



Rail Accident Investigation Branch

Rail Accident Report



**Collision between a train and a tractor at
Oakwood Farm User Worked Crossing,
Knaresborough
14 May 2015**

Report 07/2016
April 2016

This investigation was carried out in accordance with:

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

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Preface

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

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

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

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

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

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

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

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

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Collision between a train and tractor at Oakwood Farm User Worked Crossing, Knaresborough, 14 May 2015

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Summary

On 14 May 2015, a passenger train collided with a tractor at Oakwood Farm user worked crossing near Knaresborough, North Yorkshire. The train was carrying 66 people and travelling at 65 mph (105 km/h), but did not derail. The collision caused the front of the tractor to become detached from its cab. The tractor driver suffered minor injuries, and the train driver was treated for shock. However, in different circumstances the consequences could have been much worse.

The tractor driver began crossing the railway after the illuminated warning at the crossing started to display a red light. This was probably because he was unfamiliar with the crossing's operation; it is one of a small number in the country that had been fitted with remotely operated, powered gates. It is likely the tractor driver did not recheck the warning lights after first stopping on the approach to the crossing to press a button to open the gates. This button had not originally been intended to open the gates (it should only have been capable of being used to close them). It was situated at such a distance from the crossing that the time it took for the tractor driver to stop, open the gates and then drive onto the crossing, was greater than the time between the warning light turning red and the arrival of the train. There was no sign at the button to warn the driver to recheck the warning light before going over the crossing. The investigation also found that the warning light was not conspicuous among the many signs present at the crossing.

The underlying causes of the accident were that Network Rail did not ensure that the risks at the crossing were adequately mitigated, and that the process for the introduction of the gate operating equipment was adequately managed.

The RAIB has made three recommendations to Network Rail. The first is to improve the safety at Oakwood Farm user worked crossing and the second is to review the safety of other user worked crossings fitted, or planned to be fitted, with the remotely operated gate opening equipment. The third recommendation is for Network Rail to review the robustness of its processes for introducing new equipment on to its railway infrastructure.

Introduction

Key definitions

- 1 Metric units are used in this report, except when it is normal railway practice to give speeds and locations in imperial units. Where appropriate the equivalent metric value is also given.
- 2 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. Sources of evidence used in the investigation are listed in appendix C.

The accident

Summary of the accident

- 3 At 18:18 hrs on Thursday 14 May 2015, train 2C52, the 17:29 hrs Leeds to York passenger service, collided with an agricultural tractor at Oakwood Farm *user worked crossing* (UWC) near Knaresborough, North Yorkshire (figure 1). The tractor was pulling an unloaded trailer.
- 4 The train was travelling at the maximum permissible speed of 65 mph (105 km/h) when, approaching the crossing, the train driver saw the tractor moving closer to the crossing. The train driver gave a long blast of the train's horn and applied the emergency brake, but could not stop before colliding with the tractor.
- 5 The front of the tractor became detached from its cab, with one of the tractor's wheels becoming detached and wedged under the front of the train close to one of the leading wheels. The train did not derail. None of the passengers reported any injuries. The train driver, and another driver riding in the cab, were badly shaken. The train driver was taken to hospital and treated for back pain and was released that evening. The tractor driver suffered minor cuts and grazes and was treated in hospital and also released later the same evening.

