RAIB

Rail Accident Investigation Branch

Rail Accident Report

Pedestrian struck by a train at Lady Howard footpath and bridleway crossing, Surrey, 21 April 2022

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This investigation was carried out in accordance with:

- the Railway Safety Directive 2004/49/EC
- the Railways and Transport Safety Act 2003
- 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.

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 RAIB has described a factor as being linked to cause and the term is unqualified, this means that 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 RAIB is less confident about the existence of a factor, or its role in the causation of the accident or incident, RAIB will qualify its findings by use of words such as 'probable' or 'possible', as appropriate. Where there is more than one potential explanation 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 RAIB, expressed with the sole purpose of improving railway safety.

Any information about casualties is based on figures provided to 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. 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.

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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Summary

At about 14:49 hrs on Thursday 21 April 2022, a pedestrian was struck and fatally injured by an out-of-service passenger train at Lady Howard footpath and bridleway crossing, near Ashtead in Surrey. The pedestrian, who was walking on the crossing with a dog and pushing a wheeled trolley bag, started to cross the railway tracks shortly after a train had passed. She was struck by a second train, which was travelling in the opposite direction to the first. The driver of the train involved in the accident sounded the train's horn on seeing the pedestrian on the crossing. The pedestrian responded by hurrying forwards towards the exit of the crossing, but was unable to get clear of the path of the train in time to avoid being struck.

RAIB's investigation found that the pedestrian was apparently unaware that the second train was approaching when she made the decision to cross; there is no evidence that she was aware of it and/or had misjudged the time available to cross. This was because, although the pedestrian looked twice in the direction of the second train before starting to cross, the front of this second train was hidden behind the first train, which was moving away on the line nearest to her. RAIB also found it was possible that the pedestrian did not perceive the risk arising from the possibility that the first train was hiding another approaching train.

A probable underlying factor was that Network Rail had not provided any effective additional risk mitigation at the crossing, despite having previously deemed the risk to users to be unacceptable. Network Rail had planned to install miniature stop lights at the crossing, but complexities with the technology required at this location meant that this solution was not ready for implementation before the accident occurred. There is little evidence that Network Rail considered effective options to mitigate the risk on an interim basis while this solution was progressed, although they fitted additional warning signs for users and a camera to monitor crossing use.

As a result of this investigation, RAIB has made two recommendations, both to Network Rail. The first is intended to address the risk to pedestrians at crossings of this type arising from a second approaching train being hidden from view by another train. The second recommendation concerns the implementation of appropriate interim risk mitigations at level crossings that are awaiting long-term solutions.

Introduction

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

The accident

Summary of the accident

3 At about 14:49 hrs on Thursday 21 April 2022, a pedestrian was struck and fatally injured by an out-of-service passenger train at Lady Howard footpath and bridleway crossing, near Ashtead in Surrey (figure 1). The train was recorded as travelling at about 62 mph (100 km/h) at the time of the accident.

4 The pedestrian, who was walking with a dog and a wheeled trolley bag, had started to cross the railway tracks shortly after a previous train had passed the crossing in the opposite direction to the train involved in the accident.

5 The driver of the train involved in the accident sounded the train's horn upon seeing the pedestrian on the crossing. The pedestrian responded to the warning by hurrying forwards towards the exit of the crossing, but did not reach a point that was clear of the train's path before it arrived at the crossing.

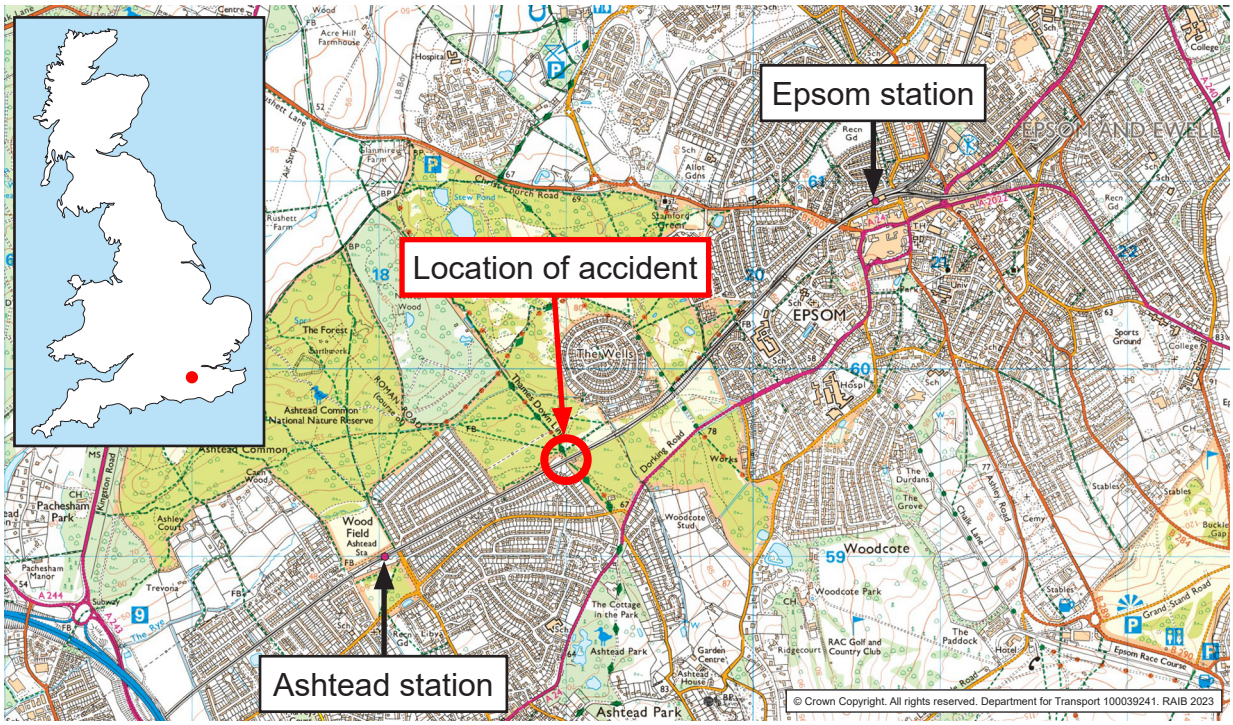

Figure 1: Extract from Ordnance Survey map showing location of accident at Lady Howard crossing.

