



Rail Accident Investigation Branch

Rail Accident Report



Fatal accident to a track worker east of Reading station
29 November 2007

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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Introduction

- 1 The sole purpose of a Rail Accident Investigation Branch (RAIB) investigation is to prevent future accidents and incidents and improve railway safety.
- 2 The RAIB does not establish blame, liability or carry out prosecutions.
- 3 Access was freely given by Network Rail and First Great Western Trains to their staff, data and records in connection with the investigation.
- 4 Appendices at the rear of this report contain the following glossaries:
 - acronyms and abbreviations are explained in Appendix A;
 - technical terms (shown in *italics* the first time they appear in the report) are explained in Appendix B.

Summary of the report

- 5 At 04:53 hrs on 29 November 2007, a track worker was struck and killed by a train while walking on the line east of Reading station. He was on site to remove *detonator protection* from the up and down relief lines following a *T3 possession*.

Key facts about the accident

- 6 The track worker, who was performing the duties of a *blocked road man* (BRM), had confirmed that detonator protection was removed at 04:49 hrs.
- 7 The accident occurred during darkness and at a time when it was raining.
- 8 The track worker was wearing an approved high-visibility waistcoat, but was believed to have been using an umbrella in preference to full foul weather clothing. This affected his ability to see the approaching train and reduced his visibility to the train driver.

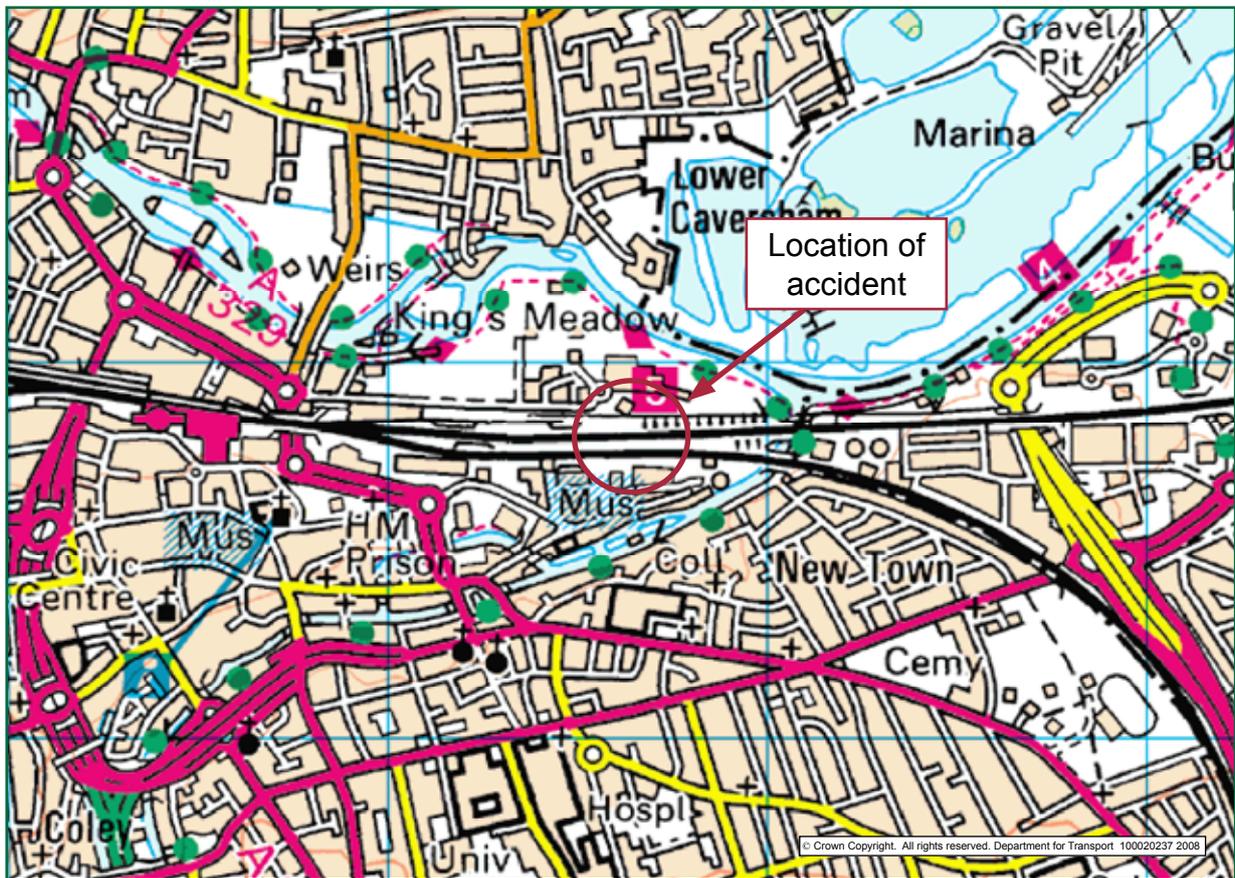


Figure 1: Extract from Ordnance Survey map showing location of accident

Immediate cause, causal, contributory and underlying factors

- 9 The immediate cause of the accident was the BRM walking in the *four-foot* of the up *relief line*, without looking up sufficiently frequently to make sure that he had enough warning of approaching trains. He was unable to reach a position of safety in sufficient time when a train approached.
- 10 Causal factors were:
 - a. the BRM's decision to use an umbrella in preference to the waterproof clothing with which he had been provided, which obscured his vision;
 - b. the BRM's decision to use the four-foot of the up relief line as a walking route, in preference to the cess, without using his knowledge and experience as a competent *Controller of Site Safety (COSS)* and *Individual Working Alone (IWA)* to ensure his own safety; and
 - c. the BRM's lack of adherence to the planned *safe system of work* which led to his informing the *Person in Charge of Possession (PICOP)* that detonator protection had been removed, thereby allowing the T3 possession to be given up, before he had returned to a permanent position of safety.
- 11 Contributory factors were:
 - a. the lack of guidance on how to withdraw the protection while maintaining a safe working area, which resulted in the BRM electing to remove the up relief protection first and being in a position to confirm that all detonator protection had been removed, while he was still remote from the access point;
 - b. the unusually short timescale between his confirmation that the detonator protection was removed and the arrival of the first train, which may have caught the BRM unawares; and
 - c. the effects of darkness and inclement weather which resulted in the BRM being less visible to the driver.
- 12 The underlying factors were:
 - a. the requirement for staff to access the track in order to place and remove detonator protection;
 - b. the lack of safety briefings which could have raised the BRM's general awareness of track safety issues;
 - c. the absence of site visits by the BRM's line manager, the possession co-ordinator, which denied the opportunity for his behaviour to be observed and possible safety improvements to be suggested;
 - d. the possession co-ordinator's workload which, following reorganisations, resulted in him being unable to adequately manage safety critical issues affecting his team; and
 - e. the lack of a robust process for monitoring the completion of safety tours and planned general safety inspections, leading to an ongoing lack of awareness by the infrastructure maintenance manager of these omissions.

Severity of consequences

13 The track worker was fatally injured as a result of being hit by a train.

Recommendations

14 Recommendations can be found in paragraph 173. They relate to the following areas:

- prohibition of use of umbrellas by staff when *on or near the line*;
- safety arrangements at the time that a possession is given up;
- the requirement for detonator protection;
- the monitoring of safety inspections; and
- the physical marking of protection locations on the track.

The Accident

Summary of the accident

- 15 At 04:53 hrs on Thursday 29 November 2007, a 62 year old track worker was struck and killed by an empty passenger train while walking on the track 1 km (0.65 miles) east of Reading station.
- 16 The deceased was working alone and was on site to remove detonator protection from the track. This followed the completion of a T3 possession of the *up* and *down* relief lines between Reading East and Slough West (Figure 2). At the time of the accident, the detonator protection had been removed and the line was open for the normal operation of trains.

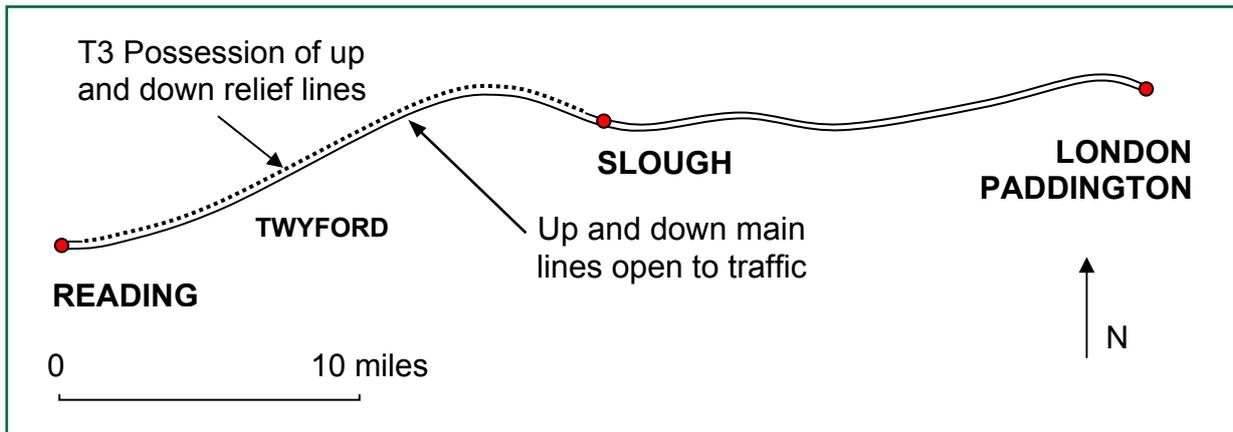


Figure 2: Simplified diagram of Great Western main line between London and Reading showing section of track under possession

