RAIB
Rail Accident Investigation Branch

Rail Accident Report

The fatality at Barratt's Lane No.1 footpath crossing
21 November 2005

Department for Transport

Report 13/2006
July 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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Contents

Introduction

Preface

1 The sole purpose of a Rail Accident Investigation Branch investigation is to prevent future accidents and incidents and improve railway safety.

2 The Rail Accident Investigation Branch does not establish blame, liability or carry out prosecutions.

3 This report contains the finding of the RAIB investigation into the cause of a fatal accident at Barratt's Lane No 1 footpath crossing on the 21 November 2005.

4 The investigation examined the fitness for purpose of the footpath crossing, the operation and handling of the two trains involved, and actions by the footpath crossing user at the time of the accident.

5 In this report certain technical terms (shown in *italics* where they first appear) are explained in a Glossary (Appendix B) at the end of this report.

6 Reference is made within this report to times from two train data recorders and the signalling centre. There are slight inconsistencies between the times recorded in all three clocks, but all times in this report have been converted to Greenwich Mean Time (GMT, also known as UTC or Universal Time Constant) and thus can be compared.

7 Access was freely given to Central Trains, Midland Main Line and Network Rail staff, data and records for the purpose of this investigation.

Summary

Key facts about the accident

8 The accident occurred at 10:35 hrs on the 21 November 2005 on Barratt's Lane No. 1 footpath crossing in Attenborough village, six miles to the southwest of Nottingham.

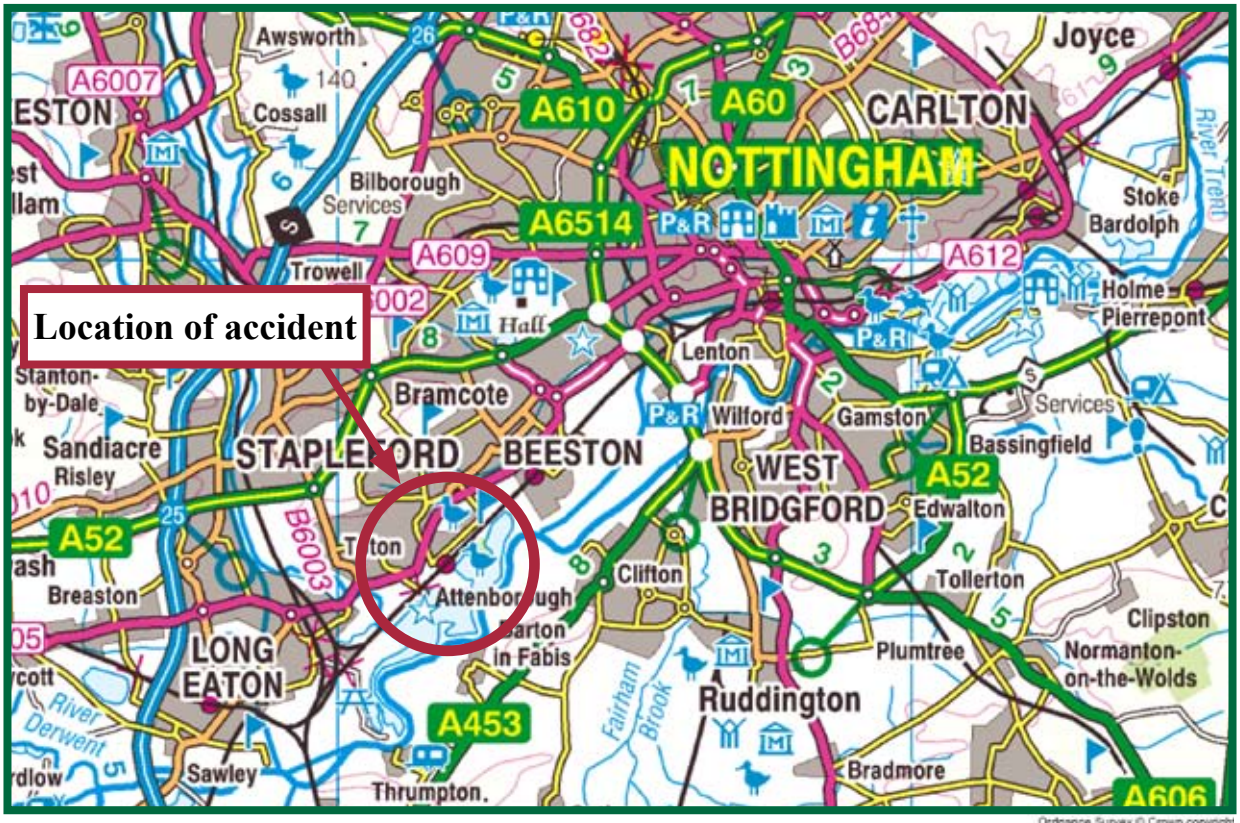

Figure 1: Location of Attenborough village and railway station

9 Figure 2 shows the location of Barratt's Lane No. 1 and No. 2 footpath crossings in relation to Attenborough station and the full barrier *Closed Circuit TV* (CCTV) controlled vehicular crossing adjacent to the station.

