



Rail Accident Investigation Branch

Rail Accident Report



Collision between a train and agricultural equipment at Kisby user worked crossing, Cambridgeshire 19 August 2021

Report 12/2022
October 2022

This investigation was carried out in accordance with:

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

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Any enquiries about this publication should be sent to:

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

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Preface

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

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

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

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

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

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

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

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

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

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Collision between a train and agricultural equipment at Kisby user worked crossing, Cambridgeshire, 19 August 2021

Contents

Preface	3
Summary	7
Introduction	8
Definitions	8
The accident	9
Summary of the accident	9
Context	10
The sequence of events	15
Analysis	19
Identification of the immediate cause	19
Identification of causal factors	19
Identification of underlying factors	24
Observation	26
Consequences of the accident	26
Previous occurrences of a similar character	28
Summary of conclusions	29
Immediate cause	29
Causal factors	29
Underlying factor	29
Observation	29
Previous recommendation that had the potential to address an observation identified in this report	30
Actions reported as already taken relevant to this report	31
Recommendations	32
Appendices	33
Appendix A - Glossary of abbreviations and acronyms	33
Appendix B - Investigation details	34
Appendix C - Letter to organisations representing the farming industry	35

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Summary

At around 09:00 hrs on Thursday 19 August 2021, the 04:10 hrs freight train service from Hams Hall (Birmingham) to Felixstowe collided with agricultural machinery being towed over the railway by a tractor at Kisby user worked crossing, between Whittlesey and March in Cambridgeshire. The train was travelling at about 66 mph (106 km/h) when it struck the machinery. The train driver suffered minor injuries in the accident and the tractor driver was uninjured. The locomotive and one wagon derailed, with both suffering some damage. There was also extensive damage to the infrastructure of the railway.

The accident happened because the tractor driver did not telephone the signaller before crossing the railway to seek permission to cross. This was a consequence of the tractor driver not being briefed about the requirement to call the signaller and his belief that he could cross safely by looking for approaching trains. This probably arose because the authorised user, the person owning land on both sides of the level crossing, was not briefing crossing users in a way which resulted in correct use of the crossing, and railway staff were unaware that this was the case until shortly before the accident. RAIB found that Network Rail was not effectively managing the safe use of Kisby, and some other user worked crossings with telephones, and that this was an underlying factor for the accident.

RAIB has made two recommendations, one addressed to Network Rail and one addressed to the Health and Safety Executive, as a result of its investigation. These seek improvements in the management and assurance processes applied to user worked crossings and an additional means of communicating crossing safety information to agricultural workers. RAIB has also written to several organisations representing farmers asking that they remind their members of the importance of following correct procedures at user worked crossings.

Introduction

Definitions

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

The accident

Summary of the accident

- 3 At around 09:00 hrs on Thursday 19 August 2021, train reporting number 4L02, the 04:10 hrs freight service from Hams Hall (Birmingham) to Felixstowe, collided with agricultural machinery being towed across the railway at Kisby user worked crossing,¹ while travelling on the up line between Whittlesea and March stations in Cambridgeshire (figure 1). The train comprised a class 66 locomotive and 36 container wagons. It was travelling at about 66 mph (106 km/h) when it struck the machinery.
- 4 The leading axle of the locomotive and the sixteenth wagon in the train derailed. The locomotive, three wagons, level crossing equipment, signalling equipment and around 780 metres of track were damaged. The agricultural machinery, known as a bale chaser and used to collect and transport straw, was being towed behind a tractor. The tractor was undamaged, but the bale chaser was damaged beyond repair.

