Rail Accident Investigation Branch

Rail Accident Report

Fatal accident at Tibberton No. 8 footpath crossing
6 February 2019

Report 13/2019
October 2019

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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Preface

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. 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.

The RAIB's findings are based on its own evaluation of the evidence that was available at the time of the investigation and are intended to explain what happened, and why, in a fair and unbiased manner.

Where the RAIB has described a factor as being linked to cause and the term is unqualified, this means that the RAIB has satisfied itself that the evidence supports both the presence of the factor and its direct relevance to the causation of the accident or incident that is being investigated. However, where the RAIB is less confident about the existence of a factor, or its role in the causation of the accident or incident, the RAIB will qualify its findings by use of words such as 'probable' or 'possible', as appropriate. Where there is more than one potential explanation the RAIB may describe one factor as being 'more' or 'less' likely than the other.

In some cases factors are described as 'underlying'. Such factors are also relevant to the causation of the accident or incident but are associated with the underlying management arrangements or organisational issues (such as working culture). Where necessary, words such as 'probable' or 'possible' can also be used to qualify 'underlying factor'.

Use of the word 'probable' means that, although it is considered highly likely that the factor applied, some small element of uncertainty remains. Use of the word 'possible' means that, although there is some evidence that supports this factor, there remains a more significant degree of uncertainty.

An 'observation' is a safety issue discovered as part of the investigation that is not considered to be causal or underlying to the accident or incident being investigated, but does deserve scrutiny because of a perceived potential for safety learning.

The above terms are intended to assist readers' interpretation of the report, and to provide suitable explanations where uncertainty remains. The report should therefore be interpreted as the view of the RAIB, expressed with the sole purpose of improving railway safety.

Any information about casualties is based on figures provided to the RAIB from various sources. Considerations of personal privacy may mean that not all of the actual effects of the event are recorded in the report. The RAIB recognises that sudden unexpected events can have both short- and long-term consequences for the physical and/or mental health of people who were involved, both directly and indirectly, in what happened.

The RAIB's investigation (including its scope, methods, conclusions and recommendations) is independent of any inquest or fatal accident inquiry, and all other investigations, including those carried out by the safety authority, police or railway industry.

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Fatal accident at Tibberton No. 8 footpath crossing, 6 February 2019

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Summary

At 09:58 hrs on 6 February 2019, a passenger train struck and fatally injured a pedestrian at a passive footpath crossing in the village of Tibberton, Worcestershire. The weather at the time was foggy.

Passive crossings rely on the user looking and listening for trains. However, the foggy weather conditions had made the crossing unsafe to use: in these conditions, the pedestrian could not see or hear the approaching train early enough to be able to decide to cross safely.

This happened because the risks associated with using the crossing in fog had not been adequately mitigated. Network Rail does not actively manage the effects of fog on the safety of its passive crossings, and had not carried out an assessment of the risks introduced by fog on the safety of its level crossings at national level.

The RAIB has made a recommendation to Network Rail aiming to ensure that it understands the risks presented by fog at passive level crossings, and implements a strategy to ensure that the risk to an individual using a passive level crossing in fog is acceptably low.

The investigation also identified three learning points, two relating to the management of crossings and one as a reminder to train drivers to bring their trains to a stand upon hearing a railway emergency call.

Introduction

Key definitions

1 Metric units are used in this report, except when it is normal railway practice to give speeds and locations in imperial units. Where appropriate the equivalent metric value is also given.

2 All mileages in the report are measured from a datum at London Road Junction, Derby.

3 The report contains abbreviations explained in appendix A. Sources of evidence used in the investigation are listed in appendix B.

The accident

Summary of the accident

4 At 09:58 hrs on 6 February 2019, passenger train 1V05[1], the 08:09 hrs service from Nottingham to Cardiff Central, struck and fatally injured a pedestrian on Tibberton No. 8 footpath crossing in the village of Tibberton, Worcestershire (figure 1). The weather at the time was foggy.

5 Another passenger train, 1M29, the 07:01 hrs service from Paignton to Manchester Piccadilly, had passed over the crossing in the opposite direction shortly before the accident.

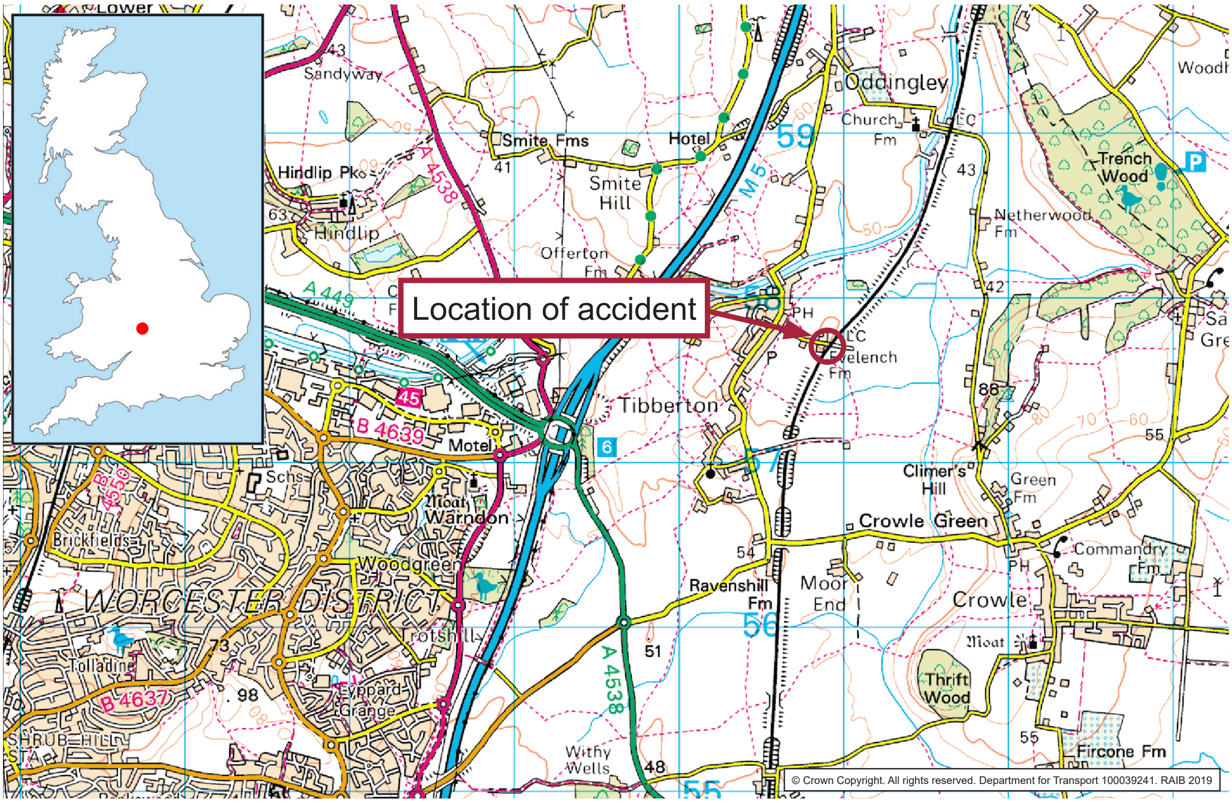

Figure 1: Extract from Ordnance Survey map showing location of accident

Context

Location

6 Tibberton No. 8 footpath crossing is located at 63 miles and 54 chains[2] on the line between Bromsgrove and Cheltenham Spa via Dunhampstead (figure 2). There are two railway tracks at the crossing and the maximum permitted speed for trains travelling in either direction is 100 mph (161 km/h). Train movements in the area are controlled from the West Midlands Signalling Centre at Duddeston (Birmingham). Trains travel in the 'up' direction towards Birmingham, and in the 'down' direction towards Cheltenham Spa and Bristol.

[1] Each train operating on Network Rail infrastructure is allocated an alphanumeric reporting code.

[2] A unit of length equal to 22 yards (20 metres). The datum point is given in paragraph 2.

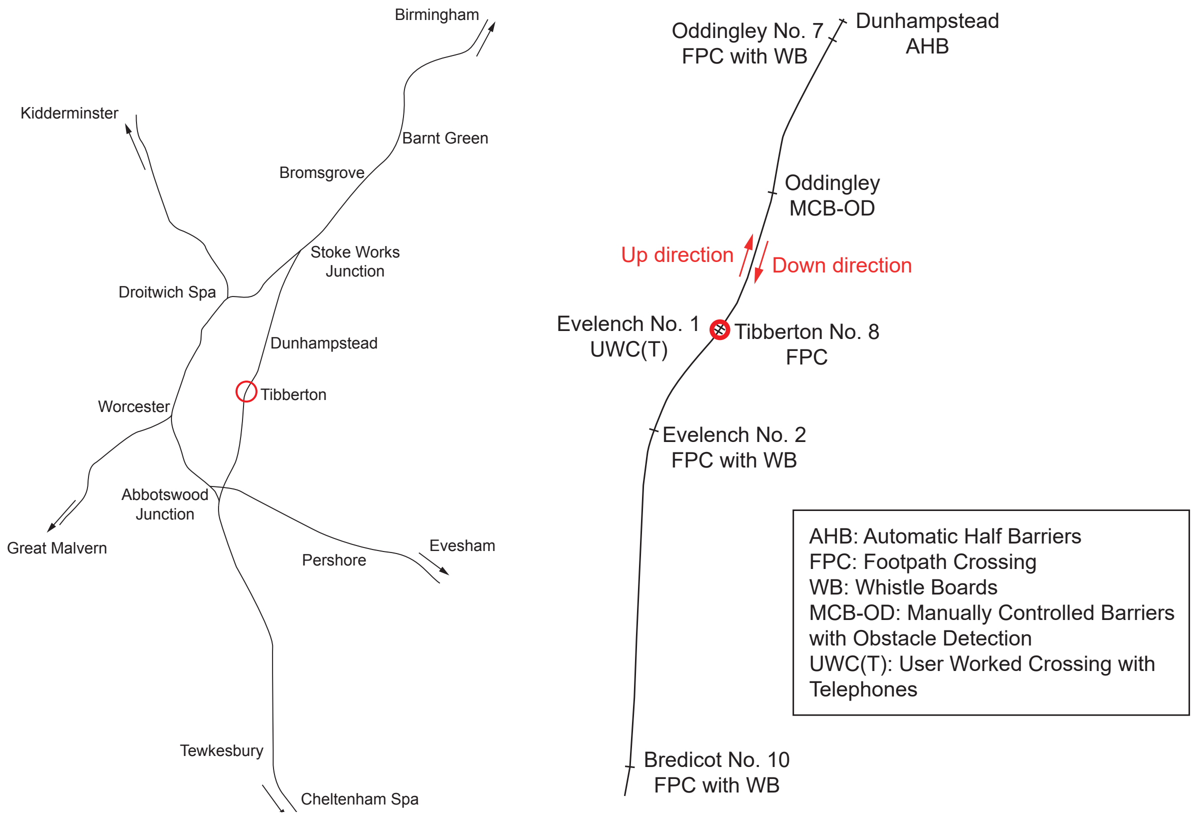

Figure 2: Overview of area

7 There are a number of other level crossings near Tibberton No. 8 footpath crossing (figure 2). In the up direction, Evelench No. 1 level crossing, a user worked crossing with telephones, is immediately adjacent to Tibberton No. 8 crossing. Oddingley level crossing, a crossing with manually-controlled barriers and obstacle detection, is 1.5 kilometres away. Oddingley No. 7 level crossing, another footpath crossing is located 2.4 kilometres away. Because of restricted sighting distances, Oddingley No. 7 footpath crossing is equipped with whistle boards (paragraph 33). These are positioned approximately 400 metres on either side of the crossing.

