



Rail Accident Investigation Branch

Rail Accident Report



**Fatal accident at Tackley station level crossing,
Oxfordshire
31 March 2008**

Department for
Transport

Report 09/2009
March 2009

This investigation was carried out in accordance with:

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

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Fatal accident at Tackley station level crossing, Oxfordshire, 31 March 2008

Contents

Introduction	5
Preface	5
Definitions	5
Summary of the report	6
Key facts about the accident	6
Immediate cause, causal, contributory and underlying factors	6
Recommendations	7
The Accident	8
Summary of the accident	8
The organisations involved	8
Location	8
External circumstances	8
Train(s)/rail equipment	8
Events preceding the accident	10
Events during the accident	10
Consequences of the accident	10
Events following the accident	10
The Investigation	12
Investigation process and sources of evidence	12
Key facts about the accident	13
Train 9O18	13
The deceased person	13
Tackley crossing	13
RAIB assessment of sighting distances	18
The Cross Country Route Modernisation project	20
Analysis	24
Identification of the immediate cause	24
Identification of causal and contributory factors	24
Identification of underlying factors	26
Other factors for consideration	27
Observations	28

Conclusions	30
Immediate cause	30
Causal factors	30
Contributory factor	30
Underlying factors	30
Additional observations	31
Actions reported as already taken or in progress relevant to this report	32
Actions reported as already taken which address factors in the report so that the RAIB does not issue a recommendation	33
Recommendations	34
Recommendations to address causal and contributory factors	34
Recommendations to address other matters observed during the investigation	34
Appendices	36
Appendix A - Glossary of abbreviations and acronyms	36
Appendix B - Glossary of terms	37
Appendix C - Key standards current at the time	39
Appendix D - Urgent Safety Advice	40

Introduction

Preface

- 1 The sole purpose of a Rail Accident Investigation Branch (RAIB) investigation is to prevent future accidents and incidents and improve railway safety.
- 2 The RAIB does not establish blame, liability or carry out prosecutions.

Definitions

- 3 Mileages are measured from London Paddington via Didcot.
- 4 The *up line* is used by trains heading south towards Oxford; the *down line* for trains heading north towards Banbury. The down line and down side of the crossing are closest to Tackley village.
- 5 Left and right are defined from the point of view of a train approaching the crossing on the up line.
- 6 Appendices at the rear of this report contain the following glossaries:
 - acronyms and abbreviations are explained in Appendix A; and
 - technical terms (shown in *italics* the first time they appear in the report) are explained in Appendix B.

Summary of the report

Key facts about the accident

- 7 At about 15:16 hrs on 31 March 2008, a train travelling from Dundee to Bournemouth struck and fatally injured a female pedestrian at Tackley station level crossing in Oxfordshire.
- 8 There was no damage to the train or the railway infrastructure.

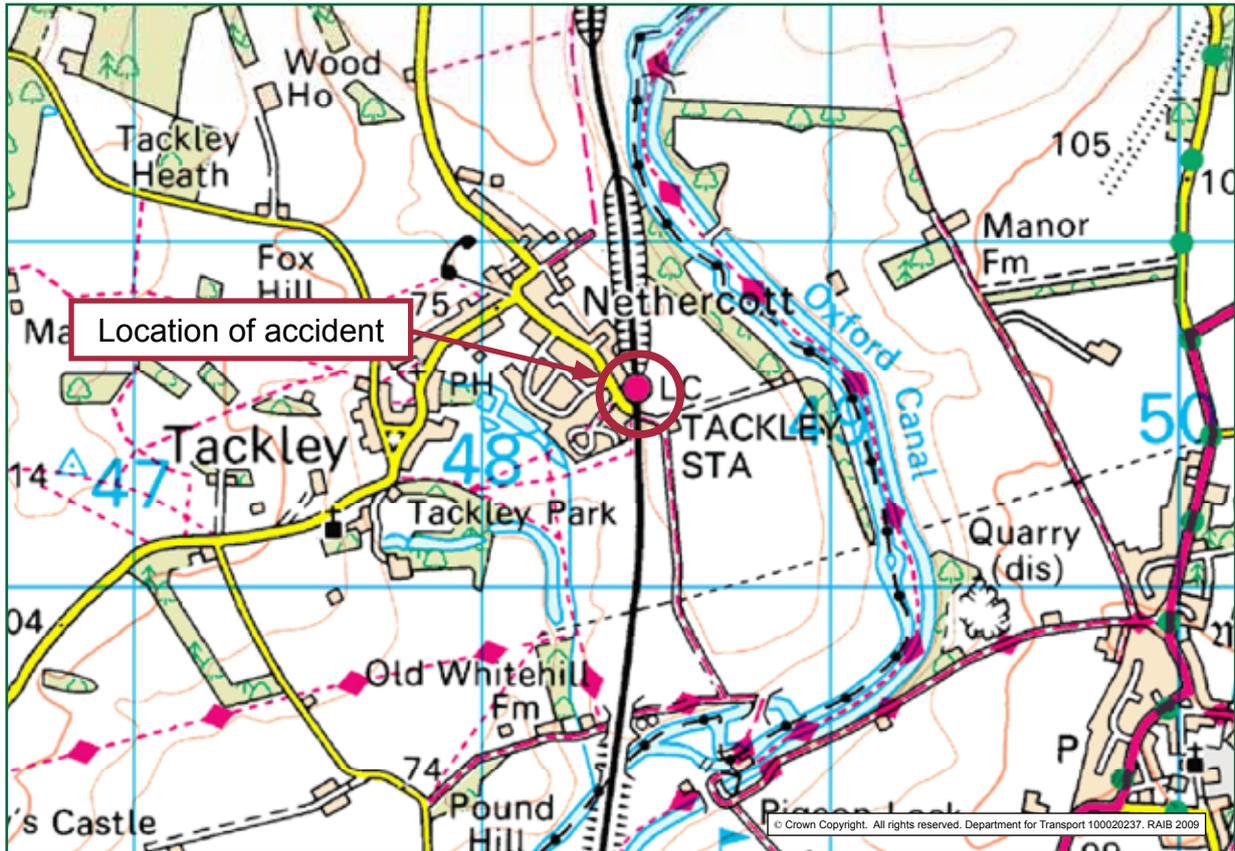


Figure 1: Extract from Ordnance Survey map showing location of the accident

Immediate cause, causal, contributory and underlying factors

- 9 The immediate cause of the accident was that the pedestrian stepped onto the crossing and into the path of an approaching train.
- 10 Causal factors were:
 - a. Either the deceased mistaking a late running through train for the stopping service, which was due at about the same time, and which she had intended to catch (incorrect use); or
the deceased being unaware of the approaching train until after she had committed herself to using the crossing, possibly by being unable to hear its approach; and
 - b. The restricted sighting of trains from outside the railway boundary, from the down (ie village) side of the crossing, due to a poorly sited palisade fence.

- 11 The following factor was considered to be possibly contributory:
- The use of a *decision point*, which was not required to be marked, within the wicket gate for assessment and inspection purposes. This did not accurately reflect the behaviour of crossing users, but allowed the crossing to pass its assessment and inspections and meant that the need to improve sighting was not recognised.
- 12 An underlying factor was:
- The local authorities' rejection of proposals to replace the crossing at a time when it was cost effective to take action, which meant that this opportunity was lost. As a consequence, no reasonably practicable measures could be taken, and this was an underlying factor in the crossing remaining in use.

Recommendations

- 13 Recommendations can be found in paragraph 158. They relate to the following areas:
- safety improvements associated with Tackley level crossing;
 - the control of fencing at crossings; and
 - the marking of decision points and required sighting distances at crossings.

The Accident

Summary of the accident

- 14 At 15:16 hrs on Monday 31 March 2008, train 9O18, the 07:03 hrs Dundee to Bournemouth CrossCountry service, struck and fatally injured an 82 year-old female pedestrian at Tackley station level crossing (Tackley crossing) in Oxfordshire. The deceased person was a local resident who was using the crossing to access the station.
- 15 At the time of the accident, train 9O18 was running approximately nine minutes late, and travelling at 90 mph (145 km/h).