Context

Location

6 Lady Howard crossing is situated in Surrey, between the stations at Epsom (1.3 miles (2.1 km) away) and Ashtead (0.7 miles (1.1 km) away). The line is used by South Western Railway trains running from London Waterloo to Guildford and Dorking, as well as Southern trains from London Victoria to Horsham. The crossing is 15 miles 43 chains[1] from a datum point at London Waterloo measured via Worcester Park.

[1] A unit of length equal to 66 feet or 22 yards (around 20 metres).

7 The railway at this location runs broadly north-east to south-west and comprises two tracks, known as the up and down Portsmouth lines (towards and away from London respectively; figure 2). An electrically live conductor rail, energised at 750 V DC, is located adjacent to each track to provide power to trains. The maximum permitted speed for trains travelling in either direction over the crossing is 60 mph (97 km/h). Signalling in this area is controlled from Wimbledon Area Signalling Centre.

8 The crossing itself is part of a footpath and bridleway linking Craddocks Avenue in Ashtead (around 350 metres to the south-east of the crossing) to Ashtead Common on the north-west side of the railway.

Figure 2: Google Earth view of the crossing.

Organisations involved

9 Network Rail is the owner and maintainer of the railway infrastructure at the location of the accident, which includes Lady Howard crossing and the land inside and including the boundary fences. It also employed the staff responsible for gathering data about the crossing and for assessing and managing its safe use (see paragraphs 27 and 28). Lady Howard crossing falls within Network Rail's Wessex route on its Southern region.

10 Govia Thameslink Railway, under its Southern brand, operated the train involved in the accident as well as the train that passed the crossing in the opposite direction just before the accident. It also employed the drivers of both trains.

11 Network Rail and Govia Thameslink Railway freely co-operated with the investigation.

The level crossing

12 In common with many footpath and bridleway crossings (see paragraph 13), Lady Howard crossing does not have any active protection, such as lights, to warn of approaching trains, or barriers to restrict access over the crossing. Crossing users on foot are expected to stop, look and listen for approaching trains, and to make their own decision about whether or not it is safe to cross. Telephones and instructions are provided for equestrian users to contact the signaller to ask permission before crossing. This is because the railway perceives that there is an additional risk involved in taking horses over a crossing of this type and the mitigation of this risk involves the signaller checking whether any trains are approaching the crossing before giving permission to cross.

13 Nationally, at the time of writing, there are 1336 crossings of the same type as Lady Howard (as described in paragraph 12) on Network Rail's infrastructure. On the Wessex route, there are 154 such crossings, out of a total of 315 level crossings.

14 On each side of Lady Howard crossing, users enter through a latched gate that opens towards the railway. The gate leads users through the railway boundary into a corridor laid with an asphalt surface. This corridor is enclosed with metal fencing, approximately 1.25 metres tall. Signs at each gate warn users of the following:

- to 'Stop, Look, Listen – Beware of trains'
- that cyclists should dismount
- that people in charge of animals should telephone the signaller before crossing
- that users should remove their headphones before crossing
- not to touch the live rail
- not to trespass on the railway
- that there have been several near fatalities at this crossing.

At the time of the accident, some of these signs had been painted with graffiti (figure 3).

15 RAIB measured the fenced corridor inside the gate on the Ashtead Common side of the crossing (the approach used by the pedestrian involved in the accident) to be 4.5 metres long. This ends with a white line painted on the asphalt surface 2 metres from the nearest rail of the up Portsmouth line (figure 4). This white line, known as the 'decision point', is the notional point at which users on foot are expected to make a decision as to whether or not it is safe to cross the railway. For crossing users with horses, Network Rail uses a decision point 3 metres from the nearest rail, although this point is not marked on the ground.

16 At the marked decision point, the metal fencing opens out in both directions along the railway. RAIB measured the sighting distances (the distances at which approaching trains can be seen by crossing users) in each direction at this point. On the Ashtead Common side, a user standing at the decision point can see for around 440 metres in the direction towards Epsom (the direction from which the train involved in the accident approached). Beyond this point the railway curves to the left from the observer's point of view (figure 5 and figure 6). In the other direction, the railway is straight and users can see for at least 1000 metres to Ashtead station.

Figure 3: The entrance to Lady Howard crossing, approaching from Ashtead Common (the direction of the pedestrian at the time of the accident).

Figure 4: Inside the gate at Lady Howard crossing showing the decision point, approaching from Ashtead Common.

Figure 5: View from the decision point on the Ashtead Common side of Lady Howard crossing, looking towards Epsom.

