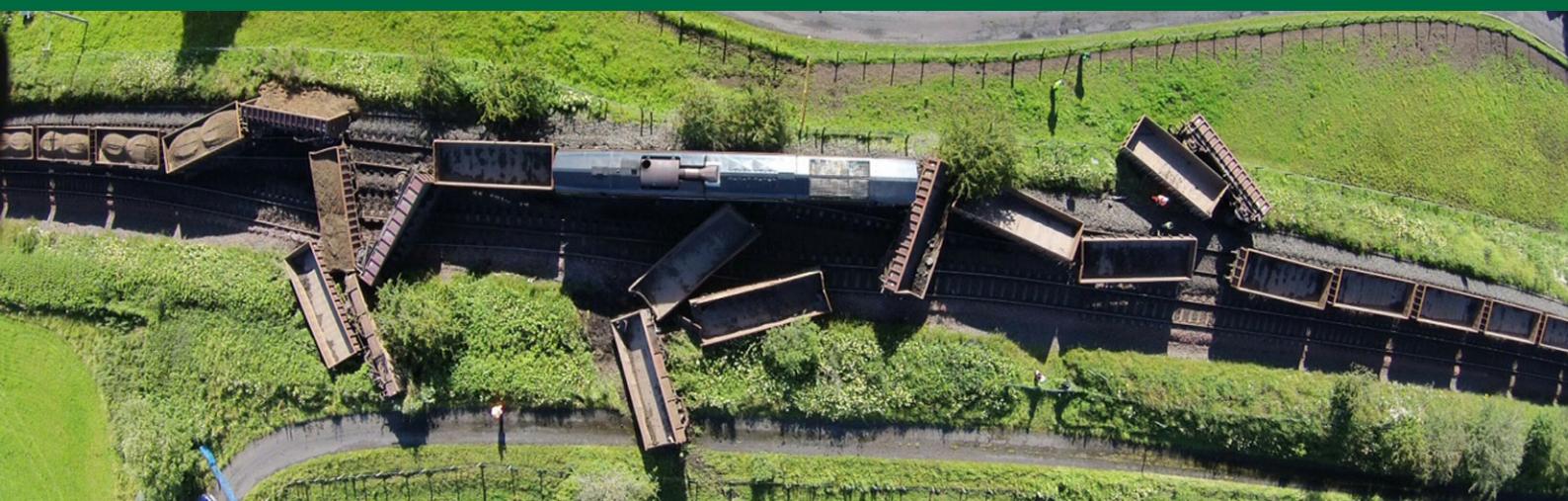




Rail Accident Investigation Branch

Rail Accident Report



**Freight train collision near Logan, East Ayrshire
1 August 2015**

Report 13/2016
July 2016

This investigation was carried out in accordance with:

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

The 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 the RAIB has described a factor as being linked to cause and the term is unqualified, this means that the RAIB has satisfied itself that the evidence supports both the presence of the factor and its direct relevance to the causation of the accident. However, where the RAIB is less confident about the existence of a factor, or its role in the causation of the accident, the RAIB will qualify its findings by use of the words 'probable' or 'possible', as appropriate. Where there is more than one potential explanation the 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 but are associated with the underlying management arrangements or organisational issues (such as working culture). Where necessary, the words '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 event 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 the RAIB, expressed with the sole purpose of improving railway safety.

The 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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Freight train collision near Logan, East Ayrshire

1 August 2015

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Summary

On 1 August 2015 at about 11:11 hrs, a freight train travelling within a work site collided with the rear of a stationary freight train at 28 mph (45 km/h). Engineering staff had authorised the driver of the moving freight train to enter the work site at New Cumnock station, travel about 3 miles (4.8 km) to the start of a track renewal site, and bring the train to a stand behind the stationary train. There were no injuries but the locomotive and seven wagons from the moving train and eleven wagons from the stationary train were derailed; the locomotive and derailed wagons were damaged. One wagon came to rest across a minor road. There was also substantial damage to the track on both railway lines.

The immediate cause was that the moving train was travelling too fast to stop short of the rear of the stationary train when its driver first sighted the train ahead. This was due to a combination of the train movement in the work site not taking place at the default speed of 5 mph (8 km/h) or at caution, as required by railway rules, and the driver of the moving train believing that the stationary train was further away than it actually was. An underlying cause was that drivers often do not comply with the rules that require movements within a work site to be made at a speed of no greater than 5 mph (8 km/h) or at caution.

The RAIB has made four recommendations, which are addressed to freight operating companies. One relates to the monitoring of drivers when they are driving trains within possessions and work sites. Two recommendations relate to short and long term measures for implementing a method of formally recording information that is briefed to drivers about making train movements in possessions and work sites. The fourth recommendation relates to investigating the practicalities of driving freight trains in possessions and work sites for long distances at a speed of 5 mph (8 km/h) or at other slow speeds, and taking action to address any identified issues.

The RAIB has also identified three learning points. One relates to the importance of providing drivers with all of the information they need to carry out movements in possessions and work sites safely. The second is a reminder to provide drivers (before they start a driving duty) with information about how and when they will be relieved. The third highlights the importance of engineering staff giving instructions to drivers through a face to face conversation when it is safe and practicable to do so.

Introduction

Key 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 technical terms (shown in *italics* the first time they appear in the report). These are explained in appendices A and B. Sources of evidence used in the investigation are listed in appendix C.

The accident

Summary of the accident

- 3 On Saturday 1 August 2015 at about 11:04 hrs, a freight train entered a possession and work site (which started at the same place) at New Cumnock. Engineering staff had authorised its driver to take the train about 3 miles (4.8 km) to the start of a track renewal site near Logan¹ (figure 1) where it was to come to a stand behind a stationary freight train that was waiting to go into the track renewal site. The track renewal required freight trains to bring materials to the site and to take away spoil.

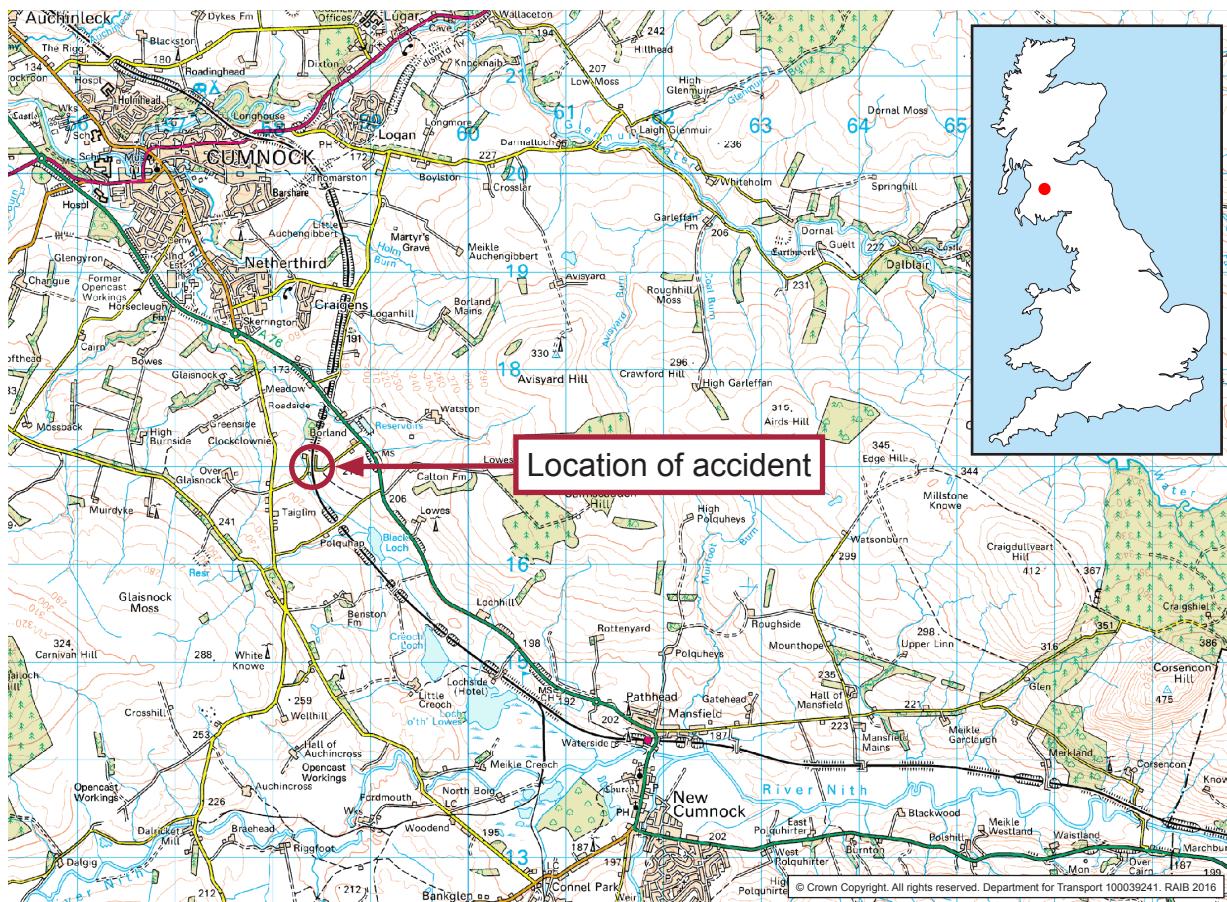


Figure 1: Location of accident

- 4 At about 11:11 hrs, while travelling towards Logan the train collided with the rear of the stationary freight train at 28 mph (45 km/h). There were no injuries but the locomotive and seven wagons from the moving train, and eleven wagons from the stationary train were derailed; the locomotive and derailed wagons were damaged. One wagon came to rest across a minor road. There was also substantial damage to the track.

¹ The location of this accident was described by the railway industry as being at Logan, although the town of that name is about 2.5 miles (3.5 km) away and there are other settlements nearer. For consistency the RAIB has used the industry's location reference in this report.

Context

Location

- 5 The collision occurred on the *down main* line between New Cumnock and Auchinleck, at 52 miles 140 yards (from a zero reference at the former Glasgow Bridge Street station), which is part of Network Rail's *Scotland Route*. At this location the railway comprises two tracks, the *down main* and *up main* lines (figure 2), and is known as the Glasgow South Western line.

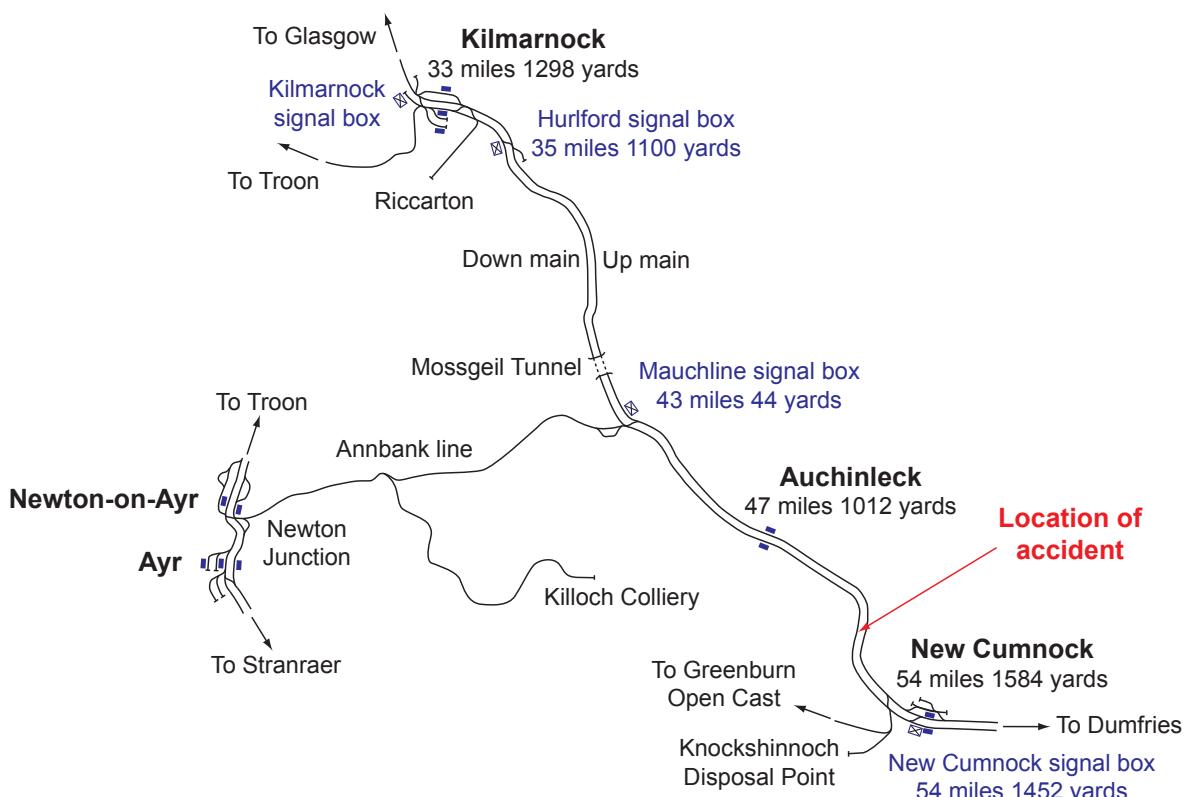


Figure 2: Overview of track layout and key locations

- 6 The collision happened on a right-hand curve (in the train's direction of travel) of about 790 metres radius (figure 3) and on a falling gradient of about 1 in 175 (0.57%). Trains are normally signalled through this area using the *absolute block* system, with the controlling signal boxes located at New Cumnock (54 miles 1452 yards) and at Mauchline (43 miles 44 yards). However, at the time of the accident the signalling system was not in use as this section of railway was under possession and both lines were within a work site.

Organisations involved

- 7 Network Rail owns, operates and maintains the infrastructure where the collision occurred. Network Rail had scoped, planned, and was overseeing the delivery of the track renewal near Logan. Network Rail contracted SW Global Resourcing to provide staff who held the required competencies to carry out the duties of a *Person In Charge of Possession* (PICOP) for the possession taken for the track renewal.