The organisations involved

- 16 The level crossing is on the railway between Oxford and Banbury, which is owned, operated and maintained by Network Rail (Thames Valley area).
- 17 The train was operated by CrossCountry Trains Ltd and the train crew (driver and guard) were CrossCountry employees.
- 18 Tackley station was operated by First Great Western Ltd, trading as First Great Western Trains.
- 19 The above parties freely cooperated with the investigation.

Location

- 20 Tackley station is located at 72 miles 50 chains on the Didcot to Chester line, between Oxford and Heyford. Tackley crossing is situated 35 metres (38 yards) south of the station (Figure 4).
- 21 The railway is double track with a 90 mph (145 km/h) line speed, increasing to 110 mph (177 km/h) for high speed trains south of Tackley crossing.
- 22 The railway is used by a mix of through-passenger and freight services, and local trains serving Tackley station.
- 23 The weekday timetable at the time of the accident listed 12 departures from Tackley in the up direction, and 10 departures in the down direction. The daytime passenger stopping service was infrequent, with three trains departing in the up direction between 10:00 hrs and 19:00 hrs.

External circumstances

- 24 The weather on 31 March was dry with normal visibility and a 5 mph south-easterly wind.

Train(s)/rail equipment

- 25 Train 9O18 was formed of a five-car 'Voyager' *diesel multiple unit*, 221 117, with a maximum speed of 125 mph (201 km/h).

- 26 Tackley crossing is *user-worked* with separate vehicular and wicket gates, the vehicular gates normally being kept locked (Figure 2). The crossing provides three types of access:
- it is an *accommodation crossing* giving access for Tackley Estate, who are the only *authorised users*, and can use the crossing for farm vehicles in connection with managing and using the Estate;
 - it allows a footpath and bridleway to cross the railway, and forms part of an on-road cycle route promoted by the National Cycle Network; and
 - it is the only means of access to the up (London bound) platform of Tackley station from the village.



Figure 2: Approach to Tackley crossing from the down (ie village) side

- 27 Tackley crossing is defined as an *unprotected crossing* in accordance with Network Rail's operations manual procedure 5-23 'level crossing risk assessment – site visits & censuses' (procedure 5-23), as it is neither manned nor an *automatic level crossing*. It is equipped with *whistle boards* for trains approaching in both up and down directions, and there are telephones fitted at the crossing for use by level crossing users with vehicles or animals.
- 28 The crossing deck is constructed from rubber panels providing a surface level with the rails. At the time of the accident, the deck was in good condition
- 29 North of Tackley station, an emergency crossover provides a facility for crossing trains between the up and down lines. This crossover is operated at low speed and was not in use on 31 March 2008.
- 30 The railway is equipped with colour-light signals controlled from Oxford power signal box. The lines are fitted with a mix of DC and U-type Aster *track circuits*.
- 31 For trains approaching Tackley in the down direction, visibility of the crossing is restricted by a long left-hand bend. The approach in the up direction is straight for 600 metres (Figure 4).

Events preceding the accident

- 32 Train 9O18, operated by CrossCountry, was scheduled to run non-stop between Banbury and Oxford at a maximum speed of 110 mph (177 km/h) where permitted.
- 33 The train forming the 15:20 hrs First Great Western service from Tackley to Oxford was delayed by approximately four minutes at Banbury in order to allow the late running CrossCountry service to run ahead of it.

Events during the accident

- 34 Train 9O18 approached Tackley station at 15:16 hrs on the up line and at a speed of 90 mph (145 km/h). The driver sounded the horn as he approached a whistle board located 365 metres before the crossing and observed that the crossing was clear. At this time, the train was nine seconds from the crossing and would have been clearly visible to a crossing user.
- 35 As the train ran through the station, the driver states he observed a child with two adults standing behind the yellow line on the up platform. The driver then checked his speedometer before he looked ahead again.
- 36 The driver observed a female pedestrian on the crossing ahead of him, walking from right to left (ie towards the up platform) and looking ahead. The person on the crossing appeared to run in an attempt to get clear when she became aware of the train, but was unable to avoid being struck.
- 37 The driver applied the emergency brake nine seconds after sounding the horn, during which time the train travelled 355 metres.

Consequences of the accident

- 38 The level crossing user was fatally injured as a result of being struck by the train.

Events following the accident

- 39 The driver applied the emergency brake and brought the train to a halt. He switched on flashing lights to warn any trains approaching in the opposite direction and made an emergency call to Network Rail's Operations control, using an emergency button on the train's National Radio Network (NRN) radio. He informed the controller of the accident and requested the attendance of the emergency services.
- 40 The driver contacted the Oxford signaller using his mobile telephone, as the NRN radio had stopped working, to inform him of the accident. The driver was told that all other trains in the vicinity would be stopped and that his train was now protected. The driver then spoke to a British Transport Police incident room on the instructions of the signaller.

- 41 The driver informed the on-board train manager of the accident. The train manager walked back towards the level crossing to try and ascertain the location of the deceased. Members of the public waiting at the station were unaware of the accident until being informed by the train manager.
- 42 The emergency services arrived at approximately 15:25 hrs.
- 43 The driver was relieved of duty on site and was breathalysed as a routine precaution. This gave a negative result. The train was taken forward to Oxford before being taken out of service.

The Investigation

Investigation process and sources of evidence

- 44 The investigation focused on the following aspects:
- a. actions of the driver;
 - b. the actions of the deceased;
 - c. crossing layout and conditions at the time of the accident;
 - d. visibility of approaching trains; and
 - e. crossing assessment and maintenance activity.
- 45 Evidence has included:
- f. examination of the site;
 - g. witness statements;
 - h. on-train data recorder records;
 - i. level crossing records; and
 - j. planning records relating to the proposed replacement of Tackley crossing.

Key facts about the accident

Train 9O18

- 46 Train 9O18 had been delayed by a signal failure in the Wakefield area (Yorkshire) earlier in its journey, and was running late on arrival in Birmingham. It was due to depart from Birmingham New Street at 14:03 hrs, but eventually left 13 minutes late. The delay had reduced to nine minutes on departure from Banbury.
- 47 The *on-train data recorder* confirms that the train did not exceed the 90 mph (145 km/h) speed limit as it approached Tackley station, and that the driver sounded the horn as he passed the whistle board on the approach to the crossing. It also confirms that the driver applied the emergency brake nine seconds later and that the train travelled for 704 metres (771 yards) with the emergency brake applied before coming to a complete halt.

The deceased person

- 48 The deceased person was 82 years-old, and a longstanding resident of Tackley village. She was an occasional user of the level crossing, and was active and able to walk without aid. She had been intending to travel by train to Oxford on 31 March 2008 and was wearing appropriate shoes for walking. She had experienced some loss of hearing.

Tackley crossing

- 49 The village of Tackley is situated entirely on the west side of the railway, which was opened between Oxford and Banbury in 1850. A level crossing was required to allow the railway to cross an existing local road between Tackley and the nearby village of Kirtlington. In 1931, a halt (station) was opened adjacent to the crossing to serve Tackley village. At that time, a crossing keeper was provided on a 24-hour basis and the crossing gates were interlocked with the signalling system. With the closure of the crossing as a through route and withdrawal of the crossing keeper, the crossing subsequently became user-worked, and is now unmanned.
- 50 Network Rail own over 7600 level crossings, including 165 unprotected *station-related crossings*. Twenty six of these are defined as 'user-worked' or 'footpath crossings', as opposed to those provided for the operation of the station. Tackley is the only location identified by the RAIB where an unprotected level crossing combines station access with a public bridleway.
- 51 A local access road runs adjacent to the railway from the south-west corner of the crossing. The crossing's vehicular and wicket gates are positioned approximately 2.3 metres from the nearest track, and in line with the railway boundary fence to the south. Crossing signage and a telephone are positioned on this fence line (Figure 2). As the crossing is defined as a road to which the public have access, all signs are required to comply with the traffic signs regulations.