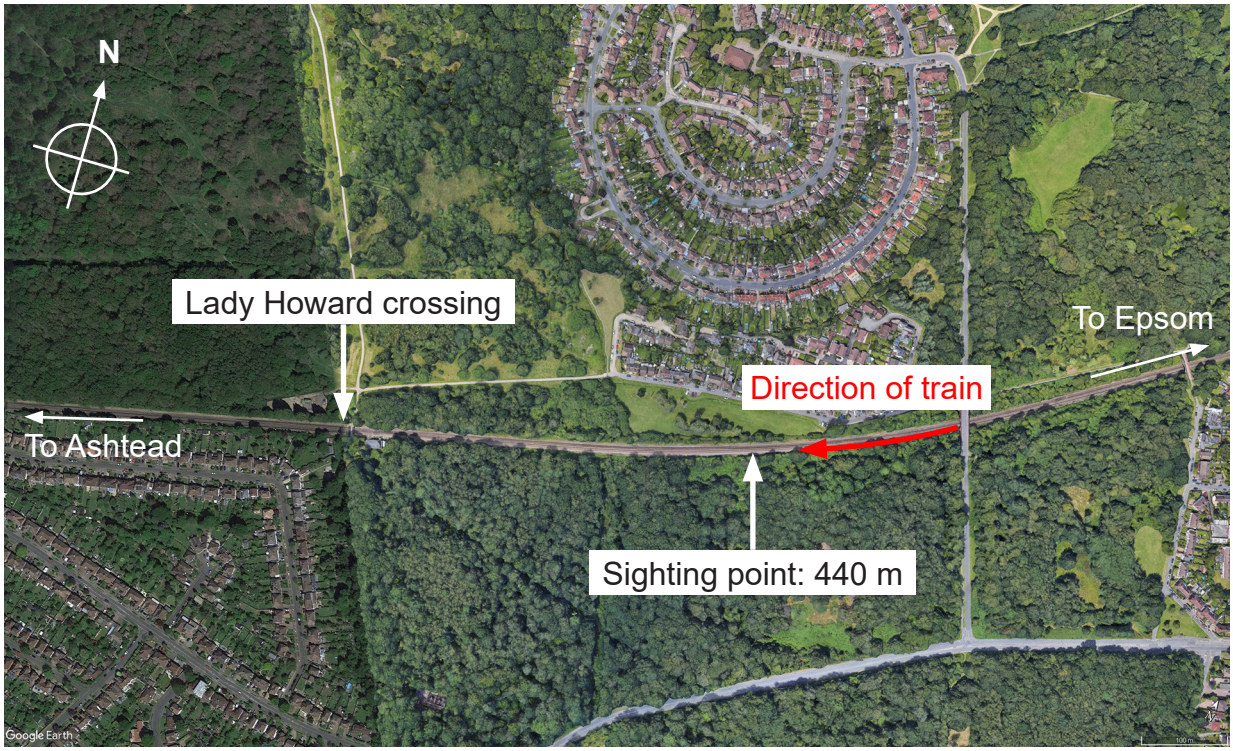

Figure 6: Google Earth view of the location, showing the crossing and the left-hand curve in the direction towards Epsom.

17 The distance between the two decision points (located 2 metres from the nearest rail on each side of the crossing) is known as the 'traverse distance'. RAIB measured this distance to be 9.3 metres. Because Lady Howard is also a bridleway crossing, Network Rail's measurement of the traverse distance starts at the decision point 3 metres from the nearest rail (paragraph 15) and ends 2 metres beyond the farthest rail. Network Rail measured the traverse distance to be 10.2 metres, which is comparable to RAIB's measurement (accounting for the additional metre).

18 Network Rail uses the traverse distance to calculate the amount of time it takes a user to cross. Network Rail uses a defined walking speed of 1.189 m/s for this calculation which, in some instances (including at Lady Howard crossing), is reduced by 50% to allow for vulnerable users (such as families with young children, dog walkers, or the elderly, who may walk slower). Including this 50% allowance results in a traverse time of 12.87 seconds. This is therefore the minimum required sighting time in each direction for trains approaching the crossing at the maximum permitted speed on the line (in this case, 60 mph or 97 km/h). A train at that speed will cover 345 metres in that time; hence, this is the minimum sighting distance that users require to decide if it is safe to cross.

19 Because the actual sighting distance exceeds the required sighting distance on both sides of Lady Howard crossing (440 metres towards Epsom and over 1000 metres towards Ashtead), there is no requirement for the crossing to be fitted with any type of additional protection that may be used for reduced sighting distances, such as a whistle board instructing train drivers to sound the train horn on the approach to the crossing.

20 Network Rail's most recent risk assessment (see paragraph 57) for Lady Howard crossing before the accident (dated October 2021) noted that an average of 201 users and 225 trains per day passed over the crossing. Users were identified as mainly being recreational, using the crossing to access Ashtead Common.

21 Network Rail assesses the risk of all its level crossings on two criteria. These are:

- the risk to an individual user of the crossing (rated from A to M, where A is the highest risk)
- the total, collective risk of harm to crossing users and those on board trains (rated from 1 to 13, where 1 is the highest risk).

The October 2021 risk assessment for Lady Howard crossing rated it as B2, ranking it the sixth highest risk footpath crossing on the Wessex route.

22 The October 2021 risk assessment documented six near misses at the crossing between 28 March 2019 and 29 March 2021 and one fatality on 9 August 2019, which Network Rail recorded as a deliberate act. The October 2021 risk assessment also recorded that Network Rail installed a motion-activated camera at the crossing, in response to a number of incidents that it classified as deliberate misuse.

Trains involved

23 The train involved in the accident, reporting number 5Z56, was the 14:05 hrs empty coaching stock movement (a train movement without passengers) from Selhurst depot to Dorking down sidings. It was a class 377 train formed of 10 coaches. The train was fitted with an on-train data recorder (OTDR) but not with forward-facing CCTV (FFCCTV) cameras.

24 The train which passed the crossing just before the accident, reporting number 1I37, was the 14:14 hrs passenger service from Horsham to London Victoria. It was also a class 377, formed of 8 coaches. This train was fitted with an OTDR as well as an FFCCTV camera, but not a camera looking behind the train. This means that there was no rearward-facing CCTV evidence available.

People involved

25 The pedestrian was an 85-year-old female from Hampton, south-west London. Her eyesight prescription showed that she had a mild astigmatism (a cause of blurred vision that can be corrected with glasses or contact lenses), but good distance vision. She also used a hearing aid and, while her mobility was good, the trolley she used was described to RAIB as also acting as an aid to standing. Although RAIB could not establish with certainty whether the pedestrian was familiar with the crossing, the circumstances suggest that, while she was unlikely to have used it regularly, it is possible that she had used it before.

26 The driver of train 5Z56 was based at Selhurst depot and had worked for Southern since November 2001. His competence assessments were up to date with positive feedback about his performance and no reported issues of concern.

27 The level crossing manager (LCM) with responsibility for Lady Howard crossing had worked for Network Rail since 2000, with the exception of one year working for a train operator. He had worked as an LCM in this area since 5 November 2018. Lady Howard was one of around 48 crossings that fell within his area of responsibility.

28 The route level crossing manager (RLCM) for Wessex route, to whom the LCM reported, joined Network Rail in 2003 and began managing level crossings about two years later. He had been RLCM for about 10 years and, at the time of the accident, managed a team of five LCMs. Since the accident (but not as a response to it), Network Rail's Wessex route has restructured the organisation of these roles, and the RLCM now works at a regional level.