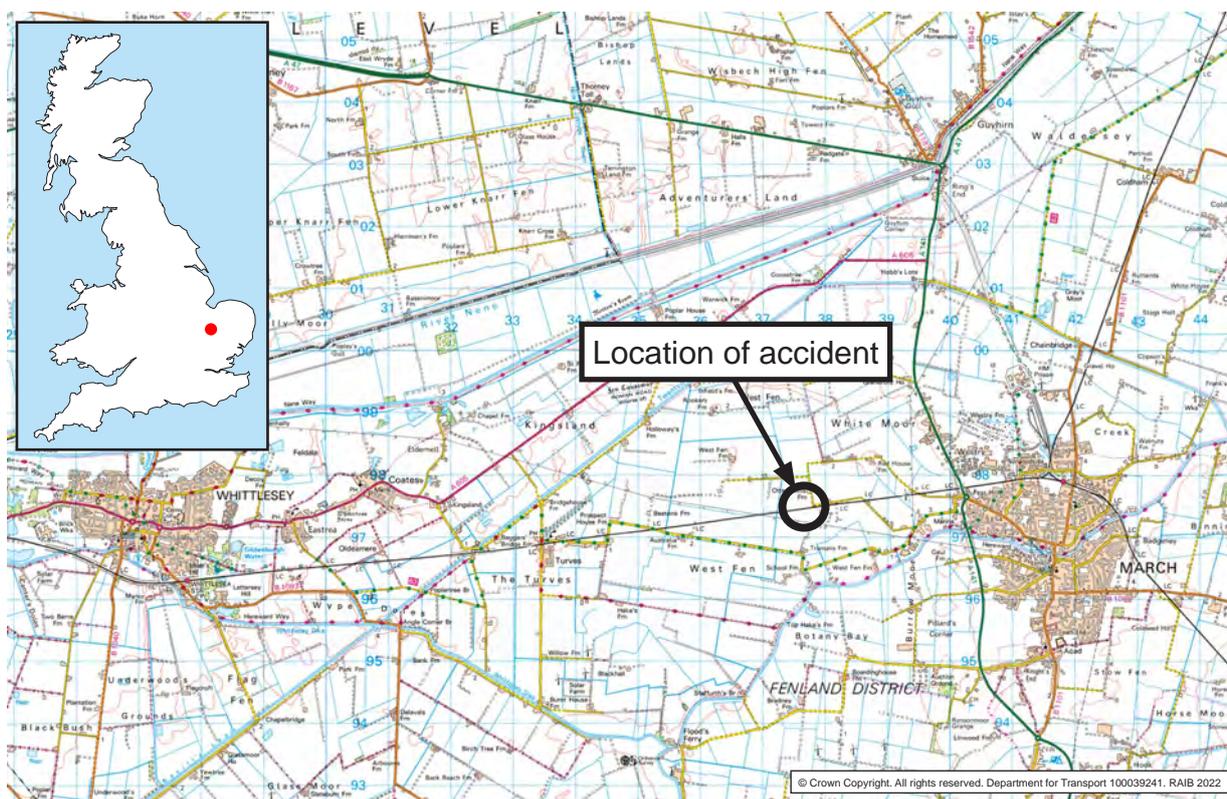


Figure 1: Extract from Ordnance Survey map showing location of accident.

¹ A level crossing where the barriers or gates are operated by the user.

Context

Location

- 5 Kisby level crossing is located between March (around two miles to the east) and Whittlesey (around five miles to the west) on the railway between Ely North Junction and Peterborough. The crossing serves an unclassified farm track connecting agricultural land south of the railway to a minor public road (Middle Road) and a farmyard north of the railway (figure 2). The area surrounding the level crossing is generally flat and the railway is straight.
- 6 The railway at this location is a two track, non-electrified line, with a maximum permitted speed of 75 mph (121 km/h) for trains travelling in either direction. It is controlled from March East Junction signal box with three aspect colour light signals capable of showing danger (red), caution (single yellow) or proceed (green) aspects. The aspect displayed by the nearest signal on both lines is visible to level crossing users. The signal for the up line, on which trains travel east (towards March) is around 370 metres east of the crossing. The signal for the down line, on which trains travel west (towards Whittlesey) is approximately 600 metres to the west of the crossing.