- 52 The Office of Rail Regulation (ORR) is the safety authority for the national rail network. ORR's Her Majesty's Railway Inspectorate (HMRI), formerly part of the Health and Safety Executive, provide guidance for use by railway infrastructure owners. The document 'Railway Safety Principles and Guidance' Section 2E 'Guidance on Level Crossings' (RSPG Section 2E) relates to level crossings, and was published by the Health and Safety Executive in 1996.
- 53 RSPG Section 2E establishes the principle of a 'decision point' as being a point where guidance on crossing safely is visible and at which a decision to cross or wait can be made in safety. In addition, RSPG Section 2E stipulates that 'a sign explaining to the user how to proceed safely over the crossing eg 'Stop, Look, Listen' or 'Cross only if green light shows' or 'Stop, always telephone before crossing' should be provided facing the user at the decision point.'
- 54 In paragraph 138, the guidance states '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.'
- 55 In paragraphs 147 and 148, the guidance recommends that 'in assessing the speed at which users will traverse the crossing, allowance should be made for the mobility of the likely users and the type of crossing surface'. For the purpose of calculating crossing times, 'a speed of 1.2 metres per second (m/s) should be used where the surface is at or near to rail level' and that 'the calculated time in traversing the crossing should be increased to take account of foreseeable circumstances such as impaired mobility of users, numbers of prams and bicycles or where there is a slope or step up from the decision point'. Network Rail standard RT/LS/S/012 'Specification for assessment of user worked and bridleway level crossings' (now superseded) recommended that the crossing time be increased by 50 % in urban areas.
- 56 The guidance also stipulates in paragraph 213, that at a user-worked crossing, gates should not to be closer to the track than the decision point.
- 57 RSPG Section 2E further stipulates additional protective equipment that may be provided at user worked crossings. These include audible warnings from trains where speeds are low and the service infrequent, with whistle boards positioned not more than 400 m from the crossing; and telephones where the minimum *warning time* cannot be obtained (ie where the crossing time exceeds the sighting time of approaching trains). For footpath and bridleway crossings, the same mitigation measures apply with the proviso that telephones are only applicable at bridleway crossings.
- 58 Tackley crossing is 9.5 metres long between wicket gates. The decision points are at the same level as the crossing, but the road slopes downwards towards the village once outside of the railway boundary fence.
- 59 There have been no accidents or significant incidents recorded at this location on the Rail Safety and Standards Board's safety management information system (SMIS) database, which includes information dating back to 1990.

Whistle boards

- 60 At Tackley, whistle boards are positioned on both the up and down lines to increase the warning time available for crossing users. The position of the whistle board on the up line, 365 metres from the crossing, gives a crossing user approximately 7.9 seconds warning of an approaching train.

Crossing telephones

- 61 Signs adjacent to the telephones instruct users with vehicles or animals to contact the signaller before crossing to check whether there is sufficient time to cross. The telephones are not intended for use by pedestrians in normal circumstances as this would place an excessive demand on the signaller. Pedestrians are expected to rely on the visual sighting and audible warning of approaching trains.

Crossing assessment

- 62 Tackley crossing is located within Network Rail's Thames Valley area. The area's Level Crossing Risk Control Co-ordinator is responsible for overseeing and reviewing risk assessments for the 228 level crossings in this area.

The All Level Crossing Risk Model

- 63 In January 2007, Network Rail launched an 'all level crossing risk model' (ALCRM), a computer modelling tool. This tool was designed to standardise the assessment of risks for all types of crossings across the network and its purpose is to support and inform decision making on level crossings in accordance with standard NR/SP/OPS/100 'Provision, Risk Assessment and Review of Level Crossings'.
- 64 The relevant section of the Network Rail operations manual, procedure 5-24 'Use of the all level crossings risk model', requires that each level crossing shall be subject to a risk assessment at not more than three-yearly intervals. Additional assessments are required following changes in traffic patterns or after an accident or serious incident. The assessment regime is supplemented by six-monthly inspections by Network Rail maintenance staff (paragraph 83).
- 65 The ALCRM requires the type of crossing to be identified and data from a site survey to be input. This includes sighting distances, line speeds and a census of crossing users. Procedure 5-23 lists three types of census: a 'full census' covering a 24 hour period, for which special arrangements need to be made; a 'quick' census covering a 30 minute period between 09:30 hrs and 16:30 hrs on a weekday, for which the results are multiplied by 27 to give a total estimated usage per day; and an estimate. Procedure 5-23 states that a quick census is the standard requirement for public vehicular crossings and the first preference for other crossings unless use is very light.
- 66 The risks associated with a particular crossing are divided into collective and *individual risk* categories. A *collective risk* is defined as the risk posed to groups, such as on-board staff, train passengers, tractor or vehicle occupants, whereas an individual risk is that posed to a regular crossing user.
- 67 The model gives the crossing a risk score for each risk category, and identifies the factors contributing to this. It is intended to support and inform an assessor, but the output does not highlight unacceptably short sighting times or take account of the provision of whistle boards. The user is required to exercise judgement in assessing the output.

- 68 The Level Crossing Risk Control Co-ordinator is required to visit the site and consider risk mitigation if a crossing is assessed as having a collective risk score of 1 to 3 on a range of 1 to 13, where 13 represents the lowest risk, at sites where the contribution of the train accident risk comprises more than 50 % of the total risk at the level crossing. A site visit has to be considered for those crossings with a collective risk score of A to C on a range of A to M, where M represents the lowest risk.
- 69 The model calculates an *equivalent fatalities* value, which is a statistical measure, before and after any mitigation is applied. The result is a numeric value which can be used for the purposes of cost-benefit analysis. Network Rail have developed a risk mitigation 'toolkit' to assist Level Crossing Risk Control Co-ordinators in identifying appropriate risk mitigation measures.
- 70 The initial programme of ALCRM assessments was required to include public vehicular crossings and *station foot crossings* within the first 12-month cycle commencing in January 2007, with all crossings being incorporated into a 3-year rolling programme. Assessments are normally undertaken by the Level Crossing Risk Control Co-ordinator or by a local mobile operations manager on his behalf.

ALCRM survey and assessment for Tackley crossing

- 71 Tackley crossing was assessed in April 2007 as a 'user worked crossing with telephone' rather than as a footpath crossing despite the majority of users being pedestrians. This was because the risk to a train was considered greater if it encountered a horse or vehicle on the crossing (ie collective risk) rather than a pedestrian (ie individual risk). The assessment was undertaken by the Level Crossing Risk Control Co-ordinator, who had been trained to use the tool and was an experienced level crossing assessor. The assessment policy was subsequently modified to require separate assessments for each element of a multiple-use crossing such as Tackley.
- 72 A 30 minute census was undertaken at the same time, and this was timed to include the departure of an up train. The census recorded five crossing users during this period and was not required to distinguish between station users and walkers heading for the nearby river and canal. Vehicular use of the crossing is rare.
- 73 Sighting distances from the crossing were measured by the Level Crossing Risk Control Co-ordinator using optical distance measurement (range-finder) equipment. Procedure 5-23 states 'measure the distance at which the train comes into sight'. He recorded sighting distances from the down side of the crossing as:
- a. for trains approaching from the down direction: 420 metres with the file note 'sighted to trees'; and
 - b. for trains approaching from the up direction: 624 metres, sighted to a signal post.
- 74 Sighting distances from the up side of the crossing are greater due to the curvature of the track.