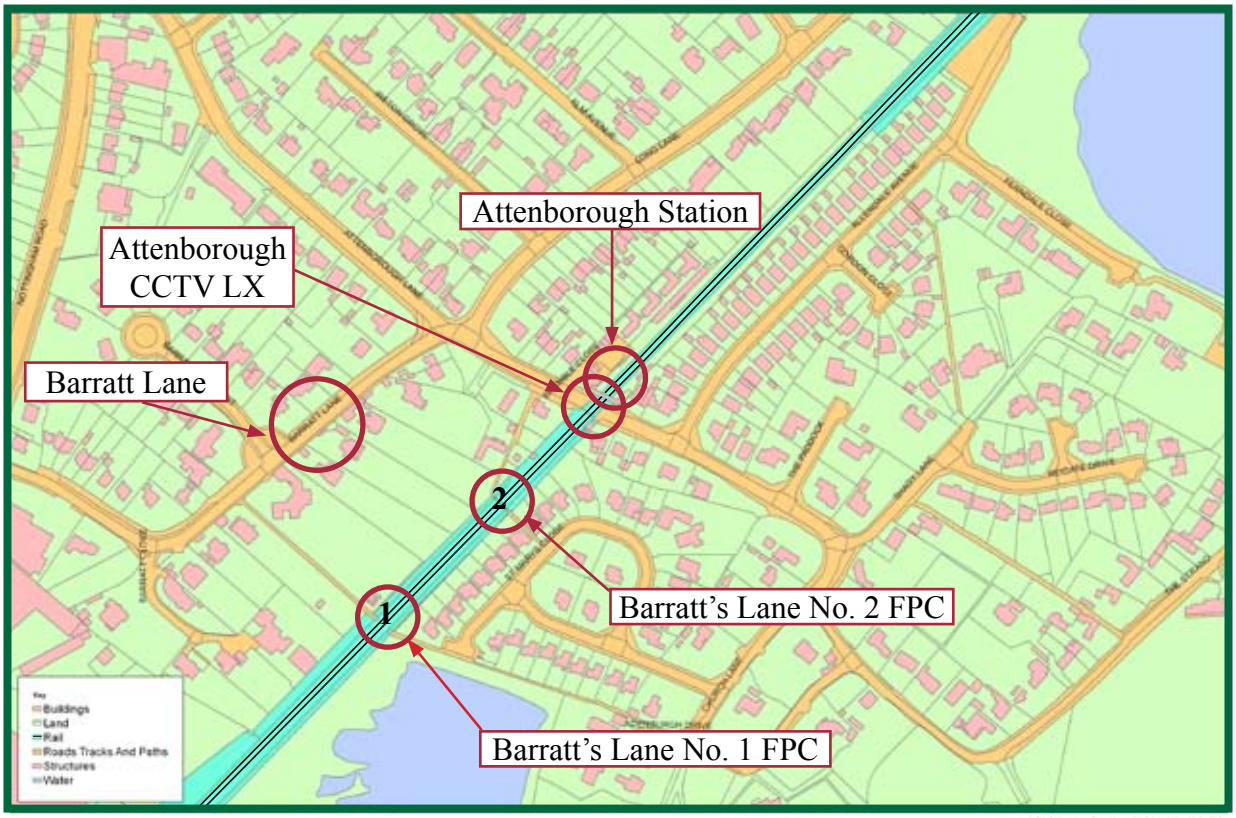

Figure 2: Barratt's Lane No. 1 footpath crossing and environs

10 The weather at the time of the accident was foggy with an air temperature of around zero degrees Celsius.

11 A train, referred to below as train 1, travelling towards Nottingham on the *down line* in the fog observed a person on the crossing, sounded the horn and concurrently made an emergency brake application.

12 The train struck the pedestrian on the crossing and fatally injured him. In the course of the impact the pedestrian was knocked onto the opposite running line, the *up line* to London.

13 A second train, below to hereafter as train 2, the 10:30 hrs departure from Nottingham towards London, was given a visual warning (hazard lights and hand danger signal) to stop by the first train but was unable to stop short of the accident site despite an emergency brake application and therefore passed over the body, coming to a halt quarter of a mile beyond the crossing.

14 The pedestrian had a hearing impairment which may have contributed to the accident.

The immediate cause

15 The immediate cause of the accident was the pedestrian being struck by a train while using the footpath crossing in foggy conditions.

Contributory factors

16 Contributing factors were:

- The fog, the presence of which meant that the pedestrian made his decision to cross the railway and commit to that action unaware that a train was approaching. In fog there is a breakdown of the effectiveness of the primary safety check (ie visual) available to pedestrians. At the time of the accident there was not sufficient visibility for the individual concerned to obtain adequate assurance of the absence of trains on the crossing for the whole of the time taken to make the transition from the point of commitment to a position of safety.
- The reduced forward visibility caused by the fog prevented the driver of train 1 seeing the pedestrian using the crossing while there was still sufficient time for the driver's subsequent warning to be assimilated by the pedestrian and for that person to move to a position of safety.
- The impaired hearing of the pedestrian, both from his disability and from the use of a hood at the time of the accident, may have prevented him registering any audible cues of the approach of the train before the sounding of the warning horn and while sufficient time remained to get clear. The degree to which this contributory factor is relevant to the outcome of the accident remains unknown.

