



Rail Accident Investigation Branch

Rail Accident Report



Fatal accident at Frampton level crossing 11 May 2014

Report 05/2015
May 2015

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.

© Crown copyright 2015

You may re-use this document/publication (not including departmental or agency logos) free of charge in any format or medium. You must re-use it accurately and not in a misleading context. The material must be acknowledged as Crown copyright and you must give the title of the source publication. Where we have identified any third party copyright material you will need to obtain permission from the copyright holders concerned. This document/publication is also available at www.raib.gov.uk.

Any enquiries about this publication should be sent to:

RAIB	Email: enquiries@raib.gov.uk
The Wharf	Telephone: 01332 253300
Stores Road	Fax: 01332 253301
Derby UK	Website: www.gov.uk/raib
DE21 4BA	

This report is published by the Rail Accident Investigation Branch, Department for Transport.

Fatal accident at Frampton level crossing, 11 May 2014

Contents

Summary	5
Introduction	6
Preface	6
Key definitions	6
The accident	7
Summary of the accident	7
Context	7
Events preceding the accident	13
Events during the accident	13
Events following the accident	14
The investigation	15
Sources of evidence	15
Key facts and analysis	16
Background information	16
Identification of the immediate cause	16
Identification of causal factors	17
Identification of underlying factors	28
Observations	32
Previous occurrences of a similar character	34
Summary of conclusions	35
Immediate cause	35
Causal factors	35
Underlying factors	35
Additional observations	36
Recommendations that are currently being implemented which are relevant to this accident	37
Other recommendations relevant to this investigation	40
Actions reported of relevance to this investigation	42
Learning point	43
Recommendations	44

Appendices	47
Appendix A - Glossary of abbreviations and acronyms	47
Appendix B - Glossary of terms	48

Summary

At around 18:45 hrs on Sunday 11 May 2014, a passenger train approaching the village of Frampton Mansell, in Gloucestershire, struck a motorcycle on Frampton level crossing. The rider of the motorcycle was fatally injured. The train did not derail, and there were no reported injuries to anyone on the train.

The rider was crossing the railway on a trail bike, a type of motorcycle designed for use on public roads and for off-road use. He was the last of a group of three riders who had reached the level crossing along an unsurfaced track leading from a minor road near the village of Sapperton.

Signage on the approach to the crossing instructed vehicle users (which would include trail bike riders) to use a telephone located close to the crossing. This allowed the railway signaller to tell users whether it was safe to cross the railway. The riders did not use the telephone because they believed that they could cross safely by looking for trains before crossing, and because the signs did not grab their attention sufficiently for them to read the information on them. The riders did not know that a curve in the railway meant that they could not rely on seeing an approaching train early enough to decide whether it was safe to cross. The train's warning horn was sounded as it approached, but the trail bike riders could not hear this because they were wearing full-face crash helmets and their trail bike engines were noisy. Network Rail had received some information that trail bikers were using the crossing, but had not taken effective action to manage the associated risk of unsafe use.

Although permitted to use vehicles on both approaches to the level crossing, the trail bike riders were unaware they were not among the people permitted to use vehicles on the crossing. The signs giving instructions to vehicle users did not explain this, and there was no other indication at the crossing, or on the approaches. There was no requirement for signs or other indications to be provided by Network Rail, or any other organisation, to indicate that the general public were not permitted to take vehicles onto the level crossing.

The investigation identified three observations, unrelated to the accident, relating to level crossing signage, correct sounding of train warning horns and provision of reliable images from CCTV cameras fitted to trains.

The RAIB has made six recommendations. Four addressed to Network Rail, one addressed to the ORR and one addressed to the Department for Transport relate to improved content and positioning of information provided to level crossing users. Two recommendations addressed to Network Rail require it to seek a better understanding of actual (not only permitted) use of level crossings, and, in conjunction with highway authorities, to raise public awareness of locations where the general public are not permitted to take vehicles onto level crossings.

Introduction

Preface

- 1 The purpose of a Rail Accident Investigation Branch (RAIB) investigation is to improve railway safety by preventing future railway accidents or by mitigating their consequences. It is not the purpose of such an investigation to establish blame or liability.
- 2 Accordingly, it is inappropriate that RAIB reports should be used to assign fault or blame, or determine liability, since neither the investigation nor the reporting process has been undertaken for that purpose.
- 3 The RAIB's investigation (including its scope, methods, conclusions and recommendations) is independent of any inquest and all other investigations, including those carried out by the safety authority, police or railway industry.

Key definitions

- 4 This report uses metric units, except where it is normal railway practise to give speeds and locations in imperial units. Where appropriate the equivalent metric value is also given.
- 5 The report contains abbreviations and technical terms (shown in *italics* the first time they appear in the report). These are explained in appendices A and B.

The accident

Summary of the accident

- 6 At around 18:45 hrs on Sunday 11 May 2014, train 2G98¹, the 18:18 hrs Swindon to Gloucester passenger service, struck a trail bike (a type of motorcycle) on a level crossing. The rider of the trail bike was fatally injured. The rider was the last of a group of three that were crossing the railway at Frampton level crossing, near the village of Frampton Mansell, Gloucestershire.

Context

Location

- 7 Frampton level crossing crosses the two-track Swindon to Gloucester railway close to the village of Frampton Mansell, around 6 miles (10 km) east of the town of Stroud, Gloucestershire (figure 1). The two railway tracks are called the *Up* and *Down Kemble* lines, and train 2G98 was travelling from Swindon towards Gloucester along the Down Kemble line. The maximum permitted speed of trains approaching the level crossing from either direction is 50 mph (80 km/h). The crossing was not equipped with warning lights or audible alarms.

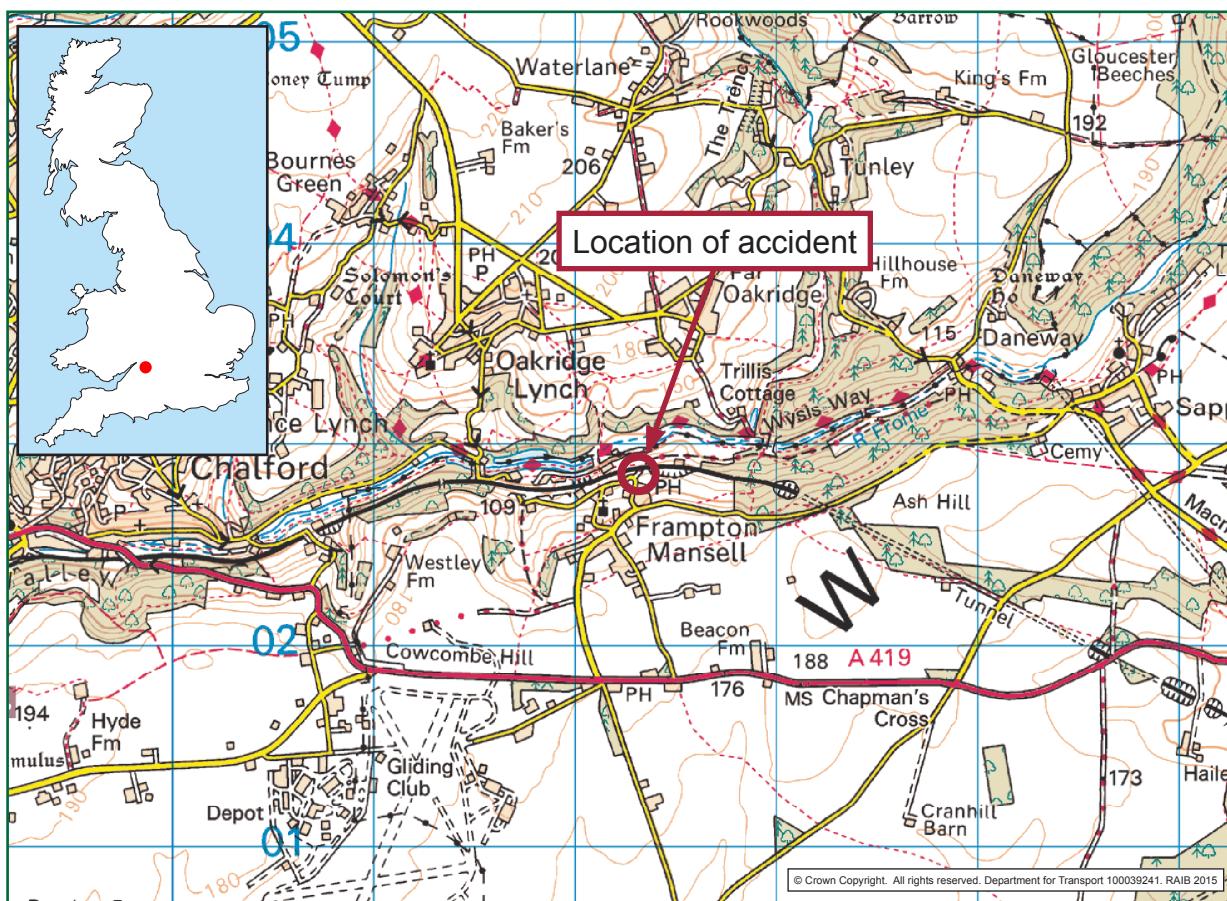


Figure 1: Extract from Ordnance Survey map showing location of accident

¹ An alphanumeric code, known as the 'train reporting number', is allocated to every train operating on Network Rail's infrastructure.

- 8 Frampton level crossing (figure 2) comprised a wide-gated crossing, known as a *user worked crossing* intended for use by *authorised users* with vehicles such as cars and tractors, and a smaller *bridleway crossing* gate intended for use by pedestrians, pedal cyclists, and equestrians (horse riders and persons leading horses). The bridleway gate has a latch and closing spring to prevent it being left open. Both gates gave access to the same crossing surface. Telephones on the approach to the crossing provided a direct line to the signaller controlling train movements in the area. Signs at the crossing instructed people to use the telephone if crossing with vehicles (which includes trail bikes²) or animals. The signs did not instruct pedestrians to use the telephones.

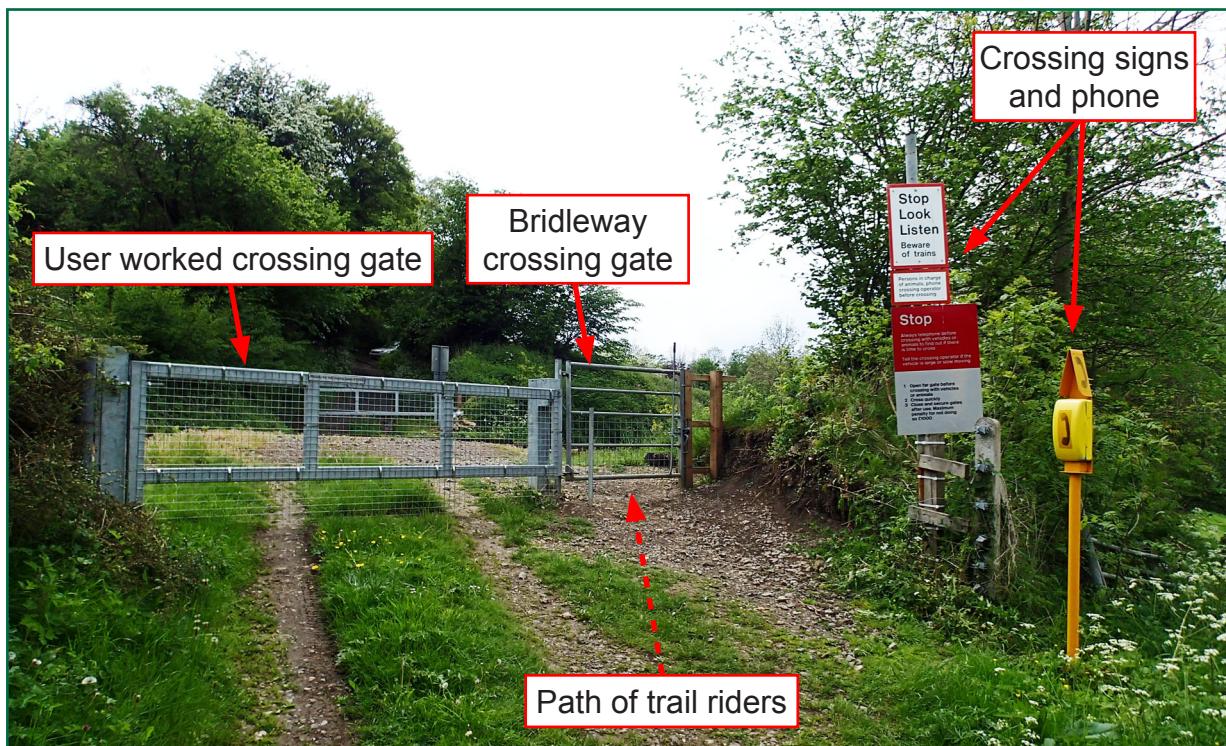


Figure 2: Photograph showing the arrangements on the north side of the crossing at the time of the accident

- 9 Trains travelling from Swindon approached Frampton level crossing on a curved section of track which meant that train drivers could not see the crossing until the train was around 175 metres from it (figure 3).
- 10 People approaching the crossing from the north side, the side from which the three riders approached, passed through a crossing gate. At the time of the accident, vegetation growth meant that they then had to reach a position about 3.8 metres from the nearest rail of the Up Kemble line, before they could see trains approaching from the Swindon direction along the Down Kemble line (figures 4 and 5). Because of the track curvature, their *sighting distance* for these trains (the distance to the first point where they could see them) was 175 metres, and their *warning time* (the time taken for a train to travel this distance at the maximum permitted speed) was about 8 seconds.