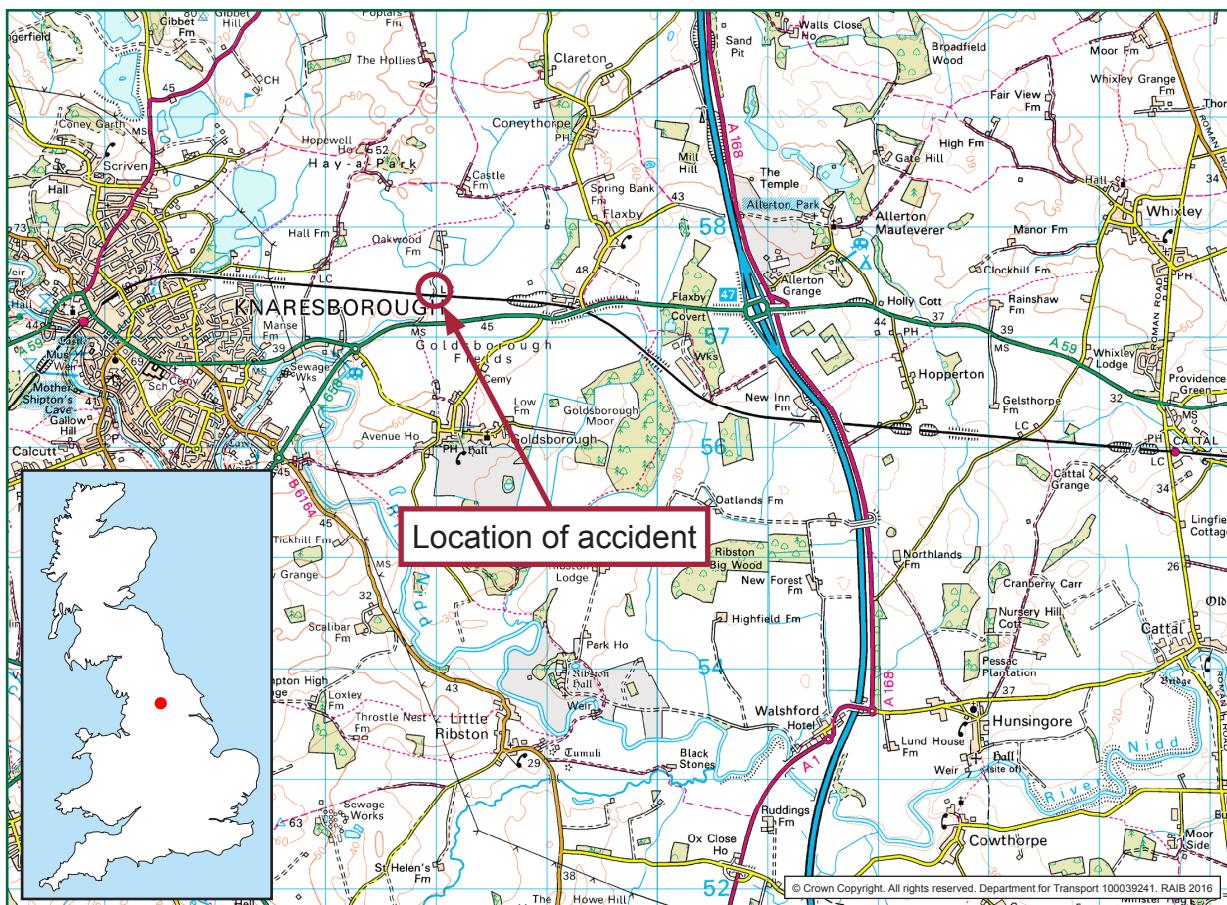


Figure 1: Extract from Ordnance Survey map showing location of accident

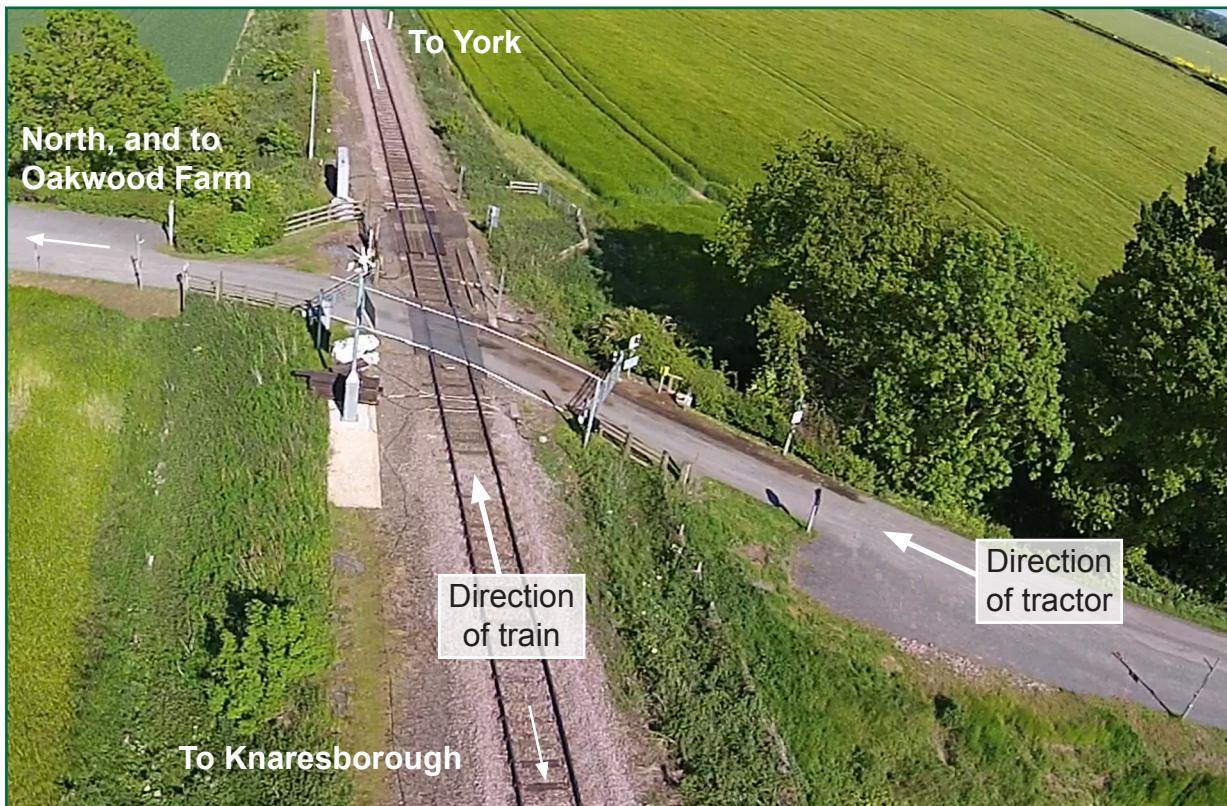


Figure 2: Oakwood Farm UWC

Context

Location

- 6 Oakwood Farm user worked crossing is located on a single track section of the Leeds to York via Harrogate line, between Knaresborough and Cattal stations. The line runs approximately west to east and the maximum permitted speed is 65 mph (105 km/h).
- 7 The road which crosses the railway is a private road allowing access from the A59 south of the railway to Oakwood Farm to the north (figure 2).

Organisations involved

- 8 Network Rail owns, operates and maintains the infrastructure, and was also responsible for the specification and approval of the equipment at the crossing.
- 9 Northern Rail was the operator of train 2C52 and the employer of the train crew.
- 10 Hullah Contractors was the employer of the tractor driver.
- 11 The owner of Oakwood Farm is recognised by Network Rail as the crossing's *authorised user*.
- 12 All of the parties involved freely co-operated with the investigation.

Train involved

- 13 Train 2C52 was formed of two Class 150 *diesel multiple units*. The investigation found that neither the condition of the train, nor the actions of the train crew played any part in the accident.

- 14 At the time of the accident there were 66 passengers on board and three train crew. There were two drivers in the front cab; one of whom had completed his train driving duties earlier at Harrogate and was returning to York.

Rail equipment/systems involved

- 15 Oakwood Farm crossing is a user worked crossing on a private road. It consists of two crossings, ten metres apart (figure 2). Immediately to the east of the crossing on which this accident occurred, is another user worked crossing giving access from the private road on the north side of the railway to the fields on its south side. This crossing played no part in the accident, and this report is only concerned with the western crossing which allows users to travel along the private road between the A59 and Oakwood Farm.
- 16 The private road crosses the railway at an angle of approximately 35 degrees. The crossing is fitted with miniature stop lights (MSLs) situated on each side of the crossing. Each MSL fixture consists of a red and a green *LED* light fitted to a post-mounted backboard (figure 3). The green light illuminates when it is safe to cross the railway. When a train approaches the crossing, the green light extinguishes and the red light illuminates, warning users not to cross.



Figure 3: The MSL on the approach to the crossing

- 17 The crossing is also fitted with telephones on each side connected to Knaresborough signal box. Their purpose is to allow users to contact the signaller and obtain permission to cross if the MSLs are not working correctly, or if they wish to cross with a large or slow vehicle. There is a 'whistle' board on both railway approaches to the crossing, instructing train drivers to sound their train horns. On the approach from Knaresborough the whistle board is situated 267 metres from the crossing. There are also audible alarms at the crossing. These are intended to give pedestrians additional warning of the approach of a train and they sound when the red light is illuminated.

- 18 The metal crossing gates open away from the railway. The southern gate is 6.7 metres from the nearest running rail. Both gates are fitted with remotely controlled opening and closing equipment, operated by the crossing user. This equipment is known as a power operated gate opener (POGO).

People involved

- 19 The train driver had driven for Northern Rail since 2001. His shift that day had started at 14:48 hrs in Harrogate and he subsequently had made several trips that day between York and Leeds.
- 20 The tractor driver had held a full tractor licence since 2011 and a full road driving licence for other vehicles since January 2012.
- 21 The tractor driver had last been to the crossing some 18 months to 2 years previously, as a passenger in a vehicle.

External circumstances

- 22 The accident occurred in daylight. The weather was dry and bright, with clear visibility. At the time of the accident the sun was at a position that was over the tractor driver's left shoulder. The RAIB observed the MSLs at a similar time of day and in similar conditions, and noted that they were not washed out by sunlight, and did not appear to be falsely illuminated.

The sequence of events

Events preceding the accident

- 23 The driver of the tractor began work at around 07:00 hrs in his company's depot, repairing a dumper truck. At around noon he drove to collect some spare parts; a round trip involving approximately three hours of driving. He then drove the tractor, with the attached 7.9 metre long low-loader trailer carrying the dumper, approximately 5 miles (8 km) to the north of Harrogate to deliver the dumper. Following this, he drove the tractor and the unloaded trailer (which he was delivering to the farm) approximately 10 miles (16 km), passing through Knaresborough at around 18:00 hrs, and arriving at the private road to Oakwood Farm at around 18:15 hrs.
- 24 Train 2C52 left Knaresborough station at 18:15 hrs. The distance from Knaresborough station to the crossing is approximately 2 miles (3.2 km) and the train was travelling at the maximum permissible speed of 65 mph (105 km/h) as it approached the crossing.

Events during the accident

- 25 Shortly after 18:15 hrs the tractor arrived at the crossing. The driver stopped the tractor on the left-hand side of the road beside a post on which were two buttons to operate the gates (figure 4). He opened the left-hand side tractor door, stood on the step of the tractor and pushed the higher of the two buttons. He then re-entered the cab, closed the door and drove slowly towards the crossing as the gates were opening.



Figure 4: The approach to the crossing towards Oakwood Farm showing the left-hand roadside post

- 26 At around this time, the signalling system detected the approach of train 2C52 from Knaresborough, which turned the MSLs from green to red and activated the audible alarms.

- 27 The train driver reported that he sounded the train horn at the whistle board. He then saw the tractor was proceeding onto the crossing. He sounded the train horn again continuously and operated the emergency brake when the train was about 100 metres from the crossing.
- 28 The tractor continued towards the crossing, driving up the incline beyond the open gate towards the track. Upon reaching the top of the slope, the driver stopped the tractor with its front left-hand wheel over the nearest running rail. The images recorded from the limited footage¹ available from the CCTV system installed at the crossing, indicated that when the tractor stopped, the train was approximately 40 metres, or 1.4 seconds travelling time, away.
- 29 The train's speed was not reduced in the short period between the emergency brake application (paragraph 27) and train's arrival at the crossing and it collided with the front of the tractor at around 18:18 hrs, still travelling at 65 mph (105 km/h) on impact. The right-hand side front corner of the train collided with the front left-hand wheel of the tractor. The impact caused the portion in front of the cab to become separated from the rear portion (figure 5).



Figure 5: The damaged tractor following the accident (image courtesy of British Transport Police)

- 30 The tractor's front left-hand wheel detached and became wedged under the right-hand side of the train's *obstacle deflector*. Although the tyre was in contact with the leading right-hand train wheel, the *lifeguard* is likely to have prevented the train from derailing (figure 6).

¹ The footage from the crossing's CCTV system only recorded the last two seconds before the collision and one second afterwards.



Figure 6: The tractor's front wheel and tyre wedged under the front right-hand side of the train (image courtesy of British Transport Police)

- 31 The train stopped around 468 metres beyond the crossing with the tractor's wheel still wedged under the right-hand side of the train.

Events following the accident

- 32 The train driver contacted the signaller at Knaresborough signal box using the cab radio and reported the accident before the train came to a stop. He then went through the carriages to check on the passengers. The crossing's authorised user was the first to arrive at the crossing. The other train driver left the train and walked to the crossing to check on the tractor driver, who by that time had got out of the tractor cab, walked across the line, and phoned his employer and one of his relatives.
- 33 Network Rail contacted the emergency services who subsequently arrived at the crossing. Network Rail conducted checks on the level crossing equipment and reported that no faults were found. RAIB attended the site to record and obtain evidence. Repairs were made to damaged equipment and the road surface, and the line was fully opened at 14:12 hrs the following day.
- 34 The local police subsequently examined the tractor and the British Transport Police (BTP) reported to the RAIB that there was no evidence of any faults with it that could have contributed to the accident.