- 75 He assessed the crossing length as being 9.0 metres between decision points. As this was an early application of the ALCRM, he calculated the sighting requirements independently based on train speed and the required crossing time, using a crossing speed of 1.189 m/sec in accordance with procedure 5-23. This was slightly more conservative than the 1.2 m/sec recommended by RSPG Section 2E, giving a crossing time of 7.6 seconds. His assessment indicated that a minimum sighting distance of 324 metres was required, or 486 metres if an allowance, in this case 50 %, were made for users with impaired mobility (paragraph 55). He concluded that sighting was acceptable for normal users but deficient if the longer crossing time was considered.
- 76 The Level Crossing Risk Control Co-ordinator did not consider that a 1.8 metre high palisade fence, located on the down side at the north-west corner of the crossing, affected sighting. This was on the basis that the decision point was on the track side of the wicket gate where the sighting was not obscured (Figures 3 and 4).
- 77 The assessment record included the note: 'vegetation must be under control to maximise sighting, particularly down side approach to the south'. He did not consider that immediate action was necessary, which would have required him to log it as a defect with Network Rail control, or inform the local maintenance organisation who had responsibility for vegetation control (paragraph 84).
- 78 The ALCRM model was run using information obtained during the site survey and census, with 50 % additional time allowance for impaired mobility users.
- 79 The model gave the crossing a 'C2' risk score which indicates that both the collective and individual risks were relatively high, and this required Network Rail to consider mitigation measures. The model identified the following factors as contributing to this risk:
- a. crossing is near a station;
 - b. train frequency; and
 - c. low sighting time.
- 80 The associated cost-benefit analysis suggested a figure of £600,000 to mitigate this risk. This value was derived by multiplying the annual *fatalities and weighted injuries* (FWI) value by the lifecycle of the proposed mitigation with relevant discount factors applied.
- 81 The Level Crossing Risk Control Co-ordinator judged this to be insufficient for a subway or footbridge suitable for use by horses, and he was aware of various schemes which had been proposed and not gained planning approval at this site. A *miniature stop light* scheme, displaying red or green lights to indicate the approach or absence of a train, was also considered, but the ALCRM did not indicate that this would be cost-effective due to the limited safety benefits associated with this type of crossing when located close to a station, due to the risk of misuse when passengers are rushing to catch a train.
- 82 At the time of the accident, the Level Crossing Risk Control Co-ordinator was waiting for further advice on footbridge costs for various sites including Tackley. However, the lack of any acceptable alternative to the crossing meant that the issue was otherwise in abeyance.

Crossing maintenance

- 83 Network Rail carried out crossing inspections at six month intervals in accordance with standard NR/SP/SIG/19608 Issue 2, 'Level Crossing Infrastructure (Inspection and Maintenance) Handbook'. The purpose of these inspections is to ensure that 'level crossing systems are safe, reliable and legally compliant'.
- 84 Network Rail's local maintenance organisation, led by the Area Services Manager, provided crossing inspectors for this purpose. The inspectors worked in pairs to allow minor maintenance tasks to be completed during the inspection visit, and were able to generate work orders if the need for more significant work was identified. NR/SP/SIG/19608 states 'the inspector must have access to relevant information to assess the level crossing, including as appropriate layout of signs and sighting distances. The Level Crossing Risk Control Co-ordinators shall maintain the sighting distance requirement for each crossing where this applicable, [sic] and shall make this information available to the Area Services Manager'.
- 85 Tackley crossing was visited by crossing inspectors in July 2007, and the same team revisited in December 2007. The inspectors identified minor defects on both occasions. The report form required the inspectors to compare the *required sighting distance* from each side of the crossing and compare this with the actual sighting distances, recommending that vegetation clearance be considered if the outcome was borderline. Specifically:
- a. The July 2007 report identified a required sighting distance of 878 metres, but noted that this was not achieved on either side of the crossing. The whistle boards and crossing telephones were cited as mitigation; and
 - b. The December 2007 report identified a required sighting distance of 800 metres, noting that this could not be achieved from the down side of the crossing. However, on the up side the report stated that sighting exceeded 800 metres. On this occasion, the crossing telephones were cited as mitigation.
- 86 No action was taken to improve sighting as the provision of whistle boards meant that the crossing was compliant.

RAIB assessment of sighting distances

- 87 The RAIB assessed sighting distances and timings at the crossing using range-finder equipment and, where possible, a stop-watch on the day following the accident, with corroboration provided by a member of Network Rail's operations staff. For consistency, a train was deemed to be visible when its headlight could be seen although in the case of trains approaching on the down line (ie from the south), the roof was visible earlier.
- 88 From the down side of the crossing, observing trains travelling on the up line (ie approaching from the north):
- a. Just outside of the railway boundary (ie wicket gate): 120 metres, equivalent to 3 seconds at 90 mph (145 km/h). The palisade fence at the north-west corner of the crossing obstructed visibility from this position (Figure 3).
 - b. Inside of wicket gate and approximately 2.2 metres from the running rail: 600 metres, equivalent to 15 seconds at 90 mph (145 km/h). This is the maximum possible distance due to curvature of the track and applies to sighting from both sides of the crossing (Figure 4).



Figure 3: Visibility from the down side of the crossing to the north, photographed from outside of the railway boundary



Figure 4: Visibility from the down side of the crossing to the north from within the wicket gate

- 89 From the down side of the crossing observing trains approaching on the down line:
- Just outside of wicket gate: 925 metres, equivalent to 23 seconds at 90 mph (145 km/h). Approaching trains were visible across a field due to the curvature of the track.
 - Inside of wicket gate: 300 metres, equivalent to 7.6 seconds at 90 mph (145 km/h). Visibility from this position was restricted by vegetation on the inside of the curve growing on raised ballast, and by signs at the crossing. The roof of an approaching train was just visible above the vegetation as it passed the whistle board, 350 metres from the crossing (Figure 5) but this may not be apparent to all crossing users.



Figures 5 & 6: Train approaching on the down line, viewed from the down side of crossing outside of the wicket gate. The train is visible in the distance (Figure 5), but becomes hidden by vegetation as it approaches the crossing (Figure 6)

- 90 During the RAIB's daylight visit, several trains failed to sound their horns as they approached the crossing. This issue was reported at the time, and the RAIB raised an urgent safety advice notice which it issued to Network Rail and all train operating companies using this route. A copy is included as Appendix D.

The Cross Country Route Modernisation project

- 91 In 1999, Railtrack plc, as the then infrastructure owner, commenced a project to upgrade the line through Tackley as part of the Reading-Birmingham Cross Country Route Modernisation project. The project was designed to achieve line speed improvements in preparation for a new timetable to be introduced in September 2002 to complement the introduction of high speed class 220 and class 221 trains.

- 92 In order to achieve an increase in the line speed through Tackley from 90 mph (145 km/h) to 110 mph (177 km/h), it was considered necessary to close the crossing and provide alternative means for crossing the line. A higher approach speed means that crossing users need to be able to see an approaching train at a greater distance in order to use the crossing safely. The speed of trains is therefore directly related to the sighting distance required, assuming that the time to use the crossing remains constant.

Proposed footbridge

- 93 On 19 December 2000, Railtrack made a planning application for a footbridge to the local planning authority, West Oxfordshire District Council. The footbridge was to be sited immediately north of the existing level crossing, and was intended for pedestrians only, supplementing rather than replacing the crossing (Figure 7).



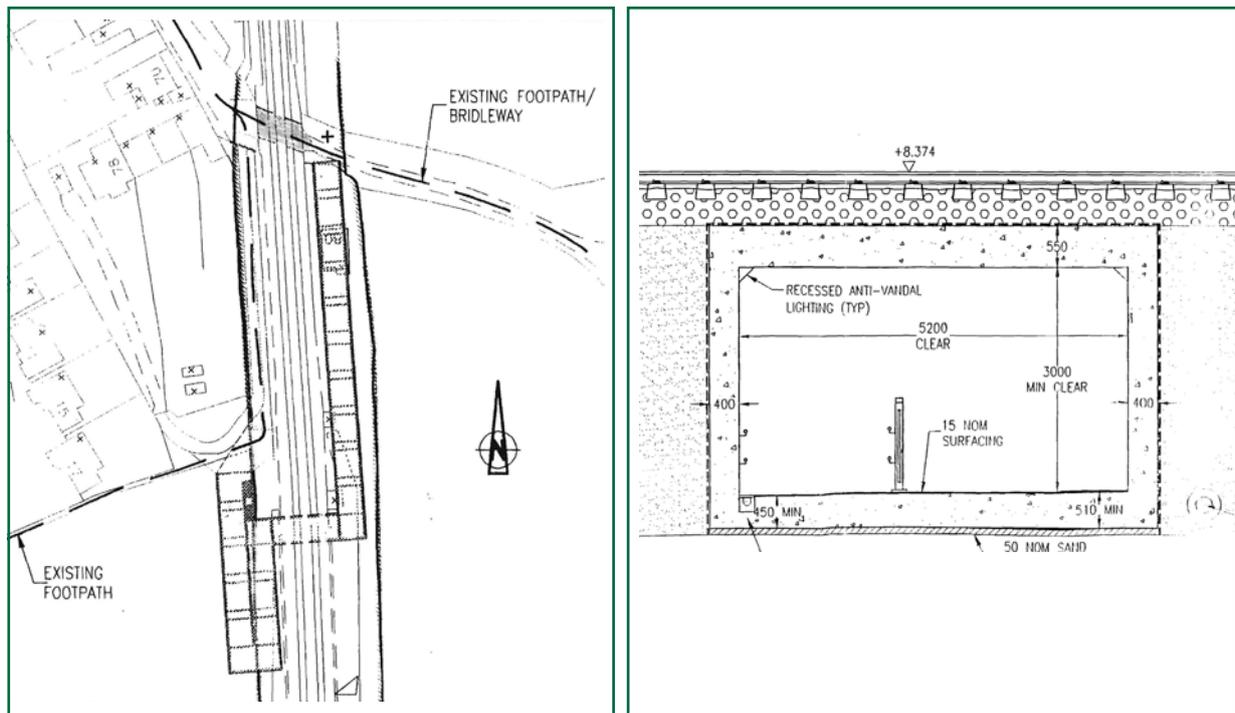
Figure 7: Artist's impression of proposed footbridge (Network Rail)

- 94 On 6 March 2001, this planning application was refused by the local planning authority, citing 'that the proposed footbridge will, by reason of its size, design and use of materials represent an alien, incongruous and overtly urban feature in this rural location'.

