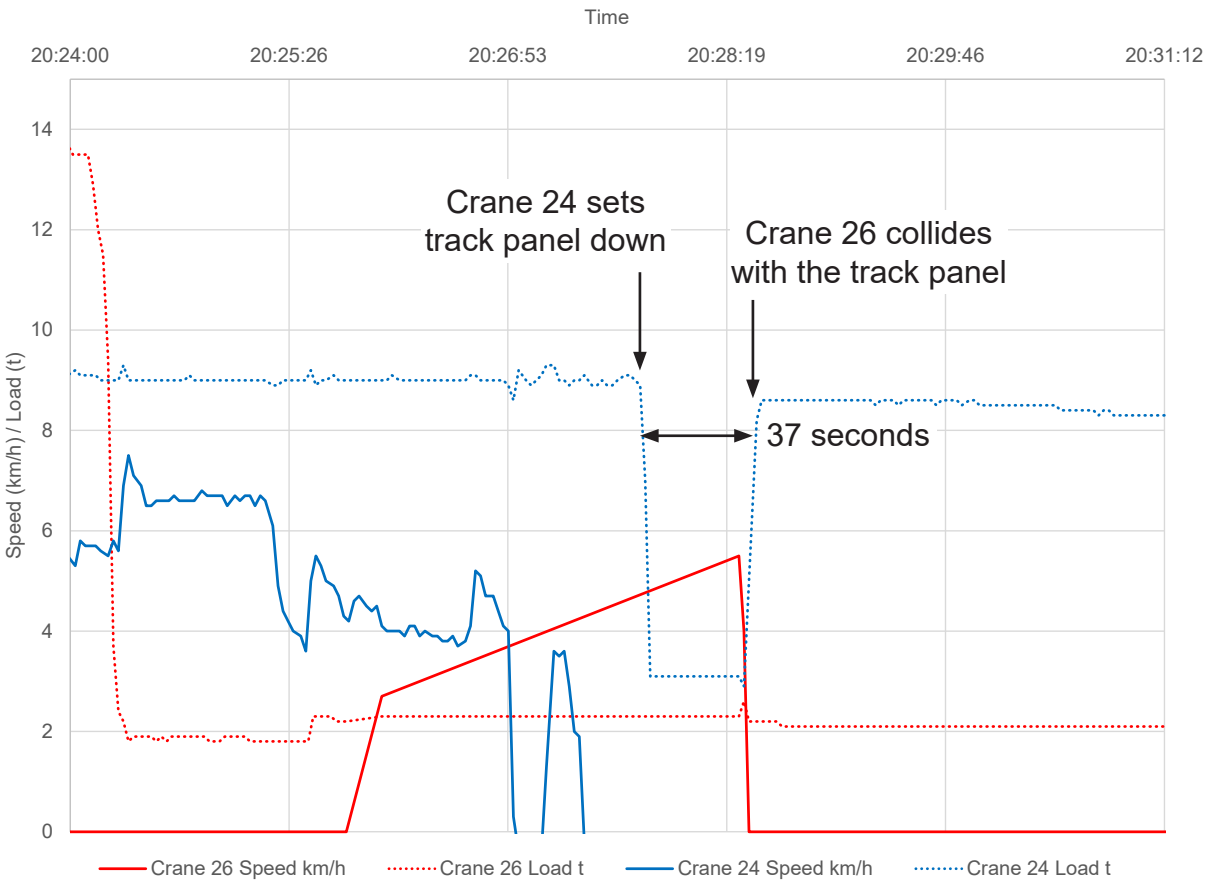

Figure 9: Data from cranes 24 and 26 data recorders.

58 Crane 26 continued moving, propelling the wagon, before coming into contact with the controller of crane 26 and the slinger, and then the track panel and its associated lifting beam.

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

a. The operator of crane 26 had almost no visibility of the line ahead because the crane was travelling in reverse and the coupled wagon obstructed the CCTV view (paragraph 60).

b. The operator of crane 26 did not receive an instruction from the controller of crane 26 to stop the crane (paragraph 70).

Each of these factors is now considered in turn.

Visibility of the line ahead

60 The operator of crane 26 had almost no visibility of the line ahead because the crane was travelling in reverse and the coupled wagon obstructed the CCTV view.

61 At the time of the accident, crane 26 was moving eastwards, in reverse, with the boom trailing (facing west), and with a wagon carrying three track panels coupled to the leading end. This was not an unusual move, as the cranes are designed to operate in either direction, and are often coupled to wagons carrying track panels during renewal work. This movement was part of the pre-planned sequence of crane movements required to transport the required track panels to the relaying site, in the correct order, over the period of the work.

62 The crane's boom can be slewed 360 degrees to face either direction. Turning the crane boom requires considerable space around the crane and is limited by both the boom load and the need to deploy side stabilisers when lifting and slewing. These limitations, along with the presence of overhead line structures, meant that it was not possible to fully rotate the crane where it was intended to collect the track panels delivered by cranes 24 and 25. As a result, the plan required crane 26 to travel with the boom facing west, to be able to deliver the panels to the relaying location. This meant that crane 26 had to move past the track panels delivered by cranes 24 and 25 before picking them up. Because crane 26 was on the down line, this meant that the track panels had to be placed on the up line. However, crane 24 had placed the panel on the down line (paragraph 34 and figure 3).

63 The cab of each crane is located to the right-hand side of the lifting boom (figure 6), facing forward, meaning that the operator has no direct view to the rear and a restricted view to the left. A CCTV camera is fitted to the rear of the crane, with a monitor in the cab. This gives the operator some visibility to the rear (figures 10 and 11 and see paragraph 68) but not a full view.

Figure 10: Rear of crane 26, showing CCTV camera and flood lighting.

64 The crane operator's lack of full visibility is intended to be mitigated by the presence of the crane controller. The crane controller is defined by Network Rail as being '*a person who is trained and certificated as competent in the organisation & control of crane lifting operations on railway infrastructure sites*'. For this type of rail crane, the crane controller is involved in the planning and operation of the work, to ensure that the lifts to be undertaken are within the crane's capability, and are implemented safely in the rail environment.