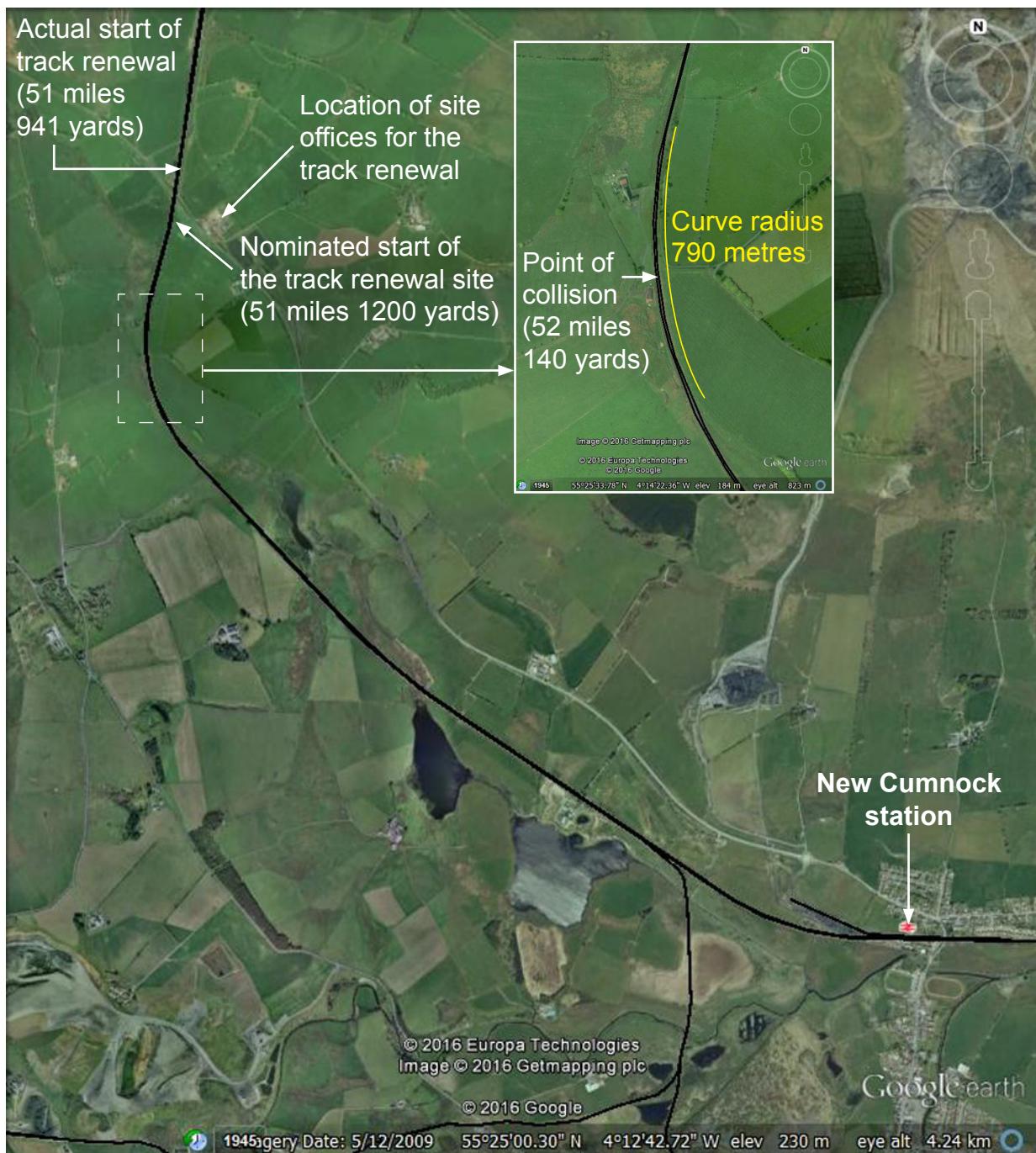


Figure 3: Google Earth view of accident site

- 8 Babcock Rail (part of Babcock International Group PLC) was carrying out the work through its contract with Network Rail for delivering plain line track renewals on Scotland Route. Babcock Rail contracted SW Global Resourcing to provide staff who held the required competencies to carry out the duties of an *Engineering Supervisor* (ES) for the work site.
- 9 Direct Rail Services Limited owns the locomotives and was the operator of the two freight trains that collided. It had hired drivers from Freightliner Heavy Haul to work these trains.
- 10 Freightliner Heavy Haul (part of Freightliner Group Ltd) employed the drivers of both trains involved.

- 11 DB Schenker (UK) Limited (known as DB Cargo (UK) Limited since 1 March 2016) owns the wagons that formed both trains.
- 12 All of the organisations involved freely co-operated with the investigation.

Train(s) involved

- 13 The stationary freight train that was struck was train 6K06, the 07:03 hrs service from Carlisle Yard to New Cumnock. It consisted of a class 66 diesel-electric locomotive (number 66 305) hauling 36 two-axle 'coalfish' wagons (figure 4). These were a combination of 25 MHA wagons, 8 MTA wagons and 3 MFA wagons, forming a train that was 348 metres long. The front 12 wagons were loaded with sand and the rear 24 were empty.



Figure 4: Coalfish wagon

- 14 Train 6K06 was struck by train 6K07, the 09:17 hrs service from Carlisle Yard to New Cumnock. It also consisted of a class 66 diesel-electric locomotive (number 66 428) hauling 36 two-axle 'coalfish' wagons. These were a combination of 30 MHA wagons, 3 MTA wagons and 3 MFA wagons, forming a train that was 349 metres long. The leading 4 wagons were empty, the next 10 were loaded with sand, and the remaining 22 were loaded with clean ballast. The maximum permitted speed for train 6K07 was 60 mph (97 km/h).

Staff involved

- 15 The driver of train 6K07 was based at Freightliner Heavy Haul's Carlisle train crew depot. He had 23 years' experience of driving trains and held the required competencies to drive that class of locomotive. He also held the required competencies to drive over that route, which he did frequently with various types of freight train including coal and ballast trains. He was familiar with driving freight trains in work sites and possessions and had done this on the previous five weekends.

- 16 Three staff were responsible for managing the movements of trains in the possession and work site. The PICOP who controlled train movements in the possession had 14 years' experience, held the *Senior PICOP* competency and was qualified as a competence assessor for other PICOPs. The ES who controlled train movements in the work site held the qualifications to carry out this role and had 17 years' experience in the rail industry, including the past four years working as an ES on track renewals for Babcock Rail. The ES also had a competent person working alongside him to assist with train movements in and out of the work site. This person had 10 years' experience and was also qualified to carry out ES duties. This competent person is referred to as the Engineering Supervisor's Assistant (ESA) in this report.

External circumstances

- 17 It was daylight at the time of the accident. The local weather, based on witness accounts and data from the nearest weather station 2.5 miles (4.0 km) away, was dry with sunny periods and scattered clouds. The rails were dry. Train 6K07 was travelling in a northerly direction and the sun was high in the sky. The weather did not play any part in the accident.

The sequence of events

Events preceding the accident

- 18 Two days before the accident, on Thursday 30 July, Freightliner asked the driver to work an additional duty on the morning of Saturday 1 August. This duty was to drive train 6K07 from Carlisle to New Cumnock. The driver agreed to do this.
- 19 On the same day, the ES attended a briefing about the track renewal that was planned to take place near Logan over the forthcoming weekend. At this briefing the ES was given details about the work that would be taking place, including information about the freight trains that were planned to be used within the work site. That day the PICOP did not attend a briefing but received his information pack which included details of the trains that were planned to enter the possession. The PICOP and ES needed the information they received so that they could manage the movements of these trains.
- 20 The track renewal began at 01:04 hrs on Saturday 1 August when the night shift PICOP took possession of both lines between New Cumnock and Kilmarnock. The possession was from 55 miles 0 yards at New Cumnock through to 34 miles 0 yards at Kilmarnock on the Glasgow and South Western lines (figure 5). The possession also included the Annbank single line from Mauchline at 43 miles 220 yards to Newton Junction (figure 2). The night shift PICOP was granted possession of these sections of line by each signaller who controlled a signal leading into them. The night shift PICOP then sent engineering staff to place *possession limit boards* and *detonators* at the ends of each section of line to mark the extremities of the possession.
- 21 Shortly afterwards at 01:07 hrs, the night shift PICOP gave the night shift ES permission to set up a work site which extended from 55 miles 0 yards to 39 miles 0 yards (figure 5). At these locations, engineering staff placed *work site marker boards* on the track to mark the limits of the work site. At 01:20 hrs the first freight train (train 6K01) entered the possession and work site on the down main line at New Cumnock and travelled to a point near 51 miles 1200 yards (figure 5). This was the nominated point that trains waited at before entering the site of work where the track was being renewed. By 03:19 hrs, a further four freight trains (6K02, 6K03, 6K04 and 6K05) had entered the possession and work site.
- 22 At 08:32 hrs, train 6K06 arrived at New Cumnock. At 08:55 hrs it entered the possession and work site. It travelled for just over 15 minutes until it stopped short of train 6K05. Train 6K05 was waiting at the nominated start of the track renewal site to be called up into the area where work was taking place.
- 23 At 09:00 hrs, the night shift PICOP handed over control of the possession to the day shift PICOP (from now on referred to as the PICOP). The handover included a brief on the current status of the work and the paperwork for the possession. The PICOP then informed all the signallers and each ES responsible for a work site within the possession of the change in PICOP. At 10:30 hrs, the night shift ES responsible for the track renewal work site handed over to the day shift ES (from now on referred to as the ES). The handover included a briefing on the six trains that were already within this work site and their approximate locations.

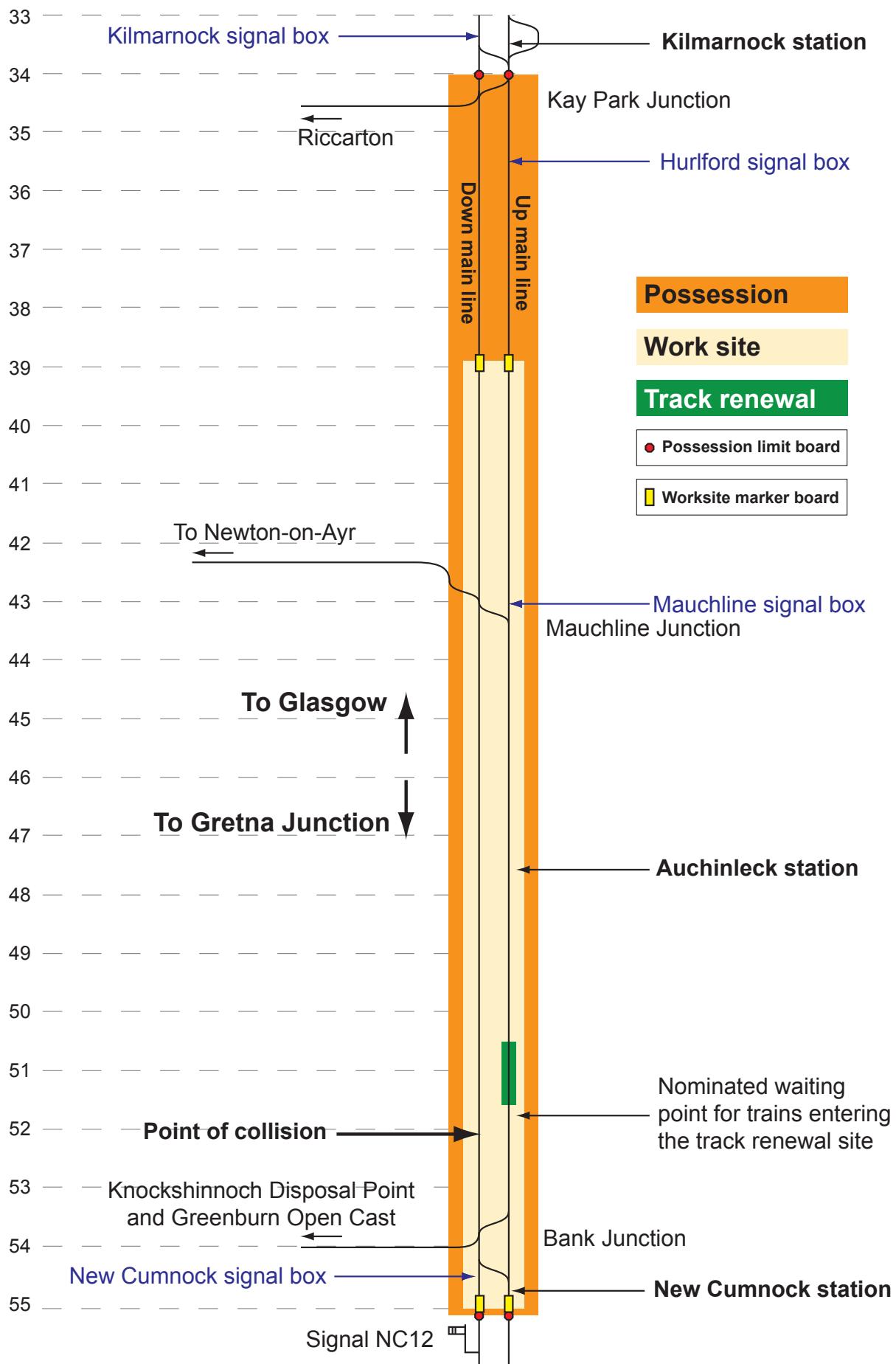


Figure 5: Possession, work site and track renewal site limits

- 24 Meanwhile, train 6K07 had departed from Carlisle 12 minutes early at 09:05 hrs and arrived at signal NC12 on the down main line at New Cumnock (figure 5) at 10:48 hrs. At the same time, the ES called the New Cumnock signaller as he wanted to check the position of a set of points at New Cumnock station before he allowed train 6K07 into the work site. During this conversation the signaller told the ES that train 6K07 had just arrived at signal NC12. The ES agreed to let the PICOP know that the train had arrived. The signaller then took a call from the driver of train 6K07 and asked him to wait at the signal for further instructions.
- 25 At 10:55 hrs the PICOP called the signaller and authorised him to give permission for the train to proceed up to the possession limit board. The signaller then called the driver and authorised him to pass signal NC12 at danger and proceed as far as the possession limit board and detonator protection for the possession. The driver repeated these instructions back and at the same time checked with the signaller where the boards and detonator protection were located.
- 26 The driver moved train 6K07 from signal NC12 and stopped short of the possession limit board. Here the driver was met by the PICOP and the ESA. Once the train had stopped, the ESA called the ES to let him know the train had arrived at the possession limit board. The ES had just arrived at New Cumnock station and asked the ESA to hand his mobile phone to the driver, which he did. The ES then briefed the driver by telephone and gave the driver details of the movement he was required to make within the work site.
- 27 Once the ES had completed the briefing, the PICOP and ESA removed the detonators and possession limit board from the down main line. They did not remove the work site marker board as it was already lying between the rails on the down main line. Both the PICOP and ESA then stood to the side of the track so the train could proceed. At this point, the driver got out of the locomotive cab and went to the PICOP and ESA to query if he could proceed. The driver began repeating back the instructions the ES had given him. However, the PICOP stopped the driver and instead asked if he had received a briefing from the ES. The driver confirmed he had been briefed by the ES. The PICOP then told the driver that as he had been briefed by the ES, he was good to go. The driver then returned to the cab.
- 28 At 11:04 hrs, train 6K07 entered the possession and work site and accelerated away from New Cumnock, towards to the rear of the stationary train 6K06 which was 2.9 miles (4.7 km) away. After train 6K07 had departed, the PICOP replaced the possession protection and the ES replaced the work site protection on the down main line.

Events during the accident

- 29 The locomotive's *on-train data recorder* shows that from 11:04 to 11:07 hrs, train 6K07 slowly accelerated until it reached a speed of 30 mph (48 km/h) within the work site (figure 6). For the next four minutes, train 6K07 maintained a speed between 28 mph (45 km/h) and 33 mph (53 km/h).