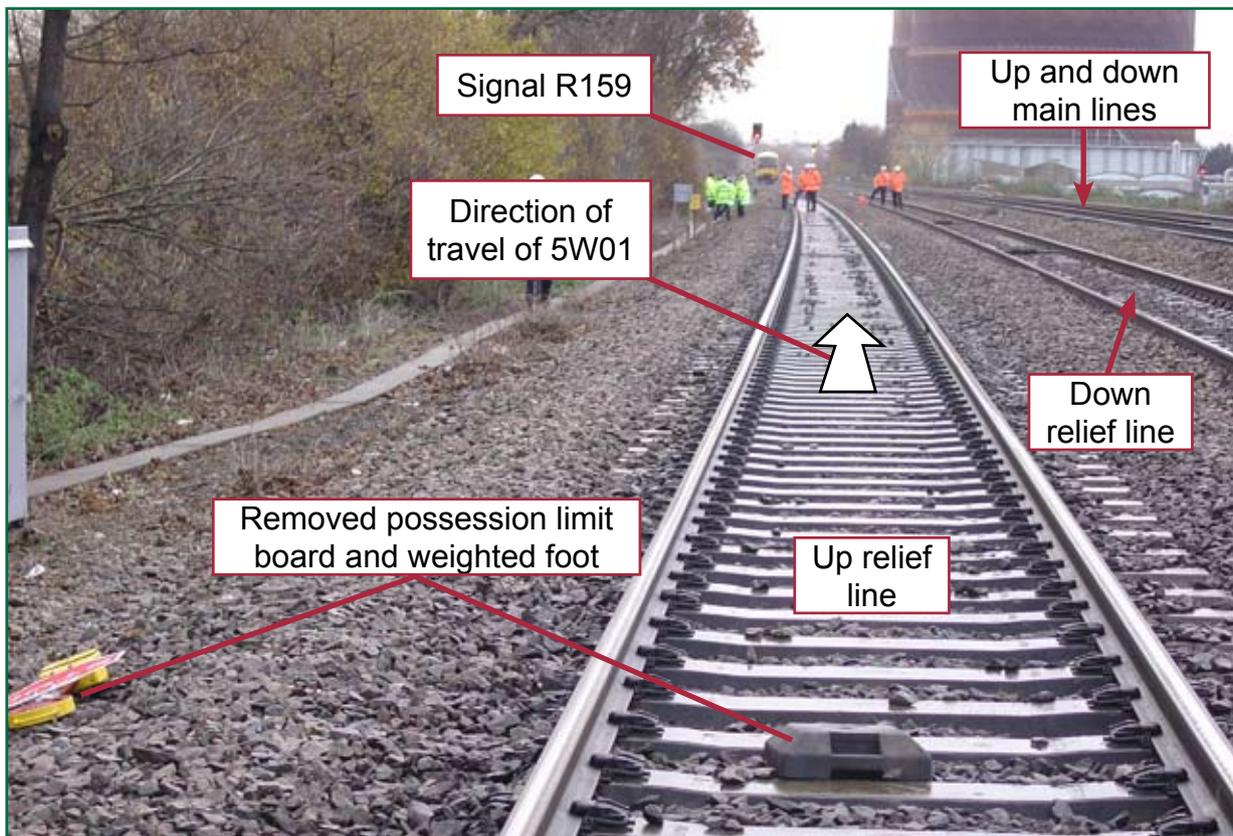


Figure 3: View east from the detonator protection position on the up relief line (35 miles 24 chains)

- 17 Train 5W01, the 04:55 hrs Reading depot to Slough empty coaching stock movement, had joined the up relief line east of Reading station and was accelerating under clear signals. The train was travelling at 48.6 mph (78.2 km/h) at the time of the accident.

The parties involved

- 18 The deceased was employed by Network Rail, and worked for the area delivery planning manager's department based at Reading, part of the infrastructure maintenance manager (Thames Valley) organisation. He was based at the Cattle Pens depot in Reading.
- 19 The train was operated by First Great Western Trains.

Location

- 20 Reading station is located 36 miles from London Paddington. The up direction is towards London. Signalling is by the *track circuit block* system with three and four-aspect colour light signals controlled from the signal box at Reading.
- 21 The accident occurred 60 metres (66 yards) west of signal R159, and 1000 metres (1090 yards) east of Reading station on a four-track section of the Great Western main line. In this area, the up and down relief lines are located to the north of, and separated by more than three metres from, the up and down main lines, with the up relief line on the northernmost side of the formation (Figure 4). None of the lines are electrified.

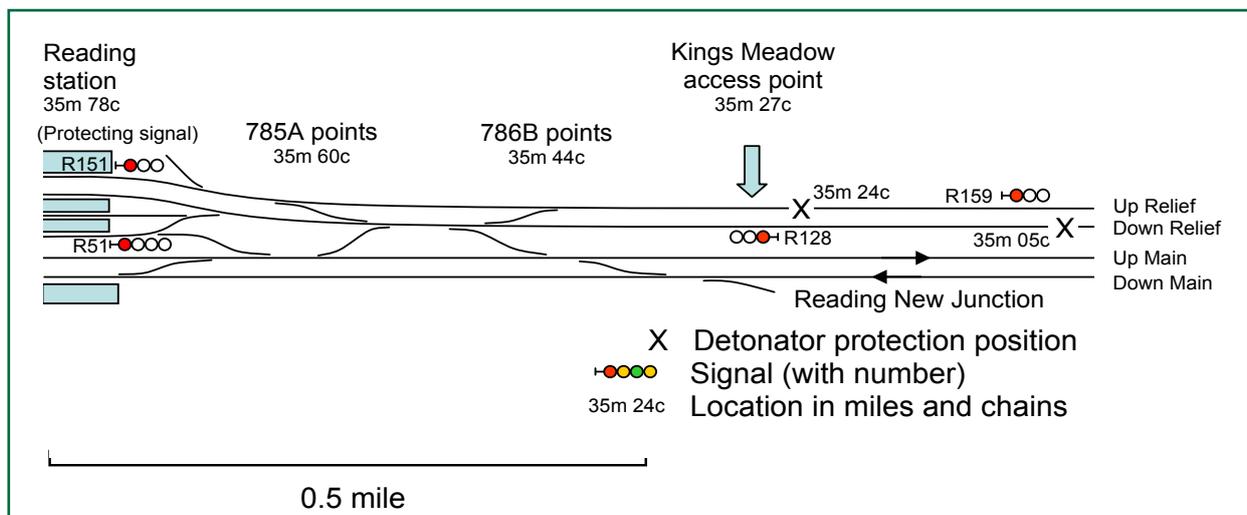


Figure 4: Schematic diagram of site prior to end of possession

- 22 East of Reading station, the railway is carried on an embankment and on a slight left-hand curve when travelling in the up direction. The northern face of the embankment is heavily vegetated, and there is an inclined ballast shoulder, cable troughing route and signalling equipment in the *cess* adjacent to the track.
- 23 The permitted speed for trains using the up relief line east of Reading New Junction is 75 mph (121 km/h).
- 24 Signal R159 is located on the *cess* (north) side of the up relief line at 35 miles 15 *chains*.
- 25 The detonator protection positions were established in accordance with module T3 of the railway *rule book* (GE/RT8000) as detailed in planning documents provided for the possession. The up and down relief lines were regularly blocked at these locations.

- 26 Network Rail's track layout plans show four access points on the north side of the railway within the first mile east of Reading station. Of these, Kings Meadow pedestrian access at 35 miles 27 chains, is closest to the detonator protection position for the up relief line (Figure 4).

External circumstances

- 27 At 04:30 hrs on the morning of 29 November 2007 it was dark and raining with a 10 mph westerly/south-westerly wind. Local weather records indicate that the rain started at 04:14 hrs and continued until 05:06 hrs.

Train

- 28 The train involved was a two-car class 165 diesel multiple unit (DMU), number 165 119, which was forming the 5W01 empty coaching stock movement from Reading depot to Slough. This train was to become the Slough-Windsor shuttle service with a first departure from Slough at 05:38 hrs. Unit 165 119 was based at Reading depot.
- 29 Class 165 DMUs have a maximum permitted speed of 90 mph (145 km/h).

Rail equipment

- 30 The detonator protection equipment for each line comprised three *detonators* positioned on the rail head, 20 metres (22 yards) apart (in accordance with module T3 of the rule book) and a *possession limit board*, formed of a lightweight post mounted with a stop board, a red flashing lamp and a detachable weighted foot (Figures 3 and 5). On the night of 28/29 November, staff located at Reading and Slough each had responsibility for placing and later removing two sets of detonator protection (ie six detonators and two boards each) which were required to protect the up and down relief lines respectively.

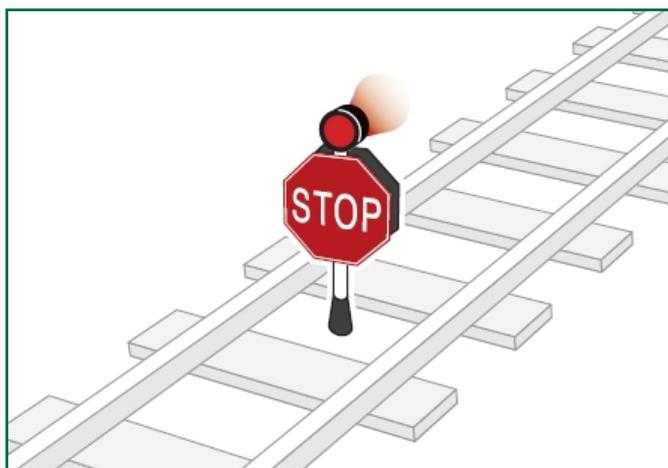


Figure 5: Illustration of a possession limit board from rule book module S1

- 31 The possession activity involved an *on-track machine* (a tamper) working on the down relief line within a *work site* east of Twyford station and under the local control of an *engineering supervisor*.

Events preceding the accident

- 32 During the week commencing Monday 26 November, a series of four nightly possessions were planned between Reading East and Slough West. These possessions affected the up and down relief lines and details of these arrangements were included in Network Rail's Western Route *Weekly Operating Notice* (WON). Each possession was scheduled to commence at 22:15 hrs and finish at 05:45 hrs the following morning.
- 33 The possessions were referenced in the WON as items 15, 22, 30 and 37, and involved the same possession management staff; a PICOP located at Westbury and 'personnel carrying out detonator protection', located at both Reading and Slough. The name normally given to staff performing this duty is 'blocked road man' (BRM), and although this is an unofficial term, it is completely and widely understood by Network Rail, contractors and agency staff.
- 34 The actual possession start and finish times had varied during the preceding days, and for items 15, 22 and 30 were as follows:
 - a. Item 15 (26/27 November): possession granted at 22:47 hrs and given up at 01:36 hrs.
 - b. Item 22 (27/28 November): possession granted at 22:31 hrs and given up at 05:15 hrs. This possession was extended to include part of Reading station between 01:05 hrs and 04:59 hrs and required the BRM to use four sets of protection equipment.
 - c. Item 30 (28/29 November): possession granted at 22:49 hrs and given up at 04:52 hrs.
- 35 The normal method of communication between the PICOP and two BRMs was by mobile phone. The PICOP was also responsible for all communication with the signaller, engineering supervisor and tamper operator within the possession and for recording each communication within a log.