Figure 11: CCTV screen in cab of crane 26.

65 During operation of a crane, in addition to the operator, the presence of a crane controller is mandatory, and they act to oversee and direct movements and lifting activities undertaken by the crane. In effect, they are acting as the eyes of the crane operator on the ground, allowing them to be aware of any hazards around the crane and to enable them to move the crane safely and stop when required. This part of the role is very similar to that of a machine controller for OTP.

66 The crane controller must be in communication with the crane operator to provide instructions regarding lifting, manoeuvring, travelling and stopping safely. This communication can be face-to-face where appropriate, using radios, or by hand signals when practical. However, normal practice is to use radios, as this is not reliant on the crane controller being located where the crane operator can see them.

67 The cranes used at Port Glasgow were all fitted with a fixed radio receiver/transmitter set in the cab, operated by a button on the operator's control joystick (figure 12). The crane operator does not wear a headset, instead using the loudspeaker and microphone built into the radio unit. The crane controllers and slinger all had portable radio handsets individually issued to them which allowed them to contact the crane operators (figure 12).

CCTV on the cranes

68 The image from the CCTV camera is displayed to the operator on a small screen that is positioned directly ahead of them (figure 11). If no wagons are coupled to the rear of the crane, this screen gives a view of the line ahead and the leading end of the crane when reversing. The camera, coupled with the floodlights, would enable the crane operator to identify a track worker wearing high visibility clothing that was standing on the track ahead.

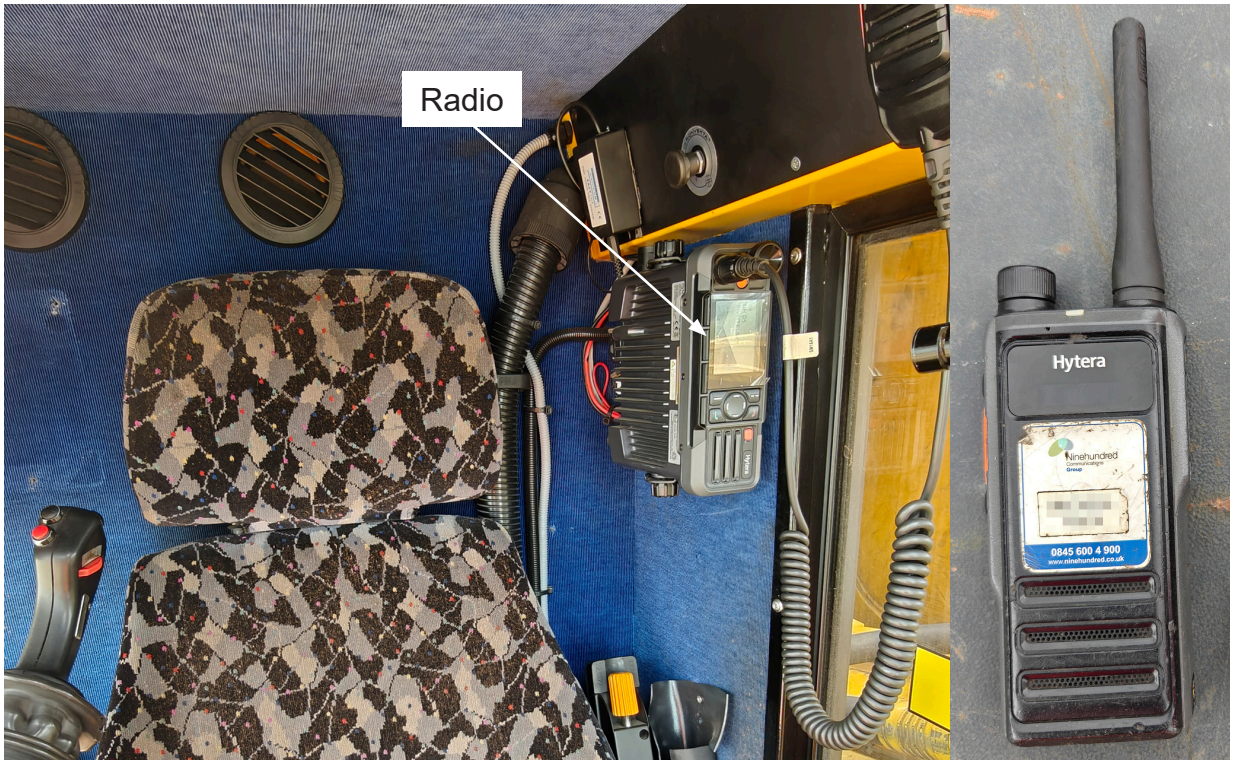

Figure 12: Radio fitted to the cab of crane 26, and that used by the staff on the ground.

69 At the time of the accident, the salmon wagon being propelled was loaded with three track panels (figure 13). The effect of this was to obstruct the CCTV camera's view of the collision point and to move the first point a track worker would be visible 20 metres further away from the camera. RAIB has estimated that the high visibility clothing on a person would only start to become visible on the CCTV monitor if the person was standing further than around 25 metres from the end of the wagon. The consequence of this was that the crane operator had little chance of seeing anyone standing ahead of the salmon wagon in the dark, and made them completely reliant on the instructions from the crane controller over the radio.

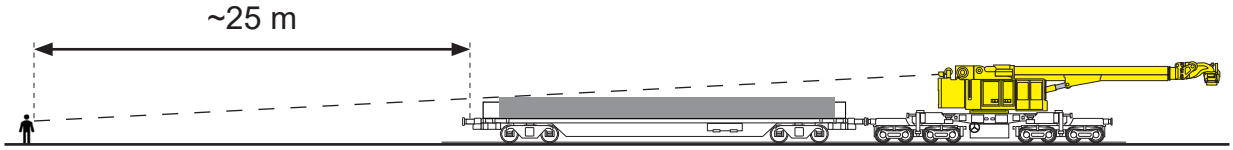

Figure 13: CCTV view restricted by track panels loaded on the salmon wagon.

