



Rail Accident Investigation Branch

Rail Accident Report



**Fatal accident at Kings Mill No.1 level crossing,
Mansfield, 2 May 2012**

This investigation was carried out in accordance with:

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

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Summary

At around 16:32 hrs on 2 May 2012, a cyclist who was using the footpath and bridleway level crossing at Kings Mill, near Mansfield in Nottinghamshire, was struck and fatally injured by a passenger train travelling at about 56 miles per hour (90 kilometres per hour).

The cyclist rode over the crossing into the path of the train. He was unaware of the train's approach, probably because he had not looked towards it after passing through the gate protecting the crossing and he was wearing earphones, which probably prevented him from hearing warnings sounded by the train's horn.

The RAIB has made one recommendation, which is not related to the causes of the accident, but arises from matters relating to the management and history of the crossing that were observed during the investigation. Addressed to the Health & Safety Executive and the Office of Rail Regulation, it is intended to improve the awareness of local authorities (who may promote or approve developments which affect the usage of level crossings) in relation to the hazards which exist at level crossings.

There is also a key learning point for Network Rail and other crossing operators, relating to the importance of considering all possible measures to reduce risk at crossings, not just those that involve major changes.

Introduction

Preface

- 1 The purpose of a Rail Accident Investigation Branch (RAIB) investigation is to improve railway safety by preventing future railway accidents or by mitigating their consequences. It is not the purpose of such an investigation to establish blame or liability.
- 2 Accordingly, it is inappropriate that RAIB reports should be used to assign fault or blame, or determine liability, since neither the investigation nor the reporting process has been undertaken for that purpose.

Key definitions

- 3 All dimensions in this report are given in metric units, except speed and locations which are given in imperial units, in accordance with normal railway practice. Where appropriate the equivalent metric value is also given.
- 4 The report contains abbreviations and technical terms (shown in *italics* the first time they appear in the report). These are explained in appendices A and B.

The accident

Summary of the accident

- 5 At 16:32 hrs on Wednesday 2 May 2012, train number 2H19, the 15:55 hrs service from Nottingham to Mansfield Woodhouse, struck a cyclist who was crossing the railway at Kings Mill No.1 level crossing, near Mansfield, Nottinghamshire.

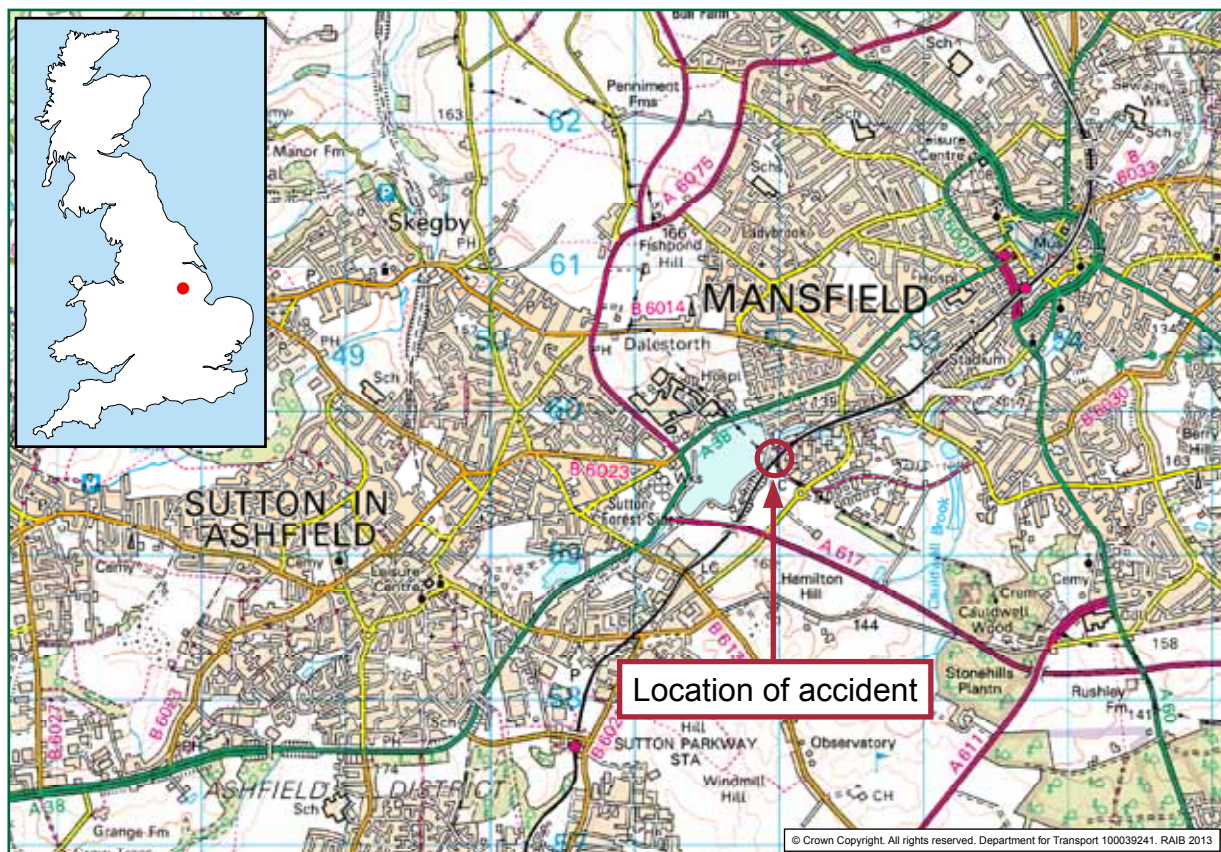


Figure 1: Extract from Ordnance Survey map showing location of accident

- 6 The cyclist, Mr Philip Dawn, suffered serious injuries, and died at the scene of the accident.

Context

Location

- 7 Kings Mill No.1 level crossing is a bridleway¹ crossing where Kings Mill Lane, which is no longer a through route for vehicles, crosses the railway between Sutton-in-Ashfield and Mansfield. It is 139 miles 22 chains² from London (St Pancras), at a point where the double track railway runs roughly south-west to north-east, and is on a curve. The crossing has gates (opened by the user) on either side.

¹ A bridleway allows use by those on foot, horse and since the Countryside Act 1968, on bicycles. This includes normal accompaniments such as pushchairs, wheelchairs and mobility scooters. The bridleway is recorded as Mansfield Bridleway No.23.

² A chain is a unit of length, equal to 22 yards or 20.1 metres. There are 80 chains in one mile.

- 8 The crossing is on the edge of the built-up area of Mansfield: there is open country on the south-west side, housing and light industry on the north-east (figure 2), and a large hospital and a supermarket a short distance to the north-west. A footpath which runs alongside the railway joins Kings Mill Lane immediately south of the crossing.



Figure 2: Aerial view of Kings Mill crossing and surrounding area

- 9 At the time of the accident, the maximum permitted speed of trains over the crossing was 60 mph (96 km/h) on the *down* line (used by trains travelling towards Mansfield) and 50 mph (80 km/h) on the *up* line (used by trains travelling towards Nottingham). The signalling on the railway is controlled from Network Rail's East Midlands Control Centre at Derby.

Organisations involved

- 10 Network Rail owns, operates and maintains the railway infrastructure, and is the employer of the level crossing management and other operations staff.
- 11 East Midlands Trains was the operator of train 2H19, and the employer of the train driver.
- 12 Nottinghamshire County Council maintains the bridleway and promotes the Timberland Trail, a multi-user route which forms part of the Ashfield and Mansfield Trails and uses part of Kings Mill Lane where it passes over the level crossing.
- 13 Network Rail, East Midlands Trains and Nottinghamshire County Council freely co-operated with the investigation.

