



Rail Accident Investigation Branch

Rail Accident Report



**Two near misses at Crofton Old Station No.1
Level Crossing, near Wakefield, West Yorkshire
1 and 18 May 2006**

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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Any enquiries about this publication should be sent to:

RAIB	Email: enquiries@raib.gov.uk
The Wharf	Telephone: 01332 253300
Stores Road	Fax: 01332 253301
Derby UK	Website: www.raib.gov.uk
DE21 4BA	

This report is published by the Rail Accident Investigation Branch, Department for Transport.

Two near misses at Crofton Old Station No.1 Level Crossing, near Wakefield, West Yorkshire 1 and 18 May 2006

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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 Bombardier to their staff, data and records in connection with the investigation.
- 4 Appendices at the rear of this report contain glossaries explaining the following:
 - acronyms and abbreviations are explained at Appendix A; and
 - technical terms (shown in *italics* the first time they appear in the report) are explained at Appendix B.

Summary of the report

Key facts about the incidents

Incident 1

- 5 At around 12:45 hrs on 1 May 2006, Class 66 locomotive 66508, running light and forming train 0D52 from Midland Road to Sudforth Lane, passed over Crofton Old Station No.1 level crossing whilst the crossing gates were open to the road.
- 6 The crossing gates had been open for approximately two minutes prior to the arrival of train 0D52. A car had used the crossing around a minute prior to the train passing over the crossing.

Incident 2

- 7 At around 09:45 hrs on 18 May 2006, Class 155 diesel multiple unit (DMU) 155345, forming train 2F65 from Wakefield Kirkgate to Knottingley, passed over Crofton Old Station No.1 level crossing whilst the *down line* side crossing gate was open to the road.
- 8 At the time of the train's passage over the crossing, the crossing keeper was attempting to close the gates to the road.

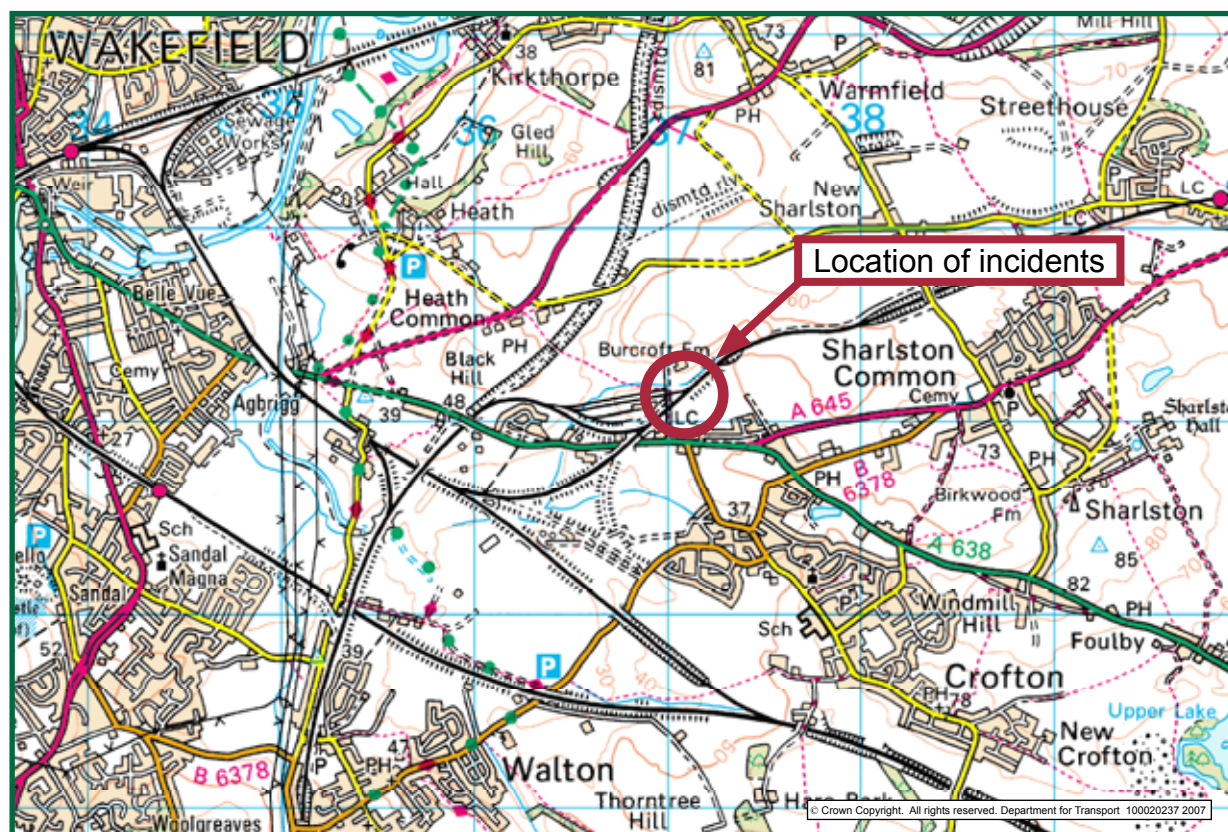


Figure 1: Extract from Ordnance survey map showing the location of the incidents

Immediate cause, causal and contributory factors

- 9 The immediate cause of both incidents was that the level crossing's down line protecting signal, Signal O313, showed a clear aspect for the passage of trains whilst the level crossing gates were open to the road.

- 10 The following causal factors were identified:
- no *interlocking* was present between the level crossing gates and its down line protecting signal, Signal O313. There was also no interlocking to its *up line* protecting signal, Signal O318; and
 - human error in omitting steps within the procedure for working the crossing.
- 11 In addition, the following factors were considered to be contributory:
- interlocking was not provided:
 - a) at the time of the depot development in 2000;
 - b) at the time the crossing was permanently staffed and re-designated as an MGH crossing;
 - c) once the high crossing usage and its possible risks were known, because of financial and installation constraints;
 - the new method of working introduced in February 2006 was susceptible to human errors;
 - the risk assessment undertaken, and subsequently reviewed prior to the approval by the issuing of the level crossing order, did not take account of the risks of human error in the new method of working; and
 - for incident 2, distraction led to the *special crossing reminder appliance* not being replaced over the switch for Signal O313 the last time it was used.

Severity of consequences

- 12 In both incidents there were no injuries and no damage.

Recommendations

- 13 Recommendations can be found in paragraph 175. They relate to the following areas:
- the provision of interlocking at Crofton Old Station No.1 level crossing;
 - risk assessment and review to identify and mitigate residual risk following interlocking fitment with consideration of the risks associated with human error;
 - undertaking of risk assessments on other staffed level crossings where the method of working relies solely upon human actions for the safe operation of the crossing;
 - the review of level crossing standards to consider risks associated with human error at staffed level crossings where the safe operation relies solely on procedures;
 - thorough process of review by the Office of Rail Regulation (Her Majesty's Railway Inspectorate) ORR (HMRI) to ensure that risk assessments are robust and complete;
 - ORR (HMRI) processes to ensure that level crossing operational and physical requirements, which have been identified for the safe operation of level crossings, are in place; and
 - review of non-standard practices in the operation of staffed level crossings that may introduce risk.

The Incidents

- 14 Crofton Old Station No.1 level crossing is situated at 52 miles and 25 chains on the double track up and down Goole lines to/from Wakefield Kirkgate. The line speed for both of the main lines over the level crossing is 50 mph (80 km/h) (Figure 1).
- 15 The line is controlled by *Track Circuit Block* signalling. The control of the level crossing and the signals in its vicinity is from Oakenshaw signal box.

Summary of incident 1

- 16 At around 12:45 hrs on 1 May 2006, Class 66 locomotive 66508, running light and forming train 0D52 from Midland Road to Sudforth Lane, passed over Crofton Old Station No.1 level crossing whilst the crossing gates were open to the road.
- 17 The crossing gates had been open for approximately two minutes prior to the arrival of train 0D52, during which period Signal O313 had been cleared for the passage of the train. A car had used the crossing around a minute prior to the train passing over the crossing.