Proposed subway

- 95 On 15 July 2002, Railtrack submitted an alternative planning application, this time for a subway located south of the crossing. This scheme was intended to accommodate the bridleway and footpath, and together with a permanent diversion of vehicular traffic via a different route by agreement with Tackley Estate, would allow the complete closure of Tackley crossing.

- 96 Due to the existing access road at the south-west corner of the crossing, the subway was to be sited approximately 90 metres to the south on agricultural land. Drainage concerns dictated that the structure be kept as shallow as possible; the design drawings showing a structure passing beneath the railway at the minimum depth, and with insufficient headroom for horse riders to remain mounted. To minimise the amount of land required, the approach ramps were to be situated close to the railway fence, with steps and a ramp provided on the west approach and a shared ramp on the east side. A dividing barrier was proposed between bridleway and pedestrian sections (Figures 8 and 9).



Figures 8 & 9: Proposed subway showing location and cross-section (Network Rail)

- 97 On 10 October 2002, the planning application was refused by West Oxfordshire District Council, on the basis of “the design’s failure to make safe and convenient provision for horses, their riders, pedestrians, cyclists, the elderly and disabled people; and that the subway would appear as an unduly prominent and intrusive feature in the rural scene”. This decision was supported by Oxfordshire County Council.
- 98 Network Rail, which replaced Railtrack in October 2002, responded by lodging an appeal with the Planning Inspectorate on 24 October 2002 and made minor amendments to the scheme including proposing an alternative bridleway diversion via the bridge to the south and moving the subway ramps further from the railway.
- 99 A planning inspector appointed by the Secretary of State visited the crossing on 21 March 2003. The inspector was not qualified to assess the level crossing risk, but stated “I saw that trains run fairly frequently along this line, and that sight lines are not particularly good. It is my view that using the existing crossing would be a very hazardous event for anyone with any significant visual impairment or mobility difficulties”. The inspector also noted that “whilst negotiating the subway would mean a longer route, some of it at the maximum recommended gradient, it would in my view be likely to make the station more accessible for some disabled users than the present situation”.

- 100 On 8 July 2003, the Planning Inspectorate allowed the appeal, noting the inspector's comments on safety and convenience, and concluding that the proposed subway "would not cause unacceptable harm to the character and appearance of the landscape". Network Rail were granted planning permission and given five years in which to construct the works.
- 101 By mid-2003, Network Rail had substantially completed the Cross Country Route Modernisation project and project resources were being wound down. The company determined that the line speed increase proposed through Tackley was no longer cost effective and a decision was made not to progress the scheme. The planning approval finally lapsed in July 2008.

Miniature stop lights

- 102 The use of miniature stop lights was considered by the project, but was not pursued due to the belief that the HMRI would object to such a proposal. The project's view was that there were factors at the crossing which made it extremely unlikely that the HMRI would not object to proposals to install miniature stop lights here. This was due to the risk:
- that late passengers could rush across for their train, such users being easily confused or tempted into taking risks and disobeying any coloured light warning system;
 - that passengers would be looking out for their Oxford bound train approaching on the far tracks, and that this could distract them from looking in the opposite direction towards trains approaching from Oxford on the near track with a sighting time of approximately six seconds at the new line speed; and
 - that late commuters face a lengthy wait for the next train, providing a strong incentive to run in front of approaching trains.
- 103 Railtrack did not pursue the miniature stop light option on this basis, citing another station with much lower line speeds where similar arrangements were prone to abuse, and the intended replacement of a similar crossing at Kings Sutton station with a footbridge.
- 104 HMRI have confirmed that miniature stop light installations at other stations are routinely disregarded if a crossing user is unable to see an approaching train. At Tackley, the bridleway would require a user to be given 40 seconds warning of an approaching train, as opposed to 20 seconds warning for a footpath crossing further increasing the risk of misuse. Level crossings in close proximity to stations pose a much higher level of risk, due to both the higher usage, and passenger violation to catch trains.

Analysis

Identification of the immediate cause¹

105 The accident was caused by a person stepping onto the crossing and into the path of an approaching train.

Identification of causal² and contributory³ factors

Train 9O18

- 106 Train 9O18 had been delayed, and approached Tackley station at about the time that a passenger intending to catch the 15:20 hrs stopping service might expect to first see their train approaching.
- 107 Both fast and stopping trains are required to sound their horns on the approach to Tackley crossing, so this would not allow a crossing user to distinguish between them. A person crossing in front of a train travelling at 90 mph (145 km/h) would be unable to cross safely if the train was closer than 305 metres when they stepped out from the decision point, based on a 7.6 second crossing time (paragraph 75). For a train approaching on the up line, this is beyond the north end of the station platforms, and after it has passed the whistle board and sounded its horn.
- 108 The driver of train 9O18 sounded the horn nine seconds before he applied the emergency brake. The horn was witnessed by passengers on the station platform, and the train would therefore have been audible to a crossing user, and clearly visible from within the wicket gate. The deceased had either committed herself to crossing the track before she became aware of the train, or was aware of it and mistook it for the stopping service, assuming that she would have time to reach the up platform before it arrived. A passenger missing this train would have to wait over two hours for the next service giving a strong incentive to try and catch the train.
- 109 The mistaking of a late-running through train for the stopping train, or a lack of awareness of the approaching train, which might be exacerbated by loss of hearing, are both possible causal factors in this accident.

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

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

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

Actions by the driver

- 110 As train 9018 approached Tackley station, the driver observed members of the public on the up platform and was satisfied that a young child was under adult supervision. He also checked his speedometer having had to reduce speed to pass through Tackley. These actions, which are part of the normal activities of a driver, meant that he could not continuously observe the approaching level crossing at the far end of the station and it was not an absolute requirement for him to do so. When he looked up, he observed a person already on the crossing and was unable to take any avoiding action other than to immediately apply the emergency brake.
- 111 The driver brought his train to a halt and instigated the emergency procedure which included informing Network Rail and requesting the attendance of the emergency services.
- 112 The driver acted appropriately and his actions did not contribute to the accident.

Public use of pedestrian level crossings

- 113 Level crossings which provide public access across the railway have no restrictions on the age or mobility of those who wish to use them. RSPG Section 2E requires crossing assessments to consider and make allowance for the mobility of likely users. Tackley crossing is adjacent to the village and persons of reduced mobility are potential users of the crossing.

Tackley crossing

- 114 Tackley crossing has a good safety record (paragraph 59). The crossing deck is level and was in good condition, with gates arranged to give a near-minimum crossing distance. Once on the crossing, sighting is good in both directions. However, local residents have expressed concern about its safety and Tackley Parish Council made a representation to Network Rail on this issue in 2003.
- 115 This accident involved a pedestrian crossing from the down side (ie west to east), and a train approaching on the up line (ie from the north). From the down side of the crossing, the visibility of trains approaching on the up line was restricted by a palisade fence at the north-west corner of the crossing until the user had passed through the wicket gate (Figures 3 and 4). The height of the fence served no meaningful security purpose as it was not continuous and the rear of the enclosed area, adjacent to the down platform access, was protected by a lower wooden fence.
- 116 The palisade fence reduced the visibility of trains approaching on the up line to 120 metres from outside of the wicket gate. This represents three seconds travelling time for a train travelling at 90 mph (145 km/h) and was inadequate to assess whether it was safe to cross. Adequate sighting could be obtained from within the wicket gate (paragraph 88b).
- 117 The palisade fence at the north-west corner of the crossing created an unnecessary obstruction and its effect on sighting of the train by the deceased, and of a pedestrian beside the crossing by the train driver, until she was inside the wicket gate was a causal factor in the accident.