External circumstances

29 The weather at the time of the accident was sunny and warm, about 18°C, with clear visibility. The sun was to the right of the pedestrian as she approached the crossing (in the direction towards Ashtead), the same direction from which the train that passed the crossing just before the accident approached. It is possible that the sunlight played a role in the accident (see paragraph 46).

The sequence of events

Events preceding the accident

30 At around 14:33 hrs on the day of the accident, Network Rail's camera at Lady Howard crossing recorded the pedestrian using the crossing for the first time that day. The pedestrian was walking towards Ashtead Common with a dog and a wheeled trolley bag.

31 At 14:49:06 hrs, the front of train 1I37 passed over Lady Howard crossing, travelling towards Epsom on the up Portsmouth line (from right to left when viewed from the Ashtead Common side of the crossing) at a speed of approximately 50 mph (80 km/h). As the train passed the crossing, its FFCCTV system recorded the pedestrian standing, stationary, waiting inside the boundary gate on the Ashtead Common side of the crossing, about 1.9 metres back from the white line marking the decision point and looking towards the oncoming train. The field of view of the camera at the crossing also showed the dog waiting stationary while train 1I37 passed the crossing.

32 Around one second after the front of train 1I37 passed the crossing, the front of train 5Z56 emerged round the curve on the down Portsmouth line. Train 5Z56 was about 440 metres from Lady Howard crossing at that time, travelling from the Epsom direction, and would have been visible from the crossing. After about 6 seconds, from the point of view of someone standing on the Ashtead Common side of the crossing, the front of the approaching train 5Z56 would have been obscured behind train 1I37 as it moved away.

33 Less than one second later, the rear of train 1I37 had cleared Lady Howard crossing, and the pedestrian started to move towards the decision point. The camera at the crossing showed that she briefly turned her head to the left as she started to move forwards and did so again as she crossed the decision point. During both of these glances, the front of train 5Z56 would have been hidden behind train 1I37. The pedestrian crossed the decision point about 4 seconds after train 1I37 had cleared the crossing.

Events during the accident

34 Around one second after the pedestrian crossed the decision point, the front of train 5Z56 emerged from behind train 1I37 and would have been visible from the crossing. The crossing would also now have been visible from the driving cab of the train. At this point, OTDR evidence shows that train 5Z56 was travelling at 62 mph (100 km/h) and that it was about 130 metres, or approximately 4.7 seconds, from the crossing. CCTV evidence from the crossing shows that the pedestrian was at that point moving across the up Portsmouth line, and that she was looking down and ahead.

35 Approximately 2.7 seconds later, the driver of train 5Z56 sounded the train's horn. The pedestrian, by now about to cross the down Portsmouth line, responded by looking to her left and starting to hurry across this line towards the exit of the crossing. The collision occurred at about 14:49:24 hrs.

Events following the accident

36 The pedestrian sustained injuries that were immediately fatal. The driver applied the emergency brake just over one second after the collision, and the train subsequently stopped about 315 metres beyond the crossing. The driver used the GSM-R (Global system for mobile communications – railway) train radio system to report the accident to the signaller and subsequently reported it to his employer.

37 Emergency services and Network Rail staff attended the scene from around 15:20 hrs. The driver was authorised to take the train on to Ashtead station where he was relieved, and another driver returned the train to Selhurst depot.

Analysis

Identification of the immediate cause

38 The pedestrian crossed into the path of train 5Z56 as it approached.

39 The FFCCTV footage from train 1I37 and images from the CCTV camera at the crossing (paragraph 22) showed that the pedestrian had waited for train 1I37 to pass the crossing, and that she then crossed behind it, having looked twice to her left before passing the decision point. The pedestrian did not look again to her left until she heard the horn of train 5Z56, after which she attempted to hurry to the other side of the crossing.

40 RAIB determined that the driver's reaction time in sounding the horn after seeing the pedestrian, which at most was about 2.7 seconds, was within the bounds of an appropriate response based on research[2] into car drivers' reaction times. Furthermore, if the driver had applied the train's emergency brake instead of (or as well as) the horn, it would have had no effect on the train's speed before the accident because the nature of the train's braking system means that there is a delay of about 3 seconds between applying the brakes and the beginning of deceleration. Finally, the apparent discrepancy between the train's speed of 62 mph (100 km/h) as recorded on the OTDR on approach to the crossing, and the maximum permitted speed on that line of 60 mph (97 km/h), is within the margin of tolerance allowed in rail industry standards.[3]

Identification of causal factors

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

a. The pedestrian was apparently unaware that train 5Z56 was approaching when she made the decision to cross (paragraph 42).

b. The pedestrian did not perceive the risk arising from the possibility that the passing train was hiding another train (paragraph 48). This is a possible causal factor.

Each of these factors is now considered in turn.

Awareness of the train

42 The pedestrian was apparently unaware that train 5Z56 was approaching when she made the decision to cross.

43 Based primarily on the CCTV evidence from the camera at Lady Howard crossing (paragraph 22), RAIB has concluded that the pedestrian had probably neither seen nor heard the approach of train 5Z56 when she started to cross. There is no evidence to suggest that she was aware of this second train when she made the decision to cross, or that she was aware of it but had misjudged the time available to cross safely.

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[2] Coley, G., Wesley, A., Reed, N. & Parry, I. (2009). Driver reaction times to familiar but unexpected events. TRL Report 313.

[3] RIS-2273-RST 'Post Incident and Post Accident Testing of Rail Vehicles', issue 2, December 2017.

44 RAIB created a computer model of the two trains passing at the crossing, to determine what may or may not have been visible to the pedestrian at the two points when she looked to the left, towards the approaching train 5Z56 (paragraph 35). The model was based on the OTDR evidence from both trains, FFCCTV footage from train 1I37, footage from the CCTV camera at the crossing, and RAIB's survey data for the crossing. Because the OTDR and CCTV data sources are not synchronised, and must be cross-referenced manually, there is a small level of inaccuracy (fractions of seconds) possible with this kind of analysis. However, RAIB has determined that the conclusions which follow reflect the best available evidence.