² A motorbike, thus a trail bike, is commonly understood to be a vehicle. This understanding is reflected in current road traffic legislation. For example, the Road Traffic Act 1988 states that a motorcycle means 'a mechanically propelled vehicle, not being an invalid carriage, with less than four wheels and the weight of which unladen does not exceed 410 kilograms'.

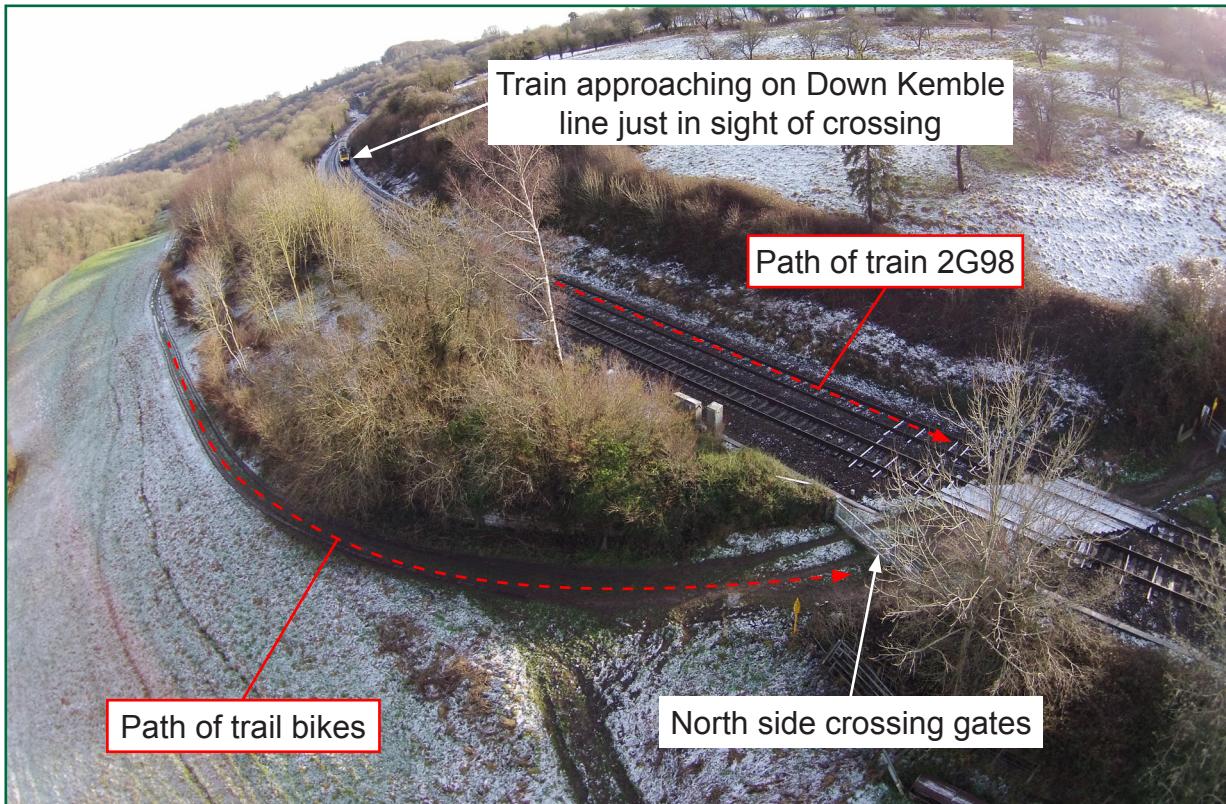


Figure 3: The curved approach to Frampton crossing (January 2015 photograph, altered to show crossing signs at the time of the accident)

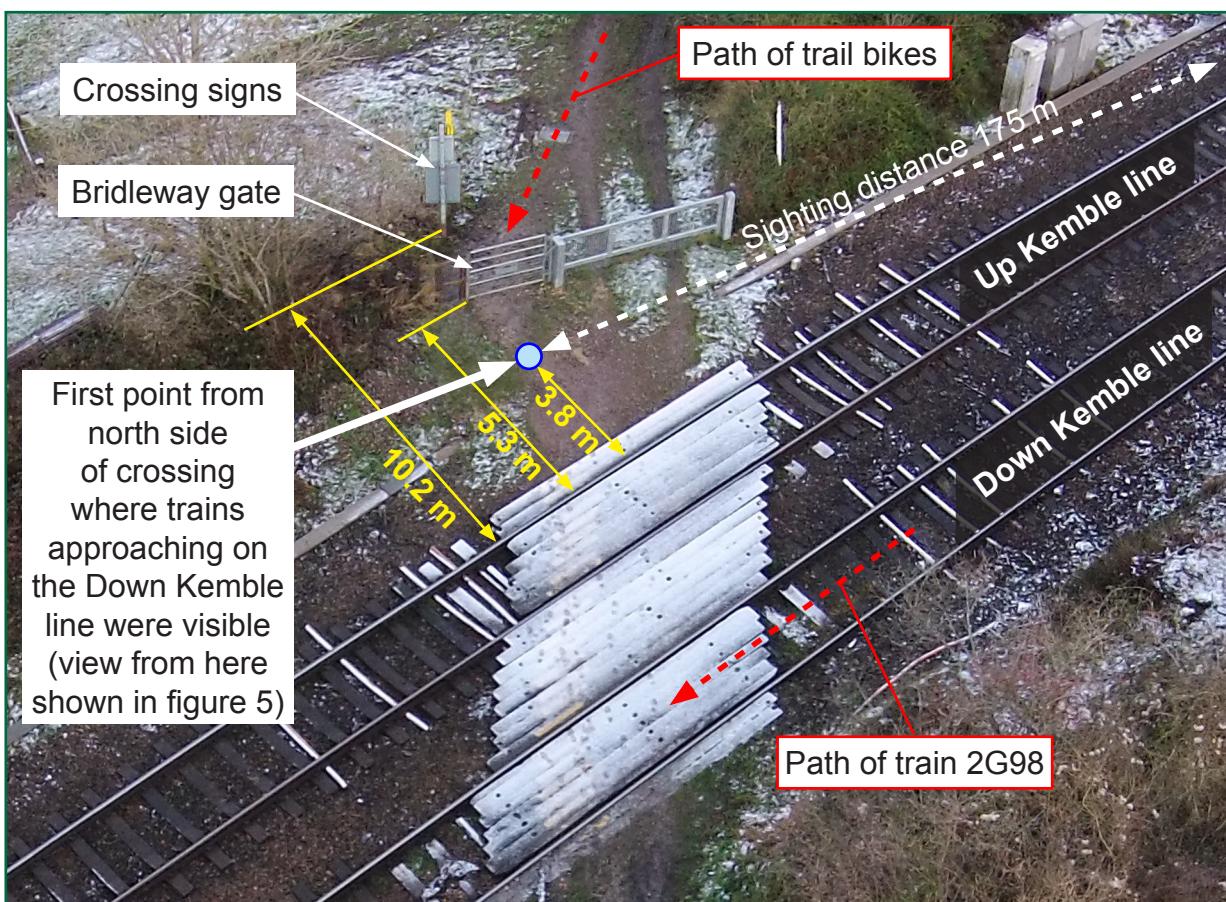


Figure 4: North side of crossing (January 2015 photograph altered to show crossing signs at the time of the accident)



Figure 5: View from north side of crossing towards trains approaching from Swindon (May 2014 photograph)

- 11 Sighting times were greater when looking from the north side of the crossing towards trains approaching from Gloucester. However, sighting times for trains approaching from both directions were significantly less when standing on the south side of the crossing. Although not a factor in the accident, the shorter sighting times are relevant when considering the importance of signage at the crossing (paragraphs 58 to 71).
- 12 Network Rail standards required pedestrians using Frampton level crossing to receive at least 9 seconds warning of an approaching train in order for them to decide if it was safe to cross. This is based on a calculation of the time required to traverse the crossing using a walking speed of 1.2 m/sec from a point measured 3 metres from the nearest rail, to a point measured 2 metres beyond the furthest rail. As there is insufficient sighting distance to achieve this warning time, a *whistle board* beside the track on each approach to the level crossing instructs approaching train drivers to sound the train horn as a warning to level crossing users³.
- 13 There are three level crossings near to the village of Frampton Mansell which require whistle boards: Frampton Common, Frampton (where the accident occurred) and Frampton *footpath crossing* (figure 6). Although only one whistle board is normally provided on each approach to a level crossing, the positions of these crossings in close proximity to each other meant that drivers of trains from the Swindon direction should sound the train's horn three times on approach to the accident location. Table 1 shows the approximate warning time given to users of Frampton level crossing by a train, such as that involved in the accident, travelling at the maximum permitted line speed of 50 mph (80 km/h) and sounding its horn as it passes each whistle board.

³ Train horns are not sounded between 23:00 hrs and 07:00 hrs in order to reduce noise nuisance to neighbours. This is not relevant to the accident at Frampton crossing, which happened outside these hours.

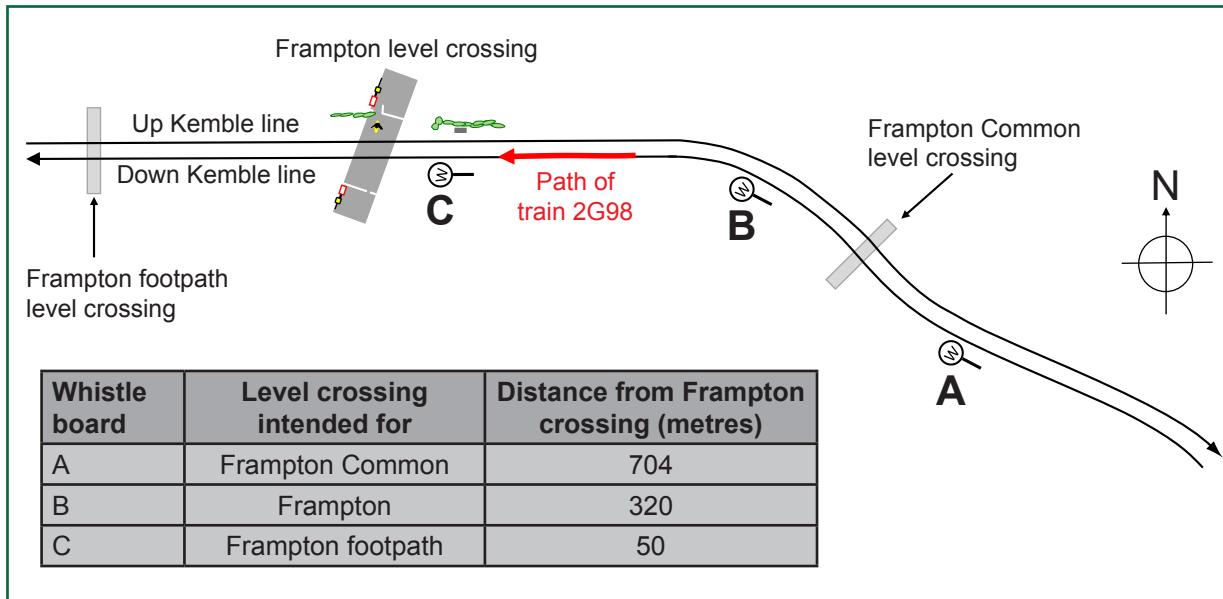


Figure 6: Locations of whistle boards approaching Frampton crossing (not to scale)

Crossing to which whistle board applies	Distance from whistle board to Frampton level crossing (metres)	Approximate warning time provided by the warning horn sounded at the whistle board (seconds)
Frampton Common	704	31 ⁴
Frampton	320	14
Frampton footpath	50	2 ⁵

Table 1: Whistle boards and available warning times

- 14 The northern approach to Frampton level crossing comprises an unsurfaced track leading from a minor road near the village of Sapperton (figure 7). The southern approach comprises a partly surfaced track leading from a minor road near the village of Frampton Mansell (figure 7). Both approaches are shown as a ‘highway maintainable at public expense’ on Gloucestershire County Council’s *Highway Record*. Except where legal restrictions have been imposed, the public are generally entitled to use highways shown on this record for the purpose of passing and repassing on foot, on horseback, with animals or with vehicles. Gloucestershire County Council has stated that it is not aware of any legal restrictions applying to the Frampton level crossing approaches.