17 The root cause of the accident is the decision by the pedestrian to use the crossing in foggy weather in preference to other safer but less convenient crossings nearby.

Recommendations

18 There are no recommendations for the railway industry arising from this accident.

The Accident

Information about the accident

19 A pedestrian was using a footpath crossing in Attenborough, a village south-west of Nottingham between Beeston and Long Eaton, to cross from the south-east to the north-west of the main line to London when he was struck at 10:35 hrs on 21 November 2005 by a train heading towards Nottingham.

The infrastructure

20 Barratt's Lane No. 1 Crossing lies on the railway line between Trent Junction and Nottingham, and carries an intensive service of local and main line trains. The *Engineers Line Reference* is TSN1.

21 The railway is owned and maintained by Network Rail.

22 The railway in the vicinity of the accident location between Beeston and Attenborough Junction consists of double track and is signalled with colour light signals and continuous *track circuiting* controlled from the signal box at Trent Junction.

23 The line speed (maximum speed at which trains are permitted to travel) at this location is 80 miles per hour (mph) on both the up and down lines (equal to 128.7 km/h). There were no temporary or emergency speed restrictions in force.

24 The footpath crossing where the accident occurred is known as Barratt's Lane No. 1 crossing (shown in Figure 3) and is located at 121 miles 61 *chains* on the London to Nottingham railway line, the zero datum being the buffer stops at St Pancras Station in London.

Figure 3: Barratt's Lane No.1 crossing as seen from the approach from the St Mary's Close side, as used by the pedestrian.

25 Figure 3 shows the footpath to Barratt Lane leading away from the far side of the crossing. The train that struck the pedestrian travelled from the left to the right on the far track (the down line) as seen in Figure 3 and Figure 4.

Figure 4: View from inside the wicket gate at Barratt's Lane No.1 footpath crossing looking towards London from the side the pedestrian crossed from (St Mary's Close)

26 Figure 4 shows the view the pedestrian would have had to the southwest when making a final decision whether to cross or not, except it was foggy on the day. The nearest track is the up line to London; the furthest is the down line on which train 1 approached. The signal is located 66 metres from the crossing.

27 The footpath crossing connects with Barratt Lane in Attenborough on the northwest side of the railway via a walled public footpath between private properties. It connects to the cul-de-sac part of St Mary's Close to the southeast. Attenborough Nature Reserve is a wetland immediately to the southeast of the railway and can be reached by residents on the northwest side of the railway via the crossing.

28 At the point of the crossing, and for over one mile either side, the double track railway is straight and on a level gradient, heading northeast - southwest. Barratt's Lane No. 2 crossing (also a footpath crossing but with kissing gates) is 5 chains (100.58 m) further towards Nottingham at 121 miles 66 chains. Despite its name, it connects to Attenborough Lane via a public footpath in one direction (and not Barratt Lane) and to St Mary's Close in the other.

29 To the northeast of Barratt's Lane No. 2 crossing (towards Nottingham) is a full barrier CCTV controlled level crossing located at 121 miles 70 chains, just beyond which is Attenborough station. In the other direction there are no distinguishing features until the Barton Lane *automatic half barrier crossing* at 121 miles 36 chains.

30 Barratt's Lane No 1 crossing comprises fenced footpath approaches on both sides that each terminates in a pedestrian wicket gate opening away from the railway. The up and down tracks are level with each other and the crossing is at right angles to the line. The walkway is of wood with a surface covering of a non-slip material and is within 30 mm of being level with the top of the rails. Appropriate warning signs are provided on both approaches to the tracks. Both wicket gates are manually operated and are self-closing after each opening. It is possible to see without obstruction both tracks in both directions from both sides of the crossing.

The trains

31 Train 1, which was first in collision with the pedestrian, was a Central Trains class 170 Turbostar three-car diesel multiple unit forming the 09:19 hrs Birmingham New Street to Nottingham service. Its Network Rail train reporting number was 1T55 and it was formed of unit number 170117. The train was fitted with a *train data recorder* which was functioning at the time. It is noted that Central Trains records show the train reporting number as 1M55 – this report uses Network Rail's number from their records.

32 Train 2, which was second in collision with the pedestrian, was a Midland Main Line class 43 High Speed Train forming the 10:30 hrs Nottingham to London St Pancras service, reporting number 1B23. The leading power car was number 43059 which was not fitted with a train data recorder (all HST power cars that will be in service beyond the end of 2007 need to be fitted with data recorders by the end of 2005; this power car was taken out of service on 20 December 2005 and returned to traffic fitted with a data recorder in February 2006. On the date of the accident it had not yet been fitted). The *trailing* power car was 43081 and was fitted with a train data recorder in working order, though it only recorded a limited set of data since it was not in the lead of the train. It did not, for example, record the position of the controls in the leading 'activated' cab but just recorded basic data available in the trailing 'deactivated' cab such as speed.