Train involved

- 14 Train 2H19 was formed by two-carriage *diesel multiple unit* 156410, which was built in 1987 by Metro-Cammell.

External circumstances

- 15 The weather at the time of the accident was mild, dry and overcast. The wind was from the north-east, at about 20 km/h, gusting to 33 km/h.

The crossing user

- 16 Mr Dawn was employed at an engineering company near to the crossing, and used it regularly when he went to and from work by bicycle.

Events preceding the accident

- 17 Train 2H19 left Sutton Parkway station (about one and a half miles (2.5 km) from Kings Mill crossing) about five minutes late, at 16:27 hrs, travelling on the down line. The driver accelerated the train to 40 mph (64 km/h), and maintained this speed until passing the point half a mile (0.8 km) from the crossing, where the permitted speed for passenger trains increases to 60 mph (97 km/h). The driver then applied power again, and the train's speed increased to 57 mph (92 km/h) as it approached Kings Mill crossing.
- 18 Two men were walking towards the crossing along the path which runs from Hermitage Lane to Kings Mill Lane, between the industrial estate and the railway. As they came up to the level crossing, a cyclist overtook them and they stood aside to let him ride by.

Events during the accident

- 19 The train driver states that he sounded the warning horn as the train passed the 'whistle' board, 418 metres from Kings Mill crossing. The driver could not see the crossing at that time, but it came into view as the train rounded the right-hand curve.
- 20 As the crossing came into his view, the driver saw a group of people at the gate on the right-hand (up) side of the railway. Witness evidence confirms that he sounded the horn again.
- 21 Meanwhile, the cyclist had turned to the right, and witness evidence indicates that he stopped after passing the two men and, without dismounting, he pulled open the level crossing gate. The pedestrians caught the cyclist up as he opened the gate, and one of them held it open for him. As the cyclist went through the gate, the other men looked along the line, and heard and saw the approaching train. They shouted to the cyclist to stop.
- 22 The cyclist rode onto the railway, across both lines, and was almost clear of the down line when the train struck him. He was thrown clear of the train's path. The train driver applied the emergency brake, and the train stopped about 350 metres past the crossing.

Events following the accident

- 23 A member of the public used one of the telephones at the level crossing to report the accident to the signaller at East Midlands Control Centre. The train driver then contacted the signaller and made a similar report.
- 24 The two pedestrians, and local residents who had heard the sound of the collision, attempted to assist the cyclist. The police and ambulance services were called at 16:33 hrs by local residents and Network Rail, and arrived about seven minutes later, but Mr Dawn was declared dead at the scene.
- 25 The train was moved to Mansfield station at 17:26 hrs, where the passengers were asked to alight. The train then ran empty to Mansfield Woodhouse, where it was put in a platform clear of the main lines. The line was re-opened at 17:42 hrs.

The investigation

Sources of evidence

26 The following sources of evidence were used:

- witness statements;
- the train's on-train data recorder (OTDR) data;
- Closed Circuit Television (CCTV) recordings taken from cameras fitted in the cabs of the train;
- site photographs and measurements;
- weather reports;
- observations at the site;
- Network Rail's file on the history and management of the level crossing;
- a review of previous reported occurrences at the crossing (none of which transpired to be relevant to this accident); and
- a review of previous RAIB investigations that had relevance to this accident.

Key facts and analysis

Background information

History of the crossing

- 27 Kings Mill level crossing was created in about 1871 when the Mansfield and Pinxton section of the Midland Railway (which dated from 1819) was diverted onto a new alignment south of Mansfield to avoid a sharp curve. At this time the crossing is believed to have had the status of a public road. Following the National Parks and Countryside Act of 1949, Kings Mill Lane at this point was designated as a Cart Road Footpath (CRF) or, as later known throughout England and Wales, as a Road Used as a Public Path (RUPP). A RUPP recognised that the route was an old all-purpose carriageway which had at least the designation of bridleway with possible higher vehicular rights. The Countryside Act 1968 recognised the confusion of what rights existed on RUPPs. The 1968 Act introduced a reclassification process and a new designation, Byway Open to All Traffic (a path mainly used by those on foot and horseback but can be legally used by vehicles). As a result of this reclassification process, Kings Mill Lane was legally designated from RUPP to bridleway in 1985, therefore removing any public vehicular rights.
- 28 Passenger services on the railway through Mansfield ceased in 1964, but the line remained open for freight, mainly coal trains. By 1971 the crossing at Kings Mill was regarded by British Rail as being of 'occupation' status, meaning that it carried private vehicle rights as well as a public footpath, although there was no-one who could be identified as owning or exercising the vehicle rights.
- 29 In 1992, in response to an enquiry from British Rail, Nottinghamshire County Council advised that a bridleway now existed over the crossing, but the council had no objection to British Rail's proposal to close the crossing to vehicles. In 1995 the existing gates, including the vehicle gates which had been locked shut for many years, were removed and bridleway gates were provided. These gates were 1.5 metres wide, designed to be self-closing, and fitted with extended handles so that they could be operated by horse riders.
- 30 In the 1990s a passenger service between Nottingham and Worksop, marketed as the 'Robin Hood Line', was introduced in stages. Passenger trains began to run from Newstead to Mansfield Woodhouse, over Kings Mill crossing, in 1995. At that time the line speed in both directions on this section was 40 mph (64 km/h). The passenger service was extended to Worksop in 1998, and trains now run half-hourly throughout the day in both directions over the section that includes Kings Mill crossing. There are no longer any freight trains timetabled to use the line.
- 31 In 2008 Network Rail began a project to raise line speeds on the Robin Hood route, to reduce journey times and increase capacity on the line. As part of this project, in November 2009 the line speed at Kings Mill was changed to 60 mph (97 km/h) on the down line and 50 mph (80 km/h) on the up line³.

³ For passenger trains: lower speeds apply to freight trains.

Description of the location

- 32 This description relates to the crossing as it was at the time of the accident. It has since been re-aligned to cross the railway at right angles (paragraph 84). There are two approaches to Kings Mill crossing from the up or south-east side of the line. Kings Mill Lane runs almost due north towards the crossing, and another path runs parallel to the railway, behind the industrial estate east of the crossing, and joins the lane immediately south of the crossing.
- 33 The lane crossed the railway at an angle of about 40 degrees.