Summary of incident 2

- 18 At around 09:45 hrs on 18 May 2006, Class 155 DMU 155345, forming train 2F65 from Wakefield Kirkgate to Knottingley, passed over Crofton Old Station No.1 level crossing whilst the down line side crossing gate was open to the road.
- 19 At the time of the train's passage over the crossing, the crossing keeper was attempting to close the gates to the road.

The parties involved in both incidents

- 20 Network Rail, London and North East (LNE) Territory, is the owner and operator of the crossing. It is also responsible for the provision, training and supervision of both crossing keepers and signallers who operate the crossing.
- 21 Bombardier Transportation is the current lessee of Crofton depot, the road access to which is via Crofton Old Station No.1 level crossing. At the time of the train depot's construction, they were known as Bombardier Prorail.
- 22 Her Majesty's Railway Inspectorate, now as part of the Office of Rail Regulation, was responsible for the approval of changes to the level crossing. In this case, the changes were detailed by the creation of a level crossing order under the Level Crossings Act 1983.

Additional parties involved in incident 1

- 23 Train 0D52, from Midland Road to Sudforth Lane, was operated by Freightliner.
- 24 Signaller 1 was on duty at Oakenshaw signal box on 1 May 2006.

- 25 Crossing Keeper 1 was on duty at Crofton Old Station level crossing on 1 May 2006.
- 26 Crossing Keeper 2 began duty at Crofton Old Station level crossing at around 12:45 hrs on 1 May 2006, and was also the driver of the car involved in the incident.

Additional parties involved in incident 2

- 27 Train 2F65 from Wakefield Kirkgate to Knottingley, was operated by Northern Rail.
- 28 Signaller 2 was on duty at Oakenshaw signal box on 18 May 2006.
- 29 Crossing Keeper 3 was on duty at Crofton Old Station level crossing on 18 May 2006.

Level crossing location and control

- 30 The *protecting signals* for Crofton Old Station No.1 level crossing on the up and down Goole lines are O318 and O313 respectively (Figure 2).

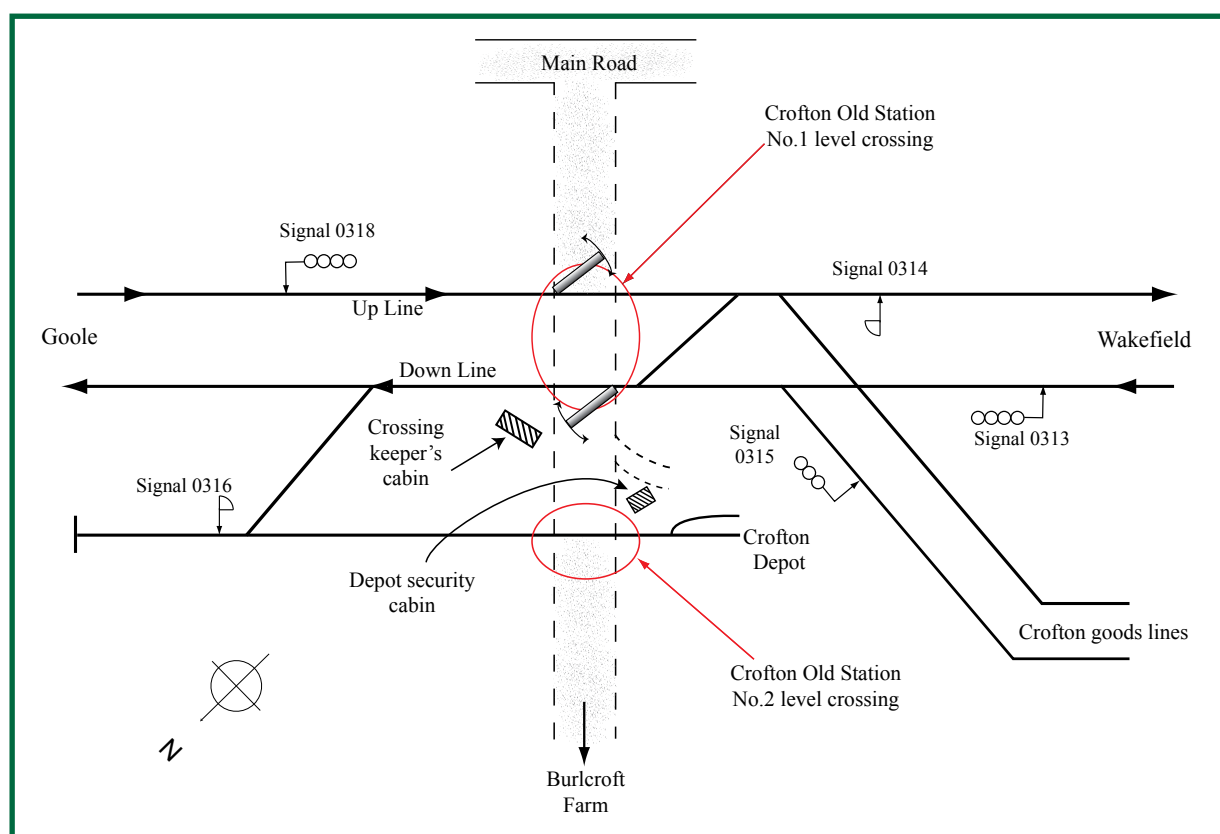


Figure 2: Simplified diagram of crossing layout and signals

- 31 Crofton Old Station No.1 level crossing consists of hinged, full road gates which are normally open to road traffic. The gates open outwards to the road, away from the railway. Adjacent to each road gate is a wicket gate for use by pedestrians (Figure 3).
- 32 Rail traffic use over Crofton Old Station No.1 crossing at the time of both incidents consisted of an hourly passenger train in each direction during service times and up to twenty freight trains and light locomotives per day. This typically gave fifty operations of the level crossing gates per day. There could be up to six full operations of the crossing gates per hour during peak times, and the gates were often closed for more than one train to pass.



Figure 3: Crofton Old Station No.1 crossing

- 33 Permanent crossing keepers operated the crossing on a three shift system. The crossing keeper had a cabin near to the crossing on the down side of the railway.
- 34 The method of working of the No.1 gates in place at the time of both incidents was as follows:
- the level crossing gates were normally open to the road;
 - signals O318 and O313 were normally prevented from being mistakenly cleared by special crossing reminder appliances which covered the operating switches on the signal panel; signals O314, O315, and O316, the protecting signals on other lines, should have been similarly protected, but Network Rail took the view that the large number of reminder appliances required could have confused the signaller, and did not supply them to the box or require them to be used, for these signals;
 - when the signaller on duty at Oakenshaw signal box required the crossing gates to be closed to the road, the signaller called the crossing keeper by telephone;
 - the crossing keeper closed both gates and then secured them by means of chains and padlocks;
 - the crossing keeper telephoned the signaller to confirm that the gates were closed to the road and that the crossing was clear;
 - the signaller and the crossing keeper would record the status of the gates and the time in the train register book and cabin occurrence book respectively;

- the signaller removed the special crossing reminder appliances from the switch(es) of the protecting signal(s) and then cleared the required protecting signal(s) to allow trains to pass over the crossing (Figure 4);
- once a train had passed over the crossing, the protecting signals for any particular train passage reverted back to danger by means of activation of the *track circuits*;
- when the signaller decided that train passages were complete, the signaller contacted the crossing keeper to request that the gates be opened to the road;
- the signaller replaced the special crossing reminder appliances over the switch of the protecting signal(s); and
- the signaller and the crossing keeper would record the new status of the gates and the time in the train register book and cabin occurrence book respectively.