Key facts and analysis

Background information

History of Oakwood Farm user worked crossing and the introduction of the POGO equipment

- 35 The *power operated gate opening equipment* (POGO) had been installed at Oakwood Farm crossing in November 2012. This was the second version of the equipment that had been installed at the crossing, following an unsuccessful earlier trial with the first version which had been installed between December 2009 and September 2011. Before December 2009 the equipment at the crossing consisted of manual gates together with the MSLs and whistle boards, as described in paragraphs 16 and 17.
- 36 Network Rail records show that the crossing had persistently suffered from users not closing the gates after crossing. This was a concern as it presented a risk to subsequent users who could drive over the crossing without stopping if they happened not to observe the MSLs. Documents showed that Network Rail had calculated the cost of train delays when the gates were left open. This cost was due to train drivers having to either stop to close the gates, or having to travel at a cautionary speed to reduce the risk of a collision. Documents also showed that Network Rail was hoping to close two other crossings on the landowner's property if the POGO equipment proved to be successful. Both before and since the fitting of the POGO gates, Northern Rail drivers had reported near misses with road vehicles using the crossing.

Design and operation of the crossing

- 37 The red and green lights of the MSLs are linked to the railway's signalling system. When an approaching train is detected, the green light on the MSL extinguishes and the red light illuminates. The distance from the crossing that a train is detected gives crossing users a minimum warning time of 40 seconds before a train's arrival based on a maximum train speed of 65 mph (105 km/h).
- 38 The addition of the POGO equipment allows a crossing user to open and close the gates remotely. Network Rail believed this would be a safety improvement, as the user would no longer have to leave their vehicle manually to open and close the gates, thereby reducing the number of times that each user had to cross the railway line. Because it would also make it easier for a user to close the gates, Network Rail thought it would be less likely that the gates would be left open. Data from Network Rail shows that reported incidents of gates being left open at Oakwood Farm UWC reduced by around 80% after the introduction of the POGO equipment.
- 39 Regular users, such as the farm's employees, had been issued with remote control key fobs by Network Rail, via the authorised user, allowing them to operate the gates from inside their vehicles. For users without key fobs, there are five push buttons on each road approach to the crossing.

- 40 On the southern approach to Oakwood Farm crossing there is one button for pedestrian use located by the latch on the gate post. Two buttons are located on a post on the right-hand side of the road approximately 7 metres from the gate (figure 7). The remaining two buttons are on a post on the left-hand side of the road, 24 metres from the gate. The purpose of these buttons is further discussed in paragraph 53. The buttons mounted on each of the road-side posts are at different heights; the lower button is for use by car and van drivers, and the upper button is for lorry and farm vehicle drivers. At the time of the accident, any of the buttons could be pressed to either open or close the gates, depending on their pre-existing position. Each single opening or closing operation takes approximately 15 seconds.

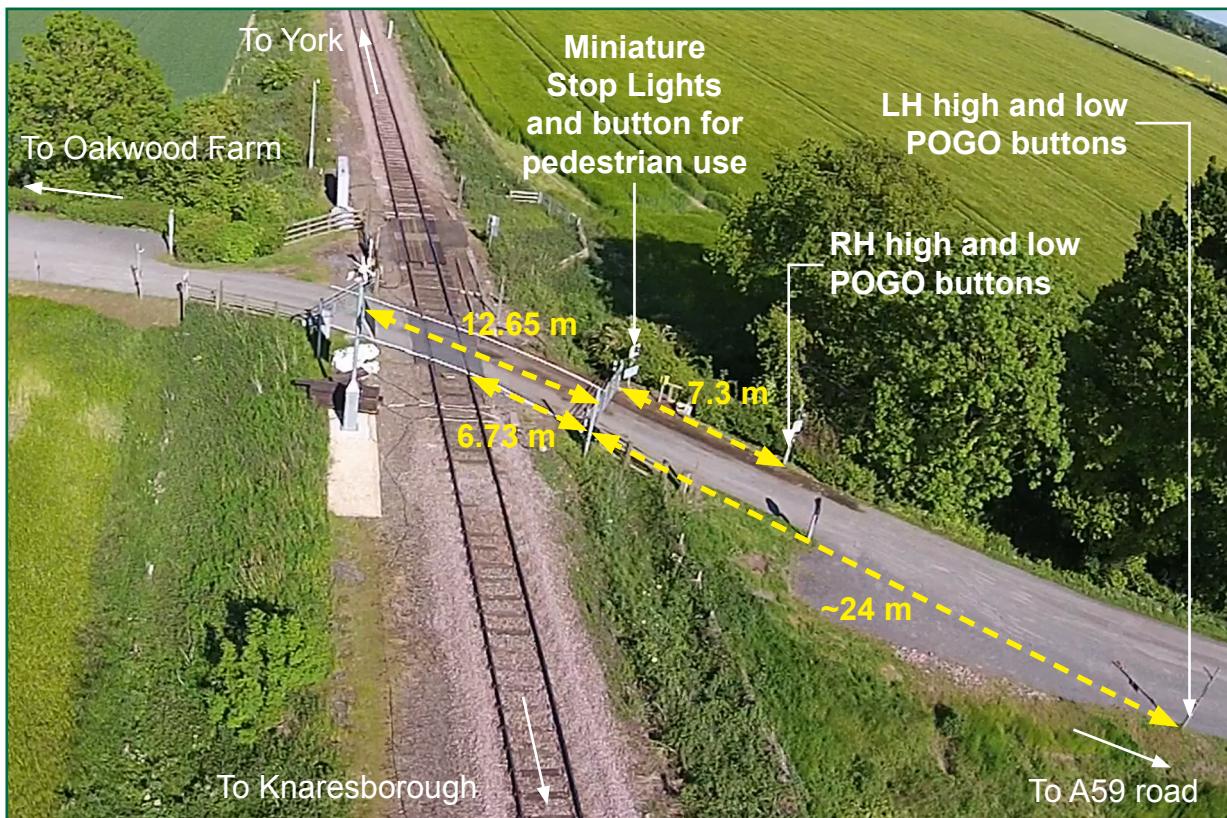


Figure 7: Location of the POGO operating buttons

- 41 The POGO equipment is independent of the railway signalling system, so the gates can be opened or closed at any time even if a train is approaching and the MSL is displaying a red light. Therefore the safe use of the crossing still relies upon the user checking the MSL before crossing.

Identification of the immediate cause

- 42 **The tractor driver started to cross the railway line when the MSL was displaying a red light.**
- 43 Witness evidence following the accident indicates that both red and green MSL lights were working at the time of the accident. The RAIB's analysis of the crossing's data logger indicates that the control system of the MSLs (paragraph 37) was working correctly at the time of the accident.

Identification of causal factors

- 44 The accident occurred due to a combination of two causal factors:
- it is probable that, having opened the gates by using the distant left-hand roadside button (which was not originally intended for this purpose), the tractor driver did not recheck the MSL when approaching the crossing (paragraph 45); and
 - by the time the train driver realised that the tractor was not going to stop, it was too late to stop the train (paragraph 66).

Each of these factors is now considered in turn.

Rechecking the MSL

- 45 **The tractor driver probably did not recheck the MSL when approaching the crossing, having used the distant left-hand roadside button to open the gates.**

- 46 RAIB measurements at the crossing show that the MSL was continuously visible from a distance of 41 metres. There were no external effects, such as poor visibility due to sun glare or *washout* that prevented the MSL from being seen.
- 47 The approaching train was travelling at the maximum permissible speed of 65 mph (105 km/h), which would have caused the MSLs to change from green to red 40 seconds before it arrived at the crossing. Therefore, considering the tractor's speed (paragraph 52), the MSL was displaying a red light as the tractor driver approached the crossing from the roadside buttons. The possibility that he rechecked and then disregarded the MSL has been considered. However, the RAIB considers this unlikely and has concluded that the tractor driver, having previously made his decision to cross, probably did not recheck the MSL, or notice that the light was red.
- 48 This situation probably arose due to a combination of the following:
- the tractor driver made his decision that it was safe to cross while he was at the left-hand roadside buttons (paragraph 49);
 - the tractor driver was unfamiliar with the crossing and had not received instructions on how to use the crossing safely (paragraph 55); and
 - the MSL was not *conspicuous* to the tractor driver (paragraph 64).

Each of these factors is now considered in turn.

The button used by the tractor driver to open the gates.

- 49 The tractor driver reported to the RAIB that as he approached the crossing, he saw that the MSL was displaying a green light. He then stopped at the buttons on the left-hand post and pressed the upper button mounted on this post (paragraph 25). It is probable that having seen the green light and the gates opening, the tractor driver made the decision that it was safe to cross at that point.
- 50 He stopped at the left-hand post because it was easier for him to reach the upper button on this post than the upper one on the right-hand roadside post closer to the crossing. This was because access in and out of the tractor's cab via the right-hand cab door was restricted by the tractor's cab controls, in common with many other modern tractors. The fact that he could open the gates from the left-hand post is discussed at paragraph 53.