8 In the down direction, Evelench No. 2 level crossing, a footpath crossing with whistle boards, is 440 metres away. The whistle boards are positioned approximately 400 metres on either side of the crossing. There is therefore a whistle board for Evelench No. 2 crossing approximately 40 metres to the south of Tibberton No. 8 crossing (figure 3). Bredicot No. 10 level crossing, another footpath crossing with whistle boards, is 3.3 kilometres away.

Organisations involved

9 Network Rail owns, operates and maintains the railway infrastructure on which the accident occurred, as part of its Western Route. It also employed the staff responsible for gathering data about the crossing, and for assessing and managing its safe use.

10 CrossCountry was the operator of trains 1V05 and 1M29 and employed the drivers.

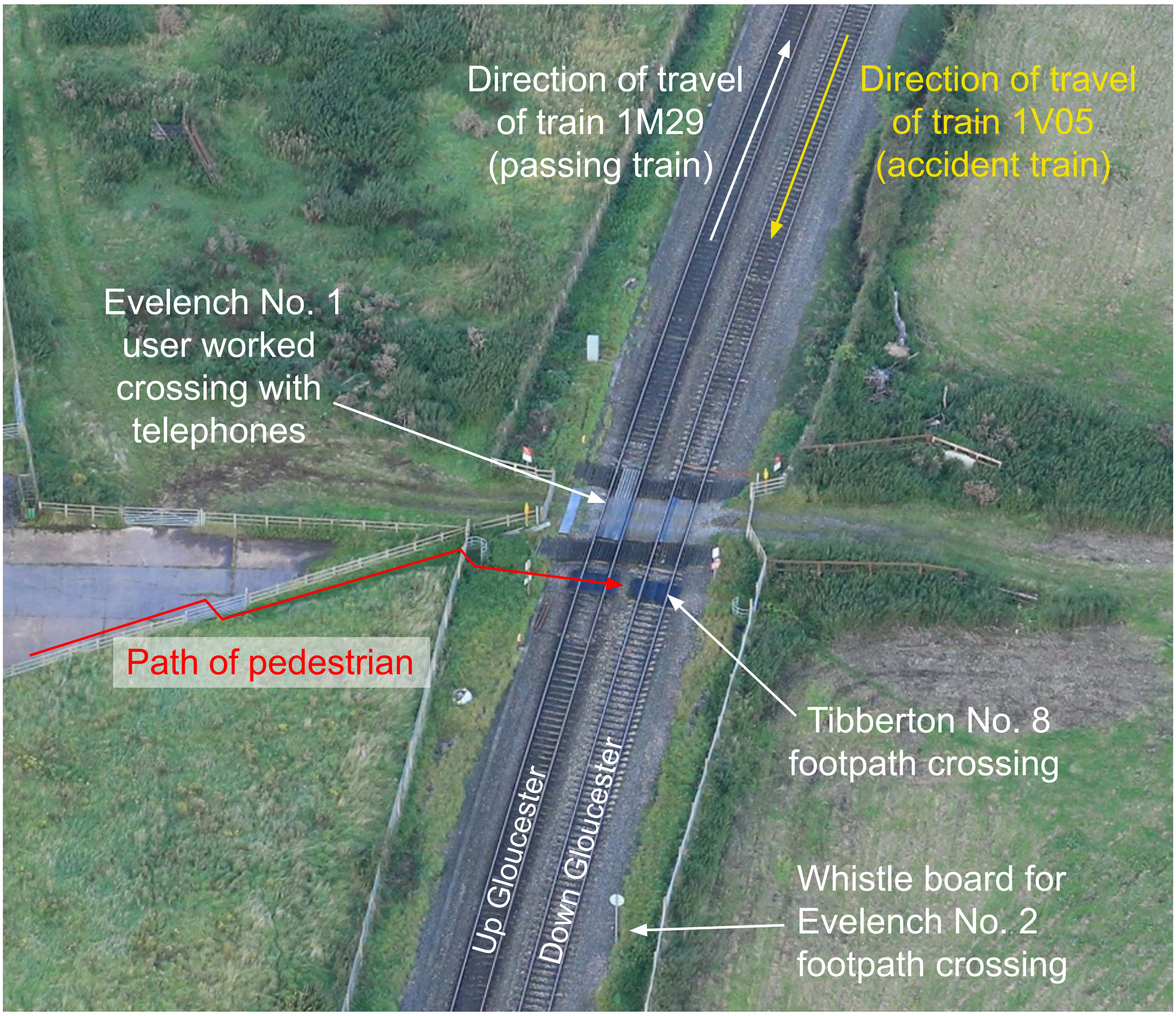

Figure 3: Overview of site showing geographical relationship of key features (image courtesy of Network Rail)

Trains involved

11 The train involved in the accident, 1V05, was formed of a three-coach class 170 diesel multiple unit, number 170102. The forward facing CCTV (FFCCTV) footage from train 1M29, which passed train 1V05 shortly before the accident, shows that the lights were working on the front of train 1V05 and there was no obvious degradation of the yellow-coloured areas provided to improve conspicuity. Post-accident inspection and testing by CrossCountry recorded nothing untoward with the headlights[3], brakes, warning horn operation, or the windscreen wiper and washer. The RAIB found no evidence that the condition of the train contributed to the cause of the accident.

12 Train 1M29 was formed of a five-coach class 221 diesel-electric multiple unit, number 221134. The FFCCTV footage from train 1V05 shows that the lights were working on the front of train 1M29 and there was no obvious degradation of the yellow-coloured areas provided to improve conspicuity.

[3] Headlights on trains are primarily fitted to the front of the train to provide a visual warning of an approaching train, and to illuminate the lineside signs.

Level crossing

13 Records provided by Worcestershire County Council show that there has been a crossing over the railway near this location since 1901, or possibly earlier. However, the crossing was originally approximately 60 metres south of the current location. In 2007, permission was granted by the Council to move Tibberton No. 8 footpath crossing next to Evelench No. 1 crossing, and in 2012 the crossing was moved to this location. On its original site, Tibberton No. 8 had been a footpath crossing without a deck.

14 Figure 4 shows the general layout of Tibberton No. 8 footpath crossing at the time of the accident. The railway at this location runs approximately north-east to south-west in a relatively wide strip of railway land. Kissing gates at the railway boundary provide access to an open lineside leading to a rubber crossing deck made up of two separate sections, one for each line, with a ballast infill between the lines. Inside the railway boundary, signs instruct users to stop, look and listen, and beware of trains. The pedestrian was crossing the railway from the west (figure 3). Figure 5 shows the significant features when approaching in this direction.

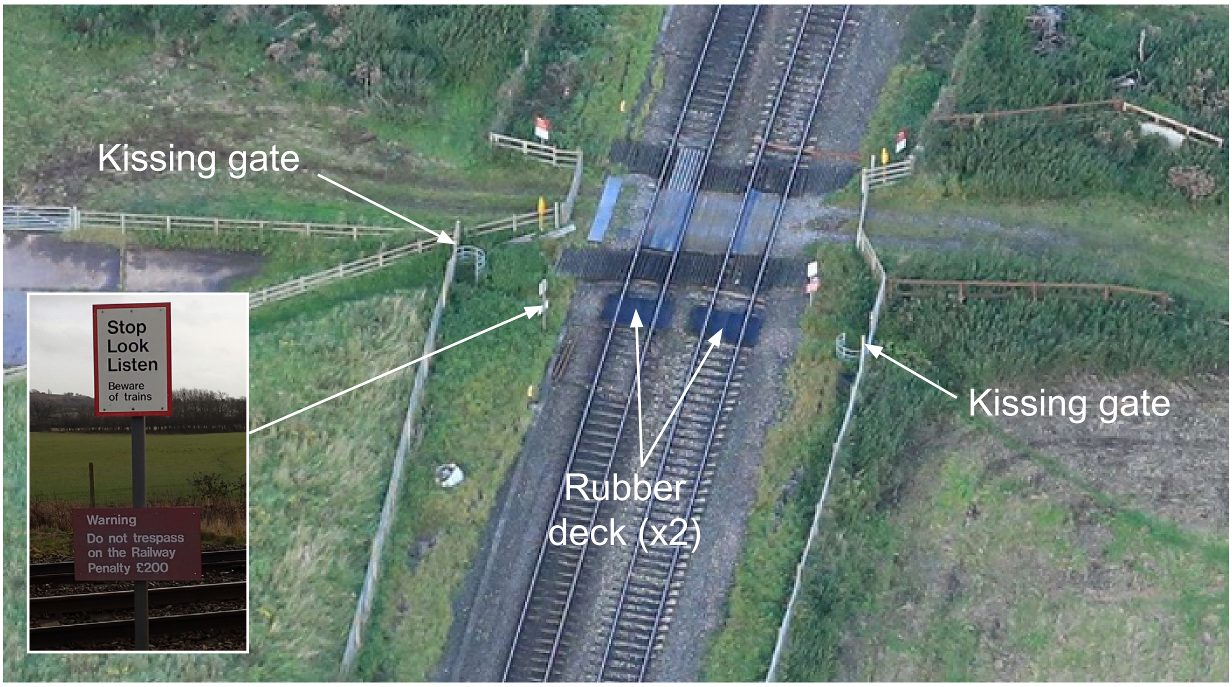

Figure 4: Layout of Tibberton No. 8 footpath crossing (image courtesy of Network Rail)

The pedestrian

15 The member of the public involved in the accident was a 72-year-old man from Selly Oak (a south-western suburb of Birmingham). He was a rambler belonging to several rambling groups. He explored future routes for the groups, and his family believes that this was what he was doing on the day of the accident. It is uncertain whether he had used this crossing before. He had no known problem with seeing distant objects and he had no known hearing difficulties. He was not on medication. As a rambler who was undertaking weekly walks of up to 12 miles, his walking speed was described by others in his group as ‘average for a man of his age’.

Figure 5: Significant features of Tibberton No. 8 footpath crossing when approaching from the west

Staff involved

16 The driver of train 1V05 had joined CrossCountry in September 2018. He was an experienced freight train driver who used to drive on the same route. As part of his conversion to driving passenger trains, he needed to be accompanied on 30 journeys to familiarise himself with the higher speed of operations and the more frequent stops. This was his 20th such journey and he was being accompanied by an experienced passenger train driver. The RAIB found no evidence that the way the train was driven contributed to the accident.