Wednesday 28 November

- 36 On Wednesday 28 November, the PICOP first contacted the BRMs at Slough (Slough BRM) and Reading (Reading BRM) at 22:40 hrs. The purpose of these calls was to instruct them to place detonator protection, and to confirm to him when this had been done.
- 37 The Reading BRM accessed the track via the Kings Meadow access point and, after unlocking and passing through the railway boundary gate, carried his equipment up a flight of steps to track level. He then had to walk along the track to the locations where the detonator protection was required. The nearest detonator protection position to the access point was situated on the up relief line at 35 miles 24 chains, approximately 60 metres (66 yards) to the east and close to signal R128. The corresponding down relief detonator protection position was a further 382 metres (418 yards) to the east at 35 miles 05 chains (refer to Figure 4).
- 38 The Reading BRM contacted the PICOP at 22:48 hrs to confirm that the protection was in place. He was instructed to remain on site in order to allow the tamper into the possession and to contact the PICOP when it arrived.
- 39 The Reading BRM contacted the PICOP again at 22:58 hrs when the tamper arrived. The PICOP gave him authority to remove the detonator protection from the down relief line to facilitate its access into the possession, and to confirm when he had replaced it. At 23:02 hrs, the Reading BRM confirmed that the protection had been replaced following entry of the tamper. He was stood down by the PICOP until further notice, and had the option of returning to wait in his van or driving to his depot.
- 40 At approximately 23:15 hrs, CCTV equipment at Network Rail's Cattle Pens depot in Reading showed a white van, similar to that used by the Reading BRM arriving.

Thursday 29 November

- 41 The PICOP took the first steps associated with handing back the possession at 04:01 hrs when he contacted a signalling fault technician. The purpose was to check whether any damage to signalling equipment had occurred during tamping of the track.
- 42 The PICOP next contacted Reading signal box at 04:02 hrs to request permission for the tamper to come out of the possession by means of a junction west of Twyford station. This would allow it to exit the possession, cross onto the down main line and return to Reading via that route. The signaller gave permission for this movement.
- 43 At 04:25 hrs the engineering supervisor confirmed that the tamper had left his work site and was proceeding towards the junction west of Twyford.
- 44 The PICOP contacted the Reading BRM at 04:36 hrs to ask him to go out to the furthest point of the site and await his call. At approximately the same time, the Cattle Pens depot CCTV system shows a van leaving the depot. It has not been possible to positively identify either the van or its driver although the van was similar to that being used by the Reading BRM and it is probable that it was his. The journey from the depot to the Kings Meadow access point is approximately 1 mile and required a vehicular gate to be unlocked and opened prior to driving through at the outer railway boundary.
- 45 The Reading BRM turned his van round before parking it adjacent to the Kings Meadow access point gate. The van was left in a secure area with its engine running.
- 46 The PICOP received confirmation from the engineering supervisor that the tamper was out of the possession at 04:42 hrs. The PICOP's next action was to contact the Slough BRM and Reading BRM and instruct them to remove the detonator protection, and to confirm to him when this was done.
- 47 At 04:44 hrs, the PICOP contacted the signallers at Reading and Slough and informed them that he was ready to give up the possession.
- 48 The Reading BRM removed the detonators and detached the up relief possession limit board from its weighted foot as he passed. This was laid in the cess for collection on his return (Figures 3 and 6).
- 49 At 04:49 hrs the Reading BRM contacted the PICOP. From the 17 second conversation that ensued, the PICOP understood that the detonator protection had been removed from the up and down relief lines and that the Reading BRM was clear of the track; he repeated the message back. At 04:50 hrs he received a similar confirmation from the Slough BRM.
- 50 The PICOP then contacted the signallers at both Reading and Slough and formally gave up the possession after confirming that the track was clear and safe for trains to run on. The PICOP and signallers each recorded this event at 04:52 hrs.

Train 5W01

- 51 The driver of train 5W01 booked on at Reading depot at 04:20 hrs and prepared his train.
- 52 The initial movement of unit 165 119 occurred at 04:45 hrs when it progressed towards the depot exit signal, R543, at a speed of 5 mph (8 km/h) in preparation for a scheduled departure time of 04:55 hrs. The train stopped at the signal which was displaying a red aspect.

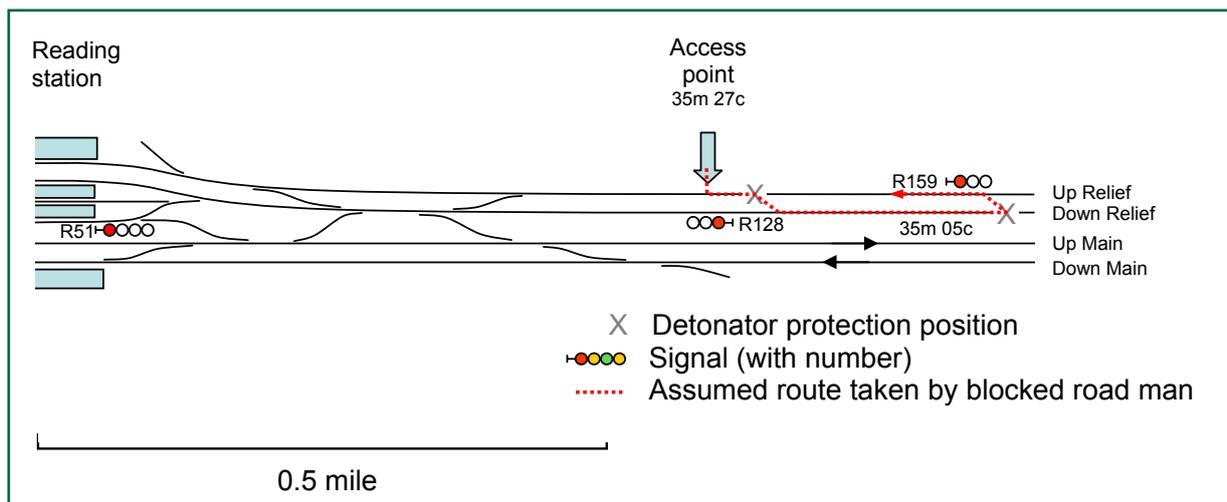


Figure 6: Assumed route taken by blocked road man

- 53 At 04:49 hrs, the depot exit signal changed to a *proceed aspect* and the driver took power for the move from the depot towards Reading station. The train was routed via the up main line between platforms 4 and 5, and towards signal R51 at the east end of the station which was held at red while an on-track machine crossed from the down main line into the north part of the station. Train 5W01 attained a maximum speed of 17 mph (27 km/h) during this part of the journey, before slowing to 5 mph (8 km/h) as it approached the signal (Figure 7).
- 54 The first train over a section of line affected by a possession has to be specially watched by a signaller to check the operation of the track circuits. Module T3 of the railway rule book states that a signaller should prevent a second train entering the portion of line that had been under possession until the first train has left it. Complying with this requirement is a potential cause of delay if it has to be undertaken during a busy period.
- 55 As train 5W01 approached signal R51 at low speed, the possession of the relief lines was given up, and this gave the signaller the opportunity to use train 5W01 to check the track circuits. At 04:52:23 hrs, the signaller set a route for train 5W01 from the up main line onto the up relief line (Figure 7). Signal R51 changed to a proceed aspect with a junction indicator showing that the route to the up relief line was set. The driver applied full power and accelerated the train to a maximum of 39 mph (63 km/h) before reducing power.
- 56 The cross-overs from the up main to the up relief line east of Reading station have a 40 mph (64 km/h) speed limit, and train 5W01 travelled at just below this limit until it was clear of the junction. The driver then reapplied full power, passing over the *automatic warning system magnet* (AWS magnet) for signal R159, situated close to the Kings Meadow access point at 04:53:36 hrs and at a speed of 45 mph (72 km/h). The *on-train data recorder* (OTDR) download indicates that an AWS bell was received, indicating that signal R159 showed a green aspect.

Events during the accident

- 57 At 04:53:44 hrs, the driver of 5W01 sounded the horn after suddenly becoming aware of a person on the track an estimated one coach length in front of him. He moved the control handle from full power to emergency brake in a single movement. The OTDR shows that the train came to a halt after travelling a further 241 metres (264 yards), and experienced some wheel slip while braking. The driver sent an emergency message to Reading signal box using the *cab secure radio* as soon as the train had come to a stand. He stated that he had hit a track worker and requested the emergency services.
- 58 The Reading BRM did not become aware of the train in sufficient time to get fully clear and was struck a glancing blow by the front of the train.
- 59 The collision occurred at a speed of 48.6 mph (78.2 km/h).