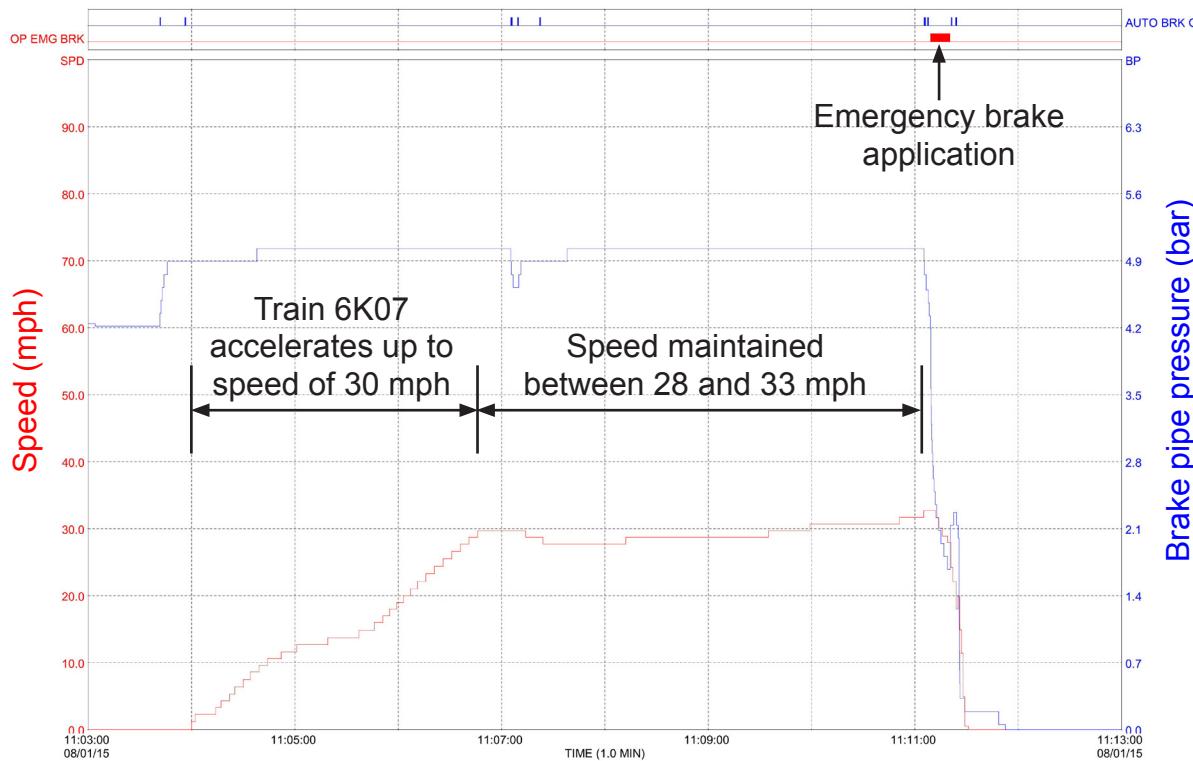


Figure 6: Data recorded by the locomotive's on-train data recorder

- 30 At 11:11:05 hrs, the driver made a brake application and the *brake pipe* pressure recorded by the on-train data recorder fell from 5.0 bar to 4.3 bar. This was 210 metres from the point of collision. Four seconds later the driver made an *emergency brake* application while travelling at 33 mph (53 km/h). This was 156 metres from the point of collision. Shortly after this the driver got out the driver's seat and braced himself behind the seat on the right-hand side of the cab as he realised a collision was unavoidable.
- 31 At 11:11:20 hrs, train 6K07 collided with the rear of train 6K06 at a speed of 28 mph (45 km/h). By this time, the *brake pipe* pressure recorded on the locomotive had fallen to 1.7 bar. However, the *brake cylinder* pressures on the locomotive had not yet had enough time to reach their maximum value.
- 32 The on-train data recorder logged that train 6K07 continued to travel for 11 seconds after colliding with train 6K06. A site survey indicated that the locomotive had travelled about 78 metres in that time. The locomotive and leading seven wagons had derailed (figure 7). The locomotive's windscreen was broken and the side of the driving cab was punctured (figure 8). The driver of train 6K07 was not injured although he was badly shaken.
- 33 Train 6K06 was stationary with just the brakes on the locomotive applied. When struck, train 6K06 was pushed forward and its rear nine wagons derailed (figure 7). The 20th and 21st wagons towards the middle of the train also derailed after overriding (figure 9).



Figure 7: Aerial view of the derailed locomotive and wagons

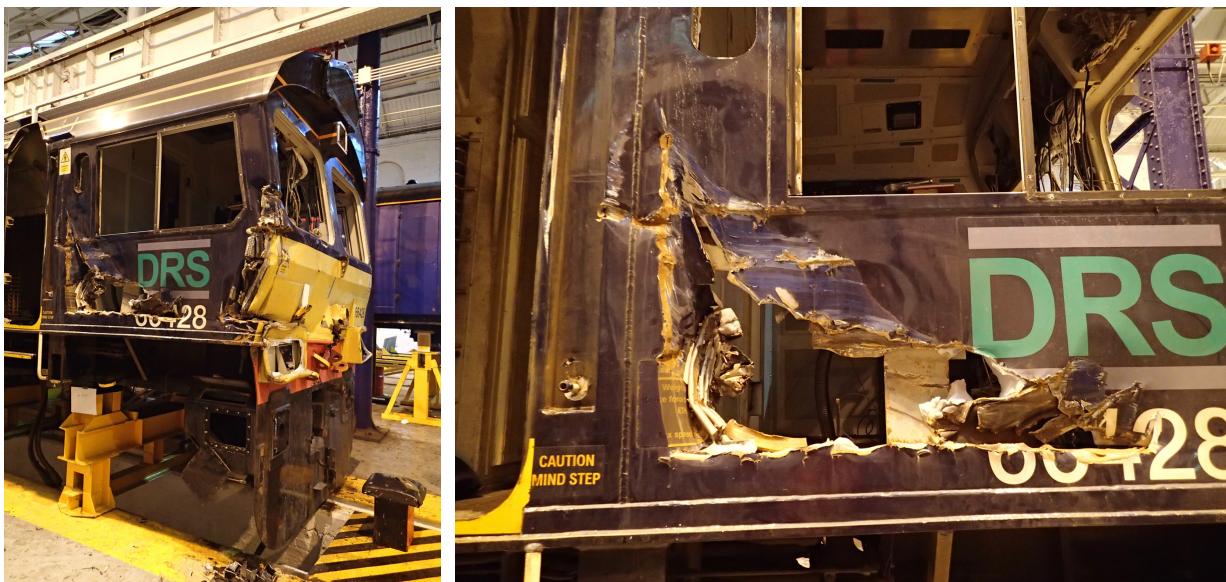


Figure 8: Damage to the locomotive of train 6K07



Figure 9: The derailed wagons within train 6K06

Events following the accident

- 34 The driver of train 6K07 stated that immediately after the accident he pressed the *emergency call button* on the locomotive's *GSM-R radio* console, but there is no record of an *emergency call* having been made.
- 35 The driver of train 6K06 felt a jolt when his train was pushed forward. He used a hand-held radio to raise the alarm (engineering staff had provided the driver with the radio so they could instruct him to move his train when it was being used within the track renewal site). He reported over the radio that his train may have been struck from behind and that he was walking back to investigate. This alerted the engineering staff, including the supervisor responsible for the track renewal site.
- 36 The driver of train 6K06 then walked back and confirmed over the radio that a collision had occurred. When he got to the rear of his train, he found the driver of train 6K07, who by now had got out of the cab. The driver of train 6K06 took the other driver back to train 6K06's locomotive while engineering staff from the track renewal site arrived at the trains.
- 37 By 11:22 hrs, Network Rail had begun to receive reports from the track renewal site that a collision had occurred. Staff from Network Rail, Babcock Rail, Direct Rail Services and Freightliner were mobilised to site. Network Rail notified the RAIB at 11:38 hrs and the RAIB attended later that day.
- 38 The process to recover the derailed locomotive and wagons commenced soon afterwards. This required an access road and hard standing pad for a crane to be built. Once the wagons and locomotive were recovered, the track was repaired. At the same time, the engineering trains needed to complete the track renewal were re-planned so they could access the site from the Kilmarnock end of the possession and work site. The railway line between New Cumnock and Kilmarnock reopened on 17 August at 05:22 hrs.

Key facts and analysis

Background information

The rules for train movements in possessions and work sites

Person In Charge Of Possession (PICOP)

- 39 The PICOP is a member of railway staff responsible for implementing and then managing a possession of the line. The PICOP will hold a valid PICOP certificate of competence that allows them to:
- put the protection arrangements for the possession in place at the start and remove them at the end of the possession;
 - manage access to the possession by each ES;
 - work with each ES to establish work sites within the possession;
 - liaise with the signaller for the passage of trains into and out of the possession; and
 - control the movement of trains between the protection and work sites, which includes instructing a driver on where a movement is to proceed to but does not include telling a driver the maximum speed for the movement (see paragraph 44).

The rules that a PICOP follows to do this are published in *Rule Book* handbook HB11, GE/RT8000/HB11, ‘Duties of the person in charge of the possession (PICOP)’.

Engineering Supervisor (ES)

- 40 The ES is a member of railway staff responsible for implementing and then managing a work site within a possession. The ES will hold a valid ES certificate of competence that allows them to:
- work with the PICOP to agree that the work site can be set up;
 - put the work site protection arrangements in place and remove them when the work site is given up;
 - manage access to the work site by each *controller of site safety* (COSS) or *individual working alone* (IWA) who wants to carry out work within it;
 - liaise with the PICOP for the passage of trains into and out of the work site; and
 - control the movement of trains within the work site.

The rules that an ES follows to do this are published in Rule Book handbook HB12, GE/RT8000/HB12, ‘Duties of the engineering supervisor (ES) or safe work leader (SWL) in a possession’.

- 41 GE/RT8000/HB12 requires an ES to give instructions to a driver before a train movement can take place within a work site. Section 6.1 states that an ES ‘must give the exact location the movement is to proceed to’, and afterwards check that the driver clearly understands the location the movement is to proceed to.

- 42 Section 6.1 also requires an ES to give instructions to a driver on the maximum speed allowed for the movement. This speed will depend upon what the ES has agreed with any COSS or IWA who has signed into the work site, as each COSS or IWA will set up a safe system of work for their activity based on trains moving at a maximum speed. In parts of the work site where no one is working, GE/RT8000/HB12 allows an ES to authorise movements at a speed of no greater than 40 mph (64 km/h). Where staff are working, GE/RT8000/HB12 requires an ES to authorise train movements in the work site at no greater than 5 mph (8 km/h) for most safe systems of work² as this slow speed mitigates the risk of someone being struck by a moving train. If the safe system of work uses lookouts to give a warning of approaching trains, provided that only site lookouts are needed, GE/RT8000/HB12 allows an ES to authorise movements at no greater than 40 mph (64 km/h) in these parts of the work site. If a COSS wants to implement a safe system of work using lookouts during darkness, poor visibility or when in or near a tunnel, the ES must agree with the COSS that movements will take place at a speed of no greater than 20 mph (32 km/h).
- 43 If the ES does not give instructions to the driver on the maximum speed to travel at, drivers are required to travel at no greater than 5 mph (8 km/h) throughout the work site (see paragraph 44). This speed applies everywhere in the work site, not just the locations where a COSS or IWA may have set up a safe system of work and staff can be seen working.

Train Drivers

- 44 The rules that apply to drivers when making movements in possessions and work sites are published in Rule Book module T3 (GE/RT8000/T3, ‘Possession of a running line for engineering work’). Section 9 describes the driver’s duties from arriving at a protecting signal for the possession through to moving into a possession, into a work site, and back out again. Section 9.6 states that when making a movement in a possession or work site, a driver ‘must’:
- *Make the movement at caution*
 - *Not exceed 40 mph (65 km/h) at any point in the journey when entering, making a movement within, or leaving a possession*
 - *Make any movement in a work site at no greater than 5 mph (10 km/h) unless you are given specific instructions by the ES or SWL on the maximum speed to be applied*
 - *Be prepared to stop before reaching a handsignal that is being displayed’*

At the time of the accident, ‘at caution’ was defined in issue 9 of Rule Book module TW1, GE/RT8000/TW1, ‘Preparation and movement of trains’. Section 25 of this module states:

‘If instructed to proceed at caution, you must, as well as not exceeding any specified speed, proceed at a speed that will allow you to stop the train within the distance you can see to be clear’.

² The safe systems of work available to a COSS or an IWA in a work site can be where all lines are blocked (safeguarded) or using a safety barrier (fenced). A COSS can also implement safe systems of work using site wardens (site warden protected) or using lookouts (lookout warning). A safe system of work that uses an equipment warning cannot be used in a work site.

- 45 The second of these requirements, not to exceed 40 mph (65 km/h) at any point in the journey, was first included in Rule Book module T11, GE/RT8000-T11 ‘Movements of engineering trains under T3 arrangements’, in June 2007. This 40 mph (64 km/h) speed limit aligns with the maximum speed that an ES can authorise for movement in a work site (paragraph 42). It aligns with other requirements in the Rule Book that allow a COSS to set up a safe system of work using lookout protection on a section of track within a possession. It is also the maximum speed that a train can proceed at when safety equipment such as the *Train Protection and Warning System* is isolated³. In parallel with this requirement, a driver must always make the movement in a possession or work site ‘at caution’. To proceed ‘at caution’, a driver will often need to travel at a speed much slower than 40 mph (64 km/h).
- 46 After an accident in a work site at Kitchen Hill in January 2014, the freight operating companies which operate trains in possessions and work sites raised concerns that the 40 mph (64 km/h) maximum speed referred to in GE/RT8000/T3 was being used as a target speed by drivers, and that this was taking away the emphasis from the requirement to proceed ‘at caution’.
- 47 In October 2014, the *Rail Freight Operations Group* (RFOG), with the support of the freight operating companies, proposed a change to the Rule Book to remove the 40 mph (64 km/h) maximum speed reference from GE/RT8000/T3. Any changes to the Rule Book are proposed to the Traffic Operation and Management Standards Committee⁴ (TOMSC). TOMSC supported the proposed change and RSSB drafted a revision to GE/RT8000/T3. However, when the wider rail industry was consulted over the proposed Rule Book changes, Network Rail commented that this change should not be made as a COSS who was setting up a safe system of work using lookouts within a possession would need to know the maximum speed at which a train could approach (paragraph 42). When TOMSC reviewed the consultation comments, this comment was upheld and TOMSC rejected the proposed rule change.

The possession and work site

- 48 The possession taken for the track renewal was 21 miles (34 km) long and extended from 55 miles 0 yards at New Cumnock to 34 miles 0 yards near to Kilmarnock. The work site for the track renewal was 16 miles (26 km) long, while the actual site of work where the track was being renewed on the up main line was 0.85 miles (1.37 km) long, from 51 miles 941 yards to 50 miles 1205 yards (figure 10). The nominated start point for the track renewal site was at 51 miles 1200 yards (figure 10). Here, wooden decking was provided to allow on road rail vehicles to be moved from one line to another.

³ A PICOP or ES will control the train’s movement in a possession or a work site and will authorise the driver to disregard any signals. Therefore drivers need to isolate the Train Protection and Warning System equipment when driving in possessions and work sites to prevent this equipment from making unwanted emergency brake applications due to the train passing signals showing a red stop aspect.

⁴ The Traffic Operation and Management Standards Committee is facilitated by RSSB and its membership includes representatives from passenger train operators, non-passenger train operators, Network Rail and other infrastructure managers, rolling stock owners (including rolling stock leasing companies), infrastructure contractors and suppliers. Members of RSSB personnel also attend. Its coverage includes train operation, signalling and infrastructure operation, workforce safety and safety management systems. It includes working instructions for people employed in a range of activities on the main line railway network (the Rule Book and other National Operations Publications).