External circumstances

17 The weather at the time of the accident was foggy with an air temperature of around 6°C reported at Pershore[4], approximately 10 miles (16 km) south of Tibberton (figure 2). Visibility at Pershore was recorded as being between 0 and 1,000 metres as shown in figure 6. The weather station at Pershore also recorded a south-south-west wind of 7 mph (11 km/h) at 10:00 hrs. There had been no precipitation over the previous 12 hours.

Train driving in foggy weather conditions

18 The only instruction to train drivers in the Rule Book[5] regarding driving with reduced visibility is in section 22 'Poor visibility'. This instructs train drivers to reduce speed as they consider necessary, if unable to see signals or other lineside indicators soon enough to react to them. Both trains were travelling through the area on green signals, which were supplemented by the audible and visual indications provided in the cab of the train by the automatic warning system with which all trains on the national network are equipped. Witness evidence indicates that under those circumstances, neither of the drivers involved felt that they needed to reduce the speed of their train.

[4] Weather conditions as reported on Network Rail's weather database.

[5] GE/RT8000-TW1 issue 12 – September 2017 – Preparation and movement of trains.

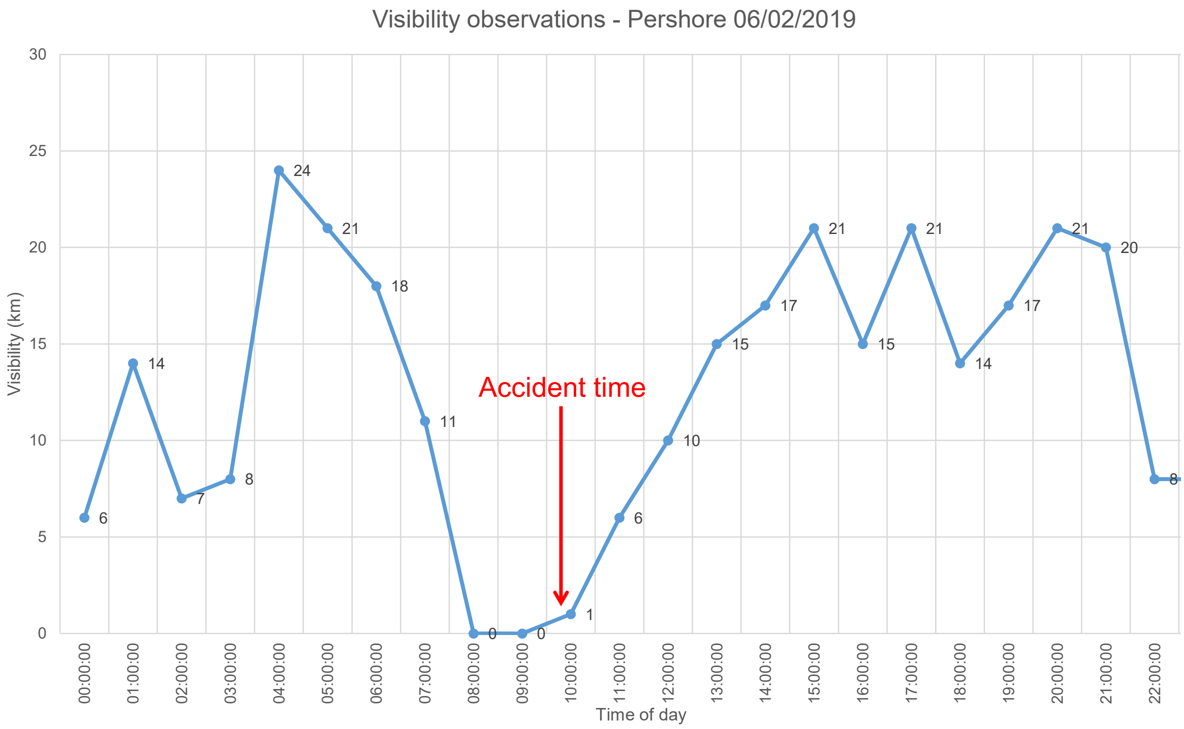

Figure 6: Observed visibility data at Pershore on the day of the accident

The sequence of events

Events preceding the accident

19 At 09:57:32[6] hrs, train 1V05 (the accident train) was travelling south at around 100 mph (161 km/h) and approaching Oddingley No. 7 footpath crossing, when the driver sounded the train's horn at the whistle board (figure 7). Train 1M29 (the passing train travelling north) was approximately 2 kilometres south of Tibberton No. 8 footpath crossing at this point. It was also travelling at around 100 mph (161 km/h).

20 At 09:57:56 hrs, the driver of train 1M29 sounded the train's horn as expected on the approach to the whistle board for Evelench No. 2 footpath crossing. Train 1V05 was over 1.8 kilometres north of Tibberton No. 8 footpath crossing at this point[7].

21 At 09:58:08 hrs, train 1M29 reached Evelench No. 2 footpath crossing. Train 1V05 was approximately 1.3 kilometres north of Tibberton No. 8 crossing at the time.

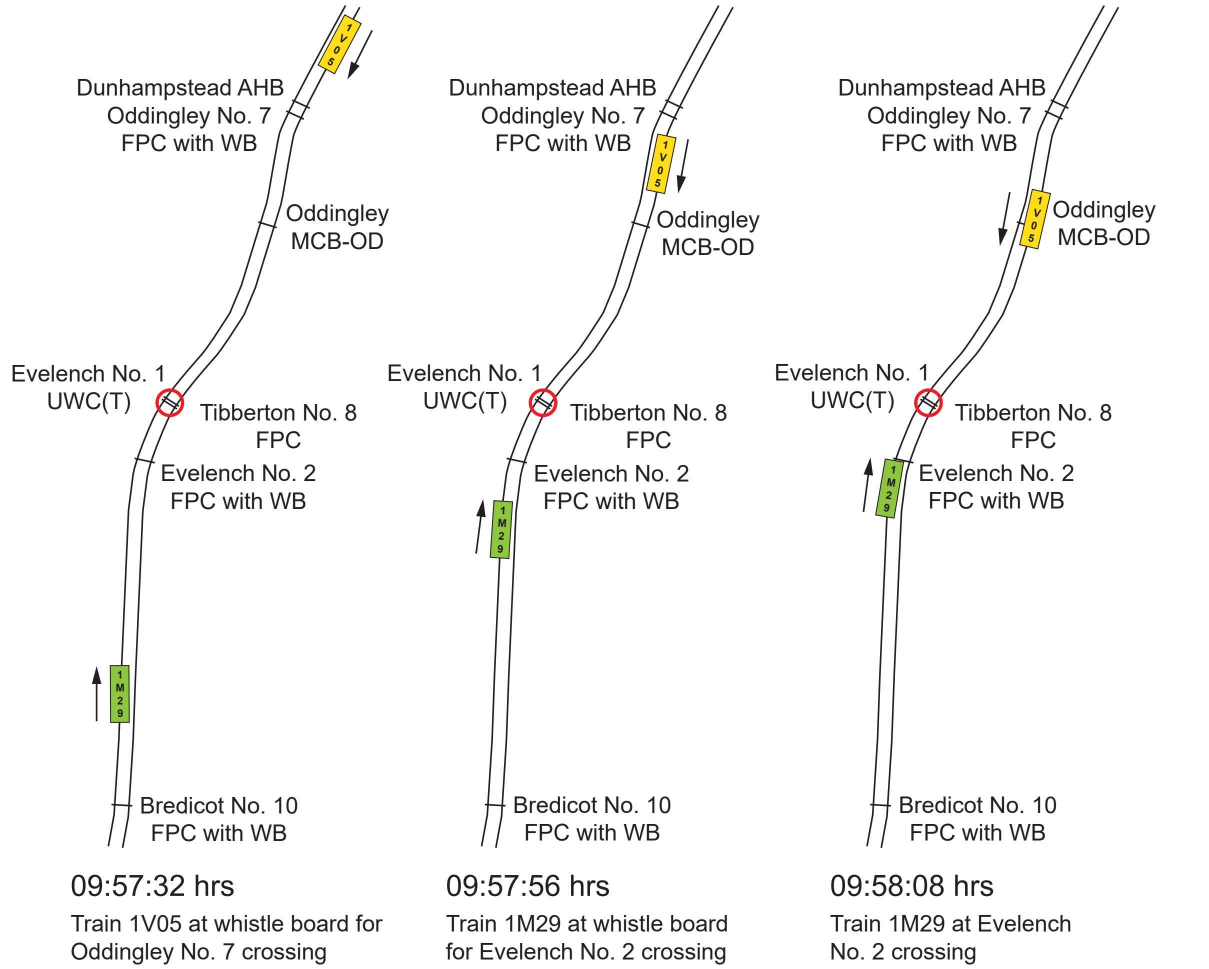

Figure 7: Sequence of events before the accident

[6] All timings corrected to match the clock on the FFCCTV of train 1V05, the accident train.

[7] At linespeed of 100 mph (161 km/h), this equates to approximately 40 seconds of travel time.

Events during the accident

22 Figure 8 shows the sequence of events during the accident. Train 1M29 reached Tibberton No. 8 footpath crossing at 09:58:18 hrs. The pedestrian can be seen on the FFCCTV from train 1M29. He was standing within the kissing gate on the west side of the railway. At that time, train 1V05 was approximately 880 metres away from the crossing.

23 It took about three seconds for train 1M29 to pass the crossing. At 09:58:29 hrs, train 1M29 reached train 1V05, and at 09:58:30 hrs, the front end of train 1V05 passed the back end of train 1M29. At that time, train 1V05 was approximately 350 metres, or 8 seconds from the crossing and travelling at 99 mph (159 km/h).

24 At 09:58:36 hrs, with train 1V05 less than 100 metres from the crossing, the member of public first becomes visible on the FFCCTV from the train, and witness evidence indicates that both drivers on train 1V05 saw him at that point. The pedestrian was walking on the crossing in the six-foot[8] at the time.

25 At 09:58:37 hrs, the driver of train 1V05 reacted to the sighting by sounding the train horn, quickly followed by applying the emergency brake. At 09:58:38 hrs, train 1V05 reached the crossing and fatally struck the pedestrian.

Events following the accident

26 At 09:59:12 hrs, train 1V05 came to a stop approximately 715 metres beyond the crossing. With the train stationary, the accompanying driver made a railway emergency call using the train's GSM-R[9] radio and requested the attendance of the emergency services.

27 Railway staff and the emergency services arrived at the crossing at around 10:20 hrs.

[8] The space between the two railway lines.

[9] Global System for Mobile Communications – Railway is an international wireless communications standard for railway communication.