- 51 The warning time (ie the time interval between the red light illuminating and the arrival of the train) was 40 seconds, which is compliant with the minimum standard requirement for user worked crossings fitted with MSLs at the time they were fitted.
- 52 The tractor driver has stated that he drove slowly towards the crossing after pressing the button on the left-hand roadside post. The limited footage from the crossing's CCTV recording also suggests that he was driving slowly. RAIB analysis shows that if the tractor driver had seen that the MSL was green before stopping at this post, then the time taken to stop, open the left-hand door to gain access to the button from outside the cab, re-enter the cab and drive to the railway line, could have been at least 40 seconds. It is therefore probable that the light on the MSL changed from green to red during this sequence of events. Although the tractor driver has stated that the MSL was displaying a green light as he passed it, the evidence indicates that the MSL was displaying a red light (paragraph 43). Therefore the RAIB believes that it is probable the tractor driver did not recheck the MSL after pressing the button to open the gates.
- 53 The POGO equipment in place at the time of the accident, was the second example of this type of equipment that had been installed at the crossing. There had been an earlier trial of POGO equipment in 2009, and the pairs of buttons on both roadside posts had been installed at that time. A Network Rail standard created for this earlier trial indicates that the intention was that the buttons on the left-hand roadside posts would only be for closing the gates and not for opening them (paragraph 74). Post-accident testing showed that all of the buttons at the crossing could be used to both open and close the gates, depending on their pre-existing position.
- 54 Had the buttons been wired to the intent of the original standard, the tractor driver would not have been able to open the gates from the left-hand post and he would have had to open the gates using one of the buttons on the right-hand post. Having to use one of the right-hand buttons would have placed him closer to the MSLs and the gate (7 metres away, rather than 24 metres when at the left-hand post). This would have given him a more direct view of the MSL. He would also have seen the sign on how to use the crossing safely (paragraph 57) instructing him to check the MSLs, open the gates and recheck the MSLs. Furthermore, being closer to the crossing would have allowed him more time to cross should the MSL have turned red just as the gates had reached the fully open position. The reasons why the crossing button and associated wiring are like this are further explored in paragraph 74 onwards.

The tractor driver was unfamiliar with the operation of the crossing

- 55 The tractor driver has stated that this was the first time that he had driven over the crossing himself. The previous occasion he had visited the crossing was as a passenger between 18 months and two years previously. He has stated that he had been over the crossing approximately six or seven times previously as a passenger. He remembered that the gates were 'automatic' on at least one previous occasion. Despite his previous visits as a passenger, the RAIB considers that he was not fully familiar with using the crossing himself.

- 56 The tractor driver had not received any specific instruction on the safe use of the crossing. There were two methods of instructing users; the first was by means of signs at the crossing, and the second was by means of a briefing from the authorised user.
- 57 There was a sign mounted on the right-hand roadside post instructing users how to use the crossing (figure 8). This sign, although not of the correct type authorised by Network Rail in September 2013 for the nationwide use of the POGO equipment, instructed users to push the button and to cross only when the green light was showing. Although there is conflicting evidence, the RAIB's view is that the tractor driver did not see these instructions because he had already used the button on the left-hand post. There was no such sign on the left-hand post as Network Rail did not consider that this button would be used to open the gates (paragraph 74). Had there been a sign at the left-hand post, it might have prompted the driver to recheck the MSL before crossing.



Figure 8: The instruction sign on the right-hand roadside post

- 58 The authorised user of this crossing, who is the landowner and manager of Oakwood Farm, has a duty of care to visitors using the crossing under the Occupiers' Liability Acts 1957 and 1984. Authorised users who are also employers owe a duty to their employees under the Health and Safety at Work Act 1974. This means that authorised users are under an obligation to ensure that crossing users are instructed about the way to use the crossing correctly.

- 59 The authorised user of Oakwood Farm UWC told the RAIB that he had briefed his direct employees on the safe use of the crossing. He also stated that whenever possible he gives a briefing to visitors whom he knows are coming to the farm. This includes briefing employers of vehicle drivers making regular deliveries and requesting that any unfamiliar drivers stop and phone him to receive a verbal brief before using the crossing. To assist the authorised user in this, Network Rail produced a briefing document for the trial of the second POGO equipment. This was given to the authorised user in November 2012 and contains the instructions to check the MSL, open the gates and recheck the MSL.
- 60 The authorised user has informed the RAIB that he had used Hullah Contractors, the employer of the tractor driver, to undertake work on his land for many years. He stated that he gave a briefing to the manager of Hullah Contractors when the first POGO equipment was installed in December 2009. The tractor driver reported that his employer had given him a general briefing on using level crossings safely. Although there is conflicting evidence whether he had received a specific briefing on using Oakwood Farm UWC, the RAIB believes that he was not specifically instructed on the need to recheck the MSLs after opening the gates and before crossing.
- 61 The tractor driver has stated that he was watching the gates opening as he drove his tractor towards the crossing. Considering his unfamiliarity with using the crossing, he may have taken the gate opening as a visual cue that it was safe to cross. This, together with his previous observation that the MSL was displaying a green light, probably reinforced his decision that it was safe to cross.
- 62 Watching the gates opening may have distracted him, causing him not to notice that the light had changed from green to red. At this time he may also have been checking that the far gate was open before crossing, that there was not a vehicle on the other side of the crossing, and have been manoeuvring his tractor to the centre of the road to pass through the gates. Additionally, the RAIB observed that there were many signs on the approach to the crossing (figure 9) which could distract an unfamiliar user from checking or rechecking the MSLs before crossing.



Figure 9: The signs present on the approach to the crossing

- 63 There is a general lack of understanding by motorists of the purpose of the MSLs. A study undertaken by RSSB² which looked into the behaviour of people using private road level crossings, not fitted with POGO equipment, found that 13% of the participants stated that they did not think it was necessary for motorists to check the MSLs before deciding that it was safe to cross. Also 83% of participants stated that car drivers should look in both directions before using this type of level crossing. The report states that 'it appears that some respondents either did not understand the meaning of the MSLs, or did not trust them and would expect to check for trains themselves to determine whether or not to cross.'

The conspicuity of the MSLs

- 64 The red light of the LED MSL is a single light, situated on the right-hand side of the road. It has a diameter of 90 mm and is small compared to a public road traffic light which has a diameter of 200 mm (figure 10). It is below the tractor driver's eye line. It is likely that it was fitted at this location and height to be visible to pedestrian users of the crossing. In addition, the lights of the MSLs are mounted on a board on which there is text (figure 3). That, combined with the many other signs present, cause the MSL's to be less conspicuous (figure 11).