The weather

33 The weather reported by witnesses at the accident site was foggy to very foggy with visibility estimated at 200 yards (180 m) at the time of the accident. One key witness reported dense fog at the time.

34 The UK Meteorological Office recorded light westerly winds (0 to 7 knots, or 0 to 3.6 m/s), and mist or fog across the region at the time of the accident. The temperature at measuring stations around the accident location was between plus three and minus two degrees Celsius.

The pedestrian

35 The pedestrian was a male aged sixty nine, who lived in Attenborough on the south eastern side of the railway. He was a keen walker but due to a previous injury to a leg he had a slight impairment to mobility. He used a walking stick which was with him on the day. He also suffered from degraded hearing and had used a hearing aid for fifteen years.

36 He was wearing a warm coat with a hood at the time of the accident as well as a hat and gloves. This was consistent with the ambient temperature at the time.

Events during the accident

37 The last train to pass Barratt's Lane No. 1 crossing prior to the accident was a passenger train heading towards Nottingham with the train reporting number 1D12. This train passed the crossing between 10:32 hrs and 10:33 hrs as determined from signalling records of *track circuit occupation time*s.

38 Train 1 approached the crossing under full power and green signals at 10:35 hrs and 40 seconds GMT. From analysis of the available data (see paragraph 69) the driver observed a person wearing a hood on the crossing when he was some 140 to 200 m from the crossing. The speed of the train was 63 mph (101 km/h) and the train reached the crossing some 5 to 7 seconds after the driver first saw the pedestrian. In this time he sounded his horn and applied his emergency brake, but the person did not move clear and was struck by the train.

39 The impact of the train on the pedestrian was fatal. The pedestrian was reported to be knocked 100 m into the path of another train travelling in the direction of London on the up line.

40 The driver of train 1, who had applied his emergency brake, stopped in Attenborough Station, 332 m after the brake command was initiated. He attempted to warn an oncoming train (train 2) with hazard warning lights and by showing a hand danger signal from within the cab. The driver had also made an emergency call on the train-borne NRN radio system to the signaller to warn of danger.

41 Train 2 was unable to stop in time to avoid a second collision with the pedestrian's body, despite heeding the warning signals.

42 The British Transport Police (BTP), the Ambulance Service, paramedics, Network Rail's site safety staff and the undertakers all attended the scene of the accident. The body was removed from the site and given into the care of the undertakers. The pedestrian's possessions were recovered by the BTP.

43 Central Trains and Midland Mainline each provided a relief driver to their respective train, enabling both, after inspection and once permission was given, to proceed under their own power from where they had come to a stand.

44 Once the body had been removed and all personnel were clear, Trent Power Signal Box was given authority by Network Rail's site safety staff to resume traffic at full line speed at 11:52 hrs

45 A last check that the infrastructure was completely clear was made later.

46 The infrastructure suffered no damage from the accident.

47 Train 1 was not significantly damaged in the accident and was subsequently driven to the depot in Nottingham.

48 Train 2 was not damaged in the accident and was subsequently driven to Leicester where the passengers were detrained. The train then returned to its depot in Derby.

The Investigation

Analysis

49 Analysis of the data relating to the accident was conducted by the RAIB during the course of its investigation.

The pedestrian

50 Analysis of the reported and estimated visibility at the time and the response times, actions and control inputs made by the driver of train 1, lead to the judgement that the pedestrian's mobility impairments had no bearing on the outcome of the accident.

51 The pedestrian's hearing impairment may have had an impact on the outcome of the accident, despite the assistance given by the habitual use of a hearing aid. It is, however, not possible to determine this linkage for certain.

52 Use of a hood by the pedestrian, as observed by the driver of train 1, may also have further impaired his hearing.

53 Data from the train data recorder shows that train 1 approached the crossing under full power. It is likely, but not known for certain, that the pedestrian did not hear the approach of train 1 when it was still shrouded in fog and therefore not visible. If he had done so sufficiently early, the accident may have been avoided.

54 Even for those with full hearing, audible warnings of the approach of trains, whether in fog or not, can be unreliable; there is no obvious correlation between the sound and the distance of the train until it is very close. Fog can muffle sounds, and severely restricts visibility. Depending on the combination of circumstances, sometimes no audible cues are received until the train is within a few seconds of passing.

55 The pedestrian clearly made a decision to use the crossing and it will now never be known if subsequent visual checks of the line were made by the pedestrian as he walked over the crossing. The wearing of a hood may have restricted the pedestrian's ability to pick up secondary visual cues of the approaching train while crossing. These would only have yielded a result in the last five seconds, but it will never be known if the hood had any detrimental effect.

56 It is likely that the driver of train 1 will have seen the pedestrian before the pedestrian saw train 1, if he saw it at all. The driver has only one external direction in which to look – the crossing user must check two directions and conditions underfoot concurrently.