Figure 10: Google Earth view of the site of work for the track renewal

- 49 The possession included three absolute block signalling sections between New Cumnock, Mauchline, Hurlford and Kilmarnock signal boxes (figure 5). Babcock Rail extended its work site north to 39 miles 0 yards to accommodate requests from Network Rail to carry out other activities within its work site (these included drainage works, track maintenance, track inspection and work by off-track staff). This removed the need for Network Rail to set up separate work sites, each with its own ES. Babcock Rail extended the work site south to New Cumnock to include an access point for road rail vehicles to use to get to the track renewal site. Including this access point in the work site gave Babcock Rail increased flexibility as its ES could control these movements.

Identification of the immediate cause

- 50 Train 6K07 was travelling too fast to stop short of the rear of train 6K06 when the driver first sighted the train ahead.
- 51 Train 6K07 was travelling at a speed of 33 mph (53 km/h) when the driver first sighted the rear of train 6K06. The RAIB surveyed the site and estimated that the earliest sighting of the rear of train 6K06 would have been from about 168 metres away. This is consistent with the driver having made an emergency brake application when train 6K07 was 156 metres from the rear of train 6K06 (paragraph 30).
- 52 Railway Group standard GM/RT2043, 'Braking System and Performance for Freight Trains', defines the distances in which a freight train must stop when a *full service brake* application is made. From a speed of 30 mph (48 km/h), it defines a maximum stopping distance of 401 metres. Using information from the on-train data recorder covering an earlier full service brake application to stop at New Cumnock, the RAIB has calculated that the full service brake stopping distance for train 6K07 from a speed of 30 mph (48 km/h) would have been about 332 metres on level track. On the falling gradient at the site of the accident (paragraph 6), the stopping distance would increase to about 375 metres. The calculated stopping distance for train 6K07 from 30 mph (48 km/h) is compliant with GM/RT2043.
- 53 The driver was experienced in driving this type of train and was aware of its braking performance. Freight trains formed of 'coalfish' wagons take a long distance to stop as the brakes on these wagons operate in 'goods' timings⁵ and are controlled via a single brake pipe. In 'goods' timings, once the driver has demanded a brake application it can take between 18 and 30 seconds for the brakes to fully apply on each wagon. Drivers control the brakes on this type of freight train by using the brake valve on the locomotive to change the pressure in the brake pipe. When there is 5 bar of pressure in the brake pipe, the train's brakes are released. Wagons along the train respond to a fall in the brake pipe pressure by applying their brakes. Since freight trains, like train 6K07, only have a single brake pipe running along their length, it takes time for a drop in pressure in the brake pipe at the locomotive to propagate along the brake pipe to the wagons towards the rear of the train. This also increases a freight train's stopping distance.
- 54 When the driver saw the rear of train 6K06, he made an emergency brake application but this was just 11 seconds before the collision. As the train was formed of wagons with brakes that operated in 'goods' timings and were controlled via a single brake pipe, none of the brakes on the wagons were fully applied by the time the collision occurred. The locomotive's own brakes began to apply after one second, but the braking effort from the locomotive and minimal braking effort from the wagons was only able to reduce the train's speed from 33 mph (53 km/h) to 28 mph (48 km/h).
- 55 Using the braking performance data for the stop at New Cumnock, the RAIB has estimated that for train 6K07 to stop within 156 metres (paragraph 51), its speed at the start of braking would have had to be no more than 17 mph (27 km/h).

⁵ In response to a brake demand, the brakes should take between 18 and 30 seconds to apply in 'goods' timing (this is the time for the brake cylinder pressure to reach 95% of its maximum on a single pipe brake system, see Railway Group standard GM/RT2045, 'Braking Principles for Rail Vehicles').

56 The RAIB has discounted the following factors:

- *Reduced braking performance due to the condition of the braking equipment on the locomotive or the wagons in train 6K07.* Notwithstanding the fact that there was insufficient time for the brakes on any of the wagons to be fully applied when the collision happened (paragraph 53), there were no brake equipment defects reported in the maintenance records for the locomotive and wagons. The driver also made no allegation of poor braking performance when he brought the train to a stop from a speed of 60 mph (97 km/h) at New Cumnock. RAIB calculations for this brake application suggest the train's braking performance was compliant with GM/RT2043 (paragraph 52).
- *Inadequate brake force for the weight of train 6K07.* Railway Group Standard GO/RM3056, the 'Working Manual for Rail Staff Freight Train Operations' (also known as the 'White Pages'), defines what a train's minimum *equivalent brake force* must be. This value, which is measured in tonnes, is set by the train's total weight (locomotives and wagons) and its maximum speed. For train 6K07's weight and speed, its minimum equivalent brake force was 390 tonnes. Documentation for train 6K07 showed that its calculated equivalent brake force was 440 tonnes. Therefore the locomotive and wagons that formed the train should have been capable of stopping within the applicable maximum stopping distances given in GM/RT2043.
- *Reduced braking due to poor rail head conditions.* At the time of the accident the rail head was dry and the RAIB saw no signs of contamination when it was examined after the accident.
- *Reduced visibility of the rear of train 6K06 due to it not having an illuminated tail lamp.* After the accident the RAIB found the tail lamp attached to the rear wagon from train 6K06 and it was still illuminated.
- *Degraded performance of the driver of train 6K07 due to fatigue, alcohol or drugs.* The driver was unlikely to be fatigued. He had been on annual leave at the start of the week, followed by two rest days, and he stated he was also off work the day before the accident. After the accident the driver was tested for drugs and alcohol and no such issues were identified.
- *The driver of train 6K07 being distracted due to making or receiving a mobile telephone call.* The records for the driver's mobile phone showed no calls were made during the time that the driver was driving train 6K07. There is no evidence from the way in which the train was being controlled (as logged by the on-train data recorder) that the driver was distracted by receiving a call.

Identification of causal factors

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

- a. The movement of train 6K07 within the work site was not made at the default speed of 5 mph (8 km/h) defined in the Rule Book (GE/RT8000) and was not made at caution (paragraph 58).
- b. The driver of train 6K07 believed that train 6K06 was further away than it actually was, due to a misunderstanding about the location of train 6K06 (paragraph 77).

Each of these factors is now considered in turn.

The speed of the movement

- 58 The movement of train 6K07 within the work site was not made at the default speed of 5 mph (8 km/h) defined in the Rule Book (GE/RT8000) and was not made at caution.
- 59 Before train 6K07 entered the work site at New Cumnock, the ES briefed the driver (paragraphs 41 and 42) on the movement he would be making up to the track renewal site. The ES stated that he briefed the driver to travel at 5 mph (8 km/h), while the driver stated that he could not recall being given a maximum train speed by the ES. Either way, the driver was required to make the movement at a speed of no greater than 5 mph (8 km/h) because section 9.6 of GE/RT8000/T3 states that if an ES does not specify a maximum speed for a movement within a work site, a driver must make the movement at a speed of no greater than 5 mph (8 km/h) (paragraph 44).
- 60 Train 6K07 was travelling faster than 5 mph (8 km/h) within 30 seconds of leaving New Cumnock station and ran at speeds of up to 33 mph (53 km/h) through to the point of collision (paragraphs 29 to 31). The driver did not drive train 6K07 'at caution' when the train entered the curve on the approach to the accident site. The train was travelling at 33 mph (53 km/h) when the driver first sighted the rear of train 6K06 about 168 metres away, but at this speed the stopping distance for train 6K07 was much greater than the available distance (paragraph 52). As such, train 6K07 was not travelling at a speed that allowed the driver to stop in the distance that he could see to be clear. After the accident, when asked about the rules for driving trains in possessions and work sites, the driver of train 6K07 demonstrated that he knew what proceeding 'at caution' meant. He explained that the default maximum speed in a work site was 5 mph (8 km/h) and the default maximum speed in a possession was 40 mph (64 km/h).
- 61 The RAIB has discounted any direct externally induced time pressure on the driver to encourage him to go faster than the 5 mph (8 km/h) permitted by GE/RT8000/T3. Babcock Rail's plan for this train allowed two hours from entering the work site to it being needed at the track renewal site. Investigations of previous collisions in possessions or work sites found that time pressure is more often placed on drivers to move their train to the exit of a work site or possession quickly, so that the railway can be handed back in time for normal operations. This was not a factor in this accident because train 6K07 had just entered the work site and was travelling to the track renewal site.
- 62 It is possible the driver's choice of speed through the work site was influenced by two factors:
- he thought the movement was taking place in a possession rather than a work site (paragraph 63); and
 - he wanted to arrive at the track renewal site as soon as possible and find out when he would be relieved from this driving duty (paragraph 71).

The driver's perception of where he was driving

- 63 After the accident, the driver of train 6K07 stated that he might have thought he was driving in a possession rather than a work site while travelling from New Cumnock to site of the track renewal, and so could proceed at a speed of up to 40 mph (65 km/h). The protection arrangements in place at the entrance to the possession and work site may have led to the driver's uncertainty. At New Cumnock, the possession limit boards and the work site marker boards were located together at the possession detonator protection (figure 11). However, when train 6K07 approached, the work site marker board was not visible to the driver as it was lying face down between the rails (figure 12). It is not known when it was placed in this position but the RAIB obtained CCTV footage from New Cumnock station, which began at 10:30 hrs, that showed it was already lying face down by this time.

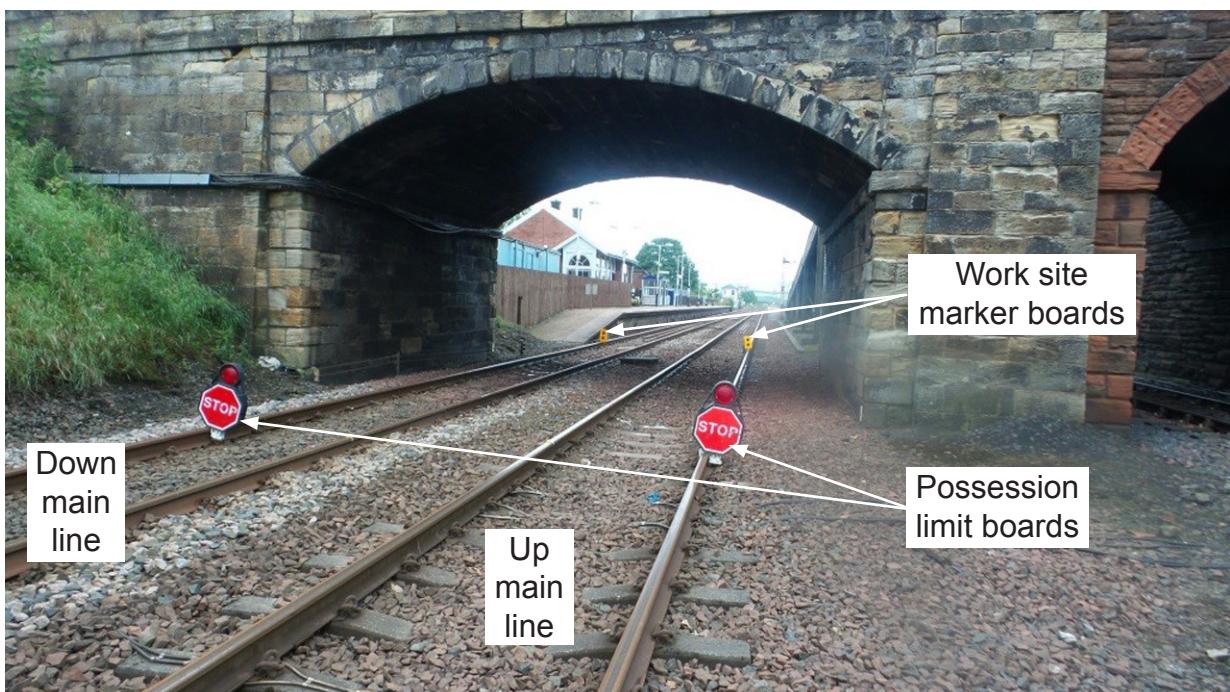


Figure 11: The possession limit and work site marker boards at New Cumnock (image courtesy of Network Rail)⁶

- 64 Section 3.4 of GE/RT8000/HB12 states that the work site marker board will normally be placed at least 100 metres from the possession detonator protection. It also states that if this distance cannot be achieved, the work site marker board should be placed at the detonator protection along with the possession limit board. At New Cumnock, the work site marker board was placed next to the last detonator, so was placed about 20 metres from the possession limit board which was located at the middle detonator. However, only the possession limit board was visible to the driver of train 6K07.

⁶ This photograph was taken in the days after the accident so may not show the exact positions of the boards as seen by the driver of train 6K07 on the day of the accident.



Figure 12: CCTV image from New Cumnock station (courtesy of ScotRail)

- 65 Possessions with non-standard protection arrangements are identified by Network Rail in the *Weekly Operating Notice* by showing a '#' symbol next to the mileage for the possession limits. The published Weekly Operating Notice covering the week of the accident included a '#' symbol next to the possession mileages for the entry for the track renewal.
- 66 The protection arrangements at New Cumnock were non-standard for a second reason. Section 2.4 of GE/RT8000/T3 requires the possession detonator protection (and therefore the possession limit board) to be placed a distance of 400 metres from the protecting signal. It was about 320 metres from the protecting signal, NC12, to the possession limit board (figure 13). When the distance of 400 metres cannot be met, GE/RT8000/T3 requires the protection to be placed as close to the standard distance as possible.
- 67 The location of the protection boards at New Cumnock was driven by the operational requirements for the work site. Babcock Rail wanted to include the road rail access point at New Cumnock within the work site (figure 13). Babcock Rail also wanted sufficient space to hold a train at the exit to the work site while its rear was still clear of this access point. Locating the protection boards at the end of the platform ramp was also convenient for staff to get to when trains were coming into or going out of the work site and possession.



Figure 13: Overview of possession and work site arrangements at New Cumnock

- 68 By co-locating the possession limit and work site marker boards, it meant each train that entered the possession and work site was required to pass both boards in one movement. When a train arrived at protecting signal NC12, its driver contacted the signaller. The signaller then obtained permission from the PICOP for that train to move up to the detonator protection by the possession limit board. The signaller then authorised the driver to pass signal NC12 at danger and move up as far as the possession limit board.
- 69 When the train arrived at the possession limit board, the ES briefed its driver for the next movement, which would be to enter the possession and work site and to move up as far as the start of the track renewal site. Once the driver was briefed, the PICOP lifted up the possession limit board and detonator protection, while the ES (or ESA) lifted up the work site marker board. Each train then set off into the possession and the work site in one movement. This arrangement meant the PICOP did not speak to the driver at any time during the process to give a separate authority to enter the possession. This is not a standard arrangement for possession and work site protection, but Network Rail reports that it is not uncommon for this to happen on its Scotland Route.
- 70 The RAIB's review of the evidence concluded that it is possible that the driver of train 6K07 might have mistakenly believed he was travelling in a possession. This may explain the train's speed of about 30 mph (48 km/h) along straight sections of track. However it does not explain why this speed was maintained when the train entered the curve on the approach to the point of collision when the train's speed needed to be reduced by about half for it to be proceeding at caution as required by GE/RT8000/T3 (paragraph 44).

