RAIB
Rail Accident Investigation Branch

Rail Accident Report

Near miss at Poplar Farm level crossing, Attleborough, Norfolk 1 July 2008

Department for Transport

Report 14/2009
June 2009

This investigation was carried out in accordance with:

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

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Introduction

Preface

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 Appendix A explains the meaning of technical terms (shown in *italics* the first time they appear in the report) and Appendix B is a description of the All Level Crossing Risk Model.

The Incident

Summary of the incident

4 At about 16:13 hrs on 1 July 2008, a *mobility scooter* was driven onto Poplar Farm level crossing, Attleborough, Norfolk (Figure 1), into the path of the approaching train 1M30, the 15:52 hrs from Norwich to Liverpool Lime Street. The train driver saw the mobility scooter but was unable to stop the train before it reached the crossing. The mobility scooter moved clear of the crossing before the train arrived, and there were no injuries or damage. The crossing is shown in Figure 2.

5 The crossing gates had been opened by a *crossing keeper* located at the crossing so that road vehicles, including the mobility scooter, could cross the railway.

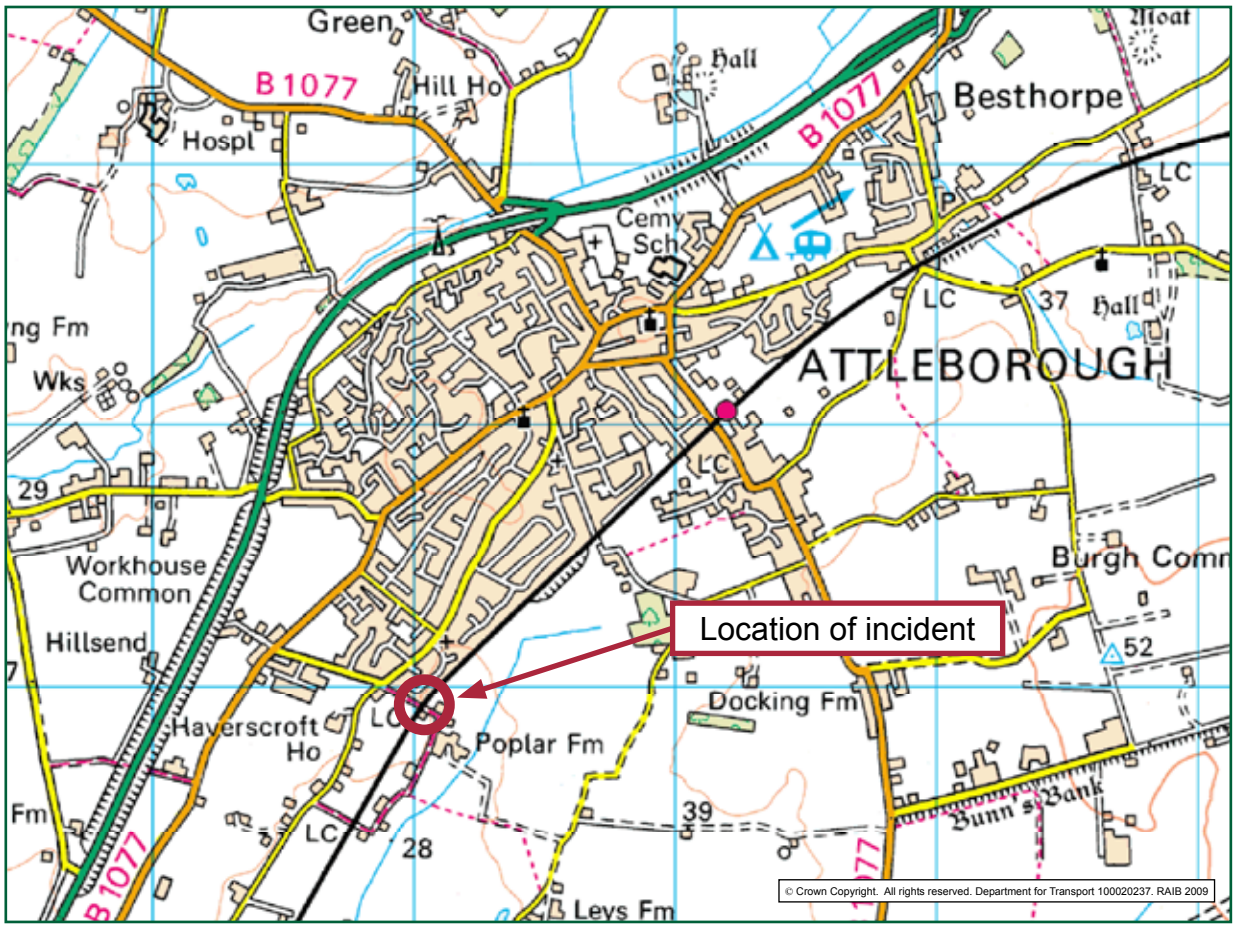

Figure 1: Extract from Ordnance Survey map showing location of incident

6 The train was operated by East Midlands Trains and consisted of a two-car class 158 diesel multiple unit. The level crossing is owned and operated by Network Rail Infrastructure Limited.