57 It is calculated from the train recorder data that the warning horn first sounded when train 1 was 100 metres from the crossing and that it took fractionally over 3.6 seconds for it to reach the crossing from that point. The sounding of train 1's warning horn may have been heard by the pedestrian immediately it started, or as it approached and its sound level at the crossing increased, or not at all. It will never be known with certainty which was the case.

58 Even if the horn had been heard by the pedestrian immediately it started, the reduced visibility shortened the warning time compared to that which could be expected on a clear day to the point where there was insufficient time for the pedestrian to assimilate the warning and move to a position of safety. It is therefore not central to the outcome of the accident whether the pedestrian heard the warning given or not.

59 Once the pedestrian decided to cross (the hood has little to no bearing on that decision), a chain of events unfolded where the only realistic barrier remaining was whether or not a train was approaching.

Train 1 (travelling towards Nottingham)

60 The driver of train 1 (1T55) had booked on duty at 05:25 hrs and was adequately rested. There were no issues of concern regarding the driver's competence or fitness to drive trains. No 'for cause' medical screening was conducted for the driver. The train approached the level crossing where the accident took place travelling towards Nottingham on the down line in fog with an estimated visibility of 200 yards. As the crossing became visible, the train driver saw a person on it between the up and down lines.

61 The analysis of the data downloaded from the train's data recorder shows that train 1 was travelling at 63 mph (28.2 metres/sec) immediately prior to the accident. A train travelling at that speed takes 6.5 seconds to cover 200 yards (183 m).

62 Figure 5 gives a schematic representation of the sequence of events derived from data records starting with Train 1 passing the AWS magnet for Signal TT349 (and therefore at that point still in fog and invisible to anyone looking from Barratt's Lane No. 1 crossing) to the moment of impact on the crossing. These events are described in more detail in the paragraphs that follow.

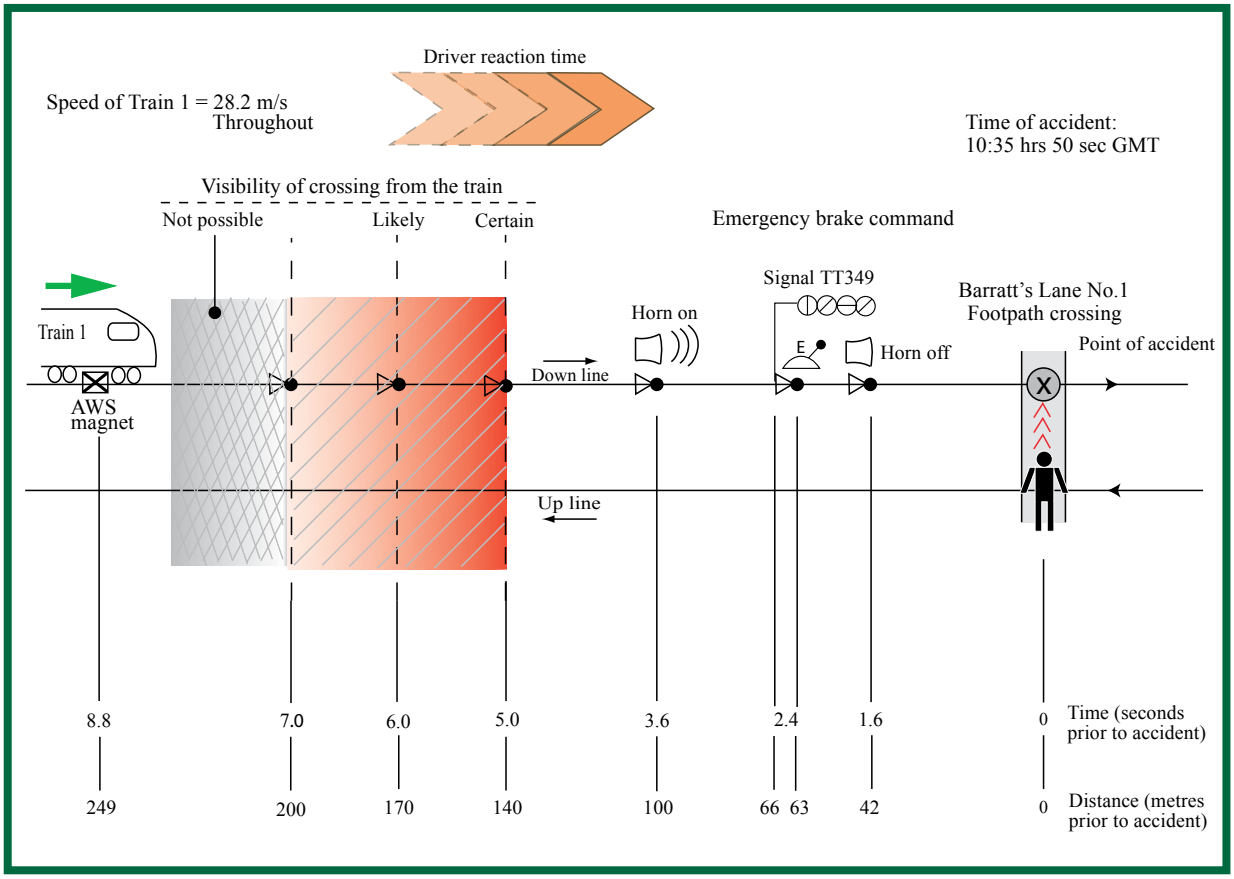

Figure 5: Schematic representation of the sequence of events leading up to the accident derived from the data records