Decision point

- 118 The ALCRM assessment, and subsequent crossing inspections, were based on the assumption that the decision point for pedestrian users on the down side was at a location inside the wicket gate (ie approximately 2 metres from the closest track). The decision point is not marked, or required to be, but while this arrangement gave an acceptable view of trains approaching on the up line (Figure 4), it necessitated a crossing user looking round the 'Stop, Look, Listen' warning signs to sight trains approaching on the down line (Figures 5 and 6).
- 119 This dimension was compliant with the minimum given RSPG Section 2E (paragraph 53), although the crossing user was required to look round the warning signs, but the resultant arrangement did not accurately reflect the behaviour of crossing users, as the various sighting obstructions present on 31 March meant that there was no single clear point for pedestrians to decide whether it was safe to cross the line or not. In theory, the decision point for trains approaching on the down line was outside the railway boundary, but inside it for trains approaching on the up line. Standing inside the gate before making a decision on whether to cross the railway may have been counter-intuitive for crossing users, and there was no signage to suggest this might be required.
- 120 The use of a decision point, which allowed the crossing to pass its inspections, but did not accurately reflect the behaviour of crossing users, meant that the need to improve sighting was not recognised, and was a contributory factor.

Identification of underlying⁴ factors

Crossing replacement proposals

- 121 The Cross Country Route Modernisation project made various attempts to modernise or replace Tackley crossing to allow the line speed to be increased to 110 mph (177 km/h).
- 122 Mixed-use crossings of this type are rare on the national rail network, and the conflicting needs of the various user types made an acceptable solution difficult to find. Tackley crossing has three modes of use (paragraph 26), and alternative facilities for each type of user needed to be provided to allow the crossing to be closed.
- 123 The project was unable to find a scheme which satisfied the requirements of all users and the local planning authority. The local authorities' rejection of alternative proposals at a time when it was cost effective to take action meant that this opportunity was lost.
- 124 Network Rail ultimately obtained planning consent for a subway following an appeal to the Planning Inspectorate. The closure of the crossing had been sought to allow an increase in line speeds, but with the new timetable already in operation by this time, the reason for replacing the crossing had gone. The closure of the crossing was never intended as a safety improvement in its own right, and despite the later ALCRM assessment requiring action to be taken, no suitable solution could be found in light of the earlier planning decisions. The crossing, although assessed as being a higher risk than others on the network, was compliant at the time of the accident.

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

125 As a consequence of delays caused by the planning process, no reasonably practicable measures to replace the crossing could be taken, and this was an underlying factor in it remaining in use.

Other factors for consideration

Network Rail's local organisation

126 A lack of regular communication between the operations and maintenance departments prevented Network Rail from forming a coordinated view of the condition and maintenance requirements of the crossing. Information contained on the ALCRM assessment record, for example 'vegetation must be controlled to maximise sighting, particularly from the south' was not communicated to the maintenance organisation, and the Level Crossing Risk Control Co-ordinator was not aware that the crossing inspectors were incorrectly relying on crossing telephones as mitigation for reduced sighting (paragraph 85).

Assessment and measurement of sighting distances

127 The level crossing inspectors did not have access to information on the required sighting distance (paragraph 85) and there is no evidence that they requested it. This may explain why the required sighting values differed between the July and December inspections of the crossing, but there was no reason why the value should change and this inconsistency was not identified by the inspectors themselves, or those responsible for reviewing their reports.

128 Network Rail provides training for staff responsible for inspecting level crossings and collecting data for ALCRM assessments. The training material identifies that both track curvature and vegetation can affect the sighting distance, but does not highlight the risk of error occurring if measuring to a non-specific point, or the effect of measuring to the outside of a curve (Figure 10). Range-finder equipment works by reflecting an infra-red beam off an object in its sightline. If there is no feature to reflect the beam at the required distance, the measurement will be incorrect.

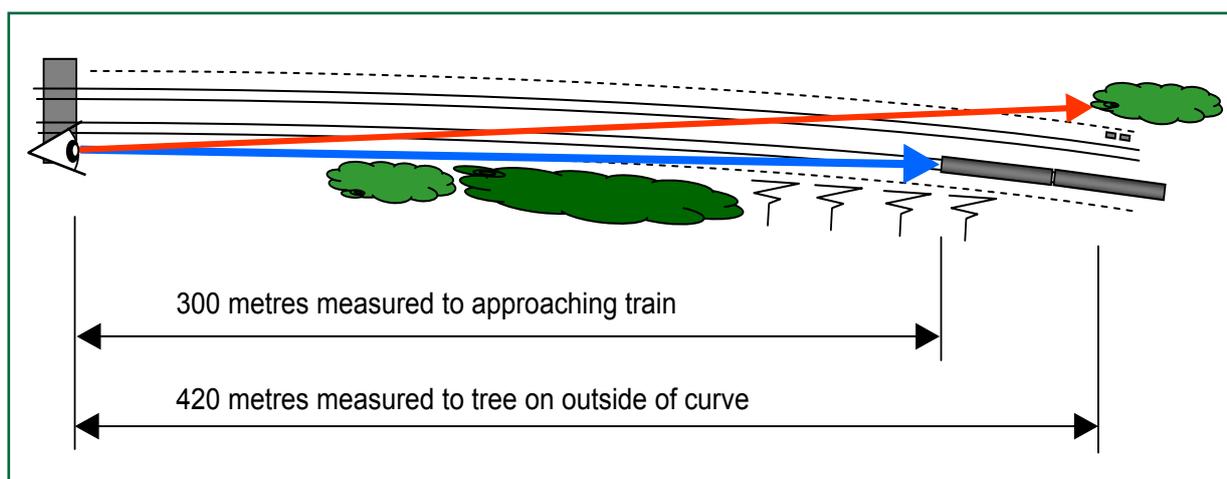


Figure 10: Schematic diagram showing over-measurement of sighting distance on a curve

129 The difficulty in accurately assessing distances using range-finder equipment is evidenced by the April 2007 ALCRM assessment and December 2007 crossing inspection reports. Specifically, the ALCRM assessment used the distance to the outside of the curve, giving a sighting distance of 420 metres, 40 % greater than that calculated by the RAIB by observing approaching trains and using a stop-watch (paragraph 89b). The December 2007 level crossing inspection report gave a sighting distance from the up side of the crossing of over 800 metres, which is 30 % greater than that which is possible for trains approaching on the up line due to a curve in the track. The methods currently in use result in unacceptable variations in the measurement of sighting distances which could compromise the safety of crossing users.

Whistle boards

130 The restricted sighting for crossing users was mitigated by whistle boards positioned at each approach, and these were within the 400 metre maximum distance permitted by RSPG Section 2E. A train approaching on the up line sounding its horn as it passed the whistle board would provide a crossing user with a minimum 7.9 seconds warning of its approach, which exceeds the calculated safe crossing time of 7.6 seconds (paragraph 75). If these boards were positioned at the maximum 400 metres from the crossing, the warning time would increase to 8.7 seconds.

Observations

Night time quiet period

131 Since June 2007, trains have no longer been required to sound their horns at whistle boards following an amendment to the section of the railway rule book relating to train working (GE/RT8000/TW1) unless in emergency or if a person is seen on the track. This rule change established the principle of the night-time quiet period (NTQP), and resulted from research by the Rail Safety and Standards Board (RSSB) into the safety benefits provided by train horns at level crossings (Report T668). The report found that, while the risks to users were higher at night, the level of night time use by trains and users was relatively low at most locations. This was off-set by the societal benefits of reducing noise at night.