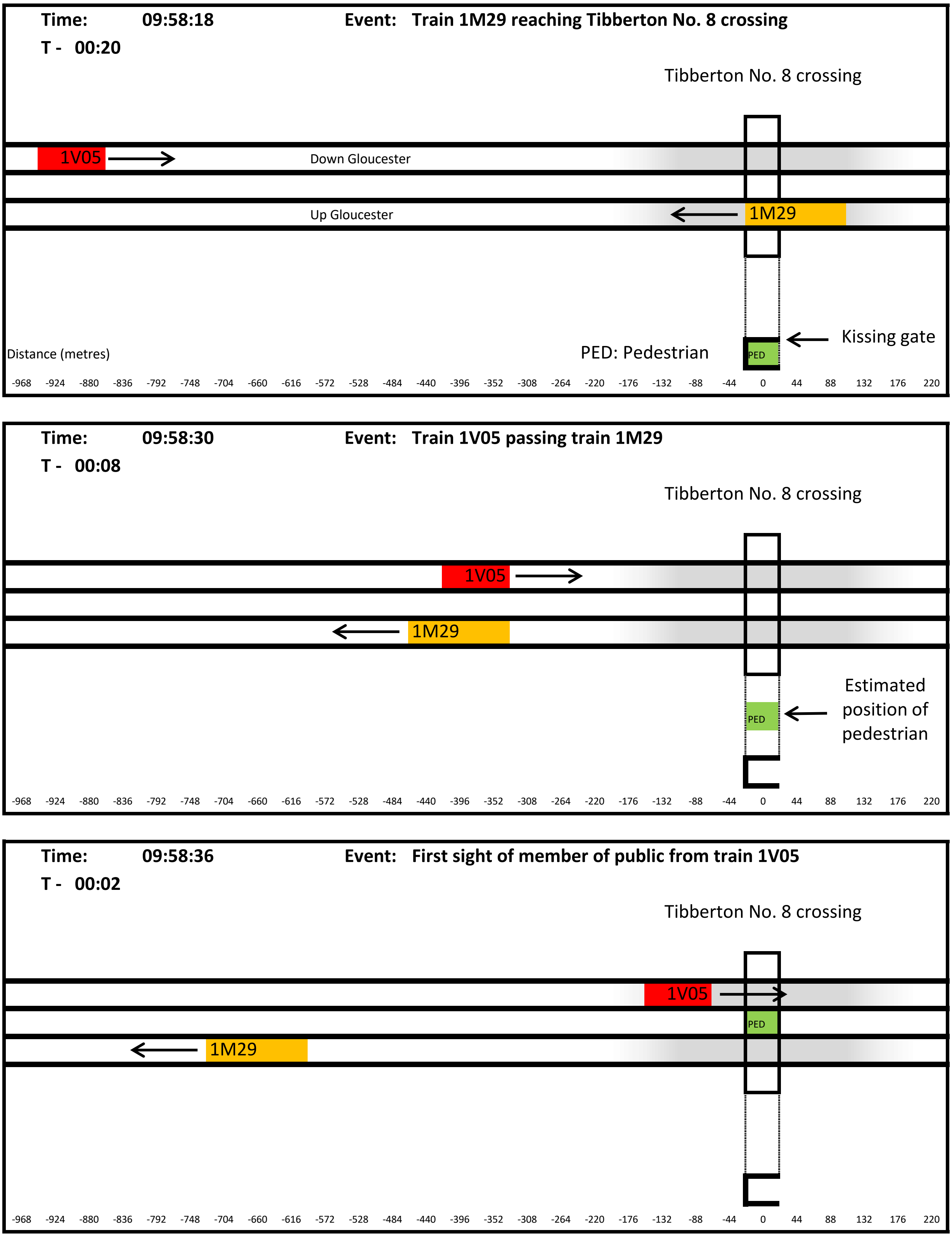

Figure 8: Sequence of events during the accident

Background information

Organisational arrangements

28 Network Rail's Western Route includes approximately 660 level crossings, 340 of which are footpath crossings. In 2013, Network Rail introduced the new role of level crossing manager (LCM) on its Western Route as part of a nationwide initiative. There are currently 10 LCMs in the route level crossing team, each allocated with a number of level crossings. The LCMs report to one of two Route Level Crossing Managers (RLCM). The RLCMs report to the Operations Risk Advisor (ORA) who heads the route level crossing team.

29 Network Rail explained that one of the key motivations for introducing the LCM role was so that a single suitably-qualified specialist was regularly visiting the level crossings within an area and developing a detailed understanding of the issues to be managed.

Footpath crossings

30 Footpath crossings, such as Tibberton No. 8, are found where the railway crosses a path on which pedestrians have a right of way. For this type of level crossing, guidance provided by the Office of Rail and Road (ORR) in its Railway Safety Publication[10] states that 'users are expected to use reasonable vigilance to satisfy themselves that no trains are approaching before they start to cross'. They are then expected to cross quickly while remaining alert.

31 Safe use of a footpath crossing depends on users having sufficient time to reach a position of safety on the opposite side of the railway. Therefore, the time from when the user first becomes aware of an approaching train until the time the train arrives at the level crossing (the warning time) needs to be greater than the time required by users to cross (the traverse time). The traverse time is conventionally calculated from the decision point[11] on one side of the railway to the decision point on the other side.

32 The warning time needs to account for the maximum permitted speed of trains approaching the crossing. Network Rail's process requires LCMs to determine the warning time by undertaking measurements of the distance at which trains can first be seen when standing at the decision point (the sighting distance). Knowing the maximum speed at which a train can approach, they are able to calculate the warning time.

[10] Railway Safety Publication 7 – December 2011 – Level crossings: a guide for managers, designers and operators.

[11] The decision point is defined in Railway Safety Publication 7 as 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 metres from the nearest running rail for tracks where the linespeed is up to and including 100 mph (161 km/h).

33 Where the warning time is found to be insufficient, additional means of warning may need to be considered. These may include:

- Audible warnings provided by a train driver's response to a whistle board (a lineside sign requiring approaching drivers to sound the train warning horn prior to the train coming into view from the crossing). This is by far the most common method of warning.
- Miniature stop lights.
- Audible warnings provided automatically at the crossing.
- Telephones (for contacting the signaller or other railway control staff).

Where whistle boards are provided, Network Rail assesses the warning time provided by the sounding of the horn, but there is no other assessment of the audible warning time provided by the general noise caused by an approaching train.

34 Tibberton No. 8 footpath crossing is a passive crossing, one of the 320 passive footpath crossings on the Western Route[12]. As the warning time in normal conditions is sufficient in both directions from both sides of the railway, there is no active warning system at the crossing to advise the user of an approaching train[13] (paragraph 48). For the same reason, whistle boards are not installed on the approach to the crossing.

Network Rail's management of safety at level crossings

35 Network Rail manages its responsibilities for the safety of footpath crossings in accordance with wider arrangements for the routine management of level crossings. Two key processes are involved:

- Level crossing risk assessment: regularly assessing the risks associated with collisions (and other incidents) on level crossings and identifying and implementing necessary control measures.
- Level crossing asset inspection and defect rectification: regularly inspecting level crossings, identifying defects and managing their rectification.

Level crossing risk assessment

36 Network Rail's current process for level crossing risk assessment is described in national operating procedure 3.08, 'Risk assessing level crossings', and referenced guidance documents. It includes:

- a periodic site visit to each level crossing to collect data relating to its condition, environment and use;
- using the collected data and the algorithms in Network Rail's all level crossings risk model (ALCRM) to quantitatively model the risk and calculate an ALCRM risk score (paragraph 39);

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[12] Of the 340 footpath crossings on the Western route (paragraph 28), 20 crossings are 'active', meaning that an active warning system is provided at the crossing.

[13] Evelench No. 1 crossing that sits adjacent to Tibberton No. 8 footpath crossing is fitted with telephones. This is because, as a user worked crossing, it is used by vehicles to cross the railway. Vehicle users need significantly more time to cross than pedestrians because of the need to open and close the gates in front of and behind their vehicle.

- investigating different risk control options to make the crossing safer; Network Rail refers to this as optioneering, and it involves the use of quantitative cost benefit analysis using the benefit predicted by ALCRM, and qualitative assessment (for instance, expert judgement) to identify and recommend level crossing improvements;
- completing a narrative risk assessment report describing the identified risks and their management, supporting information and the recommended risk control options; and
- arrangements for managing and implementing the approved risk control options after financial authority and approval has been granted.

37 The frequency of risk assessments largely depends on the crossing's ALCRM risk score; the higher the score, the more frequent the risk assessment. Risk assessments are also required in the event of other triggers, for instance an accident, a near miss or a proposed operating or design change.

38 The site visit to a crossing is used to collate information about its state at the time of the visit. Sighting distances are routinely measured as they may have changed from one visit to the next due to changes in vegetation. A census recording the number of users of the crossing is also undertaken. The LCMs follow a script which guides them in the collection of the information. Some of the questions in the script will have pre-defined answer options and some will require free text entries as a response. The LCM is also expected to take photographs and make notes in preparation for the narrative risk assessment.

39 The data captured during the site visit is then uploaded into ALCRM. ALCRM is a risk score calculator. It uses some of the data collected during the site visit to calculate the risk score and predict key risk drivers. ALCRM expresses the risk level in terms of predicted Fatalities and Weighted Injuries[14] (FWI) per year at the crossing. This is translated into a risk score, made up of a letter representing the risk to an individual regularly[15] using the crossing and a number representing the collective risk of harm (to crossing users and those on board trains). These scores represent the range of risk across all types of crossings with an individual risk of A and a collective risk of 1 being the highest while M and 13 are the lowest. The data is sense-checked by another LCM before the ALCRM assessment is signed off.

40 In addition, ALCRM outputs key risk drivers at the crossing. The key risk drivers that ALCRM can output are:

- Frequent trains
- Blocking back
- User misuse
- Gates left open
- Sun glare
- Large numbers of users

[14] Defined by RSSB as the aggregate amount of safety harm. One FWI is equivalent to one fatality, 10 major injuries or 200 minor injuries or shock/trauma events requiring hospital admission or 1000 minor injuries or shock/trauma events not requiring hospital admission.

[15] A regular user is defined by Network Rail as someone making a daily return trip over the crossing.

- Crossing approach
- Large numbers of heavy goods vehicles
- Infrequent trains
- Crossing is near station
- Second train uses crossing
- Low sighting time[16]
- Road visibility

41 Sign-off of the ALCRM assessment is required to take place within six weeks of the site visit. Once the ALCRM assessment has been signed off, the process of optioneering takes place. This is when the LCM explores the options available to improve safety at the crossing. Network Rail national operating procedure 3.08 indicates that the level crossing risk management toolkit (www.lxrmtk.com) provides a good source of information for potential mitigation measures. For a given risk influencing factor, the toolkit returns a list of possible risk mitigation measures covering a range of costs from low to high. Options are modelled in ALCRM to determine their impact on risk levels. Options are also subject to cost benefit analysis to support the decision making process.