63 Train 1 passed the *AWS magnet* for TT349 signal, receiving a bell-sound indicating a green signal, at 10:35 hrs and 41.2 seconds GMT (10:38 hrs and 8.3 seconds according to train 1's data recorder clock time Tr1). This magnet is a feature fixed in the railway infrastructure and passage over it is picked up by each train's data recorder. Such time-records in a data recorder combined with measurement of the location of the magnet allows the time of passage of the train past other fixed features to be calculated. This is done using the distance of the feature from the known magnet and the recorded time-speed data of the train relative to the time the train passed the magnet.

64 At 10:35 hrs and 46.4 seconds the driver started sounding the warning horn after observing the person on the crossing. At 47.1 seconds he started to move the power brake controller from notch 3 throttle (maximum power) into emergency brake. At 47.6 seconds the emergency brake demand was activated. It took a further 3.5 seconds for the brake system to respond and generate a significant part of the full brake effort.

65 It is estimated from the train data recorder information cross-correlated with the distance between the AWS magnet and the footpath crossing that the pedestrian was struck 2.4 seconds after the emergency brake demand was made by the driver (that is, at 10:35 hrs 50 seconds GMT which is registered as 10:38 hrs and 17.2 seconds by the train data recorder of train 1). Due to the brake system response time, the brakes did not reduce the speed of the train by the time of the impact.

66 The train horn was sounded for a total of 2.0 seconds. The driver released the horn 1.6 seconds prior to the train striking the pedestrian. Earlier warning was not possible – continuing the warning later would have served no additional purpose.

67 The train data recorder analysis gives 63 mph (28.2 m/s) as the most likely speed of train 1 from first sighting to when the pedestrian was struck. The brakes, though applied promptly by the driver, did not develop an effective braking force until after the point of collision was passed. This situation arose through a combination of the fog, the human response time to an emerging obstruction, and the brake system response times.

68 From the data records of the horn and power brake controls and reasonable prior human reaction time (between one and three seconds total reaction time for assimilation of the presence of the pedestrian and performance of the cognitive activities required to activate response actions) it is possible to estimate that the visibility at the time of the accident was the equivalent of between 5 and 7 seconds journey time at the speed of train 1, or 140 to 200 m (153 to 219 yards). The mid-point of this estimate (170 m or 186 yds) correlates acceptably with the witnesses estimates of a visibility of 200 yards (183 m). The error is 7 per cent or less than 0.5 seconds travel time at the speed of train 1. Figure 6 gives an impression of this visibility distance as seen by someone beside the crossing.

Figure 6: View from inside the wicket gate at Barratt's Lane No.1 footpath crossing looking towards London from the side the pedestrian crossed towards (Barratt Lane)

69 The coal train in Figure 6 on the up line provides a mobile scale – each wagon is 17.75 metres between coupler centres. The first wagon visible on the left has its coupler over the footpath crossing and acts as a zero datum. The locomotive at the head of the train is seven wagons distant, or 124 metres to its near end and 146 metres to its leading end. This is 6 metres more than the minimum calculated visibility distance in the fog at the time of the accident. The maximum calculated visibility is a further three wagons distant.

70 If the horn warning was audible the instant it sounded and adding a response time of the pedestrian to it of between one and three seconds, he would have had at best between 2.6 and 0.6 seconds in which to take any avoiding action.

71 However, there is no report of the pedestrian taking any perceptible avoiding action upon the warning horn sounding.

72 The above and the further fact that the pedestrian had a hearing impairment and was wearing a hood at the time leads to the conclusion that it is most unlikely he perceived any danger up to the point of the accident, or that danger became apparent too late for him to move clear of the approaching train.

73 By 10:35 hrs and 53.1 seconds GMT, 6.7 seconds after the horn was first sounded, the full deceleration rate had built up and the train speed had reduced to 50 mph (22.4 m/s).

74 Train 1 came to a complete stand at 10:36 hrs and 8.9 seconds GMT, 22.6 seconds and 370 m after first sounding the horn, 21.3 seconds and 332 m after applying the emergency brake, and 270 m beyond Barratt's Lane No. 1 footpath crossing in Attenborough Station.

75 The driver of train 1 (1T55) undertook all possible emergency actions to warn the person on the crossing and stop the train promptly and fully.

76 After coming to a halt the driver of train 1 made an emergency call to the *signalling control centre*, switched on the train's emergency hazard lights, and gave a hand danger signal to the driver of the oncoming train on the up line (train 2, reporting number 1B23) indicating that it needed to stop immediately.