7 Network Rail and East Midlands Trains freely co-operated with the investigation.

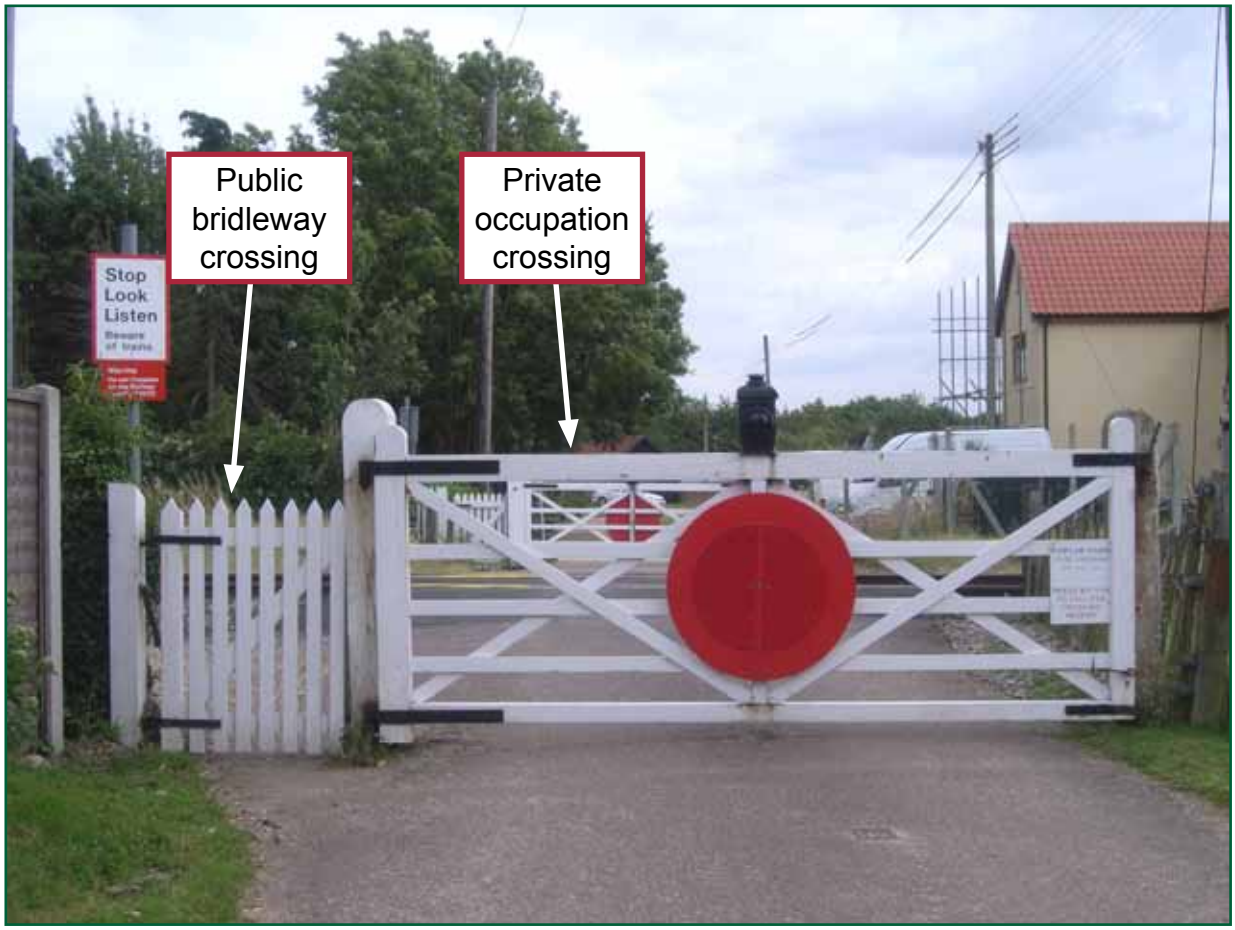

Figure 2: Poplar Farm level crossing from the down side of the railway (the direction approached by the mobility scooter)

Location and description of crossing

8 Poplar Farm level crossing is located on the railway from Ely to Norwich at 107 miles 21 *chains* (as measured from London Liverpool Street), 78 chains west of Attleborough station and 2 miles 65 chains east of Eccles Road station. The detailed location is shown in Figure 3. The railway is double track and consists (from south to north) of the *up line* towards Ely and the *down line* towards Norwich. The permitted maximum speed of trains on the up line is 75 mph (121 km/h). The down line over the crossing has two permissible speeds, 75 mph (121 km/h) for all trains and a higher *differential speed* of 90 mph (145 km/h) starting just before the crossing for class 158 trains and other types of similar modern diesel multiple units. However, at the time of the incident, a temporary speed restriction (TSR) on the down line, due to the condition of the rails, restricted all trains to a 75 mph (121 km/h) maximum speed over the crossing. The existence of the TSR had no bearing on the incident.

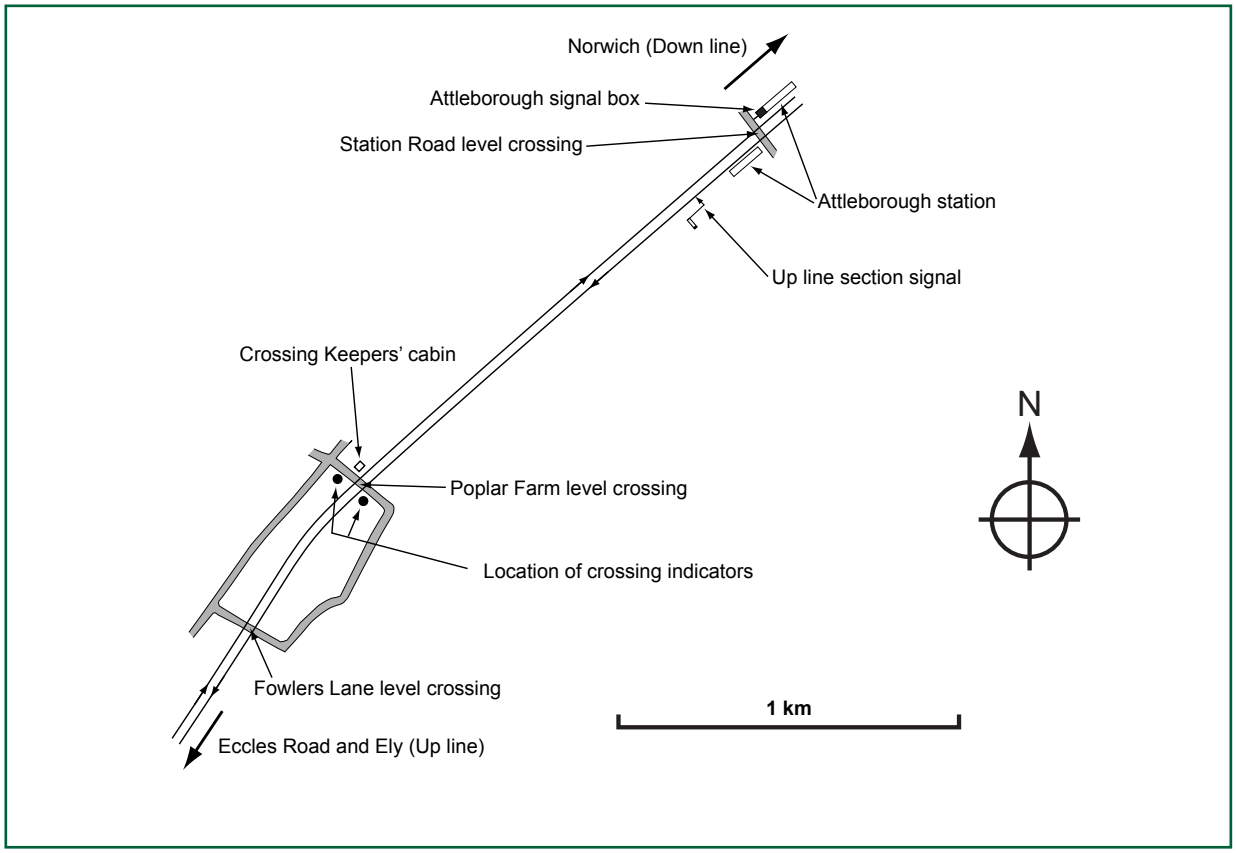

Figure 3: Location of Poplar Farm level crossing

9 The level crossing, although appearing to be one crossing, consists of two discrete parts (see Figure 2) with both having a boarded timber surface at rail level:

- a private *occupation crossing* giving vehicular access to 13 *authorised users* and others who have business with them, protected by outward opening gates on each side of the railway, which are normally closed across the road; and
- a public bridleway crossing, protected by outward opening self-closing *wicket gates* giving access across the railway to members of the public on foot, horse-riders and cyclists.