Relief driver arrangements

- 71 Train 6K07 was operated by Direct Rail Services but it had hired the driver from Freightliner Heavy Haul. Direct Rail Services contracted Freightliner to provide a driver who would book on that morning at 06:00 hrs, drive train 6K07 from Carlisle Yard to New Cumnock, then move the train within the work site as required by Babcock Rail's staff, and finally stable the train once its work at the track renewal was complete. Babcock Rail's train plan showed that train 6K07 was due to arrive at the start of the work site at 11:00 hrs and then be used within the track renewal site from 13:00 hrs until 17:30 hrs. It was then to be taken north of the track renewal to stable behind train 6K06.
- 72 The driver Freightliner provided for this duty was already allocated to work another duty for Freightliner the next day. This subsequent duty required the driver to travel to Montrose on Saturday afternoon, lodge overnight, book on again at 09:30 hrs on Sunday morning and drive a train from a possession in the Montrose area to Mossend Yard. The driver would then travel back to Carlisle on a passenger train and book off.
- 73 When, on Thursday 30 July, Freightliner asked the driver to work on Saturday to drive train 6K07, he queried how this additional duty would fit in with the duty he was already allocated to work on Sunday. Freightliner's roster staff told the driver that a relief driver would be provided sometime on Saturday to allow him to leave the work site in time to travel to Montrose.
- 74 On Friday 31 July, the driver again asked Freightliner what arrangements were in place to relieve him, but he did not receive an answer. Consequently, the driver arranged to take a company van back to his home that evening. He would then be able to travel by taxi from the track renewal site to his home, before using the van to drive to Montrose on Saturday afternoon. It would take at least one hour to travel to his home and then at least three and a half hours to travel about 180 miles (290 km) from his home to Montrose. The driver was aware that after booking-on on Saturday morning, he needed to complete this journey before he had been working for 12 hours, ie by 18:00 hrs. The driver was also aware that he needed to be in Montrose on Saturday evening in enough time to be sufficiently rested before his planned duty started on Sunday morning.
- 75 When the driver booked on for duty on the morning of Saturday 1 August, he asked his control when he would be relieved at the track renewal site. Freightliner's control told the driver that another driver had not yet been found to relieve him, but he should take train 6K07 to the track renewal site and then call back for further information. Once he had arrived there, he might be asked to leave the site after securing the train or he might be asked to wait with the train for a relief driver to arrive. As a result, the driver was driving train 6K07 without knowing what was happening later about his relief.
- 76 The driver later stated that while driving train 6K07 up to the track renewal site, he was thinking about how he was going to get to Montrose in time. His understandable desire to find out about the arrangements for being relieved once stopped might have influenced the way in which he drove train 6K07.

Location of train 6K06

- 77 The driver of train 6K07 believed that train 6K06 was further away than it actually was due to a misunderstanding about the location of train 6K06.
- 78 When the ES briefed the driver before train 6K07 entered the work site, he told the driver to go to 51 miles 1200 yards but stop short of a train ahead that was waiting to go into the track renewal. However, during this briefing a misunderstanding arose and the driver formed the view that 6K06 was standing in the vicinity of 51 miles 200 yards (figure 14). The driver stated he wrote this mileage down, but the RAIB has been unable to locate the paper that this was recorded on.

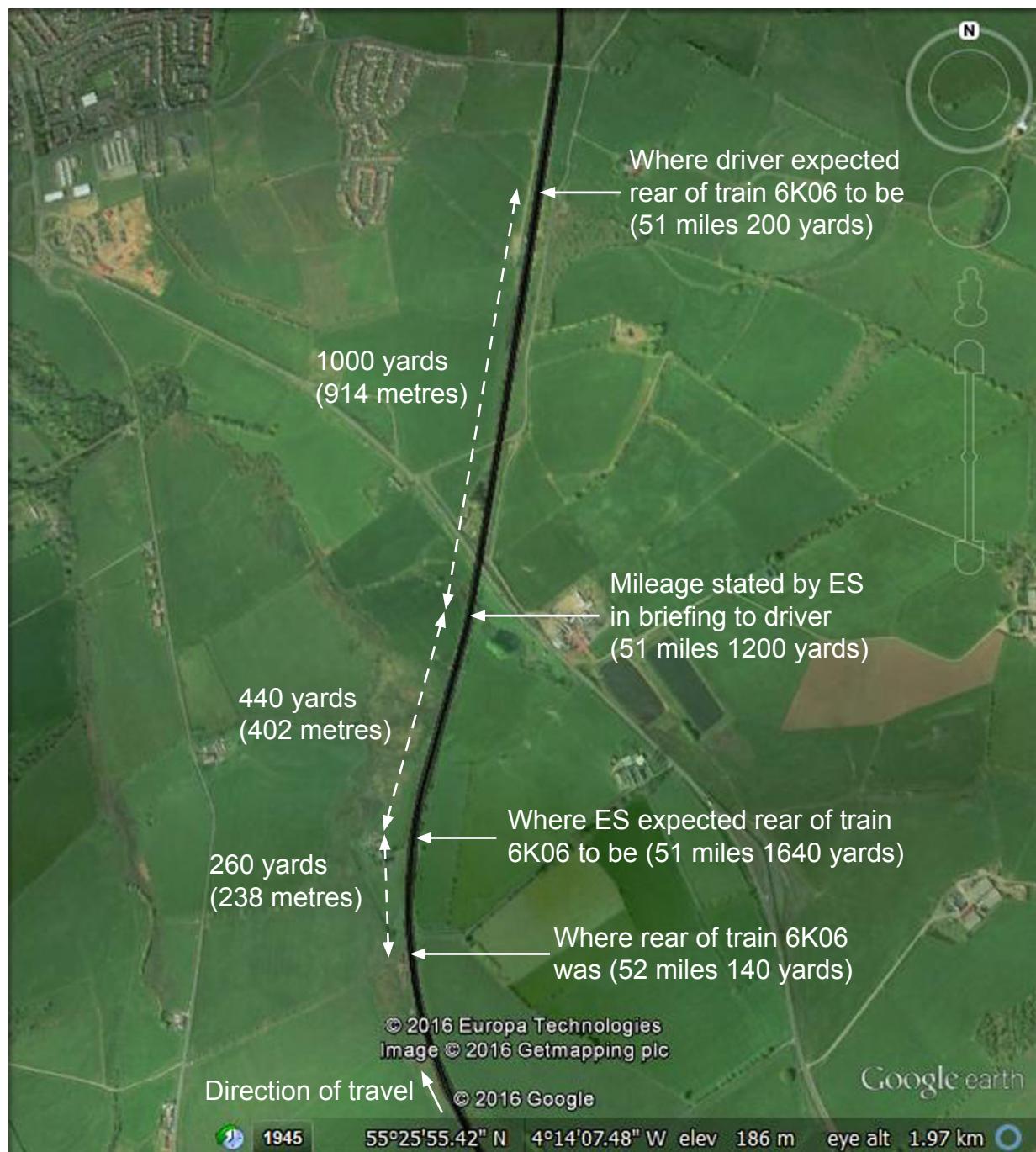


Figure 14: Location of train 6K06 and locations where driver and ES believed the train was standing.

- 79 When the ES took over responsibility for the work site (paragraph 23), he was told that train 6K06 was waiting to move up into the track renewal site. Based on this information, the ES expected the rear of train 6K06 to be about 440 yards (about 400 metres) short of the start of the track renewal (at 51 miles 1200 yards), which would place the rear of the train at about 51 miles 1640 yards (figure 14). The rear of train 6K06 was actually nearer to New Cumnock at 52 miles 140 yards (figure 14), which was about 1 mile (1.6 km) closer than the driver thought.
- 80 Based on evidence from the locomotive's on-train data recorder and the driver's account, instead of proceeding at caution the driver drove as if he had authority to move from one point to another, ie from the start of the possession and work site to the rear of the stationary train ahead. After leaving New Cumnock, the driver counted down the *mileposts* as he proceeded towards the track renewal site. The driver began braking at the 52½ milepost (52 miles 440 yards) in anticipation of stopping in the vicinity of the 51½ milepost (51 miles 440 yards). However, at this point the rear of train 6K06 was only about 300 yards (274 metres) away, out of sight around a curve.
- 81 This arose due to a combination of the following:
 - a. The instructions briefed by the ES to the driver included a mileage for the nominated start of the track renewal site but not a location for the rear of train 6K06 (paragraph 82).
 - b. The potential for a misunderstanding was increased when the instructions were briefed by the ES to the driver via a mobile phone conversation rather than face to face (paragraph 86).
 - c. The instructions briefed by the ES to the driver were not properly written down, which reduced the opportunity for the driver to confirm the details given or identify information that was not provided (paragraph 90).

Each of these factors is now considered in turn.

Location provided in ES briefing

- 82 Earlier that morning when train 6K06 had entered the work site, the night shift ES had told its driver to move up to the start of the track renewal site but stop short of train 6K05 that was already there waiting to go into the track renewal. Train 6K05 was about 300 yards (275 metres) long so its rear was at about 51 miles 1500 yards. When train 6K06 stopped behind train 6K05, its rear wagon was at about 52 miles 140 yards (figure 14). The driver of train 6K06 had asked the night shift ES if he should move his train up to the start of the track renewal once train 6K05 had moved off. The night shift ES had instructed him to stay where he had stopped. At the handover from the night shift ES, the ES was only told that train 6K06 was stationary south of the track renewal site.
- 83 The ES is required to give the driver the exact location the movement is to proceed to (paragraph 41). However, when the ES briefed the driver of train 6K07, he gave the driver the mileage for the nominated start of the track renewal site, at 51 miles 1200 yards, but also told the driver to stop two engine lengths short of a train (6K06) which was standing ahead of his train. The rear of train 6K06 was actually about 700 yards (640 metres) closer than the mileage that the ES gave in his brief to the driver.

- 84 Within long work sites, it is difficult for an ES to know exactly where a train has stopped. This in turn makes it difficult for an ES to give an exact location for the next train to proceed to, particularly when the length of the train ahead has to be taken into account. This problem should be mitigated by GE/RT8000/T3 which requires a driver to make movements in a possession or work site at caution, so regardless of what mileage the ES has provided, the driver should be able to stop short of the train ahead.
- 85 Instead, the driver of train 6K07 drove in anticipation of stopping short of where he believed train 6K06 to be. However, due to the misunderstanding over the mileage he needed to go to (paragraph 78), the driver expected to stop about one mile (1.6 km) beyond the actual location of the rear of train 6K06 (figure 14).

Method of ES briefing

- 86 When the ES found out that train 6K07 had arrived at New Cumnock (paragraph 24), he was in the site offices for the track renewal, which were located near to Logan (figure 3). After making a telephone call to the PICOP, the ES left to travel about 3.5 miles (5.6 km) in his van to New Cumnock station.
- 87 At the same time as the ES arrived at New Cumnock station, the ESA, who was standing by the possession limit board, called the ES to say that train 6K07 had just arrived. The ES asked the ESA to pass his mobile phone to the driver and the ES then proceeded to brief his instructions to the driver for the movement into the possession and work site. While the ES gave his brief, he moved from his van to the platform at New Cumnock station. By this time the ES was only about 60 metres away from the train (figure 15).
- 88 There was no time pressure on the ES to carry out the briefing straight away as the train had arrived 13 minutes early at New Cumnock and was not needed at the track renewal site for another two hours. The ES could have walked down the platform to the train within a few minutes to give a face to face briefing. However, it was normal practice for the ES to brief drivers by mobile phone so he chose to do it this way. By giving his instructions in this way, the ES did not need to go onto the railway, but the risk in doing so was minimal as train 6K07 was already at a stand at the possession limit board and there were no other trains in the area.
- 89 Giving instructions by mobile phone rather than face to face can increase the potential for misunderstanding. A face to face conversation helps the person giving out the information to determine if the recipient has understood the instructions, by non-verbal means such as the recipient's body language or facial expressions. Technical issues such as a poor mobile phone signal can also cause distortion or a loss of sound during a conversation. This can result in incorrect information being received. To identify these inaccuracies, drivers and engineering staff (including PICOPs and ESs) are trained to repeat back the safety critical information passed during a conversation. Witness evidence is contradictory as to whether information was repeated back. As the conversation between the driver and ES was by mobile phone, there was no recording and so the quality of the communication between the two parties and their use of repeating back could not be checked.



Figure 15: CCTV image of ES on platform at New Cumnock while briefing the driver of train 6K07 (courtesy of ScotRail)

There was no record of the details provided by the ES

- 90 The driver stated that when the ES gave him his briefing, he wrote down the mileage he believed he needed to go to on the back of a paper document (paragraph 78).
- 91 Before setting off into the work site, the driver had attempted to check the information he had been given by the ES by repeating back his instructions to the PICOP and ESA who were standing near the train. However, this did not happen as the PICOP stopped the driver and instead just asked him to confirm that he had received a briefing from the ES (paragraph 27). The protection arrangements at New Cumnock meant the next movement by the train was into the possession and work site at the same time. Consequently, it was only the ES who gave the driver an authority to make this movement (paragraph 69). At the time, the driver did not realise he had spoken to the PICOP.
- 92 Drivers are not required to write down any of the information briefed to them by a signaller, PICOP or ES when making movements from a signal to the possession protection, within a possession or within a work site. Recording this information has the advantage that it provides an opportunity for the driver to refer back to the information that has been provided. The driver can use it to confirm their understanding of the movement, such as where it is being made to and what speed it can be made at. By completing a written record, it also helps a driver ensure they have received all of the information required for the movement they are being asked to make.

Identification of underlying factor

Non-compliance with the rules for driving in work sites

- 93 **The Rule Book requirement in GE/RT8000/T3 for making movements within a work site at a speed of no greater than 5 mph (8 km/h) or at caution is often not complied with by drivers.**
- 94 After the accident, the RAIB requested that the on-train data recorders from other locomotives that hauled trains within the work site were downloaded. The RAIB obtained data from two other locomotives which showed that trains 6K03 and 6K06 were driven faster than 5 mph (8 km/h) for large parts of the movement from the start of the work site to the track renewal site.
- 95 Train 6K03 entered the work site at 02:29 hrs so its journey took place in darkness. It took 22 minutes to travel 2.9 miles (4.7 km) from the start of the work site to the track renewal site. For the first 7 minutes, it maintained a speed of 6 mph (10 km/h). Over the next 2 minutes, its speed gradually increased to 10 mph (16 km/h), which it then maintained for the next 10 minutes. During the last 3 minutes of its journey, it began to slow down before coming to a stand.
- 96 Train 6K06 entered the work site at 08:54 hrs so its journey was in daylight. It took 15 minutes to travel 3.1 miles (5.0 km) from the start of the work site to a stop near the track renewal site. In the first 2 minutes of its journey it accelerated to 8 mph and for the next 5 minutes its speed gradually increased to 14 mph. During the next 6 minutes its speed remained between 13 mph and 17 mph. During the last 3 minutes of its journey, it began to slow down before coming to a stand.
- 97 This underlying factor may have arisen due to a combination of the following:
- The speeds at which drivers travel are not routinely monitored when driving trains in possessions or work sites (paragraph 98).
 - As a result of long work sites, drivers may have to travel long distances at 5 mph (8 km/h) or at some other slow speed, while proceeding at caution, in conditions that can encourage a driver to go faster (paragraph 103).
 - The ability of drivers to proceed at caution at speeds greater than 5 mph (8 km/h) in possessions and work sites is not routinely observed, so if it is deficient, it is not corrected (paragraph 108).