132 The introduction of the NTQP removes the protection provided by whistle boards at Tackley crossing during the night. Three of the twelve daily services in the up direction call at Tackley during this period, including the only two morning commuter trains timed to arrive in London before 09:00 hrs. Although this matter is not of direct relevance to this accident, a significant proportion of the regular crossing users have to rely solely on the visual sighting of approaching trains at a time of day when reduced sighting due to poor visibility is more likely.

Effect of a stationary train in the down platform

133 The visibility and audibility of trains approaching on the up line from the down side of the crossing is reduced when a train is stationary at the down platform. The respective layout of the station platforms and crossing means that a train travelling at 90 mph (145 km/h) becomes fully visible less than three seconds before it reaches the crossing. Network Rail refers to this phenomenon as a 'hidden train factor' (Figure 11).



Figure 11: Photograph of train in down platform, in August 2008, illustrating the 'hidden train factor'. Note that the green palisade fence has now been removed, but that sighting is still affected by fencing on the platform

134 This risk to crossing users is not identified by warning signs as the crossing is defined as a road to which the public have access, and all signs are required to comply with the traffic signs regulations. In these circumstances, the whistle board performs a vital function.

Conclusions

Immediate cause

135 The immediate cause of the accident was the deceased stepping onto the crossing and into the path of an oncoming train.

Causal factors

136 Causal factors were:

- a. Either the deceased mistaking a late-running through train for the stopping service, which was due at about the same time, and which she had intended to catch (incorrect use) (paragraph 109); or
the deceased being unaware of the approaching train until after she had committed herself to using the crossing, possibly by being unable to hear its approach (paragraph 109, **Recommendation 1**); and
- b. The restricted sighting of trains from outside the railway boundary at the down side of the crossing, due to a poorly sited palisade fence (paragraph 117, **Recommendation 2**)

Contributory factor

137 The following factor was considered to be possibly contributory:

- The use of a decision point, which was not required to be marked, within the wicket gate for assessment and inspection purposes. This did not accurately reflect the behaviour of crossing users, but allowed the crossing to pass its assessment and inspections and meant that the need to improve sighting was not recognised (paragraph 120, **Recommendation 3**).

Underlying factors

138 An underlying factor was:

- The local authorities' rejection of proposals to replace the crossing at a time when it was cost effective to take action, which meant that this opportunity was lost. As a consequence, no reasonably practicable measures could be taken (paragraph 125).

Additional observations⁵

- 139 A lack of communication between operations and maintenance departments led to a lack of shared knowledge concerning the condition of the crossing, and an incorrect assumption about the purpose of the crossing telephones going unchallenged (paragraph 126, **Recommendation 4**).
- 140 Assessment of the required sighting distances was inconsistent and, although conservative, inaccurate. There was no reason why this figure should have varied between inspections or could not have been established in advance as required by standard 19608 (paragraph 84). The anomalies were not identified by those responsible for reviewing the completed reports (paragraph 127, **Recommendations 4b and 5**).
- 141 Assessments of the actual sighting distances available were of variable accuracy and in some cases misleading (paragraph 129, **Recommendation 5**).
- 142 Sighting of trains approaching on the down line from the down side of the crossing was restricted by vegetation, some of which was growing on mounds of ballast deposited beside the track (paragraph 89, **Recommendation 6**).
- 143 The whistle boards are compliant, but closer than the 400 metres maximum allowed by RSPG Section 2E. This reduces the maximum warning time available to crossing users (paragraph 130).
- 144 Fast trains approaching on the up line are visible for less than three seconds before they reach the crossing when a second train is stationary in the down platform. This risk is not identified to crossing users (paragraph 134, **Recommendation 1**).
- 145 The driver of 9O18 was unable to use his NRN radio to report the accident to the Oxford signaller as this stopped working after the initial emergency call.
- 146 On 16 February 2009, the driver of train 1M54, the 13:45 hrs Bournemouth to Manchester Piccadilly CrossCountry service, reported having a near-miss at Tackley level crossing with an elderly person who did not seem to react to the noise of the train horn. The driver made an emergency brake application.
- 147 Although not the case in this accident, drivers did not always sound their horns when approaching Tackley crossing in daylight (paragraph 90).

⁵ 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.

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

- 148 The RAIB issued an urgent safety advice Network Rail and all train operators using this route on 8 April 2008 to highlight the following issues:
- Obstructions to visibility from the down side of crossing;
 - The lack of signage to advise crossing users that sighting of up through trains is impaired by any stationary train in the down platform; and
 - Inconsistent observation of the whistle board by approaching trains.
- 149 Network Rail responded to the urgent safety advice by removing part of the palisade fence.
- 150 The crossing was reassessed following the accident as both a user-worked crossing with telephone and as a bridleway crossing. Its 'C2' risk score was confirmed.
- 151 Network Rail report that they have since made further improvements to sighting at Tackley crossing by a reduction in the height of fence lines, and removal of vegetation and rubble. The signage at the crossing has been de-cluttered, and unnecessary parking notices have been removed. The crossing was assessed again following these works in November 2008, and the ALCRM risk profile has improved, giving a 'C4' risk score for the footpath and bridleway elements and a 'D4' risk score as a station foot crossing, this having not previously been assessed (paragraph 71). As a consequence, the whistle boards are no longer part of the primary means of protection at the crossing for foot users. However, the near-miss which occurred on 16 February 2009 (paragraph 146) suggests that there are still issues with sighting at the crossing.
- 152 The benefits of Network Rail's embankment clearance work were compromised by a local resident fly-tipping a substantial volume of garden waste onto Network Rail land. This matter was brought to the attention of the British Transport Police who took appropriate action.
- 153 Network Rail report that they are reviewing the station fencing with First Great Western Ltd to see if further improvements in sighting can be made although minimum standards are already met. The fencing on the platform ramp falls within the First Great Western station lease estate (Figure 11).
- 154 Network Rail report that they have recommenced reviewing possible options for a bridge at this location to accommodate all elements of the crossing, accompanied by the permanent diversion of vehicles via an alternative route. The introduction of new technology has reduced the cost of this type of structure, and has made this option potentially viable for the first time.
- 155 Network Rail has established a National Level Crossing Programme team to develop improved level crossing control systems. As part of this programme, a miniature stop light system has been fitted to a user-worked crossing with footpath at Healing station in Lincolnshire during 2008. This system is understood to be capable of predicting the speed of approaching trains and giving an 'another train coming' indication.

156 RSSB are undertaking a research project in response to a recommendation made in the RAIB's report into the fatal accident at Elsenham station in December 2005 (report 23/2006). The project, entitled 'understanding human factors and developing risk reduction solutions for pedestrian crossings at railway stations' (reference T730), is expected to be published during 2009.

Actions reported as already taken which address factors in the report so that the RAIB does not issue a recommendation

157 Network Rail have repositioned the whistle boards at 400 metres on each approach to the crossing. In the light of this action which mitigates the risk identified in paragraph 143, the RAIB has decided not to issue a recommendation covering this risk.

Recommendations

158 The following safety recommendations are made⁶:

Recommendations to address causal and contributory factors

- 1 Network Rail should investigate whether it is reasonably practicable to install a predictor miniature stop light warning system, capable of warning users of the approach of fast trains and if a second train is coming, at this location, and whether safety benefits would be gained from such an installation (paragraphs 136 and 144).
- 2 Network Rail should issue an updated policy or standard to improve the control of fencing at unprotected crossings, such that decision points are not forced to the minimum dimension or sighting distances unnecessarily compromised (paragraph 136b).
- 3 Network Rail should, at unprotected crossings where the location of the decision point is between the instruction sign and the track and therefore potentially counter-intuitive, propose measures to clearly mark the point at which the final decision to cross should be made for acceptance by the ORR. This is for the benefit of crossing users and for the guidance of persons making inspections of the crossing (paragraph 137).

Recommendations to address other matters observed during the investigation

- 4 Network Rail should incorporate in their procedures:
 - a. arrangements to routinely pass the findings of level crossing assessments and inspections between operations and maintenance departments, so that the organisation achieves a co-ordinated view of the condition of those assets (paragraph 139); and
 - b. an audit process to identify errors, inconsistencies or the application of inappropriate mitigation measures in crossing inspection reports (paragraph 140).

continued

⁶ Those identified in the recommendations, have a general and ongoing obligation to comply with health and safety legislation and need to take these recommendations into account in ensuring the safety of their employees and others.