10 The person driving the mobility scooter involved in the incident was using the vehicular occupation crossing to cross from the down side of the railway to the up side.

11 A crossing keeper employed by Network Rail is provided at the crossing to open the vehicular occupation crossing gates when requested to do so, providing there is no train approaching the crossing. A person requiring vehicular access over the crossing is required to depress a button located on the approach to the crossing (see Figure 4). This rings a bell in the crossing keeper's cabin located on the down side of the railway on the Attleborough side of the crossing (Figure 3).

Figure 4: User instructions, Poplar Farm level crossing

12 The crossing keeper is not required to operate the gates protecting the bridleway crossing. Users of this crossing are expected to exercise sufficient vigilance in accordance with the 'stop/look/listen' signs, located adjacent to the bridleway gates on each side of the crossing, to cross the railway in safety (Figure 2).

13 The railway between Ely and Norwich is signalled using the principles of the *absolute block system.* Poplar Farm level crossing is within the *block section* between the signal boxes at Attleborough and Eccles Road stations.

14 Indicators operated by the *block section circuit* between Attleborough and Eccles Road signal boxes are provided on both sides of the crossing on the Eccles Road side (Figure 3) to give guidance to the crossing keeper on whether it is safe to open the gates to allow vehicles to drive over the crossing. There is one indicator for each line and when energised through the block section circuit, the needle indicates either 'train in section' or 'train approaching section'. When the indicators are de-energised, they are referred to as being 'normal'. Figure 5 shows one of the sets of indicators.

Figure 5: Poplar Farm level crossing indicators (note the up line indicator is showing 'train in section')

15 As an example, the following occurs for an up direction train approaching Attleborough:

- The signaller at Attleborough asks the signaller at Eccles Road by *bell code* whether the block section to Eccles Road is clear.
- If so, the Eccles Road signaller switches his up line block instrument to 'line clear' causing the up line indicator at Poplar Farm crossing to be energised and to show 'train approaching section'.
- When the train passes the signal box at Attleborough, the signaller there sends a bell code to Eccles Road signal box to advise 'train entering section'.
- The signaller at Eccles Road operates his block instrument to 'train on line' which causes the up line indicator at Poplar Farm crossing to change to 'train in section'.
- When the train arrives at Eccles Road, the signaller there will send the 'train out of section' bell code to the signal box at Attleborough and turn the block instrument to the 'normal', de-energised position. This de-energises the up line indicator at Poplar Farm level crossing.

Figure 6 shows the block instrument in Attleborough signal box for the block section to Eccles Road. The top indicator repeats the indications following the operation of the block instrument for up trains by the signaller at Eccles Road.

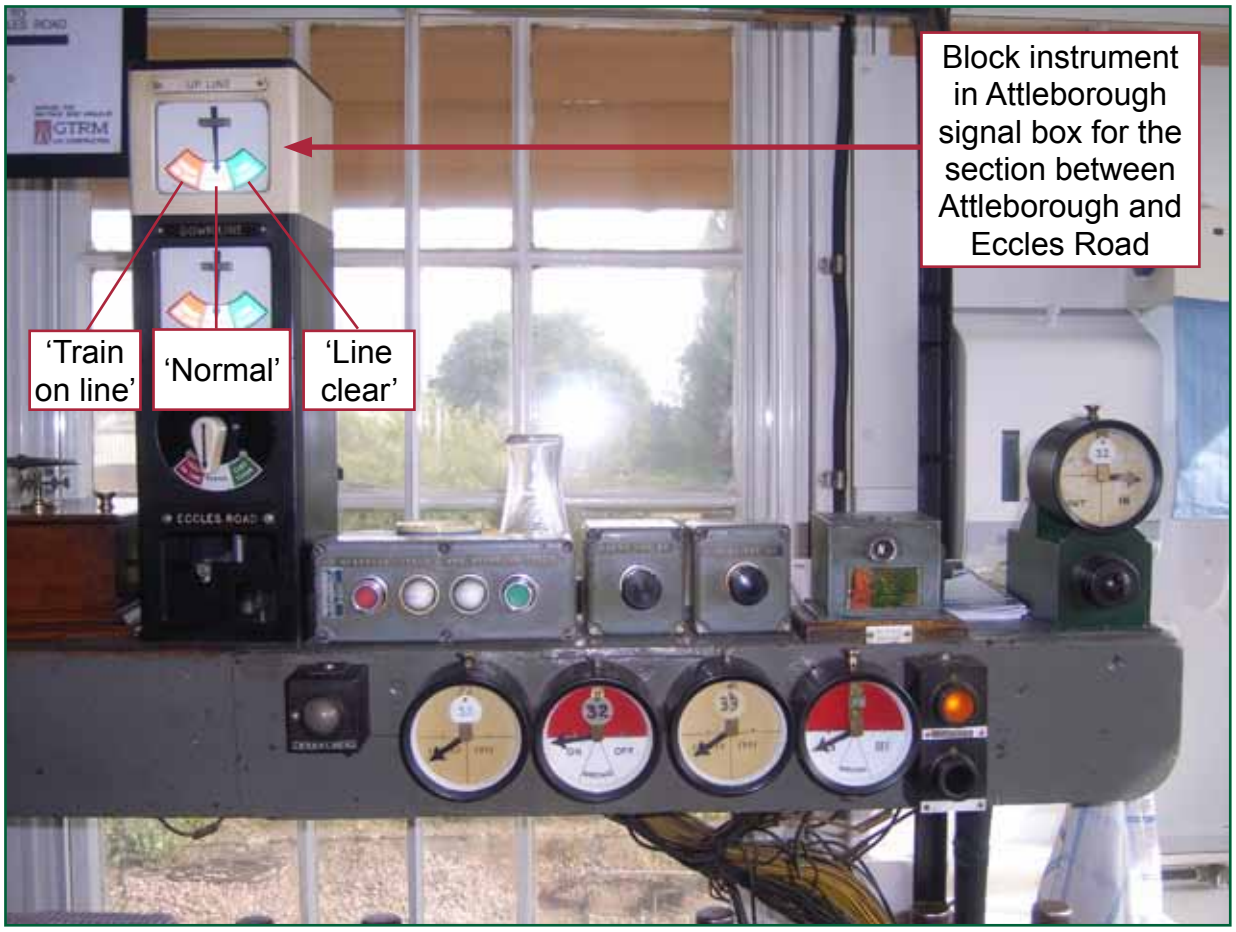

Figure 6: Block instrument in Attleborough signal box for the section to Eccles Road

16 The crossing keeper is not required by the crossing instructions to continuously monitor the position of the indicators; they are provided to inform the crossing keeper whether or not it is safe to open the vehicular crossing gates when a request to cross the railway from a user of the vehicular crossing is received.