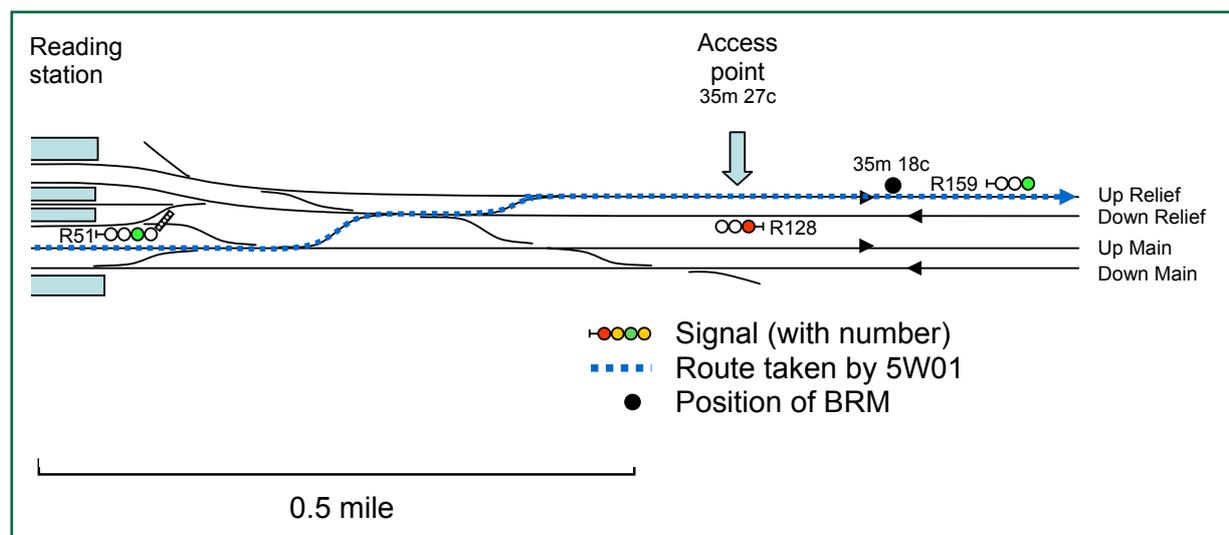


Figure 7: Route taken by 5W01

Consequences of the accident

- 60 The Reading BRM received a blow to the head and was fatally injured. The subsequent post-mortem examination confirmed that he had sustained multiple injuries caused by being struck by a train.

Events following the accident

- 61 The Reading signaller contacted Network Rail's Route Operations Control at Swindon to arrange the attendance of the emergency services. He then contacted the PICOP to inform him of the accident.
- 62 A Network Rail mobile operations manager (MOM) was on site at 05:10 hrs. The site was subsequently attended by the emergency services, including the British Transport Police.
- 63 Train services were initially suspended on all lines until authority was given to reopen the main lines by British Transport Police. Following removal of the body, the relief lines were reopened at 09:52 hrs.
- 64 The train driver was routinely screened for drugs and alcohol. The results were negative.

The Investigation

Investigation process

- 65 The investigation focused on the following aspects:
- a. site layout and conditions at the time of the accident;
 - b. possession arrangements;
 - c. communication between the PICOP and other staff;
 - d. actions of the PICOP;
 - e. actions of the signaller;
 - f. actions of the Reading BRM;
 - g. training provided to the Reading BRM;
 - h. actions of the driver; and
 - i. condition and maintenance of unit 165 119.

Sources of evidence

- 66 Evidence has included:
- a. examination of the site;
 - b. training records;
 - c. mobile phone records;
 - d. Weekly Operating Notice (WON) relating to possession activity;
 - e. possession documentation including the PICOP log;
 - f. signalling records;
 - g. OTDR records; and
 - h. interviews with the staff involved.

Key Information

Evidence found at the scene of the accident

- 67 The Reading BRM was found on the railway embankment, approximately 180 metres (197 yards) east of the Kings Meadow access point. He had walked 260 metres (282 yards) from the down relief detonator protection position before encountering the train (Figure 6). He was wearing an unfastened orange high-visibility padded waistcoat over a dark fleece and dark trousers.
- 68 The Reading BRM's mobile phone was found at the accident scene, together with a possession limit board and a woollen hat. An open umbrella which had sustained impact damage was found adjacent to the track, and a torch with its switch in the 'on' position was found at the foot of the embankment.
- 69 The Reading BRM's van contained waterproof trousers, a hard hat and an umbrella.
- 70 The Reading BRM's van also contained an envelope containing safety documentation relating to the possession activity and a *Sentinel card* which showed the following competencies:
- Personal Track Safety (PTS), valid until 26/10/2008;
 - Individual Working Alone (IWA), valid until 26/10/2008;
 - Controller of Site Safety (COSS), valid until 26/10/2008; and
 - Auxiliary Operating Duties (Handsignaller), valid until 13/06/2007.

There were no suspended or withdrawn competencies or access restrictions indicated. The Reading BRM had passed a medical in May 2007 without restrictions being imposed.

The Reading BRM

- 71 The Reading BRM had worked a total of 54 hours during the week preceding the accident, and was rostered to work eight hour shifts from 24 to 29 November inclusive on a fixed night duty. His last rostered rest day was on Friday 23 November.
- 72 The Reading BRM had been issued with personal protective equipment (PPE) by Network Rail in accordance with their policy for track staff. This included orange high-visibility foul weather jackets, waterproof trousers and head protection. Two unworn high visibility jackets were found in his locker at the Cattle Pens Depot following the accident.

Training and experience

- 73 The Reading BRM had in excess of 20 years railway experience, including more than five years in placing and removing detonator protection associated with T3 possessions. He had previously worked for the incumbent *infrastructure maintenance contractor* until being transferred to Network Rail when maintenance activities were taken in-house in July 2004.
- 74 He was initially appointed to the local track maintenance organisation, but in February 2007, he transferred to the area delivery planning manager's department (paragraph 18). Although this resulted in a change in his job title and reporting line, it did not affect his primary duties working as a BRM within T3 possessions.

- 75 The Reading BRM was familiar with the Reading East area and had been responsible for placing and removing detonator protection at the same locations on the up and down relief lines on 30 occasions during 2007.
- 76 He held track safety competencies, including PTS, IWA and COSS (paragraph 70), which allowed him to access the track alone and demonstrated that he was able to establish a safe system of work. From this training, he would have been aware of the need to:
- wear high-visibility clothing of an approved type in the correct way;
 - walk facing the direction from which trains normally approach;
 - look up at least every 5 seconds; and
 - move to a position of safety when a train approached.
- 77 The Reading BRM's COSS competency demonstrated that he was able to set up a safe system of work for a work group (ie for others as well as himself). He was regarded by colleagues as being competent and reliable and was a valued member of the possession management team.
- 78 In December 2006, Network Rail introduced a new method for maintaining staff competence known as *Assessment in the Line*. This computer based process has replaced training schools for maintaining track safety competencies throughout Network Rail, and it operated on a local basis, with the results of an assessment being reviewed between the individual and his line manager. The Reading BRM undertook Assessment in the Line for track safety in March 2007, and the results of this assessment are summarised in Table 1:

Competency	Attempts	Result
Track safety – PTS	1	Passed
Track safety – Lookout	1	Passed
Track safety – COSS	1	Passed
Auxiliary Operating Duties (Handsignaller)	3	Passed
Auxiliary Operating Duties (Level Crossing Attendant)	3	Passed
Auxiliary Operating Duties (Points Operator)	4	Failed
Safety critical communication	1	Failed

Table 1: Results of the Reading BRM's assessment-in-the-line competence assessment (March 2007)

The associated 'mandatory evaluation form' and 'manager's statement' had not been completed or signed.

Training for T3 possession duties

- 79 Module T3 of the railway rule book specified the requirement for the PICOP to give instruction to ‘personnel carrying out detonator protection’ in connection with establishing or handing back a T3 possession, but did not establish a title for this role or define any required competencies. Prior to the introduction of Assessment in the Line, training for this role had been provided by means of a module within Network Rail’s handsignaller training course, and this meant that a BRM had to be certified as a handsignaller. In turn, this required a BRM to maintain PTS and IWA competencies to allow them to safely access the track. As a safeguard, the handsignaller competency automatically lapsed if PTS or IWA competencies expired or were withdrawn.
- 80 The handsignaller course fulfilled the training needs for ‘personnel carrying out detonator protection’ (ie BRM duties) and the Reading BRM last received such formal training in June 2005. This competency had a validity of two years as indicated on his Sentinel card (paragraph 70). The handsignaller course also covered a range of other subjects including handsignalling duties in connection with defective or disconnected signals and the control of single line working.
- 81 In December 2006, the T3 protection (ie BRM) element of the handsignaller course was removed following difficulties experienced by Network Rail. Some handsignallers had only worked as BRMs and had not retained the full range of handsignaller expertise.
- 82 Following the introduction of Assessment in the Line, BRMs continued to be assessed using the handsignaller element in the absence of an alternative training syllabus. At the time of the accident, the ongoing arrangements for training BRMs had not been finalised by Network Rail, leaving a gap in the competency framework.

The PICOP

- 83 The PICOP was experienced, having undertaken this role for about 10 years. There is evidence that he was thorough in his work, giving the BRMs information on the placing of detonator protection, and repeating back messages that he received.
- 84 The PICOP and signallers maintained written records of telephone calls made and received within their respective logs.
- 85 Telephone records indicate that the calls were of short duration, but resulted in the appropriate actions being taken by each party, and fulfilled the requirements of module T3 of the railway rule book.

The Possession Co-ordinator

- 86 In February 2007, the possession management staff at Reading were transferred into the area delivery planning manager’s department, and formed into a team led by a possession co-ordinator. This team comprised two senior PICOPs and four BRMs who were dedicated to T3 possession activity in the Reading area and took no other role in infrastructure maintenance activities. The possession co-ordinator reported to the possession delivery manager who, in turn, reported to the area delivery planning manager. The area delivery planning manager reported to the infrastructure maintenance manager.

- 87 The possession co-ordinator had not instigated regular meetings for his newly established team, preferring to discuss issues with individual members when they visited his office, for example, to collect documents. These arrangements did not satisfy Network Rail's requirements for regular team meetings, and did not provide a forum for team discussions on relevant safety issues. A safety bulletin, issued by Network Rail following a fatal accident to a member of the Reading infrastructure maintenance team at Ruscombe junction in April 2007 was briefed out, but no record was kept of who this included.
- 88 The possession co-ordinator, as a line manager, was required to oversee the Assessment in the Line process for his staff and to agree and develop action plans to remedy any identified shortcomings. The Reading BRM had sat his assessment at about the same time that he transferred into the area delivery planning manager's department, and while the possession co-ordinator had received the results of his Assessment in the Line assessment (Table 1), he had not received a briefing from the Reading BRM's former line manager on this matter, or developed an action plan to deal with gaps identified.
- 89 Network Rail's standard maintenance procedure (NR/PRC/MTC/SE/0117) 'Planned General Safety Inspections', was introduced in December 2006 and mandated the requirements for planning, conducting and reporting planned inspections. The possession co-ordinator, as a line manager, was required to visit sites and undertake planned general safety inspections to monitor and support his staff working in T3 possessions.
- 90 BRMs who worked alone were treated by NR/PRC/MTC/SE/0117 as one person units, with an inspection being required once every four weeks. The Reading BRM, as one of four similar staff, could therefore have expected a visit once every 16 weeks. A function of this type of inspection is to identify unsafe acts or conditions, and also to record best practice where this is observed. Fulfilling this requirement required managers to undertake site visits at night and at weekends.
- 91 The possession co-ordinator's workload involved the detailed planning and delivery of possessions. His area of responsibility had recently increased following an expansion of the Thames Valley maintenance area to include Swindon and Westbury. This change coincided with the absorption of possession management staff into his team and the departure of an experienced assistant. As a consequence, he routinely worked in excess of 50 hours per week and needed to take work home on a regular basis.
- 92 In addition to constraints imposed by his workload and the difficulty in accommodating shift patterns worked by his team, the possession co-ordinator was prevented from undertaking the required site visits as his PTS competence had lapsed nine months prior to the accident. He was therefore unable to go onto the track pending retraining, but alternative arrangements had not been identified or put in place by the possession delivery manager or the area delivery planning manager.
- 93 At the time of the accident, the Reading BRM had worked for the the area delivery planning manager's department for nine months. He had not been visited on site by the possession co-ordinator or other line manager during this time.