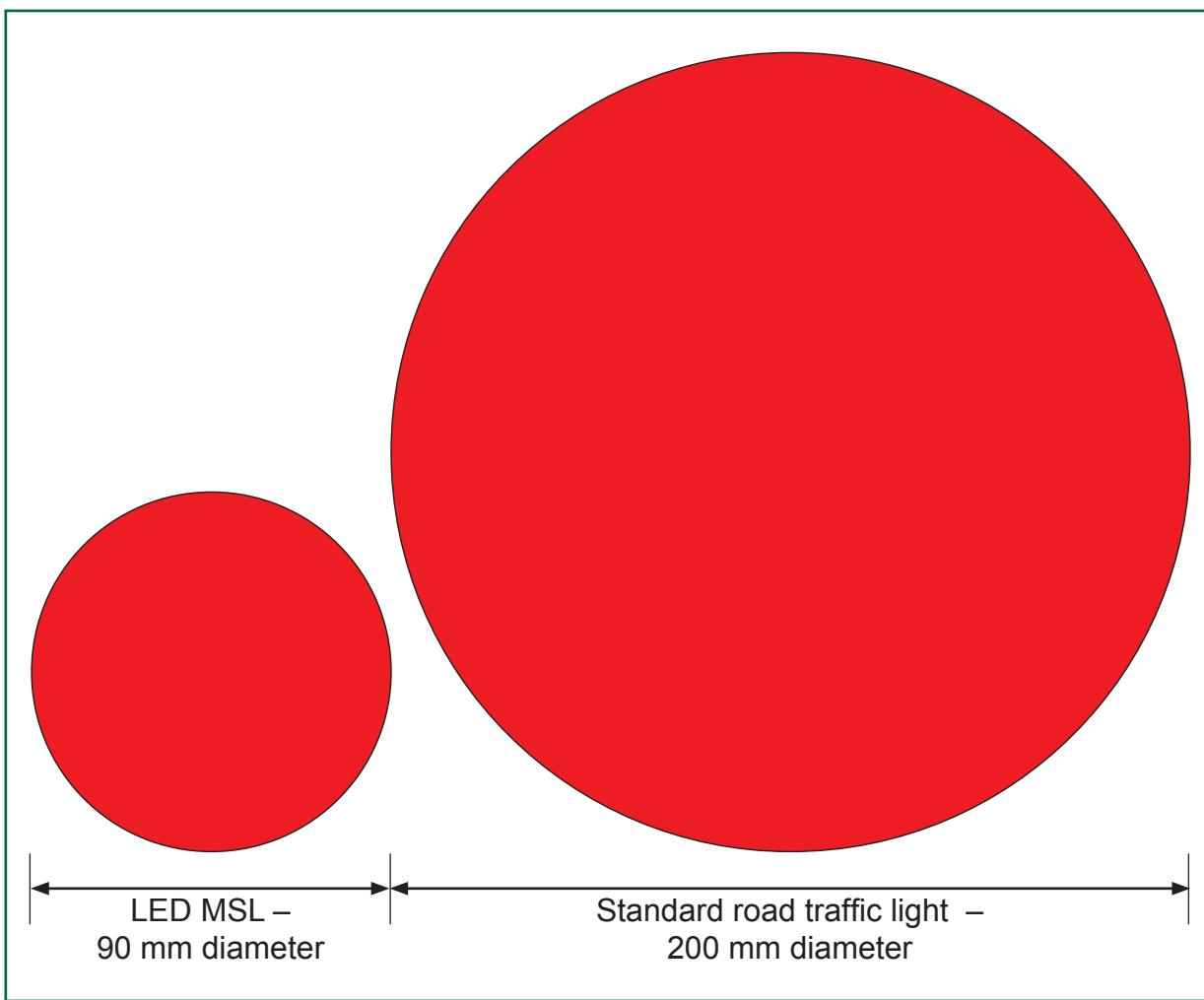


Figure 10: Relative sizes of a LED MSL and a standard road traffic light

² The company is registered as Rail Safety & Standards Board Ltd but trades as RSSB. Signs at private road level crossings (Report T983) RSSB available at: <http://www.rssb.co.uk/pages/research-catalogue/pb023515.aspx>.



Figure 11: The view of the MSLs and the signs from the position of the left-hand roadside buttons

65 CCTV evidence shows that the tractor driver stopped the tractor 1.4 seconds before the collision. The tractor driver stated that he looked to the left ‘out of general caution’, saw the train was very close and applied the brakes. He has stated that he did not have time to look to the right. Looking to the left may have been a response to seeing the train in his peripheral vision, hearing the train’s horn as it approached, or it may have been part of his normal behaviour to look both ways when using a level crossing.

The approaching train

- 66 **By the time the train driver realised that the tractor was not going to stop, it was too late to stop the train.**
- 67 The line is straight and the visibility was good. The train driver reported that he sounded the horn at the whistle board, 267 metres from the crossing, and then saw the tractor approaching the crossing from his right-hand side. He then sounded the horn continuously and applied the train’s emergency brake. The driver recalled that the tractor continued moving towards the railway line.
- 68 The emergency brake was operated when the train was around 100 metres from the crossing, but even with full emergency brake applied, the train stopped 468 metres beyond the crossing after the collision with the tractor.

Factors that were not causal to the accident

Fatigue of the tractor driver

- 69 The RAIB considered the possibility that fatigue of the tractor driver might have been relevant to the accident. The tractor driver had been working since 07:00 hrs which had included driving for three hours. The tractor driver has informed the RAIB that he did not feel tired at the time of the accident and that the nature of his work meant that he was used to working relatively long days. Although fatigue cannot be entirely discounted, the RAIB has concluded that it was unlikely to have been a factor in the causation of this accident.

Audibility of the crossing alarms

- 70 Witness evidence following the accident confirmed that the audible alarms were working correctly and therefore they were likely giving an audible warning during the time that the MSLs were red.
- 71 The tractor driver stated that he did not hear the alarm. Tests conducted by the RAIB indicated that the audible warning, which is for the purpose of warning pedestrians of an approaching train, is unlikely to have been heard by the tractor driver. If the alarm had been sounding when he was outside the cab at the left-hand roadside post, the tractor's engine noise is likely to have masked its sound. As the tractor moved forward, the alarm would have been difficult to hear because the tractor's cab has sound insulation. The tractor driver told the RAIB that he had the radio on which would have further decreased the audibility of the alarm.

Identification of underlying factors

Management of the trial POGO installation

- 72 Network Rail did not ensure that the risks to crossing users at Oakwood Farm UWC were adequately mitigated.**

- 73 The factors related to this are:
 - a. Network Rail did not adequately control the design and installation of the wiring of the gate operating buttons at Oakwood Farm UWC (paragraph 74);
 - b. Network Rail did not implement previously recommended improvements to Oakwood Farm UWC (paragraph 80); and
 - c. Network Rail did not risk assess the POGO as a full system before installing it at Oakwood Farm UWC (paragraph 88).

The design and installation of the wiring of the buttons

- 74 At the time of the accident, the POGO equipment was the second version that had been fitted for trials at Oakwood Farm UWC. For the first POGO trial, Network Rail created standard NR/L2/SIG/30039 in December 2009. Within this standard was a plan which showed a layout of a typical user worked crossing with MSLs, including the positions of the buttons (figure 12). Buttons located on the right-hand roadside posts (those closest to the gates) were specified as 'opening' buttons. Buttons on the left-hand roadside posts were specified as 'closure' buttons. These 'closure' buttons are located further away from the crossing to allow long vehicles and farm machinery to be clear of the gates when the button is pressed to close the gates. This configuration also allowed drivers of right-hand drive vehicles to reach the buttons without having to leave their vehicles.
- 75 The layout plan also shows that a sign was to be fitted to each left-hand roadside post, facing towards users leaving the crossing, instructing them to stop and close the gates. Such a sign was on the post that the tractor driver stopped at to operate the gates (figure 13), although he would not have seen it on his approach as it was facing in the opposite direction.

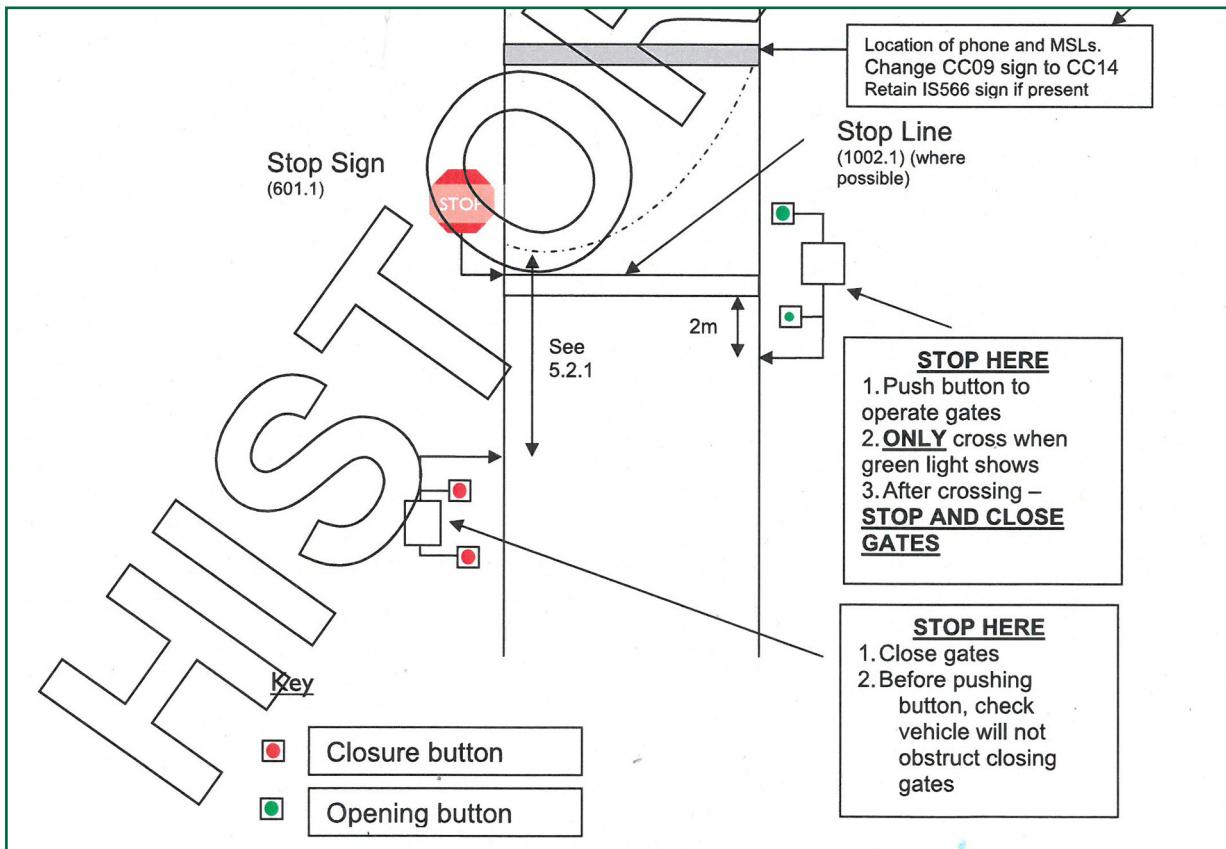


Figure 12: Extract from superseded Network Rail standard NR/L2/SIG/30039, Issue 1, December 2009