Instruction to stop

70 The operator of crane 26 did not receive an instruction from the controller of crane 26 to stop the crane.

Radio system use

71 The normal method of communication between members of the crane crew was to use back-to-back radios. These were simplex radios, meaning that only one radio at a time could communicate with the others, when its PTT button was pressed (paragraph 46). Simultaneous pressing of the PTT button on two radios means that neither message will be received.

72 The crane crew had an operational protocol for using the radios, to ensure that they were used safely. For messages between a crane controller and a crane operator, these were normally initiated by the crane controller. The crane operator would normally await instructions and would only initiate messages if they had a query. To send a message, the crane controller would press the PTT button, speak the message and then release the PTT. The crane operator would then press their PTT button (on the crane joystick), acknowledge or repeat the message back and then release their PTT button.

73 The radios also have a rotary control, used to adjust the loudspeaker volume. Additionally, this control can be pushed in and rotated simultaneously to change the channel on which the radio sends and receives messages. At the time of the accident, the crane operator and crane controller for crane 26 were using one channel, while the other staff associated with cranes 24 and 25, including the slinger, were using a separate channel.

74 During a transit movement of the crane, the crane controller would regularly issue 'safe to continue' messages, each of which would be acknowledged by the crane operator. Witness accounts varied as to the intended spacing between these messages, ranging from every 5 seconds to every 15 seconds.

75 None of the staff involved were able to identify any specific training that they had received about how to use the radios, but all the staff were fully aware of the protocol and stated that they routinely applied it when using the radios. The Network Rail approved industry training for Kirow crane controllers and operators states that staff can use either back-to-back (simplex) or duplex radios to communicate. However, this training does not cover how these radios should be used. Despite this, all the staff had developed an awareness of the protocol probably based upon on-the-job practice within the team, who consistently worked together.

76 The railway Rule Book GERT8000 Handbook HB14, 'Duties of the person in charge of loading and unloading rail vehicles during engineering work', issue 3 dated March 2021, and Handbook HB15, 'Duties of the machine controller (MC) and on-track plant (OTP) operator', issue 7 dated December 2024, contain almost identical requirements for radio communications. The latter states:

> '*When a radio is being used to control movements from the ground, the MC must … speak continuously throughout the movement or transmit a continuous bleep signal*' and '*instruct the operator to stop immediately if the radio transmission is failing. The OTP operator must stop the movement immediately if the MC stops speaking or the continuous bleep signal cannot be heard*'.

77 The protocol that the crane crew was using to operate the back-to-back radios appears to meet the intent of the Rule Book requirement, in that communication during the movement was repeated for the duration of the movement to ensure that an ongoing authority to move was being maintained. The use of back-to-back radios, and this protocol, is consistent with how movements of engineering trains within a possession are normally controlled on Network Rail managed infrastructure.

Loss of the message

78 Witness evidence indicates that a ‘stop’ instruction was issued when the crane controller for crane 26 became aware of the track panel being on the down line ahead. However, witness evidence also indicates that this instruction was not received by the operator of crane 26, and that the operator would have stopped immediately if such a message had been received.

79 There are several possibilities for how a stop message from the crane controller might not have got through to the crane operator:

- Although the crane controller was familiar with the radios and used them regularly, they might not have pressed the PTT button at all, or might have incorrectly pressed it, when sending the stop message to the crane operator.
- The channel on the crane controller’s radio could have been accidentally changed from the one that the crane operator was using, possibly because of the crane controller carrying the radio in their jacket pocket on the night of the accident.
- The crane operator might have tried to talk to the crane controller on the radio at the same time as the stop message was being sent. This is considered unlikely, because it is not supported by the available witness evidence, and the operational protocol used by the team does not normally lead the operator to initiate messages.
- The crane controller could have been in a blackspot for radio reception from the crane. This is considered unlikely, because the crane controller was standing in the same position relative to the crane that they had been in for the entire transit move, and this was a normal position for them to be in.
- The crane controller might not have issued the stop message at all. This is considered unlikely, given the crane controller’s long experience, and that their sole task when they sent the message was to control the crane movement.
- It is also possible that the operator of crane 26 did not hear the message after it was successfully sent. This is considered unlikely, given that it was quiet in the cab and that there is no evidence of any fault in the radio system.

80 RAIB considers a technical failure with one of the radios causing the message not to be transmitted or received to be highly unlikely. This is because the radios were successfully used on both previous shifts and on subsequent shifts after the accident.

81 The crane controller did not recognise that they had not received confirmation from the crane operator that the stop message had been received. As a result, they did not realise that the crane could still be moving. Consequently, they did not attempt to move off the track out of the crane’s path. Had the crane controller followed their normal operational protocol for using the radios, they would probably have identified that the stop message had not been received by the crane operator, and the accident might have been avoided.

82 The crane controller did not physically turn round to confirm that the stop instruction that they had issued had been actioned and that crane 26 had come to a stop. With crane 24 nearby, they also did not hear the wagon, nor crane 26 at its other end, approaching. This meant that they did not recognise that crane 26 was still moving.

83 The operator of crane 26 did not perceive that any of the expected 'safe to continue' messages were missing before feeling the impact of the collision. There were 37 seconds (paragraph 55) between the track panel touching the ground and the collision, and the time from the crane controller issuing a stop instruction to the collision could have been less than that. It is likely that the time after the last 'safe to continue' message was longer than normal, but it is also likely that, in practice, the time between messages will have deviated to some extent from the 'every 5 to 15 seconds' period stated by the staff. It is, therefore, possible that the extended period after the last message was not considered unusual enough to alert the crane operator to a missing message, and thus to prompt them to check it was still safe to continue moving, or to come to a stop.

84 Although rail cranes are classified as OTM, it is of note that when OTP is being used on Network Rail infrastructure, Network Rail requires all communications associated with its operation to use duplex communications systems. It is possible that the use of effective duplex communications systems could have allowed the crane operator to have either received the stop message, recognised that a message was missing, or to recognise that communications had been lost. The non-use of duplex communications is discussed further in paragraph 99.

Location of the track workers

85 The two track workers were standing between the rails of the down line, unaware that the wagon being propelled by the crane was still moving towards them.