Figure 4: Oakenshaw signal box switch panel showing special crossing reminder appliances

- 35 Crofton Old Station No.2 level crossing is situated approximately 40 metres from No.1 level crossing and forms the rail access to and from the Bombardier train maintenance depot. It is connected to the main lines via a headshunt (Figure 2).
- 36 Crofton Old Station No.2 level crossing has gates which are normally open to the road. One set of gates, when closed, completes the boundary fence of the train depot, the other allows access to and from the headshunt. The operation of these gates was also the responsibility of the Crofton crossing keeper. The request to operate the No.2 gates was from the train depot Designated Person.
- 37 The road passing over both level crossings is a private road. Beyond No.2 level crossing, the road gives access for the residents at Burcroft Farm. Between the two level crossings there is a road access gate for the Bombardier train depot, and hence this road is effectively used by the public (paragraph 100).

Preceding events applicable to incident 1

- 38 Crossing Keeper 1 signed on for duty at 05:20 hrs on 1 May 2006 at the crossing keeper's cabin situated close to Crofton Old Station No.1 level crossing.
- 39 Signaller 1 signed on for duty at 12:15 hrs on 1 May 2006 at Oakenshaw signal box
- 40 At 12:35 hrs, the signaller at Wakefield Westgate called Signaller 1 and told him that there were two trains to be directed on the down line. These were train 2F71 followed by train 0D52. Signaller 1 recorded this in the Train Register Book.
- 41 At 12:36 hrs, Signaller 1 telephoned Crossing Keeper 1 to request that the gates at Crofton Old Station No.1 level crossing be closed to the road.
- 42 Between 12:36 hrs and 12:38 hrs, Crossing Keeper 1 closed and locked both gates and confirmed this to Signaller 1 by telephone at approximately 12:38 hrs.
- 43 Between 12:38 hrs and 12:40 hrs, Signaller 1 cleared signal O313 for train 2F71 to pass over the crossing on the down line.
- 44 Train 2F71 passed over the crossing at around 12:41 hrs and signal O313 reverted back to danger by activation of the track circuits.

Events during incident 1

- 45 At around 12:42 hrs, after train 2F71 had passed over the level crossing, Crossing Keeper 1 left the crossing keeper's cabin and opened both level crossing gates to the road.
- 46 Between 12:41 hrs and 12:43 hrs, Signaller 1 cleared Signal O313 for train 0D52 to pass over the crossing on the down line.
- 47 At around 12:44 hrs, a car, driven by Crossing Keeper 2, crossed over the crossing. Crossing Keeper 2, who was about to commence his shift of duty, parked his car close to the cabin and entered the cabin to sign on. The changeover duty occurred and was recorded in the cabin occurrence book.
- 48 At around 12:45 hrs, train 0D52 passed over the crossing with the gates open to the road (Figure 5).



Figure 5: CCTV image of 0D52 passing over the crossing during incident 1

Consequences of incident 1

- 49 There were no injuries and no damage as a result of this incident.
- 50 This incident had the potential to have resulted in much more severe consequences, had a road vehicle been on the crossing at the time of the train passage. At this crossing, users were reliant upon the crossing keeper and the method of working to ensure their safety when crossing the lines.

Events following incident 1

- 51 Both Crossing Keepers 1 and 2 witnessed the train passing over the crossing with the gates open.
- 52 Crossing Keeper 1 proceeded to close the gates to the road, albeit only after having moved his car from the down line side to the up line side of the level crossing.
- 53 At 12:47 hrs, Signaller 1 telephoned Crossing Keeper 2, to inform him that the No.1 gates could be opened to the road. In the same conversation, Signaller 1 informed Crossing Keeper 2 that there was a train coming out of the depot via No.2 gates.
- 54 Crossing Keeper 1 returned from his car to the crossing to operate No.2 gates.
- 55 Around this time, changes were made to the cabin occurrence book to indicate that the gates were closed at the time of shift changeover, instead of the previously recorded open condition.
- 56 No reports of the incident were made by the crossing keepers or the signaller at the time. Signaller 1, being remotely located from the crossing, was unaware of the incident.
- 57 Network Rail was informed of the incident on 2 May 2006, by staff at the Bombardier depot. The incident had been recorded by the depot CCTV system and a copy of the recording was made available to Network Rail investigators.
- 58 Network Rail began an investigation on 2 May 2006. As the incident had taken place the previous day it was not reported to the National Operations Centre (NOC), which records incidents only in real time. As the NOC is the sole reporting point of Network Rail to the RAIB, the incident was not notified to the RAIB. Since the incident was on the previous day, Network Rail also decided not to test the staff involved for drugs and alcohol.
- 59 The RAIB received an anonymous e-mail on 7 May 2006 alleging that an incident had occurred, but not giving sufficient detail to make clear what and where it had happened. The RAIB checked the Network Rail National Log which records incidents. Records covering the period from 24 April to 8 May 2006 were checked, but no recorded incidents were found. A request was made for further information from the source of the original e-mail, but none was forthcoming. On 12 May 2006, another anonymous e-mail was sent to RAIB with details of the approximate location and Network Rail was requested to assist in finding the exact location and the incident details, with confidentiality of the e-mail sender being maintained. On the morning of 18 May 2006, the RAIB were informed that Crofton may have been a likely location. The RAIB initiated an investigation later that day after Network Rail notified them of the second incident.

Preceding events applicable to incident 2

- 60 Crossing Keeper 3 signed on for duty at approximately 06:00 hrs on 18 May 2006 at the crossing keeper's cabin situated close to Crofton Old Station No.1 level crossing.
- 61 Signaller 2 signed on for duty at approximately 06:00 hrs on 18 May 2006 at Oakenshaw signal box.
- 62 At 09:17 hrs, Signaller 2 instructed Crossing Keeper 3 to open the gates to the road following an earlier request to close the crossing.
- 63 The Signaller had not replaced the reminder appliance over the signal switch of Signal O313 after he had last used it.
- 64 At 09:17 hrs Crossing Keeper 3 opened the gates to the road.
- 65 At 09:37 hrs, the signaller at Wakefield Westgate called Signaller 2 and told him that train 2F65 was to be directed on the down line. Signaller 2 recorded this in the Train Register Book. This train formed the 09:38 hrs Northern Rail service from Wakefield Kirkgate to Knottingley.

Events during incident 2

- 66 Between 09:37 hrs and 09:44 hrs, Signaller 2 cleared Signal O313 for train 2F65. During this time the Signaller was also attending to other issues, including a personal telephone call.
- 67 At 09:44 hrs, Signaller 2 telephoned Crossing Keeper 3 to enquire as to the position of the level crossing gates at Crofton Old Station No.1 level crossing, realising that he may have cleared Signal O313 before requesting and receiving subsequent confirmation that the level crossing gates were closed to the road. Upon hearing that the gates were open to the road, Signaller 2 requested that the gates be closed to the road and said that he had cleared Signal O313 in error.
- 68 Crossing Keeper 3 left the cabin, crossed over the main lines and closed the up side line gate. Train 2F65 sounded the train horn as it approached Signal O313.
- 69 Train 2F65 passed over the crossing as Crossing Keeper 3 had just locked the up side line gate. He was between the gate and the running lines as the train passed. The gate closest to the down side line was still open to the road (Figure 5).



Figure 6: CCTV image of 2F65 passing over the crossing during incident 2

Consequences of incident 2

- 70 There were no injuries and no damage as a result of this incident.
- 71 This incident had the potential to have resulted in much more severe consequences, had the crossing keeper been closer to the track whilst attempting to close the gates, or if a road vehicle been on the crossing at the time of the train passage.