Train 2 (travelling towards London)

77 The driver of train 2 (reporting number 1B23) had booked on duty at 09:23 hrs and was adequately rested. There were no issues of concern regarding the driver's competence or fitness to drive trains. No 'for cause' medical screening was conducted for the driver.

78 Train 2 (1B23) had departed Nottingham at 10:30 hrs and 2 seconds GMT and accelerated up to a maximum recorded speed of 79 mph (127 km/h). At 10:36 hrs and 12 seconds GMT (10:36 hrs and 46 seconds according to the clock of train 2's data recorder), the emergency brakes were applied by the driver of train 2 after receiving a visual warning from train 1 which was just coming to a stand in Attenborough Station.

79 Train 2 passed over the body of the pedestrian before it came to a stand at 10:36 hrs and 44 seconds GMT quarter of a mile (400 m) beyond the crossing in the direction of London, 32 seconds after application of the brake.

80 The driver of train 2 (1B23) undertook all possible emergency action to stop the train promptly and fully.

The infrastructure

81 The arrangements and facilities provided by Network Rail for Barratt's Lane No. 1 footpath crossing were inspected against the requirements in *Railway Safety Principles and Guidance*, Part 2, Section E, Chapter 11 - Footpath Crossings and Bridleway Crossings. The crossing fulfils all the requirements of this Chapter.

82 The crossing's risk assessment and most recent maintenance inspection record were requested from Network Rail and were reviewed.

83 The risk assessment showed that the crossing was suitable for the location and category of user. The minimum warning time was given as 14.1 seconds and the crossing time at a walking speed of 3.9 feet per second was given as 7.43 seconds. Applying a 50 per cent margin to this (as recommended in the Network Rail procedure) to allow for mobility impaired users gives a crossing time of 11.2 seconds which is still less than the shortest warning time, albeit calculated for good weather.

84 The maintenance records showed repairs to the non-slip surface were requested in late August 2005. These were completed before the date of the accident. No other issues were raised by the inspection report bar graffiti on one of the warning signs. A visual inspection of the crossing by the RAIB on 23 November 2005 found it to be in excellent working order with all of the required facilities and furniture provided. The graffiti mark found on the sign on the approach side used by the pedestrian did not make it illegible (see Figure 3).

Signalling records and best estimate of time of the accident

85 The signalling records obtained from Network Rail show both train 1 and train 2 approaching the accident site at 10:35 hrs.

86 At 10:35 hrs and 35 seconds train 1 (1T55) is shown just southwest of the Barton Lane automatic half barrier (AHB) crossing and train 2 (1B23) is shown passing Beeston.

87 At 10:35 hrs and 43 seconds train 1 is shown on the northeast side of the Barton Lane AHB crossing while train 2 is still in the Beeston area. This is just a few seconds before train 1 struck the pedestrian.

88 At 10:36 hrs and 0 seconds train 2 is shown in the Attenborough station area and the time is therefore after train 1 had struck the pedestrian but before train 2 had reached him.

89 At 10:36 hrs and 7 seconds both train 1 and train 2 are shown both to be in Attenborough station area to the northeast of the Attenborough CCTV crossing.

90 At 10:36 hrs and 18 seconds train 2 had passed the accident site and also passed to the southwest side of Barton Lane AHB crossing. Neither train 1 nor train 2 progressed beyond these reported positions, both coming to a stand at these locations.

91 The above records put the most likely time of the pedestrian being struck by train 1 as 10: 35 hrs and 50 seconds GMT.

92 The most likely time of both trains passing in Attenborough station, when an emergency brake application was made by train 2, is 10:36 hrs and 12 seconds.

Previous occurrences

93 Since 1994, Network Rail (NR) holds records of all reported incidents on a central database. With respect to previous incidents at Barratt's Lane No. 1 crossing since 1994, there have been three recorded fatalities: one a confirmed suicide (2003); one a suspected suicide (earlier in 2005 – inquest pending); and one, recorded as an open verdict (1999), of a person struck near the crossing but not formally using it. There have been four separate incidents where children have been reported playing on or near the crossing (1999 and three in 2001).

94 The Rail Safety and Standards Board (RSSB), an industry research organisation, has reported the statistics of major injury and fatalities on footpath crossings in Great Britain for the period 1998 to 2005 inclusive. During this period of eight years there were 31 reported fatalities including this accident at Barratt's Lane No. 1 crossing and 11 major injuries. The accident covered in this report was the only fatality where reduced visibility was implicated. One other accident was reported as occurring to a person with impaired hearing.

95 The statistics indicate an average of just under four fatalities each year during the eight-year period. However, 13 of the 31 fatalities were recorded as suicides, and a further five involved actions that were rated as trespass on the railway. It is thus appropriate only to consider the 13 remaining fatalities where death was recorded as accidental or of unknown cause.

96 Eight of these thirteen fatalities took place during the months of May to August, when fog is unlikely.

97 Of the five fatalities that took place during the months of September to April, none of the RSSB records state that fog was a factor. This, however, cannot be considered conclusive as the Barratt's Lane accident, where fog is an issue, was in these statistics. At most the potential fatality rate where fog is an issue can thus be considered as five fatalities in eight years, an average of one such accident every nineteen months. However, the more probable figure is less given that not every accident during this period would have involved fog.