86 After the salmon wagon struck them, both the crane controller and the slinger were forced under the leading end of the wagon (paragraph 37) and into the four-foot of the down line, adjacent to the track panel. This indicates that both were positioned close to the track panel and in the four-foot when they were struck.

87 The controller for crane 26 was walking about 40 metres ahead of the crane, in the four-foot, when they saw the track panel being lowered. The crane was moving along the down line on the two-track railway, which is on top of a structure (figure 4). On the approach to the accident location, there were two stationary wagons on the adjacent up line, and vegetation in the down cess (the area between the running lines and the structure, figure 14). Due to these obstructions, the crane controller considered the four-foot of the down line to be the safest place to walk, and this would have been a normal position for a crane controller to be in when guiding a transiting crane along the railway.

88 The slinger had also walked in the four-foot of the down line, alongside crane 24, which was travelling on the up line, on the transit with the track panel from the access point at Glasgow Road. The crane controller for cranes 24 and 25 was adjacent to crane 25, which was behind crane 24 with another track panel.

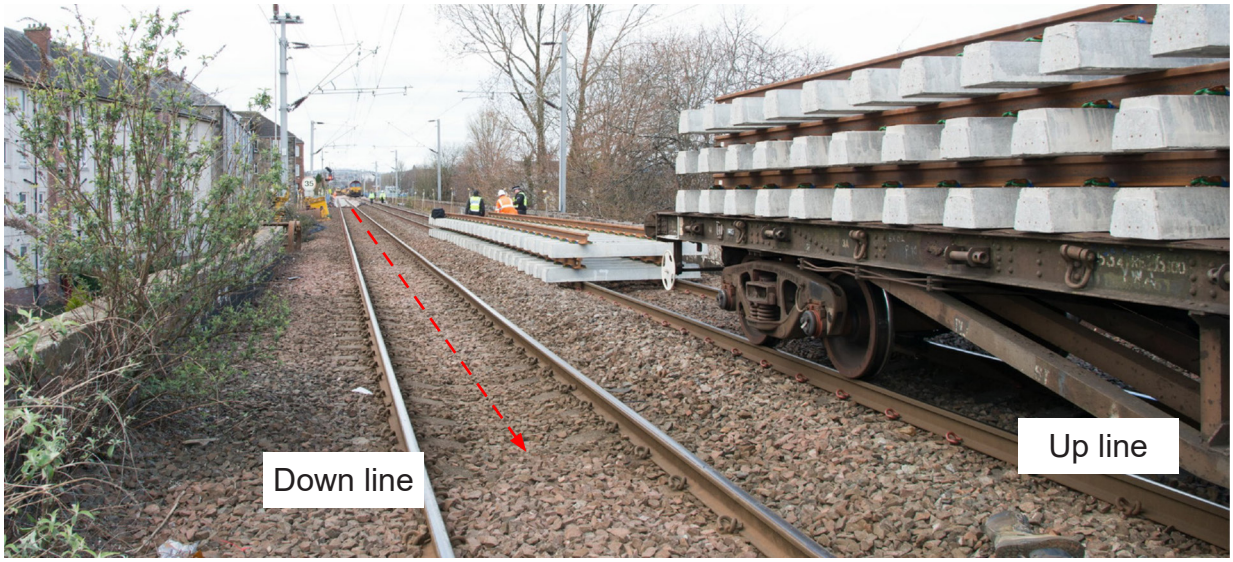

Figure 14: Walking route of the crane 26 controller on the approach to the accident (courtesy of British Transport Police).

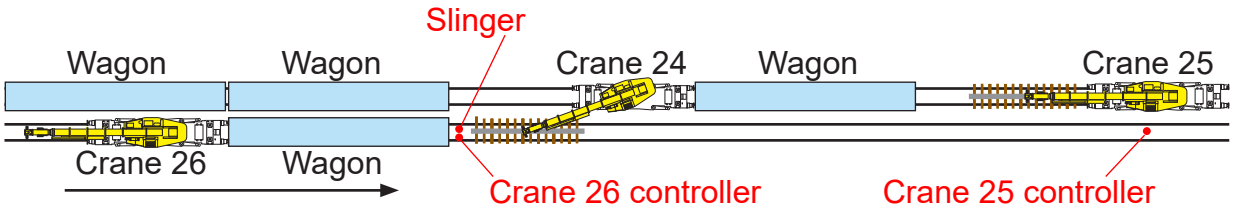

Figure 15: Positions of staff at the time of the accident.

89 The crane team had discussed, before starting the shift, which panels were to be moved in which order. However, the slinger did not explicitly know on which line crane 24's panel was supposed to be dropped when arriving at the transfer location. The slinger was aware that crane 26 would be travelling towards them on the down line to collect the panel but was unaware that it was travelling with the boom trailing.

90 The two wagons stabled on the up line (paragraph 87) marked the location where cranes 24 and 25 were supposed to stop. The slinger considered the safest action to be to set the track panel down while waiting for crane 26, rather than leaving it suspended in the air. Not being aware of a specific instruction as to where to set the track panel down, the slinger opted to do this on the down line, with the up line ahead blocked and crane 26 approaching on the down line. The slinger also thought that it would be easy to move the track panel, if required, if it was left attached to crane 24.

91 After issuing the stop instruction to crane 26, the crane controller walked forward towards the slinger, and they met in the four-foot at the end of the track panel to discuss its position (paragraph 35). The crane controller was focused on the track panel and the discussion with the slinger, and the slinger was also focused on the discussion. Neither of them saw or heard the crane and wagon approaching, possibly because there were no lights on its leading end, and the wagon would have been quiet compared to the engine of the adjacent crane 24. Both of them heard the warning horn sounded by the operator of crane 24 (paragraph 36), which would have drawn their attention towards that crane, and almost immediately they were struck by the wagon propelled by crane 26.

Absence of lighting

92 There were no lights on the leading end of the wagon being propelled by the crane to alert the track workers that it was approaching. This is a possible causal factor.