Each of these factors is now considered in turn.

No routine monitoring

- 98 The drivers of trains 6K06 and 6K07 were both aware of the rules in GE/RT8000/T3 that applied to them when driving trains in possessions and work sites. A driver's knowledge of these rules is regularly tested as part of a rules assessment process which forms part of a driver competency management system. The driver of train 6K07 was last assessed in July 2014 and no deficiencies in his knowledge of the rules were noted.

- 99 All of the freight operating companies who operate trains in possessions and work sites have a competency management system for their drivers, which includes assessing the skills and competencies a driver needs to drive trains. There are differences in the competency management system that each freight operating company has but each system includes elements that monitor driver performance and checks that drivers are adhering to rules. This may include a number of occasions each year when a driver is accompanied by a manager while driving and the manager records observations on the driver's performance. It may also include a number of occasions each year when a manager downloads a locomotive's on-train data recorder after a journey and analyses the data to assess a driver's performance. The driver is not told in advance when this will happen.
- 100 Evidence provided by freight operating companies indicates that these assessments by managers are almost always for journeys when the train is being driven on a running line and the driver is controlling the train in response to information provided by the signalling system. Freight trains in possessions and work sites can spend a lot of time either stationary or only moving short distances at slow speed, so there are limited opportunities to observe the driver controlling the train. Consequently, freight operating companies do very little or no monitoring of driver performance when driving in possessions or work sites; some freight operating companies reported that their managers might do this occasionally, while other freight operating companies reported that their managers never do it.
- 101 While freight train drivers are rarely accompanied by their managers in possessions or work sites, some freight operating companies do carry out unannounced on-train data recorder downloads. However, movements in possessions and work sites can be very difficult for managers to analyse as the contents of the briefing given by the ES to a driver are unknown, plus the train protection and warning system which records information that can help identify the train's location will be isolated (paragraph 45). Therefore, the manager's checks tend to be limited to confirming that all of the movements in the possession or work site took place at a speed of less than 40 mph (64 km/h).
- 102 As a consequence of the general lack of monitoring of drivers when driving trains in possessions and work sites, drivers are aware that there are unlikely to be any consequences of violating the rule that requires them to drive at a speed of 5 mph (8 km/h), or of travelling too fast when proceeding at caution if authorised by the ES to go at a higher speed.

Driving long distances at slow speed

- 103 Work sites used to be much shorter and generally limited to areas close to work activities. Several work sites would be set up within a possession, with each work site having its own ES. Over time, this way of working has changed so that work sites are now much longer (sometimes almost as long as the possession) and inside a work site there will be multiple places where activities are taking place. These places are often referred to as 'sites of work'. This way of working relies on one ES controlling a very long work site, with a COSS responsible for each site of work. The arrangements for the track renewal were typical of this, with a possession that was 21 miles (34 km) long and a work site that was 16 miles (26 km) long within it (paragraph 48). This was so that a number of different activities could be accommodated within the possession and work site (paragraph 49).

104 When possessions and work sites are so long, often there will be sections of railway in which no work will be taking place, so a driver will not see anyone on the track. This was the case when train 6K07 travelled the 3 miles (4.7 km) from New Cumnock to the track renewal site. In many instances, long possessions and work sites will include lengthy straight sections of track. The journey from New Cumnock to the track renewal site included two long straights (figure 16). In daylight and fine weather conditions visibility will be good, so a driver can see a long way ahead to the end of these straights. If drivers can see a long way ahead that the line is clear with no one working on it, it may alter a driver's perception of the risk of moving within the work site and cause some drivers to question the reason for travelling a long distance at such a slow speed. This may therefore encourage a driver to travel faster than the 5 mph (8 km/h) default speed limit and in violation of the rules. Once some drivers view a rule as unnecessary it is likely that they will be more likely to travel in work sites at higher speeds. Since there is no monitoring in place (paragraphs 98 to 102), this behaviour is most often not detected by driver managers or corrected.

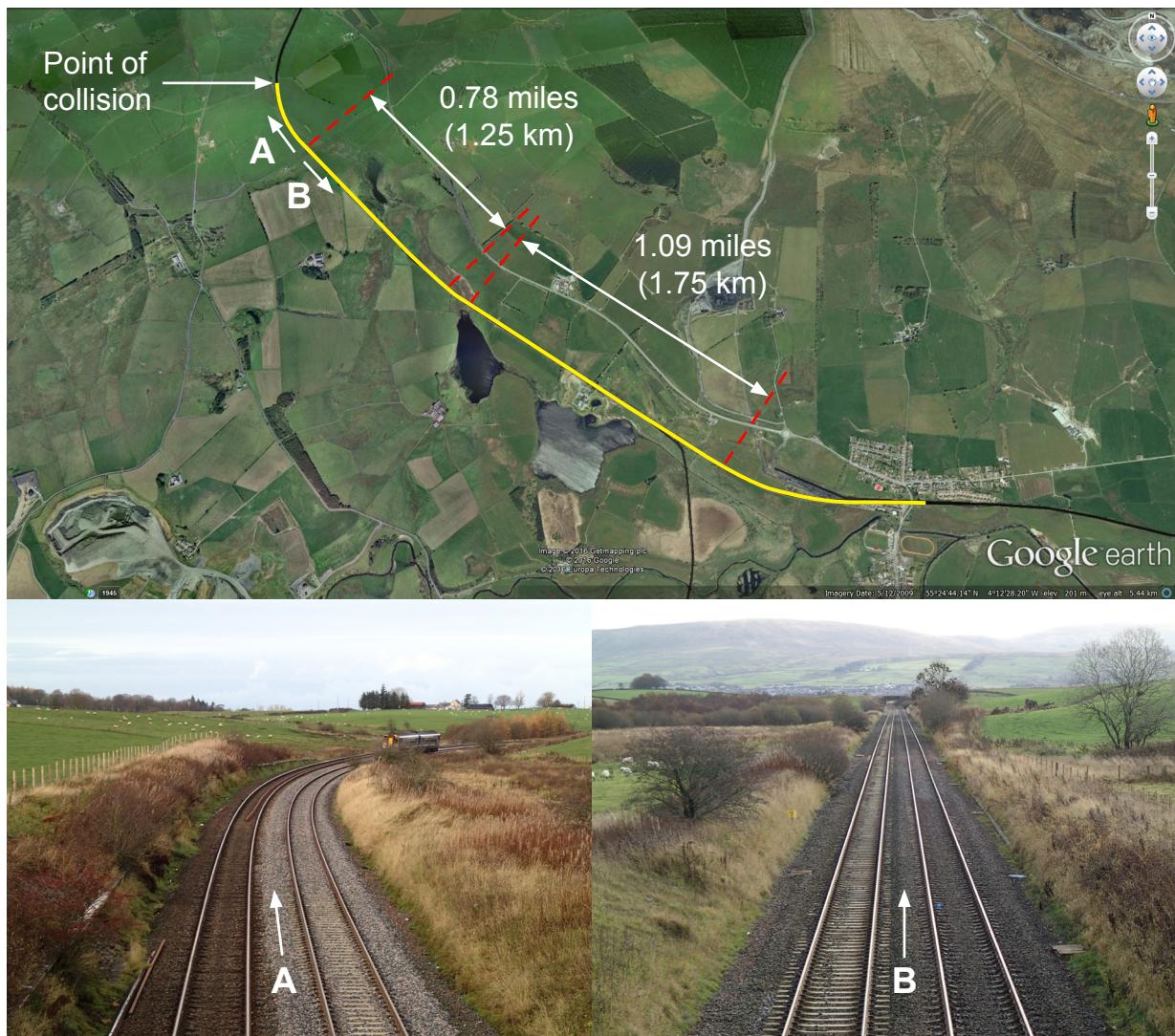


Figure 16: Views of the track from New Cumnock to the track renewal site

105 Additionally, driving a freight train for long distances at 5 mph (8 km/h) is not easy. On rising and level gradients, the driver can vary the amount of traction on the locomotive to control the train's speed. However, driving at 5 mph (8 km/h) becomes more difficult when the train is on a falling gradient, particularly with the wagons in this type of train which have their brakes set to 'goods' timings (paragraph 53). Due to the length of time it takes the brakes to apply and release, drivers need to be particularly careful with how they apply the brakes otherwise the train could come to a stand. The lengthy brake application and release times can also lead to some parts of the train being unbraked while other parts are in a braked condition. If the driver then applies traction, this can cause shockwaves along the train, which can break the couplings and cause the train to divide.

106 Some class 66 locomotives, such as the one that was hauling train 6K07, are fitted with a slow speed control system. This allows the driver to set a speed to travel at, up to 10 mph (16 km/h). It is normally used when passing through automatic loading or unloading facilities at terminals where the track is level. The system only controls the traction on the locomotive; it does not control the brakes on the locomotive or the train. Hence when the train is on a falling gradient, it will accelerate due to gravity and its speed can rise above the set speed. Such slow speed controls are not designed for controlling a train's speed over long distances with varying gradients.

107 Increases in work site length (paragraph 103) mean that drivers might need to drive for long distances at 5 mph (8 km/h), so it takes a long time to travel a relatively short distance. For example, it should have taken train 6K07 about 40 minutes to travel the 3 miles (4.7 km) from New Cumnock to the track renewal site. Frequent exposure to the practicalities of complying with the rule can cause a driver to question its necessity.

Proceeding at caution at speeds greater than 5 mph (8 km/h)

108 Trains can be driven at up to 40 mph (64 km/h) in possessions (paragraph 44), and also up to this speed in work sites when authorised by the ES (paragraph 42). When a PICOP or an ES tells a driver the maximum speed for a movement, it is based on what activities are taking place within the possession or work site and does not take into account what is a safe speed for the train to travel at. It is the driver who must decide what speed it is safe to travel at by proceeding at caution. To be able to proceed at caution a driver needs to have a good understanding of the train's braking performance combined with a good knowledge of the geography of the line being driven. However, there are practical difficulties associated with both.

109 Drivers know from experience that trains consisting of wagons with brakes in 'goods' timings require many seconds for the brakes to apply, which increases the train's stopping distance. However, the actual stopping distance will vary from train to train due to factors such as the types of wagon in the train, the number of wagons, and their weight. Therefore when starting a journey, drivers perform a test to check that the train's brakes are working properly. Drivers also familiarise themselves with the train's braking performance during a journey. By the time drivers make a movement into a possession or work site, they should know their train's braking performance.

- 110 The route knowledge a driver needs when proceeding at caution within a possession or work site is different to that required during normal operations. During normal running, train speed is determined by the driver's knowledge of the route and information provided by the signalling system. To proceed at caution in a work site or possession, a driver needs to control the train's speed in anticipation of how the distance that can be seen ahead will change. When the route includes features such as changes in the track's curvature that will alter a driver's sighting, a driver needs to start braking in sufficient time so that the train is travelling at a safe speed when it enters the curve (ie the train's speed must be reduced so that the train is able to stop in the distance that a driver can now see to be clear ahead). This requires a driver to know where to start braking in anticipation of the features that will reduce the sighting distance, even when these factors may not yet be visible. The route knowledge a driver has for normal operations does not include this amount of detail⁷ on features that can alter sighting distance. Proceeding at caution also requires drivers to judge distance accurately, which is less necessary when driving in response to signals or stopping at stations, where drivers know the locations where braking should normally start.
- 111 While drivers are given training on what proceeding 'at caution' means, most of this is via briefings with very little practical training on how to do it. Many drivers are not accompanied by managers in possessions or work site (paragraph 100), so their ability to proceed at caution is not observed, and if it is deficient, it is not corrected.

Previous occurrences of a similar character

- 112 There have been a number of collisions between trains in work sites which the RAIB has investigated since 2006 and made recommendation on (paragraph 117):
- 'Collision at Badminton', 31 October 2006, when two on-track machines collided in a long work site ([RAIB report 30/2007](#)).
 - 'Freight train collision at Leigh-on-Sea', 26 April 2008, when a freight train was unable to stop in time and collided with the rear of a stationary freight train in a work site ([RAIB report 24/2009](#)).
 - 'Collision between a stoneblower and ballast regulator near Arley, Warwickshire', 10 August 2012, when a collision occurred between two on-track machines in a work site ([RAIB report 12/2013](#)).

⁷ For normal running, train operators identify the characteristics for each route that their drivers must know if they are to drive over it safely and efficiently. These characteristics might include features along the route such as stations, depots, yards, sidings, junctions, points, crossings, signal boxes, bridges, tunnels, names of running lines, direction of travel of running lines, gradients, etc. They might also include the signalling system(s) in use over the route (eg signal position, sighting and function of signals, etc), the commencement and termination points of train radio systems, the locations of signage along the route, the permitted train and line speed restrictions for all normal and degraded conditions, the location of level crossings including any special working arrangements for degraded situations, and the power supplies along the route as applicable. Each train operator also identifies any particular risks associated with operating its trains over that route, which also forms part of a driver's route knowledge. The exact requirements for a driver's knowledge of a particular route will be determined by the train operator. Once a driver has attained this knowledge and is assessed as competent, they can drive over that route. Drivers must then keep their knowledge of the route up to date.

- ‘Engineering train collision at Kitchen Hill, near Penrith’, 12 January 2014, when a freight train was unable to stop in time and collided with the rear of a stationary freight train in a work site ([RAIB Bulletin 01/2014](#)).
- 113 Since the accident near Logan, on 27 February 2016, another collision occurred within a work site near to Ivybridge, Devon. A freight train entered a work site with a stationary freight train ahead of it and accelerated to a speed of 20 mph (32 km/h). As the train proceeded around a curve, its driver sighted the rear of the stationary train. The driver made an emergency brake application but the train was unable to stop before it collided with the rear of the stationary train. No one was injured but the locomotive and two wagons derailed, and the track was damaged. The circumstances of this accident were very similar to the accident near Logan so the RAIB chose to publish a Safety Digest rather than a detailed investigation report ([RAIB Safety Digest 01/2016](#)).

Summary of conclusions

Immediate cause

114 Train 6K07 was travelling too fast to stop short of the rear of train 6K06 when the driver first sighted the train ahead (paragraph 50).

Causal factors

115 The causal factors were:

- a. The movement of train 6K07 within the work site was not made at the default speed of 5 mph (8 km/h) defined in the Rule Book (GE/RT8000) and was not made at caution (paragraph 58, see also Arley recommendation 1 (paragraph 128)). It is possible that the driver's choice of speed through the work site was influenced by two factors:
 - i. he thought the movement was taking place in a possession rather than a work site (paragraph 63, see also Arley recommendation 2 (paragraph 131), **Learning point 1**).
 - ii. he wanted to arrive at the track renewal site as soon as possible and find out when he would be relieved from this driving duty (paragraph 71, **Learning point 2**).
- b. The driver of train 6K07 believed that train 6K06 was further away than it actually was, due to a misunderstanding about the location of train 6K06 (paragraph 77, see also Arley recommendation 2 (paragraph 131), Kitchen Hill learning point (paragraph 133) and Leigh-on-Sea recommendation 2 (paragraph 122)). This causal factor arose due to a combination of the following:
 - i. The instructions briefed by the ES to the driver included a mileage for the nominated start of the track renewal site but not a location for the rear of train 6K06 (paragraph 82, see also Arley recommendation 2 (paragraph 131), **Recommendations 2 and 3**).
 - ii. The potential for a misunderstanding was increased when the instructions were briefed by the ES to the driver via a mobile phone conversation rather than face to face (paragraph 86, **Learning point 3**).
 - iii. The instructions briefed by the ES to the driver were not properly written down by the driver which reduced the opportunity for the driver to confirm the details given or identify information that was not provided (paragraph 90, see also Leigh-on-Sea recommendation 1 (paragraph 118) and Arley recommendation 2 (paragraph 131), **Recommendations 2 and 3**).