The incident

17 Train 1M30 from Norwich departed from its booked stop at Attleborough station at 16:12 hrs on the up line and at about the same time, the bell sounded in the crossing keeper's cabin on the down side of the crossing to indicate that a person wished to cross over the level crossing. The crossing keeper looked at the indicators and saw that the up line indicator showed 'train in section' while nothing was indicated on the down line indicator. He looked along the railway towards Attleborough station and could see no train approaching the crossing on the up line. He also observed that the up *section signal* (Figures 3 and 7) was at danger.

18 From this, the crossing keeper concluded that the up line indicator was showing 'train in section' because the last up train over the crossing had not yet reached Eccles Road where it would clear the block section from Attleborough. He thought it was safe to open the level crossing gates because he believed that the train indicated as 'in section' had already passed the crossing. He did not realise that the train had not yet reached the crossing and was hidden from his view by the growth of lineside vegetation between Attleborough station and the crossing. Figure 7 shows the view towards Attleborough station from the down side of the crossing following the removal of lineside vegetation from the up side of the railway (paragraph 70).

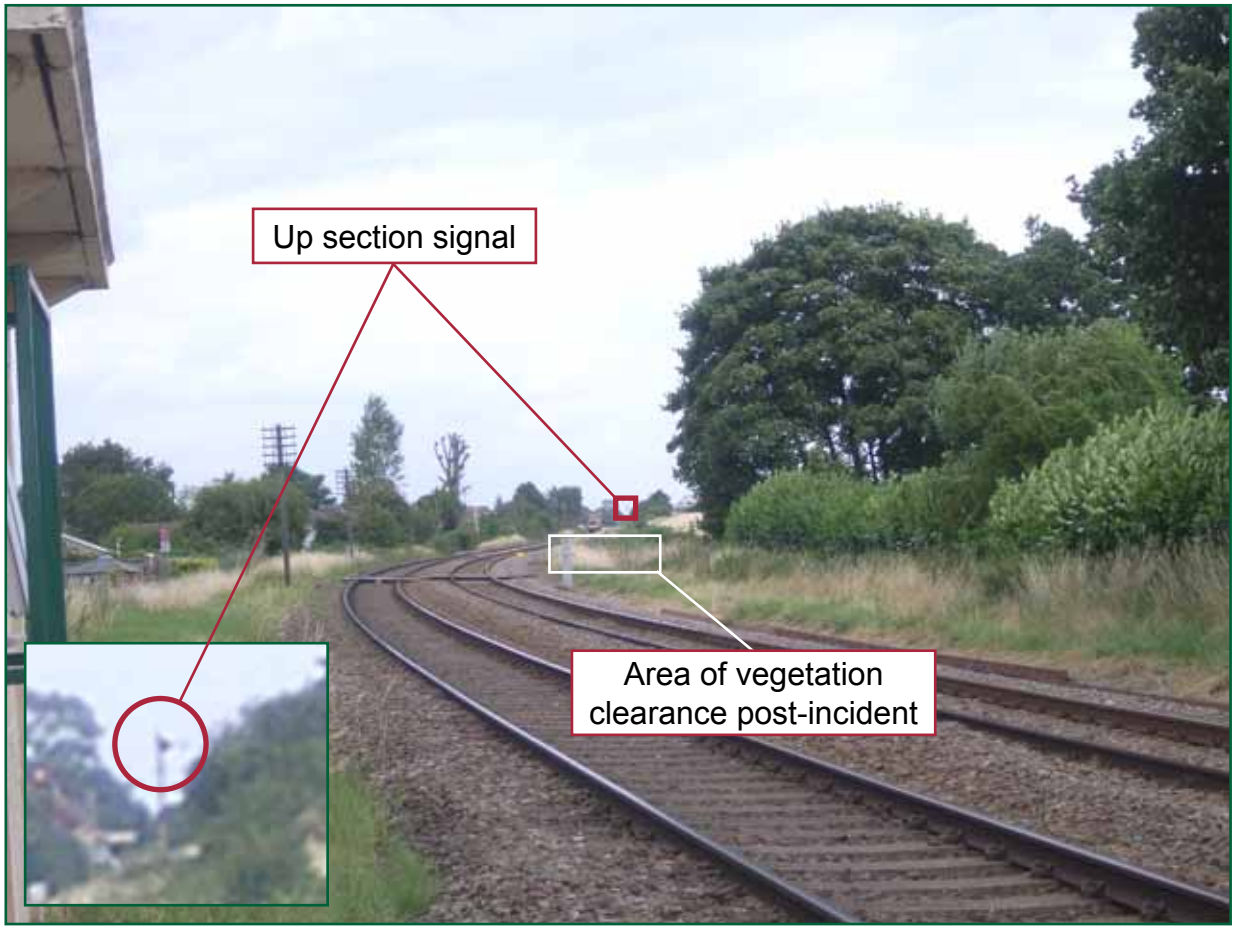

Figure 7: View from the down side of Poplar Farm level crossing to Attleborough station

19 Two vehicles crossed safely over the crossing from the down side to the up side and these were followed by a mobility scooter. As the mobility scooter drove onto the up line, the crossing keeper heard a train warning horn and saw train 1M30 approaching the crossing on the up line from Attleborough station. The mobility scooter drove clear of the up line with no collision occurring. A further vehicle which had been in the queue behind the mobility scooter reversed back off the crossing.

20 The train driver sounded the train's horn and applied the emergency brake while travelling at about 45 mph (72 km/h). Train 1M30 stopped approximately 200 metres beyond the crossing and then proceeded to Eccles Road signal box, where the driver reported the incident to the signaller.

21 Following the incident, the crossing keeper was relieved from duty and tested for alcohol and drugs in accordance with the normal industry procedures. The results were negative.

22 Network Rail did not report the incident to the RAIB because the extent of the near miss was not immediately clear and it was not thought to be sufficiently serious to require reporting. By the time the RAIB became aware of the incident from perusal of the Network Rail control log and decided to carry out a preliminary examination of the site, the data in train 1M30's *on train data recorder* for the period covering the incident had been over-written with more recent data. The lineside vegetation obstructing the crossing keeper's view from the crossing (paragraph 49 and Figure 7) had also been cleared.

23 There were no records within Network Rail or the industry's *Safety Management Information System* of previous incidents or accidents affecting vehicle users at Poplar Farm level crossing.

Key Information

Crossing instructions

24 The written instructions to the crossing keeper on the operation of the vehicular occupation crossing stated that when an indicator is in other than the 'normal' position, the gates must not be opened for road traffic until the train concerned has passed over the crossing. The crossing keeper must therefore always keep the gates closed across the road whenever an indicator shows 'train approaching' and may only open them when an indicator shows 'train in section' if the crossing keeper is sure the train has already passed over the level crossing.