Events following incident 2

- 72 Once the train had passed, Crossing Keeper 3 closed the down line side gate and then telephoned Signaller 2 to inform him that he had only managed to close one gate prior to the train's passage.
- 73 A discussion followed between the signaller and the crossing keeper as to whether the security guard at the Bombardier depot had seen the incident.
- 74 The incident was reported by staff at the Bombardier depot to local Network Rail staff who then informed Network Rail NOC, who in turn notified the RAIB.
- 75 Network Rail LNE Territory began an investigation during which Signaller 2 was relieved of his duties at Oakenshaw signal box at around 11:10 hrs and was tested for drugs and alcohol as per Network Rail procedures following an incident. The tests proved to be negative. Statements were obtained from the Signaller, Crossing Keeper and the Security Guard who witnessed the event. Crossing Keeper 3 was not tested for drugs and alcohol, contrary to Network Rail procedures.
- 76 The operational conditions and requirements of the working of the level crossing at the time of both incidents were specified within the Crofton Old Station No.1 level crossing order. This came into force on 12 February 2006. One of the conditions and requirements within the level crossing order was that the operator should ensure that special crossing reminder appliances be used over the controlling signal switches of Signals O313, O314, O315, O316 and O318. At the time of both incidents, only the switches for Signals O313 and O318 had special crossing reminder appliances fitted. The reminder appliances for the other signal switches were delivered to the signal box by a local signalling manager on 19 May 2006, after the two incidents, to enable compliance to the level crossing order.
- 77 Documentary evidence indicates that Network Rail made a visit, as part of a signalling safety tour, to Oakenshaw signal box on 3 March 2006. This identified the action to place a graphic on the signal box diagram to indicate the position of Crofton Old Station level crossing. This was intended to serve as a visual reminder to the signaller to request that the crossing gates be closed to the road prior to the clearing of the protecting signals. This had previously been identified as an 'essential' action on 27 May 2004 when concerns over the level of traffic were first documented. The graphic was added to the signal box diagram by a local signalling manager on 19 May 2006 after the two incidents (Figure 6).
- 78 On 19 May 2006, ORR (HMRI) suggested to Network Rail that they reconsider the provision of keylocks which had not been undertaken at an earlier time (reference to paragraphs 97 and 98) as the risk assessment of the method of working appeared to take insufficient account of human error.

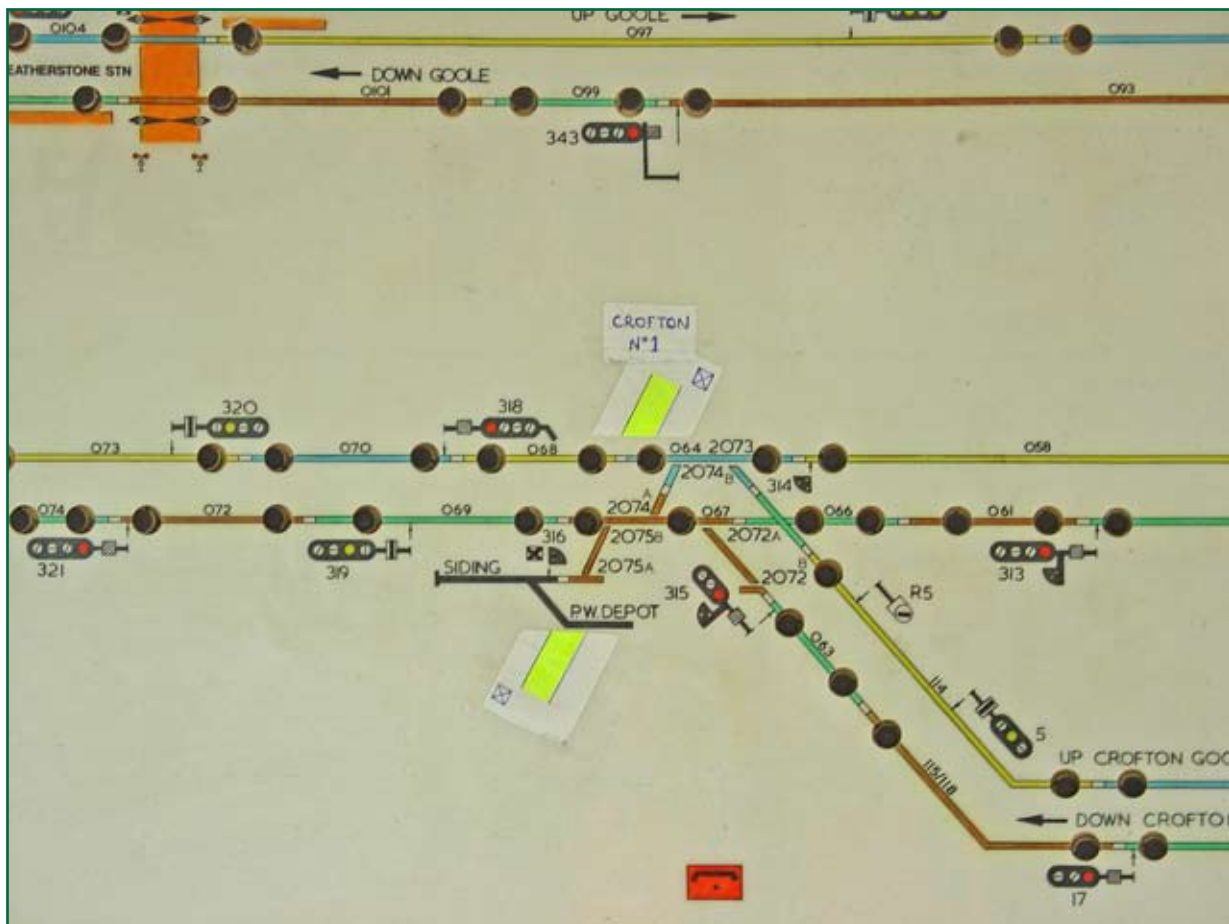


Figure 7: Crofton crossing graphic added to Oakenshaw signal box diagram

79 Network Rail held a meeting on 24 May 2006 to discuss the issue of irregular working at Crofton Old Station No.1 level crossing. Significant points discussed that are relevant to this investigation were:

- The possible delay to the programme of the proposed area resignalling scheme which would delay the proposed full upgrading of the level crossing.
- A decision that as from 22 May 2006, Network Rail signal managers would undertake three supervisory visits per week to both the crossing and the signal box. These visits would include voice tape sampling and monitoring to ensure good communications between signaller and crossing keeper. It was stated that no additional monitoring or supervisory visits, as specified within the level crossing order, had taken place up to the time of incidents, except the visit of 3 March 2006.
- The recording of the decision to add the graphic of the crossing to the signal box diagram, which was done on 19 May 2006.
- A reversal of the decision to implement the additional special crossing reminder appliances that had been delivered to the signal box on 19 May 2006. Although these were required for compliance with the level crossing order, the meeting notes recorded that the use of too many may diminish their significance in situations where they were needed for other signal box operations.
- A decision to change the method of working to include the verbal confirmation from the signaller to the crossing keeper that the special crossing reminder appliances have been applied once the gates are confirmed as being open to the road.

- A decision to review that the additional works as stated in the requirements of the level crossing order have been completed.
 - A decision to develop a non-standard keylock system or a simplified CCTV system. The non-standard system of keylocking involved the interlocking of the crossing gates to the protecting signals directly, without the need to disturb the wiring at Oakenshaw signal box.
- 80 On 9 June 2006, Network Rail informed ORR (HMRI) that a review had taken place and that the actions taken forward were the addition of the graphic to the signal box diagram, a change in communication for the crossing keeper to remind the signaller to apply the special crossing reminder appliances, and an increase of supervisory visits to three per week. ORR (HMRI) was informed of the likely programme slippage of the area resignalling scheme and that an interim measure of the provision of the non-standard keylock system was being pursued.
- 81 On 14 June 2006, ORR (HMRI) informed the RAIB that they were satisfied that all interim measures were in place to minimise a reoccurrence until such time that interlocking was provided.
- 82 On 14 August 2006, ORR (HMRI) informed RAIB that the planned date for the fitting of the non-standard keylock system would be November 2006. This system was fitted and commissioned on 26 November 2006.

The Investigation

Investigation process

83 The RAIB investigation involved:

- interviews with witnesses and key personnel;
- examination of CCTV recorded footage of the incidents captured by the depot security camera;
- examination of Network Rail's own investigation reports for the incidents;
- examination of voice recordings from Oakenshaw signal box; and
- examination of Network Rail and ORR (HMRI) records relating to the level crossing.