98 Railway Safety Principles and Guidance (RSPG), part 2, section E, chapter 11 specifies the requirements for footpath and bridleway crossings. Paragraph 138 of this chapter states that: 'Users are expected to use reasonable vigilance to satisfy themselves that no trains are approaching the crossing before they start to cross the line, and to cross as quickly as possible. Users should have sufficient time from first seeing or being warned of an approaching train to cross safely'. At Barratt's Lane there was enough warning time in normal weather circumstances.

99 Paragraphs 149 and 153 of chapter 11 specify when *miniature stop lights* may be required. There are four circumstances:

- insufficient warning time;
- the crossing is the only access to houses;
- the highest attainable train speed exceeds 140 km/h; or,
- the provision of whistle boards is considered inappropriate.

None of these circumstances apply at Barratt's Lane, so there is no requirement to provide miniature stop lights.

100 Chapter 11 does not consider the effect of fog on warning times at level crossings.

101 There are approximately 2,600 level footpath and bridleway crossings on Network Rail controlled infrastructure, plus a further number, running into some hundreds, on light and heritage railways.

102 The RAIB has looked at a number of potential measures to reduce the risk to pedestrian users of all crossings in fog as part of this investigation. These include:

- 'fog whistle boards' to prompt trains to sound their horns in poor visibility at specific locations;
- specific text on the pedestrian's approach path to selected crossings to advise of the presence of any nearby alternative crossing that would be less risky to use in fog; or,
- a general, non-specific text on all 'stop, look and listen' signs advising the user to take extra (unspecified) precautions in the case of fog.

The RAIB judged that the latter measure, while practicable, would bring little benefit as it was unlikely to be observed and was too general, whilst the other two measures were seen to be impracticable and disproportionate in their implementation challenges relative to the possible benefit they could bring to the nationwide level of risk.

Conclusions

103 The immediate cause of the accident was the pedestrian being struck by a train while using the footpath crossing in foggy conditions.

104 Contributing factors were:

- The fog, the presence of which meant that the pedestrian made his decision to cross the railway and commit to that action unaware that a train was approaching. In fog there is a breakdown of the effectiveness of the primary safety check (ie visual) available to pedestrians. At the time of the accident there was not sufficient visibility for the individual concerned to obtain adequate assurance of the absence of trains for the whole of the time to make the transition from the point of commitment to a position of safety.
- The reduced forward visibility caused by the fog prevented the driver of train 1 seeing the pedestrian using the crossing while there was still sufficient time for the driver's subsequent warning to be assimilated by the pedestrian and for that person to move to a position of safety.
- The impaired hearing of the pedestrian, both from his disability and from the use of a hood at the time of the accident, may have prevented him registering any audible cues of the approach of the train before the sounding of the warning horn and while sufficient time remained to get clear. The degree to which this contributory factor is relevant to the outcome of the accident remains unknown.

105 The root cause of the accident is the decision by the pedestrian to use the crossing in foggy weather in preference to other safer but less convenient crossings nearby.

Measures that have already been taken

106 RSSB has agreed to remind all industry stakeholders of the need to enter all relevant data, specifically including weather conditions, into every incident logged in the nation-wide accident and incident database called SMIS.

Recommendations

107 There are no recommendations for the Railway Industry arising from this accident.

Appendices

Glossary of abbreviations and acronyms — Appendix A

AWS	Automatic Warning System
CCTV	Closed-Circuit Television
FPC	Footpath Crossing
LX	Level Crossing
NRN	National Radio Network
SMIS	Safety Management Information System

Glossary of terms — Appendix B

Automatic half barrier crossing	A level crossing with barriers that close off half the width of the road on each side of the railway when operated automatically by the approach of a train
AWS magnet	Device fitted to the track on the approach to a signal or speed restriction to operate equipment on a train. This gives drivers advance warning at a signal or speed restriction
Chains	Units of linear measurement equal to 22 yards or 20 metres
Closed Circuit TV	System used for train station security and monitoring level crossings
Down line	Lines taking trains away from London (generally)
Engineers line reference	An alphanumeric code used to identify a line of route
Miniature Stop Light	Small red and green lights mounted on a board adjacent to a user worked level crossing or footpath crossing. The lights are operated by the passage of trains.
Railway Safety Principles and Guidance	Publications by Her Majesty's Railway Inspectorate that describes what needs to be considered in railway works and operation to provide an acceptable level of safety.
Signalling control centre	The location at which a signaller controls the setting of points and signals
Track circuit occupation time	The duration of time that a train occupies a track circuit
Track circuiting	Electrical device using rails in an electric circuit which detects the absence of trains on a defined section of line
Trailing	The rear driving cab of a train
Train data recorder	A 'black box' style data recorder thar captures and logs critical variables of a train's journey, such as speed and use of controls, as a function of time
Up line	Lines taking trains towards London (generally)

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