RAIB

Rail Accident Investigation Branch

Rail Accident Report

Near miss incident at Ufton Automatic Half Barrier Crossing, Berkshire 4 September 2011

Report 28/2012
December 2012

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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Near miss incident at Ufton Automatic Half Barrier Crossing, Berkshire, 4 September 2011

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Summary

At 12:28 hours on Sunday 4 September 2011, the 11:13 hrs train from London Paddington to Bedwyn went over Ufton level crossing at a speed of 61 mph (98 km/h) while the barriers were in the raised position and the red road traffic signals were not flashing. A car approaching the crossing had to stop suddenly to avoid a collision. Engineering work meant that the equipment which normally operated the crossing automatically had been disabled and the crossing barriers and lights were being operated by an attendant located at the crossing.

The incident occurred because a signaller did not carry out the rules requiring him to speak with the attendant and the train driver so that the barriers were lowered and the train approached the crossing at low speed. It is probable that these omissions were a result of a lapse and the signaller being overloaded by activities that he was required to undertake in connection with the engineering work and the resumption of passenger services after completion of this work. It is possible that the signaller actions were affected by shortcomings in the presentation of information on the display screens used at his workstation. Inadequate consideration of signallers' workload associated with engineering work is considered a probable underlying cause.

The RAIB has made seven recommendations addressed to Network Rail. Five directly relate to the incident and cover presentation of information on display screens used by signallers; the introduction of an interface intended to remind signallers to take appropriate precautions when automatic crossings are being controlled by attendants; and consideration of signallers' workload when planning engineering work. Two recommendations, based on observations made during the investigation, relate to the positioning and removal of the red flags and red lights used by level crossing attendants to stop trains.

Introduction

Preface

1 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.

2 The RAIB does not establish blame or liability, or carry out prosecutions.

Key definitions

3 All dimensions and speeds in this report are given in metric units, except speed and locations which are given in imperial units, in accordance with normal railway practice. Where appropriate the equivalent metric value is also given.

4 Locations on the railway are referenced by distance from London Paddington.

5 Ufton crossing is on the Berks & Hants line and carries trains running between Reading and Westbury. Trains heading towards Westbury are running in the 'down' direction and those towards Reading in the 'up' direction according to UK mainline railway convention. The up line is known as the 'up Westbury' and the down line, the 'down Westbury'.

6 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.

The incident

Summary of the incident

7 At 12:28 hrs on Sunday 4 September 2011 train reporting number 1K54, the 11:13 hrs service from London Paddington to Bedwyn, passed over Ufton crossing (between Aldermaston and Theale, Berkshire) while the barriers were raised and the red stop lights were not flashing on the *road traffic light signals*. A car, which was approaching from the south east on Ufton Lane at a slow speed, had to stop suddenly to avoid colliding with the train (figures 1, 2 and 3).

8 The train had been travelling at 61 mph (98 km/h) and, because the train driver had seen the approaching car and realised the barriers were raised, was braking heavily as it passed over the crossing. The train stopped approximately 480 metres after the crossing.

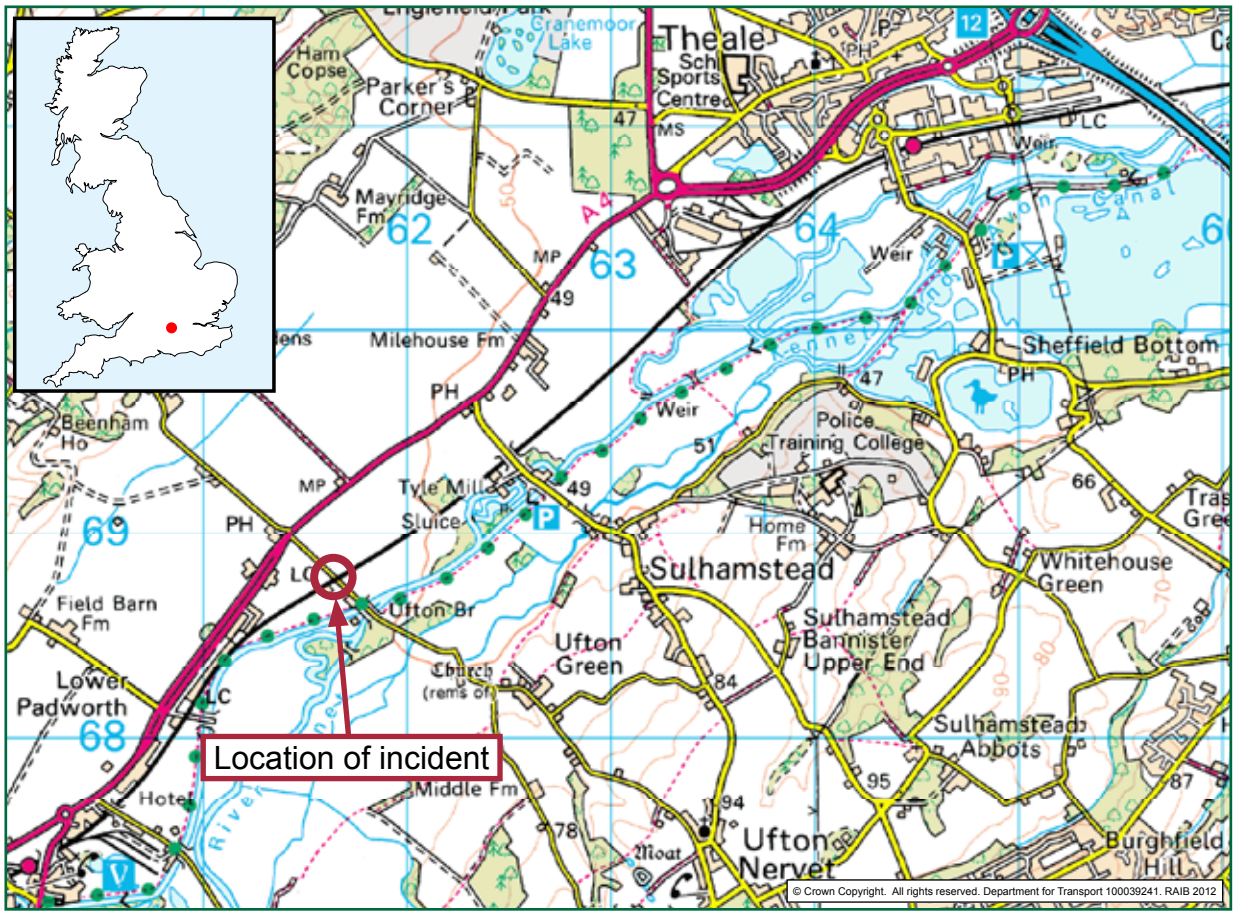


Figure 1: Extract from Ordnance Survey map showing location of incident

9 No injuries or damage resulted from the incident, but there was clearly potential for a collision between the train and the car.

10 The double track main line over Ufton crossing had been closed since 01:13 hrs on 4 September in connection with engineering work. The down line was re-opened at 12:15 hrs and train 1K54 was the first train to travel over Ufton crossing. The up line remained closed for engineering work until 14:28 hrs the same day.

11 At the time of the incident, Ufton crossing was being controlled by a person located at the crossing. This person, known as a level crossing attendant, had not received any instruction from the signaller to lower the barriers before the train arrived.

Context

Location

12 Ufton level crossing is located to the south west of Reading, Berkshire. The crossing is situated on Ufton Lane, 0.2 miles (0.3 km) from the A4 road and approximately 1.4 miles (2.3 km) from Ufton Nervet village.

Figure 2: Ufton Automatic Half Barrier crossing looking north west along Ufton Lane

13 The level crossing is situated 43 miles 39 chains from London Paddington and lies between Theale and Aldermaston (figure 3).

14 Road traffic usage over the crossing is light. Ufton Lane is an unclassified road and the majority of road traffic to Ufton village uses other routes which cross the railway by road bridges.

Organisations involved

15 Network Rail owns, operates and maintains the main line infrastructure at Ufton, including the level crossing. It employed the signallers at the Thames Valley Signalling Centre (TVSC).

16 First Great Western (part of FirstGroup plc) operates the passenger service between London Paddington and Westbury, including train 1K54. It employed the driver of that train.

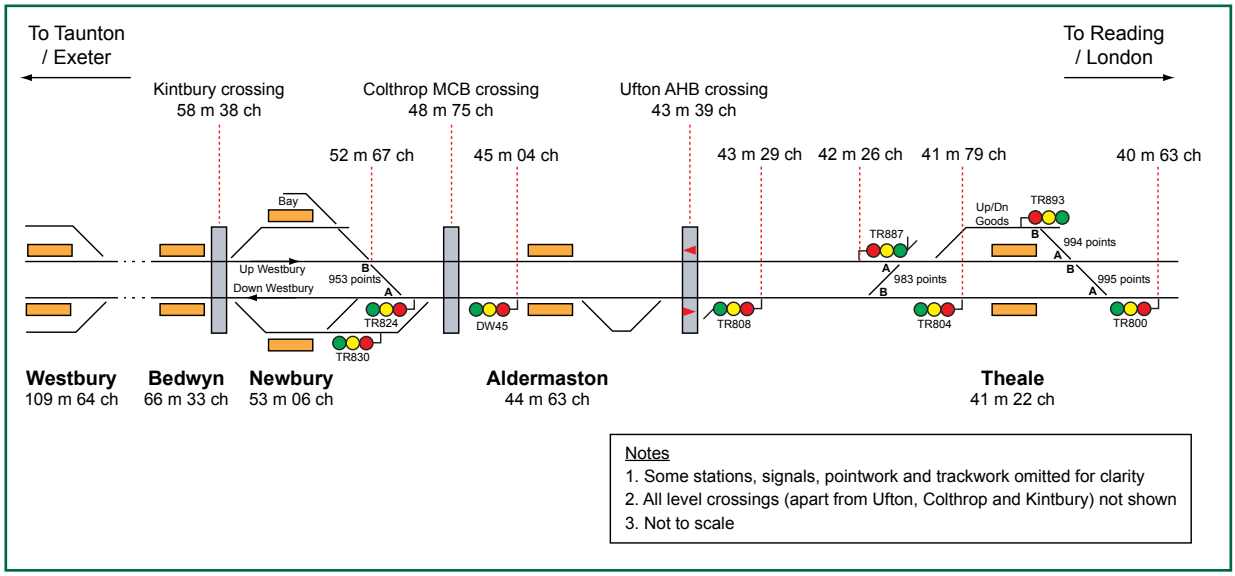


Figure 3: Track plan

17 AmeyColas (a joint venture between Amey and Colas Rail) had sub-contracted McGinley Support Services (part of McGinley Group) to provide a level crossing attendant at Ufton crossing. AmeyColas also provided some of the staff needed for work connected with the engineering work on Sunday 4 September.

18 Network Rail, First Great Western, AmeyColas and McGinley freely co-operated with the investigation.

Train involved

19 The train involved in the incident was a three carriage Class 165 diesel multiple unit. The Class 165 units were introduced into service between 1990 and 1992 and operate at speeds of up to 90 mph (140 km/h).

Rail equipment/systems involved

Thames Valley Signalling Centre (TVSC)

20 Thames Valley Signalling Centre (TVSC) is an *Integrated Electronic Control Centre* (IECC) system. TVSC is located at Didcot and controls part of Network Rail's Western Route. Control of the incident area's signalling and the associated signallers were transferred from Reading signal box to the TVSC in 2010, as part of a phased transfer of control from existing signal boxes. At the time of the incident, the IECC was controlling the line from Reading (inclusive) to Westbury (exclusive).

21 The TVSC contained five IECC *workstations* all in one large room with one signaller operating each of the four workstation positions and one signaller shift manager supervising the signallers at the fifth workstation. Each workstation included several flat screen visual display units (VDUs) displaying the track layout and the position of trains. The signaller monitors the trains and operates the equipment to set *routes* and operate points etc using a tracker ball with buttons and a keyboard (figures 4 and 5). Each workstation also includes a *Cab Secure Radio* (CSR) system (for direct communication with a train driver) and a touch screen telephone system.

22 The Newbury workstation covered the area from Theale (inclusive) in the east to Westbury (exclusive) in the west. This included Ufton crossing.