Additionally, for the purposes of regulation 12(1) of the Railways (Accident Investigation and Reporting) Regulations 2005, these recommendations are addressed to The Office of Rail Regulation to enable it to carry out its duties under regulation 12(2) to:

- (a) ensure that recommendations are duly considered and where appropriate acted upon; and
- (b) report back to RAIB details of any implementation measures, or the reasons why no implementation measures are being taken.

Copies of both the regulations and the accompanying guidance notes (paragraphs 167 to 171) can be found on RAIB's web site at www.RAIB.gov.uk.

- 5 Network Rail should review their methods for assessing warning times, as the current arrangements which rely on calculations and the measurement of distances using optical equipment have been shown to be unreliable, particularly on curved track. This should include consideration of permanently identifying the sighting distances to be achieved, so that visibility can be positively verified from each decision point when crossings are inspected to improve the objectivity of these assessments (paragraph 141).
- 6 Network Rail should consider providing a permanent solution to the restricted visibility from the down side of Tackley crossing by profiling the embankment to the south-west of the crossing and removing surplus material (paragraph 142).

Appendices

Appendix A - Glossary of abbreviations and acronyms

ALCRM	All Level Crossing Risk Model
HMRI	Her Majesty's Railway Inspectorate
MSL	Miniature Stop Lights
NTQP	Night time quiet period
ORR	Office of Rail Regulation
RSPG	Railway Safety Principles and Guidance
RSSB	Rail Safety and Standards Board
SMIS	Safety Management Information System

Appendix B - Glossary of terms

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

Accommodation crossing	A level crossing provided for the sole use of a landowner whose property was divided when the railway was built.*
Authorised user	Denoting a person or body registered with the Infrastructure Controller as a user of an Accommodation Crossing or Occupation Crossing.
Automatic level crossing	Any level crossing where the warning to highway users is given automatically, triggered by the approach of a train.*
Collective risk	The average number of fatalities, or fatalities and weighted injuries per year that would be expected to occur from a hazardous event, or group of hazardous events.
Decision point	A point where guidance on crossing safely is visible and at which a decision to cross or wait can be made in safety. 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 160 km/h (100 mph). For bridleway crossings and user worked crossings this should not be less than 3 m from the nearest running rail.
Diesel multiple unit	A multiple unit train whose source of power is a diesel engine. The transmission of this power to the driving wheels can be achieved electrically, hydraulically or mechanically.*
Down line / down direction	A track on which the normal passage of trains is in the down direction ie away from London, the capital, or towards the highest mileage.*
Equivalent fatalities	A way of expressing injuries in terms of fatalities for the purposes of risk assessment. Ten major injuries or 200 minor injuries are equated to one fatality.*
Fatalities and weighted injuries	A way of combining fatalities and injuries into a single number, used by RSSB and Network Rail to measure risk.
Individual risk	The probability of fatality per year to which an individual is exposed from the operation of the railway.
Miniature stop lights	Miniature lights, most often red and green, used as the warning at certain types of automatic level crossing. Previously miniature warning lights (MWL).*
On-train data recorder	A data recorder fitted to traction units collecting information about the performance of the train. Including: <ul style="list-style-type: none"> ● speed; ● regulator and brake control positions; ● activations of horn, DSD and AWS cancel button, etc.*

Required sighting distance	The distance from which trains must be visible in order to provide the required warning time.*
Station foot crossing	(see ' <i>Station-related level crossing</i> ')
Station-related level crossing	The level crossing forms a means for accompanied or non-accompanied passengers (or members of public) to cross between platforms or to access the platform from the road (or car park) or vice versa. Crossing may be of any type. Staff only crossings excluded.
Track circuit	An electrical or electronic device used to detect the absence of a train on a defined section of track using the running rails in an electric circuit.*
User worked crossing	A level crossing where the barriers or gates are operated by the user. There is generally no indication of the approach of trains, but a telephone may be provided to contact the signaller.
Unprotected crossing	A crossing which is not manned or automatic. Types of unprotected crossing include: footpath and bridleway crossings; open crossings; station foot and barrow crossings; and user worked crossings.
Up line / up direction	A track on which the normal direction of trains is in the up direction, ie towards London, the capital or lowest mileage. The opposite is down line.*
Warning time	The shortest possible time for trains to travel the sighting distance or, where whistle boards are provided, the shortest time between the sound being heard at the crossing and the train arriving at the crossing. In calculations of warning time the highest attainable train speed should be used.
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 accommodation crossings, footpath crossings and occupation crossings.*

Appendix C - Key standards current at the time

GE/RT8000	Railway rule book
NR/SP/OPS/100	Provision, Risk Assessment and Review of Level Crossings
5-23	Network Rail operations manual: Level Crossing Risk Assessments – Site Visits and Census
5-24	Network Rail operations manual: Use of the All Level Crossing Risk Model
5-25	Network Rail operations manual: Determining the Reasonable Practicability of Level Crossing Risk Reduction and Mitigation measures
NR/SP/SIG/19608 Issue 2	Level Crossing Infrastructure (Inspection and Maintenance) Handbook

Appendix D - Urgent Safety Advice

1. INCIDENT DESCRIPTION	
INCIDENT REPORT NO	0277
DATE OF INCIDENT	31 March 2008
INCIDENT NAME	Pedestrian fatality at Tackley station level crossing
TYPE OF INCIDENT	Level crossing fatality
INCIDENT DESCRIPTION	At 15:16 hrs on 31 March 2008, an 82 year old female was struck by Arriva Cross-Country 9018 Dundee to Bournemouth service at Tackley station user worked crossing. The crossing forms the only access between the up and down platforms at Tackley station and the above person was using the crossing to access the up platform. Tackley village is situated on the down side of the line.
SUPPORTING REFERENCES	ELR: DCL Location: 72 miles 47 chains

2. URGENT SAFETY ADVICE	
USA DATE:	08/04/2008
TITLE:	Safety of footpath crossings
SYSTEM / EQUIPMENT:	User worked crossing (used as a footpath crossing)
SAFETY ISSUE DESCRIPTION:	<p>1. Visibility of approaching trains from the down side:</p> <p>The crossing gates are set 9.5 metres apart. Assuming a crossing speed of 1.2 metres per second^a this equates to a crossing time of 8.3 seconds between wicket gates, or 12.5 seconds if a 50% allowance is made for use by impaired users.</p> <p>A person approaching the crossing on foot from the down side does not have adequate sighting of trains approaching from the north until they have passed through the pedestrian wicket gate and are within 2.5 metres of the track. From outside the gate, visibility is restricted to 120 metres (3 seconds warning time) by a palisade fence situated on the railway boundary.</p> <p>Trains approaching from the south are visible at a distance of 925 metres (23 seconds) across a low lying field due to a right hand curve in the track from outside the wicket gate. However, an approaching train is then hidden by vegetation on the railway embankment which forms a blind spot until it is 300 metres (8 seconds) from the crossing.</p> <p>Network Rail to improve visibility of approaching trains from down side wicket gate.</p> <p>2. Crossing signage</p> <p>Sighting of up through trains is impaired by any stationary train in the down platform. Audible warnings from trains will not be given between the hours of 11pm and 7am following recent changes to rule book section TW1. Passengers using the crossing to access the up platform at night (eg for four daily timetabled services serving Tackley between these hours) will be at particular risk.</p> <p>The crossing signage does not alert users to these risks.</p> <p>Network Rail to improve crossing signage.</p> <p>3. Observance of whistle boards</p> <p>Whistle boards are provided between 350 and 365 metres from the crossing in both approach directions. Drivers do not consistently observe the requirement to sound a warning.</p> <p>Whistle board positions are not compliant with sighting distance requirements at line speed^a.</p> <p>Train operating companies to remind drivers to observe all whistle boards in accordance with section TW1 of the railway rule book.</p> <p>Network Rail to review use of whistle boards to protect crossing.</p> <p>^a Railway Safety Principles and Guidance, Part 2 Section E: Guidance on Level Crossings</p>
CIRCUMSTANCES:	Safety of public when using crossing
CONSEQUENCES	Risk of being struck by a train
REASONS FOR ISSUE:	Fatal accident to member of public

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