Figure 13: View looking away from the crossing towards the left-hand roadside post showing the sign instructing users to close the gates

- 76 Witness evidence indicates that during this first trial, all the buttons could be used to both open and close the gates. This indicates that the buttons on the left-hand roadside post had been incorrectly wired such that they could be used to close and open the gates. Network Rail has not been able to explain why the crossing did not comply with its standard NR/L2/SIG/30039 at that time.
- 77 Following the abandonment of the first trial in September 2011, Network Rail created another standard in the same month, NR/L2/SIG/11201/Mod X42, for the trial of the second POGO equipment. This stated that if additional buttons are to be used, these are to operate in parallel with the other buttons. This updated standard, which was in force at the time of the accident, specified that all of the buttons be capable of opening and closing the gates. The second POGO equipment which was installed in November 2012 was wired to allow this.
- 78 Although at the time of the accident, Oakwood Farm UWC (then the only operational POGO crossing with the additional buttons) complied with the current standard in this respect (noting paragraph 76), its operation was a significant departure from the intention of the original POGO standard.
- 79 Network Rail has provided no evidence that the specific risk of using the left-hand buttons to open the gates was considered and assessed before, or during, both trials. A risk assessment should have resulted in either the buttons being rewired to the intention of the original POGO standard, or as a minimum, some instructions at the left-hand post on how to use the crossing safely.

Lack of implementation of recommended improvements

- 80 The poor conspicuity of the MSLs (paragraph 64) and the lack of instruction signs at the left-hand post on how to use the crossing safely (paragraph 57) were probable factors in the accident. There had previously been suggestions to address both these factors in order to improve the crossing.
- 81 In March 2010, Network Rail asked the authorised user to give feedback on using the crossing during the first POGO equipment trial, by which time it had been working sporadically for 3 months. His comments on improvements included the following:
 - a. Fitting an additional set of MSLs to each side of the crossing, so that there would be one at each end of each gate facing an approaching user. He mentioned that this would make users more aware of the MSLs. (The authorised user was aware of a barrier crossing at Moulinearn, Scotland to which Network Rail had fitted additional MSLs.)
 - b. Improving the signs to inform users that the gates and the lights were not linked (meaning that the gates opening does not mean that it is safe to cross). His concern was that somebody would open the gates and cross in front of a train.
 - c. Adding a white line to the road approaches to indicate where a user should stop. (Although this was in the original POGO standard, no lines were provided.)
 - d. Moving the buttons which were closest to the gates further back, as some users had expressed concerns that the gates could collide with the fronts of their vehicles.

- e. Providing some illumination to the signs, buttons and gates to assist users during darkness.
- 82 Network Rail documents indicated that the POGO project team regarded the suggestions as 'mainly cosmetic' with 'no immediate need'. Documents indicated that Network Rail intended to make the suggested changes at Oakwood when time allowed, but this did not happen. However, some changes were made to another POGO crossing under trial (paragraph 105) in line with the suggestions.
- 83 The first three of the above authorised user's comments are directly related to giving users more information at an appropriate point on how to cross safely. Internal Network Rail correspondence shows that it thought that the presence of the audible alarms would largely mitigate the risk of someone opening the gates while the MSL was displaying a red light. There was neither consideration that a user may open the gates from one of the distant left-hand buttons (and be too far away to hear the alarm), nor that they could be in a soundproof cab, such as a tractor (paragraph 71). Audible alarms are intended to warn pedestrians and not drivers of road vehicles.
- 84 In February 2013, two months into the trial of the second POGO equipment, Network Rail asked an independent human factors consultant to review the signs at the crossing. The consultant's report stated that the MSLs should be made more clearly visible by removing or replacing signs that were not critical to the safe operation of the crossing. The report stated that there were too many signs which presented a risk of confusing crossing users, and that there was conflicting information between the signs. It noted that where a user should stop to operate the gates should be made more easily understandable. This included a recommendation to add white lines on the road approaches.
- 85 At the time of the accident only one of the nine signs on the approach to the crossing towards Oakwood Farm, which the consultant had commented on, had been removed. The RAIB noted that of the eight remaining signs, only three provided information useful to the safe use of the crossing. The sign that had been removed was previously on the same post as the MSLs, so its removal did little to improve their conspicuity.
- 86 In February 2013, the authorised user wrote to Network Rail again asking whether the signs could be improved for the benefit of first time users.
- 87 Apart from the removal of the one sign, Network Rail did not make any other changes recommended by its consultant, nor those suggested by the authorised user, before the accident.

Risk assessment

- 88 The report from Network Rail's consultant in February 2013 was the only documented evidence that Network Rail provided to the RAIB which indicated that the possible risks to unfamiliar crossing users were considered during the trials. There was no evidence that any formal risk assessments were conducted before, or during, the trial of the first POGO equipment (even though this was a requirement stipulated in the third, revised issue of Network Rail's certificate to approve the trial, dated July 2011).

- 89 There is no evidence that risks to users were considered before the trial of the second POGO equipment which began in November 2012. There had been a project meeting before the trial of the second POGO equipment in August 2012. The minutes of that meeting show that there was some discussion of risks and their mitigation but only in relation to failure of the equipment (ie events that could affect the POGO's reliability). The way in which a user should interact safely with the POGO equipment was not discussed and the meeting was not attended by anyone with expertise in human factors.
- 90 By May 2013, Network Rail was considering the POGO equipment for wider use across the rail network. In that month it conducted a risk assessment which included expertise on, and consideration of, human factors. The risk assessment was in the form of a hazard identification (HAZID) study. This is a structured workshop activity in which hazards (a potential source of harm to people or property) are identified, recorded and ranked in terms of their severity of consequence. Mitigations to eliminate or reduce the risks of these hazards occurring are then discussed and recorded, together with a revised severity rating. This then leads to actions that have to be undertaken to reduce the risks.
- 91 The record of this study shows that there were 35 hazards identified. Two of the top three, in terms of severity, are directly relevant to this accident:
 - a. 'an unfamiliar user may not understand how the system works leading to an unsafe act'; and
 - b. 'the user presses the button without following the correct procedure, the gate opens and they assume it is safe to cross when it may not be'.
- 92 One of the mitigations proposed to minimise the risk from these two hazards was to ensure that signs are clear and concise and easy for an unfamiliar user to understand. The workshop also noted that too many signs should be avoided otherwise users may ignore them.
- 93 This document formed a part of Network Rail's requirements for full product acceptance of the POGO equipment which was granted in July 2014. Although the HAZID report was signed as completed by the POGO project team in September 2013, Network Rail had not addressed these risks at Oakwood Farm UWC by the time of the accident.
- 94 Another mitigation proposed to address two of the top three hazards, and also five other hazards discussed in the HAZID workshop, was to ensure that authorised users brief visitors about how to use their crossings. Other Network Rail documents provided to the RAIB showed that heavy reliance had been placed on the authorised user informing others about how to use Oakwood Farm UWC safely. This was despite the recognition of the first POGO project team, that the authorised user had little control over his visitors using the crossing correctly. It is unrealistic to expect that all unfamiliar users can be briefed before they arrive at the crossing in all instances. Therefore, it is important to inform users at the point they need to make a decision how to use the crossing safely through clear, concise signs.
- 95 Despite the suggestions from the authorised user (paragraph 81), the consultant's assessment of the signage on the crossing (paragraph 84), and the identification of hazards in 2013 (paragraph 90), little was done to improve the safety of unfamiliar users at Oakwood Farm UWC.

Introduction of the POGO equipment

- 96 Network Rail did not adequately manage the introduction of POGO equipment.

Network Rail's Product Acceptance Process

- 97 Network Rail's product acceptance process is defined in its company standard NR/L2/RSE/100/05, 'Product introduction and change', and is managed by the Network Rail Acceptance Panel (NRAP). Its purpose is to ensure that Network Rail complies with its legal responsibilities and its *Safety Management System* when it introduces new equipment or systems onto its infrastructure. This can be done in a series of discrete stages, including monitored trials, which allows a controlled assessment to be made to identify any operational risks that may emerge. In this way, risk can be minimised and mitigations can be introduced before the equipment or system is given full approval, (known as full acceptance), and thereafter used more widely across the rail network.
- 98 Certificates of acceptance are issued both before monitored trials and to authorise equipment when fully accepted. The certificate records the details of the equipment or system, the conditions under which it may be used, and a list of documents reviewed in support of its acceptance. If a certificate is issued for trial use, a monitoring period can be specified and the criteria by which the outcome of the trial will be assessed can be defined. Certificates of acceptance are generally signed by both a member of NRAP and the professional head of the engineering discipline to which the product or system best applies, eg track, signalling.