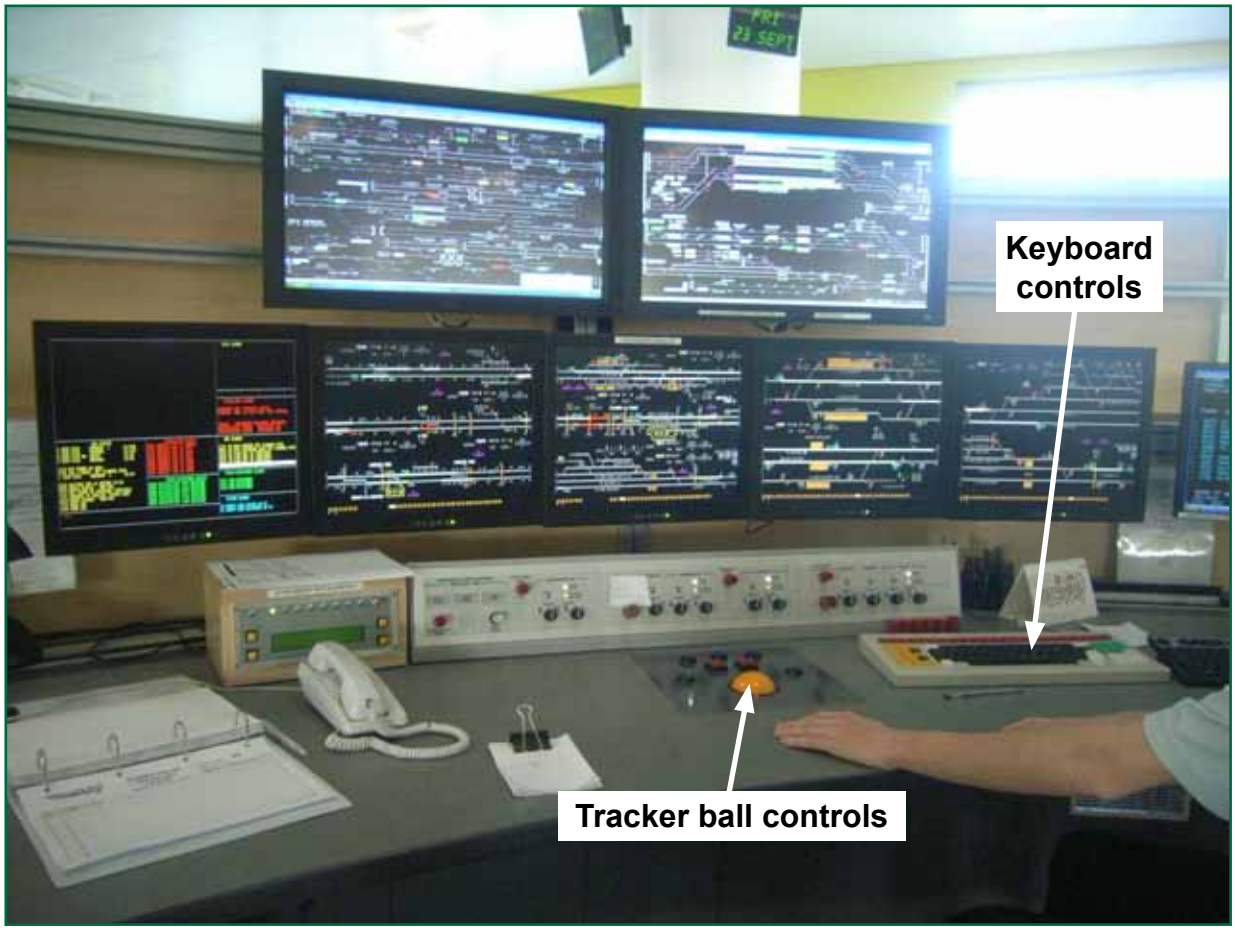


Figure 4: Newbury workstation

Use of signal reminder, point reminders and engineering possession 'highlighting'

23 When operating the signalling system it is sometimes necessary for the signaller to maintain a signal at danger. One example of this is the requirement to maintain all *controlled* signals at danger within engineering *possessions* when lines are closed to normal traffic so engineering work can take place. For such cases the IECC system is provided with a 'reminder' function that can be activated by the signaller. Once applied, this prevents the signaller from clearing the signal in the normal manner.

24 When a reminder is used on an IECC system a coloured symbol surrounds the piece of equipment selected on the workstation display screen. For example, a blue box surrounds the existing signal head when a reminder is placed on that signal (figure 6).

25 Signallers are also required to place blue engineering possession 'highlighting' around lines when they are under possession (figure 6). Signallers select the appropriate track sections that are to be highlighted by operating workstation keyboard commands.

Ufton Automatic Half Barrier Crossing (AHB)

26 Ufton level crossing is an Automatic Half Barrier crossing (AHB) (figures 2 and 7). The road traffic light signals and barrier lowering are normally automatically activated by an approaching train. There is no automated linkage between an AHB and the railway signals. In normal operation the crossing operates independently from the railway signals.

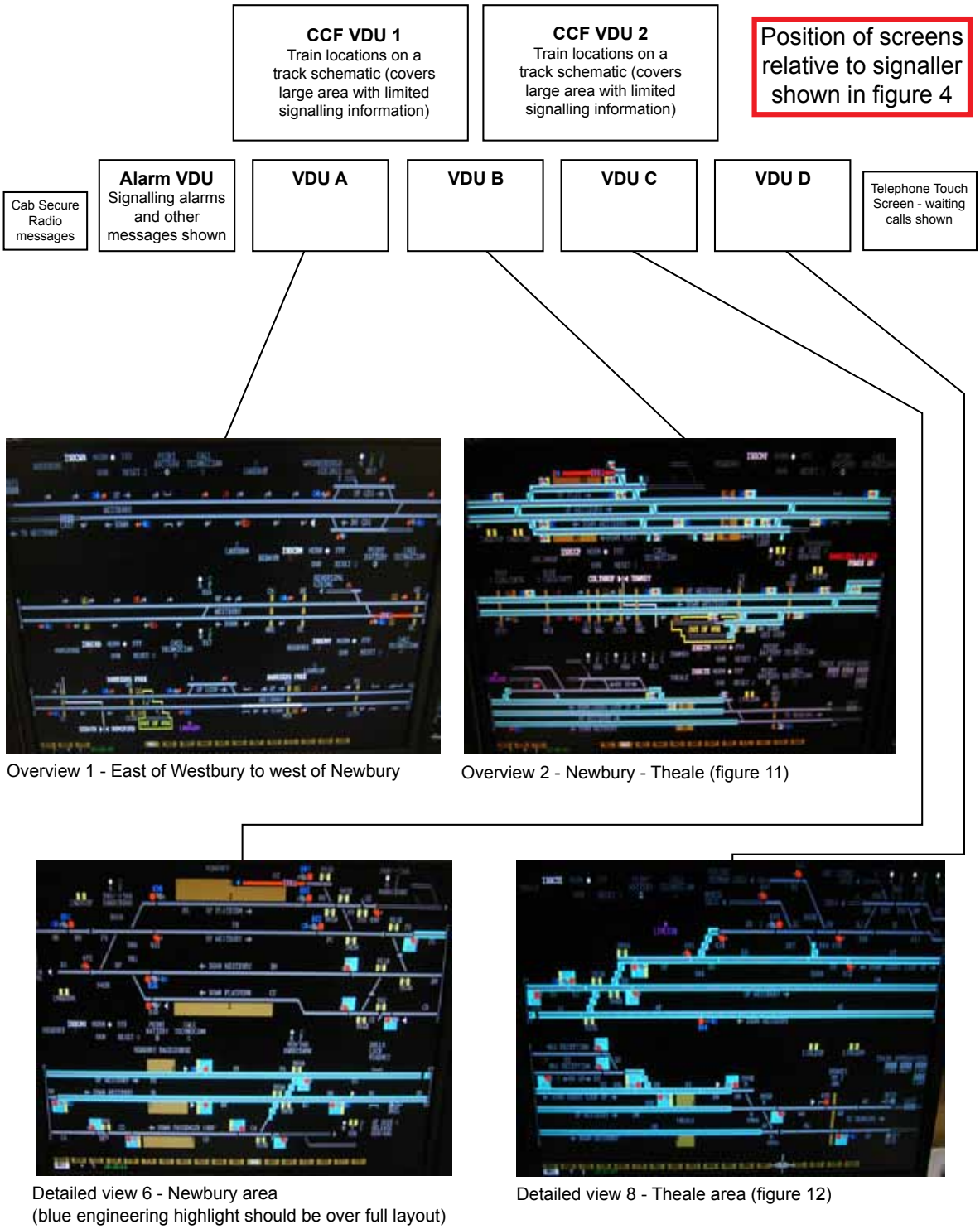


Figure 5: Newbury workstation screens as probably displayed when signaller B took over the workstation on Sunday 4 September 2012

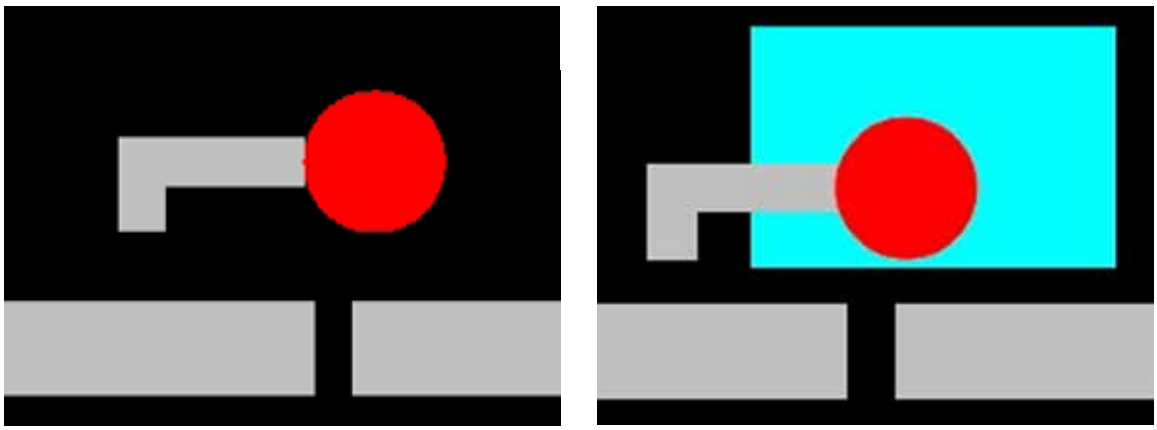


Figure 6: Selected symbols used on VDU displays

27 At times of failure of the crossing equipment, or when the lines are under possession (so trains can approach in the wrong direction or at an abnormally low speed), the level crossing is not allowed to operate automatically. During these times a level crossing attendant is present and operates the crossing from a control panel at the barriers, a procedure known as *local control*. When under local control the automatic operation of the crossing is disabled.

28 The level crossing attendant at Ufton is expected to operate the barriers in accordance with verbal instructions from the Newbury workstation signaller in the TVSC for train movements on a line that is open to traffic and from an *engineering supervisor* (ES) or *person in charge of possession* (PICOP) for movements on a line that is under possession.

29 The level crossing attendant is required to display a red flag or red light to rail traffic unless the barriers are lowered and it is safe for trains to use the crossing.

Signal TR808 at Ufton crossing

30 Signal TR808 is the *protecting signal*[1] for Ufton crossing on the down line (figure 3). It is the last signal before the crossing and the signaller can directly operate controls to maintain it at a *stop aspect*. It is positioned at 43 miles 29 chains from London Paddington station.

[1] Signal TR808 normally operates independently of Ufton AHB. When the crossing is under local control, signal TR808 becomes the 'protecting signal' and is operated to a red (stop) aspect by the signaller until he has applied the procedures permitting a train to pass over the crossing.

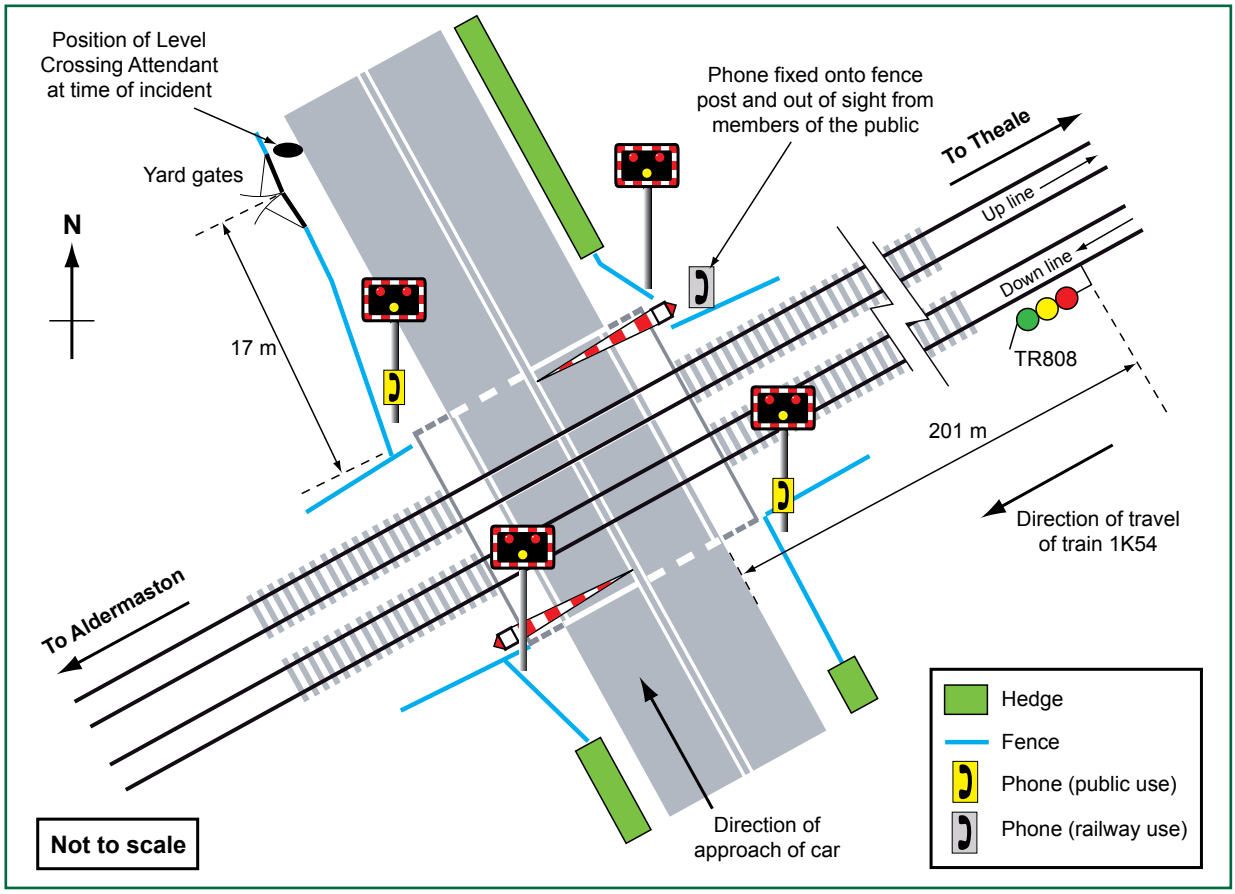


Figure 7: Plan of crossing

Engineering possession of the lines

31 The double track main line between Reading and Westbury had been under possession from 01:13 hrs on 4 September. The work involved the removal of old rail, re-ballasting, the laying and welding of new rail, *tamping* work and the disconnection and reconnection of some signals and associated equipment. This included reconnection and testing of signal TR887.