93 Crane 26 was fitted with floodlights facing in the direction of travel, located both above and below the crane counterweight (figure 16). Because there was a salmon wagon loaded with three panels coupled to that end of the crane, these lights would have been obscured from view for staff positioned ahead of the wagon (figure 13).

Figure 16: Lighting on the leading end of crane 26.

94 The salmon wagon did not have any lights on its leading end while it was being propelled by the crane that might have aided its conspicuity to the staff standing on the line ahead of it (figure 17).

95 There are a number of requirements in the Rule Book GERT8000 and in Network Rail's standards that require different types of vehicles and trains to have lights fitted and illuminated in different circumstances. Most of these are not directly applicable to OTM. These requirements include:

- Rule Book Handbook HB15, 'Duties of the machine controller (MC) and on-track plant operator', issue 7 dated December 2024. Section 7.3 states '*Any vehicle that the OTP is propelling must display two white lights at the leading end*'.
- Network Rail standard NR/L2/RMVP/0200, 'Infrastructure Plant Manual' Module P509, 'Trailers and Wheeled Attachments', issue 5 dated March 2024. Section 6.3 states '*display of head and tail lights … shall be in accordance with GERT8000/HB15*', and '*if an overhanging load obscures any light, an alternative shall be provided to maintain compliance*'.

Figure 17: The end of the salmon wagon, after the collision, showing no lighting fitted (courtesy of British Transport Police; taken after two of the panels had been removed).

- Rule Book Module SS2, 'Shunting', issue 7 dated December 2024. Section 10.1, relating to shunting within a possession, states '*If there is no fixed headlight on the leading vehicle of a propelling movement, you must place a portable headlight on the leading vehicle before the movement starts*'.
- Rule Book Module T3, 'Possession of a running line for engineering work', issue 12 dated December 2024. Section 9.3 states '*If the train is detained outside a work site, you must make sure that a red light is showing at both ends of the train*'.
- Rule Book Module T1, 'Preparation and movement of trains', issue 20 dated December 2024. Section 14.2 states '*You must make sure there is a tail lamp that is lit at the rear of the train when it is … being propelled in the right direction*'.
- Rail industry standard RIS-1530-PL, 'On-Track Plant, Trolleys and Associated Equipment', issue 7.1 dated March 2024. Section 5.15.1.2 states '*The machine shall always display white marker lights in the direction of movement along the track and red tail lights at the opposite end that are visible during daylight on the track from 50 m away'*.

96 Module SS2 requires any wagons being shunted within a possession to have a light on the leading end. It does not specify what type of train or vehicle it applies to, and so would be applicable to wagons being propelled by OTM. The way operational rules are applied to OTM is discussed further in paragraph 119.

97 It is of note that module P509 requires lighting on OTP to be augmented when it is obstructed by loads on vehicles coupled to them. This requirement does not apply to OTM even though, as shown by this accident, similar circumstances may arise.

98 If the wagon had had a light attached to the leading end, it is possible that this might have drawn the attention of either the controller for crane 26 or the slinger to its approach in time to issue another instruction to the crane to stop or to get out of the way before the collision occurred.

Identification of underlying factors

Non-use of duplex communications equipment

99 The radio system used on the rail crane was not compliant with Network Rail's requirement for on-track machines to use duplex communications systems. This is a possible underlying factor

100 Network Rail standard NR/L2/RMVP/0200, 'Infrastructure plant manual' Module P300, 'Plant Approval and Design', issue 5 dated June 2022, requires operations on Network Rail sites to use duplex communications systems. It states:

> '*Where personnel are required to undertake controlling and operating activities involving OTMs, OTP and non-rail mounted plant (civils) on Network Rail construction sites (civils and rail), the Principal Contractor shall arrange for full digital duplex communication systems to be provided and used. Full Duplex communication systems shall be product approved.'*

101 Within the same standard, Module P503, 'Lifting operations', issue 5 dated June 2022, additionally requires that contractors '*only use product approved digital full duplex communication systems when undertaking lifting operations*'.

102 These requirements have been in place since the first issue of module P300 was published in March 2013, and added to issue 4 of module P503 in December 2018. These requirements are applicable to the operators of both OTP and OTM, during lifting operations and other movements.

103 Network Rail has approved a number of different models of duplex communications systems for use on its infrastructure. These systems all deliver continuous communications, which means that they require headsets to be worn over, or in, users' ears at all times when in use.

104 At the relaying project at Wemyss Bay Junction, RSAS, representing the principal contractor, provided duplex communications equipment for all the OTP that its suppliers brought to site. RSAS, and its constituent companies, did not recognise that the Network Rail standard requirement to provide duplex communications systems also applied to OTM, such as the rail cranes.

105 However, the rail cranes were fitted with built-in radios and the staff that operated them were all equipped with compatible radios to allow the crane crew to communicate with each other. These radios were simplex radios and were not compliant with the requirement for duplex communications to be used (paragraph 84).

106 When Swietelsky Construction acquired the rail cranes, they were fitted with analogue back-to-back radios. These radios were used for up to 15 years, with replacements being required by 2021. In late 2021, trials were undertaken with several possible replacement radios, including a duplex communications system, in conjunction with Swietelsky Construction's radio supplier. These trials identified several issues with the duplex communications system, including:

- Open channel communications meant that the crane operator could hear everything that the crane controller was saying, including discussion of upcoming movements and lifts with other staff at site. This led to frequent misunderstandings, with the crane operator struggling to separate relevant instructions from other conversations not directed towards them.
- The crane operators also found the constant background noise from surrounding machinery was being fed to their headset, leading to distraction and misunderstanding of instructions.
- The duplex radios were more prone to black spots around the cranes than the older simplex radios that they had previously used.
- The battery life on the duplex radios was significantly less than the older radios and they were often unable to last the duration of a work shift.
- Crane operators found that the 'over the ear' headsets limited their ability to hear the operation of their crane, and that this compromised their ability to manage the fine control of lifting operations.

107 At the end of the trials, in January 2022, Swietelsky Construction selected a digital simplex back-to-back radio system to replace the previous analogue system. These radios operated in a very similar manner to the previous models, meaning that there was very little operational change required. However, the new radios had better clarity and experienced fewer blackspots when working around the rail cranes.