25 Providing that clear sightlines are maintained, particularly towards Attleborough, the crossing keeper can check visually whether or not a train is still approaching the crossing, or has already passed over it. The crossing keeper can also telephone the signaller for confirmation about the whereabouts of a train if he is unsure.

26 The crossing indicators could change to 'train approaching' while the crossing keeper opens the gates to permit road traffic to cross. To cover this situation, the crossing instructions require the crossing keeper to clear the crossing of road traffic immediately and close the gates across the road if an indicator moves from the normal position.

27 If the up line indicator changes to 'train approaching' the normal running time to the crossing is five minutes, and if the down line indicator changes to 'train approaching' the normal running time to the crossing is seven minutes (Table 1). This should provide sufficient time for the crossing keeper to clear the crossing and close the gates across the road in accordance with the instructions.

28 The number of timetabled passenger trains on the Ely to Norwich line was approximately doubled in 2002 when a new service from Norwich to Cambridge was introduced, supplementing the existing service from Norwich to Liverpool. At the time of the incident, there were two up and two down passenger trains per hour. Occasional freight trains also use the route but rarely more than one in each direction per day.

29 The level of train service using the route causes the indicators at the crossing typically to display as shown in Table 1 during any 60 minute period. This information is also portrayed graphically in Figure 8.

30 In any one hour therefore, and providing trains are running according to the timetable, both indicators typically show 'normal' for 33 minutes, and at least one of the indicators shows 'train in section' for 15 minutes (for two minutes in every hour, both indicators show 'train in section'). During the period when an indicator shows 'train in section', the crossing keeper must ensure that any train concerned has passed over the crossing before opening the vehicular crossing gates in response to a user request.

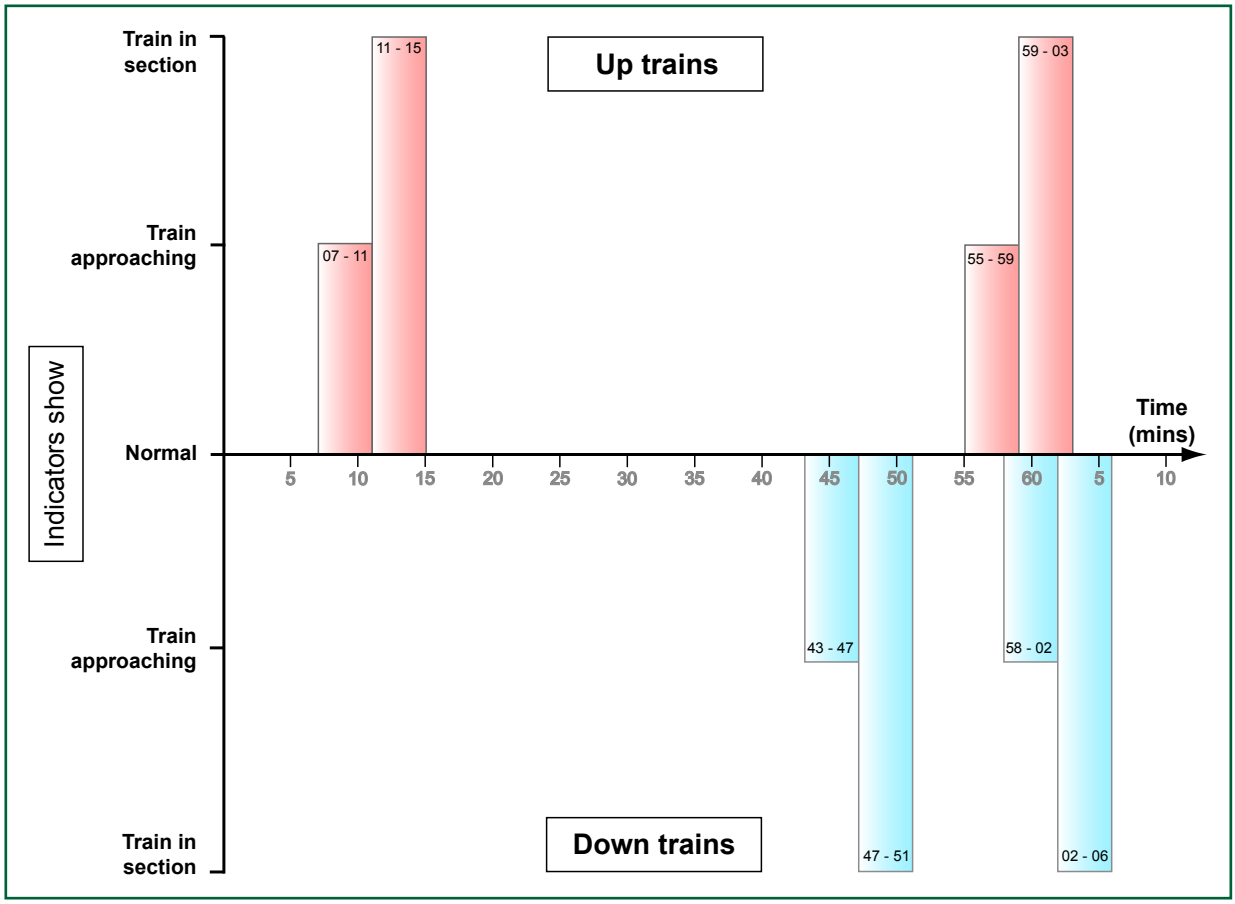

Figure 8: Operation of crossing indicators during any typical 60 minute period

Time	Train	Direction	Indication
xx:07 hrs	Norwich to Liverpool	Up	Train approaching
xx:11 hrs	Norwich to Liverpool	Up	Train in section (pass Poplar at xx:12 hrs)
xx:15 hrs	Norwich to Liverpool	Up	Normal
xx:43 hrs	Liverpool to Norwich	Down	Train approaching
xx:47 hrs	Liverpool to Norwich	Down	Train in section (pass Poplar at xx:50 hrs)
xx:51 hrs	Liverpool to Norwich	Down	Normal
xx:55 hrs	Norwich to Cambridge	Up	Train approaching
xx:58 hrs	Cambridge to Norwich	Down	Train approaching
xx:59 hrs	Norwich to Cambridge	Up	Train in section (pass Poplar at xx:01 hrs)
xx:02 hrs	Cambridge to Norwich	Down	Train in section (pass Poplar at xx:04 hrs)
xx:04 hrs	Norwich to Cambridge	Up	Normal
xx:06 hrs	Cambridge to Norwich	Down	Normal

Table 1: Operation of indicators at Poplar Farm level crossing

31 Table 1 also shows that for an up direction train, the indicator at Poplar Farm crossing typically shows 'train approaching section' for four minutes, followed by 'train in section' for four or five minutes (depending on whether the train is one that stops at Attleborough). The running time from Poplar Farm crossing to Eccles Road is about three minutes and unnecessary closure of the road and delay to road users would occur if the crossing keeper were required to wait for the indicator to de-energise having already seen the train concerned pass over the crossing and being certain that this was the train indicated.