32 The possession had been planned in four parts which allowed restricted passenger services to operate before all engineering work was complete (figure 8). The plan had been circulated to TVSC signalling staff and engineering staff before the possession started and a summary of the four part plan is shown below:

- Part 1: 00:50 hrs to 12:00 hrs:
  all lines closed between Westbury (exclusive) and Theale (inclusive);
- Part 2: 12:00 hrs to 12:20 hrs:
  Newbury station area and both lines from Westbury through Bedwyn to Newbury reopened;
- Part 3: 12:20 hrs to 12:45 hrs:
  down Westbury line reopened from Theale to Newbury allowing train 1K54 to operate in the down direction; and
- Part 4: 12:45 hrs to 16:20 hrs:
  crossover and up Westbury line reopened at Theale station allowing up direction trains to operate between Newbury and Theale via the down line under *single line working* conditions.

33 In order to implement a possession, the signaller and PICOP should liaise to follow a procedure to prevent trains entering the possession. The signaller stops normal traffic by setting selected signals to a stop aspect and applies reminder devices and engineering possession 'highlighting' (paragraphs 23 to 25). The PICOP should arrange for physical warnings (possession limit boards and detonators) to be placed on the railway at the limits of the possession. When the possession is no longer required, the physical warnings should be removed by possession staff before the PICOP hands back the railway to the signaller. The signaller then should remove the reminders and possession 'highlighting' that were applied at the beginning of the possession.

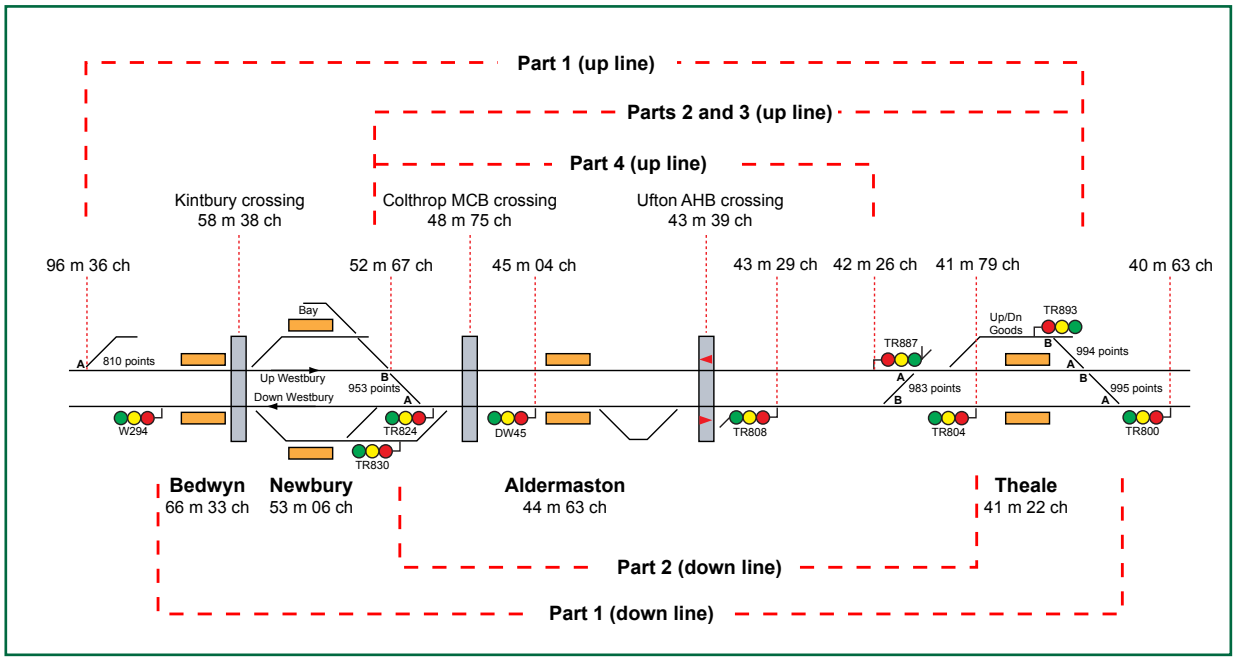


Figure 8: Schematic diagram of possession limits (parts 1 to 4)

Staff involved

The driver

34 The driver of train 1K54 had been employed by First Great Western for four years and had been fully qualified as a driver since 1980.

Signaller A

35 Signaller A was employed by Network Rail and had 24 years experience. He transferred to Reading panel signal box in 1992 and subsequently to TVSC in 2010.

Signaller B

36 Signaller B was employed by Network Rail and had eight years experience. He transferred to Reading panel signal box in 2007 and subsequently to TVSC in 2010.

The level crossing attendant

37 The level crossing attendant was employed by McGinley and had nine years experience in various trackside roles. He had held the Network Rail 'auxiliary operating duties' competence, required to act as a level crossing attendant, for just over one year and had worked as a level crossing attendant on many occasions during this period.

External circumstances

38 The weather at Ufton crossing at the time of the incident was light rain and drizzle. The sky was overcast and cloudy. Weather conditions did not contribute to the incident.

The investigation

Sources of evidence

39 The following sources of evidence were used:

- witness statements;
- the train's *on train data recorder* (OTDR);
- the IECC signalling time and data records;
- results from RAIB simulation testing and reconstruction of the incident on an IECC simulator workstation;
- voice recordings of telephone conversations related to the incident;
- forward facing and rear facing Closed Circuit Television (FFCCTV and RFCCTV) recordings taken from train 1K54;
- site photographs;
- weather reports and observations at the site;
- records of previous reported occurrences at the crossing (none of which transpired to be relevant to this incident);
- level crossing accident and incident data held by RSSB[2]; and
- previous RAIB investigations that had relevance to this incident.

[2] A rail industry body formerly known as the Rail Safety Standards Board.

Key facts and analysis

Sequence of events

Events preceding the incident

40 The level crossing attendant booked on duty at Ufton crossing at 08:00 hrs on 4 September and relieved another attendant who had been at the crossing since 01:20 hrs that morning.

41 Signaller B booked on duty at 05:30 hrs on 4 September 2011 and worked on other workstations at TVSC until 11:58 hrs, when he begun work at the Newbury workstation.

42 At 11:27 hrs, the PICOP (for the possession between Theale and Westbury) rang signaller A[3] at the Newbury workstation to confirm details of the possession. During the conversation, the PICOP gave signaller A a mobile phone number for the level crossing attendant at Ufton crossing. The mobile number was incorrect.

43 At 11:56:02 hrs, the engineering supervisor rang signaller A to request permission for signalling testing staff to ring the signaller to request certain routes to be set as part of the re-connection and testing of signal TR887. Signaller A agreed with the request.

44 At 11:56:44 hrs, the PICOP rang signaller A to state the possession limits were now reduced to the part 2 limits (paragraph 32 and figure 8). The signaller agreed with the possession alterations and completed the associated paperwork.

45 At approximately 11:58 hrs, signaller B booked on duty at Newbury workstation and received a handover from signaller A who then left the operations floor.

46 Subsequent events leading to the near miss at Ufton crossing are shown on the timeline at figure 9 and described in paragraphs 47 to 67.

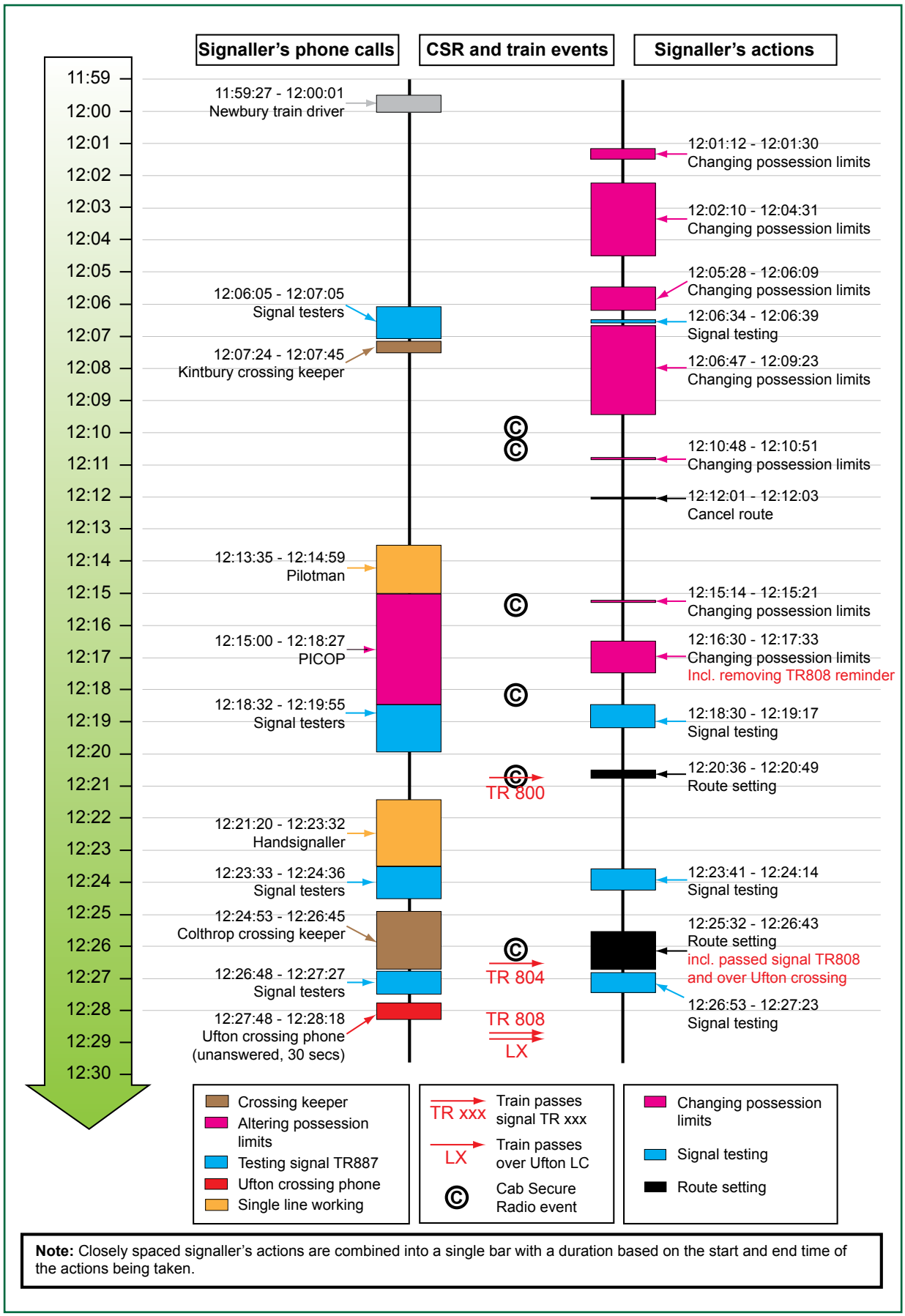
47 Signaller B immediately removed the signal reminders, point reminders and engineering possession highlighting from areas which had been returned to normal traffic when part 2 of the possession had been implemented. He then operated the controls needed to allow a train berthed in Newbury station bay platform 3 to be shunted to platform 2. These actions were completed by 12:09:23 hrs.