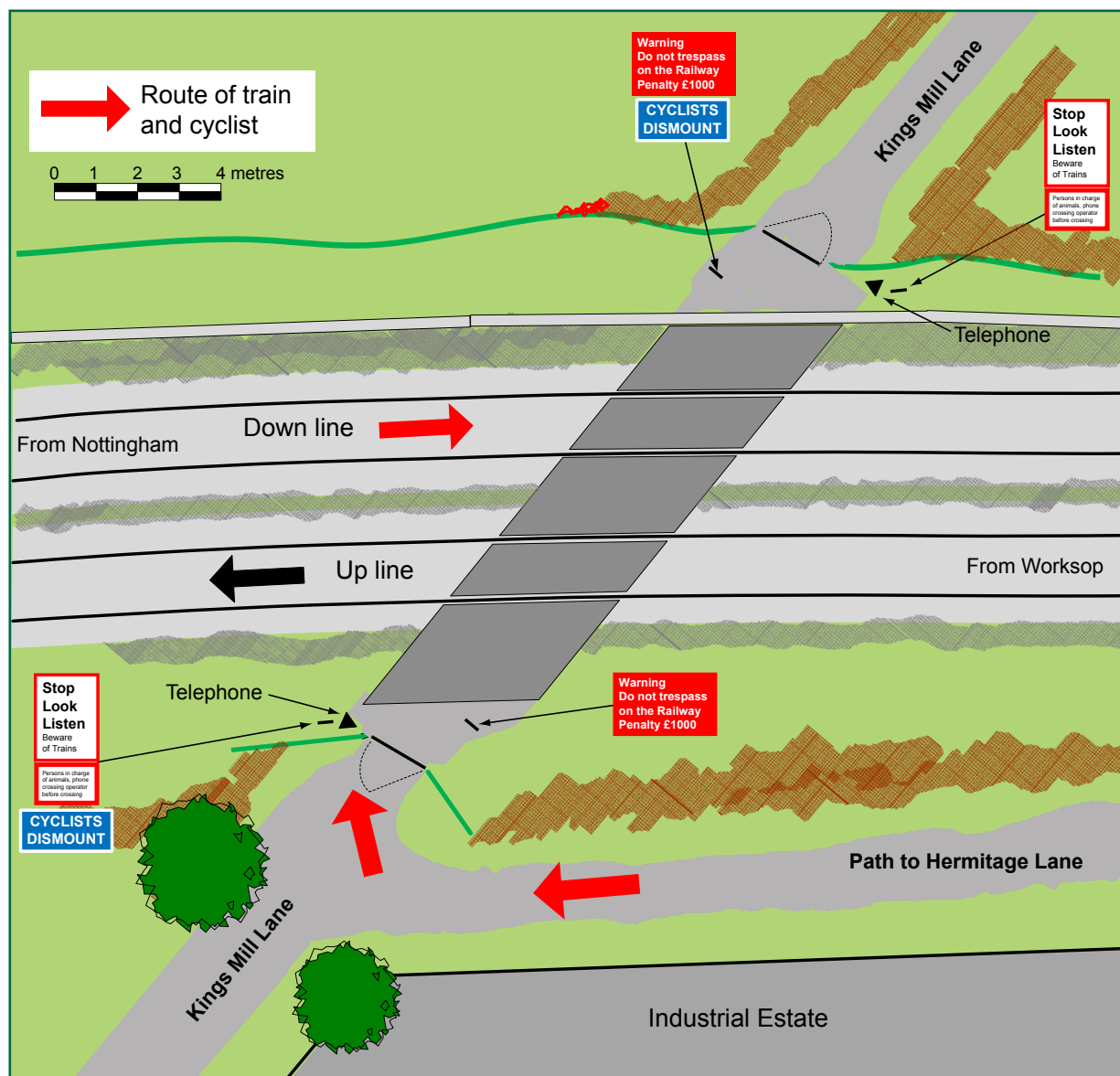


Figure 3: Plan of crossing



Figure 4: Signs on up side of line

- 34 There were signs to the left of the crossing gate giving instructions on its use (figure 4).
- 35 The sign instructing people in charge of animals to phone the crossing operator is a standard sign at bridleway crossings. The 'Cyclists Dismount' sign was added to the other signs at Kings Mill in 2009 (paragraph 115). The signs and gates, on both sides, are approximately three metres from the nearest rail. This is the position, for this type of crossing, at which a user should be able to make a decision on whether it is safe to cross (see paragraph 66).
- 36 At the time of the accident, the crossing was constructed across the railway on the line of Kings Mill Lane, at the angle at which the lane and railway intersect. This increases the length of the crossing deck and the time taken to traverse it, as compared with a crossing at right angles to the line, by about 40%.
- 37 The curvature of the line limits visibility in both directions from the up side. There is rising ground to the south-west which may form a barrier to sound travelling from that direction.

Identification of the immediate cause⁴

- 38 **The immediate cause of the accident was that the cyclist rode over the level crossing into the path of the approaching train.**
- 39 The eye-witness evidence confirmed that the cyclist opened the gate, and did not dismount. The CCTV from the train shows him riding over the crossing as the train approached.

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

Identification of causal factors⁵

The actions of the cyclist

40 The cyclist was unaware of the train before he rode onto the crossing.

- 41 The eye-witnesses describe how the cyclist rode along the path from Hermitage Lane, passing them and acknowledging them as he did so, then turned towards the crossing, and opened the gate towards himself, away from the railway.
- 42 The witnesses came up to the cyclist and one of them held the gate as he cycled through. The forward facing CCTV on the train shows him cycling onto the crossing, standing up on the pedals to move away quickly from a standing start, but then sitting down in the saddle as he crosses the lines.
- 43 Mr Dawn's actions, as described by the eye-witnesses and shown on the train's CCTV, indicate that he was unaware of the approaching train. The reason for this was probably a combination of some or all of the following factors:
- He was probably wearing earphones which may have prevented him from hearing the train (paragraph 47).
 - He did not look towards the approaching train (paragraph 50).
 - The view of approaching down trains from the up side, which he was coming from, is limited (paragraph 52).
 - The angle of the crossing meant that Mr Dawn was facing away from the train as he cycled across (paragraph 56).
 - He may not have been expecting trains to be running that day (paragraph 59).
- Each of these factors is now considered in turn.

The safe use of level crossings

- 44 Guidance for the railway industry on the management and operation of level crossings, produced by the Office of Rail Regulation (ORR) and its predecessors, has existed for many years, and is set out in paragraphs 66 and 67 of this report.
- 45 The ORR has also produced guidance for the public on the safe use of level crossings⁶. The section directed at pedestrians, cyclists and horse-riders using crossings in rural areas says:

Take special care when crossing railway lines at level crossings, especially crossings along footpaths, bridleways and other rights of way where there are no barriers or railway staff. In particular, pay attention to the following important points.

- *You **must** obey instruction signs, warning lights and alarms.*
- *If you hear a train horn, this means a train is approaching so do not cross. Remember though that train drivers will not always sound a horn (for example, at night).*

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

⁶ Using Level Crossings Safely, available on the ORR web site at http://www.rail-reg.gov.uk/upload/pdf/using_level_crossings_safely.pdf.

- *Before you reach the crossing remove hoods, earphones, headphones or any device that could stop you from hearing a train approaching. Remember that modern trains are quiet and weather conditions such as high winds and fog can reduce your ability to hear or see a train approaching.*

46 There is no evidence that Mr Dawn was aware of this guidance, which has been on the ORR web site since March 2011, although it has not been widely publicised or brought to the attention of members of the public who may be potential level crossing users. However, the crossing was equipped with signs instructing users to Stop, Look and Listen, as well as the signs instructing cyclists to dismount and instructions to people in charge of animals.

The cyclist did not hear the approaching train

47 The cyclist was probably wearing earphones which may have prevented him from hearing the train.

48 As Mr Dawn passed the eye-witnesses and turned towards the crossing, he appeared to use his left hand to remove or replace something in his ear. After the accident, a pair of earphones, with music playing 'loudly' (witness description) was found on his body. Mr Dawn is reported to have been in the habit of only using one earphone when he was cycling around roads and railways, but he did not appear to react to the sound of the train's horn, even when it was close to him.

49 The RAIB has investigated two accidents in which people who may have been wearing earphones have been struck, with fatal consequences, by trains or trams: at Morden Hall Park crossing on the London Tramlink system (Croydon) on 13 September 2008, which also involved a cyclist (RAIB report 06/2009), and at Johnson's footpath crossing, near Bishop's Stortford on 28 January 2012 (RAIB report 27/2012). The RAIB has also carried out preliminary examinations of several non-fatal accidents in which wearing of earphones has been a factor.