42 Following optioneering, the LCM will prepare the narrative risk assessment. The narrative risk assessment is a document which captures all the above activities. It describes the findings from the site visit, the results of the ALCRM assessment and the results of optioneering. LCMs are expected to provide an enhanced qualitative narrative of the risks present at the crossing and to suggest how to best manage them in the short, medium and long terms. Recommendations for improvements are made at the end of the narrative risk assessment. The narrative risk assessment is to be completed within 12 weeks of the site visit.

43 Investment approval is required to implement a selected risk control option at a crossing. On the Western Route, any work above the level of 'minor enhancements', such as fitment of active warning systems, will be considered by the level crossing steering group[17]. The group's final decision on the improvements to take forward are based on consideration of a variety of factors: the narrative risk assessment, the ALCRM risk score, the condition of the crossing, the site suitability of the crossing (particularly for the fitment of technology) and the nature of any known use or misuse.

Level crossing asset inspection

44 Network Rail's current process for level crossing asset inspection is described in its standard NR/L2/SIG/19608, 'Level crossing asset inspection and implementation of minimum action codes'. This requires that level crossings are inspected regularly with the aim of identifying defects and arranging rectification.

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[16] Network Rail advised the RAIB that the low sighting time risk driver referred to in ALCRM is not influenced by adverse weather conditions, but by permanent structures (e.g. a bridge) or vegetation.

[17] On the Western Route, the steering group is chaired by the director of route asset management and has mandatory attendance by RLCM, ORA, level crossing sponsors, director of safety, route asset manager and senior asset engineers. The group meets every eight weeks.

45 Inspections of footpath crossings consider the condition of the level crossing signage, fences, gates and walking surfaces. The inspections also include an assessment of the adequacy of the sighting and the need to remedy any deficiency, for instance clearing vegetation.

46 Standard NR/L2/SIG/19608 lists the action required for different types of defects and the timescale for rectification.

Network Rail's management of safety at Tibberton No. 8 footpath crossing

Risk assessment

47 The last site visit before the accident, as part of the risk assessment process, took place on 13 March 2017. The associated narrative risk assessment was signed off on 14 March 2017. The next narrative risk assessment was not due until June 2019.

48 The risk assessment found that the warning time of up and down trains was compliant with the standard when starting to cross from either side of the railway. At the side from which the pedestrian was crossing, a sighting distance of 399 metres was recorded for down trains (the direction in which train 1V05 was travelling). This is equivalent to a warning time of 9 seconds. The traverse time from a decision point two metres away from the nearest track to the decision point on the other side of the railway, using a crossing speed of 1.189 metres/second[18], had been calculated to be 7.6 seconds. No allowance was made for vulnerable users or uneven surfaces in the calculation of the traverse time.

49 In the narrative risk assessment, the LCM had identified fog as a potential risk influencing factor for sighting distances. The LCM had answered '*yes*' to the following question in the script:

> '*Are there any other visibility issues at this crossing at certain times of year? (e.g. fog likely or foliage growth)*'.

The LCM had also qualified his response in the assessor's notes:

> '*Fog in winter months, however this may clear by midday.*'

50 The narrative risk assessment described the route as a busy one with 118 trains per day (passenger and freight trains). The user census data supporting the narrative risk assessment was based on an estimated usage of one or two pedestrians per day.

51 The risk assessment on 13 March 2017 assessed Tibberton No. 8 footpath crossing as having an ALCRM risk level of 0.000106 FWI/year (equivalent to one fatality on average every 9,400 years). The individual risk score was a 'C' and the collective risk score was '6'. The only key risk driver output by ALCRM for Tibberton No. 8 crossing was 'frequent trains'.

52 Two risk control options were evaluated as part of the supporting optioneering exercise:

- crossing closure; and
- installing miniature stop lights.

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[18] This crossing speed is quoted in Network Rail Level Crossing Guidance document, LCG1, as being applicable to pedestrians where a deck surface is provided. It equates to 3.9 feet/second.

53 Both options were considered to be long term improvements. The cost benefit analysis was not completed for either option. Witness evidence indicates that cost benefit analysis was not routinely carried out at that time within the Western Route, due to a lack of confidence with the costing tool.

54 In the conclusion of the narrative risk assessment, the LCM declared that he was satisfied with the crossing, suggesting that he thought it was safe to be used. Although having considered crossing closure in the optioneering exercise, he reported that he did not believe it to be a viable option, as there was no suitable diversionary route for users trying to cross the railway near this location. However, he proposed that the fitment of miniature stop lights and audible warnings[19] should be considered to further mitigate the risk, if funding was available (paragraph 90).

55 In the conclusion of the narrative risk assessment, the LCM also discussed the risks associated with fog and stated: '*Environmental conditions in the area of the crossing are generally favourable: low lying fog usually lifts very early in the morning and there is no nearby watercourse to add to conditions. On day of visit trains could be heard approaching far in advance of sighting*.'

Asset inspection

56 The RAIB obtained level crossing asset inspection records for the two years prior to the accident. They showed inspections were being carried out in accordance with the intervals prescribed in NR/L2/SIG/19608.

57 In the last inspection before the accident on 10 September 2018, the LCM identified improvement work needed on the vegetation to improve sighting and on the ballast levels in the cess[20] and six-foot. The work was completed by 5 November 2018. No identified improvement work was outstanding at the time of the accident.

[19] In this context, the audible warnings referred to are the ones provided automatically at the crossing (and not provided through the whistle boards). The fitment of audible warnings had not been considered as part of the optioneering exercise.

[20] The space on the field side of the railway.

Analysis

Identification of the immediate cause

58 **The pedestrian, unaware of the approaching train, started to cross the railway when there was insufficient time for him to get to a position of safety on the other side.**

59 Fifteen seconds before the accident, the pedestrian is seen waiting at the kissing gate, on the rear facing CCTV from train 1M29. Two seconds before the accident, he becomes visible on the FFCCTV from train 1V05, walking across the gap between the two tracks. There is no evidence available to determine when the pedestrian left the kissing gate or when he reached the decision point. However, he is likely to have waited a short time after the passing of train 1M29 before approaching the crossing and reaching the decision point (paragraph 79). Witness evidence indicates that it is likely that the pedestrian became aware of the approaching train after he had passed the decision point and after he had made the decision to cross.

Identification of causal factors

60 In its narrative risk assessment, Network Rail calculated that a crossing user standing at the decision point needed a minimum of 7.6 seconds of warning time to be able to safely negotiate the crossing (paragraph 48).

61 The accident occurred due to a combination of the following causal factors:

- because of the fog, the approaching train was not visible until it was three to four seconds away from the crossing (paragraph 62);
- regardless of the weather conditions, the approaching train could not be heard until it was three to four seconds away from the crossing (paragraph 68); and
- the risks associated with foggy weather conditions had not been mitigated for this crossing (paragraph 83).

Each of these factors is now considered in turn.

Sighting time

62 **Because of the fog, the approaching train was not visible until it was three to four seconds away from the crossing.**

63 When train 1V05 left Birmingham New Street station at 09:30 hrs the weather was overcast but clear. It was only when the train passed Barnt Green on the outskirts of Birmingham that fog began to appear. Visibility got progressively worse and witness evidence indicates that by the time the train reached Bromsgrove, visibility was limited to a '*couple of hundred metres*'. The weather at this location on the day of the accident was described as '*very foggy*'.

64 The CCTV footage from train 1V05 shows how the fog progressively thickened as the train approached Tibberton No. 8 footpath crossing. Based on the footage, the RAIB calculated that the sighting time four kilometres north of Tibberton No. 8 crossing was approximately eight seconds. As the train approached the crossing, the visibility and hence the sighting time reduced to between three and four seconds.

65 Railway staff who attended the site took a photograph (figure 9) approximately 45 minutes after the accident (at around 10:45 hrs), at a time when the fog had started to lift. They indicated that at the time of their arrival on site (at around 10:20 hrs), the trees shown on the photograph were not visible.

Figure 9: (left) Site conditions at 10:45 hrs and (right) FFCCTV from train 1M29 showing site conditions at 09:58 hrs (left image courtesy of Network Rail, right image courtesy of CrossCountry Trains)

66 A still image in the FFCCTV footage from train 1M29 which passed over the crossing approximately 20 seconds before the accident is shown in figure 9. The same trees cannot be seen on this footage. The trees are about 225 metres away from the crossing which, at a travelling speed of 100 mph (161 km/h), represents 5 seconds of warning time. A second later, the tree on the left-hand side starts to become visible.

67 At the time of the accident, the sighting time of a class 170 train[21] from the crossing was therefore between three and four seconds[22]. This is significantly less than the minimum required warning time of 7.6 seconds calculated in the narrative risk assessment.

[21] A class 221 train is fitted with higher intensity headlights and would have provided a marginally greater sighting time of four to five seconds. This is still less than the minimum required warning time of 7.6 seconds calculated in the narrative risk assessment

[22] For the drivers inside the cab of train 1V05 approaching Tibberton No. 8 footpath crossing, the warning time was less, at about one to two seconds (paragraph 24). This is because a person is more difficult to visually discern in fog than an approaching train.

Audible cues

68 Regardless of the weather conditions, the approaching train could not be heard until it was three to four seconds away from the crossing.

Audibility of a train passing over a level crossing

69 At level crossings without whistle boards, Network Rail does not assess the audibility of trains as a means of determining warning times (paragraph 33). However, following the accident, the RAIB commissioned an independent acoustic specialist to undertake sound measurements at the crossing, with a view to determining how much audible warning time was available to a crossing user. Sound recording equipment was installed at the decision point, two metres away from the nearest running rail, on the side of the railway which had been used by the pedestrian to approach the crossing. To confirm the repeatability of the results, the passage of at least three trains of each type in each direction at near linespeed was recorded. The class of train (class 220/221 or class 170), the number of vehicles in the consist and the speed of passage were recorded for each train.

70 Measurements of background sound pressure levels (SPL) were carried out and found to be between 34 and 46 dB, depending on the time of day. The acoustic specialist advised the RAIB that there was no existing standard or research which defined the required difference in sound pressure level to make the general noise caused by an approaching train audible above the ambient noise[23]. Based on his experience, he suggested that a 6 dB difference represented a 'just audible' condition[24] (this being double the sound pressure). A typical sound trace of a train passing the crossing is shown in figure 10.

71 Table 1 shows the results of the tests and in particular presents:

- the time from the train becoming 'just audible' to the front of the train reaching the crossing (depending on the background sound level); and
- the time from the rear of the train passing the crossing to the train becoming 'just inaudible' (also depending on the background sound level).