Underlying factor

116 The underlying factor was:

- a. The Rule Book requirement in GE/RT8000/T3 for making movements within a work site at a speed of no greater than 5 mph (8 km/h) or at caution is often not complied with by drivers (paragraph 93). This underlying factor arose due to a combination of the following:
 - i. The speeds at which drivers travel are not routinely monitored when driving trains in possessions or work sites (paragraph 98, **Recommendation 1**).
 - ii. Drivers have to travel long distances at 5 mph (8 km/h) or at slow speeds while proceeding at caution, as a result of possession and work site lengths, in conditions that can encourage a driver to go faster (paragraph 103, see also Leigh-on-Sea recommendation 2 (paragraph 122), **Recommendation 4**)
 - iii. The ability of drivers to proceed at caution at speeds greater than 5 mph (8 km/h) in possessions and work sites is not routinely observed, so if it is deficient, it is not corrected (paragraph 108, **Recommendation 1**).

Previous RAIB recommendations relevant to this investigation

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

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

Freight train collision at Leigh-on-Sea, 26 April 2008, RAIB report 24/2009, Recommendation 1

- 118 The RAIB considers that it is possible that implementation of recommendation 1 in [RAIB report 24/2009](#) might have addressed one of the factors that led to this accident (paragraph 115b.iii). This recommendation read as follows:

Recommendation 1

Network Rail should introduce a procedure that will provide a written record of instructions between the Engineering Supervisor, train driver and ‘competent person’ with verbal read back to confirm an understanding of the planned movement.

- 119 Network Rail did not implement this recommendation. It argued that the existing rules for controlling train movements in possessions and work sites were adequate but their application was weak. In February 2010, Network Rail participated in a joint industry workshop at which this recommendation was discussed. The consensus from within the workshop was that the completion of a form for train movements was not practicable, as its interpretation of the recommendation was that the form would be filled in for every movement made, including each time the train moved a small distance to unload wagons. However, the RAIB had made this recommendation to address causal factors that were only relevant to long movements made by trains through work sites, such as when entering or exiting the work site.

- 120 In response to Network Rail indicating that the application of the existing rules was weak, the Office of Rail and Road (ORR) decided to include this concern within its assurance work for year 2011–2012, as part of the ORR intervention project NRIP 2011–12: Train Movements In & Out Of Possessions. This work aimed to concentrate on how well Network Rail, freight operating companies and contractors managed the interfaces associated with the movements of engineering trains and on-track machines to work sites and through possessions. The ORR identified that effective communications was a key part of this work, and it would include identifying where the application of the rules was weak and where appropriate corrective action would be taken. The ORR reported that this assurance work was to be completed by 31 March 2012.

- 121 Since 2010 there have been further collisions at Arley and Kitchen Hill, this accident at Logan, and more recently at Ivybridge, where the effectiveness of the communications between the ES and driver has been a factor.

[Freight train collision at Leigh-on-Sea, 26 April 2008, RAIB report 24/2009.](#)
Recommendation 2

- 122 The RAIB considers that more effective implementation of recommendation 2 in [RAIB report 24/2009](#) could have addressed two of the factors that led to this accident (paragraphs 115b and 116a.ii).
- 123 This recommendation read as follows:
- Recommendation 2
- Network Rail should incorporate a challenge stage within the planning process so that possession and work site length are minimised and that planned train movements are operationally risk assessed.*
- 124 In March 2010, Network Rail advised that a challenge stage was now an embedded part of its planning process, in accordance with company standard NR/L2/NDS/202 ‘Principles, Timescales and Functional Responsibilities for Engineering Work, Access and Heavy Resource Planning’. Network Rail stated that the length of possessions was minimised around the work sites contained within them, where this is assessed as the safest alternative. Work site length was determined by the work site requestor and Network Rail would question its length if there was a transparent reason to do so.
- 125 The ORR subsequently reported to the RAIB that this recommendation had been implemented. The ORR noted in its report that when considering Network Rail’s response, it believed that to demonstrate this recommendation had been fully addressed, NR/L2/NDS/202 should be considered along with Network Rail company standard NR/L3/NDS/303 ‘T3 possession of the line for engineering work delivery requirements’.
- 126 During this investigation the RAIB could not find any reference within NR/L2/NDS/202 or NR/L3/NDS/303 to a challenge stage within Network Rail’s planning process for possession or work site lengths, nor reference to carrying out operational risk assessments for planned train movements.
- 127 Network Rail reviewed its implementation of this recommendation as part of its investigation of the accident near Logan and determined that the intent of the recommendation had not been met. In 2016, Network Rail informed the ORR that it was reopening this recommendation and would be taking action to implement it.

Recommendations that are currently being implemented

Collision between a stoneblower and ballast regulator near Arley, Warwickshire, 10 August 2012, RAIB report 12/2013, Recommendation 1

128 The above recommendation addressed one of the factors identified in this (Logan) investigation (paragraph 115a). So as to avoid duplication, it is not remade in this report. The wording of this recommendation and its current status is given below.

Recommendation 1

Network Rail should:

- a. *Review potential systems of work, and/or technical solutions, for reducing the risk of collision between trains when travelling to and from their sites of work. This review should include consideration of the following options:*
 - i. *greater use of the signalling system during engineering work for controlling the movement of trains;*
 - ii. *means for detecting the position of trains when normal signalling is suspended; and*
 - iii. *planning arrangements for engineering work that address the issue of simultaneous movements of trains travelling to and from their sites of work and which minimise the potential for such moves to bring trains in close proximity.*
- b. *Review (in consultation with RSSB as appropriate) permitted train speeds applying to movements in sections of line that are closed to normal traffic for engineering work, taking account of human factors affecting a driver's ability to judge the distance they can see to be clear, the stopping distance that can be achieved by their train's braking performance, the limitations of headlight illumination in darkness and a driver's route knowledge.*
- c. *Seek an understanding of the reasons for, and scale of, local unauthorised deviations from possession plans, the effectiveness of the planning process to avoid such changes, as well as the suitability of procedures and managerial arrangements for identifying, and subsequently reviewing, unauthorised changes.*

The measures identified to further reduce the risk of collisions during engineering work should then be implemented in accordance with a timebound programme.

129 In November 2013, Network Rail reported to the ORR that it was taking action to implement this recommendation. In its last report to the RAIB in October 2014, the ORR reported that it had requested further information from Network Rail on how it was implementing this recommendation.

130 In March 2016, the RAIB asked the ORR for an update on Network Rail's work to implement this recommendation. The ORR reported that in response to the accident near Logan, Network Rail had established a cross-industry working group to review the operation of trains in possessions and work sites, including a review of the previous similar incidents at Arley, Leigh-on-Sea, Kitchen Hill and Badminton. This group had developed action plans to address issues it had identified (see paragraph 138). Network Rail intends to implement this recommendation through these actions.

[Collision between a stoneblower and ballast regulator near Arley, Warwickshire, 10 August 2012, RAIB report 12/2013, Recommendation 2](#)

131 The above recommendation addressed four factors identified in this (Logan) investigation (paragraphs 115a.i, 115b, 115b.i and 115b.iii). So as to avoid duplication, it is not remade in this report. The wording of this recommendation and its current status is given below.

Recommendation 2

Network Rail should:

- a. *Review the equipment and protocols used by those managing possessions for communicating with train drivers to ensure that:*
 - i. *Drivers are provided with all the information they need to carry out movements safely. The review should consider the use of a standardised format so that any missing information can be readily identified and queried by the driver. In addition to information such as the authorised maximum speed of travel and the driver's treatment of signal aspects, the format could also include confirmation that there are no vehicles obstructing the line to the driver's authorised stopping point.*
 - ii. *Communications with drivers are made in a manner which does not risk distracting the driver from the driving task.*
- b. *Network Rail should define when it may be necessary and appropriate to use competent persons as intermediaries when communicating instructions on vehicle movements to drivers. It should then further consider the formal competencies and non-technical skills required of a competent person and the means by which their competency and non-technical skills may be assured. Consideration should also be given to the practicalities of relaying instructions to drivers in ways that do not risk distracting drivers from their driving task.*

Any resulting actions should be implemented as soon as possible.

132 In November 2013, Network Rail reported to the ORR that it was taking action to implement this recommendation and in its last report to the RAIB in October 2014, the ORR reported that it had requested further information from Network Rail on how it was implementing this recommendation. The ORR provided an update in March 2016 stating that Network Rail intends to implement this recommendation through actions identified by a cross-industry working group (paragraph 130).

Previous RAIB learning points relevant to this investigation

133 Following the accident at Kitchen Hill (paragraph 112), the RAIB published a bulletin which included the following learning point⁸ (number 1) which highlighted that it is important:

That all movements of engineering trains (and on-track machines and plant) in work sites (and possessions) are made ‘at caution’ – this means that trains should always be capable of stopping in the distance ahead that the driver can see the line to be clear.

⁸ ‘Learning points’ are intended to disseminate safety learning that is not covered by a recommendation. They are included in a report when the RAIB wishes to reinforce the importance of compliance with existing safety arrangements (where the 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.

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

Response by freight operating companies

- 134 After this accident, Freightliner Heavy Haul began its own investigation. On 3 August, Freightliner Heavy Haul issued an urgent operating advice to its drivers. This advice reiterated the requirement in GE/RT8000/T3 to make all movements in possessions and work sites at caution. It included the definition in GE/RT8000/TW1 of proceeding 'at caution'.
- 135 Direct Rail Services also briefed its drivers on the need to proceed at caution within possessions and work sites. In addition to this, Direct Rail Services introduced a form which it mandated its drivers to complete when driving into, within or out of a possession or work site. Drivers are required to use the form to record information given to them:
- by the signaller when authorised to pass the protecting signal for the possession and move up to the possession limit board;
 - by the PICOP when briefed on the movement to be made into or out of the possession; and
 - by the ES when briefed on movements to be made from or to the work site marker board.
- 136 At the end of any duties that have included driving within a possession or work site, drivers are required to submit the completed form to their line manager. Freightliner Heavy Haul has since introduced its own form for its drivers to complete when working in possessions and work sites. GB Railfreight has also introduced an electronic version of the form for its drivers to complete.

Urgent Safety Advice

- 137 On 11 August, the RAIB issued an Urgent Safety Advice (appendix D) to Network Rail and the freight operating companies. The RAIB advised Network Rail and freight operating companies to carry out an urgent review of the adequacy of current procedures in place to control the movement of trains within work sites (and possessions). The review should consider what can be done to address inadequacies that are identified, so that the risks associated with the movement of engineering trains within work sites are better controlled during the time it is taking to fully implement the RAIB's recommendations 1 and 2 from its Arley investigation.
- 138 In response to this, Network Rail led four industry workshops in October and November 2015 to review the operation of trains in possessions and work sites. The workshops identified four areas where longer term actions were required: possession planning, systems of work, human factors and the use of technology. For each area, the workshops identified the actions that should be taken, who was responsible for each action and the timescale for each to be completed.

139 The workshops also identified that a short term mitigation to control the risk of a collision could be the imposition of a 5 mph (8 km/h) speed restriction in all work sites and a 15 mph (24 km/h) speed restriction in all possessions. The freight operating companies supported this action but Network Rail opposed the imposition of a blanket 15 mph (24 km/h) speed restriction in all possessions. Network Rail wanted a 20 mph (32 km/h) speed restriction to be imposed as this speed matched the nominal speed that planners used when deciding how long it is likely to take a train to move from one location to another within a possession. Network Rail also argued for the speed restriction to be 20 mph (32 km/h), rather than 15 mph (24 km/h), as it matched one of the speeds that engineering staff already use for controlling train movements and it believed that using an existing speed would reduce the risk of confusion.

140 In December 2015, the freight operating companies planned to introduce a requirement on their drivers to proceed at no greater than 5 mph (8 km/h) in all work sites and 15 mph (24 km/h) in all possessions. Network Rail opposed the widespread implementation of this short term mitigation as it wanted the mitigation to only be applied to trains that had been planned to travel at these lower speeds. Instead Network Rail proposed a managed introduction of the change so that it could evaluate the impact on the delivery of its infrastructure works, as this could introduce other risks, including unintended risks due to overrunning engineering work. Network Rail proposed holding trials, with trains planned to travel at these lower speeds in possessions and work sites, on London North Eastern Route from February 2016. National rollout would then be completed later in 2016. Initial trials took place in April 2016, with further trials in June 2016. In the meantime, the freight operating companies have continued to brief drivers on what proceeding at caution means and have provided guidance to drivers on how to drive in possessions and work sites to ensure that they will comply with the rules in GE/RT8000/T3.

Recommendations and learning points

Recommendations

141 The following recommendations are made⁹:

- 1 *The intent of this recommendation is to reduce the risk of trains colliding in possessions or work sites due to excessive speed. By reducing train speed through compliance with the rules, trains will take longer to transit through possessions and work sites, which may in turn promote shortening the length of possessions and work sites.*

Each freight operating company should have a driver competency management system that includes monitoring of its drivers when driving trains within both possessions and work sites to:

- identify and address any non-compliances with the rules for driving in possessions and work sites; and
- assess how well its drivers are able to proceed at caution when travelling in a possession or work site and address any observed deficiencies (paragraphs 116a.i and 116a.iii).

This recommendation may also apply to other organisations who operate on-track machines in possessions and work sites.

continued

⁹ 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 Road and Rail 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.

- 2 *The intent of this recommendation is to take action in the short term to reduce the risk of a misunderstanding (missing or incorrect information) when drivers are given instructions for making a movement from a signal protecting a possession, within a possession or within a work site.*

The freight operating companies should collaborate to produce a common form which will then be issued to all freight train drivers to record the instructions briefed to them when making:

- any movement into, within or out of a possession;
- movements into, within or out of a work site (other than short distance shunting movements and movements made during the work activity) (paragraph 115b.i and 115b.iii).

This recommendation may also apply to other organisations who operate on-track machines in possessions and work sites.

- 3 *The intent of this recommendation is to implement longer term measures to reduce the risk of a misunderstanding (missing or incorrect information) when drivers are given instructions for making a movement from a signal protecting a possession, within a possession or within a work site.*

The freight operating companies, in conjunction with Network Rail, should implement a method of working such that the content of briefings given to freight train drivers for making movements in accordance with Rule Book module GE/RT8000/T3 (Possession of a running line for engineering work) is recorded. The method adopted should include consideration of:

- the minimum amount of information within these briefings that must be recorded for the safe movement of the train;
- the person who must record this information;
- how this information must be recorded; and
- where the requirement on relevant staff to record this information should be mandated (paragraph 115b.i and 115b.iii).