Organisations involved

- 15 Network Rail owned and maintained Frampton level crossing and the associated railway infrastructure. It was the employer of the level crossing management team and the other operations staff involved in maintaining the level crossing.

⁴ It is unlikely that a horn sounded for Frampton Common crossing will always be audible to all users of Frampton crossing; this is likely to depend on local atmospheric conditions (eg wind direction and the noise of wind in trees). An RAIB inspector standing at Frampton crossing has heard a train horn sounded for Frampton Common crossing.

⁵ The whistle board provided for users of Frampton footpath crossing is included in this table because it is on a train’s approach to Frampton crossing; the two-second warning provided by a horn sounded at this whistle board is not intended to assist users of Frampton crossing and would provide little benefit to them.

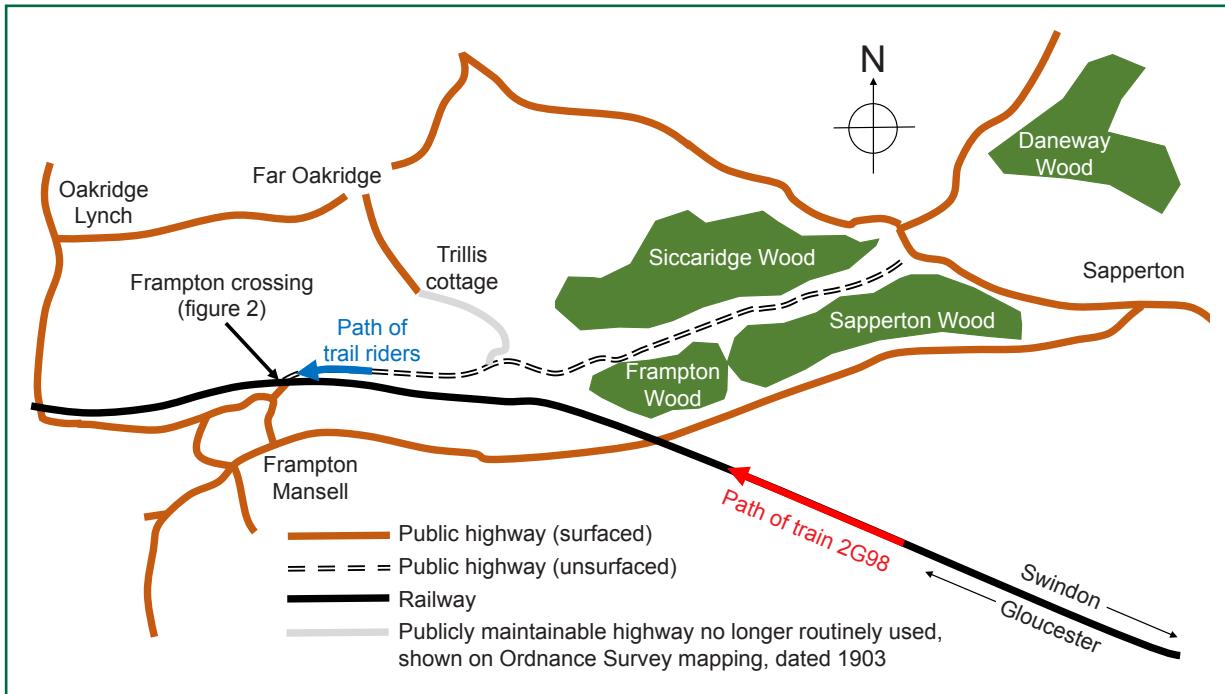


Figure 7: Frampton crossing context

- 16 Gloucestershire County Council had a statutory responsibility⁶ for the management, maintenance and recording of Gloucestershire's public highways.
- 17 First Great Western operated and maintained train 2G98, and employed the train driver.

Train involved

- 18 Train 2G98 was formed by a two-carriage *diesel multiple unit*, number 150239. This type of train is known as a 'Sprinter', and was built by British Rail Engineering Limited between 1984 and 1987. Train 2G98 was fitted with a closed-circuit television system (CCTV) that included forward and rear facing CCTV cameras, and an *on-train data recorder* (OTDR).

The level crossing users

- 19 There were three people in the group using Frampton level crossing when the accident occurred. All three were riding trail bikes, a type of motorcycle designed for use on public roads, and for off-road use on different surfaces including grass and mud.
- 20 The deceased, rider 1, was the most experienced rider of the group, and had been trail riding for about two years. He led the group on the day of the accident. It is not known how he knew about the routes they took that day, but witnesses report that he had used Frampton level crossing on his trail bike before.
- 21 Rider 2 had known rider 1 for many years. He had about six months' experience of trail riding, and had ridden with rider 1 on five or six occasions in the months before the accident. This included crossing the railway at Frampton level crossing on two occasions, but in the opposite direction to that on the day of the accident.

⁶ These duties are defined by the Highways Act 1980.

- 22 Rider 3 was the least experienced trail rider of the group, and had never ridden with rider 1 before. He had ridden over Frampton level crossing once before, but again this was in the opposite direction to that on the day of the accident.

Staff involved

- 23 Frampton level crossing had been managed by Network Rail's Western route level crossing management team. This team also had other operational risk management responsibilities in addition to their responsibilities for level crossings. Since April 2013, Network Rail has introduced the role of level crossing manager, which is dedicated to level crossing inspection and management.

External circumstances

- 24 It was a clear, bright sunny evening and the RAIB has no evidence to suggest that weather conditions contributed to the circumstances of the accident.

Events preceding the accident

- 25 During the late-afternoon/early evening on the day of the accident, the three riders had spent about an hour riding around green lanes⁷ in the Sapperton area.
- 26 Witnesses reported that, as they headed home along the unsurfaced highway leading from the village of Sapperton towards Frampton Mansell, rider 1 was leading.
- 27 Shortly before reaching Frampton level crossing, rider 1 stopped to open a closed farm gate, and the order of the riders changed. Rider 2 now led, knowing that the level crossing was not far ahead.
- 28 On arriving at the north side of the level crossing, rider 2 opened the bridleway gate. A short while later, rider 1 and rider 3 arrived at the level crossing.
- 29 Rider 1 got off his bike and held the gate open so that riders 2 and 3 could cross to the other side of the railway tracks. On reaching the other side of the crossing, rider 2 got off his trail bike, walked back over the railway, and held open the bridleway gate to allow rider 1 to cross the railway on his trail bike.
- 30 While this was happening, train 2G98 was travelling around the curved track approaching the crossing. The OTDR fitted to the train recorded that the warning horn was sounded three times on the approach to the crossing; around 34 seconds from the crossing, around 16 seconds from the crossing, and around 7 seconds from the crossing. The third horn warning was sounded around the time that the driver could first see Frampton level crossing.

Events during the accident

- 31 The train driver saw rider 1's trail bike moving onto the level crossing and into the path of the train. Realising that the train might strike the trail bike rider, the train driver made a full brake application but was unable to avoid the collision. Witness evidence indicates that rider 1 may have been unaware of the approaching train until just before the collision. The location of damage shows that the front left-hand edge of the train struck the rear of the trail bike.

⁷ Typically unsurfaced roads and tracks.

Events following the accident

- 32 When riders 2 and 3 realised that rider 1 had been struck by the train, they decided to call the emergency services, but neither of them was in possession of a mobile phone. The riders knew from their local knowledge that there was a public house not far from the crossing, and so rider 3 went there on his trail bike to call the emergency services. Neither of the riders thought about using the phones at the level crossing. The train driver reported the accident to the signaller using the train's radio. The emergency services attended the scene of the accident.

The investigation

Sources of evidence

33 The following sources of evidence were used:

- witness interviews;
- information recorded by the train's OTDR;
- Closed Circuit Television (CCTV) recordings taken from the rear-facing camera fitted to the train (the forward-facing CCTV camera was found to be defective);
- site photographs and measurements;
- video footage of trains approaching the crossing;
- video footage of the approach to the crossing from the cab of a train;
- information provided by Gloucestershire County Council;
- the Network Rail level crossing file;
- information about train-fitted CCTV systems provided by First Great Western
- internet videos of trail riders using Frampton level crossing;
- a recording of the evidence heard at the Coroner's inquest; and
- a review of previous RAIB investigations that had relevance to this accident.

Key facts and analysis

Background information

History of the crossing

- 34 The level crossing formed part of the railway which was authorised by the 1836 Cheltenham & Great Western Union Railway Act. The railway opened between Kemble and Gloucester in 1845. At that time, the level crossing was considered to be on a public road, and as such it was provided with gates which were operated by a resident crossing keeper.
- 35 The level crossing was provided for people, animals, and vehicles using the local highways linking Frampton Mansell, Far Oakridge, and Sapperton (figure 7). In response to a British Railways proposal to withdraw the crossing keeper at this location, a letter dated 9 December 1968 from the office of Gloucestershire County Council's County Surveyor, indicated that public vehicular traffic had not used the route over the level crossing for an estimated 20 to 30 years.
- 36 The right for the general public to take vehicles over the crossing was withdrawn on 22 March 1971 using legal powers granted in the British Railways Act 1970. This Act required that the railway maintained the crossing for use by persons on foot, leading horses or on horseback. The right to take vehicles over the crossing was restricted to persons who owned or occupied land that was served by the road that crossed the railway at the crossing. In practice, Network Rail managed crossings of this type on the basis that authorised users also included people, such as employees, who needed access to adjoining land when, in similar circumstances, the owners or occupiers would have a right to use the crossing.
- 37 The powers granted by the Act did not alter the status of the approaches to the crossing. These remained public highways with no known restrictions on their use by vehicles.

Identification of the immediate cause⁸

- 38 **The trail biker crossed into the path of the approaching train.**
- 39 The reasons why rider 1 acted as he did cannot be established with certainty, but evidence suggests that he was unaware of the threat from the approaching train until it was too late. This, and other possible causes, are discussed below.

⁸ The condition, event or behaviour that directly resulted in the occurrence.

Identification of causal factors⁹

- 40 The accident occurred due to a combination of the following causal factors:
- Rider 1 was unaware of the threat from the approaching train until it was too late (paragraph 41);
 - The trail riders did not use the telephone to call the signaller to see if it was safe to cross (paragraph 54);
 - The signs at the level crossing did not influence the behaviour of the trail riders (paragraph 58); and
 - The trail riders were not aware that they were not permitted to use the level crossing with their trail bikes (paragraph 78).

Each of these factors is now considered in turn.

The actions of rider 1

- 41 **Rider 1 was unaware of the threat from the approaching train until it was too late.**
- 42 Witness evidence concerning the character of rider 1 suggests that he would have intended to look before crossing the railway. Because nobody saw his actions as he began to use the crossing, there is no evidence showing what he actually did before he decided to cross. However, it appears that rider 1 was unaware of the threat from the approaching train until just before it struck him (paragraph 31), and so the RAIB has considered the circumstances which could have meant that he did not achieve a safe crossing of the railway.

Rider 1 may not have seen the train

- 43 If rider 1 looked before crossing, it is possible that the train was visible, but that he did not register its presence. This a known human factors issue often referred to as 'looked but did not see'¹⁰.
- 44 The full-face helmet worn by rider 1 limited his vision, so it is possible that this contributed to him not seeing the train. This is particularly relevant because the skew of the crossing relative to the railway tracks meant that the trail bike would be oriented away from the approaching train (figures 3 and 4). It is likely that once on the crossing, rider 1 would have been looking forward as he steered his trail bike over the crossing surface (paragraph 51). In these circumstances his helmet would prevent him seeing the train in his peripheral vision; this was confirmed by riders 2 and 3 who were wearing helmets of a similar design to that worn by rider 1. Photographic evidence indicates that rider 1's helmet visor was clean and clear, and would not have affected his vision.
- 45 It is also possible that rider 1 did not look, or looked without sufficient attention. It is possible that this was because his perception of the risk was low, perhaps because the other two riders had already crossed over the railway safely, and one of the riders had walked back over the crossing to hold the gate open to allow him to cross.

⁹ Any condition, event or behaviour that was necessary for the occurrence. Avoiding or eliminating any one of these factors would have prevented it happening.