45 When the pedestrian looked twice to the left, the front end of train 5Z56 (which is the most conspicuous part of the train, being painted yellow and displaying headlights) was hidden behind train 1I37, which was receding from the crossing. The front end of train 5Z56 did not re-emerge from behind 1I37 until after the pedestrian had started to cross. Although it may have been possible for the pedestrian to have seen the side of train 5Z56 in the gap beyond train 1I37 and before the railway curved to the left out of view, it would have appeared very small at that distance and not particularly conspicuous (figure 7). This is in part because the green and white painted livery of the train would have provided relatively low contrast against the background of green vegetation.

46 The pedestrian was wearing prescription sunglasses and had been facing towards Ashtead just before crossing, in the direction of the approaching train 1I37. In that position and at that time of day, she was almost directly facing the sun. When she turned to look towards the left, there may have been some after-effects of facing the sun that could have reduced her sensitivity to contrast, and this may have been further attenuated by the sunglasses. However, the predominant factor affecting the pedestrian's ability to see the oncoming train 5Z56 was the presence of train 1I37 as it moved away from the crossing. This would have been much more conspicuous and largely hid the approaching train, 5Z56, from view.

Figure 7: Computer-generated reconstruction of the view from the pedestrian's perspective looking to her left as she started moving towards the crossing.

47 The driver of train 5Z56 did not, nor was he required to, sound the train's horn on the approach to the crossing, until a few seconds before the accident when he reacted to seeing the pedestrian ahead. In the absence of a train horn, the noise generated by an electric train at distance is relatively inconspicuous, and again would have been masked by the similar noise being produced by train 1I37, which was closer. The pedestrian also used a hearing aid, although her prompt response to the train's horn when it sounded just before the accident indicates that she was able to hear this warning.

Perception of risk

48 The pedestrian did not perceive the risk arising from the possibility that the passing train was hiding another train. This is a possible causal factor.

49 Among the signage at the crossing is an instruction for users to 'Stop, Look, Listen – Beware of trains'. The CCTV evidence shows that the pedestrian did stop for the first train passing the crossing (1I37) and then looked twice to the left before starting to cross.

50 When the pedestrian took the second glance, as she passed the decision point, RAIB calculated that the rear of train 1I37 was around 100 metres beyond the crossing. RAIB has also concluded that, at that point, it is more likely than not that the pedestrian would have been looking towards her left for oncoming trains on the down Portsmouth line to the right of, rather than beyond the front of train 1I37 and into the diminishing gap between it and the curve of the railway line.

51 Visibility past the trailing end of train 1I37 towards the down Portsmouth line would have been greater than 100 metres (figure 8). Given the extent of the visibility available to the pedestrian, it is possible that she decided that this was sufficient distance to be able to safely traverse the crossing, not realising that a train travelling at the maximum permitted speed of 60 mph (97 km/h or 27 m/s) could cover the visible distance in around 4 seconds. At the time of the accident, there were no warnings at the crossing to alert users to this risk.

Figure 8: Computer-generated reconstruction of the view from the pedestrian's perspective looking to her left as she crossed the decision point.

Identification of underlying factor

Risk management

52 Network Rail had not provided any effective additional risk mitigation at the crossing despite having deemed the risk to be unacceptable. This is a probable underlying factor.

Background information

53 The Office of Rail and Road (ORR), the safety authority and economic regulator for Britain's railways, has set out principles and guidance for managing level crossing safety in a document[4] published in June 2021. This document includes guidance that states '*It is essential that decisions and options for level crossing control measures are informed by a suitable and sufficient assessment of the risks*'.

54 Under health and safety law, duty holders (in the case of this crossing, Network Rail) are required to reduce the level of risk so far as is reasonably practicable. Options for controlling the risk should be considered according to the hierarchy of prevention.[5] Eliminating the risk (such as through closure of the level crossing) should be the first consideration, followed by engineering controls (for instance, technologies providing an active warning system), and finally administrative controls (such as signage and instructions).

55 Deciding what is reasonably practicable is a matter of judgement for each duty holder but, given the risks to railway staff, passengers and members of the public, the ORR guidance document states that risk control measures should be deemed reasonable unless the cost of the measure is grossly disproportionate to the risk. This can be determined by using a cost-benefit analysis as part of the risk management process.

56 The ORR guidance document also includes a principle which states:

> *'User Principle 6: Provide a suitable warning for users that a train is approaching to enable them to be in a safe place before a train passes. To help you achieve this, you should consider, at least, these factors:*
>
> *(a) an active warning system in preference to relying on the user to determine whether or not a train is approaching the level crossing;*
>
> *(b) user behaviours and actions in relation to the operation of the level crossing, e.g. to prevent them from being trapped within a closed crossing or starting to cross when it is unsafe to do so;*
>
> *(c) foreseeable actions of different users in a 'another train coming' scenario, these trains may be coming in the same or different directions; one may be inaudible and hidden from view…'*

57 Network Rail's process for managing risk at level crossings begins with an assessment by an LCM of the crossing. This includes measuring sighting distances and the traverse length and conducting a census of both users and trains over the crossing. The results of this assessment are entered into Network Rail's computer-based all level crossing risk model (ALCRM), which calculates a quantitative risk score for the crossing (paragraph 21).

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[4] https://www.orr.gov.uk/sites/default/files/2021-06/principles-for-managing-level-crossing-safety-june-2021_0.pdf

[5] The Management of Health and Safety at Work Regulations 1999, schedule 1.

58 The LCM uses the information from the site visit and the output from ALCRM to produce a written narrative risk assessment (NRA). The NRA documents their findings and, if the risks are deemed not to be as low as reasonably practicable, proposes options to mitigate the risk. The quantitative risk score from ALCRM is used to calculate a cost-benefit ratio for each of the proposed risk mitigations. The cost-benefit ratio is a whole-life calculation of how much each proposed measure costs[6] and by how much they are expected to reduce the risk. The LCM then uses their experience and professional judgement to supplement this calculation and determine whether the options are reasonably practicable to implement, considering qualitative factors associated with risk at the crossing as well as the results of any cost-benefit analysis.