48 At 12:06:05 hrs, during the signallers work described above, a signal tester rang the signaller to request a route to be set as part of the testing needed for signal TR887 (figure 3). The signaller agreed and set the route at 12:06:34 hrs.

49 At 12:07:24 hrs, the signaller telephoned the crossing keeper at Kintbury CCTV level crossing to inform him that a train running from Newbury to Bedwyn would be with him shortly.

50 Train 1K54 arrived at signal TR800 at approximately 12:09:56 hrs. This signal was displaying a red (stop) aspect.

[3] Signaller A was already working at Newbury workstation and was about to change over with another signaller.



Note: Closely spaced signaller's actions are combined into a single bar with a duration based on the start and end time of the actions being taken.

Figure 9: Timeline

51 At 12:13:35 hrs, the signaller received a call from the *pilotman* in connection with single line working (paragraph 32). During this call, the pilotman provided the correct phone number for the level crossing attendant at Ufton crossing. The call ended at 12:14:59 hrs. Immediately after this call ended, the PICOP rang the signaller to implement part 3 of the possession (figure 8). This involved the re-opening of the down line between Theale and Newbury. However, since the up line was still under possession, the level crossing at Ufton remained under local control.

52 During the call from the PICOP, the signaller removed reminders from five signals within the area being returned to normal traffic by the PICOP. This included signal TR808, the protecting signal for Ufton crossing. As soon as the call ended, the signaller placed a reminder on signal TR804.

53 At 12:18:32 hrs, five seconds after the call from the PICOP ended, the signal tester rang the signaller to request a different route to be set (and points to be operated) as part of testing signal TR887. The signaller completed the operations associated with the testing during the call and the call ended at 12:19:55 hrs.

54 After train 1K54 had been standing at signal TR800 (figure 3) for 11 minutes and 13 seconds (during which the train driver had used the Cab Secure Radio (CSR) to transmit one CSR 'standing at signal' and three 'request to speak to signaller' alarms to the signaller), the signaller set the route from TR800 to signal TR804 at 12:20:49 hrs. Signal TR800 changed from a red to a yellow aspect and train 1K54 started to move forward.

55 At 12:23:56 hrs, train 1K54 arrived in the down platform at Theale station and, after completing platform duties in approximately 34 seconds, the train departed.

56 At 12:21:20 hrs, a *handsignaller* rang the signaller to discuss the forthcoming single line working (paragraph 32). This call ended at 12:23:32 hrs.

57 Immediately this call ended, the signal tester rang the signaller to request another route to be set from signal TR887. This was at 12:23:33 hrs. The signaller completed the operations associated with the testing during the call and the call ended at 12:24:26 hrs.

58 From 12:25:32 hrs to 12:26:45 hrs, the signaller had a telephone conversation with the crossing keeper at Colthrop (figure 3) to discuss the running of train 1K54 over his crossing. During this conversation the following occurred:

- other crossings under local control were discussed, but Ufton crossing was not mentioned;
- at 12:25:32 hrs the signaller removed the reminder from signal TR804 (paragraph 52);
- at 12:25:34 hrs train 1K54 approached signal TR804 at red and stopped;
- at 12:25:58 hrs the driver of train 1K54 sent a CSR 'standing at signal' alarm to the signaller;
- at 12:26:32 hrs the signaller set the route from signal TR804 to signal TR808 (the protecting signal for Ufton level crossing); and
- at 12:26:43 hrs the signaller set the route from signal TR808 to signal DW45 (over Ufton level crossing).

59 The signaller had not instructed the level crossing attendant to lower the barriers at Ufton crossing and had not *cautioned* the driver of train 1K54 that the crossing was under local control and to approach at caution.

60 After receiving a *proceed aspect* at signal TR804, the driver of train 1K54 applied power and his train accelerated away from the signal.

61 At 12:26:48 hrs (3 seconds after the signaller had finished speaking with the Colthrop crossing keeper) the signaller answered a telephone call from the signal tester to state he had completed the testing. The call ended at 12:27:27 hrs.

62 At 12:27:48 hrs, the signaller attempted to contact the level crossing attendant by ringing Ufton crossing phone in order to check that the barriers had been lowered. The signaller let the phone ring for 30 seconds, but it was unanswered. The signaller did not ring the level crossing attendant's mobile phone.

63 Immediately following this, the shift signaller manager (SSM) observed that signal TR808 was *clear* on his VDU, and had not heard the signaller caution the driver of train 1K54 (ie warn the driver that Ufton crossing was under local control). The SSM asked the signaller if Ufton was under local control and the signaller confirmed that it was. That was approximately 15 to 20 seconds before the near miss occurred.

64 As the train passed signal TR808 at 12:28:50 hrs, it was travelling at 61 mph (98 km/h) and the signal was displaying a green (proceed) aspect. This was 201 metres on the approach to the crossing.

65 Approximately 147 metres further on and 54 metres on the approach to the crossing, the driver of train 1K54 saw the car approaching the crossing (from the south east). He realised that the barriers were raised and sounded the train warning horn for 1.5 seconds at 12:28:54 hrs. At about the same time, he also shut off power and made a *full service brake* application.

Events during the incident

66 The car driver, who was approaching the crossing at approximately 15 mph (24 km/h), became aware of the train just before reaching the crossing and braked immediately. The car stopped past the raised barrier and approximately two metres from the nearest *running rail* (figure 10).

67 The train was travelling at 61 mph (98 km/h) as it passed over the crossing at 12:28:56 hrs. By this time it was braking heavily.

68 The level crossing attendant, who was standing approximately 17 metres away from the barriers at Ufton was aware of a car approaching from the south east side of the crossing, but was unaware of the train until it was passing over the crossing.

Events following the incident

69 As soon as the train had passed over the crossing the level crossing attendant rang the pilotman who then contacted the signaller to report the near miss. Witness evidence suggests that the level crossing attendant phoned the pilotman because this was the last person the attendant had spoken with concerning train movements over the crossing, a conversation which had taken place less than 15 minutes before the incident.

Figure 10: Rear facing CCTV image from train 1K54 showing Ufton Crossing and the car involved in the near miss

70 At about the same time, the car driver reversed his car to check that the road traffic signals were not illuminated. Having found that they were not illuminated, he drove over the crossing and onwards to his final destination.

71 The train stopped approximately 480 metres after the crossing and the train driver immediately contacted the Newbury signaller by both the CSR system and by telephone from the cab.

72 On receiving the details of the near miss, signaller B immediately placed a reminder on signal TR808 (the protecting signal for Ufton crossing).

73 At 12:37:54 hrs, signaller B contacted the driver of train 1K54 and, after the driver stating that he was fit to continue driving, gave him permission to take the train forward to Newbury. At approximately 12:40 hrs, train 1K54 began moving forwards towards Newbury.

74 At 12:42 hrs, the PICOP and a signaller (that had relieved signaller B) agreed that the possession was to be altered to part 4 of the possession plan (paragraph 32).

75 At 14:28 hrs, the possession was given up which allowed the normal operation of up and down trains.

Identification of the immediate cause[4]

76 **The signal protecting Ufton crossing was displaying a green (proceed) aspect to the driver of 1K54 as the train approached despite the barriers being in the raised position.**

Identification of causal factors[5]

77 **The signaller did not stop and caution the driver of train 1K54 at signal TR808 (the signal protecting the crossing) to inform him that Ufton crossing was under local control. This was a causal factor.**

78 The rules relating to signaller's instructions are contained in module TS9 of the railway Rule Book published by RSSB (GE/RT8000, module dated June 2008). Section 1.13.3.1 of this module states that 'After local control has been taken and before the signaller clears the protecting signal, the signaller must instruct the driver of each train to:

- approach the crossing at caution
- not pass over it until authorised by a green *handsignal* shown at the crossing.'

79 Although train 1K54 was signalled (from when it first appeared on the Newbury workstation) manually from signal TR800 to TR804, TR804 to TR808 and then TR808 (over Ufton crossing) to signal DW45, the signaller did not warn the driver about Ufton crossing being under local control. This caution was normally given at signal TR808.

80 When a level crossing is under local control, Network Rail signallers are required to activate a reminder (paragraph 24) on all protecting signals as a prompt for them to wait for the driver to stop at the signal to be cautioned before they set the route and clear the signal.

81 The reminder on signal TR808 had been in place since the start of the engineering possession (at 00:50 hrs on 4 September) and long before signaller B took over the Newbury workstation position at 11:58 hrs. At 12:15 hrs, signaller B commenced a telephone conversation with the PICOP in which part 3 of the possession was implemented. Approximately mid-way through this conversation, the signaller cancelled five reminders relating to signals in the area where the possession was no longer in place, including signals TR804 and TR808. Although most reminders were no longer required because the signals were no longer within the possession, the reminder should have remained on signal TR808 because it was the protecting signal for down direction trains approaching Ufton crossing.

82 It is probable that the signaller erroneously removed the reminder from signal TR808 because his attention was diverted by his conversation with the PICOP while operating the signal controls. An unintended error of this type is known as a lapse. It is possible that the signaller recognised that he had incorrectly removed the reminder from signal TR808 and believed that he had corrected this when, shortly afterwards, he replaced the reminder on signal TR804 (paragraph 52).

[4] The condition, event or behaviour that directly resulted in the occurrence.

[5] Any condition, event or behaviour that was necessary for the occurrence. Avoiding or eliminating any one of these factors would have prevented it happening.

83 In addition to probable distraction due to conversing with the PICOP, it is possible that the following were also factors:

- the workload of this signaller (paragraph 93); and
- the level crossing barrier status message was not displayed adjacent to the control that was possibly used to remove the reminder (paragraph 105).

84 At 12:26:43 hrs, towards the end of a telephone conversation with the crossing keeper at Colthrop and nine minutes after the reminder was removed from signal TR808, the signaller set the route from signal TR804 to signal TR808 and then immediately set the route from signal TR808 over Ufton crossing. It is possible that the signaller was encouraged to do this rapidly because it is likely that the signaller's telephone VDU showed that there was a call waiting. Voice recordings show that the signaller answered a call from a signal tester immediately after the route from signal TR808 was set.

85 The signaller may have been prompted to set the route from signal TR804 and then signal TR808 at this time because the train was running on time and, approximately 30 seconds before the route was set, the driver of train 1K54 had sent a CSR 'standing at signal' alarm to the signaller.

86 Despite the absence of the reminder, the signaller should still have cautioned the train driver before setting the route from signal TR808. The following are possible reasons for him not remembering to do so:

- distraction due to his phone conversation with the Colthrop crossing keeper;
- distraction caused by his awareness that there was another phone caller waiting (the associated workload issues are discussed at paragraph 93); and
- the level crossing barrier status was shown on the signaller's display at a location where it could be overlooked by the signaller (paragraph 110).

87 The signaller's roster for the two weeks leading up to the incident has provided no evidence that the signaller would have been fatigued at the time of the incident. No other evidence has been found indicating that fatigue or other factors were likely to have affected his performance. The signaller was familiar with the procedures applicable to local control of Ufton crossing because he had been a signaller for eight years and had worked at Reading signal box from 2007, controlling train movements over Ufton crossing, until he moved to TVSC when Reading signal box closed in 2010.

88 The signaller was tested for drugs and alcohol after the incident, in line with normal industry practice and found to be clear of both.

89 **The signaller did not instruct the level crossing attendant to lower the barriers. This was a causal factor.**

90 Recordings of phone calls made by the signaller and witness evidence shows that the signaller did not instruct the level crossing attendant to lower the barriers. It is probable that the signaller omitted to instruct the level crossing attendant for the same reasons as he omitted to caution the train driver (paragraph 77).

91 The rules relating to the level crossing attendant are contained within Rule Book module TW8 (Issue 4 dated 7 June 2008). Section 1.13.3.2 states that 'the signaller must tell the attendant about the approach of each train in enough time to allow the attendant to close the crossing to road traffic before the train arrives'.

92 The signaller has stated that, when the train was approaching Ufton crossing, he believed that he already had instructed the attendant to lower the barriers and that the train driver had been cautioned. This evidence is supported by an independent report of the signaller's response when, about 15 to 20 seconds before the near miss, his shift manager asked him whether the crossing was under local control (paragraph 63).

93 **The signaller's workload was high. This was a probable causal factor.**

94 If the signaller had more thinking time available, it is possible that he would not have made errors or, if he had made errors, it is possible that additional thinking time would have resulted in him noticing, and then rectifying, his errors.

95 The RAIB have assessed signaller B's activities using data recorded during the incident supplemented by a 'reconstruction' undertaken on an IECC simulator. Telephone calls, cab secure radio messages and control operations (eg setting routes and applying/removing reminders) are summarised on figure 9. In addition to these directly measurable activities, the signaller also required time to complete the standard Network Rail forms used to record possession arrangements, time to view his VDUs and thinking time.