¹⁰ Langham, M. et al (2002). 'An analysis of looked but failed to see accidents'. Available at: <http://www.tandfonline.com/doi/abs/10.1080/00140130110115363>.

- 46 It is unlikely that the sun's position made it difficult to see the approaching train because the sun was positioned to the right of rider 1, and the train was approaching from his left. It is also unlikely that the vegetation (paragraph 10) influenced rider 1's decision to cross, as it is unlikely that he would have decided to cross when looking to his left at a position where he could see that vegetation obscured his view of approaching trains.

Rider 1 may have seen the train, but decided it was safe to cross

- 47 It is possible that rider 1 saw the train, but misjudged its speed and/or its distance from the crossing. RSSB research project T269, 'User behaviour at user worked crossings', reported that crossing users tended to over-estimate the time required for a train to reach the crossing. This is consistent with research¹¹ which shows that crossing users cannot easily determine the speed and distance of an object approaching from head-on until the object is relatively close. This is because the image size on the retina only increases slowly until the object is close to the viewer.

The time taken to cross

- 48 The RAIB has considered whether it was possible that rider 1 took longer to cross the railway than he expected. Publicly available videos posted on the internet¹² showed trail riders using Frampton level crossing. The RAIB timed 10 riders using the crossing and each took about 5 seconds to cross the railway.
- 49 The train driver stated that, when rider 1 appeared on the crossing, he realised that the train might collide with the trail bike and so he decided to immediately apply the train's brakes. The OTDR shows that the brakes were applied around 2 seconds before the collision. Damage to the trail bike shows that rider 1 had nearly made it over the railway when struck by the train (paragraph 31). Allowing a typical response time of around 2 seconds¹³ for the train driver to perceive the situation developing ahead of him, to decide what to do, and then to apply the train's brakes, it is unlikely that rider 1 would have taken significantly longer to cross than the typical crossing time of around 5 seconds (paragraph 48).
- 50 There was no evidence of a defect on the trail bike, and no evidence that rider 1 was unable to operate his trail bike normally. No defects with possible relevance to the accident were identified during a post-accident examination of the trail bike by the police. Neither of the other riders reported seeing or hearing anything unusual about the trail bike, or the way it was being ridden over the level crossing, until the collision occurred.
- 51 Witness and photographic evidence indicates that the crossing surface was dry, and in an acceptable condition at the time of the accident. It is therefore unlikely that rider 1 had difficulty in moving towards and over the crossing because of the condition of its surface.

¹¹ Green, M. et al (2008) 'Forensic Vision: With applications to highway safety', available at: <http://www.visualexpert.com/Resources/rearendcollision.html>.

¹² The earliest of these videos was posted online on 24 January 2012.

¹³ McGee et al (cited in Dewar, R.E. and Olson, P.L. 'Human factors in traffic safety'. Arizona: Lawyers and Judges Publishing Company, Inc; 2002) found that the total time taken to perceive, decide and react to braking was 2.08 seconds (50th percentile), 3.19 seconds (85th percentile) and 4.55 seconds (99th percentile).

Rider 1 probably did not hear the approaching train

- 52 The train's warning horn was sounded three times as it approached the crossing, with the last warning sounded around 7 seconds (156 metres) from the crossing (paragraph 30). Neither rider 2 nor rider 3 heard these warnings because they were wearing crash helmets that muffled sound, and because of the noise from their trail bike engines. For these reasons, it is likely that rider 1 also did not hear the train's warning horn.

It is possible that the riders expected a warning at the crossing when a train was approaching

- 53 Both rider 2 and rider 3 said that it was possible that, within their thought processes, they were expecting a warning to sound at the crossing if a train was approaching. Frampton level crossing was not fitted with such warning devices. Four nearby crossings were fitted with audible warnings (using a siren fitted at the crossing) but, unusually for level crossings with audible warnings, no warning lights were provided at these crossings. Rider 3 had experience of using a nearby crossing that had audible warning devices of this type. It is not known if rider 1 expected to hear an audible warning at the crossing.

The crossing telephone

- 54 **The trail riders did not use the telephone to call the signaller to see if it was safe to cross.**
- 55 Rider 2, the first person to arrive at the crossing, saw the telephone but did not use it. He stated that this was because he did not realise that using the telephone was essential for the safe use of the crossing with vehicles, such as trail bikes. It is not known if rider 1 was aware of the telephone and, if he was, his reasons for not using it.
- 56 Rider 2 and rider 3 have both stated that they saw the signs at the level crossing, but they did not read them. The signs said that the telephone must be used if crossing with vehicles. It is unlikely that rider 1 had thought that rider 2 had used the telephone before he arrived at the crossing because, on the previous occasions when they had used the crossing together, the telephones had not been used (paragraph 21).
- 57 Riders 2 and 3 thought it was safe to cross the railway without using the telephone because:
- they believed there was sufficient sighting distance to look for approaching trains;
 - the distance to cross the railway did not look far; and
 - they could cross quickly.

Level crossing signs

- 58 The signs at the level crossing did not influence the behaviour of the trail riders.
- 59 Riders 2 and 3 said they saw the signs at the crossing but they did not read the information on them (paragraph 56). The following paragraphs consider possible reasons why the signs at the level crossing did not draw the attention of the trail bikers sufficiently so that they read them and acted on their content. Particular consideration is given to understanding possible reasons why the signs did not persuade the trail bike riders that the risk from approaching trains meant that it was essential for them to use the telephone. There is no witness evidence relating to whether rider 1 read the signs and, if he did, the extent to which he understood the information displayed on them.
- 60 Evidence that the signs at the crossing did not influence the behaviour of other trail bike riders is provided by videos posted on the internet (paragraph 48). None of the 10 riders seen using Frampton crossing on these videos used the telephone before crossing.
- 61 Signs giving instructions to crossing users are provided on both sides of the crossing and, although the layout of the signs varied, the content was similar on both sides (figure 8). Sighting of trains from the south side of the crossing was more restricted than from the north side (the side on which the trail bikers actually approached the crossing). This meant that risks associated with not acting on the instructions on signs were greater, in some circumstances, for people approaching the crossing from the south side than for those approaching from the north.



Figure 8: Frampton crossing signs

- 62 The wording of the signs at Frampton level crossing was compliant with both legal requirements¹⁴ and Network Rail's procedures, but fell short of published 'best practice' (RSSB research project T756¹⁵) (paragraph 138) (published in November 2014, after the accident at Frampton level crossing), and Wogalter *et al*¹⁶ (published in 2002), for the reasons described in paragraphs 64 to 71.
- 63 The signs at Frampton level crossing were similar to those provided at many other bridleway, footpath and user worked level crossings in the United Kingdom. Although the following paragraphs refer to signage in the context of Frampton level crossing, the underlying principles apply at many other level crossings and this is reflected in the recommendations presented in this report.
- 64 Noticing a sign is a precursor to reading it, but the signs at Frampton level crossing lacked some of the features which increase sign *conspicuity*, and thus increase the likelihood of a sign being noticed. RSSB research project T756 reported that conspicuity can be subdivided into attention conspicuity (to attract attention when a person is not prepared for the occurrence) and search conspicuity (the capacity of a particular element of the visual environment to attract attention). RSSB suggested that to improve conspicuity of signs, measures such as adding a dynamic element to signs (such as flashing lights), adding backing boards (particularly with yellow backgrounds) and highlighting the personal risk associated with the hazard have the potential to make signs more conspicuous.
- 65 The signs at Frampton level crossing did not include words such as Danger, Warning or Caution (known as *signal words*) which research indicates may increase the effectiveness of a sign (Wogalter *et al*). RSSB research project T756 commented that using these words may be beneficial, in addition to other changes, such as using colour to aid comprehension, and using symbols to convey hazard messages.
- 66 Information on the signs was not presented in a logical sequential order chosen to maximise the effect on crossing users. Wogalter *et al* reported that an effective warning consists of four message components:
- a signal word to attract attention;
 - identification of the hazard;
 - a description of the consequences of exposure to the hazard; and
 - the instructions to be followed to avoid the hazard.
- 67 RSSB research project T756 reached a similar, although not identical, conclusion. This research concluded that it may be beneficial to provide warnings about potential hazards before other information is provided, and highlighting the personal risk associated with the hazard, in order to draw the attention of the crossing user.

¹⁴ The Private Crossings (Signs and Barriers) Regulations 1996. Available at www.legislation.gov.uk.

¹⁵ RSSB research into signs and signals at public road level crossings Annex report I: A review of human factors literature on the design of information and warnings. Available from <http://www.sparkrail.org/>.

¹⁶ 'Research based guidelines for warning design and evaluation' (2002) available at: <http://www.who.int/fctc/guidelines/ArtElevenWogalterNine.pdf>.

- 68 The signs did not highlight the relevance of hearing the train warning horn when using the crossing without using the telephone – the method of use expected for pedestrian users. The potential for this to affect safe use of the crossing, in circumstances differing from those on the day of the accident, is discussed at paragraph 106.
- 69 The signs at Frampton level crossing were closely spaced on a single post, and displayed a relatively large amount of information. Guidance issued by the Health and Safety Executive¹⁷ commented that too many signs in close proximity can result in people becoming confused, or overlooking important information. The RAIB notes that:
- the large amount of text is partly a consequence of some information being duplicated; and
 - it was not immediately obvious that different parts of the text applied to different types of user (the crossing catered for pedestrians, equestrians, and authorised users who could cross with vehicles or animals).
- 70 RSSB research project T756 cites work carried out by *Castro and Martos*¹⁸ which identified that where it is necessary to present signs simultaneously, the sign of higher priority should be positioned above signs of lower priority. The signs on either side of Frampton crossing, while displaying the same information, were mounted in a different order. Network Rail company standard NR/L2/SIG/30015 ‘Specification for station, footpath, bridleway, and user worked level crossings’ provides staff with guidance on typical signage layouts, but the guidance does not provide the information needed to adopt these layouts to suit both local circumstances, and current best practice for achieving effective signage.
- 71 The signs at Frampton crossing told users to ‘beware of trains’ and, as the crossing was not fitted with any automatic system to warn of approaching trains, users were expected to understand that a train could be approaching at any time. However, RSSB report T756 identified research indicating that there is a risk that people will ignore signs if they seldom encounter the hazard dealt with by the sign. This is particularly likely to occur at level crossings where the train service is not frequent. There were typically two trains per hour (one in each direction) that passed over Frampton level crossing. Neither rider 2, nor rider 3, had seen a train when they had used the crossing on previous occasions (paragraphs 21 and 22). It is possible that rider 1 had rarely, or perhaps never, seen a train when he had previously used Frampton crossing. Conspicuous warnings can be particularly important in these circumstances.

Decision point signage

- 72 A decision point is defined by the Office of Rail and Road (ORR) as ‘*a point where guidance on crossing safely is visible and at which a decision to cross or wait can be made in safety*’. The decision point on the north side of Frampton level crossing could not have been further than 3.8 metres from the railway as this was the first point at which trains approaching from the Swindon direction could be seen (paragraph 10).

¹⁷ The Health and Safety (Safety Signs and Signals) Regulations 1996. These regulations are available at: <http://books.hse.gov.uk/hse/public/saleproduct.jsf?catalogueCode=9780717663590>.

¹⁸ The experiments by Castro and Martos are cited in the work of Castro and Horberry ‘The human factors of transport signs’ CRC Press 2004.

- 73 Guidance provided by the Office of Rail and Road¹⁹ stated that the bridleway gate and signs explaining how to cross safely should be located at the decision point on each side of the crossing. The guidance stated that the decision point should not be less than 3 metres from the nearest rail for this type of crossing.
- 74 At Frampton level crossing, the level crossing signs and bridleway gate were not located at the decision point. On the north side of the crossing the bridleway gate was located around 5.3 metres from the nearest rail, and the signs were located around 9 metres from the nearest rail. When standing at the bridleway gate or at the level crossing signs, it was not possible to see approaching trains because vegetation blocked the view (figure 5).
- 75 Although the approach to the south side of the crossing was not relevant to the accident on 11 May 2014, the RAIB noted that the bridleway gate on this side was located around 8.7 metres from the nearest rail, and the signs were located around 10 metres from the nearest rail. Approaching trains could not be seen until a crossing user was around 1.2 metres from the nearest rail because foliage obscured the view in both directions. Even with the foliage removed, sighting distance was limited by track curvature and cutting slopes to around 110 metres (around 5 seconds sighting time) when looking for trains travelling from Gloucester on the Up Kemble line, and to around 60 metres (around 3 seconds sighting time) when looking for trains travelling from Swindon along the Down Kemble line (figure 9).