108 RAIB is unable to confirm whether the available duplex communications systems that Network Rail allows to be used on its sites would have been effective at the distance and orientation behind the crane and wagon at the location of the accident on the night. As a result, this is only a possible underlying factor. RAIB is also unable to quantify any potential additional risks associated with the use of the duplex communications systems that Swietelsky Construction trialled in 2021 and rejected in favour of the back-to-back radios that were in use at the time of the accident.

Network Rail's assurance

109 Standard NR/L2/RMVP/0200 is an operational standard, rather than a technical one, and is primarily focused on the use of OTP, rather than OTM. However, Network Rail interprets the standard to mean that it requires duplex communications systems to be used when OTM, which includes the rail cranes, are being operated on its infrastructure. The introduction of this standard was briefed in 2013 (paragraph 102), with individual companies being required to review its impact on their businesses.

110 Network Rail carries out a number of assurance activities on the operators and suppliers of OTM that are used on its infrastructure. These activities are directed primarily at ensuring that machines are compliant with technical design standards and that maintenance activities comply with the relevant approved procedures.

111 Network Rail also has assurance processes for the operational aspects of OTP, including the use of duplex communications systems, as required by standard NR/L2/RMVP/0200. This includes supplying duplex communications systems for incoming OTP, as implemented by RSAS at Wemyss Bay Junction (paragraph 104). However, RAIB could find no evidence of an equivalent assurance process being applied to OTM in respect of duplex communications systems.

Swietelsky Construction's assurance

112 Swietelsky Construction has a process for regularly reviewing changes to Network Rail standards. The requirement to use duplex communications systems was introduced in 2013 (paragraph 102) and has not changed since then. However, Swietelsky Construction did not recognise the applicability of this requirement to its rail cranes and was unable to identify any documentation relating to its review of the 2013 changes.

113 In 2021, when the radios were being replaced, Swietelsky Construction was aware of the availability and use of duplex communications equipment for OTP. It undertook trials with duplex communications and concluded that modern back-to-back, digital simplex radios were a better solution for communications between crane controllers and crane operators (paragraph 106).

114 Because Swietelsky Construction had not recognised the applicability of the duplex communications requirement, it did not seek to obtain a formal derogation from Network Rail standards that could have allowed it to continue to use simplex communication systems on its rail cranes.

Wider industry awareness

115 RAIB asked a number of other rail crane suppliers about their use of radios for communications between crane staff. RAIB found that there was a general lack of awareness of the applicability of the requirement to use duplex communications among this supplier base. RAIB also found that most of the operators of large rail cranes routinely use simplex communications, in a similar fashion to Swietelsky Construction, although one had fitted duplex radios to some of its cranes. Some indicated that they would occasionally use duplex communications if the site conditions were noisy, such as during piling work.

116 Some rail crane suppliers expressed a belief that there had been a historic derogation from the requirements, but no evidence was produced to support this. Part of this might have been driven by Network Rail's industry-wide training for Kirow crane staff including material about using either simplex or duplex communications (paragraph 75). Network Rail reported that there were no authorised derogations from the duplex communications requirement, either current or historic.

117 The ‘M&EE Networking Group’, a cross-industry working group concerned with developing guidance for the operation of plant on railways in Great Britain, has representatives from all the suppliers of OTP and OTM, as well as from Network Rail. It has written a code of practice, COP0011, ‘Lifting Operations’, issue 6 dated September 2020. This document includes rail cranes explicitly in its scope and separately highlights the Network Rail requirement for the use of duplex communications systems during lifting operations. Despite this document being signed off by representatives from all the rail crane operating companies, most did not recognise that the requirement applied to rail cranes. This is probably because COP0011, like NR/L2/RMVP/0200, is primarily focused on operators of OTP and its applicability was not generally recognised by the operators of OTM.

118 This shows that operators of OTM, such as rail cranes, routinely used simplex communication systems when there has been a long-standing requirement to use duplex systems (paragraph 102), while Network Rail was unaware of this ongoing non-compliance (paragraph 111). This is explored further in the following possible underlying factor.

Assurance of operational aspects of on-track machines

119 Although Network Rail categorises rail cranes as on-track machines, they often are subject to operational rules that are normally associated with on-track plant or engineering trains. This is a possible underlying factor.

120 A rail crane can be hauled around on the operational railway and hence is categorised as OTM. However, operationally, a rail crane functions in a similar way to some common types of OTP, such as a road-rail vehicle that is capable of undertaking lifting activities. It is also staffed by a crane operator and a crane controller and is controlled in the same manner as OTP when undertaking lifting operations. It is still subject to the same operational requirements which apply to OTP, such as the use of duplex communications required in NR/L2/RMVP/0200 (paragraph 100). However, despite this, operational assurance processes are directed towards OTP and do not extend to relevant OTM, such as rail cranes (paragraph 111).

121 A rail crane can also undertake some of the operational activities undertaken by an engineering train, such as being coupled to a railway wagon and shunting it around inside a possession. Such activities were being undertaken, with the salmon wagons, at the time of the accident. As a result of this, the rail crane is also subject to some operational requirements that apply to engineering trains in the Rule Book such as the movement of engineering trains in possessions. These are primarily directed to the engineering supervisor who is in control of train movements within work sites.

122 In practice, movement of a rail crane when undertaking lifting operations is normally delegated by the engineering supervisor to the crane controller. Despite this, some Rule Book requirements, such as that for wagon lighting (paragraph 96), are still applicable to the rail crane. RAIB found that the applicability of such rules does not seem to be well known within the industry, and there appears to be little assurance activity regarding compliance to them.

123 If the operational rules for OTP regarding the use of duplex communications systems had been applied, it is possible that the stop message would have reached the crane operator, and the accident could have been avoided. Similarly, if the operational rules relating to engineering trains had been applied, the wagon would have been fitted with lighting and the track workers could possibly have seen its approach and the accident would have been avoided.

Observations

Provision of a COSS

124 The rail crane team started work on the Saturday evening, without their controller of site safety or person-in-charge being on site.