59 The LCM submits the NRA and their risk mitigation option proposals to the RLCM, who reviews and (as appropriate) countersigns them. In Network Rail's Wessex route, the RLCM takes these options, along with those for other level crossings, to a four-weekly 'tactical group' meeting, which also involves the route's asset managers for signalling and scheme renewals. This tactical group takes decisions about which options are progressed, based on the available funding and the route level crossing strategy.

60 The latest level crossing strategy for Network Rail's Wessex route before the accident (dated January 2019) covers the period from 2019/20 to 2023/24. While the previous route strategy focused on closing level crossings where possible, the emphasis of the strategy in force at the time of the accident was on reducing risk through engineering solutions as part of upgrades or renewals, where closure is difficult or impossible. The strategy is supported by its own, ring-fenced budget which can only be used for level crossing risk reduction in accordance with the strategy. The ORR has made additional funds available which are prioritised towards risk reduction at user worked crossings (a type of level crossing typically providing vehicular access to private land).

61 Closing a crossing outright (that is, closing it without providing alternative access over the railway at that location) is not always viable because it can involve issues such as extinguishing legal rights of way, or the consequent increased risk on diversionary routes. The main alternative options to outright closure are to install a footbridge (which, for a bridleway crossing, needs to include ramps to provide access for people with reduced mobility or horse riders) or to install miniature stop lights (MSLs).

62 MSLs consist of red and green lights. The green light normally shows to users and indicates that the crossing is clear. But an approaching train automatically changes the light to red and sounds an audible alarm, to indicate that users must stop. Network Rail told RAIB that this alarm also includes a spoken warning which is triggered if another train is approaching the crossing soon after the first one has passed. This message states 'Warning – another train may be approaching'.

[6] In May 2022, Network Rail issued new guidance on these cost-benefit analyses, raising the threshold for what is considered reasonably practicable by stating that mitigations should be considered for implementation unless the costs are 'grossly disproportionate' to the benefits. This change was not made in response to this accident.

63 There are several types of MSL system that use different means to detect approaching trains, depending on the configuration of the crossing. In many cases, the MSL system can be installed independently of the main railway signalling system. This is known as an 'overlay' system. However, if the crossing is in a more complex location (such as near signals, points or stations), the MSL technology will have to be integrated with the signalling system, significantly increasing its cost and complexity.

64 Various MSL solutions have been pursued by Network Rail, and it stated that the development and approval of these products has been fraught with difficulties. Nevertheless, recent developments in technology have made it possible to install overlay MSL systems at crossings which would in the past have needed an integrated design. One such system, called 'Flex', was initially approved by Network Rail on 12 April 2021 for use in certain circumstances (including the layout at Lady Howard crossing), following trials at another crossing on the Wessex route.

65 Another option for mitigating level crossing risk is to install supplementary audible warning devices (SAWDs). Using radar to detect an approaching train, these devices play a synthesised recording of a train horn through a speaker at the crossing itself. Because the reliability of SAWDs does not meet Network Rail's standards for safety-critical systems, Network Rail considers them to be supplementary to an actual train horn. As such, SAWDs are only installed at crossings where whistle boards are provided, requiring the train driver to sound the horn because sighting distances are insufficient to provide the necessary warning time. The synthesised recording is triggered at about the same time as the sounding of the actual train horn.

Risk management at Lady Howard crossing

66 The latest NRA for Lady Howard crossing undertaken before the accident, dated October 2021, expressed concerns about vulnerable users and frequent misuse. The installation of additional signage (see paragraph 74) and the crossing camera (paragraph 22) were intended as short-term mitigation measures for these concerns. In the medium term, the NRA stated that installing MSLs was being progressed and, in the longer term, that Network Rail's aspiration was to close the crossing. However, in the meantime, the NRA stated that the risk was not considered to be as low as reasonably practicable. Similarly, the previous NRA in 2020 referred to the risk being 'unacceptable'.

67 The 2021 NRA considered four options to mitigate the risk. These were closure, a ramped (accessible) footbridge, a stepped footbridge, or MSLs. Although the cost-benefit calculations for closure and a stepped footbridge were positive, the LCM concluded that these options were not viable. This was because, if Lady Howard crossing was closed, its risk would be transferred to the nearby Craddocks Lane footpath crossing, about 380 metres towards Ashtead station. The LCM also considered that gaining the necessary consent and approval for a ramped bridge would be unlikely, due to the size of such a bridge taking it outside of Network Rail's land, and that a stepped footbridge would neither be accessible nor suitable for equestrian users.

68 The LCM therefore recommended installing MSLs, even though the cost-benefit ratio for this option was marginal.[7] RAIB has reviewed NRAs for Lady Howard crossing going back to 2017, and on each occasion the recommendation made was to install MSLs. The evidence available to RAIB indicates that Network Rail had approved and allocated funds for installing MSLs at Lady Howard crossing every year since at least 2017. However, the development of new MSL technology that would offer a solution at Lady Howard crossing has taken several years, so MSLs had not been installed at the crossing when the accident occurred on 21 April 2022.

69 Because there is a railway signal on the approach to the crossing, the site was not compatible with the simple MSL overlay system, and until recently a suitable alternative had not been available (paragraph 64). The approach taken by Network Rail's Wessex route was therefore to accept the level of risk at the crossing and defer implementation at complex sites such as Lady Howard crossing until a suitable solution (such as the Flex design) became available.

70 While waiting for these solutions, the route progressed the implementation of the simple overlay MSL system at sites where it was compatible. Twelve such sites were identified. These included one footpath crossing in Wiltshire, with the remainder being user worked crossings (following ORR's prioritisation by additional funding of these crossings; paragraph 60). At the time of writing this report, MSLs have been installed at three of the twelve crossings, including the footpath crossing.

71 Network Rail stated it has also faced issues in delivering MSLs at a national level. This is because many of the level crossings that were feasible for closure have already been closed, meaning that LCMs were frequently relying on MSLs as a risk mitigation. (RAIB has seen several examples of other NRAs, similar to those undertaken for Lady Howard, in which the options of closure or a footbridge are not deemed to be viable, leaving MSLs as the recommended solution.) This has created high demand for both the equipment and the resources to install the MSL systems and reduced their availability, thereby slowing delivery programmes.