The cyclist did not see the approaching train

The actions of the cyclist

50 The cyclist did not look towards the approaching train.

51 Mr Dawn is likely to have been concentrating on manoeuvring his bicycle through the gate, and then on starting to ride over the crossing. He was wearing a hooded top, and the witness evidence and the forward facing CCTV on the train confirms that he had the hood up. This would have made it difficult, if not impossible while he was cycling, for him to have seen the approaching train, even if he turned his head to look over his shoulder. The CCTV shows that he did not appear to look towards the train once he was on the crossing. He may have done so as he opened the gate, but the train would not have been in view at that time.

Sighting of down trains

52 The sighting of down trains (those heading towards Mansfield) from the up side at Kings Mill is limited by the curvature of the line.

53 Safe use of Kings Mill crossing relies on the user hearing the warning horn sounded by an approaching train, because the curvature of the line and rising ground combine to obscure the view of trains for people crossing from the up (south-east) side (figure 5).



Figure 5: View from up side of crossing looking south-west (towards down trains)

- 54 The RAIB measured the distance at which an approaching train becomes visible to a person standing at the up side gate at Kings Mill crossing (3 metres from the line) to be 171 metres. A train travelling at 57 mph (92 km/h or 25.5 metres/second) will cover this distance in 6.7 seconds. The forward facing CCTV shows that Mr Dawn was struck by the train approximately five seconds after he started to cross the line. The curvature of the line means that there is little increase in the available sighting of down trains as a user moves closer to the track.
- 55 If Mr Dawn looked up the line while he was opening the gate, he would not have been able to see the approaching train until less than two seconds before he started across the line, at which time he was likely to have been concentrating on manoeuvring his bicycle round the gate and onto the crossing.

The angle of the crossing

- 56 **The angle of the crossing meant that the cyclist was facing away from the train as he cycled across.**
- 57 The railway and Kings Mill Lane intersect at an angle of about 40°. For a person crossing from the up side of the line, this has the effect of placing an approaching train on the down line well behind their left shoulder.
- 58 This relative position of railway and path means that the train would not have been within Mr Dawn's field of vision, unless he turned and looked left and behind him.

The cyclist's knowledge of train times

- 59 **The cyclist may not have been expecting trains to be running that day or for a train to be running at that time.**
- 60 On Tuesday 1 and Thursday 3 May 2012, industrial action by train drivers meant that there was no passenger train service on the Robin Hood line. The dispute had received publicity locally, and it is possible that Mr Dawn was under the impression that there was also no service on Wednesday 2 May.
- 61 The train involved in the accident was running about five minutes late. It is also possible that Mr Dawn, as a regular user, was aware of the times past each hour that trains normally passed the crossing, and assumed that this train had already gone.
- 62 Either of these two factors may have influenced Mr Dawn not to look out for the approaching train. Although there is no direct evidence supporting either possibility, neither can be entirely discounted.

Discounted factors

- 63 At the moment that Mr Dawn was struck he was moving briskly and was nearly clear of the train's path, and all the evidence gathered by the RAIB indicates that he had not intended to place himself in the path of the train.

Observations⁷Kings Mill crossing's compliance with guidance and standards

- 64 **The crossing did not comply with ORR guidance and Network Rail standards on warning time.**
- 65 There are a number of documents, produced by both ORR and Network Rail which together make up the framework of standards and guidance under which level crossings in Great Britain are constructed and operated. Paragraphs 66 to 70 set out the parts which are relevant to Kings Mill crossing, and consider the extent to which the warnings available to level crossing users were consistent with this framework.

⁷ An element discovered as part of the investigation that did not have a direct or indirect effect on the outcome of the accident but does deserve scrutiny.

Guidance on level crossings provided by the Office of Rail Regulation (ORR)

- 66 Guidance for crossing operators of all types of level crossing is provided by the ORR⁸. The guidance is not mandatory, but it is used by ORR inspectors as a measure of good practice. The following extracts are relevant to the accident at Kings Mill. The paragraph numbers [in square brackets] refer to the relevant paragraph in the guidance document:
- *Users are expected to use reasonable vigilance to satisfy themselves that no trains are approaching before they start to cross the line. They should cross quickly and remain alert whilst crossing. Users should have sufficient time from first seeing, or being warned of, an approaching train to cross safely [2.150]*⁹.
 - *(Crossing operators should) consider whether cyclists use the crossing. Where appropriate, (crossing operators should) take measures to encourage cyclists to dismount [2.153].*
 - *A sign explaining how to cross safely should be displayed at the decision point¹⁰ on each side of the crossing. For footpath crossings this should be not less than 2 m from the nearest running rails or 3 m where the line speeds are higher than 100 mph. For bridleway crossings this should not be less than 3 m from the nearest running rail [2.155].*
 - *The warning time should be greater than the time required by users to cross between the decision points at either end of a crossing. In assessing how quickly users will cross, take account of the mobility of likely users and the type of crossing surface [2.160].*
 - *As a guide, a walking speed of 1.2 metres per second (m/s) may be used where the surface is level and close to rail level. In other cases 1 m/s may be more appropriate. Increase the calculated time to cross to take account of foreseeable circumstances such as impaired mobility of users, numbers of pushchairs and bicycles or where there is a slope or step up from the decision point [2.161].*
- 67 This guidance outlines the conditions under which people are expected to use the crossing, and the warning of approaching trains that should be given to users. Guidance on how this warning can be provided if there is not sufficient sighting of trains is given in the next section:
- *Where the warning time is insufficient, additional protective equipment should be provided and may include:*
 - (a) *miniature stop lights¹¹ ...;*
 - (b) *telephones provided on both sides of the crossing and connected to a supervising point, which is always open when the railway line is open; or*
 - (c) *audible warnings of trains (preferably generated at the crossing itself). Where train speeds are low and the service infrequent, whistle boards positioned not more than 400 m from the crossing may help give warning of a train's approach [2.162]*

⁸ Level crossings: a guide for managers, designers and operators. Available at www.rail-reg.gov.uk.

⁹ The same text previously appeared, in 1996, in RSPG 2E, para 138.

¹⁰ A point where guidance on crossing safely is visible and at which a decision to cross or wait can be made in safety.

¹¹ These are red and green lights, displayed to crossing users, which are operated by approaching trains and indicate whether it is (green) or is not (red) safe to cross.

- *Where whistle boards are considered, take account of:*
 - (a) *the speed of sound (330 m/s) and the speed of the train;*
 - (b) *the possibility that train drivers will not sound the horn, especially at certain times of the day or night;*
 - (c) *the possibility that train horns may be inaudible at the crossing because of background noise; and*
 - (d) *the possible impact of train horn noise on nearby residents [2.163].*

Network Rail's standards for level crossing management

- 68 The way in which Network Rail interprets the ORR's guidance on crossing operation is set out in the company's Operations Manual. In the section of the Operations Manual dealing with level crossing risk assessment, there are instructions to calculate the required warning time based on the time that people need to get across the crossing in safety, which is called the traverse time. The traverse time is obtained by dividing the length of the crossing (the distance between the gate on the side the user enters, and reaching a point clear of the furthest track, in the case of Kings Mill) by the speed at which users are deemed to travel. Where it is likely that the crossing is used by cyclists, or there is a 'higher than usual' number of vulnerable people using the crossing¹², the manual requires the calculated traverse time to be increased by 50% to give the required warning time.
- 69 People using Kings Mill crossing relied on hearing a warning given by approaching trains. The warning time, calculated in accordance with the Operations Manual¹³, should be greater than the time required for a user to traverse the crossing, from the point where the decision to cross is made (the gate) to a position clear of the furthest track.
- 70 At Kings Mill, the required warning time should have been calculated during the risk assessments that took place as part of the process for managing the crossing. In fact the warning time was insufficient, for the reasons described in paragraph 79.