96 Between taking over the Newbury workstation at approximately 11:58 hrs and 12:13:35 hrs, the signaller dealt with three telephone calls and made 60 control operations. The total duration of the phone calls was 1 minute 55 seconds. If carried out without interruption, the control operations would have required 5 minutes 32 seconds. This means that directly measurable activities totalled 7 minutes 27 seconds during the first 15 minutes 35 seconds of his duty at the Newbury workstation. Although there was some multi-tasking (operating controls whilst using the telephone) during the period, there was also 8 minutes 8 seconds when directly measurable activities were not required.

97 Between 12:13:35 hrs, when the pilotman phoned the signaller, and 12:27:48 hrs, when the signaller thought something was possibly wrong and attempted to contact the level crossing attendant, the signaller dealt with 27 control operations, an almost continual stream of phone calls and four CSR messages reminding him that train 1K54 was waiting. The directly measurable time for the control operations was 2 minutes 3 seconds and for phone calls was 12 minutes. This gives a total time of 14 minutes 3 seconds for directly measurable activities undertaken in an actual period of 14 minutes 13 seconds. There were only three short periods of 1 minute 25 seconds, 17 seconds and 21 seconds when the signaller was not using the telephone. He dealt with three control operations and received one CSR message during the 1 minute 25 second period. He did not do any measurable tasks during the other two periods.

98 The almost continuous nature of the phone calls in conjunction with his other duties meant that the signaller was probably overloaded when he removed the reminder at 12:17:26 hrs and then set the route over Ufton crossing at 12:26:43 hrs. It also meant he had limited spare capacity available to review the situation.

Network Rail IECC workstation workload assessment

99 Network Rail, assisted by specialist contractors, undertook human factors work during the design of the IECC workstations within the Thames Valley Signalling Centre. The human factors work included both ergonomic and workload issues.

100 The workload demands on each workstation were subjected to detailed assessments relating to operation of routine train services in normal mode and some degraded modes (eg operating routine train services without the system which sets routes automatically if trains are running broadly as timetabled). Network Rail does not consider it feasible to model a comprehensive range of degraded working scenarios in a workload assessment for a new IECC workstation. The IECC signalling centre design process did not consider any degraded scenarios relating to engineering possessions.

101 The Network Rail ergonomics team has reported that, if they had identified the potential for the Newbury signaller to encounter unacceptably high workloads during engineering possessions, it is unlikely to have made any change in the area covered by the workstation. The human factors team expected that local managers would assess the effect of engineering work and, if necessary, take action to avoid signallers becoming overloaded.

102 When unusual, non-routine and degraded work scenarios occur, Network Rail consider that reliance is placed upon the following controls:

- the skills of the signaller to plan and prioritise their work activities; and
- the support provided by a shift signaller manager, either in directly supporting the signaller, or co-ordinating others to provide that support.

103 Witness evidence shows that signallers are trained, and signaller B understood, that trains should be delayed if necessary to ensure that all signalling operations are carried out safely. However, witness evidence also shows that signallers felt under pressure to avoid delaying trains. As all the phone calls and control operations were necessary to avoid delaying trains or to facilitate important testing activities, it is possible that this perceived pressure encouraged signaller B to attempt too many tasks between 12:13:35 hrs and 12:27:48 hrs.

104 Witness evidence shows that signaller B did not consider that he required assistance from other staff during the period leading up to the incident.

105 **The status of the level crossing was not displayed adjacent to the signaller's control that was possibly used to remove the reminder. This increased the potential for error and was a possible causal factor.**

106 The reminder on signal TR808 can be removed by any of the following:

- with the tracker ball by clicking on 'REMinder' and then clicking on the signal TR808 location on either the 'detailed view 7' or 'overview 2' VDU screen displays (figures 11 and 12);
- with the tracker ball by clicking on 'REMinder' and then clicking on the arrow on the edge of detailed view 8 (figure 13); or
- by the use of keyboard commands (rarely used by signallers).

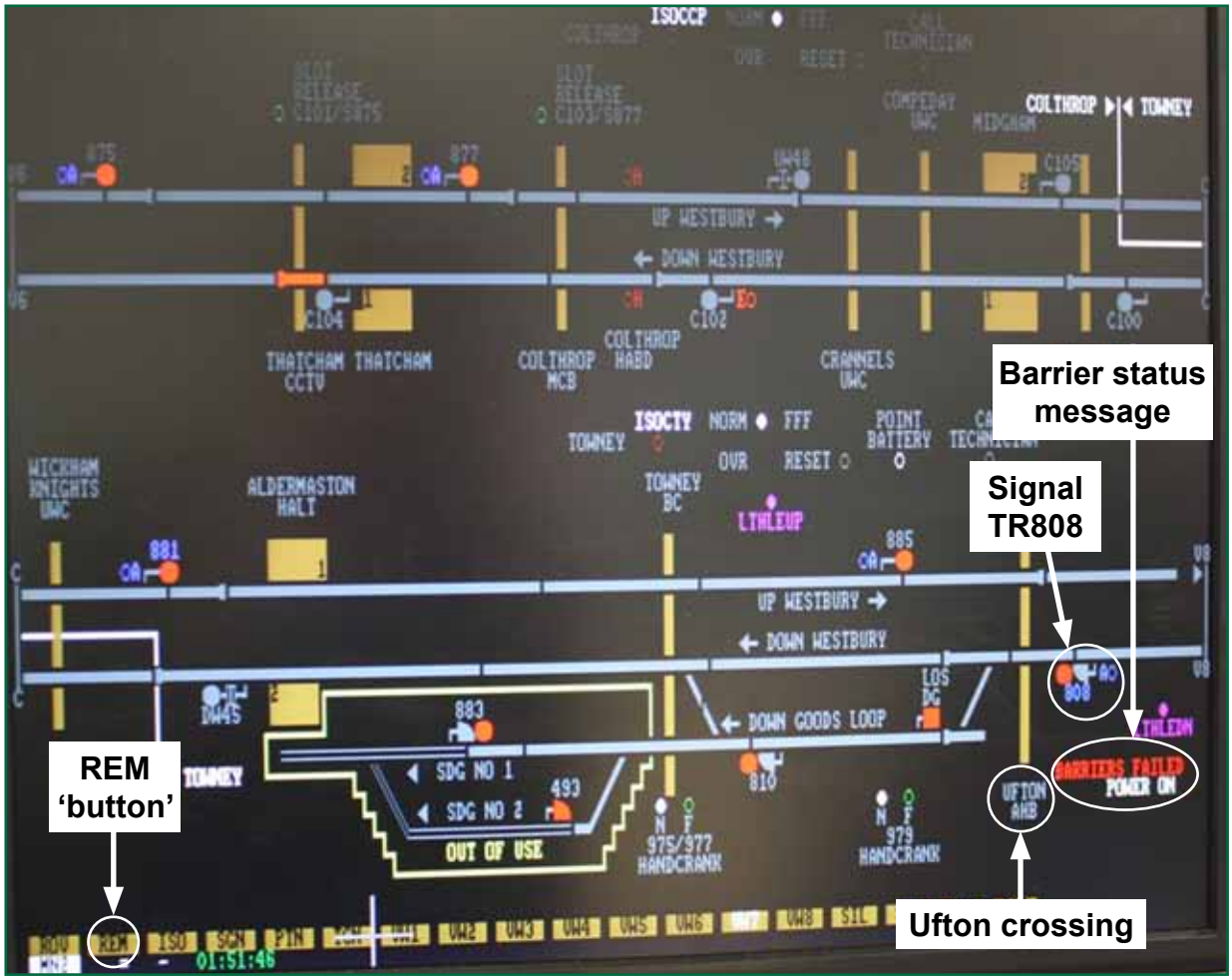


Figure 11: VDU screen 'detailed view 7'

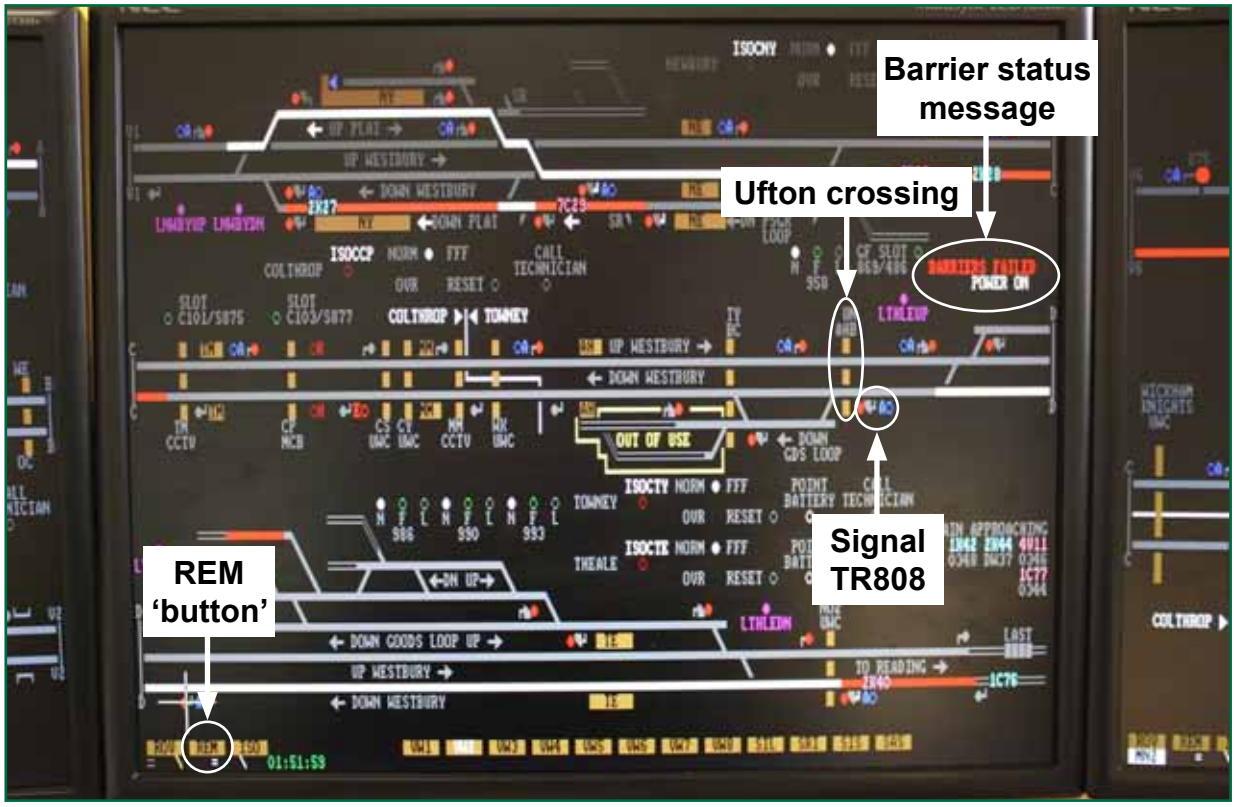


Figure 12: VDU screen 'overview 2'

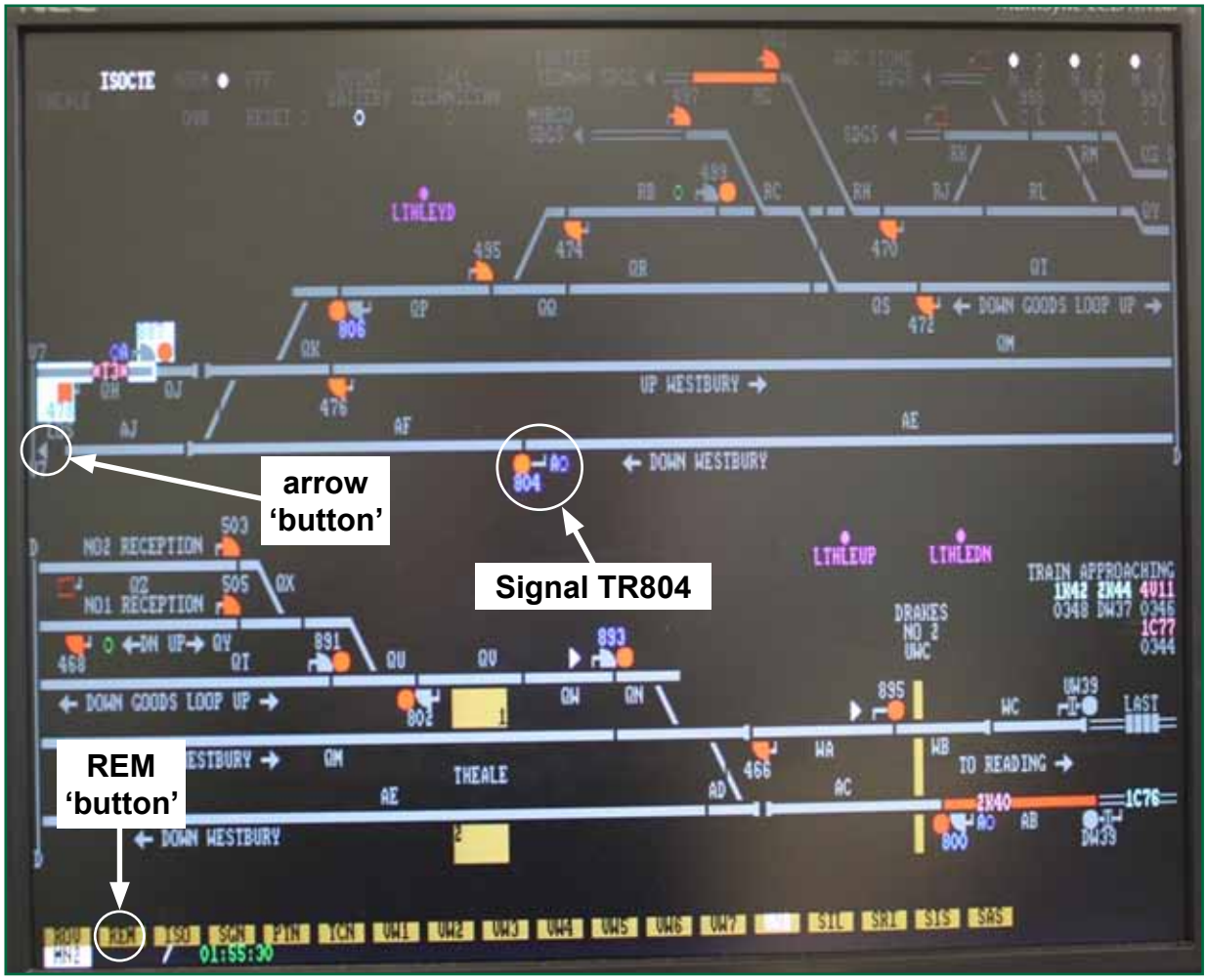


Figure 13: VDU screen 'detailed view 8'

107 The IECC *data logger* does not record the VDU views selected by the signaller or the method of reminder removal that the signaller used. Witness evidence suggests that detailed views 6 and 8, together with overviews 1 and 2, were displayed when the reminder was removed from signal TR808 (figure 14). It is improbable that the keyboard was used to remove the reminder but there is no evidence indicating whether detailed view 8 or overview 2 was used.