This recommendation may also apply to other organisations who operate on-track machines in possessions and work sites.

continued

- 4 *The intent of this recommendation is to reduce the risk of trains colliding in long possessions or long work sites due to the practicalities of drivers complying with the rules for driving in possessions and work sites.*

The freight operating companies should collaborate to:

- a) Investigate the practicalities of driving freight trains in possessions and work sites for long distances at a speed of 5 mph (8 km/h) or at other slow speeds when proceeding 'at caution' as defined in Rule Book module TW1 section 25. This should include consideration of the human factors issues that may influence the behaviour of drivers and their ability to drive trains at an appropriate speed.
- b) Assess the skills a driver needs to drive in such circumstances, the effect of freight train braking performance, and the level of geographical knowledge that a driver needs.
- c) Develop and implement a programme of work, in conjunction with Network Rail, to address any issues identified by parts (a) and (b) (paragraph 116a.ii).

This recommendation may also apply to other organisations who operate on-track machines in possessions and work sites.

Learning points

142 The RAIB has identified the following key learning points:

- 1 This accident highlights the importance of engineering staff providing drivers with all of the information they need to carry out movements in possessions and work sites safely, especially where there are protection arrangements in place that do not comply with the normal arrangements as described in GE/RT8000/T3, such as the co-location of possession limit boards and work site marker boards (paragraph 115a.i).
- 2 This accident serves as a reminder to freight operating companies to provide drivers with information about how and when they will be relieved from a driving duty prior to starting it, so that they are not distracted by a need to know what is happening at the end of their journey. This is particularly relevant if the driver needs to be relieved early from the current driving duty so there is sufficient time to travel or be rested in preparation for their next planned duty (paragraph 115a.ii).
- 3 This accident highlights the importance of engineering staff briefing instructions to train drivers through a face to face conversation, when it is safe and practicable to do so, as this can reduce the potential for misunderstanding (paragraph 115b.ii).

Appendices

Appendix A - Glossary of abbreviations and acronyms

COSS	Controller of Site Safety
ES	Engineering Supervisor
ESA	Engineering Supervisor's Assistant
IWA	Individual Working Alone
ORR	Office of Rail and Road
PICOP	Person In Charge Of Possession
RFOG	Rail Freight Operations Group
SWL	Safe Work Leader
TOMSC	Traffic Operation and Management Standards Committee

Appendix B - Glossary of terms

All definitions marked with an asterisk, thus (*), have been taken from Ellis's British Railway Engineering Encyclopaedia © Iain Ellis. www.iainellis.com.

Absolute block	A signalling principle that permits only one train in a block section at any time. The regulations concerning this method of signalling are defined in Rule Book module TS3, GE/RT8000/TS3, Absolute block regulations.
Brake cylinder	A pneumatic cylinder used to convert pneumatic pressure into braking forces.*
Brake pipe	A pipe running the length of the train that controls, and sometimes supplies, the train's air brakes. A reduction in brake pipe pressure applies the brakes.
Coalfish wagon	A general term used for a 30 ton capacity open wagon used for transporting ballast, sand and spoil.*
Controller of Site Safety (COSS)	A member of staff responsible for the application of a safe system of work at a site of work on a railway line.
Detonators	Small explosive devices that are fastened to the rail head and exploded by the passage of a railway vehicle to provide a warning to the driver.
Down main	The name in the report given to the line used by trains travelling in the direction towards Glasgow (northbound).
Emergency brake	A demanded brake application that uses a more direct and separate way than that used for normal service braking applications. This may result in quicker application of braking.
Emergency call	A direct call, which is given a high priority, that can be made by a driver to a signaller over a dedicated radio network operated and maintained by Network Rail.
Emergency call button	A dedicated button on a radio console in the driver's cab that is used to initiate an emergency call.
Engineering Supervisor (ES)	The person nominated to manage the safe execution of engineering work within a work site. This includes arranging the work site marker boards and authorising movements of trains into, out of and within the work site.
Equivalent brake force	A measure of braking capability that is directly related to the retarding force that all of the vehicles in the train should be providing at the interface between the wheel and the rail.
Full service brake application	A full (non-emergency) brake application.*
GSM-R radio	The Global System for Mobile Communications – Railways, which is a time division multiple access radio system for data transmission to and from trains.*

Individual Working Alone (IWA)	A person certified as competent to implement a safe system of work for their own protection on Network Rail controlled infrastructure.
Milepost	A coloured (generally yellow) post placed at one mile intervals along a railway. Intervening quarter-mile intervals (quarter, half and three quarter) are also similarly marked. Often, the quarter, half and three quarter are indicated by one, two or three symbols such as dots, triangles or lines.
On-train data recorder	Equipment fitted on board the train which records the train's speed and status of various controls and systems relating to its operation. This data is recorded to a crash-proof memory and is used to analyse driver performance and train behaviour during normal operations or following an incident or accident.
Person in Charge of Possession (PICOP)	The competent person nominated to: establish the protection for an engineering possession (and its removal at the end); control the movement of a train between work sites and between the protection and work sites; liaise with the respective ES regarding the passage of trains into and out of a work site; and liaise with the signaller regarding the passage of a train into and out of the engineering possession.
Possession	A specific section of line that is closed to railway traffic to allow engineering work to take place on the infrastructure.
Possession limit board	A miniature version of the stop sign used on the roads, denoting the end of a possession.*
Rail Freight Operations Group (RFOG)	A group that comprises senior operators representing all of the freight operating companies, together with attendees from Network Rail, RSSB, and ORR. It meets about every three months to discuss issues related to freight train operations and to share best practice.
RSSB	A not-for-profit company owned and funded by major stakeholders in the railway industry, and which provides support and facilitation for a wide range of cross-industry activities. The company is registered as 'Rail Safety and Standards Board', but trades as 'RSSB'.
Rule Book	Railway group standard GE/RT8000, which is the publication detailing the general responsibilities of all staff engaged on the railway system, and the specific duties of certain types of staff such as train drivers and signallers.*
Scotland Route	A name for the part of Network Rail's organisation which manages, operates and maintains the railway in Scotland.

Senior Person in Charge of Possession (PICOP)	The competent person nominated to carry out the duties of a PICOP, who can also authorise multiple train movements over sections of a line or lines identified as being under their control.
Train protection and warning system (TPWS)	A system fitted to certain signals which will automatically apply a train's brakes if it approaches the signal at too high a speed, or fails to stop at it, when it is set at danger. It will also automatically apply a train's brakes if it is travelling too fast on the approach to certain speed restrictions and buffer stops.
Up main	The name in the report given to the line used by trains travelling in the direction away from Glasgow (southbound).
Weekly operating notice	A document published by Network Rail providing information about engineering work, speed restrictions, alterations to the network and other relevant information to train drivers.
Work site	An area within a possession where engineering work is carried out and associated movements of trains and plant may take place.
Work site marker board	Signs with flashing lamps which are used to show the limits of a work site when an engineering train is present in a possession.

Appendix C - Investigation details

The RAIB used the following sources of evidence in this investigation:

- Information provided by witnesses and at meetings with employees of the parties involved;
- Information taken from the on-train data recorder fitted to locomotives hauling trains within the possession;
- CCTV recordings from New Cumnock station;
- Site photographs and measurements;
- Weather reports and observations at the site;
- Network Rail company standards;
- Rule Book modules, Rule Book handbooks and other Railway Group standards;
- Documents for the planned track renewal work including the weekly operating notice;
- Documents used by the engineering staff to manage the possession and work site;
- Competence records for engineering staff;
- Records for the driver's competence and duties worked;
- Results of drugs and alcohol testing;
- Timetables and information about the freight trains, such as their consist;
- Maintenance records for the locomotive and wagons;
- Voice recordings for calls made to the signaller at New Cumnock;
- Mobile phone records; and
- A review of previous RAIB investigations that had relevance to this accident.

Appendix D - Urgent Safety Advice

The RAIB issued the following Urgent Safety Advice after the accident:

URGENT SAFETY ADVICE



1. INCIDENT DESCRIPTION			
LEAD / INSPECTOR		CONTACT TEL. NO.	
INCIDENT REPORT No	0795	DATE OF INCIDENT	1 August 2015
INCIDENT NAME	Logan, near New Cumnock, East Ayrshire		
TYPE OF INCIDENT	Collision between engineering trains in a work site		
INCIDENT DESCRIPTION	<p>At about 11:13 hrs on 1 August 2015, two freight trains, which were being operated in connection with engineering work, were involved in a collision near Logan, East Ayrshire, on the railway line from Carlisle to Glasgow via Dumfries. The collision happened on the Down Main line at 52 miles 140 yards, which is about 3 miles (4.8 km) north of New Cumnock station. Both trains were within a work site contained inside an engineering possession. Train reporting number 6K06, the 0703 Carlisle Yard to New Cumnock, was stationary and waiting to enter into the site of work where the track on the Up Main line was being renewed. Train 6K07, the 0917 Carlisle Yard to New Cumnock, had entered the work site at New Cumnock station and been authorised by the Engineering Supervisor to move up to site of work behind train 6K06. It ran into the rear of train 6K06 at 28 mph (45 km/h).</p> <p>No one was injured but the locomotive and 7 wagons from train 6K07 and 11 wagons from train 6K06 were derailed; the locomotive of 6K07 and some wagons were severely damaged. One wagon came to rest across a minor roadway. There was also extensive damage to the track. Although the accident did not result in any injuries, the potential for more serious consequences is evident.</p>		
SUPPORTING REFERENCES	 <p>[Aerial image courtesy of Network Rail]</p>  <p>[Close up view of the locomotive from train 6K07 and wagons from train 6K06]</p>		

URGENT SAFETY ADVICE



2. URGENT SAFETY ADVICE	
USA DATE:	6 August 2015
TITLE:	The control of risks associated with the movement of engineering trains within work sites.
SYSTEM / EQUIPMENT:	Movements by engineering trains within work sites which are not controlled by the signalling system.
SAFETY ISSUE DESCRIPTION:	<p>The safe movement of engineering trains within work sites is dependent on:</p> <ul style="list-style-type: none"> • All movements being made 'at caution' – this means that trains should always be capable of stopping in the distance ahead that the driver can see the line to be clear; • Trains not exceeding 5 mph (8 km/h) unless authorised otherwise by the Engineering Supervisor to travel at a higher speed (albeit the movement should always be made 'at caution' regardless of what speed is authorised by the Engineering Supervisor); and • The Engineering Supervisor taking steps to check that drivers clearly understand the locations in the work site associated with the movement they are being asked to make. <p>This latest accident shows, once again, that trains are not travelling at caution within work sites. The intent of this safety advice is that urgent consideration be given to the efficacy of current measures that are intended to manage the risks associated with movements by engineering trains in work sites, and the steps that are required to fully implement recommendations 1 and 2 of the RAIB's investigation into an accident within a work site at Arley, parts of which were reiterated by the RAIB's bulletin for a collision between engineering trains within a work site at Kitchen Hill.</p>
CIRCUMSTANCES:	<p>The RAIB has investigated a number of collisions between trains or on-track machines which have happened when movements were taking place within a work site:</p> <ul style="list-style-type: none"> • 31 October 2006, collision between two on-track machines at Badminton (RAIB report 30/2007). • 26 April 2008, collision between two freight trains at Leigh-on-Sea (RAIB report 24/2009). • 10 August 2012, collision between two on-track machines near Arley, Warwickshire (RAIB report 12/2013). • 12 January 2014, collision between two engineering trains at Kitchen Hill, near Penrith (RAIB bulletin 01/2014). <p>The RAIB deployed Inspectors to the collision at Logan and the evidence they gathered indicated that very similar issues to those identified by previous investigations were present, such as:</p> <ul style="list-style-type: none"> • train 6K07 was travelling at a speed such that it was not capable of stopping in the distance to the rear of train 6K06 when it came into view; • a clear understanding was not reached of where train 6K07 needed to stop within the work site; and • the trains were operating within a work site that was much longer than the site of work where the track renewal was taking place. <p>Recommendations 1 and 2 from the RAIB's investigation for Arley are intended to address these issues.</p>
CONSEQUENCES	Risk of trains within work sites (and possessions) colliding with each other, resulting in damage to rolling stock and infrastructure, with the potential to also result in death or serious injury.
SAFETY ADVICE:	<p>The RAIB has investigated a number of collisions between trains in work sites and made recommendations, most recently in its report for Arley, to prevent a recurrence. In its latest update to the RAIB, the Office of Rail and Road reported that the implementation of Arley recommendations 1 and 2 by Network Rail was still in progress.</p> <p>Given the potential for serious harm in accidents of this type, the RAIB advises that Network Rail and Freight Operating Companies carry out an urgent review of the adequacy of current procedures that are in place to control the movement of trains within work sites (and possessions). This review should consider what can be done to address inadequacies that are identified, so that the risks associated with the movement of engineering trains within work sites are better controlled during the time it is taking to fully implement the RAIB's recommendations 1 and 2 for Arley.</p> <p>In the circumstances the RAIB wishes to reiterate recommendations 1 and 2 from its Arley investigation (report 12/2013). This accident demonstrates the need for the rail industry to implement a number of the changes called for by these recommendations in a timely manner, particularly parts 1b and 2ai.</p>

URGENT SAFETY ADVICE



	<p><u>Recommendation 1 of RAIB report 12/2013</u></p> <p>1 <i>The purpose of this recommendation is to point Network Rail to areas identified in this investigation for potential inclusion in its planned review of the management of engineering possessions and worksites and to encourage a fundamental assessment of the fitness for purpose of current arrangements. The recommendation is intended to achieve an improvement in the means for controlling the risk of collision between trains (and with plant) when travelling to and from their sites of work, and to gain assurance that arrangements for controlling the risks of collision are effectively planned and followed.</i></p> <p><i>Network Rail should:</i></p> <ul style="list-style-type: none"> a. <i>Review potential systems of work, and/or technical solutions, for reducing the risk of collision between trains when travelling to and from their sites of work. This review should include consideration of the following options:</i> <ul style="list-style-type: none"> i. <i>greater use of the signalling system during engineering work for controlling the movement of trains;</i> ii. <i>means for detecting the position of trains when normal signalling is suspended; and</i> iii. <i>planning arrangements for engineering work that address the issue of simultaneous movements of trains travelling to and from their sites of work and which minimise the potential for such moves to bring trains in close proximity.</i> b. <i>Review (in consultation with RSSB as appropriate) permitted train speeds applying to movements in sections of line that are closed to normal traffic for engineering work, taking account of human factors affecting a driver's ability to judge the distance they can see to be clear, the stopping distance that can be achieved by their train's braking performance, the limitations of headlight illumination in darkness and a driver's route knowledge.</i> c. <i>Seek an understanding of the reasons for, and scale of, local unauthorised deviations from possession plans, the effectiveness of the planning process to avoid such changes, as well as the suitability of procedures and managerial arrangements for identifying, and subsequently reviewing, unauthorised changes.</i> <p><i>The measures identified to further reduce the risk of collisions during engineering work should then be implemented in accordance with a timebound programme.</i></p>
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USA SIGN-OFF*			
INSPECTOR NAME:		CI / DCI NAME:	
INSPECTOR SIGNATURE:	ELECTRONIC COPY	CI / DCI SIGNATURE:	ELECTRONIC COPY
DATE:	6 August 2015	DATE	6 August 2015

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