Crossing management, risk assessment and inspection

- 71 Network Rail's requirements for the management of risk at level crossings are defined in its company standard NR/L2/OPS/100 'Provision, risk assessment and review of level crossings'. The detail of the way that risk assessment should be done is set out in the Operations Manual, sections 5-16 'Level crossing risk assessment and mitigation' and 5-23 'Level crossing risk assessment – site visits and censuses'. The standard indicates that risk assessments at footpath and bridleway crossings should be carried out every three years, unless an accident or near-miss incident occurs (in which case a risk assessment should be carried out immediately afterwards).

¹² Operations manual procedure 5-23, All UWC crossing data collection form, sections 4.3 and 8. Vulnerable is defined as "children, elderly, disabled, vision impaired, deaf, those with learning difficulties, pushchair users, etc.". There is no definition of what is meant by "higher than usual".

¹³ Network Rail operations manual procedure 5-23, section 7.7, and procedure 5-16, section 7.1.10.

- 72 These documents refer to the *All Level Crossing Risk Model* (ALCRM), a computer-based system for estimating risk. The requirements for use of the ALCRM are set out in the Operations Manual, section 5-24 'Use of the ALCRM'. The ALCRM system is operated by the operations risk control co-ordinators (ORCCs) in each Network Rail route, but other staff may be used to collect data which the ORCC will input to ALCRM.
- 73 The ALCRM system was launched in January 2007. The first time that a risk assessment using the system was carried out at Kings Mill was on 16 November 2007. The East Midlands Route's ORCC for level crossings visited Kings Mill, completed the data collection form and carried out a one-hour census of users. Although he did not note any vulnerable users (paragraph 70), he did apply the 50% increase to the calculated traverse time to reflect use by cyclists (who are expected to dismount when using the crossing, although signs requiring this were only added in 2009 (paragraph 115)).
- 74 The whistle boards were sited at 392 metres and 418 metres from the crossing on the up and down lines respectively. At the time (November 2007), the line speed for trains over the crossing was 40 mph (64 km/h), so the warning times provided by the sounding of horns at the whistle boards, 23 seconds for down trains and 22 seconds for up trains, were greater than the traverse time of 16.2 seconds calculated by the ORCC.
- 75 The ALCRM provides a prediction of risk which it classifies in the following ways:
- individual risk of fatality (identified by a letter A (high) to M (low)), which relates to the risk of death for an individual using the crossing on a frequent basis (500 times per year); and
 - collective risk (identified by a number 1 (high) to 13 (low)), which relates to the total risk at the crossing. This takes into account the overall risk of death and injury for crossing users, train crew and passengers.
- 76 Once an ALCRM risk calculation has been undertaken, Network Rail uses a web-based system known as the Level Crossing Risk Management Toolkit (LXRMTK)¹⁴ to assist with the identification of possible risk mitigation measures, taking into account local factors. It provides a listing of options for consideration and indicative costs for each one. The list can be filtered to include only those measures that are relevant to specific crossing types. The principal factors that the instructions for using the toolkit say should be considered when assessing the potential benefits of a risk mitigation proposal are the effectiveness and longevity of risk reduction against the cost of the measure proposed.

¹⁴ The Level Crossing Risk Management Toolkit is managed by RSSB and is available to view at www.lxrmtk.com.

- 77 The ORCC had a backlog of assessment work, and it was about a year from the visit before he was able to deal with the data from Kings Mill. The ALCRM system estimated the risk (paragraph 75) for Kings Mill crossing as D3. This score meant that Network Rail's procedures required the ORCC to carry out an 'optioneering' exercise to consider possible risk mitigation measures. He concluded that the only way the risk at the crossing could be reduced would be to install miniature red/green stop lights to give users a visual indication of approaching trains. There was almost no history of accidents, near-misses or incidents of misuse at the crossing, and the cost of installing lights would have been greatly in excess of the benefits that would be obtained, in terms of the risk reduction calculated by ALCRM, and so he decided that this was not reasonably practicable. The ORCC took no further action in respect of Kings Mill crossing.
- 78 The next data gathering visit in connection with risk assessment at Kings Mill took place on 17 February 2011, slightly late but generally in accordance with Network Rail's three-year cycle for the assessment of level crossings where there is no reason (such as an accident or incident) for more frequent attention. The Network Rail mobile operations manager who carried out this visit measured the distance from the decision points (on both sides) to 2 metres past the furthest rail as 12.6 metres. The traverse time (based on Network Rail's defined speed for pedestrians on decked crossings of 1.189 m/s) should therefore have been 10.6 seconds, and with a 50% increase for dismounted cyclists carried over from the previous assessment the calculated traverse time would be 15.9 seconds¹⁵.
- 79 The speed of trains passing over the crossing had been increased since the previous assessment (paragraph 31). The warning time available from train horns was therefore 14.3 seconds for down trains (allowing for the speed of sound) and 16.2 seconds for up trains, so the required warning time was no longer available in the case of down trains. The ORCC was aware of this, since he had been consulted by the project team (paragraph 113) and advised of the implementation of the speed change.
- 80 It is also the case that the down line whistle board was a short distance beyond the 400 metre limit given in the ORR's guidance for the positioning of the boards (paragraph 67). This may have slightly reduced the audibility of a train horn for a person at the crossing, although the ORCC did not specifically note this.
- 81 The ORCC received and processed the data gathered by the mobile operations manager. The estimated risk had increased to C2, probably because the ALCRM algorithm took account of the increase in line speed since the previous assessment. Because of this, and because the data gathering exercise identified that the available warning time was less than the required time, the ORCC should¹⁶ have carried out an 'optioneering' exercise, including a visit to the crossing, to consider the possible measures suggested in the LXRMTK, such as reducing traverse time by eliminating the skew of the crossing.

¹⁵ Because of an error in the calculation by the mobile operations manager, a required time of 22.47 seconds was recorded on the form.

¹⁶ Operations manual procedure 5-16, section 7.1.10.

- 82 The ORCC did not make a special visit to the crossing to carry out this exercise, because he had visited it recently, jointly with representatives of Nottinghamshire County Council, as part of a joint review of 'high risk' crossings in the county, and had a good recollection of the site. He carried out the same optioneering exercise as before (paragraph 75), and took no further action. He did not highlight the risk to his manager, the operations risk adviser (ORA), as he was required to do by the operations manual (procedure 5-24, section 5.4.7), because he believed the ORA had access to ALCRM and could see the figures for himself.
- 83 There had been no accidents at the crossing at Kings Mill since the last assessment in 2007. Witness evidence indicates that this influenced the ORCC's approach to the risk assessment of the crossing, in that he was unable to make any case for improvements to the crossing (paragraph 77).
- 84 Since the accident Network Rail has straightened the crossing deck at Kings Mill, to reduce the traverse time for users, which is one of the measures included in the LXRMTK.