72 The 2021 NRA for Lady Howard crossing also identified the 'second train coming' risk (sometimes referred to as 'another train coming'), in which an approaching train can be hidden by a passing train on the nearest line, as occurred in this accident. This risk is present on any railway with two or more tracks and increases with the frequency of train traffic, but it is almost impossible to determine where trains will actually pass each other. As with other NRAs seen by RAIB, while the risk is identified, it is not specifically addressed or controlled in the conclusions and proposed options, partly because there are few options available to mitigate this risk. Although MSLs may be effective at addressing the second train coming risk, these warnings may not entirely eliminate it, because they are dependent on users recognising the warning, understanding its significance, and then acting upon it. Recognition in particular may be affected if the user is hearing impaired or wearing headphones.

[7] RAIB reviewed the cost-benefit calculations and identified some inconsistencies in the analysis, which Network Rail was unable to resolve. Since these inconsistencies did not affect subsequent safety-related decision-making for Lady Howard crossing, RAIB determined that they were not causal to the accident. However, under different circumstances, these calculations may be pivotal to such decision-making.

Interim risk mitigations

73 Although Network Rail had recognised that the risk at Lady Howard crossing was unacceptable, and that a suitable mitigation solution was not yet available, there is little evidence that alternative options were considered as an interim measure to reduce risk to crossing users.

74 Network Rail had implemented some mitigations at Lady Howard crossing, but these did not prevent the accident on 21 April 2022. Between August 2019 and July 2020, Network Rail installed additional signs at Lady Howard crossing, which were intended to raise awareness of the risks of near misses and to warn users to remove headphones before crossing (figure 3). The 2021 NRA also recorded the installation of the motion-activated camera, primarily to monitor misuse of the crossing. These signs and the camera were in place at the time of the accident.

75 Train drivers are not required to sound the horn at Lady Howard crossing because the sighting affords sufficient warning time to be able to cross safely (paragraph 19). There is no evidence that this was considered as an interim mitigation before the accident occurred. Network Rail is mindful of the noise pollution associated with train horns, particularly in residential neighbourhoods. In the absence of a requirement to sound the train horn, Network Rail also considers SAWDs to be unsuitable because they are only intended to be supplementary to the train horn (paragraph 65).

76 In other locations on Network Rail's infrastructure, temporary speed restrictions have been applied as an interim risk mitigation for level crossings, as slowing trains down increases the warning time for crossing users. These are usually used to mitigate the risk of insufficient sighting at the crossing, for example, due to foliage growth reducing a crossing user's view. Although it cannot be known for certain what effect a temporary speed restriction would have had on this particular accident, it is possible that it would reduce the likelihood of a user being struck.

77 There is no evidence that speed restrictions were considered as an interim mitigation for the risks at Lady Howard crossing despite the risk at the crossing being deemed unacceptable (paragraph 66). While it is not clear why speed restrictions were not considered as a mitigation measure, Network Rail stated to RAIB that the introduction of speed restrictions to address the second train coming risk could potentially extend to a large number of crossings and cause very significant disruption to railway operations.

Previous occurrence of a similar character

78 At about 08:24 hrs on 1 May 2019, the driver of the 07:25 hrs passenger service from London Victoria to Horsham reported a near miss with a pedestrian with a bicycle at Green Lane footpath crossing, about 0.5 miles (0.8 km) south-west of Ashtead. The latest NRA for Green Lane (dated April 2022 and carried out by the same LCM that undertook the assessment at Lady Howard crossing) recorded that the pedestrian walked out from behind another passing train.

79 The NRA recorded the risk rating for Green Lane as C2 and stated that this ranked it as the second highest risk of all footpath crossings on the Wessex route. The LCM concluded that the risk was not tolerable or as low as reasonably practicable. As with the NRA for Lady Howard, the NRA for Green Lane also identified the 'second train coming' risk, highlighting that this risk is exacerbated by the use of longer 10- and 12-coach trains on this line and the frequency of the train service. As with Lady Howard crossing, no specific mitigations to address this risk were identified or implemented, although the LCM recommended that Green Lane crossing should be closed because of different circumstances relating to access rights over the crossing.

Summary of conclusions

Immediate cause

80 The pedestrian crossed into the path of train 5Z56 as it approached (paragraph 38).

Causal factors

81 The causal factors were:

a. The pedestrian was apparently unaware that train 5Z56 was approaching when she made the decision to cross (paragraph 42, **Recommendation 1**).

b. The pedestrian did not perceive the risk arising from the possibility that the passing train was hiding another train (paragraph 48, see paragraph 92 and **Recommendation 1**). This is a possible causal factor.

Underlying factor

82 Network Rail had not provided any effective additional risk mitigation at the crossing despite having deemed the risk to be unacceptable (paragraph 52, **Recommendations 1 and 2**). This is a probable underlying factor.

Previous RAIB recommendations relevant to this investigation

83 The following recommendations, which were made by RAIB as a result of its previous investigations, have relevance to this investigation.

Fatal accident at Gipsy Lane footpath crossing, Needham Market, Suffolk, 24 August 2011, RAIB report 15/2012, Recommendation 3

84 This recommendation read as follows:

Recommendation 3

The intent of this recommendation is for Network Rail to develop guidance for use by the level crossing teams on the circumstances under which short-term mitigation measures are to be implemented at level crossings that have insufficient sighting or warning of approaching trains.

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

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

85 Network Rail's response to this recommendation focused largely on developing guidance to identify and calculate the proportion of vulnerable users of its level crossings and producing guidance on interim risk mitigation for level crossings with deficient mitigation. On 9 June 2014, ORR reported to RAIB that it considered the recommendation to be implemented.

86 The relevance of this recommendation to the current investigation lies in the short-term risk reduction measures for level crossings with insufficient warning of approaching trains. Although sighting at Lady Howard was sufficient under normal circumstances, the causal factors of the accident were associated with insufficient warning of the second train. Therefore, recommendation 2 of this report takes a broader approach to interim risk mitigations at high-risk level crossings.