Infrastructure Maintenance Manager's organisation

- 94 The infrastructure maintenance manager's organisation included an area maintenance workforce safety & environment advisor's position, whose role was to monitor compliance with standards and facilitate internal reporting. This position was vacant from April until December 2007, and this may have been a factor in the infrastructure maintenance manager being unaware of the lack of planned general safety inspections being undertaken within the area delivery planning manager's team.

95 The area delivery planning manager had himself become aware of the infrequent level of safety tours and planned general safety inspections within his area following a briefing on the findings of the Ruscombe junction investigation (see paragraph 87) which highlighted this as an issue. In early November 2007, he had met with a safety advisor in order to develop an action plan to address this issue. This plan had not been finalised or implemented at the time of the accident.

Safe system of work documentation

96 The detailed arrangements for the possession were listed in the WON, including the lines to be blocked, the start and finish times and the location where detonator protection was to be placed (ie 400 metres (440 yards) east of 786B points and signal R128 on the up and down relief lines respectively as indicated in Figure 4).

97 The Reading BRM was provided with a six-page document, prepared by the possession co-ordinator, comprising sections entitled ‘Appendix B: Selection of safe system of work on or near the line’, and ‘COSS record of arrangements and briefing form RT9909’. These documents formed the risk minimisation (*RIMINI*) plan required by Network Rail specification NR/SP/OHS/019 ‘Safety of people working on or near the line’. The document gave a description of the protection arrangements to be used for the possession, the location where detonator protection was to be placed, and included contact numbers to assist him in performing his duties.

98 The RIMINI plan contained details of the planned safe system of work. It identified that a *separated green zone* would be maintained while the Reading BRM was ‘walking on or near the line to/from the working area’ and ‘whilst carrying out the work’ of placing and removing detonator protection. This arrangement was compliant with specification NR/SP/OHS/019, as the Kings Meadow access point was within the area covered by (ie to the east of) the *protecting signal* R151 (Figure 4). As the Reading BRM was a competent COSS / IWA (paragraph 70), he was expected to modify the planned safe system of work if it proved necessary.

99 The documentation included a ‘Record of arrangements and briefing form’ and defined hazards associated with gaining access to and working on the site (ie tripping, lighting). It also included a location map with details of signals, tracks and access points. The BRMs had each collected their copy of the document from the possession co-ordinator’s office, but did not receive a briefing despite this being a requirement of the specification.

Train and driver

100 Train 165 119 was a two-car diesel multiple unit, operated by First Great Western Trains. This class of train has engines mounted beneath the floor of each vehicle.

101 A post-accident inspection, undertaken by First Great Western Trains and supervised by the RAIB, did not identify any issues relating to the train’s windscreen wipers, lights, horn or braking systems. Inspection of the leading vehicle showed evidence of an impact mark below the left hand headlight.

102 The unit’s *automatic warning system (AWS)*, *train protection and warning system (TPWS)*, OTDR and cab secure radio were tested and confirmed to be in working order.

103 The unit involved had no history of headlight defects, and this is not a recurring problem with this class of train.

- 104 Trains are provided with day and night headlights which aid visibility of the train for persons on or about the track. Their purpose is to enable the train to be visible. Railway Group Standard GM/RT2483 (June 2004) requires headlights to be visible from a distance of 25 seconds for a train running at its maximum design speed in daylight or darkness. The standard also details cleanliness and lamp alignment criteria.
- 105 A train's night headlight is mounted on the left of the vehicle in the direction of travel and is angled to reflect off lineside signs, such as speed warning boards. The headlight is not intended to provide the driver with forward visibility in the manner of a road vehicle's headlights, to avoid the risk of dazzling oncoming trains. Consequently, a driver would be unlikely to see a person on the track in the dark in sufficient time to give warning unless a torch or other light was shone at the train or the headlight illuminated the reflective strips on any high-visibility clothing being worn.
- 106 The driver had qualified in March 2006 and was experienced in operating this class of train. He had not been involved in any similar incidents during his driving career.
- 107 Information obtained from the train's data recorder fitted to unit 165 119 is included within the description given in paragraphs 52 to 59. This data confirms the speed of the train, the actions taken by the driver and the status of signals as detected by AWS equipment on the train.

Previous occurrences of a similar character

- 108 During the 10 year period preceding the accident, there were 15 fatal accidents over the whole Network Rail system which involved track workers being struck by trains. These have included:
- a. accidents which occurred within possessions or were caused by people stepping outside a possession onto a line open to traffic; and
 - b. accidents associated with working in *red zones* with lookout protection, where individuals behaved in an unexpected manner, made mistakes or violated laid down procedures.
- 109 An accident occurred at Vauxhall in 2000, and involved an inexperienced BRM who was struck by a train while walking on a line open to traffic with his back to approaching trains. In this instance, he was with a more experienced colleague who was able to jump clear at the last moment. The formal inquiry which followed identified the lack of a safe system of work for staff working in darkness as being a cause. Specifically, a COSS was not appointed and the more experienced man was not given, and did not assume responsibility for, his less experienced colleague.

Analysis

Identification of the immediate cause

110 The immediate cause of the accident was the Reading BRM walking on a line which was open to traffic, but not detecting the presence of train 5W01 in sufficient time to stand clear when it approached. The up and down relief lines had been returned to traffic a few minutes before the incident occurred.

Identification of causal and contributory factors

The Reading BRM's awareness of the approaching train

- 111 The Reading BRM was unaware of the approaching train until immediately before it struck him. The most likely reasons for this are given below.
- 112 It is probable that the Reading BRM was using an umbrella to provide shelter from the weather as he walked between the down relief detonator protection position and the Kings Meadow lineside access point. It was raining from the time he left the Cattle Pens depot, but he had not dressed in wet weather clothing despite having the appropriate items available in his locker or van, and the clothing he was wearing was not fastened up. An open umbrella was found at the scene and he was known locally to use an umbrella when on the track.

Audibility

- 113 The Class 165 and 166 turbo trains are mid-engined diesel multiple-units and are known by track staff as being difficult to hear. Other classes of train using Reading station include high speed trains, Class 220 and 221 voyagers and freight locomotives, all of which are easier to hear.
- 114 It is probable that the noise of rain beating on the umbrella fabric made it less likely that he could hear an approaching train.
- 115 The north face of the embankment along which the Reading BRM was walking is heavily vegetated. Wind noise through the trees and bushes may also have masked the sound of the approaching train.

Visibility

- 116 The Reading BRM was walking in darkness and into the wind and rain. It is likely that he had his head inclined downwards.
- 117 The train's headlights were set to the night position by means of a switch in the driver's cab. This provides a headlight on the left hand side in the direction of travel and reduces the right hand headlight to a marker light to avoid dazzling oncoming drivers.
- 118 An approaching Class 165 train can be seen 20 seconds prior to its arrival at the scene of the accident, its visibility being limited by the slight curvature of the track (Figure 9). This is equivalent to a sighting distance of 430 metres (470 yards) at a speed of 48.6 mph (78.2 km/h), and provides adequate warning for a person walking on the track to step clear.

119 Module G2 of the railway rule book 'Personal safety when walking on or near line or on the lineside' applied to all staff within the railway boundary fence. The following paragraphs are of particular relevance:

a. Rule 6.3 'When you are walking on or near the line' states:

- 'you must take a handlamp with you during darkness and when you are walking in a tunnel.'

b. Rule 6.5 'Watching and listening for trains' states:

'When you are walking on or near the line, you must:

- watch and listen for approaching trains at all times;
- not wear or use anything which makes you less able to see or hear approaching trains, for example, hoods, headphones, mobile phones or earmuffs;
- not allow yourself to be distracted by anyone or anything.

You must also look up frequently (about every 5 seconds) to make sure you have enough warning of approaching trains so that you can reach a position of safety at least 10 seconds before a train arrives. You must do this even if you are not expecting a train to approach.'

120 If the Reading BRM was using an umbrella, he would have needed to hold this in one hand as he was also carrying the down relief possession limit board and probably a torch. An umbrella user, facing into a 10 mph wind, would have to hold it at an angle and would therefore be less able to see approaching trains. Tests undertaken by the RAIB using a similar umbrella in a 10 mph headwind suggest that forward visibility could have been as little as 5 metres (Figure 8), which the train would cover in less than one second at 48.6 mph (78.2 km/h). He would have needed to see the train at a distance of at least 215 metres (235 yards) to meet the 10 second requirement made in the rule book (paragraph 119).