108 It is possible that the signaller removed the reminder using the 'arrow' button on detailed view 8 (figure 13). Neither Ufton level crossing, nor an indication of the crossing's status (eg barriers failed) is visible when the reminder is removed using the arrow on detailed view 8. The barrier status is shown on overview 2 and (although probably not displayed when the reminder was removed) detailed view 7. Even if one of these views was displayed on an adjacent screen, the status would not be adjacent to the arrow on detailed view 8.

109 The ability to remove the reminder using the arrow on detailed view 8 is an error trap because the signaller could remove a safety critical reminder when the associated crossing status message was not visible.

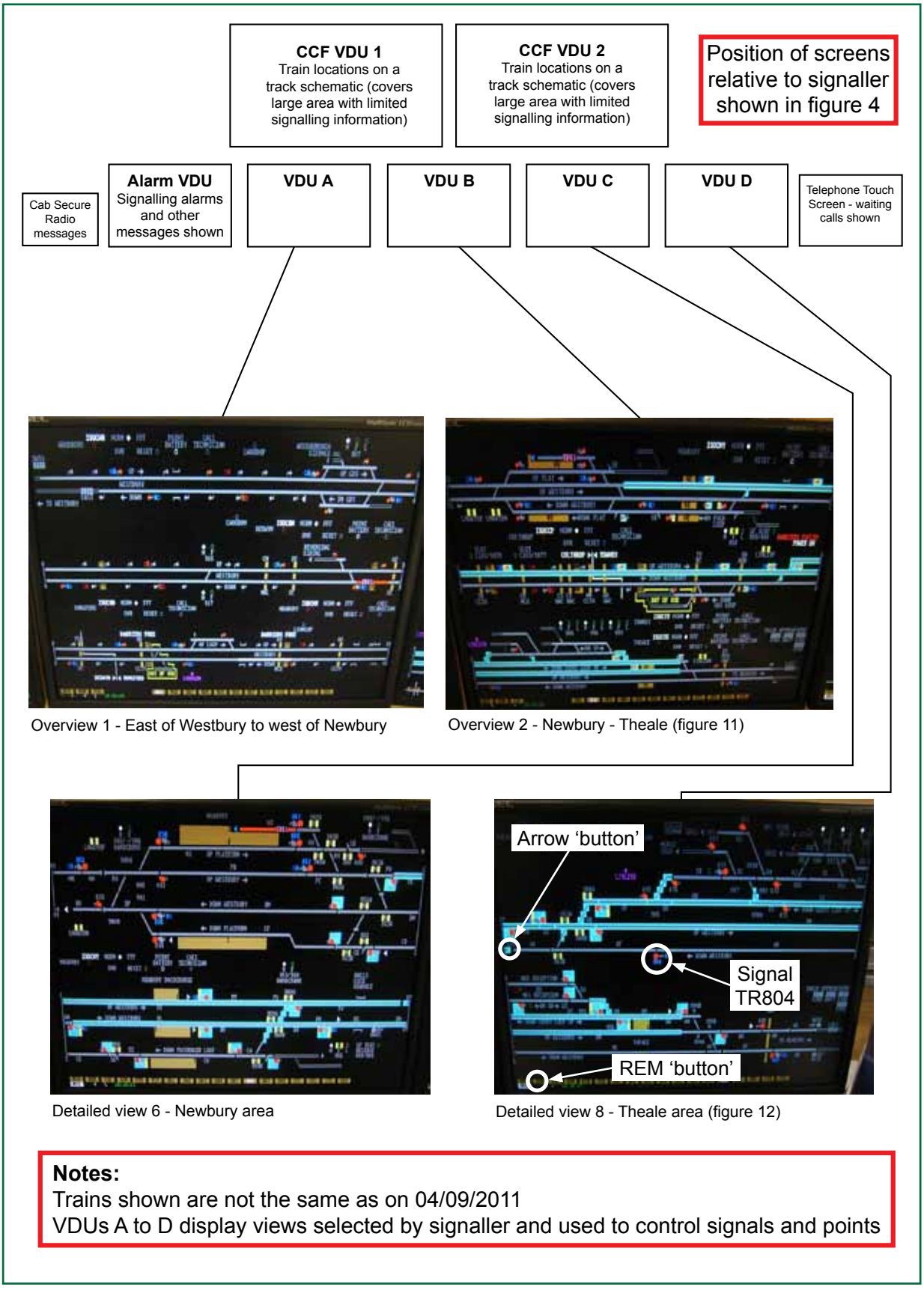


Figure 14: VDU views probably displayed when reminder removed

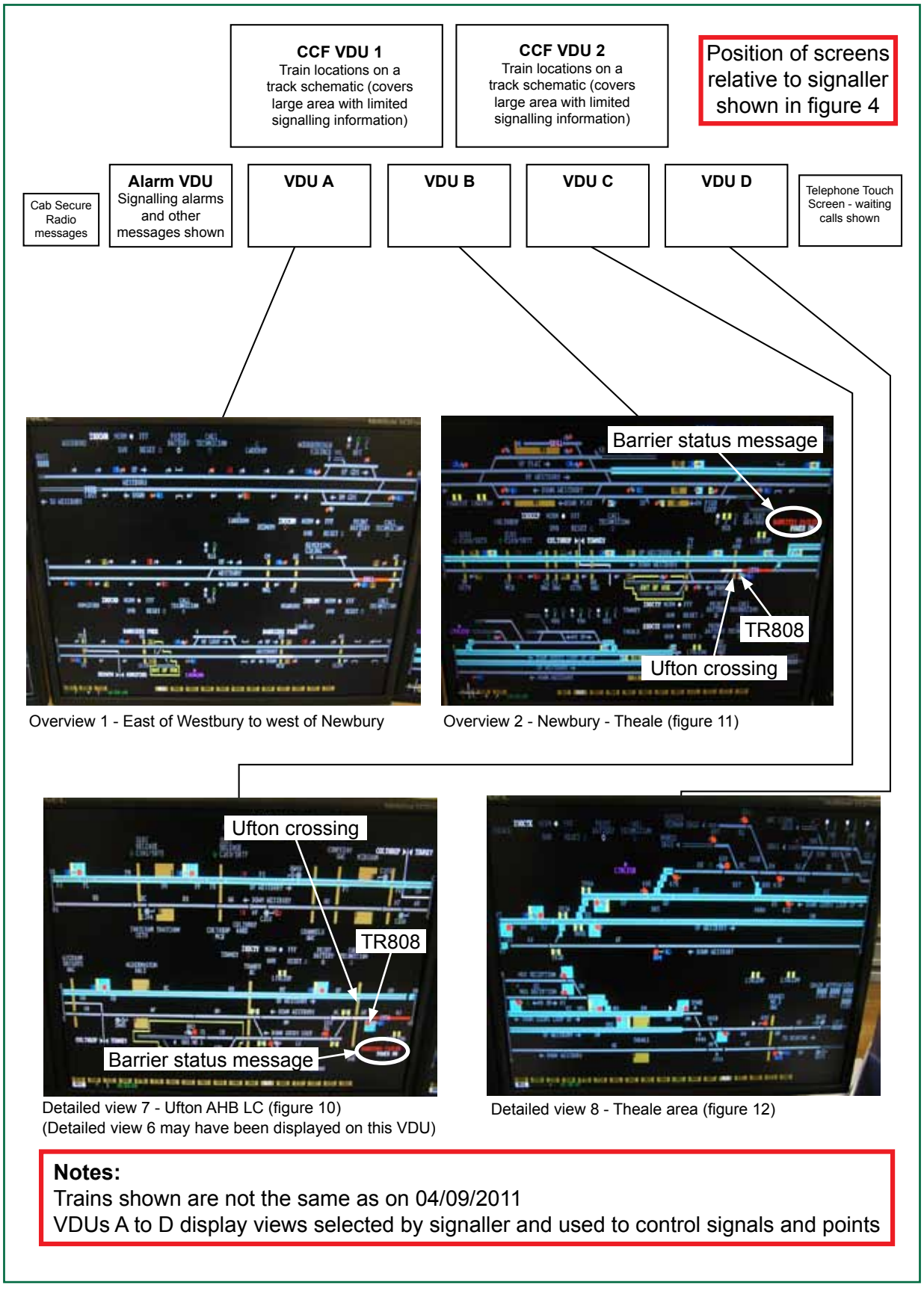


Figure 15: VDU views probably displayed when the route was set from signal TR808 and over Ufton crossing

110 **The level crossing barrier status message was positioned at a location where it could be overlooked by a signaller setting a route over the crossing. This was a possible causal factor.**

111 It is possible to set the route from signal TR808 using controls on detailed view 7 (figure 11), controls on overview 2 (figure 12) or the keyboard. Witness evidence indicates that use of the keyboard was unlikely. Neither witness evidence nor the IECC data logger indicate which screen was used. Detailed view 7 and overview 2 both include a message giving the status of the crossing at a position on the screen which is offset from the crossing signal.

112 The status message ('barrier failed') displayed on detailed view 7 and overview 2 when Ufton crossing is under local control are shown on figures 11 and 12 although the exact display detail (train locations, signal status etc) do not exactly match what would have been displayed at the time of the incident. The barrier status message is the only indication given to the signaller that the crossing is under local control excepting a warning which is acknowledged when local control is first implemented (an event which, in this incident, took place before signaller B started his shift).

113 This position of the message on both views (and particularly on overview 2) means that it can be overlooked by signallers if their eyes follow the track alignment from the symbol for signal TR808 to the symbol for next signal beyond the crossing. It is possible that signaller B did this when setting the route over Ufton crossing.

114 Ufton crossing was supervised from a fixed panel in Reading signal box until 2010. At Reading, the normal practice of signallers was to stick a small, but distinctive, note over the symbol of the crossing as a reminder that it was under local control.

115 It is possible that a more conspicuous local control indication on the IECC display (eg the crossing symbol changing from yellow to red) would have resulted in the signaller registering the status of Ufton AHB thus averting the incident.

116 **The signaller could not contact the level crossing attendant to confirm that the barriers were in the lowered position. This was a causal factor.**

117 When the signaller made his unsuccessful attempt to check that the barriers were lowered by using the level crossing phone to contact the level crossing attendant about a minute before the incident (paragraph 62), the attendant was standing approximately 17 metres north west of the crossing, adjacent to gates on the west side of Ufton Lane (figure 16). He was speaking with a colleague who was sitting in a car and was responsible for controlling access to a railway yard served by these gates. The attendant remained at this location until after the incident train passed over the crossing.

Figure 16: Level crossing attendant's view when standing near gates

118 Witness evidence suggests that level crossing attendants are trained to be near to the crossing (ie within hearing range of the ringing crossing phone) when undertaking their duties. However, this requirement was not in the Rule Book or in the Network Rail keypoints card[6] applicable to level crossing attendants at the time of the incident and issued to the incident level crossing attendant. This requirement was not added to the Rule Book or the keypoints card when they were updated in December 2011.

119 Testing by the RAIB showed that the distance to the crossing means that a person engaged in conversation in the gateway was unlikely to hear the crossing phone ring.