Train	Direction	Background sound pressure level (dB(A))	Time from the train becoming 'just audible' to the front of the train reaching the crossing	Time from the rear of the train passing the crossing to the train becoming 'just inaudible'
Class 170	Up	34[25]	8 seconds	10 seconds
		44	4.5 seconds	8 seconds
	Down	34	4 seconds	17 seconds
		45	3 seconds	8 seconds
Class 220/221	Up	34	6 seconds	12 seconds
		45	5 seconds	9 seconds
	Down	34	4 seconds	15 seconds
		46	4 seconds	9.5 seconds

Table 1: Results from acoustic measurements

[23] There is data available for the reliable detection of train horns but the gradually increasing nature of the noise caused by an approaching train means that this data is not suitable in this case.

[24] A difference of 6 dB represents the 'just audible' condition, but with a low likelihood of detection (i.e. most people would need a greater difference to be able to reliably detect the approaching train). In practice, this means that the audible warning times quoted in this report could be even shorter for most people.

[25] The results for the low background sound level were derived from the measurements at the higher background sound level as trains had not been running at the time when the background sound level was low on the day of testing.

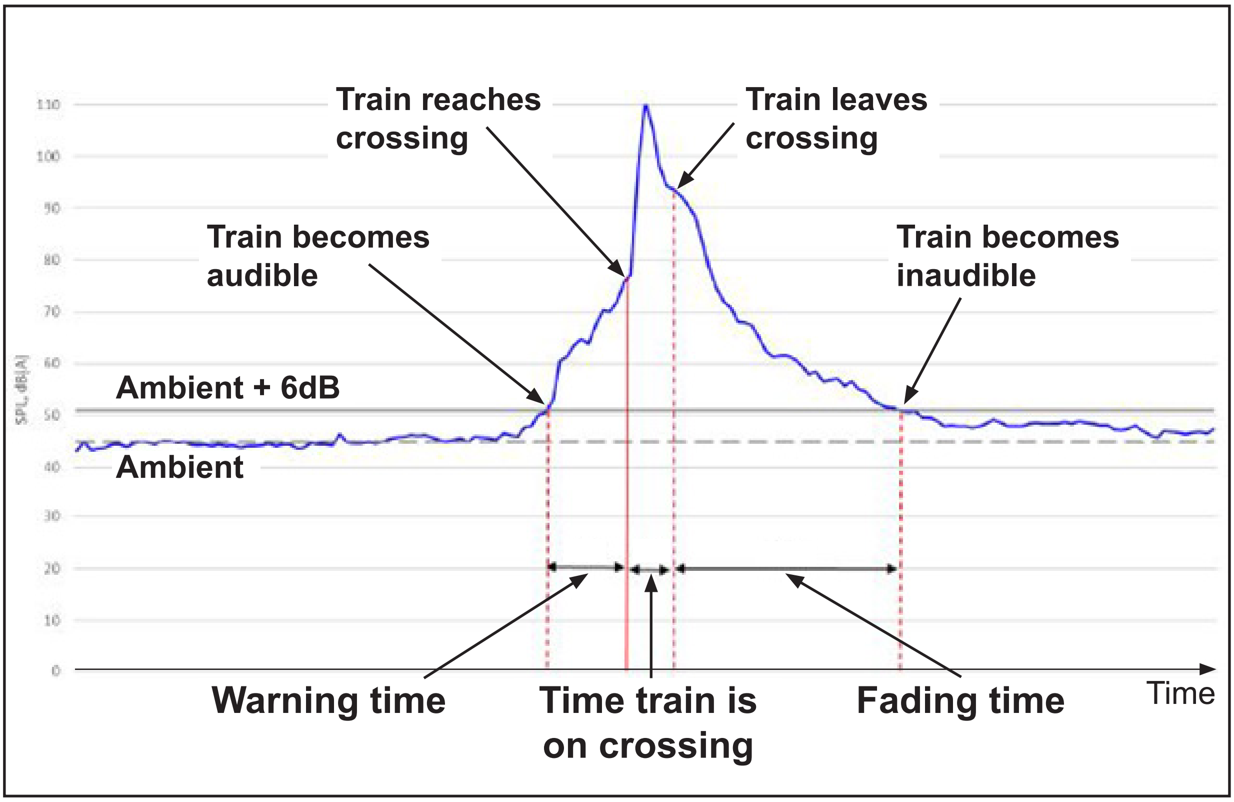

Figure 10: Typical sound trace recorded at Tibberton No. 8 footpath crossing

73 Table 1 shows that, depending on the background sound level, the time from a train becoming 'just audible' to the front of it arriving at the crossing varied between three and eight seconds. The time for it to become 'just inaudible' was longer, between eight and seventeen seconds.

74 The time from the train becoming 'just audible' to the front of the train reaching the crossing is the audible warning time. Therefore a user standing at the crossing is provided with three to eight seconds of audible warning time for the types of train considered (class 170 and class 220/221), from either direction. For a class 170 train approaching on the down line, as was the case during the accident, the audible warning time was between three and four seconds.

75 This is significantly less than the minimum required warning time of 7.6 seconds calculated in the narrative risk assessment.

Passing trains

76 The acoustic study also considered whether the passing of the first train (1M29) audibly masked the approach of train 1V05. The precise sequence of events on the day could not be replicated during the tests. However, using the sound measurement results for a class 170 train travelling on the down line and a class 220/221 train travelling on the up line, the accident scenario was recreated. The sound measurement results were aligned as if the front end of the class 170 train passed the back end of the class 221 train eight seconds before the class 170 train reached the crossing (paragraph 23).

77 Figure 11 shows the effect of the ambient sound level on the audibility of the trains for a user standing at the crossing in the scenario on the day of the accident.

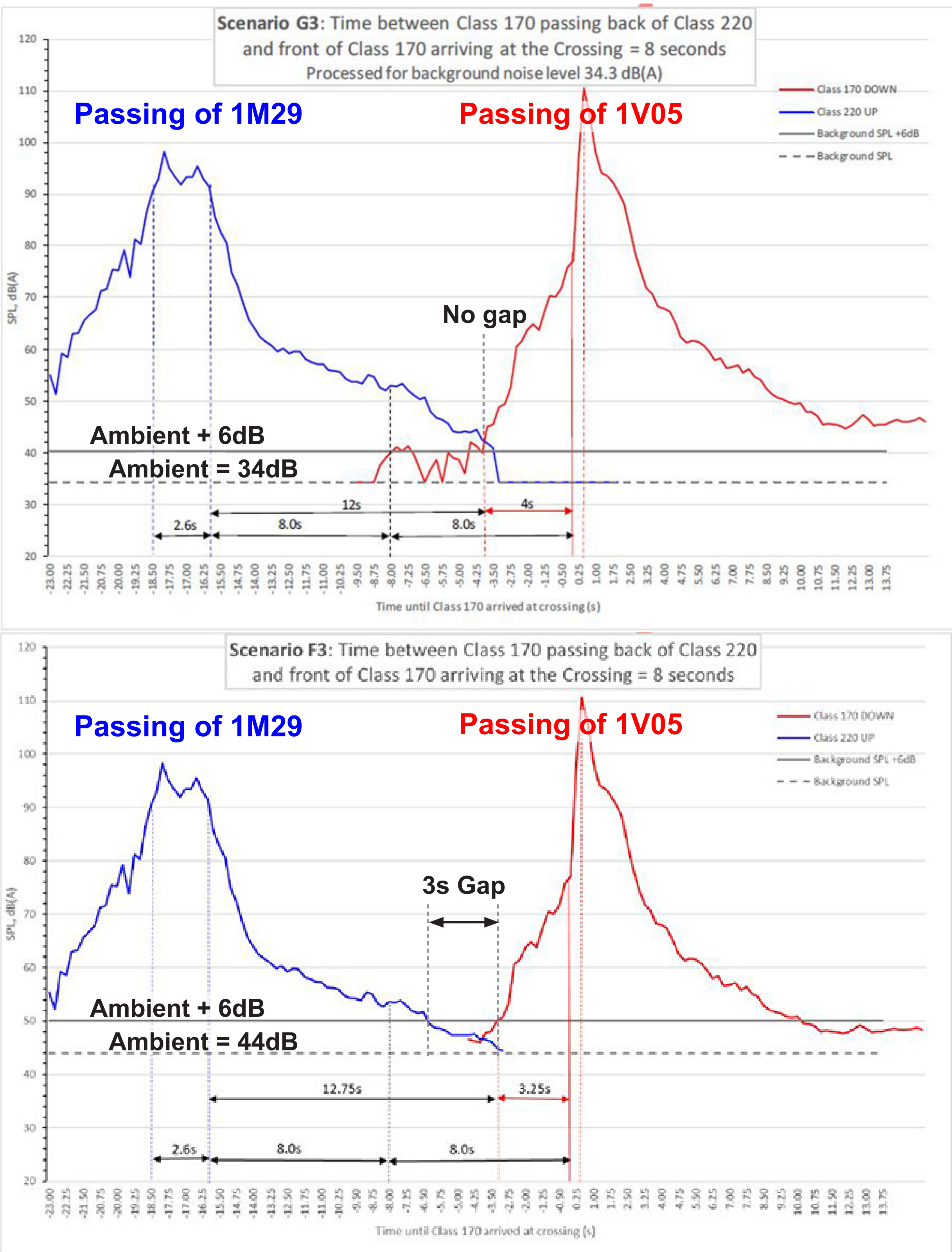

Figure 11: Passing of the two trains (low/high ambient)

78 Figure 11 shows that, for a low ambient sound level at 34 dB, the sound of the passing train (1M29) reached the inaudible level just as the sound of the approaching train (1V05) became audible. Figure 11 also shows that, for a higher ambient sound level at 44 dB[26], the sound from the passing train (1M29) had been inaudible for approximately three seconds before the sound of the approaching train (1V05) became audible.

79 The movements of the pedestrian from the time he was last seen on the footage from the rear facing cameras on train 1M29 to when he became visible on the footage from the forward facing cameras on train 1V05 are unknown. Taking into account normal walking speeds, it is likely that he waited at the kissing gate for several seconds before approaching the railway lines. Depending on the ambient sound level on the day, he may then have waited until train 1M29 could not be heard anymore before deciding to cross or he may have confused the sound of the approaching train with the sound of the receding train. In either case, by the time train 1V05 became audible, he would already have been on the crossing, probably in the four-foot[27] of the up line. The audible warning time he had for the approaching train 1V05 was not long enough to enable him to cross safely.

80 Witness evidence indicates that it is likely that the pedestrian became aware of the approaching train after he had started to cross. In these circumstances, the RAIB's experience is that level crossing users often continue to cross rather than turn back. This highlights the importance of ensuring that the warning time is sufficient.

Other audible cues

81 A crossing user standing at Tibberton No. 8 footpath crossing may be able to hear the sounding of train horns for other crossings[28]. There are footpath crossings with whistle boards on either side of Tibberton No. 8 footpath crossing (paragraphs 7 and 8). To the south is Evelench No. 2 crossing with its whistle board located at 840 metres from Tibberton No. 8 crossing. To the north is Oddingley No. 7 crossing with its whistle board located at 2.8 kilometres from Tibberton No. 8 footpath crossing. At linespeed, this places the sounding of the horn respectively 19 seconds and 64 seconds before a train arrives at Tibberton No. 8 footpath crossing.