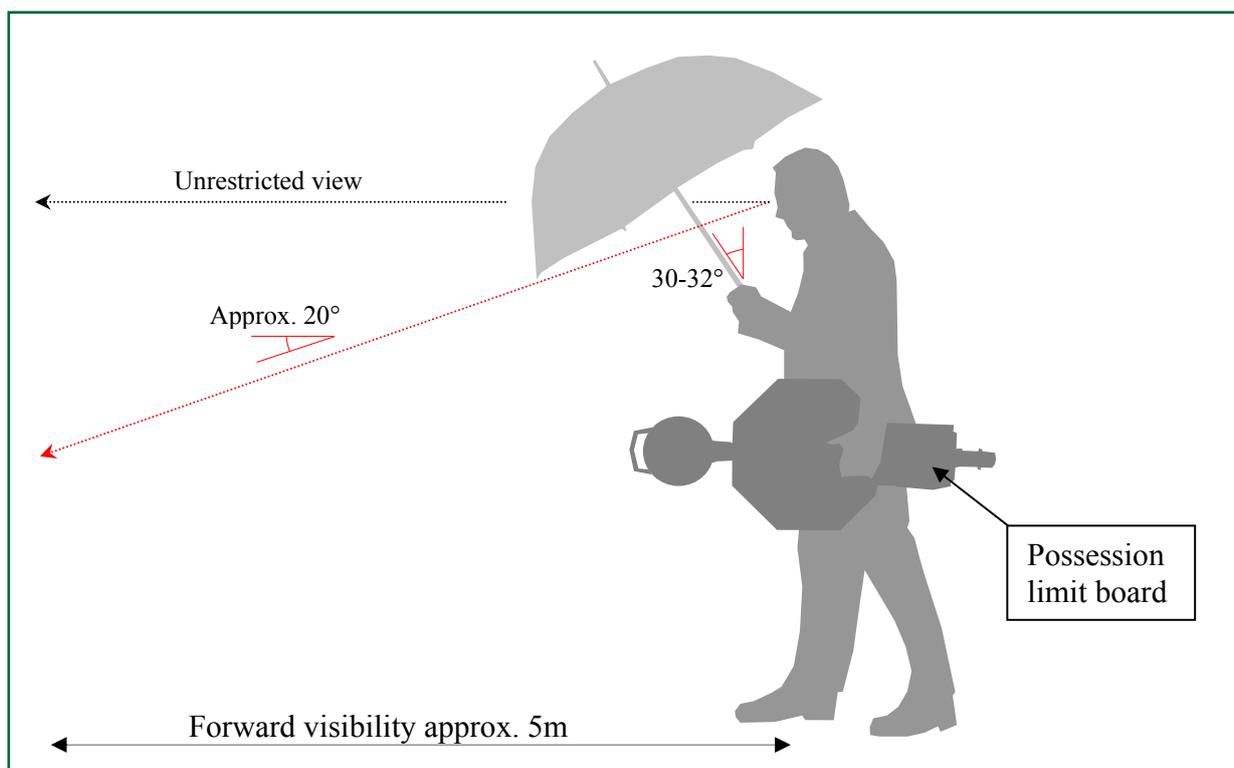


Figure 8: Diagram showing effect of 10 mph wind on forward sighting when using an umbrella

121 The Reading BRM did not observe the approaching train during the 20 seconds that it was visible to him, and the reflective properties of his high-visibility waistcoat were reduced by it being unfastened, making it less likely that the driver would see him. If the Reading BRM were using an umbrella, this would have affected his ability to keep an adequate lookout for approaching trains, and explains why he did not take avoiding action in sufficient time. The use of an umbrella in preference to waterproof clothing was therefore a causal factor in the accident.

Actions taken by the Reading BRM

122 The Reading BRM placed the detonator protection as directed by the PICOP at the start of the possession and remained on site until 23:00 hrs (paragraph 39). From that time onwards, he was free to take rest until recalled by the PICOP once the possession activity was completed, as he was dedicated to the possession management process and had no part to play in the engineering work within the possession.

123 It is probable that the Reading BRM returned to his depot for the duration of the possession (paragraph 40). This would have been a more comfortable option than remaining in his van overnight, and the depot was close by.

124 Analysis of the Reading BRM's movements suggest that he left the Cattle Pens depot immediately after receiving the call from the PICOP at 04:36 hrs. It took him an estimated six minutes to drive the one mile to the access point, as the journey included a stop in order to open a vehicular access gate at the outer railway boundary. He turned his van around and left it at approximately 04:41 hrs.

125 Local weather records indicate that it was raining at the time he left the depot. He had waterproof clothing available (paragraphs 69 and 72), but did not wear it.

126 On arrival at the Kings Meadow access point gate, he left his van's engine running while he went onto the track to remove the detonator protection. This suggests that he was intending to complete his task and return to the van as quickly as possible.

127 A flight of steps leads from the gate onto the embankment, and the up relief detonator protection position is located 60 metres (66 yards) east of the steps. Allowing time to climb the steps and assuming a typical walking speed of 3 mph (4.8 km/h) on the flat, he would have arrived at the up relief detonator protection position at about the time the PICOP contacted him for the second time at 04:43 hrs. An analysis of walking times is included in Table 2.

128 After removing the detonators and possession limit board from the up relief line, the Reading BRM walked the 382 metres (418 yards) to the down relief detonator protection position. It is not known which route he took, but as both relief lines remained under possession, he could have safely walked along either the up or down relief line. Using the same assumed walking speed, he would have arrived at the down relief detonator protection position a minimum of 5 minutes later at 04:49 hrs.

Section	Distance in metres (yards) from top of access point steps	Walking time at 3 mph (4.8 km/h)	Cumulative walking time
Top of steps to up relief detonator protection position	60 (66)	45 sec	45 sec
Up relief detonator protection position to down relief detonator protection position	382 (418)	4 mins 45 sec	5 min 30 sec
Down relief detonator protection position to top of steps (return journey)	442 (484)	5 mins 30 sec	11 min
Top of steps to up relief detonator protection position and return to steps (to clear up relief board)	120 (132)	1 min 30 sec	12 min 30 sec

Table 2: Estimated walking times for placing detonator protection from Kings Meadow access point

129 At 04:49 hrs, the Reading BRM contacted the PICOP and led him to understand that detonator protection had been removed from the up and down relief lines and that he was clear of the line. At this time, he was probably at the down relief protection position, a distance of 443 metres (484 yards) from the Kings Meadow access point, and although he may have been clear of the line at that moment, the PICOP was unaware that the Reading BRM was still some distance from the access point and was not permanently clear of the line.

130 The Reading BRM commenced his return journey towards the access point at approximately 04:50 hrs, knowing that the possession was about to be given up. The choice of walking routes available to him at this stage comprised the four foot (ie walking on the track itself), the inclined ballast shoulder or, following the lineside cable route formed of abutting pre-cast concrete troughing units in the cess (Figure 9). The ballast shoulder was an unattractive option due to its angle, and Network Rail discourage staff from walking on the cess troughing route due to the risk of trips and falls due to a lid collapsing or springing up when stood upon. There was also signalling equipment located in the cess which could have been hazardous in the dark.

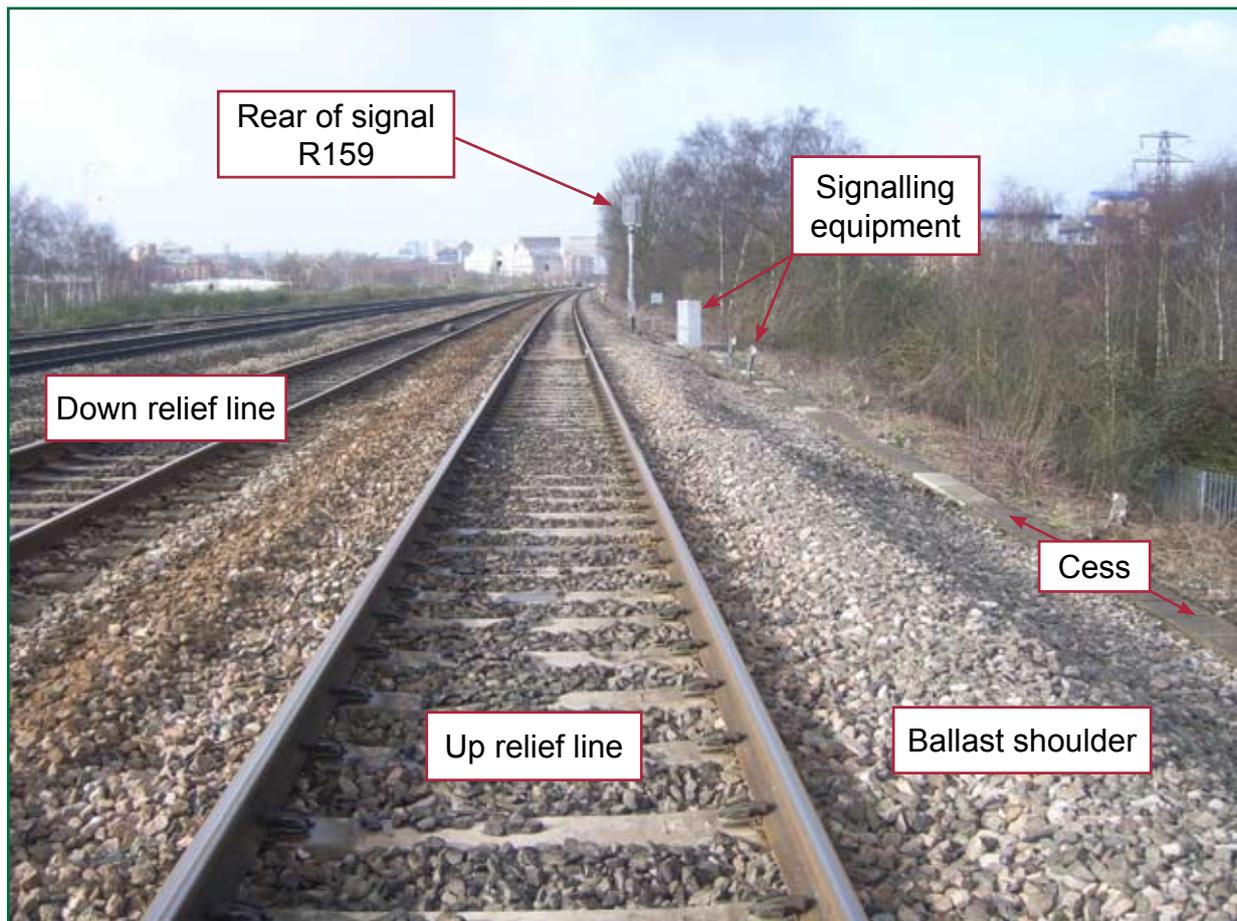


Figure 9: view west along the up relief line between detonator protection positions. The accident occurred beyond signal R159 in the centre of the photograph.