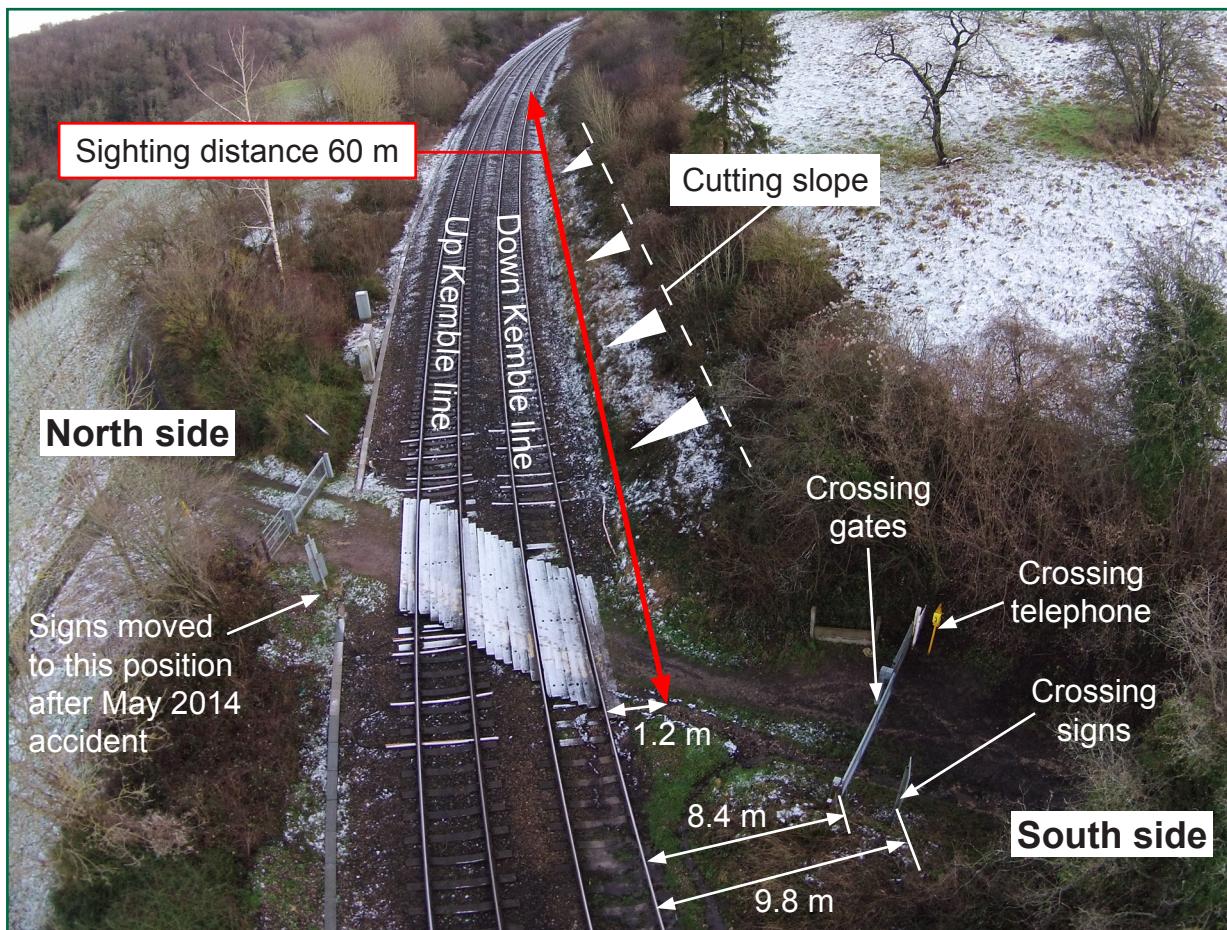


Figure 9: South side of crossing

¹⁹ Level Crossings: A guide for managers, designers and operators, available at: http://orr.gov.uk/__data/assets/pdf_file/0016/2158/level_crossings_guidance.pdf.

- 76 Network Rail company standard NR/L2/SIG/30015 ‘Specification for station, footpath, bridleway and user worked crossings’ included a requirement that bridleway gates and signs be positioned at the decision point as detailed in the ORR guidance, originally issued in 1996. However, these requirements were not retrospective. For this reason, non-compliant gates and signs were normally only moved when work was required for other reasons, such as renewal or repair. The level crossing signs on the north side of the crossing have been repositioned twice since 2002. In November 2008 the level crossing ‘Stop, Look, Listen’ sign, and the sign instructing persons in charge of animals to use the phone before crossing, were moved from a position to the left of the user worked crossing gate (figure 10a) to a position around 3 metres from the nearest rail, a location which was inside the bridleway gate (figure 10b). In March 2014, the signs were moved to their position at the time of the accident, 9 metres from the nearest rail (figure 10c), at the request of equestrians. Both bridleway gates at Frampton level crossing were renewed in 2012, but neither was moved to the decision point.
- 77 The RAIB considers it unlikely that the presence of a sign (or similar indicator) at the decision point would have caused rider 1 to look, or re-check for approaching trains. However, this possibility cannot be discounted. Recent research relevant to this issue is discussed at paragraph 130.

Awareness of restrictions on the use of the level crossing

- 78 **The trail riders were not aware that they were not permitted to use the level crossing with their trail bikes.**
- 79 There were no signs at the crossing, or on the approaches to it, to indicate that only authorised users were permitted to take vehicles onto the crossing. The British Railways Act of 1970 (paragraph 36) had removed the right of the general public to take vehicles onto the crossing, but this legislation did not include any requirement for this to be stated on signs provided at the crossing itself, or on the highway approaches to it.
- 80 It is not known how rider 1 became aware of the route over the level crossing. The RAIB has found no evidence that he was a member of any trail riding organisation. Evidence from people who knew him suggested that it was likely he had become aware of the route by word-of-mouth from other trail riders and/or while exploring the local green lanes.
- 81 Although probably not relevant to the circumstances of the accident on 11 May 2014 (because at least two of the trail riders had not read the signs, paragraph 59), the crossing signs implied that vehicles, a category including trail bikes, could use the crossing provided that the telephone was used to establish when it was safe to do so. Although these signs were only intended for authorised users, this was not apparent from the wording on the signs.
- 82 The route over the level crossing could be accessed from the village of Frampton Mansell, or from the road that leads out of Sapperton village (paragraph 14). There were no road signs on either approach to indicate that the general public were not permitted to take vehicles over the level crossing (figure 11).



Figures 10a, 10b and 10c: Frampton crossing north side signs

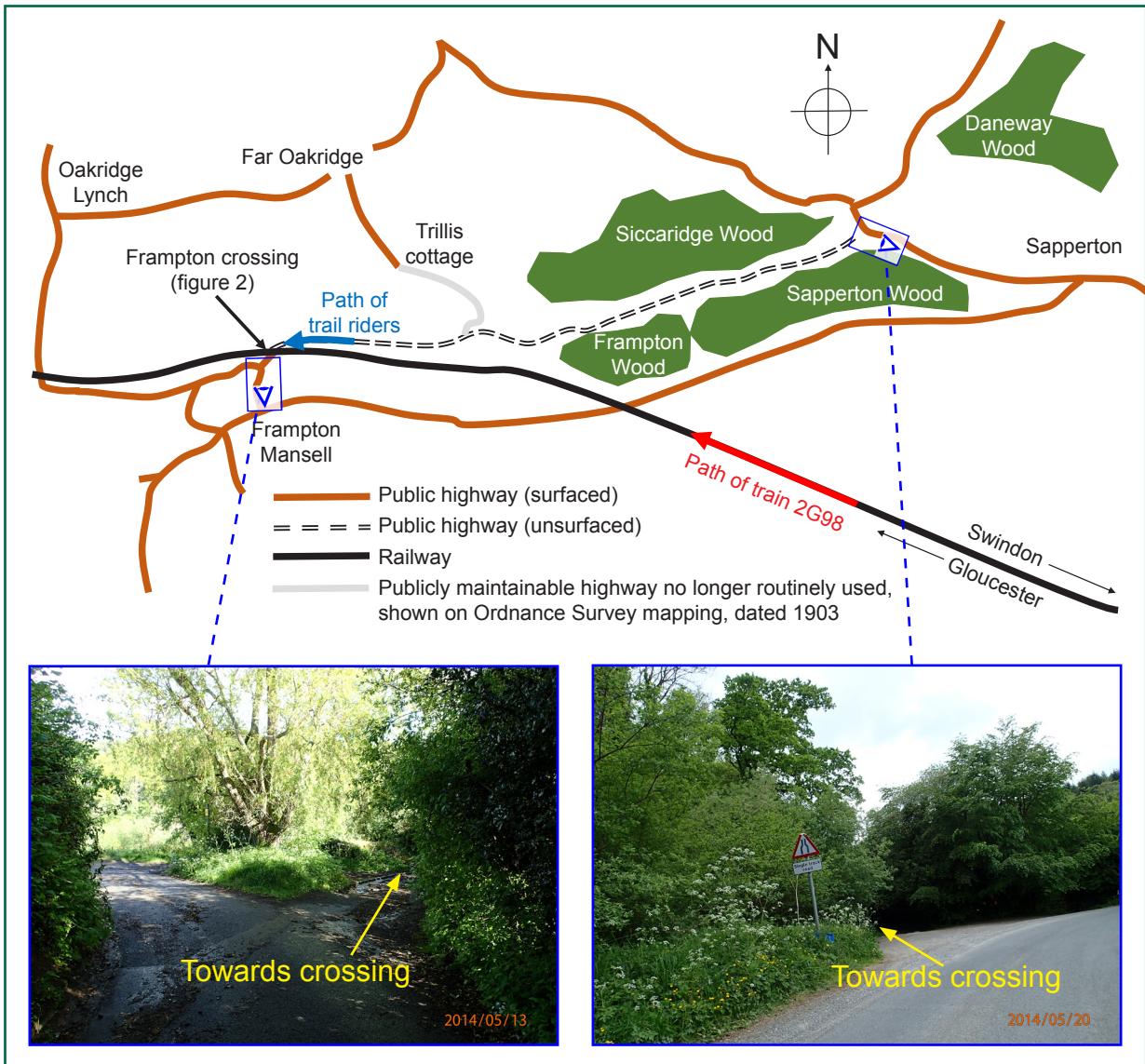


Figure 11: Highways leading to Frampton level crossing

- 83 The gates provided as part of the bridleway element of the crossing are designed so that horses can be ridden or led through them. Neither the gates, nor other features, prevented trail bikes being ridden over the crossing. It is likely that any features designed to prevent trail bikes (or other types of motorcycle) using the crossing, would also prevent horses from using it. Similarly, there is no obstacle to trail bikes using the conventional gates provided at some footpath crossings.

Publicly available sources of information

- 84 Publicly available mapping from Gloucestershire County Council and the Ordnance Survey, implied that public vehicles could cross over the railway using Frampton level crossing. Members of the public could view the Highway Record at the County Council's offices in Gloucester and this showed a highway, maintainable at public expense, running continuously across the railway (figure 12). A person seeking further information from the council about the status of this highway, would have been told that there were no known legal restrictions on its use by vehicles (paragraph 14), but that, as the highway was in the lowest maintenance category, the surface of it may be uneven and unsuitable for certain types of vehicle.