Risk assessment

32 Network Rail standard NR/SP/OPS/100 'Provision, Risk Assessment and Review of Level Crossings', dated December 2006, requires that all level crossings should be risk assessed and that the '*All Level Crossing Risk Model*' (ALCRM) should be used for this purpose. The ALCRM was implemented on Network Rail in January 2007 with the company requiring that all crossings should be assessed using it within three years of that date. The ALCRM is more fully described in Appendix B.

33 Network Rail's operations manual sets out how the ALCRM should be used. The ALCRM combines two factors: the risk to an individual (A (highest) to M) and the collective risk (1 (highest) to 13). The occupation and public bridleway crossings at Poplar Farm were considered to be one crossing for the purposes of the ALCRM assessment on 19 April 2007. The assessment from the timetable was based on an average of 62 passenger trains and five freight trains per day. A Network Rail local operations manager took a census of road vehicle movements over a thirty minute period from 12:00 hrs on 1 February 2007 and this resulted in an estimated vehicle usage of 243 vehicles per day. The result of the risk assessment was J8, and Network Rail did not consider that further action was required to reduce the level of risk.

34 Following an incident on 12 April 2008 when some children had been on the crossing with a train approaching, the crossing was re-assessed on 15 April 2008 and the result was revised to a slightly higher risk rating of G6 reflecting the fact that an incident had occurred. No action was taken to reduce the level of risk further. Although of higher risk than previously, an ALCRM rating of G6 has a low relative priority for mitigation actions as seen across the whole population of assessed crossings.

35 In January 2008, Network Rail decided that because Poplar Farm crossing consists of two discrete elements – vehicular occupation and public bridleway – each would be assessed separately using the ALCRM. The bridleway crossing was assessed using the ALCRM for the first time on 11 July 2008 with a result of C2. As a consequence, further improvements to reduce the risk level at the bridleway crossing were being considered at the time of this report. The opportunity was also taken to review the existing assessment of the vehicular occupation crossing carried out on 15 April 2008, although the operations manual did not require this. The existing result of G6 was confirmed.

36 The number of vehicle movements over the crossing is greatly in excess of that arising from the authorised users and their invitees. Following the release of land by one of the authorised users, several businesses have set up and the resulting increase in road traffic has increased the workload of the crossing keeper. This was before the assessments using the ALCRM were carried out.

37 Clause 6.1.4 of NR/SP/OPS/100 requires that when crossings are inspected, any changes of land use that may affect the safe use of level crossings are noted and advised to the Director, Operations & Customer Services. Such changes had been identified at Poplar Farm crossing prior to the ALCRM assessments and the legal position of the use of the crossing by users who were not originally authorised to use the crossing was being investigated by Network Rail's legal department.

Crossing inspections

38 Network Rail standard NR/SP/SIG/19608 'Level Crossing Infrastructure (Inspection and Maintenance) Handbook' defines the inspection regime for level crossings and since April 2006 inspections have been carried out by staff from the maintenance function of Network Rail. The standard requires that manned gated level crossings are inspected every three months and contains inspection checklists for each type of level crossing.

39 Crossing inspections have been carried out on the basis of Poplar Farm crossing being classed as a single crossing of the manned gated type. Before the incident, the bridleway crossing was not subject to separate inspections as Network Rail had decided that it was an integral part of a single manned gated crossing and did not require its own separate inspection regime.

40 Poplar Farm level crossing had been inspected every three months, but because it had been classed as a manned gated crossing, there was no requirement in the standard checklist requiring that sighting distances be checked and that the growth of lineside vegetation did not obstruct the visibility of approaching trains.

41 The crossing inspections required a check on whether any development, road works or road layout changes taking place within approximately 200 metres of the crossing were likely to cause road traffic to block back onto or stop on the crossing (the checks recorded negative to this question). There was no check required on whether increased developments were causing more road traffic to use the crossing, although this is a requirement for Operations and Customer Services staff, laid down in NR/SP/OPS/100, and had already been identified (paragraph 37).

Competence and supervision of the crossing keeper

42 The crossing keeper on duty when the incident occurred was trained in the operation of Poplar Farm level crossing and passed as competent on 29 September 2006. Since that time, in accordance with the operations manual, Network Rail's operations staff have visited the crossing keeper at Poplar Farm crossing at least once every four weeks to monitor his performance and ongoing competence. No issues concerning the crossing keeper's competence had arisen from these visits.

43 The crossing keeper was working from 14:00 hrs to 22:00 hrs, as he had the previous day, when the incident happened and there is no evidence that fatigue was a factor.

Analysis

Identification of the immediate cause[1]

44 The previous up train to the incident train 1M30 was train 1K83, the 15:40 hrs from Norwich to Cambridge, operated by National Express East Anglia. According to the *train register book* at Attleborough signal box, this arrived at Attleborough station at 16:00 hrs, 11 minutes earlier than train 1M30 at 16:11 hrs.

45 Taken from the information contained in the Attleborough train register book, the up line indicators at Poplar Farm level crossing would have indicated as shown in Table 2 for trains 1K83 and 1M30 (see paragraph 15 for further explanation of the working of the indicators).

Time	Indication on up line indicator at Poplar Farm	Reason
15:56 hrs	Train approaching section	In response to request from the signaller at Attleborough, the Eccles Road signaller changes his up line block instrument to 'line clear' for the Attleborough to Eccles Road block section for train 1K83
16:01 hrs	Train in section	Eccles Road signaller changes his up line block instrument to 'train on line' after receiving the 'train entering section' bell code from Attleborough
16:05 hrs	Normal	Eccles Road signaller changes his up line block instrument to 'normal' after sending the 'train out of section' bell code to Attleborough (1K83 arrived Eccles Road)
16:07 hrs	Train approaching section	In response to request from the signaller at Attleborough, the Eccles Road signaller changes his up line block instrument to 'line clear' for the Attleborough to Eccles Road block section for train 1M30
16:12 hrs	Train in section	Eccles Road signaller changes his up line block instrument to 'train on line' after receiving the 'train entering section' bell code from Attleborough
16:21 hrs	Normal	Eccles Road signaller changes his up line block instrument to normal after sending the 'train out of section' bell code to Attleborough (1M30 arrived Eccles Road)

Table 2: Position of up line indicators at around the time when the incident occurred

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

46 When he opened the gates for the mobility scooter and the other waiting vehicles, the crossing keeper stated that he thought the up line indicator was still showing 'train in section' for the previous train (1K83). He had heard this train go through, but did not know how long ago it was. However, Table 2 shows that the indicator normalised following the passage of this train at 16:05 hrs and remained 'normal' for a period of two minutes. The up line indicator did not show 'train in section' again, for train 1M30, until 16:12 hrs, seven minutes after it had last normalised.