Key evidence

Key evidence for both incidents 1 and 2

Witness and documentary evidence, indicate that before both incidents:

- 84 Crofton Old Station No.1 level crossing was originally a *user worked crossing* (UWC) of *Occupation* status. The road was private and gave access to the residents at Burcroft Farm. The gates were normally closed to the road and there was no crossing keeper.
- 85 Between 1962 and 1994 the crossing was used for road access to a *permanent way* assembly depot. During this period, a crossing keeper was employed to operate the gates between 07:30 hrs and 17:00 hrs. At other times the crossing reverted back to user worked operation. It is believed that telephones to contact the signaller at Oakenshaw signal box were installed in the late 1970s. After the permanent way depot closed in 1994, the crossing reverted back to a UWC with telephones.
- 86 The last recorded risk assessment as a UWC was undertaken on 26 March 1999 by Railtrack, the former owner and predecessor of Network Rail. This was in accordance Railtrack Line Procedure RT/LS/P/026 Inspection and Risk Assessment Methodology for UWC - Footpath and Bridleway Level Crossings, Issue 1 and required that a risk assessment be undertaken every three years.
- 87 This risk assessment recorded crossing abuse relating to users failing to contact the signaller before crossing, and also failures in closing the gates after use. Railtrack acted by informing users of their duties in using the crossing and actions during this period do not form a part of this investigation.
- 88 Between May 2000 and May 2001, the depot was redeveloped for use by Bombardier Prorail for the testing and commissioning of new trains. Initially a single shift crossing keeper was employed at the crossing between May and October 2000 during the depot's construction. In November 2000, the operation changed to a two shift system of crossing keepers, staffed between 05:30 hrs and 22:00 hrs.
- 89 During this time, UWC inspections were undertaken in accordance with Railtrack Line Specification RT/LS/S/012. The use of the crossing by depot staff and visitors is first recorded as being in early 2001.

- 90 At some time during late 2001 to early 2002, the depot began undertaking regular train maintenance. This change in use brought with it an increase in road traffic using the crossing.
- 91 From November 2002, the crossing was operated by three shifts of crossing keepers, in order to make it permanently staffed. Also at some time in late 2002, the crossing designation was changed from a UWC to a MGH type. This latter designation showed that it was a manned crossing with hand-operated gates.
- 92 Until February 2006, the method of operation kept the crossing gates normally closed to the road. When road traffic arrived at the crossing, the crossing keeper telephoned the signaller at Oakenshaw signal box to ask whether the gates could be opened to the road. The signaller then decided whether the gates could be opened dependant upon whether any trains were due to pass over the crossing. If the signaller deemed that it was safe to do so, the signaller would set the signals to danger and then the crossing keeper would be given permission to open the gates. The crossing keeper opened the gates to allow traffic to cross, and then closed and secured them. Once the gates were closed and locked across the road, the crossing keeper telephoned the signaller to confirm this.
- 93 There is no record of a risk assessment having been undertaken to support the change to an MGH crossing. Also, since it was no longer classified as a UWC type, the requirement to be risk assessed to comply with the revised RT/LS/P/026 procedure would not have applied.
- 94 Shortly after the three shift system had been introduced in late 2002, concerns were raised by the signallers with regard to the increase in the number of telephone calls between the signaller at Oakenshaw Signal box and the crossing keeper. This increase was attributable to the increase in road traffic use of the level crossing. The increased number of telephone calls resulted in an associated increase in entries in the train register book at Oakenshaw signal box. The frequency of crossing operation was especially high during times of the train depot shift changes.
- 95 In May 2004, Network Rail carried out a signalling safety tour in addition to the routine crossing inspections. This documented the increase of telephone calls between the signaller and crossing keeper. The records indicate that the operation of the level crossing generated approximately 180 telephone calls per day between the signaller and the crossing keeper, with the gates being operated approximately 90 times daily.
- 96 The quantity and frequency of telephone calls, especially in view of their repeated and similar nature, gave Network Rail concern over the risk of an operating error arising from possible miscommunication between the signaller and the crossing keeper.
- 97 Additional measures of crossing protection were examined in 2004 and 2005. This included the consideration of the provision of a CCTV system of operation linked to Oakenshaw signal box, or locally interlocking the level crossing gates to the crossing's protecting signals via Oakenshaw signal box.
- 98 The interlocking system is known as keylocking. This system provides the means for ensuring that the crossing's protecting signals can only show a proceed aspect to trains if the level crossing gates are closed to the road and locked. The system consisted of a detection system fitted to the gates which would have linked to the signal wiring at Oakenshaw signal box. This was considered, but discounted, because of the risks associated with its installation due to *wiring degradation* at Oakenshaw signal box.

- 99 The conversion to a CCTV level crossing was discounted for financial reasons, in view of a planned area resignalling scheme at Wakefield Kirkgate. This was to include an upgrade, including additional protective measures to the crossing, in 2007. The costs for the provision of these measures prior to the full area resignalling scheme would be four times that of the cost if undertaken as part of the scheme.
- 100 In order to undertake the change, Network Rail sought a level crossing order under Section 1 of the Level Crossings Act 1983, after discussions with ORR(HMRI). A level crossing order details both the physical and operational conditions and requirements for the method of working in circumstances where the crossing use has changed.
- 101 Documentary evidence indicates that in June 2005, Network Rail considered undertaking a risk assessment and a human factors study in support of the proposed change to the method of working. A risk assessment was undertaken. This consisted of a comparison of the number of telephone calls between the signaller and the crossing keeper between the, then, current method and that proposed. The reduction in risk of the proposed method of working was directly attributed to the reduction in the number of telephone calls; the sole consideration of risk being that arising from miscommunication. The risk of the proposed system was rated 'low to medium' as compared to the then current method being 'medium to high'. A separate human factors study was not undertaken.
- 102 The draft level crossing order was created in June 2005. In August 2005 a site visit was made by Network Rail and an ORR (HMRI) inspector. Subsequent discussions continued on the detail of provision of necessary signage requirements for the crossing. In October 2005, ORR (HMRI) requested that Network Rail consider the provision of a keylocking system and requested that Network Rail undertake a risk assessment.
- 103 Network Rail supplied the risk assessment previously undertaken in June 2005 to ORR (HMRI), together with the draft procedures for the proposed method of working. An explanation of why keylocking could not be implemented until the full area resignalling was undertaken was also supplied. This included the reasons given in paragraphs 98 and 99.
- 104 There was a further discussion on the additional audits required by ORR (HMRI) to monitor the actions of the signaller and the crossing keeper to ensure the method of working was followed correctly. A requirement specified in the draft level crossing order was to undertake audits of signaller and crossing keeper on a monthly basis and take immediate corrective actions for discrepancies found in the method of working or records. Network Rail's view was that weekly supervisory visits, in accordance with their Operations Manual procedure 3.06, were already in place to correct any irregularities found, and thus the requirements of the order were being met. ORR (HMRI)'s expectation was that the scheduled six-monthly crossing inspections carried out by Network Rail's signalling managers would increase in frequency to monthly. Discussions between Network Rail and ORR (HMRI) on this issue were not documented, but it appears that a full understanding between each party on this issue was not reached. No additional visits to those carried out prior to the change in working method were undertaken before the incidents.
- 105 The level crossing order was approved by ORR (HMRI) and came into force on 12 February 2006, along with the new method of working as detailed in paragraph 34.

Occurrences of a similar character

- 106 There was no evidence found that showed that any previous events similar to the two incidents had occurred at Crofton Old Station No.1 level crossing.