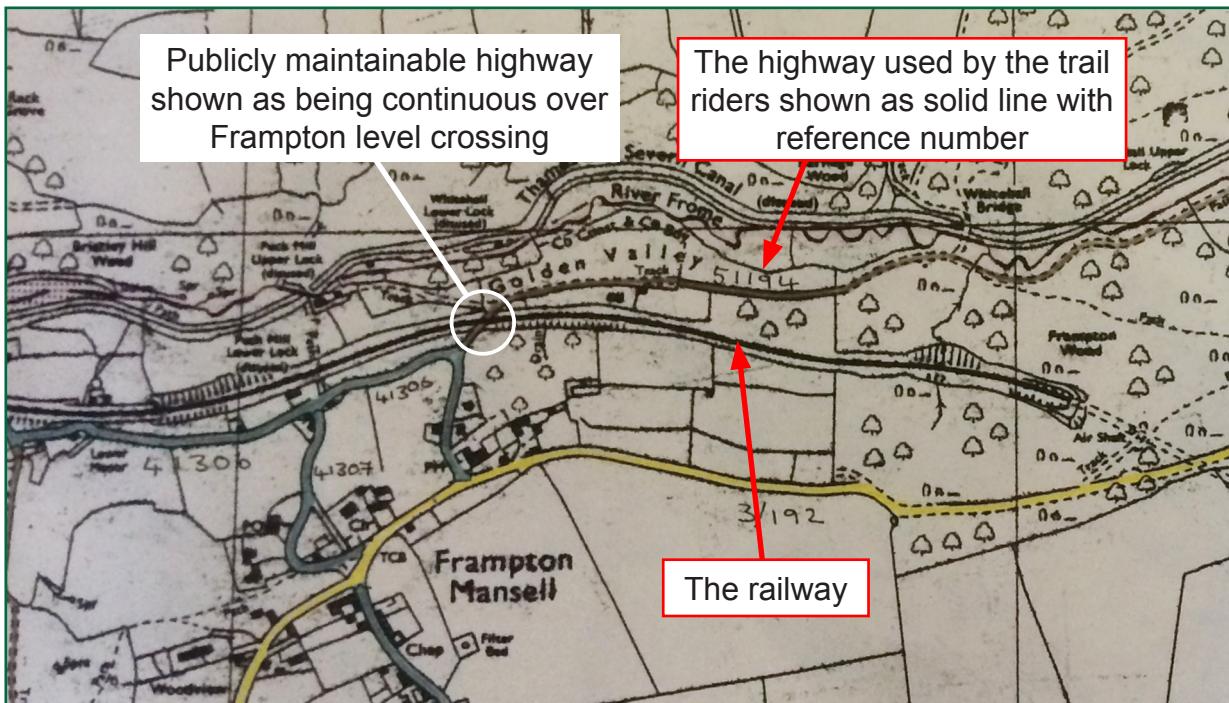


Figure 12: Extract from Gloucestershire County Council's Highway Record

85 Ordnance Survey mapping showed the route as an 'other route with public access' (figure 13). The route is implied as running continuously over the railway. Readers of these maps are informed that the exact nature of this type of route, and the existence of any restrictions, may be checked with the local highway authority. A post-accident enquiry by the RAIB to Gloucestershire County Council (the local highway authority), showed that reference to their records would have provided the information given in the previous paragraph.

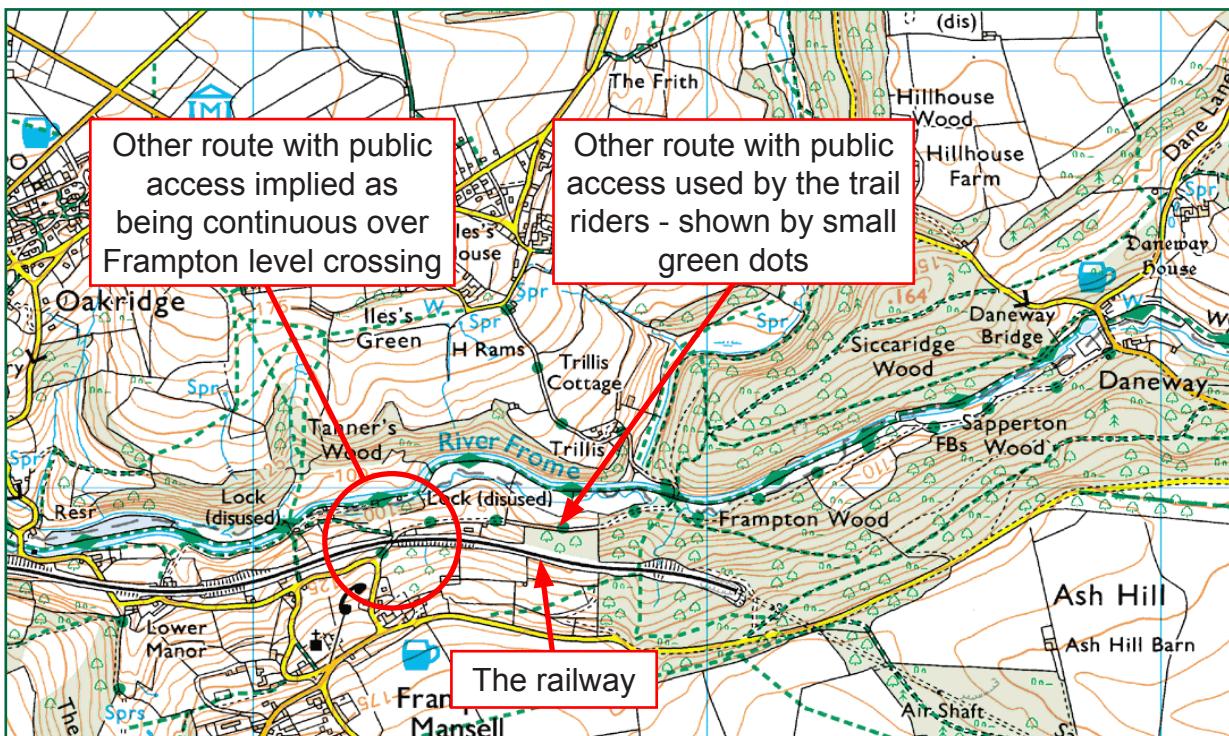


Figure 13: Ordnance survey map (scale 1:25,000) indicating 'other route with public access' (indicated by small green dots)

Identification of underlying factors²⁰

Management of the level crossing

- 86 Network Rail took no effective action to manage the risk of unsafe use by unauthorised trail bikers using the crossing.
- 87 The following paragraphs consider Network Rail's management of unauthorised use of Frampton level crossing by trail bike riders. It should be noted that use of the crossing with any vehicle, including trail bikes, is permitted for authorised users, and by Network Rail and its contractors, if the telephone is used as required by the signs at the crossing (paragraph 36).
- Level crossing risk
- 88 Network Rail's Operations Manual includes the process for managing risk at level crossings. For crossings like Frampton, the process includes a site visit every three years to gather data about the crossing, its location, and its usage. For crossings in rural locations, where there is no evidence of frequent usage, Network Rail permit usage to be estimated.
- 89 The level crossing management team used data from site visits in May 2008, May 2011 and April 2013, to undertake risk assessments for the crossing. This identified that limited visibility of approaching trains (limited sighting distance) meant that users could not just rely on seeing a train when deciding whether it was safe to cross. An exchange of emails between members of the level crossing management team, in April 2013, noted that the existing whistle board for the crossing, and the supplementary warning afforded by the whistle board for Frampton Common crossing (paragraph 13), were an acceptable mitigation for this limited sighting. Reliance on the whistle board for Frampton Common level crossing was believed by Network Rail's level crossing management team to be appropriate because, although this whistle board was 704 metres from Frampton level crossing, the local topography was considered to channel sound from it (see footnote 4).
- 90 The level crossing management team also assessed risk using Network Rail's All Level Crossing Risk Model (ALCRM) which classifies the risk at each crossing in the following ways:
- The individual risk of fatality, identified by a letter A (high) to M (low), representing the risk of death for an individual using the crossing on a frequent basis (500 times per year).
 - The collective risk, identified by a number 1 (high) to 13 (low), representing the total annual risk of death and injury to crossing users, train crew and train passengers.

²⁰ Any factors associated with the overall management systems, organisational arrangements or the regulatory structure.

- 91 The assessments for the bridleway element of Frampton level crossing, based on the last three site visits before the accident, are given in table 2. These assessments are separate to those undertaken for the user worked element of Frampton crossing (which are not relevant to this accident). Usage was estimated for all three assessments. The person undertaking the site visit on 9 April 2013 recorded pedal or motorcycle use and stated that this was due to seeing tyre marks at the crossing. It is not known if this was also the reason motorcycle use was recorded in the estimated census in May 2008.

Site visit	Risk score	Census information	Key risks identified	Mitigation chosen
9 April 2013	C6	4 pedestrians per day 1 pedal or motorcycle per week	Sighting time is less than pedestrian crossing time	Whistle boards
9 May 2011	C6	2 pedestrians per day	Sighting time is less than pedestrian crossing time	Whistle boards
13 May 2008	C8	1 or 2 pedestrians per day 1 pedal or motorcycle per week	Short sighting time	Whistle boards

Table 2: Summary of Network Rail's site visit data and ALCRM results between May 2008 and April 2013

- 92 To put the ALCRM risk score for Frampton level crossing into perspective, the Western route level crossing team were responsible for 615 crossings. Around 14% of these (84 crossings) were C6. Around 7% (46 crossings) had higher individual risk scores of A or B, and around 26% (158 crossings) had higher collective risk scores of 1 to 5.
- 93 Network Rail's operations manual²¹ stated that if a crossing was identified as having an ALCRM collective risk score of 1, 2 or 3, an additional site visit must be undertaken to look more closely at the risks and possible mitigations at that crossing. If a crossing was identified as having an individual risk score of A, B or C, together with a collective risk score of 4 or 5, information about the crossing must be further scrutinised to identify if an additional site visit was needed. Frampton bridleway level crossing did not meet these criteria, and so this particular Network Rail procedure did not require an additional site visit.

²¹ The relevant sections of Network Rail's operations manual relating to level crossing risk assessment and mitigation options have been re-issued several times since 2008. However, the requirement to undertake additional site visits based on the ALCRM result still applied at the time of the accident.

- 94 The level crossing team held regular optioneering meetings to identify and discuss potential mitigation measures to improve safety at crossings. To be considered at these meetings, a level crossing had to have an ALCRM collective risk score of 1, 2 or 3; or a score of 4 or 5 at a location where a significant risk had been identified. Frampton level crossing did not meet these criteria and so was not discussed at the optioneering meetings.

Information about use of the crossing

- 95 In 2008, the authorised user of Frampton level crossing made several complaints to Network Rail that the padlocks securing the user worked crossing gates were being broken so that the crossing could be used by unauthorised vehicles (probably 4x4 vehicles). On one occasion he found that one of the user worked crossing gates had been removed after being lifted from its hinges.
- 96 In response, Network Rail fitted tamper-proof covers to the padlocks and, in December 2008, posted a temporary notice at the crossing that reproduced the relevant extracts from the 1970 British Railways Act (paragraph 36). The notice stated that:

*'The only persons who are entitled to take vehicles over the said level crossing are the adjoining landowners whose land is served by the level crossing.
Any other person not having such authority will be liable to prosecution as a trespasser and for endangering the safe operation of the railway.'*

The notice also stated that anyone who had reason to claim rights over the level crossing should contact Network Rail's liability and clearance advisor.

- 97 In April 2009, a local trail riders association discussed this notice in one of its newsletters. The association said it was going to challenge the extinguishment of vehicular rights over the crossing and advised its members to continue to use the crossing, but to use the telephone to get clearance to cross as visibility of approaching trains was 'horrible'. The three riders involved in the accident at Frampton crossing were not members of any trail riding association.
- 98 A Network Rail employee saw the newsletter from the local trail riders' organisation and sent it on to the Western route level crossing team. There is no evidence that the Western route level crossing team took any direct action in response to this.
- 99 Around the same time, a member of the local trail riders' organisation contacted Gloucestershire County Council by email to enquire about the legal status of the crossing. The County Council followed up this enquiry by writing to Network Rail to establish the status of the crossing. Network Rail replied, sending the relevant extracts of the 1970 British Railways Act to confirm that there was now no right for the general public to take vehicles over the crossing. Gloucestershire County Council contacted the person from the local trail riders association and informed them that Network Rail had acted 'within their rights' with regard to restricting vehicular access over the crossing. There is no evidence that, during this time, Network Rail was aware that the request for information from the County Council had been initiated by an enquiry from a member local trail riders association, or that information about vehicular restrictions over the crossing had been shared with the local trail riders' association.

100 In December 2009, a national organisation representing vehicle drivers (primarily drivers of 4x4 vehicles using green lanes), wrote to Network Rail objecting to the vehicular restriction over the crossing as advertised on the temporary notice posted at the crossing in December 2008 (paragraph 96). Network Rail responded to the organisation and included the relevant sections of the 1970 British Railways Act. There was no further correspondence between the two organisations.

Actions that could have been taken

101 Network Rail's Western route level crossing team were aware from the newsletter they received in April 2009 that trail bikes were using Frampton level crossing (paragraphs 97 and 98). Although the newsletter recommended use of the crossing telephone, there is no evidence the level crossing management team considered the possibility that some trail riders (particularly those that did not see the newsletter) could be using the crossing without using the telephone, and such use was unauthorised. The management team could have addressed this by investigating the extent of any unauthorised use²², and then, if appropriate:

- provided better signage to encourage safe use;
- provided permanent signage to deter unauthorised use;
- arranged for Network Rail's own staff, or the British Transport Police, to undertake awareness briefings or enforcement action at the crossing; and/or
- considered the risk of unauthorised use in its level crossing risk assessment process (paragraphs 88 to 94).

Accessibility of the highway approaches to Frampton level crossing

102 **There were no requirements for signs to be provided on the highway approaches to, or at Frampton level crossing, to indicate the usage restrictions that applied over it.**

103 The British Railways Act of 1970 provided powers to prohibit the general public from using Frampton level crossing with vehicles. These powers did not affect the status of the approaches to the crossing, and these remained public highways with no known restrictions on their use by vehicles (paragraphs 36 and 37).