47 The crossing keeper also stated that he looked towards Attleborough station, could see no train approaching and that the Attlebrough section signal was at danger. This erroneously confirmed his view that the up line indicator was showing 'train in section' for a train that had already passed over the level crossing.

48 Crossing keepers are not required by the crossing instructions to continuously monitor the operation of the crossing indicators and it would be impracticable to do so. They are also not required to record the times of passing trains. There is therefore no information available to them to advise which specific trains have caused the indicators at the crossing to operate, although they can phone the signaller to check.

49 The growth of lineside vegetation on the up side of the railway between Attleborough station and Poplar Farm level crossing did not allow a continuous view of trains approaching from Attleborough. The Attleborough signaller replaced his section signal to danger for the stopping train, 1M30, as soon as it had passed the signal. The train was then hidden from the view from Poplar Farm level crossing by the lineside vegetation.

50 The crossing keeper was more likely to make a mistake for an up train stopping (as train 1M30) at Attleborough station than for an up non-stopping train. The Attleborough signaller must operate the level crossing gates at Station Road level crossing, Attleborough station (Figure 3) by pushing them across the road or railway by hand. To do this, he has to leave the signal box before and after the passage of each train to close and then reopen the gates.

51 For up non-stopping trains, to minimise the time the road is closed to road traffic, the signaller reopens the gates as soon as the train has passed over the crossing. In this case, the train will almost have reached Poplar Farm crossing before the signaller is able to return to the signal box and return the section signal to danger.

52 For up stopping trains, the signaller can reopen the gates while the train is stopped at the station and before it has passed the section signal. The signaller can therefore normally return the section signal to danger as soon as the train departs from the station and passes it.

53 In addition, up stopping trains were hidden for longer by the lineside vegetation because of their slower speed.

54 The immediate cause of the incident was that the crossing keeper mistakenly believed that the up line indicator showed 'train in section' for a train that had already passed over the level crossing and did not appreciate that there was an up train between Attleborough station and the level crossing.

Identification of causal factors[2]

55 Providing that clear sightlines are maintained, particularly towards Attleborough, the crossing keeper can check visually whether or not a train is still approaching the crossing, or has already passed over it. In the case of train 1M30 its approach was concealed from the crossing keeper's view by the growth of lineside vegetation.

56 The growth of lineside vegetation that hid the view of the approaching train between Attleborough station and the level crossing is therefore a causal factor of the incident.

Identification of contributory factors[3]

57 If trains are being worked according to the timetable, for 15 minutes in each hour one of the crossing indicators (or both between xx:02 hrs and xx:04 hrs) shows 'train in section' (paragraph 30). During this time, the crossing keeper must use his judgement to decide whether or not the train (or trains) concerned has already gone over the crossing when responding to a user request to use the crossing. The crossing keeper can either look along the railway or telephone the signaller at Attleborough or Eccles Road to confirm this.

58 In this incident, the crossing keeper looked along the railway towards Attleborough station, but the train concerned was hidden by vegetation. The maintenance of clear sight lines to help the crossing keeper to decide whether or not a train had already passed over the crossing was not appreciated by those who were carrying out the crossing inspections because the crossing was inspected as a manned gated crossing which did not require sighting to be checked (paragraph 40).

59 The standard lists of crossing inspection items in NR/SP/SIG/19608 (paragraph 38) did not take account of local requirements such as cutting back vegetation arising from the method of operation of the crossing.

60 The likelihood of a crossing keeper making a mistake was increased by the increased rail traffic from 2002 and more particularly by more road traffic. Three trains are scheduled to pass over Poplar crossing between xx:50 hrs and xx:04 hrs and road traffic increased owing to the number of additional users and their invitees that require access over the crossing (paragraph 36). Before the incident occurred, a total of four vehicles were waiting to cross the railway, and during some early shifts evidence was given that there can be as many as 80 road vehicle movements across the crossing in eight hours. This can put pressure on the crossing keeper to minimise road closure times and increases the likelihood of a mistake being made. It also suggests that the estimated vehicle usage used in the ALCRM (243 over a 24 hour period - paragraph 33) is actually higher than occurs in practice, because there are unlikely to be many users during the night.

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

[3] Any condition, event or behaviour that affected or sustained the occurrence, or exacerbated the outcome. Eliminating one or more of these factors would not have prevented the occurrence but their presence made it more likely, or changed the outcome.

61 The following are contributory factors to the incident:

- the operation of the crossing requires the crossing keeper to decide whether a train has passed over the crossing when an indicator shows 'train in section';
- the growth of road traffic over the crossing has increased pressure on crossing keepers to minimise road closure times increasing the opportunities for an incorrect decision to be made;
- the inspection checklists in standard NR/SP/SIG/19608 do not take account of local factors arising from the method of operation such as maintaining clear sightlines on the approach to the crossing to help the crossing keeper be able to decide whether or not a train has already passed over the crossing; and
- the inspections of Poplar Farm crossing did not check whether the growth of lineside vegetation was obscuring the crossing keeper's view of trains approaching from Attleborough.

Identification of underlying factors[4]

62 Development has taken place in the vicinity of the crossing resulting in an increase in road traffic. The regular inspections of the crossing (paragraph 41) required a check on whether any development within 200 metres of the crossing was causing road traffic to block back or stop on the crossing but did not consider other possible effects on the operation of the crossing caused by more road traffic such as the increased workload of the crossing keeper (paragraph 60). These are underlying factors.

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

Conclusions

Immediate cause

63 The immediate cause of the incident was that the crossing keeper mistakenly believed that the up line indicator showed 'train in section' for a train that had already passed over the level crossing and did not appreciate that there was an up train between Attleborough station and the level crossing (Recommendation 1).

Causal factor

64 The following factor was considered to be causal:

a. the growth of lineside vegetation that hid the view of the approaching train between Attleborough station and the level crossing.

Contributory factors

65 The following factors were considered to be contributory:

a. the operation of the crossing requires the crossing keeper to decide whether a train has passed over the crossing when an indicator shows 'train in section' (Recommendation 1);

b. the growth of road traffic over the crossing has increased pressure on crossing keepers to minimise road closure times, increasing the number of opportunities for an incorrect decision to be made (Recommendation 1);

c. the inspection checklists in standard NR/SP/SIG/19608 do not take account of local factors arising from the method of operation such as maintaining clear sightlines on the approach to the crossing to help the crossing keeper be able to decide whether or not a train has already passed over the crossing (Recommendation 2); and

d. the inspections of Poplar Farm crossing did not check whether the growth of lineside vegetation was obscuring the crossing keeper's view of trains approaching from Attleborough station.

Underlying factors

66 The following factors were considered to be underlying:

a. development has taken place in the vicinity of the crossing that has increased the amount of road traffic using it. Network Rail is investigating the legal issues arising from this (paragraph 68); and

b. the regular inspections did not consider whether increased road traffic affected the operation of the crossing, including the workload of the crossing keeper. This is already addressed by Recommendation 2.