- 107 There is no evidence of occurrences of operating errors from the year 2000 to 12 February 2006 when operating under the original method of working with the gates normally closed to the road.
- 108 There have been two further incidents at Crofton Old Station level crossing. The first occurred at approximately 02:05 hrs on 11 November 2006, when a freight train passed over the crossing on the down line with the gates open to the road. Evidence from CCTV and voice recording indicates that the crossing keeper did not follow the method of working. The second incident occurred at 15:33 hrs on 24 November 2006, when a freight train passed over the crossing on the down line, whilst the crossing keeper was attempting to close the gates. Evidence indicates that the signaller at Oakenshaw signal box did not replace the reminder appliance upon the switch for the protecting signal after its earlier use. Network Rail informed the RAIB of both of these incidents. RAIB undertook preliminary investigations and reviewed the findings. The RAIB is satisfied that the full investigation being undertaken into the two earlier incidents gives sufficient recognition of the latter two events in respect of cause and recommendations. In both of these incidents, interlocking the gates to the protecting signals would have prevented them from happening.

Analysis

Identification of the immediate causes

Incident 1

- 109 On 1 May 2006, the level crossing gates were open to the road during the passage of train 0D52 over the level crossing.
- 110 Signaller 1 had requested, and Crossing Keeper 1 had confirmed, that the crossing gates were closed to the road prior to Signal O313 being cleared for train 2F71, which was the train prior to 0D52.
- 111 Crossing Keeper 1, having seen train 2F71 pass over the level crossing, opened the gates to the road, contrary to the prescribed method of operation.
- 112 Signaller 1, believing that the gates were still closed to the road, following the earlier confirmation from Crossing Keeper 1 (paragraph 110), cleared Signal O313 for train 0D52.
- 113 The immediate cause for the incident on 1 May 2006 was that the level crossing gates were opened to the road without permission from the signaller, contrary to the prescribed method of operation.

Incident 2

- 114 On 18 May 2006, the up side gate had just been closed and the down side gate was fully open during the passage of train 2F65 over the level crossing.
- 115 The level crossing's down line protecting signal, O313, was cleared for the passage of train 2F65 before Signaller 2 had requested and received confirmation that the gates were closed to the road, contrary to the prescribed method of operation.
- 116 The immediate cause for the incident on 18 May 2006 was that the level crossing's down line protecting signal, O313, was cleared to allow the passage of train 2F65 whilst the gates were open to the road.

Identification of causal and contributory factors for both incidents

Causal Factors

- 117 In both incidents, the operation of the gates and the signals was such that the physical operation of one was not dependant upon the state of the other. Hence, the gates could be open for the passage of road traffic, whilst an approaching train was signalled over the level crossing.
- 118 Therefore, a causal factor for both incidents is that no interlocking was present between the level crossing gates and its down line protecting signal, O313.
- 119 The lack of interlocking applies to all of the crossing's protecting signals, not just Signal O313.
- 120 For the first incident, an error was made by Crossing Keeper 1 in omitting to wait for permission from Signaller 1 that the gates could be opened to the road.
- 121 For the second incident, an error was made by Signaller 2 in omitting the request for, and receipt of, confirmation that the gates were closed to the road, prior to clearing Signal O313 for the train.

122 Therefore, a causal factor for both incidents was human errors in omitting steps within the method of working.

Contributory Factors to the lack of interlocking between the crossing gates and the protecting signals

123 In 2000, when the train depot development began, Railtrack decided to operate the crossing by the use of a crossing keeper. As the usage of the depot by Bombardier Prorail was for a three year period for train commissioning purposes, with a possible extension up to ten years, Railtrack and Bombardier Prorail agreed that the crossing keeper would be appointed by Railtrack and funded by Bombardier. The crossing keeper also was to operate Crofton Old Station No.2 level crossing gates which gave rail access to and from the depot.

124 During the period between 2001 and 2002, the change in use of the depot, associated with train maintenance activities, led to an increase in shift working within the depot. This led to an increase in the road traffic levels over the crossing, particularly at times of depot shift changes.

125 Documentary evidence indicates that in 2004 it was acknowledged that the original forecast of road traffic use, undertaken when the depot was being planned, had been underestimated.

126 Therefore, a contributory factor is that the road traffic use (both daily and peak) had become greater than that which had been envisaged when the train depot was originally created.

127 Throughout 2000 to 2002, regular UWC crossing inspections, in accordance with standard RT/LS/S/012, were undertaken. The inspections involved the completion of a form specified by RT/LS/S/012. The inspections are based upon a 'tick box' approach in answering pre-prepared questions.

128 The form is principally designed for use with standard UWCs and it does not address interaction issues between signaller and crossing keeper, where crossings are reliant upon this method of operation. The inspection form also contains a section for recording crossing usage, albeit only by the selection of one of the broad, descriptive categories on the form. The usage of the crossing had been identified as 'frequent' on all inspections from January 2000 to September 2002, whereas other evidence indicates that it had grown considerably over this period as the depot use had developed.

129 The last recorded UWC inspection was in September 2002. This is also the last inspection recorded for 2002. Records also indicate that as from January 2003, inspections were undertaken in accordance with the Network Rail Operations Manual, Procedure C 5, Appendix G (MG) for MGH crossings. Witness evidence indicates that on 3 November 2002, the crossing changed to a three-shift operation by crossing keepers, although no Network Rail records have been produced to support this. There is no evidence which indicates that this change was as a result of the findings from any of the UWC inspections.

130 The inspections for the crossing as a MGH type (post November 2002) were undertaken by the completion of a form specified by Procedure C5, Appendix G (MG) within the Operations Manual. The inspections are based upon a 'tick box' approach in answering pre-prepared questions. It does not address interaction issues between signaller and crossing keeper and, unlike the earlier inspections, there is no direction to the inspector to record the crossing usage.

- 131 Evidence indicates that the UWC inspections between 2000 and 2002 may not have been undertaken in a comprehensive manner. Some inspection forms were 'pre-filled' prior to a crossing inspection. Critical sections, including measurements and timings, contained within the September 2002 inspection form are 'pre-filled' copies of those used in 2000 to 2001.
- 132 Evidence also indicates that some pages of the forms for the MGH inspections were also copied (and therefore pre-filled) from one inspection to the next. This is less of an issue than that with the former inspection regime, as by this time the crossing usage had increased and the MGH inspection form does not give any direction to record the crossing usage.
- 133 The possible lack of thoroughness of the inspections, especially when designated as UWC crossing, is considered a possible contributory factor in that early recognition of the increased usage of the crossing may have led to the opportunity of consideration of suitable protective measures, and hence their possible earlier introduction.
- 134 Of greater significance, however, is that none of the inspection forms direct the inspector to report the change in crossing use and the associated effects upon signallers and crossing keepers where this is used to ensure safe operation of a level crossing. This is a contributory factor.
- 135 Railtrack Line Procedure RT/LS/P/026 Inspection and Risk Assessment Methodology for UWC - Footpath and Bridleway Level Crossings, Issue 1, which was applicable both before and during the establishment of the train depot, specified that a risk assessment for user worked crossings was required every three years. A risk assessment for Crofton Old Station No.1 crossing was carried out on 26 March 1999; this is before the date that the depot began to be developed. There are no records to indicate that a subsequent risk assessment, due in March 2002, was undertaken.
- 136 A revision to this procedure to Issue 2, was introduced in June 2002. This mandated that all user worked crossings were to be risk assessed by 31 December 2002.
- 137 Since it is likely that the crossing was no longer regarded as a UWC by the end of December 2002 (paragraph 129), the requirement to be risk assessed to comply with this revised procedure would not have applied.
- 138 However, the lack of a risk assessment in March 2002 is a possible contributory factor to the lack of interlocking, as it does not in itself account for the lack of interlocking. If this information had been recorded, it may have led to an earlier consideration, and possible implementation, of protective measures for the crossing.
- 139 At the same time that the crossing was re-designated from a UWC to an MGH type, consideration should have been given to Railtrack Line Standard RT/LS/P/026 Issue 2, June 2002. This standard states that where the use of the level crossing has changed considerably, or has become a road to which the public has access, appropriate controls should be selected to comply with the principles shown within the then HSE publication Railway Safety Principles and Guidance, Part 2, Section E. The Level Crossing Regulations 1997 would also apply.
- 140 Railway Safety Principles and Guidance, Part 2, Section E, has well defined categories for level crossing types. Applicable in this case is Clause 40 for the category of Gated Crossings. This states that for a gated crossing operated by railway staff, the signals are to be interlocked with the gates so that it is not possible to clear the signals unless the road is fully closed by the gates. It should also not be possible to open the gates unless the signals are set to stop trains.