104 The Act did not require the highway authority, British Railways, or any other body, to provide signs on the highway approaches to, or at, the level crossing to reflect the usage restrictions that applied at the crossing.

105 Network Rail's processes for level crossing management have not included a requirement to provide signs on the approach to, or at level crossings, where British Railways Acts have imposed usage restrictions. The RAIB has made a recommendation to address this finding.

²² The earliest date of videos seen by the RAIB (paragraph 48) was uploaded onto the internet in January 2012 and would not have been available to view in 2009.

Observations²³

Level crossing signage

- 106 Although compliant with legal requirements, shortcomings in the level crossing signage included the absence of information relating to safe use of the crossing by pedestrians between 23:00 hrs and 07:00 hrs (figure 8 and paragraphs 59 to 71). During these hours, train drivers are instructed²⁴ to not sound the train's warning horn on passing whistle boards unless it is an emergency, or someone is seen on or near the railway tracks. This means that the mitigation for limited sighting of approaching trains, ie providing whistle boards, is not provided as expected by Network Rail (paragraph 89).
- 107 It is possible for pedestrians to use the crossing safely between the hours of 23:00 hrs and 07:00 hrs if the telephone at the crossing is used to contact the signaller. However, the signs at the crossing did not display this information.

Sounding the train's warning horn

- 108 The driver of train 2G98 sounded the train's warning horn approximately 60 to 80 metres²⁵ (around 3 to 4 seconds) before passing the whistle board for Frampton Common crossing, around 43 metres (around 2 seconds) before the whistle board for Frampton level crossing, and around 100 metres (around 4 seconds) before the one for Frampton footpath crossing. The position of whistle boards is intended to give level crossing users an optimum warning if the train horn is sounded as the train passes the whistle board. Sounding the horn earlier than this means that the train is further from the crossing and there is a risk that the warning horn will be less noticeable at the crossing.
- 109 The railway rule book GE/RT8000, module TW1 section 1 states that the warning horn must be sounded when passing a whistle board. The driver could not recall why he had sounded the warning horn before reaching the whistle boards. The RAIB is aware that some drivers sound the warning horn approaching a whistle board, particularly when they know a level crossing is around a curve, believing that they are providing an earlier, and thus better, warning for crossing users.
- 110 There is no evidence that the early sounding of the warning horn affected the outcome of this particular accident. It is likely that the early sounding of the warning horn for Frampton Mansell footpath crossing, around 7 seconds before the accident (paragraph 30), would have provided an effective warning to rider 1 if he had been able to hear it (paragraph 52).

²³ An element discovered as part of the investigation that did not have a direct or indirect effect on the outcome of the accident but does deserve scrutiny.

²⁴ Section 45 of module TW1 of the railway rule book contains rules about the use of train warning horns. Rule book modules are available at www.rgsonline.co.uk.

²⁵ The location of the whistle board that applied to Frampton Common crossing was calculated using information in railway industry documents. The accuracy of the information in these documents has not been verified by the RAIB. The RAIB measured the location of the whistle boards for Frampton and Frampton footpath crossings.

111 The RAIB observed, in its investigation of a fatal accident at Mexico footpath level crossing²⁶, that train drivers sometimes sounded train horns a significant distance before passing whistle boards. The RAIB report into this accident included a learning point about the importance of sounding warning horns at the whistle board. In response to the learning point, First Great Western briefed its drivers on the general requirements of the rule book relating to use of the warning horn but did not clearly highlight the importance of not sounding the horn before passing a whistle board, which was the intention of the learning point. The RAIB therefore considers it important that this aspect of the learning point is remade.

On-train CCTV equipment

- 112 Following the accident, the forward-facing CCTV camera and one of the four internal CCTV cameras on the train were found to be defective. Although sufficient witness evidence was available to allow adequate investigation of the accident at Frampton level crossing, forward-facing CCTV footage would have provided valuable confirmatory evidence. In other circumstances, images from forward-facing, or other CCTV cameras fitted to trains, could be essential in determining the factors relevant to an accident.
- 113 CCTV equipment fitted to trains is not deemed to be safety-critical²⁷. As such, trains are permitted to enter, or continue, in service without CCTV equipment functioning.
- 114 Although many new trains are constructed with CCTV equipment, and CCTV equipment has been fitted to many older trains, there is no general requirement for it to be fitted to all new trains, except when it is essential for the safe operation of a train (eg staff on some trains must view CCTV images as part of door closing procedures).
- 115 First Great Western had a maintenance programme for the CCTV systems fitted to its trains. This maintenance included checks on the health of the system and examination of the various components. The 'system healthy' light should be checked by a maintenance technician approximately every three days. The train involved in the accident last had its CCTV functionality checked on 8 May 2014 (three days before the accident). It was reported to have been functioning correctly at that time. Prior to the accident on 11 May 2014, the CCTV recordings had been downloaded on 20 December 2013 at the request of the British Transport Police in connection with an unrelated incident. First Great Western reported that the images from all six CCTV cameras, including the forward-facing camera, had recorded correctly on that occasion.

²⁶ Fatal accident at Mexico footpath level crossing (report 10/2012) available at: www.gov.uk/raib.

²⁷ A system, sub-system or component, the operation of which affects the safety of the machine or system of which it forms part.

116 Defective CCTV equipment has been identified in previous RAIB investigations²⁸ relating to events at Cheshunt Junction (report 06/2011) and Brentwood (report 19/2011). As CCTV can assist safety investigations undertaken by both the RAIB and other railway industry bodies, the RAIB has written to Train Operating Companies asking that they improve their arrangements to deliver improved availability of CCTV images. The RAIB has also requested the European Rail Agency²⁹ to include within appropriate European standards, a requirement for trains to be fitted with CCTV equipment. This equipment should include forward-facing, and where practical, rear-facing cameras.

Previous occurrences of a similar character

117 Accident data from railway industry records³⁰ shows that, from February 2002 until December 2014, there were two fatal accidents involving motorcycle riders at level crossings, not including the accident at Frampton level crossing. On 26 July 2011, it was reported that a motorcycle rider had fallen off his bike, slid under the lowered barriers at Balderton level crossing between Wrexham and Chester, and was then struck by a passing train. On 15 October 2003, it was reported that a motorcycle rider had manoeuvred around the lowered barriers at Three Horseshoes No.1 level crossing between March and Whittlesea, and was then struck by a train as he crossed the railway. Neither of these previous accidents are relevant to the circumstances of the accident at Frampton Mansell.

²⁸ RAIB reports are available at www.gov.uk/raib.

²⁹ The organisation responsible for producing the standards applicable to new trains intended for use in the European Union, including those for use in the United Kingdom. More information about the European Rail Agency can be found on its website at www.era.europa.eu.

³⁰ The Safety Management Information System (SMIS) maintained by RSSB.

Summary of conclusions

Immediate cause

118 The immediate cause of the accident was that the trail bike rider crossed into the path of the approaching train (**paragraph 38**).

Causal factors

119 Although the exact reasons for the trail bike rider's actions cannot be established, the causal factors were:

- a. Rider 1 was unaware of the threat from the approaching train until it was too late (**paragraph 41**, recommendation being implemented as described at paragraphs 128 and 129).
- b. The trail riders did not use the telephone to call the signaller to see if it was safe to cross (**paragraph 54, Recommendations 2, 3 and 4**).
- c. The signs at the level crossing did not influence the behaviour of the trail bike riders (**paragraph 58**, recommendations being implemented as described at paragraphs 123 to 127, action taken as described at paragraphs 135 to 140, **Recommendations 1, 2, 3 and 4**).
- d. The trail riders were not aware that they were not permitted to use the level crossing with their trail bikes (**paragraph 78**, action taken as described at paragraphs 135 and 136, **Recommendations 2, 5 and 6**).

Underlying factors

120 Two underlying factors have been identified:

- a. Network Rail took no effective action to manage the risk of unsafe use by unauthorised trail bikers using the crossing (**paragraph 86, Recommendations 5 and 6**).
- b. There was no requirement for signs to be provided on the highway approaches to, or at Frampton level crossing, to indicate the usage restrictions that applied over it (**paragraph 102, Recommendations 2, 5 and 6**).

Additional observations

121 Although not linked to the accident on 11 May 2014, the RAIB observes that:

- a. There were no signs at Frampton crossing informing pedestrians how to use the crossing safely between the hours of 23:00 hrs and 07:00 hrs, when train drivers are instructed not to sound the train's warning horn when passing whistle boards (**paragraph 106, Recommendations 2, 3 and 4**).
- b. The train horn was sounded while approaching, and not at, whistle boards (**paragraph 108, Learning point 1**).
- c. The forward-facing CCTV was defective on the train involved in the accident, and on some trains involved in other accidents investigated by the RAIB (**paragraph 112**, action taken as described at paragraph 142).

Recommendations that are currently being implemented which are relevant to this accident

122 The following recommendations have been made by the RAIB as a result of previous investigations. They are currently being implemented and address some of the factors identified in the current investigation. To avoid duplication, they have not been remade.

Collision between a train and a car at Jetty Avenue level crossing, Woodbridge, Suffolk on 14 July 2013 (RAIB Report 28/2014)

123 Recommendations 2 and 5 of the RAIB report into a collision between a train and a car at Jetty Avenue level crossing, Woodbridge, Suffolk³¹ are relevant to the Frampton level crossing accident because they seek improvements to signage at user worked level crossings. All users approaching Frampton level crossings see signs relating to both the bridleway crossing involved in the accident, and signs relating to the adjacent user worked crossing. Although it is important that all signage on the approaches to these crossings takes account of all users, the Frampton level crossing recommendations do not address user worked crossing signage because this is already addressed by recommendations in the Jetty Avenue investigation.

124 Recommendation 2 of the Jetty Avenue investigations states:

'Network Rail should commission research into measures to improve the safety of UWCs where vehicular users are reliant on sight to detect the approach of trains. This should utilise and, as necessary, extend existing research findings to include consideration of:

- *the ways in which the behaviour of vehicle drivers can be influenced by the design of the crossing to use the crossing as intended including stopping and looking for trains at an appropriate location;*
- *use by different types of vehicle, including heavy commercial and agricultural vehicles;*
- *use of the crossing by persons other than those briefed by the authorised user (eg unexpected visitors or delivery vehicles);*
- *instructions and/or guidance given to users, including signs and road markings where appropriate; and*
- *instructions and guidance provided to those assessing, maintaining and modifying UWCs.*

This research should take into account the safety of pedestrians (including vehicle occupants when opening gates), cyclists and equestrians who may use UWCs.

³¹ The Jetty Avenue report is available on the RAIB website: http://www.raib.gov.uk/cms_resources.cfm?file=/141215_R282014_Jetty_Avenue_UWC.pdf.

The findings of this research should be used by Network Rail to improve/clarify existing standards related to the design (including gates, signage and road markings), management of user worked crossings, guidance provided to users and training/briefing to relevant staff. Network Rail should also identify the need for any modification to the legal requirements relating to level crossing signage requirements, and make suitable representations to government that this be done.'

125 Recommendation 2 of the Jetty Avenue investigation has only recently been made and so neither Network Rail, nor the ORR, have yet provided the RAIB with a response to this recommendation.

126 Recommendation 5 of the Jetty Avenue investigation states:

'The Office of Rail Regulation³² should provide duty holders with enhanced guidance which:

- *reminds duty holders that, when determining the position of decision points at user worked crossings, they must take due account of the characteristics of vehicles likely to use the crossing and recognise that a minimum dimension of 3 metres from the nearest rail is insufficient for most vehicles; and*
- *takes account of outputs from the research and review undertaken in response to Recommendations 2 and 4'* [the reference to Recommendation 4 is not relevant to Frampton level crossing].

127 Recommendation 5 of the Jetty Avenue investigation has only recently been made and so the ORR has not yet provided the RAIB with a response to this recommendation.

Fatal accident at Mexico footpath crossing, near Penzance, on 3 October 2011 (RAIB Report 14/2012)

128 Recommendation 5 of the RAIB report into the fatal accident at Mexico footpath level crossing³³ is also relevant to the Frampton level crossing accident because it includes consideration of audible or visual warning systems which would assist trail bike riders when deciding if it is safe to cross. This recommendation states:

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

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

³² In April 2015, the Office of Rail Regulation became the Office of Rail and Road. In addition to its role as the independent safety and economic regulator for Britain's railways. It became responsible for monitoring Highways England's management of the strategic road network – motorways and main 'A' roads – in England.

³³ The report is available on the RAIB website: http://www.raib.gov.uk/cms_resources.cfm?file=/120621_R102012_Mexico_FPC.pdf.