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

67 Following the incident, the crossing keeper was re-briefed on the correct response to an up line 'train in section' indication when a request to use the crossing is made. This is either to wait for the indicator to return to 'normal', confirm the train has passed the crossing by sighting it between there and Eccles Road, or to contact the signaller at Attleborough for confirmation that no train is approaching if there is any doubt.

68 Network Rail's legal department is investigating the legal issues arising from the increased usage of the crossing by many users who may not be authorised, and its effect on the safe use of the crossing.

69 At the time of this report, Network Rail was progressing the planning of the resignalling of the Ely to Norwich line. This could result in an upgrading of the form of crossing protection provided at Poplar Farm crossing.

Completed actions which address factors which otherwise would be the subject of an RAIB recommendation

70 Network Rail has cut back the vegetation that was concealing the view of approaching trains at the time of the incident and put in place a procedure to manage the growth of vegetation in future. Inspections of the bridleway crossing element of Poplar Farm crossing also require a check that the required sighting distance of approaching trains is maintained. Vegetation growth must be controlled to achieve this.

Recommendations

71 The following safety recommendations are made[5]:

Recommendations to address causal and contributory factors

1. Network Rail should review its procedures for the operation of Poplar Farm crossing with the aim of identifying improvements that would reduce the possibility of errors being made in the operation of the crossing. This review should include consideration of:

   - current and future road and rail traffic levels; and
   - measures to reduce the likelihood of crossing keepers mistaking the location of trains indicated by 'train in section' (paragraph 67).

   All reasonably practicable improvements should be implemented (paragraphs 63, 65a, 65b).

2. Network Rail should revise its current method of crossing inspections to take account of:

   - local factors relating to the method of operation of crossings; and
   - changes in traffic levels.

   Crossing risk assessors should be advised through the process referred to above of any identified changes that are likely to increase crossing risk (paragraph 65c).

[5] 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 (Incident Investigation and Reporting) Regulations 2005, these recommendations are addressed to the 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 167 to 171) can be found on RAIB's web site at www.RAIB.gov.uk.

Appendices

Appendix A - Glossary of terms

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

Absolute block system	A system of signalling that is built around the principle that only one train is permitted to enter a block section at any time. Trains are offered and accepted between signal boxes, the acceptance only being given when the correct conditions are met. The communication is by means of block bells using a set of standard bell codes and block instruments.*
All Level Crossing Risk Model	A computer model on a central database used to compute the risk at level crossings and to evaluate reasonably practicable improvements to reduce the risk.
Authorised users	Denoting a person or body registered with Network Rail as a user of an occupation crossing.*
Bell code	A means of communication between adjacent signal boxes using a Morse key and single stroke block bell.*
Block section	The section of track between the section signal of the first signal box and the home signal of the second in absolute block areas.*
Block section circuit	The electrical circuit connecting the system of block bells and instruments between signal boxes.
Chains	A unit of length, being 66 feet or 22 yards (approximately 20.117 metres). There are 80 chains in one standard mile. Chains are the standard subdivision of miles used in the national railway network.*
Crossing keeper	The person who operates a level crossing from a control point at the crossing.*
Differential speed	Different permissible speeds that apply to different types of trains as indicated on lineside signs at the commencement of where the differential speeds apply.
Down line	A track on which the normal passage of trains is in the down direction moving away from London or lowest mileage.*
Mobility scooter	A powered vehicle for a disabled person which either has a maximum speed of 4 mph (6 km/h) and is suitable only for use on pavements (class 2 vehicle), or a maximum speed of 8 mph (12 km/h) and is suitable for use on pavements and the road (class 3 vehicle).

Occupation crossing	A level crossing that carries a private occupation road which was in existence before the railway. It may serve homes, farms or other businesses on that road. Other persons, whose lands do not necessarily adjoin the railway, may have acquired rights to use the occupation road.
On train data recorder	A data recorder fitted to trains that collects information about the train's performance.
Safety Management Information System	A railway industry database of accidents and incidents.
Section signal	In absolute block areas, the stop signal that controls access to the next block section.*
Train register book	The book in which a signaller records movements of trains, visitors and completion of other regular duties.*
Up line	A track on which the normal passage of trains is in the up direction moving towards London or lowest mileage.*
Wicket gate	A pedestrian operated outward-opening gate found at level crossings and which should self-close under the action of gravity and/or the action of a spring.

Appendix B - All level crossing risk model (ALCRM)

The ALCRM is a computer model on a central database used throughout Network Rail to assess the risk at level crossings. It predicts the risk at level crossings based on the input variables relating to the crossing such as the environmental factors (eg crossing orientation), user frequency and types, train frequency and types, train speeds, sighting/warning times, crossing approach details and risk factors (eg misuse). Its purpose is to support and inform the making of decisions about the reduction of risk at level crossings.

Network Rail believes that the ALCRM provides a common means to assess the risk at the approximately 7000 level crossings on its network and evaluating mitigation options to reduce the risk so far as is reasonably practicable. It enables Network Rail to prioritise risk reduction measures on its crossings which are of the greatest risk.

The ALCRM was developed over 12 years expanding upon a former risk model that covered automatic level crossings and was launched on 12 January 2007. Network Rail plans to assess all level crossings by 31 December 2010, and its operations manual requires that assessments are reviewed every three years, or earlier if an incident or accident occurs at a crossing.

The risk assessment starts with the gathering of site data at the level crossing concerned which is input into the model. This gives an output in two forms:

- the individual risk measured as the computed probability of fatality per year that an individual is exposed to from the operation of the railway on a scale of A (highest) to M (lowest); and
- the collective risk computed as the average number of fatality weighted injuries (FWI) per year (an FWI is one fatality = 10 major injuries = 200 minor injuries) that would be expected to occur from a hazardous event or a group of hazardous events on a scale of one (highest) to 13 (lowest).

The output from the ALCRM estimates the safety risk to crossing users, train staff and passengers and the operational risk associated with level crossing accidents and failures. It does not include a calculation of the risk to crossing keepers.

Where the collective risk is in the range of 1 to 3, or the contribution of train accident risk is more than 50%, Network Rail's operations manual requires that its Level Crossing Risk Control Co-ordinator (LCRCC) carries out a site visit to the level crossing and investigates possible measures to reduce the risk. Where the individual risk is in the range A to C and the collective risk is 4 or 5, the LCRCC must review the findings and decide whether or not a site visit is required to determine risk reduction measures. However, whatever the results, the LCRCC is required to evaluate whether there are further measures that can be taken to reduce the risk at a level crossing.

Possible measures to reduce the risk at level crossings are in the Level Crossing Risk Management Toolkit developed by Human Engineering Ltd on behalf of the Rail Safety and Standards Board (see www.lxrmtk.com). Network Rail's operations manual requires that this is used to determine what reasonably practicable measures may be available to reduce the risk.

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