120 At 11:52 hrs, the level crossing attendant had used the crossing phone to contact signaller A. During this call, the signaller checked the attendant's mobile phone number, and the attendant then assumed that further communication was to be by this method. Signaller A wrote the level crossing attendant's mobile number on a note pad on his workstation desk.

121 Signaller B received a verbal handover from signaller A at 11:58 hrs. The RAIB have been unable to establish whether communication with the level crossing attendant and the note recording his mobile number were explicitly discussed. Signaller B did not speak to the crossing attendant until after the incident.

122 At approximately 12:15 hrs (13 minutes before the incident) the pilotman called the level crossing attendant to discuss the forthcoming single line working. During this conversation the pilotman told the level crossing attendant that a signaller would call him to tell him that a train was approaching in about ten minutes. The level crossing attendant usually operated crossing barriers in response to instructions given by engineering supervisors and PICOPs using mobile phones. It is probable that the mobile phone call from the pilotman reinforced the attendant's belief that all communication on the day of the incident was to be made using his mobile phone.

[6] A card or short booklet issued by Network Rail to remind staff about their duties.

123 Witness evidence confirms that the attendant and signaller A had not come to a clear understanding of the method of communication to be used between them and the method of communication had not been clarified with signaller B. Probably due to this lack of clear understanding, the level crossing attendant believed it was appropriate to stand at a location where he could not clearly hear the crossing phone ring.

124 When the level crossing attendant did not answer the crossing phone about a minute before the incident (paragraph 62), the signaller did not ring the crossing attendant on his mobile phone, as he believed that the attendant was busy lowering the barriers for the approaching train and should not be disturbed at that time.

125 Five minutes after the incident, the signaller and the crossing attendant tested the crossing phone which worked correctly.

Identification of underlying factors[7]

126 **The plan for amending possession limits, testing signalling equipment and introducing the passenger service created the potential for overloading the signaller. There was no effective means for taking account of the signallers' workload associated with the plan. This was a probable underlying factor.**

127 The plan for amending possession limits, testing signalling equipment and introducing passenger services using single line working resulted in signaller B carrying out the following activities between 12:13:35 hrs (the start of the period when the signaller received an almost continuous stream of phone calls) and the incident in addition to signalling train movements:

- spoke with the PICOP and operated controls to implement part 3 of the possession at 12:18 hrs;
- spoke with the pilotman and handsignaller in connection with the single line working to be used when part 4 of the possession was implemented;
- spoke three times with the signal testers and operated associated controls to enable testing of signal TR887 (testing of this signal was an essential part of the planned engineering work and had to be completed before 12:45 hrs in order to allow part 4 of the possession to be implemented on time); and
- spoke to a level crossing keeper in connection with implementation of part 4 of the possession.

128 A document entitled, 'Thames Valley *Line Blockage* Signaller's Work load Planning matrix' dated 7 June 2011 and produced by Network Rail operations managers at TVSC listed the workstations at the IECC and stated that, on a Sunday, there could be:

> *'2 (line blockages) at any one time per workstation. Limit 3 per hour per workstation'.*

[7] Any factors associated with the overall management systems, organisational arrangements or the regulatory structure.

129 In addition to its uses for line blockages[8], this document was also used by Network Rail engineering possession planners as good practice when planning possession work in the relevant signalling control areas. The document dealt with the number of blockages allowed simultaneously and the possession arrangements on the day of the incident did not contravene this guidance. However, neither this document, nor any other Network Rail process gives minimum time intervals between alterations to possession limits or signaller's workload limits in respect of engineering work, testing and associated single line working.

130 Complex possession arrangements including frequent alterations to possession limits were also a factor which led to significant delays to train services during a possession in the Reading area on Sunday 18 March 2012. Arrangements were complex partly because, during some periods, 13 lines crossed the possession limits. Alterations to possession limits were due to take place at 06:00 hrs and then at intervals of 30, 25, 40, 35 and 15 minutes until an alteration at 08:25 hrs. The time allowed for each alteration was insufficient for the PICOP and the signaller to reach a clear understanding that appropriate revised arrangements were in place. This was one of the factors which meant that most of the lines intended to be returned to normal service during these alterations were not actually returned until 09:15 hrs.

Observations[9]

Wording of the level crossing barrier status message

131 The wording of the barrier status message did not accord with Network Rail operating specification standard, NR/SP/SIG/17504, issue 3 dated December 2003, 'IECC Operating Specification for Signalling Control and Indications Purposes'. It is unlikely that this affected the incident as the signaller had been trained to understand the meaning of the message actually displayed on his workstation VDUs.

132 When Ufton AHB was under local control, the Newbury workstation VDUs did not show 'FAILED/ LOCAL CONTROL' as required by the operating specification. Instead, the displays read, 'BARRIERS FAILED'. The term 'local control' has the advantage of reminding the signaller of the presence of a level crossing attendant.

133 It is unlikely that the signaller noticed a level crossing status message on his VDUs, and particularly unlikely that he did so when removing the reminder (paragraphs 82, 83 and 86). If he had noticed the message, it is likely that the wording actually displayed would have reminded him that the crossing was under local control.

[8] Line blockages and possessions both involve closing the line to regular train services. Line blockages permit only a limited range of engineering activities. They are typically of shorter duration, and cover shorter lengths of railway, than possessions.

[9] An element discovered as part of the investigation that did not have a direct or indirect effect on the outcome of the accident but does deserve scrutiny.

IECC recording and playback facilities

134 There is no facility at the TVSC IECC to record or play back an incident to review the signaller's actions. Tasks such as a 'route set' command are recorded, but information such as the method used by the signaller to select a route and the views displayed on each screen is not recorded.

135 A more comprehensive playback facility would assist investigation of incidents and accidents. It could also be utilised for competence reviews and to assist training activities.

Use of red lamps & flags by level crossing attendants

136 Level crossing attendants are required to maintain red lights or flags on each side of a level crossing when the barriers are raised (paragraphs 139 to 141). These red lights or flags are intended as a warning to trains approaching a crossing after being cautioned by a signaller, engineering supervisor or PICOP. They are not intended to give adequate warning for a train approaching at relatively high speed.

137 Four red lamps had been placed on Ufton crossing, one on each line at either side of the crossing, before the level crossing attendant started his shift on 4 September 2011. Excepting temporary removal to allow passage of trains, they remained in this position until the level crossing attendant was instructed to remove two of them during the possession hand back procedure (paragraph 146).

138 RFCCTV images indicate that a red light was in position on the up line at Ufton crossing as train 1K54 approached on the down line, but the driver does not recall seeing this.

139 Rule Book Module TW8 applied to level crossing attendants at the time of the incident. Section 3.3b of this module stated:

> *'While the barriers are raised, the attendant must display a red flag by day (or a red light during darkness, fog or falling snow) at each end of the crossing and they must be clearly visible to the driver of any train which may approach. The red flag or lamp may be fixed in or placed on the ground.'*

140 In December 2011, Rule Book Module TW8 was revised and became relevant to only train drivers. For level crossing attendants it was replaced by 'Handbook 18 Duties of a level crossing attendant' (Issue 1, December 2011). This instructs the attendant to:

> *'display a red flag or light during darkness or poor visibility at each side of the crossing'.*

141 Network Rail publish a 'keypoints' cards entitled 'Level crossing attendant (AOD level crossing attendant)'. Issue 6 applied at the time of the incident and issue 7 became effective on December 2011. Both versions state that, for level crossings such as Ufton, the level crossing attendant's equipment includes:

> *'Two red flags or red lamps to be placed in the four foot on each immediate approach to the crossing'.*

142 The level crossing attendant involved in the Ufton incident undertook a training course in September 2010 and was instructed to place one red light on each line at either side of the crossing (ie two lights on each side of the crossing on a double track railway).

143 The rules, keypoints cards and training are inconsistent in respect of the number of red lights to be placed on each side of a level crossing when trains can approach a side on more than one line.

144 Information obtained during an industry investigation of an incident similar to that at Ufton (paragraph 151) showed that, on a two track railway with the up line open to normal traffic and the down line under possession, level crossing attendants at four adjacent crossings had each received two red lights which they placed as follows (figure 17):

- at two crossings: both lights were placed on the down line, one on each side of the crossing;
- at one crossing: one light was placed on each line, the lights were on opposite sides of the crossing;
- at one crossing: one light was placed on each line, both on the same side of the crossing.

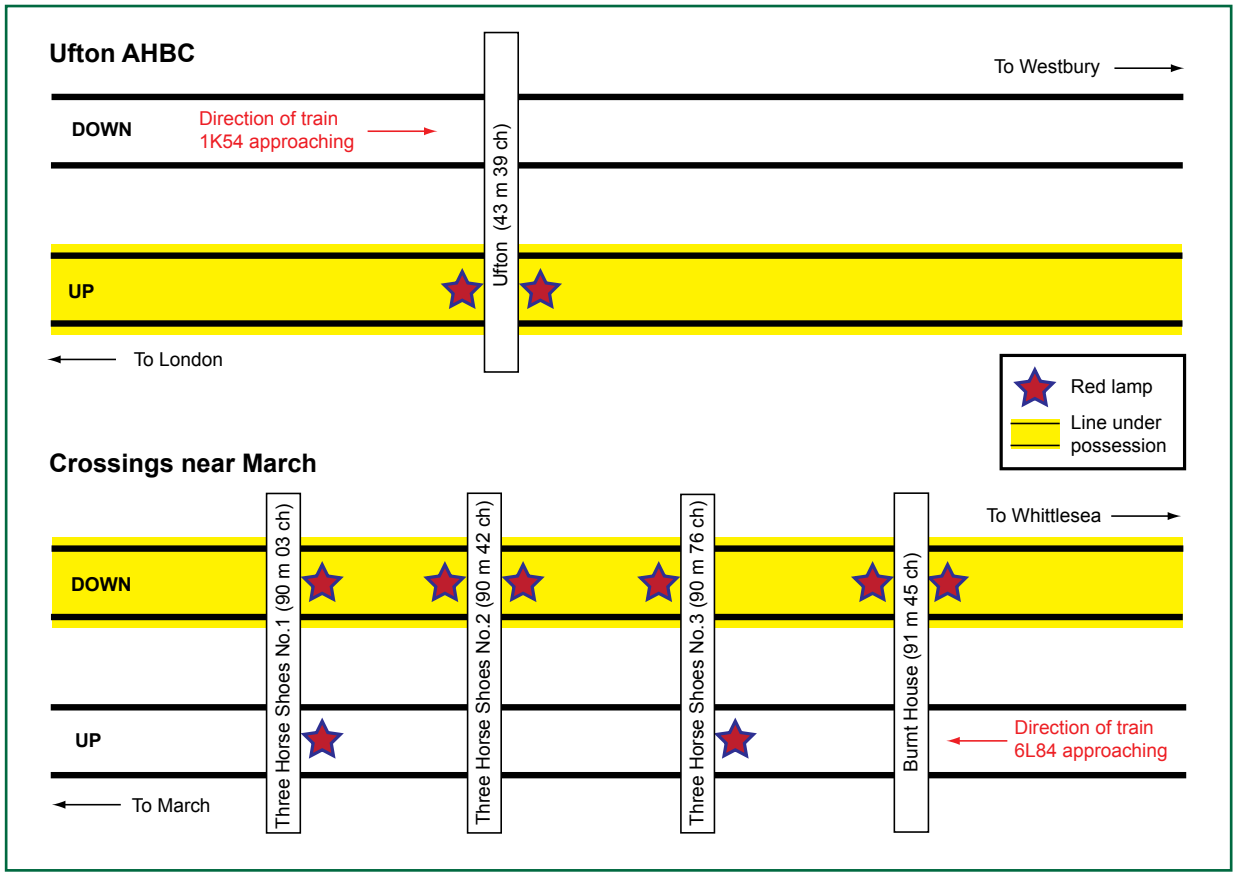


Figure 17: Ufton AHB crossing and the four crossings near March showing positions of red lamps

Removal of red lamps & flags by level crossing attendants

145 The rules, keypoint card and training only permit the level crossing attendant to remove the red lights when the barriers are lowered or when handing the crossing back to the signaller in working order. There is no rule which permits the PICOP or engineering supervisor to instruct the removal of red lights by the level crossing attendant.

146 There had been two red lights on each line at Ufton (paragraph 137) until the two lights on the down line were removed by the level crossing attendant at 11:52 hrs when instructed by the engineering supervisor. It is probable that the level crossing attendant complied with this instruction because the engineering supervisor is a relatively senior person and, during the possession, had been the person who advised the level crossing attendant when the barriers should be lowered for engineering trains to use the crossing.

147 The engineering supervisor also instructed the level crossing attendant to tell the signaller that the red lights had been removed from the down line. The level crossing attendant told signaller A on Newbury workstation at 11:52:34 hrs and was not instructed to replace the lights. Witness evidence indicates that this was because the signaller was distracted by other signalling duties.