[26] The high ambient graph shows 44 dB (instead of 46 dB) as the baseline. This is because 44 dB was the ambient sound level on the recording used in this assessment.

[27] The space between the two running rails.

[28] During the acoustic testing, the RAIB found evidence that the horns sounded for those crossings could be faintly heard from Tibberton No. 8 footpath crossing.

82 Network Rail does not rely on a warning provided for one crossing to also act as a warning of approaching trains at another crossing. The long elapsed time between the horn being sounded for Oddingley No. 7 footpath crossing and the train arriving at Tibberton No. 8 crossing means that it is quite possible for a crossing user to arrive at the crossing having missed the warning. Based on the minimum audibility requirements in GM/RT2131[29], the RAIB calculated that it is possible for the horn sound pressure level to have fallen below the ambient sound pressure level, purely based on the sound pressure level decaying over the distance travelled. Finally, it is possible that a crossing user, having heard the distant sounding of a horn, might think that it must have been associated with road traffic in the area because of the lack of visual confirmation in a reasonable timeframe.

Network Rail's management of foggy weather conditions

83 **The risk associated with foggy weather conditions had not been mitigated at this crossing.**

84 Fog is a natural weather condition, common in the UK throughout autumn and winter. The formation of fog will depend on many factors, including the geographical location, the amount of moisture in the air, the strength of the wind, the cloud cover, and the amount and intensity of sunshine. These factors make it difficult to forecast fog accurately. Nevertheless, the fact that it was foggy that day was a readily foreseeable condition that needed to be managed by the railway.

85 In the last narrative risk assessment before the accident in March 2017, the LCM identified fog as a potential risk influencing factor (paragraph 49). In the conclusion of the assessment, the LCM wrote: "*Environmental conditions in the area of the crossing are generally favourable: low lying fog usually lifts very early in the morning and there is no nearby watercourse to add to conditions*[30]*. On day of visit, trains could be heard far in advance of sighting*" (paragraph 55).

86 Witness evidence suggests that the LCM was not referring to the sound of an approaching train when discussing the ability to hear trains in advance of seeing them, but rather that he was referring to the warning horns that trains sound for other crossings on their approach to Tibberton No. 8 footpath crossing.

87 Although the narrative risk assessment makes reference to the ability to hear trains far in advance of seeing them, Network Rail clarified that this was not intended to be a proposed mitigation measure against the effects of fog (paragraphs 81 and 82). Network Rail confirmed that there was in effect no proposed measure in the narrative risk assessment to mitigate the effects of fog.

[29] Railway Group standard GM/RT2131 issue 1, December 2015, 'Audibility and visibility of trains'

[30] There is a water course within approximately 500 metres of the crossing. Witness evidence indicates that the LCM would normally consider this to have an influence on the conditions at the crossing.

Engineered safeguards

88 Network Rail's national operating procedure 3.08 suggests that LCMs can refer to the level crossing risk management toolkit to identify risk mitigation measures for a given risk influencing factor (paragraph 41). Fog is captured in the toolkit as a specific potential risk influencing factor, under the title '*Adverse weather impacting visual information*'. For adverse weather conditions affecting visibility, the toolkit returns several possible risk mitigation measures: the introduction of miniature stop lights and/or audible warnings and the installation of telephones at the crossing.

89 Miniature stop lights are designed to provide a visual confirmation at a crossing that a train is approaching. Audible warnings are designed to provide an audible confirmation at a crossing that a train is approaching. Telephones are provided at a crossing so that users can contact the signaller who can advise whether a train is approaching. However, all these options cost money, and investment in any of them has to be considered in the context of all the other crossings managed by the route. At Tibberton No. 8 footpath crossing, the installation of miniature stop lights and audible warnings had been suggested by the LCM in the conclusion of the narrative risk assessment (paragraph 54), but the suggestion had not been taken forward[31].

90 The suggestion to fit miniature stop lights and audible warnings was not taken forward because the route level crossing team considered Tibberton No. 8 footpath crossing to be a low risk crossing relative to other crossings on the route. The team stated that implementation of any engineered safeguard at this location would also necessitate implementation of engineered safeguards at other higher risk locations. They stated that the costs associated with such an extensive programme of level crossing upgrades would be prohibitive.

ALCRM and fog

91 Network Rail's Western Route provided the RAIB with the list of all its crossings, ranked according to their ALCRM risk level. The ALCRM risk level is the only means available to Network Rail to rank its crossings. Figure 12a shows that Tibberton No. 8 footpath crossing ranked 270th out of 660 crossings of all types and figure 12b shows that it ranked 122nd out of 340 footpath crossings. Tibberton No. 8 footpath crossing was therefore ranked as mid-table for both metrics, and was therefore unlikely to attract any significant investment.

92 The ALCRM input script (paragraph 38) includes a question relating to fog: 'Are there any other visibility issues at this crossing at certain times of the year (e.g. fog likely or foliage)'. However, the answer to this question has no impact on the risk level calculated by ALCRM. This is because 'fog' is not coded into the algorithms underpinning ALCRM.

[31] There were other options available (e.g.: combining Tibberton No. 8 footpath crossing with Evelench No. 1 user worked crossing with telephones, or providing a telephone at Tibberton No. 8 footpath crossing given that the telephone line was already provided for Evelench No. 1) but these had not been considered by the level crossing team.

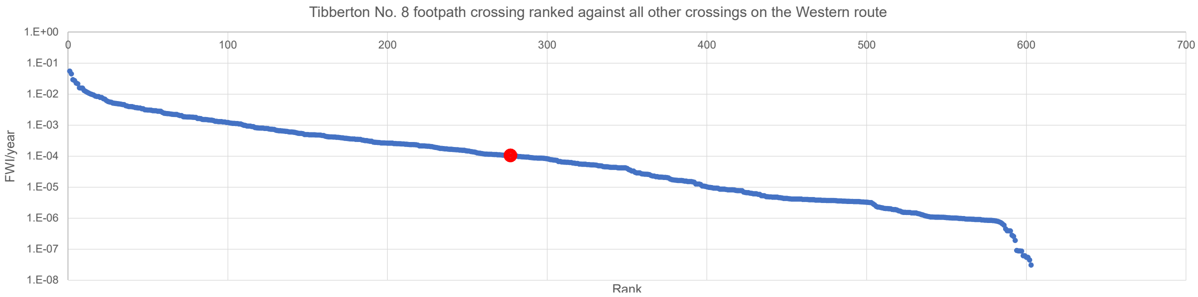

Figure 12a: Tibberton No. 8 footpath crossing ranked against all other crossings on the Western route

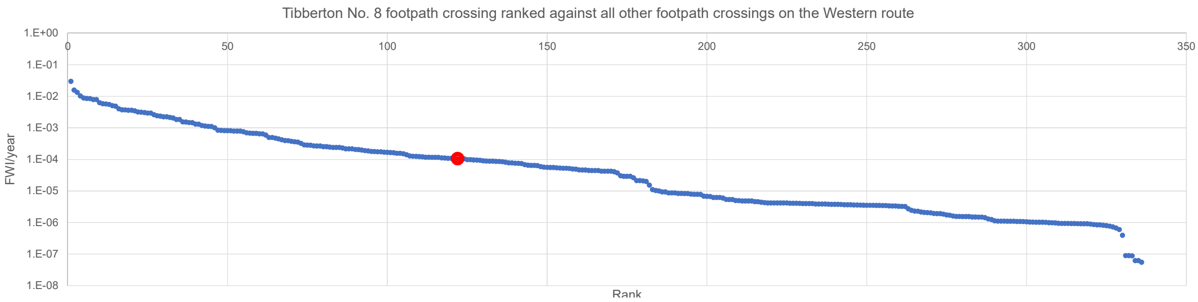

Figure 12b: Tibberton No. 8 footpath crossing ranked against all other footpath crossings on the Western route

93 Data provided by the Western Route indicates that fog was mentioned in the ALCRM input script for 48 of the 340 footpath crossings, that is one in seven crossings. Tibberton No. 8 footpath crossing was ranked 16 out of 48 footpath crossings for which fog had been identified as a potential risk factor in ALCRM.

94 Had fog been coded in the algorithms underpinning ALCRM, those crossings at which it had been identified would have sat higher in the risk ranking. This may have made crossings like Tibberton No. 8 footpath crossing more likely to be considered for investment opportunities.

Identification of underlying factors

Network Rail's approach to managing the effects of fog at passive level crossings

95 **Network Rail was not actively managing the risk associated with fog at its passive crossings.**

96 At passive footpath crossings, such as Tibberton No. 8, fog can render the crossings unsafe for an individual to use. However, Network Rail confirmed to the RAIB that it had not carried out any risk assessment at a national level to better understand the risk associated with fog at its passive crossings. Network Rail also advised that it perceives fog as a challenging weather condition to predict and quantify, as the formation of fog can be localised. Network Rail indicated that it believed that there was little cost-effective mitigation available to put in place at a crossing like Tibberton No. 8 footpath crossing and that its ALCRM ranking did not justify any significant investment. Whistle boards could be considered but Network Rail has a policy of reducing the number of whistle boards used as a mitigation measure because they can be ineffective.

97 The RAIB sought to determine what information was available to Network Rail to better understand and manage the effects of fog on the safety at its passive crossings. With the help of Network Rail, the RAIB has reviewed the incidents and accidents since 2005 where fog is likely to have played a key role. The review identified four fatal accidents, including this one at Tibberton. These were:

- Barratt's Lane No. 1 footpath crossing (21 November 2005)
- Leys Lane footpath crossing (13 February 2008)
- Riverside footpath crossing (03 September 2014)
- Tibberton No. 8 footpath crossing (06 February 2019)

98 In addition, Network Rail provided a list of seven near misses in which fog was likely to have played a part.

99 Ignoring the near misses, four fatal accidents over a fourteen year period equates to a risk level of about 0.3 FWI/year. RSSB's safety risk model[32], which captures the effects of fog as it is based on historical data, shows that the total risk level for a user at a passive footpath crossing is approximately 2.4 FWI/year. This means that fog accounts for over 10% of the total risk level, a proportion that warrants Network Rail better understanding the risks to its operations created by foggy weather conditions.

100 Network Rail uses an external supplier to provide weather forecasts to inform its routes of upcoming weather conditions. Forecasts are updated every hour. The forecast includes a prediction of the available visibility at various locations on Network Rail's infrastructure. The information provided to Network Rail also includes the observed visibility levels recorded on an hourly basis at the same locations (figure 6 is an example of the data provided). There is therefore visibility information currently available to Network Rail which could be utilised to better understand and manage the risks from foggy weather conditions.