Fatal accident at Tibberton No. 8 footpath crossing, 6 February 2019, RAIB report 13/2019, Recommendation 1

87 This recommendation read as follows:

> *Recommendation 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. …

88 Network Rail's response focused on developing a tool to identify passive level crossings that were historically vulnerable to fog, and on including that tool within the NRA process. The response included consideration of MSLs to mitigate sighting deficiencies but noted the problems in deployment of a wider solution. Network Rail also engaged with industry about the possibility of using whistle boards as a further means of reducing risk where reduced visibility is known to occur.

89 On 6 December 2021, ORR reported to RAIB that it considered the recommendation to be implemented.

90 Although the recommendation concerned a causal factor associated with foggy weather conditions, the factor is analogous to the restricted sighting associated with the second train coming risk which led to the accident at Lady Howard crossing on 21 April 2022.

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

91 From 25 May to 1 June 2022, Network Rail posted staff at Lady Howard crossing for 12 hours a day over a period of seven days to talk to users about how to use the crossing safely. On 26 October 2022, Network Rail delivered a presentation to Ashtead Residents' Association about level crossing safety.

92 On 11 October 2022, Network Rail erected a poster on the approaches to Lady Howard crossing warning users that a passing train can obstruct the view of a train coming on the other line (figure 9). Network Rail told RAIB that the poster would remain in place until MSLs are installed at the crossing.

93 Network Rail is progressing the implementation of Flex MSLs at Lady Howard crossing, with a view to completion in February 2024. In the meantime, it has considered alternative measures, such as convex mirrors or installing SAWDs, but has considered these to be unsuitable. Convex mirrors could cause glare or distraction for train drivers, while Network Rail considers that SAWDs are inappropriate at crossings where whistle boards are not fitted (paragraph 65).

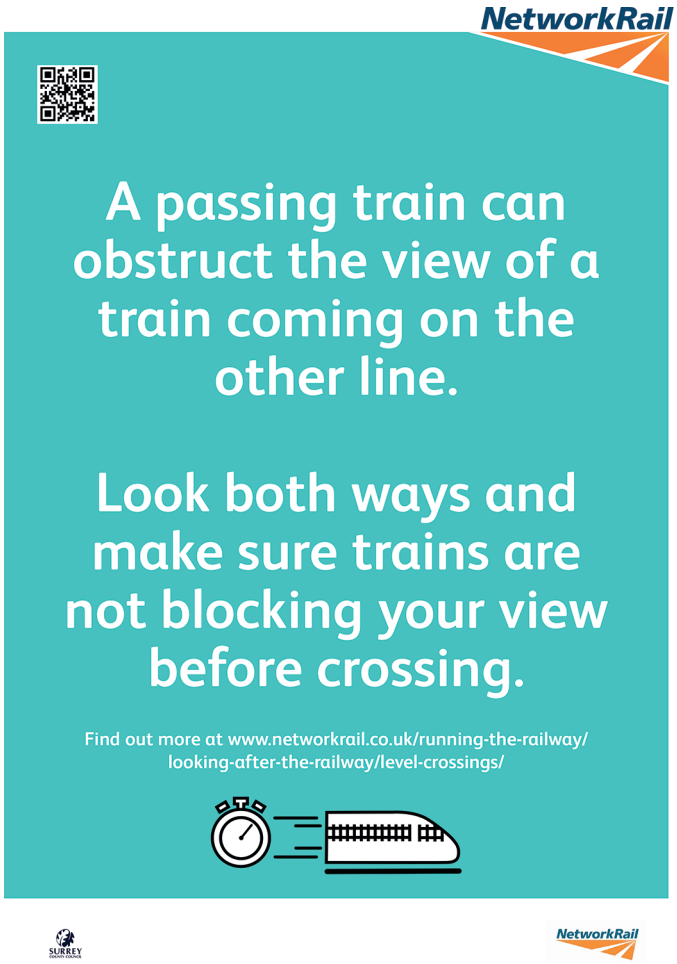

Figure 9: Design of the poster now in place at Lady Howard crossing (courtesy Network Rail).

Recommendations

94 The following recommendations are made:[8]

1 *The intent of this recommendation is to reduce the risk at footpath and bridleway level crossings of a second train approaching being hidden from the view of crossing users by a previously passing train.*

Network Rail should:

- use its existing risk assessment data to identify those footpath and bridleway crossings that present the highest risk to users of a second train approaching being potentially hidden by another train
- at those crossings identified as presenting the highest risk, implement appropriate measures to control the risk to users of a second train approaching
- in deciding what measures to implement, specifically consider technological solutions, as well as user awareness campaigns. It should also consider good practice elsewhere in the rail industry (including internationally) and the predictable limitations of human performance (paragraphs 81a, 81b and 82).

2 *The intent of this recommendation is to ensure that appropriate interim shorter-term risk mitigations are identified and implemented in a timely manner at level crossings that are awaiting long-term solutions to reduce the risk.*

Network Rail should review its existing processes for level crossing risk management and include:

- explicit provision for considering a wider range of short- and medium-term risk mitigation options than is currently the case
- steps to ensure that those responsible for implementing risk controls are aware of all the options available, including those that might offer only incremental reductions in risk or interim mitigation pending implementation of preferred long-term solutions
- documented details of short- and medium-term risk controls, including both technical and non-technical options (paragraph 82).

[8] 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 and Road 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 200 to 203) can be found on RAIB's website www.gov.uk/raib.

Appendices

Appendix A - Glossary of abbreviations and acronyms

ALCRM	All level crossing risk model
FFCCTV	Forward-facing closed-circuit television
GSM-R	Global system for mobile communications - railway
LCM	Level crossing manager
MSL	Miniature stop light
NRA	Narrative risk assessment
ORR	Office of Rail and Road
OTDR	On-train data recorder
RLCM	Route level crossing manager
SAWD	Supplementary audible warning device

Appendix B - Investigation details

RAIB used the following sources of evidence in this investigation:

- information provided by witnesses
- information taken from both trains' on-train data recorders (OTDRs)
- video footage taken from the FFCCTV of train 1I37 and from a camera at the crossing
- signalling data
- voice communications
- railway incident control logs
- documentary evidence associated with risk management for Lady Howard and other crossings on Wessex route
- site photographs and measurements
- weather reports and observations at the site
- a review of previous RAIB investigations that had relevance to this accident.

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