- 141 Therefore, a contributory factor is that interlocking was not provided in 2002 when the crossing became permanently staffed and re-designated as a MGH crossing.
- 142 It was not until the signalling safety tour in May 2004 (paragraph 95), that Network Rail documented the need to implement some additional form of protection at the crossing.
- 143 This concern led to consideration of additional forms of protection in 2004 and 2005. Measures evaluated included a CCTV system of operation linked to Oakenshaw signal box and interlocking the level crossing gates to the crossing's protecting signals by the local system of keylocks (paragraphs 97 and 98). There was also a realisation at this time that the original forecasts of road traffic use undertaken in 2000 had been underestimated.
- 144 The reasons why additional protective measures were not implemented during this period are documented as being due to financial constraints of implementation before the planned 2007 upgrade of the crossing (part of the area resignalling scheme at Wakefield Kirkgate). The cost for prior implementation was estimated to be four times that of undertaking the crossing upgrade as part of the resignalling scheme. There is no evidence that this was assessed using the principles of *ALARP*.
- 145 Local area keylocking was discounted as being impractical due to the presence of wiring degradation at Oakenshaw signal box.
- 146 Therefore, a contributory factor is that provision of additional protective measures, including interlocking, was made more restrictive by financial and physical constraints, although *ALARP* principles do not seem to have been followed.

Contributory Factors relating to the human errors in both incidents

- 147 Within the notes from the Network Rail signalling safety tour in May 2004 (paragraph 95), it was documented that the change in the method of working, so the gates were normally open to the road, would lessen the risks of collision due to a reduction in telephone calls. This is recorded as being proposed as an interim method until such time that interlocking was provided.
- 148 The risk assessment undertaken in support of the change in method of working was not comprehensive. It consisted only of a comparison of the number of telephone calls involved in the operation of the crossing between the then current method and the proposed method. It directly linked the reduction of the risk of collision between a train and a road vehicle solely to the reduction in the number of telephone calls between the two methods of working. No consideration was given to the additional risk that could arise in operating with the new method of working, including consequences of omitting steps within it. The risk assessment rated the proposed method as 'low to medium' risk as compared with the then current system being rated as 'medium to high' risk with no regard to the numerically quantified risk or true comparative level.
- 149 With no crossing gate to signal interlocking present to prevent trains being signalled over the crossing whilst the crossing gates were open to the road, the safe operation of the crossing relied solely upon following the correct steps within the procedure for the method of working.
- 150 Therefore, contributory factors to the human errors in both incidents are:
- the method of working in place at the time of both incidents was susceptible to the human errors that occurred; and
 - the risk assessment undertaken, and subsequently reviewed prior to the approval by the issuing of the level crossing order, did not take account of the risks of human error in the new method of working.

Consideration of the sources of the human errors

For Incident 1

- 151 Crossing Keeper 1 had worked as a relief crossing keeper in the area for nearly 40 years at the time of the incident. The work of a relief keeper is such that Crossing Keeper 1 had worked at nine other crossings over the past 12 months, with the Crofton being the most frequent (approximately 43 shifts out of a total of 215 shifts over the preceding 12 months).
- 152 Crossing Keeper 1's shift patterns for the month prior to the incident indicate that he had worked at Crofton on three occasions; with two of these being two and three days immediately prior to the incident. Although there is evidence that indicates that Crossing Keeper 1 had not received a full briefing at the time of the change in the method of working in February 2006, consideration of overall experience and recent work at the crossing, indicates that unfamiliarity with the method of working is an unlikely cause for the error.
- 153 The possibility exists of being unfamiliar with the passage of more than one train passing over the crossing during the time that the gates were closed. Witness evidence indicates that Crossing Keeper 1 had experience of more than one train passing over the crossing during a single cycle of gates being closed and opened to the road. Therefore, unfamiliarity of this situation as a contributory factor has been discounted.
- 154 The possibility exists of confusion over the operation of Crofton level crossing in consideration of the other crossings worked. Half of the ten crossings worked by Crossing Keeper 1 have gates that are normally open to the road, with the other half having the gates normally closed to the road. Crofton is the only crossing that has the gates normally open to the road with no additional protective measures, or interlocking. However, as Crossing Keeper 1 had worked at Crofton two and three days immediately prior to the incident and in consideration of Crossing Keeper 1's experience, confusion over location and differing methods of operation has been discounted.
- 155 There is no evidence that Crossing Keeper 1 was distracted at the time of the incident.
- 156 Crossing Keeper 1 was on leave the day before the day of the incident and had worked 6 shifts prior to this over the previous seven days. These shifts consisted of four morning shifts, followed by a non-working period of approximately 32 hours. This was followed by two night shifts at Crofton and then a period of 24 hours before beginning the morning shift on the day of the incident. The issue of fatigue due to shift patterns has thus been discounted.
- 157 The investigation found that it is custom for the exact time of change of shift to be mutually agreed between crossing keepers. The possibility therefore exists for shift lengths to be extended to a point where fatigue may be an issue. However, this was not the case on 1 May 2006 and has been discounted.
- 158 The investigation found that although the gates are under the control of the signaller when they are closed to road, a practice of '*quick swings*' is still prevalent. In this 'method', if the gates are closed to the road for an extended period and a road user wishes to cross, the crossing keeper may telephone the signaller to request that the gates are opened to the road for a short period to allow the vehicle(s) to cross, after which the gates are re-closed. A subsequent confirmation telephone call is then made to the signaller. This has the potential for confusion in that it tends to mix the old system of operation with the new and has not been risk assessed or incorporated in the formal method of working. However, as there was no road traffic waiting to cross over the crossing, this is not a factor and has been discounted.

- 159 The crossing keeper also is responsible for the operation of No.2 gates. It was known that there was a request from the signaller to operate No.2 gates about the time of the first incident. Signal box voice recordings have shown that the request for the operation of No.2 gates was after the inadvertent opening of No.1 gates and therefore confusion between No.1 and No.2 gates has been discounted.
- 160 There is no evidence to indicate that this was a deliberate or malicious act.
- 161 It is not possible to determine with certainty the source of this human error as no evidence exists. However, anticipation of the permission to open the gates from the signaller is the most likely scenario. This is supported by the following:
- the prevalent 'natural' position of the gates was open to the road; and
 - the initiating event for the inadvertent opening of the gates is likely to have been the observing of train 2F71 passing over the crossing.
- 162 In conclusion, although it is not possible to determine with certainty the source of the error, as no evidence exists, the most probable cause was an act of anticipation in opening the gates prior to the receipt of the permission to do so.

For Incident 2

- 163 Signaller 2 had been a signaller for 26 years and has been a permanent signaller at Oakenshaw for 11 years with a previous period of 10 years as relief signaller at this signal box. Therefore, unfamiliarity and inexperience have been discounted.
- 164 Signaller 2 had worked six night shifts from 22:00 hrs – 06:00 hrs the week before the incident. This was followed by a period of 32 hours off duty, then two afternoon shifts followed by a rest day period of 32 hours prior to being on duty at 06:00 hrs on the day of the incident. The issue of fatigue due to shift patterns has therefore been discounted.
- 165 There is no evidence to indicate that this was a deliberate or malicious act.
- 166 The signaller was distracted from his duties by attending to a personal telephone call.
- 167 The distraction in the duties of Signaller 2 is considered to be contributory to incident 2 in that it led to the omission of the special crossing reminder appliance not being replaced over the switch for Signal O313 following its earlier use.
- 168 The need for a level crossing graphic on the signal box diagram had been identified on two occasions prior to incident 2 (paragraph 77). The graphic would have had some ergonomic value to the signaller in acting as reminder when looking at the diagram to ensure that the crossing keeper was contacted before clearing the signal. It is not possible to determine the degree of contribution the lack of this graphic had on this incident as it is not possible to know whether Signaller 2 was looking at the diagram at the time. The lack of this graphic on the diagram is a possible contributory factor to incident 2.