Audibility of warning horns

85 The background noise and long distances make the audibility of warning horns unpredictable and unreliable.

- 86 Audibility is a complex issue, and a person's ability to hear and respond to a train horn can depend on a number of factors, including:
- the volume of the horn;
 - ambient noise at the time;
 - physical barriers (topography); and
 - the hearing ability of the individual.
- 87 During RAIB's work at the site of the accident, several trains approached the crossing. It was difficult for some of a group of people at the crossing to distinguish the warning horns sounded by these trains above the background noise. In the case of one particular train, the horn was inaudible to all of the group. The drivers of trains approaching the crossing sounded the low tone of the horn only, in accordance with the railway rule book. Witness evidence suggests that the driver of the train involved in the accident also did this, which may be a factor in making the sound less distinctive, and making users less likely to react to it (paragraph 93).
- 88 There are several trees and bushes near the line on the up side of the crossing. At the times that the RAIB visited the crossing, the wind in the foliage, and bird song, produced a steady background noise, which was often augmented by noise from the nearby industrial estate. At the time of the accident, the wind was from the north-east, blowing from the crossing towards the approaching train, and so would have tended to further reduce the audibility of the horn.
- 89 The rising ground to the south-west acts as a barrier to sound from that direction, tending to mask the horns of down trains.

- 90 The RAIB considered the subject of train horn audibility in detail in its investigation into the fatal accident at Mexico footpath crossing, Penzance, on 3 October 2011¹⁷. At that location, when a train horn was sounded more than 350 metres away, a listener could sometimes have difficulty hearing it (paragraphs 85 to 93 of the Mexico report). The investigation found that the positioning of whistle boards at level crossings across the main line railway network has not been optimised, and drivers sometimes sound train horns a significant distance before a whistle board, rather than when passing it. Both these factors are relevant to the safety of the crossing at Kings Mill, particularly because the whistle boards at the crossing are close to or beyond the defined limit of 400 metres (paragraphs 74 and 80).
- 91 The Railway Group Standard covering post-incident testing¹⁸ has no requirement for testing train horns after incidents and accidents.
- 92 Recommendations 4 and 5 of the report into the accident at Mexico footpath crossing deal with the issues identified in paragraphs 90 and 91, and so the RAIB is not making a further recommendation.
- 93 Following concerns about excessive noise from train horns, one of the mitigation measures adopted by the railway industry was to require trains drivers only to sound the low tone of the two-tone train horn at whistle boards. There is believed to be a risk of users failing to identify that the sound they hear is a train horn, if the driver only sounds a single tone of the horn. This is discussed in paragraphs 85 to 96 of the report into the accident at Mexico footpath crossing, and is not considered further in this report.

The change in use of the crossing

94 The crossing had been promoted as part of a multi-user trail, without an adequate assessment of the risk to all groups of potential users.

- 95 The 'Timberland Trail' was established by Mansfield District Council in the 1990s. It used a combination of public rights of way, disused railways and other public paths. There is no record of any discussions between the District Council and the railway infrastructure manager about the establishment of this trail and any likely impact on the usage of the crossing.
- 96 Nottinghamshire County Council became involved with the trail in 2007 as part of a promotion of the wider Sherwood Forest area. The council obtained funding to promote a 'multi-user' trail from Rainworth to Sutton in Ashfield, using a combination of existing trails, public rights of way and road sections. The funding was used for surfacing, infrastructure and landscaping.
- 97 The bridleway crossing was risk assessed as part of a joint review (between the County Council and Network Rail) of 'high risk' level crossings on 20 May 2009. This review considered the issues associated with the use of the crossing by horse riders and cyclists, and concluded that consideration should be given to replacing the crossing with a bridge. Network Rail reports that about two months before the accident it had accepted the need to replace the crossing with a bridge. However, Network Rail does not appear to have identified any source of funding for it, and no feasibility study for the construction of a bridge was carried out until after the accident.

¹⁷ RAIB report 10/2012, published June 2012.

¹⁸ GM/RT2273 'Post Incident and Post Accident Testing of Rail Vehicles'.

- 98 There was another joint assessment of the crossing in May 2010 (paragraph 82), which noted work recently carried out on improving the surfaces on the approach to the crossing.
- 99 The County Council was not aware of any concerns about the safety of the crossing. However, none of the reviews described above appears to have considered whether the crossing was suitable for use by mobility scooters, which appear on the publicity material issued by the County Council for the trail, and were observed using the crossing during one of the RAIB's visits to the site (paragraph 107). The local Network Rail staff were not aware of these users.
- 100 A person on a mobility scooter has little or no ability to remove themselves quickly from a crossing if a train appears after they have begun to cross. For this reason it is particularly important that there is adequate warning time available if mobility scooters are likely to use the crossing. The RAIB observed that a mobility scooter required 16 seconds to traverse the crossing, which is more than the warning time available for down trains at 60 mph (97 km/h) (paragraph 79). Since the accident, Network Rail has added signs to Kings Mill crossing advising users of mobility scooters and buggies to call the signaller before crossing (paragraph 125).

The ORCC's workload

101 The ORCC had a backlog of level crossing risk assessments.

- 102 As noted in paragraph 75, the risk assessment and optioneering exercise carried out by the ORCC did not take place until nearly a year after he had visited the crossing in 2007 to gather data. This delay in completing the assessment was not unusual. The ORCC, one of two in the East Midlands route, was supposed to allocate all his time to level crossing work, and was assisted by the other ORCC for about 40% of the time.
- 103 There are about 380 level crossings on the East Midlands route. Each must be risk assessed every three years, leading to a base workload of around 130 assessments per year for the team of two ORCCs to carry out. Additional risk assessments must be carried out when a near-miss has taken place at a crossing. During the period from 2006 to 2011, the ORCC was also required to provide input to project work on (among other things) level crossing renewal schemes, line speed improvements, and resignalling schemes. He gave priority to this work, over the regular risk assessments, and a backlog of assessments developed.
- 104 The RAIB has previously investigated an accident in which the workload and priorities of a level crossing team were a factor¹⁹. Following that accident, Network Rail reviewed the way in which it undertakes level crossing management. The results of this review are described at paragraph 128.
- 105 The RAIB considers that this action will address the issue, and is not making a recommendation on the subject.

¹⁹ Collision between an articulated tanker and a passenger train at Sewage Works Lane user worked crossing, near Sudbury, Suffolk on 17 August 2010: RAIB report 14/2011, published August 2011.

The accuracy of census data

106 The census figures used by Network Rail do not reflect the actual usage of the crossing.

- 107 There is evidence that Kings Mill crossing is heavily used, particularly at weekends. The RAIB counted the number of people using the crossing on two occasions: 24 May and 7 October 2012. On Thursday 24 May 2012, the crossing was used, between 11:30 hrs and 13:00 hrs, by 25 pedestrians, 4 cyclists, and two people on mobility scooters. The mobility scooters took 16 seconds to traverse the crossing. The RAIB carried out a further census on Sunday 7 October 2012. On this occasion, the crossing was used by 138 people between 10:00 hrs and 16:00 hrs, made up of 64 pedestrians, 48 cyclists, 25 dog walkers and one horse rider.
- 108 On the basis of these results, and witness evidence, the RAIB estimates that at weekends in the summer the crossing is likely to be very busy, possibly used by more than 300 people each day.
- 109 The usage censuses carried out by Network Rail staff in connection with data gathering for risk assessments were done over short periods on weekdays, as required by the Operations Manual. On Friday 16 November 2007 between 15:00 hrs and 15:30 hrs, 6 adults and one child were recorded using the crossing. On Thursday 17 February 2011, between 10:43 hrs and 11:43 hrs, 12 pedestrians and two cyclists were recorded using the crossing. Using Network Rail's standard multiplier²⁰, these two sets of figures give a daily usage of about 160 people.
- 110 The ALCRM system is very sensitive to crossing usage, and it is important that changes in the level of use are identified and acted upon. Kings Mill Lane bridleway is very busy with commuters, recreational users and people going to and from the hospital and supermarket, some of whom may be users of mobility scooters. The promotion of the Timberland trail (paragraph 95) may have had an effect on the number of people using Kings Mill crossing.
- 111 The RAIB identified the issue of the importance of accurate census figures in its investigation into the fatal accident at Gipsy Lane footpath crossing, Needham Market, on 24 August 2011 (RAIB report 15/2012) and made a recommendation relating to it (paragraph 123). For this reason, no further recommendation is made in this report.