Observations

Crossing surface

101 The crossing surface installed in 2012 did not comply with the requirements of the standard applicable at the time.

102 Tibberton No. 8 footpath crossing was moved to its current location in 2012 (paragraph 13). The applicable Network Rail standard at the time was NR/L2/SIG/30015, 'Specification for station, footpath, bridleway and user-worked level crossings'. In accordance with the standard, where a surface system is provided, the basic requirements for this surface is to be level with the head of the rail, marked with white lines along the edges, without tripping hazards and gaps greater than 10 mm, and constructed from a single type where track layout permits.

[32] The safety risk model provides a network-wide risk profile for the UK railway. Information provided in this report is from version 8.5.

103 The crossing surface at Tibberton No. 8 footpath crossing was made of two rubberised crossing decks with a gap in the six-foot (figure 13). The gap was approximately 840 mm wide and the ballast at this location was up to 100 mm lower than the crossing surface itself. As such, the crossing surface did not comply with the requirements of NR/L2/SIG/30015.

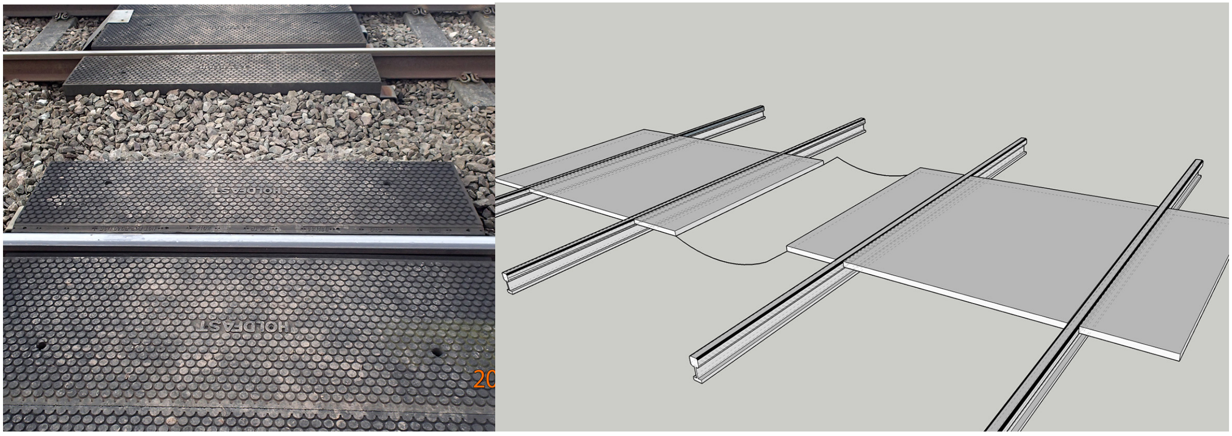

Figure 13: Crossing surface

104 Although the gap and drop in ballast height may have slightly increased the pedestrian's traverse time and directed his attention to the ground, there is no evidence to suggest that this was a factor in this accident.

Traverse time calculation

105 **The RAIB's view is that the traverse time calculated in the narrative risk assessment did not follow the guidance provided by Network Rail and the ORR.**

106 The pedestrian crossing speed used in the narrative risk assessment to calculate the traverse time is 1.189 metres/second (paragraph 48). This speed is recommended in Network Rail's guidance where a crossing deck is provided. At Tibberton No. 8 footpath crossing, the crossing deck provided only covers 5.6 metres of the 9 metres distance from decision point to decision point. For the areas not covered with a crossing deck, it might have been more appropriate to use the lower crossing speed of 1.006 metres/second, also quoted in Network Rail's guidance, for pedestrians (where a deck is not provided)[33]. This would have the effect of increasing the traverse time.

107 Guidance from the ORR in Railway Safety Publication 7 also suggests that the traverse time when calculated should be increased for stepping up on the deck and stepping down. This was not included in the calculation of the traverse time in the narrative risk assessment.

108 Finally, the narrative risk assessment assumes that the decision points are at 2 metres from the nearest running rail on both sides of the railway. Guidance from the ORR is that the decision point is a point where guidance on crossing safely is visible. At Tibberton No. 8 footpath crossing, the guidance on how to cross safely is provided by the 'Stop, look, listen' sign. Someone standing at a point where this guidance is visible is approximately 3 metres from the nearest running rail. This increase in distance would also have the effect of increasing the traverse time.

[33] Rail Safety Publication 7 uses slightly different walking speeds of 1.2 metres/second and 1 metre/second.

Response to a railway emergency call

109 **The driver of train 1M29 did not bring his train to a stop following the railway emergency call.**

110 Upon hearing the railway emergency call initiated by the accompanying driver on train 1V05 (paragraph 26), the driver of train 1M29 reduced the speed of his train to approximately 35 mph (56 km/h). He realised that the accident referred to in the emergency call was at the crossing he had just passed, and got engrossed in his thoughts, forgetting to bring his train to a stop as required by the Rule Book[34]. This had no effect on the outcome of this accident, but could have done in different circumstances.

Previous occurrences of a similar character

111 The RAIB has previously investigated a fatal accident at Barratt's Lane No. 1 footpath crossing where fog was the main causal factor (see RAIB report 13/2006). There was no recommendation made as a result of that investigation.

112 The fatal accidents at Leys Lane and Riverside crossings (paragraph 97) were the subject of preliminary examinations by the RAIB. In both cases, based on the circumstances of the accident, the RAIB decided not to carry out a full investigation.

[34] GE/RT8000-TW1 –Section 39.6 – Railway emergency group call (REC).

Summary of conclusions

Immediate cause

113 The pedestrian, unaware of the approaching train, started to cross the railway when there was insufficient time for him to get to a position of safety on the other side (paragraph 58).

Causal factors

114 The causal factors were:

a) Because of the fog, the approaching train was not visible until it was three to four seconds away from the crossing (paragraph 62, no recommendation).

b) Regardless of the weather conditions, the approaching train could not be heard until it was three to four seconds away from the crossing (paragraph 68, no recommendation).

c) The risk associated with foggy weather conditions had not been mitigated at this crossing (paragraph 83, **Recommendation 1**).

Underlying factor

115 Network Rail was not actively managing the risk associated with fog at its passive crossings (paragraph 95, **Recommendation 1**).

Additional observations

116 Although not linked to the accident on 6 February 2019, the RAIB observes that:

a) The crossing surface installed in 2012 did not comply with the requirements of the standard applicable at the time (paragraph 101, **Learning point 1**).

b) The RAIB's view is that the traverse time calculated in the narrative risk assessment did not follow the guidance provided by Network Rail and the ORR (paragraph 105, **Learning point 2**).

c) The driver of train 1M29 did not bring his train to a stop following the railway emergency call (paragraph 109, **Learning point 3**).

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

117 On 8 February 2019, Network Rail conducted a reactive risk assessment in response to the accident, in accordance with its processes (paragraph 37). The ALCRM score for Tibberton No. 8 footpath crossing remained a C-6 but its ACLRM risk level increased to 0.000265 FWI/year. A 9-day census was undertaken which concluded that the number of users of the crossing is on average 5 per day (instead of 1 to 2 in the original narrative risk assessment).

118 Network Rail has confirmed that it has prioritised the installation of a continuous crossing surface at Tibberton No. 8 footpath crossing, to take place during control period 6 (which runs from 2019 to 2024).

119 Network Rail has indicated that its tri-annual upgrade project of ALCRM is nearing completion. The project started in June 2017 and is due to be completed by December 2019. The project included a review of the algorithms underpinning ALCRM. Network Rail confirmed that fog is still not coded into the updated algorithms underpinning ALCRM.

Background to the RAIB's recommendations

120 In 2015, Network Rail published a level crossing strategy document[35] in which it stated its intention to make all passive crossings 'active' and to prioritise the elimination of passive crossings on high speed lines. It committed to equip all existing passive crossings with automatic user-based warning systems by 2039. Network Rail reports that it is in the process of publishing a revised version of this strategy document and that the time-bound commitment to equip all existing passive crossings with automatic user-based warning systems has been removed.

121 In the light of this, the RAIB has elected to make recommendations to Network Rail to improve its existing processes for managing safety at its passive level crossings.

[35] 'Transforming level crossings 2015 – 2040, a vision-led long term strategy to improve safety at level crossings on Great Britain's railways'

Recommendation and learning points

Recommendation

122 The following recommendation is made[36]:

1 *The intent of this recommendation is for Network Rail to understand the risk to crossing users presented by fog at passive level crossings and to ensure that the risk to an individual using a passive level crossing in fog is acceptably low.*

Network Rail should analyse and evaluate the risk of fog affecting the safe use of those passive level crossings where users are entirely reliant on the sighting of trains. This analysis should take into account regional and local variation of the likelihood of fog, its potential impact on visibility and the effectiveness of any existing mitigation measures. Network Rail should then use the output of this evaluation to develop and implement a strategy to adequately mitigate the effects of fog at passive level crossings (paragraphs 114c and 115). This strategy should include the development and provision of:

- guidance for level crossing managers on how to identify crossings at which fog is a reasonably foreseeable risk;
- a range of possible mitigation measures to make crossings safe to use in fog (this may involve other railway parties such as the Rail Delivery Group);
- a methodology for prioritising level crossings on the basis of the risk arising from fog at the crossing; and
- a timebound plan for the implementation of the appropriate mitigation measures at the prioritised crossings.

Learning points

123 The RAIB has identified the following learning points[37]:

1. Level crossing designers and level crossing managers are reminded that, in accordance with Network Rail's standard NR/L2/SIG/30015, crossing surfaces should be level with the head of the rail, without tripping hazards and gaps greater than 10 mm and constructed from a single type (where track layout permits) (paragraph 116a).

2. Level crossing managers are reminded that the 1.2 metres/second crossing speed quoted in Railway Safety Publication 7 can only be used where the crossing surface is level and close to the rail level. The calculated traverse time should also be increased to account for stepping up or down from the ballast onto the crossing deck (paragraph 116b).

3. Train drivers are reminded that, in accordance with Rule Book GE/RT8000 - TW1 section 39.6, they are required to bring their train to a stop immediately upon receiving a GSM-R railway emergency call (paragraph 116c).

[37] '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 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.

Appendices

Appendix A - Glossary of abbreviations and acronyms

ALCRM	All Level Crossing Risk Model
CCTV	Closed-Circuit Television
FFCCTV	Forward Facing Closed-Circuit Television
FWI	Fatalities and Weighted Injuries
LCM	Level Crossing Manager
ORA	Operations Risk Advisor
ORR	Office of Rail and Road
RLCM	Route Level Crossing Manager
RSSB	Rail Safety and Standards Board

Appendix B - Investigation details

The RAIB used the following sources of evidence in this investigation:

- information provided by witnesses;
- information provided by Network Rail;
- information taken from the train's on-train data recorder;
- closed-circuit television (CCTV) recordings taken from the trains involved;
- site photographs and measurements;
- weather reports and observations at the site;
- a report into acoustic measurements made at Tibberton No. 8 footpath crossing on 3 April 2019; and
- a review of previous RAIB investigations that had relevance to this accident.

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