Conclusions

Immediate cause for both incidents

169 The level crossing's down line protecting signal, Signal O313, showed a clear aspect for the passage of trains whilst the level crossing gates were open to the road.

Causal and contributory factors

170 The following causal factors were identified for both incidents:

- no interlocking was present between the level crossing gates and its down line protecting signal, O313 (paragraph 118); and
- human error in omitting steps within the procedure for the method of working (paragraph 122, **Recommendation 1**).

171 In addition, the following factors were considered to be contributory:

- interlocking was not provided:
 - a) at the time of the depot development in 2000 (paragraph 126)
 - b) at the time the crossing was permanently staffed and re-designated as a MGH crossing (paragraph 141)
 - c) once the high crossing usage and its possible risks were known, because of financial considerations and installation constraints (paragraph 146, **Recommendation 1**);
- the new method of working introduced in February 2006 was susceptible to the human errors that occurred (paragraph 150, **Recommendation 1**);
- the risk assessment undertaken, and subsequently reviewed prior to the approval by the issuing of the level crossing order, did not take account of the risks of human error in the new method of working (paragraph 150, **Recommendation 4**); and
- for incident 2, distraction led to the special crossing reminder appliance not being replaced over the switch for Signal O313 the last time it was used (paragraph 167, **Recommendation 1**).

Additional observations

172 During the investigation, it was found that the practice of 'quick swings' was still prevalent (paragraph 158). This has the potential for confusion in that it tends to mix the old system of operation with the new and has not been risk assessed or incorporated in the formal method of working (**Recommendation 6**).

173 The omission in the provision of the additional special crossing reminder appliances, as required by the level crossing order prior to this incident, is not thought to have been contributory. The signal switches over which the additional appliances were to be located, were not used in the signalling of trains associated with this incident. In the Network Rail meeting of 24 May 2006 a decision was taken not to implement the additional appliances as it was thought that regular use may diminish their significance when used in operational situations other than those connected with the working of the crossing. However, it should be noted that the requirements specified within level crossing orders do have legal standing under the 1983 Level Crossings Act (**Recommendation 5**).

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

174 Network Rail has installed the non-standard keylock system (Paragraph 82) at Crofton Old Station level crossing. It was commissioned on 26 November 2006.

Recommendations

175 The following safety recommendations are made¹:

Recommendations to address causal and contributory factors

1. Network Rail should provide interlocking between the gates and all protecting signals at Crofton Old Station No.1 level crossing. This should ensure that the protecting signals are not able to indicate a proceed aspect to trains when the gates are not fully closed and locked to the road (paragraph 170). A non-standard version of interlocking has already been implemented (paragraph 174). Risk assessment should be undertaken to ensure that any residual risk which remains following fitment, including from sources of human error, is mitigated so far as is reasonably practicable.
2. Network Rail should undertake a risk assessment on all staffed level crossings that have no gate to signal interlocking safeguards to ensure that the risks from human errors are considered and are mitigated so far as is reasonably practicable (paragraph 171).
3. Network Rail should review operational level crossing standards relating to staffed level crossings, or those which are UWC temporarily staffed, where the safe system of operation relies solely upon the correct following of procedures. Such standards should enforce assessment of the risk from errors in the following of correct procedures (paragraph 171).
4. ORR (HMRI) should have processes in place to ensure that when issuing level crossing orders, any supporting risk assessments are suitable and sufficient (Paragraph 171).

Recommendations to address other matters observed during the investigation

5. ORR (HMRI) should have processes in place to ensure that the requirements within level crossing orders have been implemented, and action when necessary is taken to ensure compliance (paragraph 173).
6. Network Rail should assess the extent and review the practice of ‘quick swings’ on manually operated crossings where the crossing gates are not interlocked to the signalling to ensure either that the practice is banned or that risks are reasonably mitigated (paragraph 172).

¹ Responsibilities in respect of these recommendations are set out in the Railways (Accident Investigation and Reporting) Regulations 2005 and the accompanying guidance notes, which can be found on RAIB’s web site at www.raib.gov.uk

Appendices

Glossary of abbreviations and acronyms

Appendix A

ALARP	As Low As Reasonably Practicable
CCTV	Closed-Circuit Television
DMU	Diesel Multiple Unit
HMRI	Her Majesty's Railway Inspectorate
MGH	Manned (staffed) Gated crossing, Hand operated
NOC	National Operation Centre
ORR	Office of Rail Regulation
UWC	User Worked Crossing

Glossary of terms

Appendix B

ALARP - As Low As Reasonably Practicable	A description that residual risk is acceptable, acknowledging that there will always be some small risk remaining irrespective of the funds expended to try to eliminate it.
Cleared (signal)	The operation of a signal to show a proceed aspect to trains.
Down line	The line from Wakefield Westgate to Goole, heading East over the crossing.
Interlocking (level crossings)	A system whereby the operation of crossing protecting signals is dependant upon the state of the level crossing gates.
Keylocks	A method of interlocking assisted by manually operated keys to operate locks fitted to crossing gates. This can be linked to either the signal box wiring, or directly to the signals in the case of a 'non-standard' keylock system.
Occupation (level crossing)	A level crossing on a private road leading to several premises or residences, usually provided when the road was severed at the time the railway was constructed.
Permanent way	The track including rails and sleepers.
Protecting Signals	The signals immediately before a level crossing that either permit or prevent a train from running over the level crossing.
Quick swings	The practice whereby when the level crossing gates are closed upon a request from the signaller, the crossing keeper requests that the gates are then opened for a short period to allow road traffic to cross. The Signaller decides whether there is enough time for this to take place before the train reaches the crossing.
Special crossing reminder appliance	A device which has to be removed from a signal switch before the switch can be operated. In this case the reminder is for the signal protecting a level crossing.
Track circuits	An electrical device using rails in an electric circuit which detects the absence of trains on a defined section of line.
Track circuit block	A signalling system which uses continuous track circuits and multiple aspect lights.
Up line	The line from Goole to Wakefield Westgate, heading West over the crossing
User Worked Crossing	A type of level crossing where the road user has to operate the gates or barriers themselves.
Wiring degradation	A condition of electrical wiring whereby the insulation degrades and can become easily damaged if disturbed.

British Railway Board Group Standard GO/OT0003, Issue 1, Revision A, October 1993, Protection at Occupation and Accommodation Level Crossings.

Railway Group Standard GC/RT5208, Issue 1, August 1997 Civil Engineering Requirements for Level Crossings.

Railtrack Line Procedure RT/LS/P/026 Issue 1, December 1998, Inspection and Risk Assessment Methodology for UWC - Footpath and Bridleway Level Crossings.

Railtrack Company Procedure RT/LS/P/026 Issue 2, June 2002, Inspection and Risk Assessment Methodology for UWC - Footpath and Bridleway Level Crossings.

RT/LS/S/012, Issue 2, October 1999. Inspection and Risk Assessment Forms for UWC, Footpath and Bridleway Level Crossings renamed as NR/SP/OPS/012.

Railway Group Standard GI/RT7011, issue 1, October 2002. Provision, risk assessment and review of Level Crossings.

RT/LS/S/012, Issue 3, June 2002. Specification for Assessment of User Worked and Bridleway Level crossings renamed as NR/SP/OPS/012.

Railway Group Standard GI/RT7012, Issue 1, August 2004, Requirements for Level Crossings.

Network Rail Operations Manual - Procedure C 5, Appendix G (MG). Periodic Inspections of Manned Gated (MG) Level Crossings.

This report is published by the Rail Accident Investigation Branch,
Department for Transport.

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Any enquiries about this publication should be sent to:

RAIB	Telephone: 01332 253300
The Wharf	Fax: 01332 253301
Stores Road	Email: enquiries@raib.gov.uk
Derby UK	Website: www.raib.gov.uk
DE21 4BA	