The line speed improvement project

112 The risk assessment carried out for the line speed improvement project in 2009 was incorrect and was not fully documented.

- 113 Network Rail began a project to increase the speed of trains on the Robin Hood line in 2008. In October 2008, the engineer for the project asked the ORCC what effect the proposed increase in speed on the line between Sutton Parkway and Mansfield would have on the level crossings in the area. The ORCC believed that the whistle boards would still provide adequate warning time for pedestrian users after the increase in line speed. This was incorrect (paragraph 79), but the ORCC is unable to account for his error.

²⁰ The ALCRM algorithm multiplies the recorded hourly figure by 13.5 to give a total for the whole period over which trains run.

- 114 Engineers (employed by a consultant) working on the line speed improvement project visited the crossing in June 2009, and were concerned about the visibility of approaching trains. They raised a technical query with Network Rail, saying:

This is particularly poor when crossing from the Up side (inside of the curve) – 100 m visibility? No doubt partly due to the spring growth of vegetation, but even if this was cleared around the bend, we would be concerned. (Is reliance on audible warning acceptable, bearing in mind that users may wear in-ear type earphones, may be deaf, or the wind may be blowing and obscuring any warning?)

The query also covered various points relating to the signage at the crossing.

- 115 The query was referred to the ORCC, who replied that *‘the provision of whistle boards at a crossing used by members of the public on foot is an approved form of protection, provided they are not positioned in excess of 400 metres in advance of the feature’*. He also commented on the duty of crossing users to remove ear-phones or switch off music being emitted through them. He explained that the only alternatives to the existing protection arrangements would be the installation of miniature stop lights (paragraph 75), or the closure of the crossing and its replacement with a bridge. He agreed that ‘Cyclists Dismount’ signs should be added, and they were fitted at Kings Mill in late 2009 as part of the project.
- 116 The line speed improvement project went ahead, and the increased speeds over Kings Mill crossing became effective on 29 November 2009 (paragraph 31). Shortly before the project was completed, the ORCC signed off the authorisation document, to the effect that he had visited the crossing and examined the risks using ALCRM.
- 117 The risk register created for the project did not mention level crossings, but the information and assurance provided to the project by the ORCC gave the impression that the risk associated with crossings had been properly considered and mitigated.

Previous occurrences of a similar character

- 118 The RAIB has investigated eleven accidents involving pedestrians and cyclists at level crossings on Britain’s main line railways, since it became operational in October 2005. The three most recent of these have features that are relevant to the accident at Kings Mill, and have already been discussed in this report:
- a pedestrian was fatally injured on Mexico footpath crossing, near Penzance on 3 October 2011 (paragraph 123, RAIB report 10/2012);
 - a pedestrian was fatally injured on Gipsy Lane footpath crossing, Needham Market, on 24 August 2011 (paragraph 123, RAIB report 15/2012); and
 - a pedestrian was fatally injured on Johnson’s footpath crossing, near Bishop’s Stortford on 28 January 2012 (RAIB report 27/2012).
- 119 In addition, the RAIB has investigated one accident on a tramway which had similar characteristics to the accident at Kings Mill:
- a cyclist was struck by a tram and fatally injured at Morden Hall Park crossing on the London Tramlink system (Croydon) on 13 September 2008 (RAIB report 06/2009).

Summary of conclusions

Immediate cause

120 The immediate cause of the accident was that the cyclist rode over the level crossing into the path of the approaching train (**paragraph 38**).

Causal factors

121 The cyclist was not aware of the approaching train (**paragraph 40**). It is likely that this was because of a combination of the following factors:

- a. the cyclist did not hear the train; he was probably using earphones which may have prevented him from doing so (**paragraph 47, see paragraph 127**); and
- b. the cyclist did not see the train:
 - i. he had his hood up and did not look towards the approaching train as he crossed (**paragraph 50, see paragraph 125 and Learning Point 1**);
 - ii. the sighting of down trains from the up side at Kings Mill is limited by the curvature of the line (**paragraph 52**);
 - iii. the angle of the crossing meant that he was facing away from the train as he cycled across (**paragraph 56**); and
 - iv. he may not have been expecting trains to be running that day or for a train to be running at that time (**paragraph 59**).

Additional observations

122 Although not linked to the accident on 2 May 2012, the RAIB observes that:

- a. the crossing did not comply with ORR guidance and Network Rail standards on warning time (**paragraph 64, see paragraph 124**);
- b. the risk assessment carried out for the line speed improvement project in 2009 was incorrect and not fully documented (**paragraph 112, see paragraph 126**);
- c. the background noise and long distances make the audibility of warning horns unpredictable and unreliable (**paragraph 85, see reference in paragraph 123 to recommendation 5 from the RAIB's Mexico footpath crossing investigation**);
- d. the local authority, in promoting the crossing as part of the a multi-user trail, had not fully considered the risks to vulnerable groups (**paragraph 94, Recommendation 1**);
- e. the ORCC had a backlog of risk assessment work (**paragraph 101, see paragraph 128**); and
- f. the census figures used by Network Rail probably do not reflect the actual usage of the crossing (**paragraph 106, see reference in paragraph 123 to recommendation 2 from the RAIB's Gypsy Lane footpath crossing investigation**).

Previous RAIB recommendations relevant to this investigation

123 The following recommendations were made by the RAIB as a result of previous investigations, which address factors identified in this investigation. They are therefore not remade so as to avoid duplication:

[Accident at Mexico footpath crossing, Penzance on 3 October 2011, RAIB report 10/2012 published June 2012](#)

Recommendation 4

First Great Western should make a proposal to RSSB to modify relevant Railway Group Standards to mandate the requirement to test train horns in an objective manner when a train has been involved in any accident or incident involving circumstances where the sounding of the train horn was either required by the rule book or employed by the driver during the event.

The RAIB has not yet received a response from the railway industry or the ORR regarding the implementation of this recommendation.

Recommendation 5

Network Rail should conduct a review of the arrangements for providing warnings for pedestrians at level crossings currently equipped with whistle boards. The review should address:

- the costs and benefits at each crossing of providing audible or visual warnings at the crossing itself rather than by approaching trains (taking account of the possibility of the significantly reduced costs of visual warnings referred to in paragraph 120); and
- at crossings where whistle boards will remain, whether the position of the board at each crossing has been optimised taking account of all relevant local factors including (but not limited to) prevailing wind, local topography, sources of noise and the traverse time for crossing users and the positive and negative effects on railway neighbours.

The RAIB has not yet received a response from the ORR regarding the implementation of this recommendation. However, Network Rail has informed RAIB that this recommendation will be actioned via a phased approach:

Phase one will be to develop a cost effective method of providing a visual and/or audible warning at level crossings.

Phase two is to review circa 1600 crossings fitted with whistle boards to identify:

- a. those sites suitable for the installation of new visual and or audible aids of warning;
- b. sites where there is a need to optimise the positions of existing whistle boards ie moving them; and
- c. sites where no action is required due to there being no business case or when the position of whistle boards is already optimised.

Network Rail has indicated that it plans to complete phase one and two activities by the end of 2013. This will be followed by the development of a plan for the implementation of improvements across the railway network.