125 The controller of crane 26 was directly involved in the planning of the sequence of lifting operations to be undertaken throughout the relaying project at Wemyss Bay Junction. The documentation and resourcing for the sequence were planned by staff from RSAS.

126 Some of Swietelsky Construction's staff are qualified to act as both a crane controller and COSS, and this role can be undertaken simultaneously. On this shift, the only crane controller qualified to act as COSS was that for crane 26. However, the plan for the work did not have them allocated to act as COSS. Instead, the plan had allocated an additional member of Babcock Rail staff to act as COSS alongside this team during the work. This person was also qualified as a crane controller for the rail cranes, if required, but it was not planned for them to act in that role.

127 The allocated COSS lived a considerable distance from the site which meant that their travelling time limited the hours they could work on site. This was to ensure compliance with Network Rail's limits for maximum shift lengths and rest times. As a result, the plan allocated the COSS to start their shift at 22:00 on the night of the accident, while the crane team were programmed to start their shift at 20:00. Although the controller of crane 26 had been involved in the early planning for the availability and timing for this non-Swietelsky Construction COSS, they had assumed that the final plan had been revised to resolve this problem. At the end of the previous night's shift, the controller of crane 26 recognised that there remained a discrepancy between the COSS's start time and that of the crane team. They intended that the crane team would therefore be briefed and sign in with any other available COSS until their own arrived at site.

128 When the team arrived at site on the Saturday night, the operator of crane 26 and their controller went to crane 26 at Wemyss Bay Junction (paragraph 31) and signed in with a COSS who was overseeing the work at that location.

129 The operators of crane 24 and 25, their crane controller and the slinger travelled to the Glasgow Road access point where their cranes were located (paragraph 31), with the intention of signing in with a COSS there. However, there was no COSS present at that location. Instead of invoking Network Rail's worksafe procedure, and standing down until a COSS was available, they started to work with the intention of moving the cranes towards Wemyss Bay Junction where they could sign in with the COSS there. The accident occurred before they were able to receive their safety brief or sign in with the COSS.

130 The plan for the work had allocated one COSS to oversee the three cranes, and this was sufficient on the Saturday morning shift (paragraph 29) as all three were located together at the Glasgow Road access point. However, on the Saturday night shift, the cranes were planned to be separated, with cranes 24 and 25 working together and crane 26 working independently (paragraph 31). That meant that a single COSS would have been unable to effectively oversee the safe working of all three cranes at all times.

131 In practice, this would have needed a minimum of two COSSs to oversee the two separate sets of crane movements. The controller of crane 26, who held the appropriate competency, could have been appointed to act as COSS for crane 26, with the allocated COSS overseeing cranes 24 and 25, which were working together. However, the plan did not include this option, and it was not adopted once on site.

132 If the allocated COSS had been present on site at 20:00, it is likely that they would have been acting as slinger for, and overseeing the movement of, cranes 24 and 25 during the transit move. Cranes 24 and 25 were already being overseen by a crane controller when the accident occurred. In addition, although not acting as COSS, the controller of crane 26 held that competency and had the knowledge to be able to safely manage the operation of crane 26. Although the allocated COSS would have provided a fourth person on the track at the site, the three people already there did not see or hear the approaching wagon before the collision. RAIB can find no evidence that the presence of the allocated COSS would have avoided the accident.

Approval of radio equipment

133 The radio equipment fitted to the cranes during 2022 had not been subject to Network Rail's product approval process.

134 Network Rail requires equipment that will be used in work sites on its infrastructure to have undergone its product approval process. The radios that were fitted to the rail cranes by Swietelsky Construction in 2022 (paragraph 107) were found not to be on Network Rail's list of product-approved equipment.

135 Swietelsky Construction had not recognised the need for the radios to be product-approved and had not checked that they were. Instead, it had relied on its communications supplier to deliver radios appropriate for use on the railway, without specifying the need for them to be product-approved.

136 The result of the technical trials (paragraph 106) meant that Swietelsky Construction chose the radios based on technical merit for use with the rail cranes, having evaluated a number of different systems. RAIB has not investigated whether any product-approved equipment would have delivered technical performance comparable to the radios selected by Swietelsky Construction.

Previous occurrence of a similar character

137 A member of staff was struck by an OTM in November 2023 on High Speed 1, near to Strood, when one OTM collided with a second machine that was being coupled to a third one. A driver involved in the coupling was injured during the collision (RAIB report 11/2024). The driver of the first machine had no view of the line ahead and was reliant on radio communications with a machine controller on the ground. The staff were not using a duplex communications system and an intermittent fault led to an instruction to stop not being received by the driver.

138 The operating rules for High Speed 1 (which is managed by Network Rail High Speed, a Network Rail subsidiary, on behalf of HS1 Ltd) did not mandate the use of duplex communications systems at the time of the accident. No recommendation was made by RAIB because, following the accident, Network Rail High Speed purchased headsets that enable secure open microphone communication and updated the relevant operating rules concerning the use of such systems.

Summary of conclusions

Immediate cause

139 A wagon, being propelled by crane 26, approached two track workers who were standing on the line ahead (paragraph 50).

Causal factors

140 The causal factors were:

a. Crane 26 did not stop before the wagon that it was propelling collided with the two track workers (paragraph 54), **Recommendations 1 and 2, and Learning point 2**. This causal factor arose due to a combination of the following:

   i. The operator of crane 26 had almost no visibility of the line ahead because the crane was travelling in reverse and the coupled wagon obstructed the CCTV view (paragraph 60), **Learning point 2.**

   ii. The operator of crane 26 did not receive an instruction from the controller of crane 26 to stop the crane (paragraph 70), **Recommendations 1 and 2, and Learning point 2.**

b. The two track workers were standing between the rails of the down line, unaware that the wagon being propelled by the crane was still moving towards them (paragraph 85), **Recommendations 1 and 2, and Learning point 2.** This causal factor arose due to the following:

   i. There were no lights on the leading end of the wagon being propelled by the crane to alert the track workers that it was approaching (paragraph 92), **Learning point 1.**

Underlying factors

141 The underlying factors were:

a. The radio system used on the rail crane was not compliant with Network Rail's requirement for on-track machines to use duplex communications systems (paragraph 99), **Recommendations 1 and 2.**

b. Although Network Rail categorises rail cranes as on-track machines, they often are subject to operational rules that are normally associated with on-track plant or engineering trains (paragraph 119), **Recommendation 3**.