Approval of the POGO equipment present at the time of the accident

- 99 In November 2012, the POGO project team made an application to NRAP for a trial of the second POGO installation at Oakwood Farm UWC. The application included an acceptance requirements document completed by Network Rail signalling engineers which defined the requirements by which the POGO equipment was to be assessed. This was mostly by ensuring compliance with standard NR/L2/SIG/11201/Mod X42, which had been created for this second version of the POGO equipment in September 2011. This standard defined the performance of the POGO equipment only in terms of its functional and physical attributes and did not consider the interface with the crossing user. Furthermore, the acceptance requirements document contained a section allowing the option to undertake a human factors assessment. This section was left blank. It is clear that both when creating the standard, and specifying the requirements of the POGO equipment and its trial, Network Rail did not fully consider the equipment as part of an integrated level crossing system, nor the way it could affect the behaviour of crossing users.
- 100 NRAP issued a certificate of authority for product trial in November 2011, which was authorised by the Professional Head of Signalling. This allowed the second version of the POGO equipment to be installed at Oakwood Farm UWC and two other crossings, which were to be monitored for six months. One of these other crossings was a mock level crossing on which the POGO equipment could be demonstrated. The reason for undertaking a trial on this site, according to Network Rail documents, was that it could be 'thoroughly tested in a safe environment with no impact on the live railway'.

- 101 The RAIB considers that, in the light of the equipment failures and unreliability experienced with the previous POGO equipment, it might have been prudent not to implement trials of the second POGO equipment on the live railway, such as at Oakwood Farm UWC, until operational experience had been gained in an environment with lower risk to public users.
- 102 A certificate for full product acceptance of the POGO equipment was issued in July 2014, authorised by Network Rail's Professional Head of Signalling. This gave approval for installing the second version of POGO equipment widely across the network. Network Rail had identified 79 potential POGO sites of which four were operational at the time of this accident. The certificate of acceptance made reference to the HAZID report (paragraph 90) as one of the documents that had been assessed prior to full acceptance being given. This HAZID report, signed off in September 2013, shows all of the 35 hazards to be 'open'. Network Rail has not provided any evidence to the RAIB that the hazards identified in May 2013 had been suitably mitigated before the POGO equipment was given full acceptance and implemented more widely.
- 103 Many of the hazards documented for the second POGO trial equipment had been raised as concerns by the authorised user in March 2010. Despite the hazards being known of in May 2013, Oakwood Farm UWC was still in a similar state to its condition when the first POGO equipment had been fitted in December 2009.
- 104 Correspondence shows that in September 2013, Network Rail's independent human factors consultant recommended that before the POGO equipment was more widely implemented, Network Rail should conduct user testing. They recommended that a hazard assessment should be undertaken at a trial site to assess how well the instructions can be seen and understood. Network Rail has not yet implemented this recommendation and has informed the RAIB that a review is to be carried out after all the crossings planned to be fitted with POGO equipment have been commissioned.

Near miss at Pratts Lower user worked crossing

- 105 Pratts Lower UWC is located between Billingshurst and Christs Hospital stations in West Sussex, and had been fitted with the first version of the POGO equipment in early 2010. Pratts Lower was the only other UWC with MSLs for which authority had been given under the first trial product acceptance certificate. The installation of the POGO equipment at Pratts Lower UWC, unlike Oakwood Farm UWC, did not have the additional buttons on the left-hand side of the crossing approaches. The equipment at both crossings included optical sensors whose purpose was to prevent the gates closing if the open/close button was pressed while a vehicle was travelling over the crossing.
- 106 In May 2014 there was a near miss between a train and two road vehicles, when the gates closed and trapped both vehicles on the crossing. The vehicles managed to move clear around 20 seconds before the arrival of the train. On the basis of the initial incident notification, the RAIB wrote to Network Rail and requested that the subsequent Network Rail investigation consider:
 - a. details of the POGO trial's project plan, including duration of trial, how it was being monitored and assessed to be left in place and installed at other locations; and
 - b. how the risk of potential malfunctions was identified and addressed for the trial.

107 The subsequent Network Rail investigation found that:

- a. the control system associated with the optical sensors had been set up incorrectly following rectification of another fault;
- b. Network Rail had not trained its technicians in the testing and maintenance of the POGO equipment because no training instructions had been provided (despite this being a condition of the trial acceptance certificate);
- c. there was no clear evidence that any risk assessment had been undertaken which could have identified the possibility of wrongly setting up the control system;
- d. there was no evidence that any assessment had been done of the operational risks of the POGO equipment before the trial;
- e. there was no evidence that a formal trial had been conducted and reviewed by the certificate's expiry date in March 2010 (which was also a condition of the trial acceptance certificate); and
- f. for the period between March and December 2010, there was no valid certification in place for the POGO installation.

Items b to f, above, were also applicable to the first POGO equipment during the time it was installed at Oakwood Farm UWC.

108 The report made recommendations to Network Rail to review the following:

- a. the POGO control system at Pratts Lower UWC and any derivatives, to eliminate the risk of wrongly setting it up as far as is practicable;
- b. the robustness of accepting new equipment onto the operational railway with regard to how practical training is given to personnel responsible for its maintenance to ensure that they are fully conversant with new equipment before it becomes operational;
- c. the process of how the manufacturer's product training documentation is made available to those responsible for its maintenance; and
- d. the robustness of how the trial process is completed and full product acceptance granted, to ensure that all new equipment is suitably authorised to be in use.

109 Following a review of Network Rail's investigation, the RAIB wrote to Network Rail in February 2014 (copied to the Office of Rail and Road (ORR)) expressing the following concerns:

- a. that the investigation had been conducted at a local, and not at a national level, given that the consequences of the incident could have resulted in fatalities;
- b. that the sequence of events during the design, installation and commissioning of the POGO equipment could not be determined because there were insufficient records of what was done during these stages; and
- c. that the introduction of the POGO equipment was not suitably managed with respect to risks that it may have introduced.

- 110 The RAIB also advised Network Rail that it should consider a review of the process of introducing new technology, including the level of safety assurance to be adopted. In particular it advised that it should review the provision of information and training to maintenance staff. It also advised Network Rail to consider reviewing the risk assessment process as applied to new equipment, including the proper use of risk assessment techniques to identify risk control measures.
- 111 Following the accident at Oakwood Farm UWC, the RAIB asked Network Rail to provide an update on the progress of the recommendations made within its own report into the near miss at Pratts Lower UWC. Network Rail has provided no evidence that it had reviewed the control system at the crossing, or any derivatives. Neither has it provided the RAIB with any evidence that it has reviewed the robustness of how the trial process was completed and how full product acceptance was granted for new equipment.

Observations

Record retention

- 112 Following the near miss at Pratts Lower UWC, the RAIB wrote to Network Rail expressing concern that there were insufficient records of decisions and actions made during the approval of the first POGO equipment (paragraph 109b).
- 113 As in the case of the investigation of the near miss at Pratts Lower UWC, Network Rail could not provide documents during this investigation which showed the basis on which decisions were made during the approval of the second POGO equipment. Network Rail's standard NR/L2/RSE/100/05, 'Product introduction and change', requires that the acceptance history file is to be retained for the life of the product plus seven years.

Summary of conclusions

Immediate cause

114 The tractor driver started to cross the railway line when the MSL was displaying a red light (**paragraph 42**).

Causal factors

115 The causal factors were:

- a. The tractor driver probably did not recheck the MSL when approaching the crossing, having used the distant left-hand roadside button to open the gates (**paragraph 45**). This was probably due to a combination of the following:
 - i. the tractor driver made his decision that it was safe to cross when he was at the left-hand roadside buttons (**paragraph 49, no recommendation**);
 - ii. the tractor driver was unfamiliar with the crossing and had not received instructions on how to use the crossing safely (**paragraph 55, no recommendation**); and
 - iii. the MSL was not conspicuous to the tractor driver (**paragraph 64, Recommendations 1 and 2**).
- b. By the time the train driver realised that the tractor was not going to stop, it was too late to stop the train (**paragraph 66, no recommendation**).

Underlying factors

116 The underlying factors were:

- a. Network Rail did not ensure that the risks to crossing users at Oakwood Farm UWC were adequately mitigated (**paragraph 72, Recommendation 1**), in relation to:
 - i. controlling the design and the installation of the wiring of the gate buttons (**paragraph 74**);
 - ii. not implementing previously recommended improvements (**paragraph 80**); and
 - iii. not risk assessing the POGO equipment as part of a full system before installation (**paragraph 88**).
- b. Network Rail did not adequately manage the introduction of POGO equipment (**paragraph 96, Recommendations 2 and 3**).