129 The ORR reported to the RAIB in March 2015 that it was:

'Pursuing this [Mexico footpath level crossing recommendation 5] at regular liaison meetings with NR [Network Rail's] Head of Level Crossings and by inspection in the routes. Network Rail routes are now out on the ground currently checking whistle board position and suitability, verifying the data from the desktop exercise. Whistle boards are being removed/repositioned as required and Network Rail are identifying sites for new warning systems but these are not coming on line as fast as we would have hoped. After challenge from ORR, Network Rail are producing a strategy which will outline the proposed roll out of new technology based on risk. We have inspection activities ongoing to visit crossings with whistle boards to provide assurance of Network Rail's management of the risk.'

Other recommendations relevant to this investigation

130 In June 2009, the RAIB published a report (13/2009): 'Investigation into safety at user worked crossings'. Recommendation 3, and in particular the third bullet point of this, is relevant to the accident at Frampton level crossing. Recommendation 3 states that:

'Network Rail should initiate research into reasonably practicable methods of marking the final decision point at those UWCs where such a solution is assessed as being appropriate. The scope of this research should include:

- *the requirement to reconcile the needs of various types of user (eg drivers of vehicles, pedestrians, cyclists and equestrians);*
- *the various categories of UWC (including those which also include public footpaths and bridleways);*
- *an analysis of where to locate such signs or visual features in relation to the track; and*
- *the need to protect the railway from vehicle incursions'.*

131 In response to this recommendation, Network Rail stated that:

'There are many variations that would affect this and depending upon the user type the decision point can vary. Therefore, there would be too much clutter and confusion to users... For the purposes of measuring sighting distances, Mobile Operations Managers, Operations Risk Control Co-ordinators and Maintenance Level Crossing Inspectors take the decision point to be taken as being no closer than 2m from the nearest running rail (or for bridleways and UWCs, 3m)'.

132 The ORR reported to RAIB, on 26 May 2010, stating:

'We have considered Network Rail's response and concluded that it provides full reasoning as to why the recommendation should not be delivered. Our consideration has taken account that we cannot enforce the initiation of research. We will however continue to consider the quality of site-inspections and risk assessments done by Network Rail, and the appropriateness of resulting action as part of our ongoing inspection activity. These are clear aims of ORR's 2010/11 inspection plan, made partly in response to a number of level crossing related RAIB reports'.

133 Although the ORR concluded that Network Rail had provided reasoning as to why the recommendation should not be delivered, some research has since been completed, and some is in progress (paragraphs 138 and 139). RSSB research project T984 'Research into the causes of pedestrian accidents at level crossings and potential solutions', published in December 2013, found that, at least in respect of pedestrians, the decision about when to cross the railway is not necessarily made at a single location. The decision is made based on information assimilated as the user moves towards the crossing.

134 Although it was unlikely that signage at the decision point may have caused rider 1 to look or recheck for approaching trains (paragraph 77), the RAIB cannot discount the possibility that the accident would have been avoided by full implementation of recommendation 3 of RAIB Report 13/2009 (paragraph 130). The RAIB also concluded that it was possible that the accident at Jetty Avenue level crossing that occurred on 14 July 2013 (RAIB Report 28/2014), could have been avoided by full implementation of this recommendation.

Actions reported of relevance to this investigation

- 135 Gloucestershire County Council has stated that it intends to provide highway signs on the approaches to the level crossing to inform members of the public about the vehicular restriction that applies at the level crossing (paragraph 82).
- 136 To avoid any potential confusion, Gloucestershire County Council has annotated its highway record to highlight that public vehicular rights were removed from the level crossing on the route between Frampton Mansell and Sapperton, by virtue of the British Railways Act 1970 (paragraph 84).
- 137 Network Rail has repositioned the signs at Frampton crossing. The 'Stop. Look. Listen' sign, and the instructions about the user worked crossing gate, have been mounted on a post positioned 3 metres from the Up Kemble line (figure 9). Network Rail has also fitted signs at the level crossing that say '*Level crossing closed to motorised vehicles except for farm traffic*' and is intending to prepare a brief for relevant organisations to raise awareness of the vehicular restrictions at Frampton crossing.
- 138 In November 2014, RSSB published research into traffic signs and signals at public road level crossings (research project T756). This research project looked at the effectiveness and comprehensibility of existing road traffic signs and signals on the approach to public road level crossings. This report is not directly relevant to the accident at Frampton level crossing because it is not a public vehicular level crossing. However, it is likely that some of the learning from this research will apply to other types of level crossing, including bridleway and footpath crossings.
- 139 RSSB is currently undertaking research into signs at private road level crossings (research project T983). This project is considering the types of signs that should be presented to road users at level crossings on private roads, including those at field-to-field level crossings. The project is exploring which signs and signals best convey the particular points of information that road users need when approaching these crossings. The report is due for publication in 2015. Again, this research is not directly relevant to the bridleway element of Frampton level crossing, but it is likely that learning from this report would also apply to bridleway and footpath level crossings.
- 140 RSSB has recommended that the ORR should re-evaluate current level crossing guidance, using the information from RSSB research project T756, to determine whether the guidance reflects current good practice (paragraphs 62 and 73).
- 141 The RAIB has written to Train Operating Companies encouraging improvement in the availability, and reliability of CCTV systems fitted to trains, and has asked the European Rail Agency to extend European standards so that they require fitment of CCTV equipment to trains (paragraphs 112 to 116).
- 142 First Great Western has implemented a programme to improve the reliability of the CCTV system fitted to its trains (paragraph 121c).

Learning point

143 Although not linked to the causes of this accident, the RAIB has identified a key Learning point³⁴ that addresses a general safety issue (paragraph 108). This Learning point is the same as that identified following the RAIB's investigation into a fatal accident at Mexico footpath level crossing in 2011 (paragraph 111). It is repeated here to reinforce the need for drivers to comply with the requirements of the railway rule book when on the approach to level crossings with whistle boards:

- 1 It is important that train drivers sound the warning horn **when passing** whistle boards as described in Railway Rule Book module TW1, and not before reaching them. Whistle boards are intended be positioned to provide an optimal warning for crossing users. Sounding the warning horn earlier means that the warning is less audible at the crossing and may not be noticed by crossing users (paragraphs 108 to 111).

³⁴ '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.

Recommendations

144 The following recommendations are made³⁵:

- 1 *The intent of this recommendation is to provide short-term action at level crossings where deviations from existing signage requirements are so great that remedial action is required before any implementation of improvements triggered by recent research.*

Network Rail should identify locations where level crossing sign positions differ significantly from the requirements of guidance and standards, and then install signs at the appropriate location, unless the proposed position of the signs is contrary to recent research (paragraph 119c).

- 2 *The intent of this recommendation is to improve level crossing signs, with regard to their conspicuity, message, content and clarity of information (the RAIB has already made a similar recommendation for user worked crossings (paragraph 124).*

Network Rail should utilise the findings from this investigation, and all available research (including the forthcoming RSSB research report T983), to update its guidance for signage, and other user guidance, provided at bridleway and footpath crossings. The updated guidance should take account of circumstances where another type of level crossing (eg a user worked crossing) is located at, or close to, the bridleway or footpath crossing. It should also take account of prohibitions (eg use of bridleway and footpath crossings by motorcycles) and circumstances when it is appropriate for pedestrians to use a telephone. Network Rail should also:

- liaise with the Office of Rail and Road to ensure that its updated guidance is compatible with the ORR's own version of good practice; and
- seek the assistance of the Department for Transport to enable any necessary legislative changes needed to implement the updated guidance (paragraphs 119a, b, c & d and 120a).

continued

³⁵ 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, Recommendations 1, 2, 3, 5 and 6 are addressed to the Office of Rail and Road (ORR), and Recommendation 4 to the Department for Transport, to enable them to carry out their duties under regulation 12(2) to:

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

Copies of both the regulations and the accompanying guidance notes (paragraphs 200 to 203) can be found on RAIB's website www.gov.uk/raib.

- 3 *The intent of this recommendation is to provide the ORR input needed for effective implementation of recommendation 2 by Network Rail. The two recommendations are intended to improve level crossing signs, with regard to their conspicuity, message, content and clarity of information. The RAIB has already made a related recommendation to the ORR for user worked crossings (paragraph 125).*

The Office of Rail and Road should utilise the findings from this investigation, and all available research (including the forthcoming RSSB research report T983), to update its guidance for signage, and other user guidance, provided at bridleway and footpath crossings. The updated guidance should take account of circumstances where another type of level crossing (eg a user worked crossing) is located at, or close to, the bridleway or footpath crossing. It should also take account of prohibitions (eg use of bridleway and footpath crossings by motorcycles) and circumstances when it is appropriate for pedestrians to use a telephone. The Office of Rail and Road should seek the assistance of the Department for Transport to enable the necessary legislative changes needed to implement the updated guidance (paragraphs 119a, b, c & d and 120a).

- 4 *This recommendation is intended to provide any necessary legislative support for improving level crossing signage as sought by recommendations 2 and 3.*

The Department for Transport should work with Network Rail and the Office of Rail and Road, to identify any appropriate legislative changes needed to allow implementation of the improved level crossing signage sought by Recommendations 2 and 3. If required, the Department for Transport should help make the necessary legislative changes (paragraphs 119a, b, c & d and 120a).

- 5 *This recommendation is intended to ensure that level crossing risk is managed with an adequate understanding of actual crossing usage.*

Network Rail should modify its procedures, guidance and/or training in order to obtain, where reasonably practicable, an improved understanding of actual crossing use (eg use of bridleway crossings by motorcyclists), and take action to ensure it adequately controls the associated risks. This should include considering use of social media (eg videos uploaded to internet sites), evening and/or weekend site visits to identify recreational use of the crossing, and the use of surveillance equipment (paragraphs 48 and 119d).

continued

- 6 *The intent of this recommendation is to provide clear information about locations where public vehicular restrictions exist at level crossings that cross highways.*

Network Rail should identify level crossings where safety management depends on the general public being aware that they are not allowed to use the level crossing with vehicles, including cars, motorcycles and trail bikes (paragraph 78). For these crossings, Network Rail should:

- liaise with the relevant highway authorities to ensure their highway records, and any related documents and publications, clearly show the absence of a public vehicle route at the level crossing;
- share information about prohibitions with local and national organisations representing groups such as 4x4 vehicle drivers and trail bike riders; and
- arrange for signs to be provided on the highway approaches to the level crossing, and at or near the crossing itself, to show the prohibition that applies (taking into account recommendations 2 and 3).

Appendices

Appendix A - Glossary of abbreviations and acronyms

ALCRM	All Level Crossing Risk Model
CCTV	Closed-Circuit Television
ORR	Office of Rail and Road
OTDR	On-Train Data Recorder
RAIB	Rail Accident Investigation Branch
RSSB	Rail Safety and Standards Board
UWC	User Worked Crossing

Appendix B - Glossary of terms

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

Authorised user	A person, having specific rights to use a user worked level crossing.
Bridleway	A highway over which the public have a right of way on foot, on horseback or leading a horse, with or without a right to drive animals of any description along the highway.
Bridleway crossing	A type of level crossing intended for use by pedestrians, pedal cyclists, and equestrians (horse riders and persons leading horses).
Conspicuity	The capacity of a sign to stand out or be distinguishable from its surroundings and thus be readily discovered by the eye
Diesel multiple unit	A train consisting of one or more vehicles (semi-permanently coupled together) with a driving cab at both ends, whose source of power is a diesel engine.*
Down (direction)	In the context of this report, means the direction of trains travelling from London and Swindon towards Gloucester.
Footpath crossing	A crossing provided solely to allow pedestrians to cross the railway.
Highway Record	A record of a highway authority's maintenance liabilities.
On-train data recorder	A data recorder fitted to a train that records information on the status of train equipment, including speed and brake applications.
Sighting distance	The maximum distance at which an approaching train can first be seen.
Signal word	A word used to emphasise information (eg Danger).
Up (direction)	In the context of this report, means the direction of trains travelling from Gloucester towards Swindon and London,
User worked crossing	A type of level crossing for road and agricultural vehicles where the gates giving access to the crossing are opened and closed by the user.
Warning time	The time from first being warned of the approach of a train (eg being able to see a train or hearing the train's warning horn) to its arrival at the crossing assuming the train is travelling at the maximum permitted speed.
Whistle board	A sign instructing train drivers to sound the train's warning horn.

This report is published by the Rail Accident Investigation Branch,
Department for Transport.

© Crown copyright 2015

Any enquiries about this publication should be sent to:

RAIB	Telephone: 01332 253300
The Wharf	Fax: 01332 253301
Stores Road	Email: enquiries@raib.gov.uk
Derby UK	Website: www.gov.uk/raib
DE21 4BA	