148 Removal of red lights and flags when level crossings are handed back under local control at the end of possessions, as occurred on this occasion, is contrary to the rules. AmeyColas managers made enquiries amongst a small group of engineering supervisors and found that a significant proportion of them would also instruct level crossing attendant's to remove red lights or flags in similar circumstances. These engineering supervisors believed that removal was needed so that, in accordance with the Rule Book Module T3 'Possession of a running line for engineering work' Issue 3 March 2011, section 7.3, the PICOP can tell the signaller that the lines are 'safe and clear' for normal train operation.

Potential to provide additional protection

149 Current standards do not require, and the TVSC IECC does not provide, any form of interlock to deter a signaller from setting a route across a level crossing under local control before informing the level crossing attendant and cautioning the train driver. A reminder, placed on the protecting signal by the signaller, is the only tool available to protect a route being set.

150 The RAIB notes that the IECC system contains information about the status of Ufton level crossing and interfaces with the displays and controls used by the signaller. It is possible that this information could be combined at the IECC to reduce the likelihood of a signaller setting a route over an automatic crossing under local control without applying the relevant rules. For example, it would be possible to display a message to signallers to remind them that a crossing is under local control (or in a failed condition) if the signallers omit to activate, or attempt to remove, the reminders on the protecting signals.

Previous occurrences of a similar character

151 On 25 April 2012 at 00:30 hrs, a freight train (6L84) passed over four consecutive AHB level crossings between Whittlesea and March in East Anglia without the crossing barriers being lowered to road traffic. The crossings were under local control because the down line was under possession. The up line was open to normal traffic. The signaller had not cautioned the train driver and had not advised the four level crossing attendants about the approaching train. As a consequence, two lights placed in the up line four foot were hit and damaged by the freight train.

152 The Safety Management Information System maintained by RSSB contains data relating to level crossing accidents and incidents. Data for the period from January 2003 to June 2012 includes at least eight instances, excluding the events detailed in this report, where a train travelled over an AHB level crossing without being cautioned when the barriers were raised and the crossing was under local control.

Summary of conclusions

Immediate cause

153 The signal protecting Ufton crossing was displaying a green (proceed) aspect to the driver of 1K54 as the train approached despite the barriers being in the raised position (**paragraph 76**).

Causal factors

154 The causal factors were:

a. the signaller did not caution the driver of train 1K54 at signal TR808 (the crossing protecting signal) to inform him that Ufton crossing was under local control (**paragraph 77, Recommendations 1, 2 and 3**);

b. the signaller did not instruct the level crossing attendant to lower the barriers (**paragraph 89, Recommendations 1, 2 and 3**); and

c. the signaller could not contact the level crossing attendant to confirm that the barriers were in the lowered position (**paragraph 116, no recommendation**).

155 A probable causal factor was:

a. the signallers workload was high (**paragraph 93, Recommendation 4**).

156 The possible causal factors were:

a. The status of the level crossing was not displayed adjacent to the signaller's control that might have been used to remove the reminder (**paragraph 105, Recommendation 1**).

b. The level crossing barrier status message was positioned at a location where it could be overlooked by a signaller setting a route over the crossing (**paragraph 110, Recommendation 3**).

Underlying factor

157 A probable underlying factor was:

a. The plan for amending possession limits, testing signalling equipment and introducing the passenger service created the potential for overloading the signaller. There was no effective means for taking account of the signallers' workload associated with the plan (**paragraph 126, Recommendation 4**).

Summary of observations

158 The RAIB makes the following observations which are not considered to be factors in the incident on 4 September 2011:

a. The wording of the level crossing barrier status message did not contain the text, 'local control' (**paragraphs 131 to 133, Recommendation 3**).

b. There is no record of signallers' exact actions and no playback facility within the IECC system (**paragraphs 134 and 135, Recommendation 5**).

c. There are inconsistencies in the training, instructions and rules applicable to level crossing attendants in respect of the number and location of red lamps or flags to be used on each side of a level crossing under local control (**paragraphs 136 to 144, Recommendation 6**).

d. Level crossing attendants are being instructed by some engineering staff to remove their red lamps during the possession handback to the signaller. This conflicts with the Rule Book Handbook and keypoint card which state that a red lamp/ flag should be displayed when a crossing is under local control (**paragraphs 145 to 148, Recommendation 7**).

e. Information held within the IECC system permits introduction of additional protection to reduce the likelihood of signallers omitting to take appropriate precautions before signalling trains over level crossings under local control (**paragraphs 149 and 150, Recommendation 2**).

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

159 Network Rail TVSC managers have agreed (with Network Rail possession planners) that changes to the limits of possessions will be spaced by a least 30 minutes to reduce the workload on signallers. Network Rail is currently reviewing this new minimum time period between changes to possession limits (to see if it should be increased) and if it should be implemented on a national scale.

160 On Friday 2 November 2012, Network Rail issued a press release stating that it aims to replace the incident level crossing with a road bridge (http://www.networkrailmediacentre.co.uk/News-Releases/7145/Network-Rail-aims-to-replace-Ufton-Nervet-level-crossing-with-a-road-bridge).

Recommendations

161 The following recommendations are made[10]:

1 *The intent of this recommendation is to ensure that signallers can see appropriate information on the VDU screen when considering whether to remove reminders from signals and points using controls on IECC workstation VDUs. These include reminders on signals that are used to protect an automatic crossing under local control.*

Network Rail should identify, and provide a time bound plan to eliminate, all IECC VDU controls which permit a signal or point reminder to be removed in situations where the signaller cannot see sufficient on-screen messages and indications to inform the decision whether to remove the reminder (paragraph 155).

2 *The intent of this recommendation is to provide an interface which reduces the likelihood of IECC signallers setting a route over an automatic half barrier level crossing under local control without advising the level crossing attendant and cautioning the train driver. The intent will be satisfied if a similar message is displayed in other crossing failure conditions and/or if the interface is provided within IECC software in a manner which provides a lower safety integrity level than required for some other signalling applications.*

In respect of automatic half barrier level crossings supervised from IECC installations, Network Rail should consider interfacing information about level crossing status with signal controls to reduce the risk of signallers permitting a train to pass over the crossing without applying the rules applicable to local control. Network Rail should include consideration of a warning or reminder which must be acknowledged on each occasion that a signaller attempts to set a route over a level crossing under local control. If found practical, Network Rail should modify standards and specifications to require this feature in future IECC upgrades and new installations (paragraph 158).

continued

[10] 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 Office of Rail Regulation 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.raib.gov.uk.

3 *The intent of this recommendation is to ensure that, when automatic half barrier level crossings are under local control, IECC displays provide conspicuous warnings compatible with Network Rail's IECC control and indication specification.*

Network Rail should review the local control indications displayed in respect of automatic half barrier level crossings on the Thames Valley Signalling Centre (TVSC) VDUs to identify any inconsistencies with the associated Network Rail specification requirements. If any of these inconsistencies have the potential to have a significant adverse effect on safety, Network Rail should amend the indications displayed at TVSC and/or the Network Rail IECC control and indication specification so that appropriately positioned conspicuous indications are displayed on all IECC VDUs (paragraph 156).

4 *The intent of this recommendation is to ensure that the planned arrangements for setting up, alteration and handing back of possessions, and any planned signalling input to associated activities, does not cause an excessive workload for any signaller.*

Network Rail should examine and implement ways in which the workload of signallers can be kept within reasonable levels during engineering possessions, particularly those involving multiple changes to possession limits. This work should aim to avoid, where practical, situations in which signallers must delay engineering work or train services in order to avoid excessive workload (paragraphs 155 and 157).

5 *The intent of this recommendation is to assist incident investigation and competence management of signallers by recording, and facilitating playback of, all signallers' actions during their work at workstations included in future IECC projects.*

Network Rail should modify appropriate standards and specifications so that future IECC installations include a system to fully record signaller's actions. Information recorded should include:

- reminder appliance override;
- signaller's selection of VDU view; and
- the view used when controls are operated using a VDU view.

Where practical, the system should incorporate a playback feature (paragraph 158).

continued

6 *The intent of this recommendation is to provide consistent and appropriate instructions to level crossing attendants about the positioning of red lamps and flags used when level crossings are under local control.*

Network Rail should review the existing requirements concerning the number of red flags or lights to be placed on each side of a level crossing under local control. Network Rail, if necessary in co-operation with the RSSB, should then take appropriate action to ensure that the correct, clear and consistent information is included in training, instructions and rules applicable to level crossing attendants (paragraph 158).

7 *The intent of this recommendation is to correct a misunderstanding among some engineering supervisors concerning the requirement for red lights or flags to be displayed at level crossings at all times when they are under local control unless the barriers are lowered.*

Network Rail should re-brief staff that level crossing attendants' red lamps/ flags must never be removed when level crossings are under local control and the barriers are raised or the gates are open (paragraph 158).

Recommendation 1, 2, 3 and 5 may also be applicable to other similar software based VDU signalling control systems

Appendices

Appendix A - Glossary of abbreviations and acronyms

AHB	Automatic Half Barrier (Crossing)
CCTV	Closed Circuit Television
CSR	Cab Secure Radio
ES	Engineering Supervisor
FFCCTV	Forward Facing CCTV
IECC	Integrated Electronic Control Centre
OTDR	On Train Data Recorder
PICOP	Person In Change Of Possession
RAIB	Rail Accident Investigation Branch
RFCCTV	Rear Facing CCTV
RSSB	Rail Safety and Standards Board
SSM	Shift Signalling Manager
TPWS	Train Protection and Warning System
TVSC	Thames Valley Signalling Centre
VDU	Video Display Unit

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.

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.*
Caution (approach at)	An indication or instruction requiring the driver to be ready to stop. Such an indication or instruction can be given by fixed signals, handsignals, signs or verbal communication (eg from a pilotman or signaller).*
Clear (signal)	To clear a signal is to change its aspect from its most restrictive aspect (red) to a less restrictive aspect (yellow or green).*
Controlled (signal)	A signal which can be made to display a stop aspect.
Data logger (IECC)	Equipment recording the times at which there are changes in the state of the controls operated by the signaller and visual indications on IECC monitors.
Engineering Supervisor	The person nominated to manage the safe execution of works within an engineering worksite in a possession.*
Full service brake	A full (non-emergency) brake application.*
Handsignal	An instruction given to a driver by means of arm movements, coloured flags or coloured hand held lamps at night.*
Handsignaller	A competent person authorised to control the passage of trains by means of coloured flags and railway fog signals (colloquially called detonators) in the absence of normal signalling.*
Integrated Electronic Control Centre	A type of signal control system that controls the points and signals for a whole route or a large geographical area by electronic means. The signallers' interface is normally a VDU, keyboard and pointing device.
IECC overview and detailed VDU displays	The four VDUs at each workstation can be switched to show different parts of the layout. Each part of the layout can also be selected to be shown in a detailed or overview, but a signaller will have restricted signalling controls available when viewing a layout in 'overview'.
Line blockage	Preventing trains from moving by placing or maintaining signals at danger with records kept by the signaller on form RT3181 Line Blockage Form.
Local control	A level crossing is known as being under 'local control' when it is being manually operated by the level crossing attendant at the crossing.

On Train Data Recorder	A data recorder fitted to traction units collecting information about the performance of the train. Including: ● speed; ● regulator and brake control positions; and ● activations of horn, automatic warning system cancel button, etc.*
Person In Charge of Possession	The competent person nominated to manage the following: ● safe and correct establishment of the protection for the possession, complete with detonators, possession limit boards and signals keyed to danger as required; ● managing access to the possession area by engineering supervisors; ● liaising with the signaller regarding the passage of the train into and out of the possession; and ● ensuring that all the foregoing is correctly removed in reverse sequence, the possession is relinquished and the line handed back to the signaller at the due time.*
Pilotman	A member of railway staff whose duty is to ensure that trains are worked safely (eg one at a time) over a single line section during times of signal failure or during emergencies by riding on each train through the section.*
Possession	A period of time during which one or more lines are blocked to trains to permit work to be safely carried out on or near the line.*
Proceed aspect	A colour light signal that displays a yellow or green aspect to the train driver giving authority to move.
Protecting signal	A signal that prevents trains from entering a section where conflicting movements may take place or a signal immediately before a level crossing.*
Reminder (Signal and Points)	A device used by a signaller to remind the signaller that a particular lever, electrical switch or plunger (button) should not be operated, because that device operates a signalling function which is protecting a possession or obstruction.*
Road traffic light signals	The paired red lights provided at level crossings to warn highway users that the level crossing is closing or is closed to road traffic.* (Also known as wig wag lights).
Route (Signal)	The signalled path from one signal to the next signal.*
Running rail	A Rail that supports and guides the flanged steel rail wheels of a rail vehicle.*

Single Line Working	The temporary use of one track for traffic working in both directions.
Stop aspect	A colour light signal that displays a red aspect to the train driver meaning do not pass this signal.
Tamping	The operation of lifting the track and simultaneously compacting the ballast beneath the sleepers. This operation has largely been mechanised.*
Til Dawn lanterns	A type of lantern used as a 'red light' by level crossing attendants whilst undertaking their duties.
Workstation (IECC)	A development of the signalbox panel, the signaller is provided with a display of the signalbox diagram on a VDU, and a trackball to operate the signalling functions.*

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