Observations

117 The following observation is made:

- a. Network Rail's retention of records relating to the acceptance of the POGO equipment was insufficient to show the basis on which decisions were made during the history of the trials, and was not in accordance with Network Rail standard NR/L2/RSE/100/05 (paragraphs 112 and 113, **Learning point 1**).

Previous RAIB recommendations relevant to this investigation

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

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

- 119 Recommendation 2 of [RAIB report 28/2014](#) is relevant to the Oakwood Farm UWC accident because, among other things, it sought improvements to instructions for users of user worked level crossings.
- 120 Although Jetty Avenue UWC did not have MSLs, and relied upon users looking both ways before crossing, the recommendation is relevant because it asked Network Rail to commission, and make use of the findings of research into measures to improve the safety of UWCs, including consideration of 'instructions and/or guidance given to users, including signs and road markings where appropriate' and the 'use of the crossing by persons other than those briefed by the authorised user (eg unexpected visitors or delivery vehicles)'.
- 121 On 24 February 2015, Network Rail, in response to Recommendation 2, informed the ORR that:

'A significant amount of research relating to level crossings has been undertaken in recent years, much of it delivered through RSSB led projects. Consequently, Network Rail is not seeking to initiate new RSSB research. Human factors experts will be commissioned to review and consolidate the output from existing research. If identified, additional work might be required to take account of issues specific to User Worked Crossings (UWCs) where safe use for vehicular users relies on the sighting of approaching trains.'

The review phase will consist of research into measures to improve safety at UWCs. This will take the approach of using existing research and extending it where needed to cover:

- *Behaviour of road vehicle drivers and the influence of crossing design.*
- *Crossing use by un-briefed members of the public.*
- *Different road vehicle types.*
- *Instructions and guidance given (to users) including signs and guidance.*
- *Other user groups such as pedestrians / cyclists / horse riders as appropriate.*
- *Instructions and guidance given to LCMs (level crossing managers³).*

The review phase will conclude with the production of a draft report.

If the draft report identifies that currently available research does not encompass all aspects of vehicular usage at UWCs, we will utilise the expertise of the Human Factors experts to supplement the existing findings as needed.'

³ A level crossing manager is the person locally responsible for managing inspection visits to level crossings.

- 122 The ORR informed the RAIB in December 2015 that the implementation of Recommendation 2 of the Jetty Avenue UWC report was on-going and was planned to be implemented by 31 August 2016.
- 123 Although Network Rail has stated that as part of its current review it is reviewing signs and instructions at UWCs, it is not considering these factors at UWCs fitted with MSLs and the POGO equipment.

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

124 On 22 July 2015, after the accident, the route level crossing manager responsible for Oakwood Farm UWC issued a paper to the level crossing team outlining short term and medium/long term actions to be taken at the crossing. These included:

- a. meeting with the authorised user to discuss his legal responsibilities for invited crossing users, and to discuss how risks could be managed;
- b. producing a briefing pack for the authorised user to enable him to brief his contractors;
- c. discussing with the authorised user the options for the closure of the crossing;
- d. reviewing the crossing's signs and approaches to determine any enhancements to highlight the risks; and
- e. replacing the current POGO equipment with the new nationally approved equipment.

125 In January 2016, Network Rail informed the RAIB that items 124a and 124b had been completed, and that item c, the discussions regarding closure of the crossing, had begun. Items d and e, relating to physical changes to the crossing had originally been planned for 26 May 2015, but were still awaiting the fully approved POGO system.

126 On 12 October 2015, the RAIB wrote to Network Rail asking it to consider the risks to crossing users arising from being able to use the left-hand roadside buttons to open the gates. This was in the light of the first standard for the POGO equipment stating that the intent of these buttons was for users only to be able to close the gates and not open them. RAIB raised the concern that the left-hand roadside buttons were further from the gates, gave a less direct view of the MSLs and that there were no instruction signs at this position.

Learning point

127 The RAIB has identified the following key learning point⁴:

- 1 Network Rail is reminded that its standard NR/L2/RSE/100/05, 'Product introduction and change', requires that the acceptance history file is to be retained for the life of the product plus seven years (paragraph 113). The retention of records relating to the acceptance of the POGO equipment at Oakwood Farm UWC was insufficient to show the basis on which decisions were made during the history of the trials.

⁴ '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

128 The following recommendations are made⁵:

- 1 *The intent of this recommendation is to reduce the risk to users of Oakwood Farm UWC.*

Network Rail should:

- a) undertake a comprehensive review of the safety of the crossing at Oakwood Farm UWC in the light of the findings in this report, its own hazard reviews, human factors advice, and suggestions from the authorised user, in order to minimise the risk to users; and
- b) implement any improvements identified in part a) above at Oakwood Farm UWC in liaison with the authorised user.

continued

⁵ Those identified in the recommendations have a general and ongoing obligation to comply with health and safety legislation, and need to take these recommendations into account in ensuring the safety of their employees and others.

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

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

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

2 *The intent of this recommendation is to reduce the risk to users of other POGO equipped crossings.*

Network Rail should develop and implement a programme for a timely review of the safety of other user worked crossings it has fitted with POGO equipment and those it intends to fit in the future. The review should include particular consideration of the following:

- a) the design standard for crossings fitted with POGO equipment (paragraph 77);
- b) the ways in which users in different types of vehicles operate the crossing gates, including the function of the gate operating buttons (paragraph 74);
- c) the clarity of instructions to enable unfamiliar users to use the crossings safely and to minimise reliance on the briefing of all visitors by authorised users (which is not always practicable) (paragraph 94);
- d) improving the conspicuity of the MSLs (eg using two MSLs on each side of the crossing, the use of larger 'road traffic light' style red and green lights, flashing red MSLs, or wig wag lights) and the number and clarity of the signs, to minimise confusion and distraction (paragraph 64); and
- e) whether the opening of the gates should be disabled unless the MSLs are displaying green lights (paragraphs 41 and 61).

This review should draw on the findings from recent relevant research (eg RSSB's research into signs at private level crossings (T983) and human factors advice).

Any measures for safety improvements at such crossings should then be implemented at higher risk locations and incorporated into the standards for future designs.

continued

3 *The intent of this recommendation is to reduce the risk from the introduction of infrastructure equipment onto the railway network.*

Network Rail should review the robustness of its processes for accepting new equipment and technology onto the railway, including particular consideration of the following:

- a) definition and adherence to an appropriate level of safety assurance;
- b) the early involvement of human factors expertise, where appropriate, throughout the product's introduction;
- c) the risk assessment processes applied to the new equipment itself and the infrastructure into which it is to be integrated;
- d) definition and monitoring of trials, implementation of any resulting improvements, and the roll-out of the product to other locations;
- e) maintenance of a hazard record for the life-cycle of the product; and
- f) a process for undertaking regular audits to check the implementation of its product introduction processes and correcting any identified shortcomings (paragraph 116b).

It should then, where appropriate, produce a time bound plan for the amendment of the standard.

Appendices

Appendix A - Glossary of abbreviations and acronyms

CCTV	Closed-Circuit Television
HAZID	Hazard Identification
LED	Light Emitting Diode
MSL	Miniature Stop Lights
ORR	Office of Rail and Road
POGO	Power Operated Gate Opener
RAIB	Rail Accident Investigation Branch
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 who has legal authority to use a user worked crossing.
Conspicuous / conspicuity	A subjective term which relates to the ability of an object to capture attention. It is related to the amount of contrast present between the object and its background.
Diesel multiple unit	A diesel powered train consisting of one or more coaches with a driving cab at each end, which can couple to other multiple units and control them from the leading cab.
Lifeguard	A metal bracket fitted vertically immediately in front of the leading end wheels of a train.*
Obstacle deflector	An angled metal plate fitted vertically under trains to reduce the risk of derailment in the event of a collision with large objects.
Power operated gate opener	Equipment which allows users to open and close crossing gates remotely.
Safety Management System	A formal system or framework to assist in managing health and safety responsibilities.
User worked crossing	A type of level crossing where the gates are opened and closed by the user.
Washout	An optical effect where colours are difficult to discern due to being too brightly illuminated.

Appendix C - Investigation details

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

- Information provided by witnesses;
- Information taken from the train's on-train data recorder (OTDR);
- Closed circuit television (CCTV) recordings taken from the camera at the level crossing;
- Site photographs and measurements;
- Weather reports and observations at the site;
- Sound pressure level measurements taken at the site;
- Examination report on the tractor, supplied to the RAIB by BTP;
- Records of the level crossing provided by Network Rail;
- Records supplied by Network Rail relating to the product acceptance of the POGO equipment; and
- A review of previous RAIB investigations that had relevance to this accident.

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