131 The Reading BRM was familiar with the site and had been responsible for placing or removing detonator protection for the up and down relief lines for 30 possessions since April 2007. He would therefore have walked between the down relief detonator protection position and the access point on at least 60 occasions previously. When placing protection at the start of a possession, the return leg of his walk would always occur within a *green zone*, allowing him to safely walk along the four-foot of either line, whereas at the end of the possession, a green zone would only apply if he completed his walk before confirming to the PICOP that the protection had been removed as the RIMINI plan intended. It is possible that the Reading BRM habitually used the four-foot of the up relief line when returning to the access point and did not differentiate between a low risk green zone situation and the higher risk red zone which ensued after he had contacted the PICOP to confirm that the detonator protection had been removed.

132 On this occasion, the Reading BRM elected to walk in the four-foot of the up relief line facing the normal direction of traffic. This action was permitted by the rule book (paragraph 119) and provided a walking route which was both reasonably level and free of obstructions. However, walking in the four-foot is discouraged in a red zone (ie when lines are open to traffic) unless there is no alternative and the rule book requires that the individual looks up frequently to obtain enough warning of approaching trains. He covered a distance of 260 metres (282 yards) in just over three minutes before encountering the train just after 04:53 hrs.

- 133 The Reading BRM's decision to use the four-foot of the up relief line as a walking route was reasonable, but his safety depended on him either being separated from trains by virtue of the T3 possession maintaining a green zone, or by keeping an adequate lookout for approaching trains. Being in the four foot without either of the above criteria being maintained put him in a position of danger from moving trains and was a causal factor in the accident.
- 134 The Reading BRM held the necessary qualifications for undertaking his duties and was medically fit. His roster pattern is considered unlikely to have led to work-related fatigue occurring, and there is no evidence that this was a factor in the accident.
- 135 Post-mortem toxicology results confirm that the Reading BRM had not taken drugs or consumed alcohol prior to the accident.

Removal of detonator protection

- 136 The planned safe system of work documentation provided to the Reading BRM did not provide guidance on the sequence for removing protection as it assumed that protection for the activities he was to undertake was provided by the T3 possession.
- 137 In electing to remove the protection from the up relief line as he passed, the Reading BRM created a situation whereby he was able to confirm that all protection had been removed as soon as he removed protection from the down relief line, enabling the PICOP to give up the T3 possession. This gave a small, but in this instance unnecessary, time advantage and allowed him to confirm that the protection had been removed within six minutes of being instructed to do so.
- 138 From the down relief detonator protection position, the Reading BRM required an estimated five and a half minutes to return to the Kings Meadow access point (Table 2) with the down relief possession limit board, then a further 90 seconds to return and collect the up relief possession limit board before he was finally clear of the line. Had he waited until he was clear of the line before contacting the PICOP, he would have made this call at approximately 04:57 hrs, 48 minutes before the planned completion time of 05:45 hrs.
- 139 By contacting the PICOP at 04:49 hrs (paragraph 49), and before he was finally clear of the line, the Reading BRM effectively modified the planned safe system of work (paragraph 98) and permitted the separated green zone protection provided by the T3 possession to be withdrawn around him. This left him at risk from train movements until he was able to clear himself and his equipment from the railway and meant that he was still some distance from the access point when train 5W01 arrived. The lack of adherence to the planned safe system of work was a causal factor in the accident.
- 140 Analysis of the timing of telephone calls between the PICOP and Reading BRM during the previous night's possession indicates a similar pattern of behaviour. This possession (WON item 22) involved the Reading BRM placing a second set of detonator protection at Reading station during part of the possession (paragraph 34). At 04:59 hrs, the Reading BRM confirmed that he had removed the detonator protection from Reading station and at 05:09 hrs he confirmed that he had removed detonator protection from the normal position on the down relief line (35m 05c). The ten minute interval between his calls to the PICOP was required for travelling between the two locations which are just over a mile apart and did not give him sufficient time to return to the access point before he contacted the PICOP for the second time. On that occasion, the PICOP did not give up the possession for a further six minutes as the Slough BRM was delayed in responding. This allowed the Reading BRM time to almost reach the access point by the time the possession was given up.

- 141 It cannot be ascertained why the Reading BRM contacted the PICOP before he was clear of the line. It is possible that he was under habitual time pressure to hand back the track as soon as possible, or that he did so at the earliest opportunity to avoid the risk of forgetting to contact the PICOP once he was finally clear of the line. However, he would not have known precisely when the possession was given up and he may not have comprehended the full significance of his action.
- 142 There is no evidence that the training received by the Reading BRM was inadequate, although the exclusion of personal track safety elements from the handsignaller course required a practitioner to combine information from several sources in order to establish a safe system of work. This training had not included any guidance on the sequence of placing and removing detonator protection to maintain a safe working environment.
- 143 The lack of such guidance allowed the Reading BRM to remove the protection in what was ultimately an unsafe order and was a contributory factor in the accident.

Actions taken by the PICOP

- 144 The PICOP managed the possession remotely from an office at Westbury, in accordance with the planned arrangements for this possession.
- 145 The PICOP had worked with both BRMs on numerous previous occasions and there was a good working relationship between them.
- 146 Telephone calls were kept brief, but were adequate for the purposes of directing the BRMs who were both familiar with their tasks and working environment.
- 147 The PICOP was satisfied that the protection had been removed and that the Reading BRM was clear of the line at the conclusion of a 17 second conversation initiated by the Reading BRM at 04:49 hrs.
- 148 There is no evidence that the actions of the PICOP contributed to the accident.

Arrival of train 5W01

- 149 Train 5W01 had departed Reading depot at 04:49 hrs, six minutes ahead of schedule and was routed onto the up main in expectation of the possession continuing until 05:45 hrs as booked. However, signal R51 at the east end of the station was held at danger due to a conflicting movement with a tamper crossing the path of 5W01, so initial progress was slow.
- 150 Train 5W01 was in the process of slowing to a stop on approach to signal R51 at precisely the time that the PICOP gave up possession of the relief lines, declaring that the lines were clear and safe and that all protection had been removed.
- 151 Train 5W01 was booked to travel via the up relief line, and the requirement to check the operation of the track circuits meant that it was an appropriate operational decision to route the train this way. The actions of the signaller did not contribute to the accident.
- 152 The relief lines were returned to service before train 5W01 came to a stand at signal R51, and it was therefore able to gather speed quickly once a proceed aspect was given. The train was able to accelerate quickly from a rolling start and was routed onto the up relief line within three minutes of the Reading BRM confirming that he had removed the detonator protection.
- 153 The unusually short timescale between his confirming that the detonator protection was removed and the arrival of the first train may have caught the Reading BRM unawares and was a contributory factor.

Driver's awareness of a person on the track

- 154 The driver was not aware that there was likely to be a member of Network Rail staff on the track in front of him as he left Reading station. Track safety rules depend on staff being aware of the presence of trains and moving to a place of safety before a train passes them.
- 155 The inclement weather on the morning of 29 November 2007 may have restricted general visibility from the driving cab. However, the train had been warmed prior to the driver's arrival and there is no indication that his forward view was affected by misting of the windscreen.
- 156 The Reading BRM was not wearing high visibility trousers and he did not have his high visibility waistcoat fastened up. When combined with the obscuring effect of the umbrella, this significantly limited the area of reflective material visible to the driver.
- 157 Train headlights are not designed to allow a driver to sight objects on the track far enough ahead for a train to stop since this would be impractical and would affect the night vision of drivers of approaching trains.
- 158 The driver became aware of a person on the track an estimated one second prior to impact. It is not possible to ascertain whether the driver could have seen a person on the track any earlier in the conditions that prevailed. Although he sounded the horn and applied the emergency brake, there was no other action he could have taken to avoid a collision. The actions of the driver did not contribute to the accident.
- 159 The effects of darkness and inclement weather resulted in the Reading BRM being less visible to the driver and were a contributory factor.

Identification of underlying factors

- 160 Detonators have been in use for railway protection and emergency purposes for over a century. The use of these devices carries inherent risk in that it requires staff to handle the devices, and also access the track, often alone and at night, in order to place and remove them. The requirement to place and remove on-track devices for this purpose is an underlying factor in the accident.
- 161 There is evidence that the level of contact between the possession co-ordinator and his staff was inadequate in terms of safety management, evidenced by the lack of formalised safety briefings and site visits (paragraphs 87 and 93). The BRM staff involved were lone workers and arguably in need of a greater level of support and guidance than other staff with peer support. The lack of site visits and safety inspections by the possession co-ordinator, or other managers, resulted in the Reading BRM being able to adopt working practices which increased his personal risk and contravened the safe system of work without this being identified. This was an underlying factor in the accident.
- 162 The Reading BRM's training needs identified by Assessment in the Line in March 2007, in particular relating to competence in safety critical communication, had not been followed up.
- 163 The possession co-ordinator's geographical area of responsibility had increased, as had the size of team for which he was responsible during early 2007. At the same time he lost the support of an experienced assistant (paragraph 91). The combined effect of these changes meant that the possession co-ordinator experienced a significant increase in his workload for which he was inadequately equipped or supported. This impacted on his ability to manage his team and was an underlying factor in the accident.

164 The processes in place for monitoring the completion of safety inspections were inadequate, in that they did not alert the infrastructure maintenance manager or area delivery planning manager to the shortfalls in this area. This may have been due to the vacant area maintenance workforce safety & environment advisor's position during the nine months preceding the accident, but suggests that the existing system had failed. This failure resulted in an unsatisfactory condition being allowed to continue unnoticed and was an underlying factor in the accident.

Conclusions

Immediate cause

165 The immediate cause of the accident was the Reading BRM walking in the four foot of the up relief line, but without looking up sufficiently frequently to make sure that he had enough warning of an approaching train. He was unable to reach a position of safety in sufficient time when a train approached.

Causal factors

166 Causal factors were:

- a. the Reading BRM's decision to use an umbrella in preference to the waterproof clothing with which he had been provided, which obscured his vision (paragraph 121, **Recommendation 1**);
- b. the Reading BRM's decision to use the four-foot of the up relief line as a walking route, in preference to the cess without using his knowledge and experience as a COSS and IWA to ensure his own safety (paragraph 133); and
- c. the Reading BRM's lack of adherence to the safe system of work which led to his informing the PICOP that detonator protection had been removed, thereby allowing the T3 possession to be given up, before he had returned to a permanent position of safety (paragraph 139, **Recommendation 2**).