Observations

142 Although not linked to the accident on 15 March 2025, RAIB observes that:

a. The rail crane team started work on the Saturday evening, without their controller of site safety or person-in-charge being on site (paragraph 124), **Learning point 3**.

b. The radio equipment fitted to the cranes during 2022 had not been subject to Network Rail's product approval process (paragraph 133), **Recommendations 1 and 2**.

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

143 Since the accident, Swietelsky Construction has rebriefed its staff on the communications protocols required when controlling movements of OTM, such as rail cranes. The learning from the accident has also been incorporated into training material, such as toolbox talks and both initial and refresher training. It has also emphasised to its customers that appropriate COSS provision needs to be included in the planning, and provided, when its OTM are being used.

144 Swietelsky Construction has, in collaboration with its radio provider, reprogrammed the back-to-back radios to mitigate the risk of the channels being inadvertently changed (paragraph 79). When the radio channel is changed, the radio now verbally announces the change of channel, rather than this being done silently, as before. Swietelsky Construction has also now provided staff with chest holsters (figure 18) to prevent its staff from having to carry the radios in their pockets. It has mandated the use of these holsters to further mitigate the risk of the radio channels being accidentally changed during use.

Figure 18: Chest holster for the radios.

145 The Rail Safety and Standards Board (RSSB) is intending to publish an amendment to Rule Book GERT8000 to more tightly define what is meant by persons controlling movements keeping in ‘constant communication’ when using simplex communications systems. The intention is to require gaps of no more than three seconds between messages. Initially this will apply to module SS2, relating to shunting movements within a possession.

Recommendations and learning points

Recommendations

146 The following recommendations are made:[1]

1 *The intent of this recommendation is to mitigate the risk of loss of messages being conveyed between individuals working with rail cranes.*

Swietelsky Construction Company Ltd should review its use of non-duplex radio communication systems when controlling movements of its rail cranes on Network Rail managed infrastructure.

It should use this review to inform a decision whether it should either comply with Network Rail's requirement to use product-approved duplex communications systems or apply for an approved derogation to this requirement based on an appropriate alternative method of communication.

It should then develop a timebound programme to implement any actions identified as being necessary.

This recommendation may also be relevant for other operators of on-track machines on Network Rail managed infrastructure (paragraphs 140a, 140a.ii, 140b, 141a and 142b).

2 *The intent of this recommendation is to ensure that Network Rail's requirements for on-track machine communications equipment are appropriate.*

Network Rail, working with operators of on-track machines working on its infrastructure, should review whether the requirements given in its standards for the use of product-approved duplex communications equipment when operating on-track machines effectively address the risks which may arise during operations.

Based on this review, Network Rail should develop a timebound programme to review and update as necessary the relevant requirements and communicate any changes to on-track machines operators (paragraphs 140a, 140a.ii, 140b, 141a and 142b).

[1] Those identified in the recommendations have a general and ongoing obligation to comply with health and safety legislation, and need to take these recommendations into account in ensuring the safety of their employees and others.

Additionally, for the purposes of regulation 12(1) of the Railways (Accident Investigation and Reporting) Regulations 2005, these recommendations are addressed to the Office of Rail and Road to enable it to carry out its duties under regulation 12(2) to:

(a) ensure that recommendations are duly considered and where appropriate acted upon; and

(b) report back to RAIB details of any implementation measures, or the reasons why no implementation measures are being taken.

Copies of both the regulations and the accompanying guidance notes (paragraphs 200 to 203) can be found on RAIB's website www.gov.uk/raib.

3 *The intent of this recommendation is to ensure that an appropriate assurance regime exists for the operation of on-track machines on Network Rail managed infrastructure, as it does for on-track plant.*

Network Rail should review its standards and processes for assurance activities to ensure that they provide an effective overview of the operation of on-track machines in engineering possessions.

This review should specifically consider:

- the requirements of standard NR/L2/RMVP/0200, 'Infrastructure Plant Manual' that are primarily intended for on-track plant, but which are also applicable to on-track machines
- the operational requirements in the Rule Book GERT8000 that are primarily applicable to engineering trains, but which are also applicable to on-track machines.

Based on this review, Network Rail should develop a timebound programme to review and update as necessary the relevant standards and processes (paragraph 141b).

Learning points

147 RAIB has identified the following important learning points:[2]

1 Operators of rail vehicles in possessions are reminded of the requirement for wagons being propelled inside a possession to have a lamp on the leading end, as described in Section 10.1 of the Rule Book, GERT8000 Module SS2, 'Shunting' (paragraph 140b.i).

2 Staff working with on-track machines, such as rail cranes, are reminded of the need to apply safety-critical communications protocols when controlling machine movements, particularly when confirming that any safety-critical instructions have been received and understood (paragraphs 140a, 140a.i, 140a.ii and 140b).

3 Staff working on or near the line are reminded of the need to confirm that they have received a suitable pre-work briefing from, and have signed in with, a COSS before starting work, and that they should invoke the appropriate worksafe procedure if work is started on or near the line when a COSS is not present (paragraph 142a).

[2] '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
COSS	Controller of site safety
MC	Machine controller
ORR	Office of Rail and Road
OTM	On-track machine
OTP	On-track plant
PIC	Person in charge
PTT	Push-to-talk
RAIB	Rail Accident Investigation Branch
RSAS	Rail Systems Alliance Scotland

Appendix B - Investigation details

RAIB used the following sources of evidence in this investigation:

- information provided by witnesses
- information taken from the cranes' data recorders
- site photographs and measurements, recorded by British Transport Police
- weather reports and observations at the site
- documentation relating to the operation and maintenance of the cranes
- relevant industry standards and procedures
- a review of previous RAIB investigations that had relevance to this accident.

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