Accident at Gipsy Lane footpath crossing, Needham Market on 24 August 2011, RAIB report 15/2012 published July 2012

Recommendation 2

Network Rail should have effective systems in place for accurate information gathering during data collection visits at level crossings. Any changes from previous data collected should be clearly understood and feedback given to the relevant person where data is incorrect. This includes data relating to:

- the number of crossing users where the quick census is undertaken;
- the use of whistle board protected crossings during the night-time quiet period;
- use of the crossing by vulnerable users;
- location of whistle boards;
- crossing length;
- traverse distance; and
- distance from each crossing gate and decision point to the nearest rail.

The RAIB has not yet received a response from the ORR regarding the implementation of this recommendation. However, Network Rail has informed RAIB that its National Level Crossing Team will address this recommendation as part of a project to improve safety at passive crossings. This project includes the collection of data related to the seven points listed in the recommendation. The complete scope for this project is currently being defined and agreed, with a target completion date of 30 September 2013. The National Level Crossing Team are also reported to be taking a number of measures to improve the accuracy and consistency of data collected at level crossings.

Recommendation 3

Network Rail should develop its guidance for use by level crossing teams to include:

- a clear definition of what constitutes a 'higher than usual' number of vulnerable users;
- implementing risk-reduction measures at crossings that have deficient sighting or warning times; and
- when speed restrictions must be imposed, what type of speed restriction is to be used (emergency, temporary or permanent) and the timescales for imposing speed restrictions.

The RAIB has not yet received a response from the ORR regarding the implementation of this recommendation. However, Network Rail has informed RAIB that:

- Its National Level Crossing Team has engaged Human Factors specialists. Part of their remit is to look specifically at what constitutes a 'higher than usual' number of vulnerable users. This will be informed by SmartCams that are on trial at two sites.
- The procurement toolkit already provides some guidance on mitigations and associated costs. Consideration is being given to developing additional cost effective solutions at sites affected by deficient sighting.

- Bullet point 3 is not being progressed on the basis that it is considered to be extremely difficult to determine exactly when and where it is appropriate to apply speed restrictions, and it should be left to professional/expert judgement at the time.

Collision between a train and an articulated road tanker at Sewage Works Lane user worked crossing, Sudbury on 17 August 2010

Recommendation 5

Network Rail should review its level crossing management processes to establish the costs and benefits of making data gathering, processing and risk assessment of a level crossing the responsibility of a single person or a dedicated team with a comprehensive understanding of the operating environment at that crossing, and make changes to those processes as appropriate in the light of the outcome from the review.

The ORR reported to the RAIB on 24 September 2012 that Network Rail has taken the recommendation into consideration and is taking action to implement it (paragraph 128).

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

Actions reported that address factors which otherwise would have resulted in a RAIB recommendation

- 124 After the accident, Network Rail imposed a speed restriction of 40 mph (64 km/h) in both directions over Kings Mill level crossing. It then carried out trials with an audible warning device, which sounds at the crossing as trains pass the 'whistle' boards in each direction. Representatives of the ORR visited the crossing and provided feedback to Network Rail on the effectiveness of the device.
- 125 Network Rail has realigned the deck of Kings Mill crossing so that it is at right angles to the track. This is intended to reduce the traverse time for the crossing. It will be necessary for Network Rail to make an application to the local authority under section 119a of the Highways Act 1980 if this change is to become permanent. Network Rail has also added signs at the crossing, advising that users of wheelchairs, mobility scooters, buggies, and anyone likely to experience difficulty in crossing should phone the signaller.
- 126 After realigning Kings Mill level crossing and fitting the audible warning device, Network Rail carried out a new risk assessment of Kings Mill level crossing, and concluded that no further action was required.
- 127 Network Rail has launched a national safety campaign called 'Lose your headphones' which asks people to remove their headphones at level crossings so they are not distracted from warnings about approaching trains.
- 128 Network Rail has reviewed its arrangements for managing level crossings following the RAIB's recommendation arising from the investigation into the accident at Sewage Works Lane (paragraphs 104 and 123). It concluded that change was required, and is appointing and training Level Crossing Managers (LCMs) for all routes. The company has analysed the workload for the new posts, and each LCM will be responsible for a maximum of 70 level crossings, a number that will be consistent across the network. The LCM concept was tested in the company's Scotland route, where it is now operational. Recruitment and training of LCMs for the rest of the country is now in progress, and the new organisation is due to be put into effect in March 2013.

Other reported actions

- 129 East Midlands Trains has issued an instruction that drivers must use both tones of the warning horn on the approach to the whistle boards at Kings Mill crossing (paragraph 93).
- 130 RSSB has commissioned research into the causes of pedestrian accidents at level crossings, and potential solutions. The results of this are due to be published in April 2014.

Learning point

131 The RAIB has identified the following key learning point²¹:

- 1 The possibility of making relatively small changes which may reduce the risk at crossings can be overlooked if those responsible are concentrating on the feasibility of major changes, such as provision of warning lights or total closure. At Kings Mill, the crossing deck was straightened after the accident to reduce the traverse time and thus the time that users are exposed to the hazard of approaching trains (paragraph 125). This is one of the options for risk mitigation described in the LXRMTK.

The RAIB therefore reminds crossing operators that their staff need to be aware of all the possible steps that can be taken to mitigate risks at level crossings, and they should be prepared to apply minor or interim measures pending the opportunity for significant upgrading work.

²¹ 'Learning points' are intended to disseminate safety learning that is not covered by a recommendation. They are included in a report when the RAIB wishes to reinforce the importance of compliance with existing safety arrangements (where the RAIB has not identified management safety issues that justify a recommendation) and the consequences of failing to do so. They also record good practice and actions already taken by industry bodies that may have a wider application.

Recommendation

132 The following recommendation is made²²:

- 1 *The intent of this recommendation is to raise the awareness of local authorities in relation to the risk associated with new schemes that involve level crossings.*

The Health & Safety Executive and the Office of Rail Regulation should draw the attention of local authorities to the need to consider the effects and possible risk associated with developments, such as the promotion of multi-user trails, which are likely to result in an increase in the number and type of users of routes passing over level crossings, with particular reference to the needs of vulnerable groups such as the elderly, users of mobility scooters and people with small children (paragraph 122d).

²² Those identified in the recommendation, have a general and ongoing obligation to comply with health and safety legislation and need to take this recommendation into account in ensuring the safety of their employees and others. Additionally, for the purposes of regulation 12(1) of the Railways (Accident Investigation and Reporting) Regulations 2005, this recommendation is addressed to the Office of Rail Regulation and the Health & Safety Executive to enable them to carry out their 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 website www.raib.gov.uk.

Appendices

Appendix A - Glossary of abbreviations and acronyms

ALCRM	All Level Crossing Risk Model
BR	British Rail
CCTV	Closed Circuit Television
HSE	Health & Safety Executive
km/h	kilometres per hour
mph	miles per hour
ORCC	Operations Risk Control Co-ordinator
ORR	Office of Rail Regulation
OTDR	On-Train Data Recorder

Appendix B - Glossary of terms

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

All Level Crossing Risk Model	A model used by Network Rail to evaluate the risk at level crossings.
Diesel multiple unit	A train consisting of one or more vehicles (semi-permanently coupled together) with a driving cab at both ends, whose source of power is a diesel engine.*
Down	The direction from Nottingham towards Mansfield, and the line used by trains travelling in that direction (generally north).
Up	The direction from Mansfield towards Nottingham, and the line used by trains travelling in that direction (generally south).
Whistle board	A white circular sign with a grey edge and black W in the centre that indicates to a driver that they must sound the horn or whistle. This is often used to provide a warning to users of footpath crossings.*

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