Contributory factors

167 The following factors were considered to be contributory:

- a. the lack of guidance on how to withdraw the protection while maintaining a safe working area, which resulted in the Reading BRM electing to remove the up relief protection first and being in a position to confirm that all detonator protection had been removed, while he was still remote from the access point (paragraph 143, **Recommendation 2**).
- b. the unusually short timescale between his confirmation that the detonator protection was removed and the arrival of the first train, which may have caught the Reading BRM unawares (paragraph 153).
- c. the effects of darkness and inclement weather which resulted in the Reading BRM being less visible to the train driver (paragraph 159).

Underlying factors

168 The underlying factors were:

- a. the requirement for staff to access the track in order to place and remove detonator protection (paragraph 160, **Recommendation 3**);
- b. the lack of safety briefings which would have raised the Reading BRM's general awareness of track safety issues (paragraph 161);
- c. the absence of site visits by the Reading BRM's line manager, the possession co-ordinator, which denied the opportunity for his behaviour to be observed and possible safety improvements to be suggested (paragraph 161);
- d. the possession co-ordinator's workload which, following reorganisations, resulted in him being unable to adequately manage safety critical issues affecting his team (paragraph 163); and
- e. the lack of a robust process for monitoring the completion of safety tours and planned general safety inspections, leading to an ongoing lack of awareness by the infrastructure maintenance manager of these omissions (paragraph 164, **Recommendation 4**).

Additional observation

169 The position of the possession limit boards were not marked or otherwise indicated on site. The weighted feet remained in position between possessions (Figure 3), but these were not fixed down and were observed to move between site visits made by the RAIB. The lack of markings would make it difficult for a BRM, or a manager, to confirm that protection was being positioned in the correct place (**Recommendation 5**).

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

170 Network Rail issued a safety bulletin to all staff immediately following the accident which stated:

“In all cases before the person removing detonator protection confirms to the PICOP that it has been lifted they must either:

- be in a position of safety permanently clear of running lines and with no further need to be on or near the line;

OR

- have sufficient sighting to protect their own safety while walking back to the permanent position of safety under PTS arrangements;

AND when protection has been lifted the railway must be considered to be a fully operational railway.”

171 Network Rail have reported taking action to address an underlying factor in this accident, by trialling possession protection arrangements using signals fixed at red protected by TPWS equipment in place of detonators and possession limit boards. This removes the need for staff to access the track for the purpose of placing or removing protection. If considered successful, this may lead to changes to the railway rule book by December 2009.

172 Network Rail have commenced a review of the planning and safety related documentation (RIMINI) provided to staff accessing the track, to improve the clarity and accuracy of the information provided.

Recommendations

173 The following safety recommendations are made¹:

Recommendations to address causal and contributory factors

- 1 Network Rail should specifically prohibit the use of umbrellas by staff on or near lines which are open to traffic (paragraph 121);
- 2 Network Rail should introduce procedures to improve the safety of staff removing detonator protection by:
 - a. reinforcing the message that persons removing detonator protection should either be permanently clear of the running lines, or have sufficient sighting to protect their own safety while walking back to the permanent position of safety before confirming to the PICOP that the protection has been lifted, for example by including this information in the RIMINI plan (paragraphs 139 and 170); and
 - b. providing guidance to BRMs on the sequence for withdrawing detonator protection to reduce the opportunity for a possession to be given up unintentionally before staff are clear of the track (paragraph 143);
- 3 Network Rail should look critically at the possession management process to reduce the need for staff to be on the track for the purpose of taking or giving back a possession (paragraphs 160 and 171); and
- 4 Network Rail should introduce a structured approach to the monitoring of compliance with Network Rail's standard maintenance procedure NR/PRC/MTC/0117 'Planned general safety inspections' (paragraph 164), and incorporate in this the means to assess the workload of those tasked with undertaking these inspections.

Recommendations to address other matters observed during the investigation

- 5 Network Rail should, at those locations where T3 protection is regularly placed, introduce a system to physically mark the location of possession limit boards on the track to assist staff in positioning and checking the position of equipment (paragraph 169), or consider installing a semi-permanent possession limit board system.

¹ Duty holders, 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 ORR 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 167 to 171) can be found on RAIB's web site at www.RAIB.gov.uk

Appendices

Appendix A - Glossary of abbreviations and acronyms

AWS	Automatic warning system
BRM	Blocked road man
CCTV	Closed circuit television
COSS	Controller of site safety
DMU	Diesel Multiple Unit
IWA	Individual working alone
OTDR	On-train data recorder
PICOP	Person in charge of possession
PTS	Personal track safety
RIMINI	Risk minimisation plan
TPWS	Train protection and warning system
WON	Weekly operating notice

Appendix B - Glossary of terms

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

Assessment in the line	Part of the competence management system covering Network Rail's employees involving an assessment of competence carried out under the supervision of an employee's line management.
Automatic warning system	A fail-safe arrangement of permanent magnets and electro-magnets placed in the four foot that convey information about the aspect of the associated signal to the train driver.*
Automatic warning system magnet (AWS magnet)	A component of the automatic warning system (AWS) which is fixed in the centre of the track 186 metres on the approach to a signal. The status of the magnet is controlled by the signalling system and activates the vehicle mounted equipment of passing trains. The status of the signal is shown as an input on the on-train data recorder equipment.*
Blocked road man	A colloquial term for a person who lifts and replaces the protection at the limit of a possession, on the instructions of the PICOP or signaller as appropriate. These duties are performed by a person holding the handsignaller competency.*
Cab secure radio	A radio system provided to allow signaller and train driver to communicate safety critical information as securely as if they were speaking on a land line such as a signal post telephone (SPT).*
Cess	The part of the track bed outside the ballast shoulder that is deliberately maintained lower than the sleeper bottom to aid drainage, provide a path and a position of safety.*
Chains	A unit of length, being 66 feet or 22 yards (approximately 20.117m). There are 80 chains in one standard mile.*
Detonator	The universal colloquial term for a Railway Fog Signal, these are a small disc shaped explosive warning device designed to be placed on the railhead for protection and emergency purposes. It explodes when a train passes over thus alerting the driver. Despite not fulfilling the definition of an explosive detonator in any way, Detonator is the industry standard term.*
Detonator protection	Possession protection comprising three detonators placed on the rail head at 20 metre intervals and a possession limit board opposite the middle detonator.
Down (line)	Line running away from London
Engineering Supervisor	The person nominated to manage the safe execution of works within an Engineering work site. This includes arranging the Marker Boards, authorising movements of Trains in and out of the work site and managing access to the site by Controllers of Site Safety (COSS).*

Four-foot	The area between the two running rails of a standard gauge railway.*
Green Zone	A safe place of work on or near the line. Such an area can be created by safeguarding, that is stopping all train movements by taking some form of possession.*
Infrastructure Maintenance Contractor	Formerly, the organisation with responsibility for the Maintenance of Overhead Line Equipment (OLE), Signalling and Track in a geographical area.*
On or near the line	A position within 3 metres of the nearest rail, or on the line itself. Excludes areas that are on the other side of a permanent fence or structure, even if it is less than 3 metres from the nearest rail.
On-track machine	Any piece of specialist railway plant which moves only on the rails and is normally self propelled.*
On-train data recorder (OTDR)	A data recorder fitted to traction units collecting information about the performance of the train, including speed, throttle and brake control positions, activations of horn and AWS cancel button, etc.*
Person in charge of possession	See 'PICOP'
PICOP	The competent person nominated to manage the following: <ul style="list-style-type: none"> • Safe and correct establishment of the protection for the possession, complete with detonators, point clips, possession limit boards and signals keyed to danger as required • Managing access to the possession area by engineering supervisors • Managing the establishment of engineering work sites within the possession • Liaising with the signaller regarding the passage of the train into and out of the possession.*
Possession limit board	A miniature version of the stop sign used on the roads, denoting the end of a Possession.*
Proceed aspect	A signal aspect which authorises a driver to pass that signal (ie yellow or green).*
Protecting signal	A signal that is used to protect a possession *
Red Zone	A area that is on or near the line and is too close to lines open to traffic to be a green zone. Red zone working can only be used if there is no realistic alternative and is banned in some situations (Red zone prohibited).*
Relief line	Alternative title for a slow line, mainly used on the former Western Region.*
RIMINI	<u>Risk Minimisation</u> , a standardised process for identifying and recording the safest practical Protection system for a particular activity undertaken On or Near the Line.*

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.*
Safe system of work	An arrangement of precautions which ensure that workers are exposed to least possible risk. This can include COSS briefings, provision of special equipment, possessions and isolations. The latter arrangements are the responsibility of a controller of site safety (COSS) or protection controller.*
Separated green zone	A green zone where a distance of at least 3 metres is maintained between the site of work and the nearest rail of the nearest line outside the site of work, whether the line is open to movements or not.
Sentinel card	Sentinel is the brandname for the competency control system operated by the National Competency Control Agency (NCCA) and is based on photographic identity cards. The cards details of medical fitness and railway related competencies.
T3 possession	The rules applying to Possessions of Running Lines, also known as Absolute Possession. Under these arrangements the times and extents are agreed in advance, but The Engineer decides when the Possession is given up, not the Signaller.*
Track circuit block	A signalling system where the line is proved clear to the overlap beyond the next signal using track circuits or axle counters.*
Train protection and warning system (TPWS)	An automatic trackside and on-train system which enforces limits on the speeds of trains that pass so as to avoid collisions.*
Up (line)	Line running towards London.
Weekly Operating Notice	A document published on a route basis, providing information about Engineering Work, Speed Restrictions, alterations to the network and other relevant information to train drivers.*
Work Site	The area within a Possession that is managed by an Engineering Supervisor.*

Appendix C - Key standards current at the time

NR/SP/OHS/019	Safety of people working on or near the line
NR/PRC/MTC/SE/0117	Standard maintenance procedure 'Planned General Safety Inspections'
NR/PRC/MTC/SE0118	Safety Tours
GM/RT2483	Visibility requirements for trains
GE/RT8000	Railway rule book

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