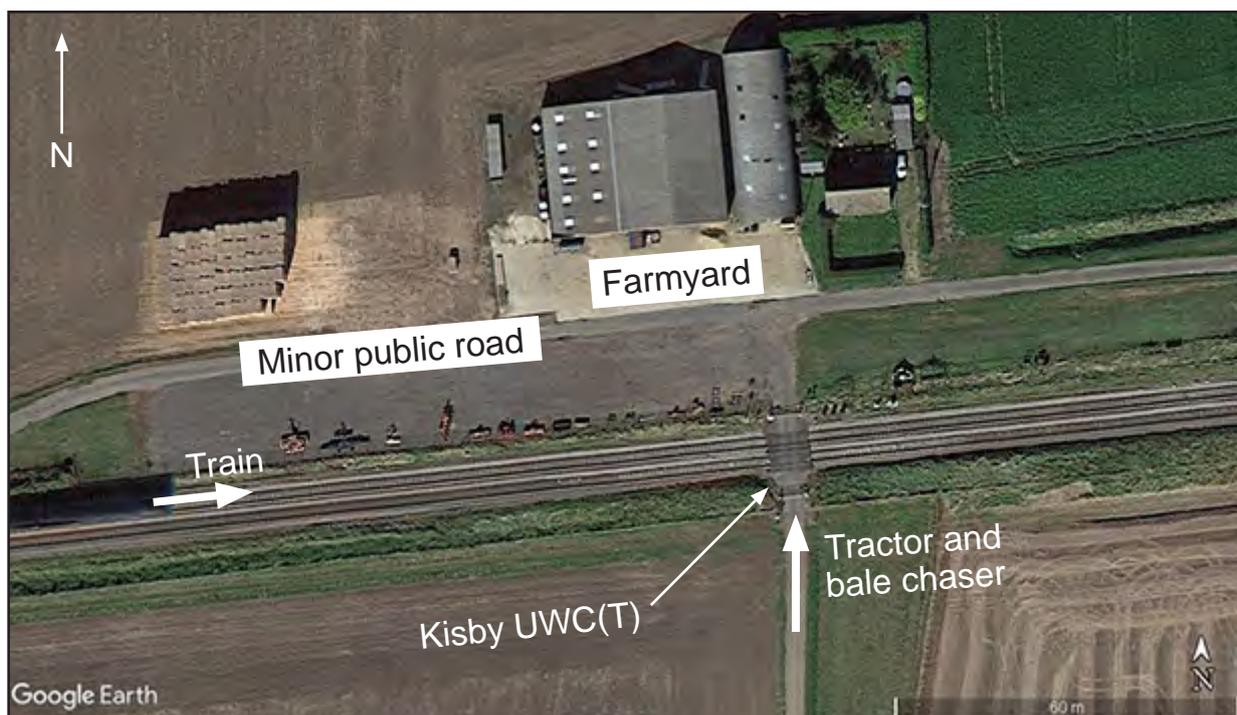


Figure 2: Aerial view of Kisby level crossing and surrounding features showing directions in which train and tractor approached the crossing (courtesy of Google).

Organisations involved

- 7 Network Rail owns and maintains the railway infrastructure where the accident occurred and employed the level crossing manager.
- 8 GB Railfreight Limited operated the train involved in the collision and employed its driver.
- 9 Network Rail and GB Railfreight freely co-operated with the investigation.

Train involved

- 10 The train was formed of a class 66 locomotive hauling 36 container flat wagons. Twenty one of these wagons were loaded with containers and 15 were empty. The wagons were a variety of types, including FEA, FWA and KFA.
- 11 There is no evidence that the way the train was driven had any effect on the accident.

Rail equipment involved

- 12 Kisby level crossing is a user worked crossing equipped with telephones (UWC(T)) which is also fitted with power operated gate openers (POGO). Users of such crossings operate the gates themselves and are required to use the telephone provided to contact the controlling signaller and seek permission to cross, having stated how long they will need to do so. The signaller will then grant permission or not based on their determination of where the nearest approaching trains are, and whether there is sufficient time to cross before the arrival of a train.
- 13 The crossing has a five metre wide power operated vehicular gate on each side of the railway (figures 3 and 4), which both open away from the railway. These are opened and closed by users pressing a green button located on the approach to each gate. The power operated gate system is not connected to the railway signalling and the gates can be opened, and remain open, when a train is approaching near to, or passing over, the crossing.



Figure 3: Southern approach to Kisby level crossing.

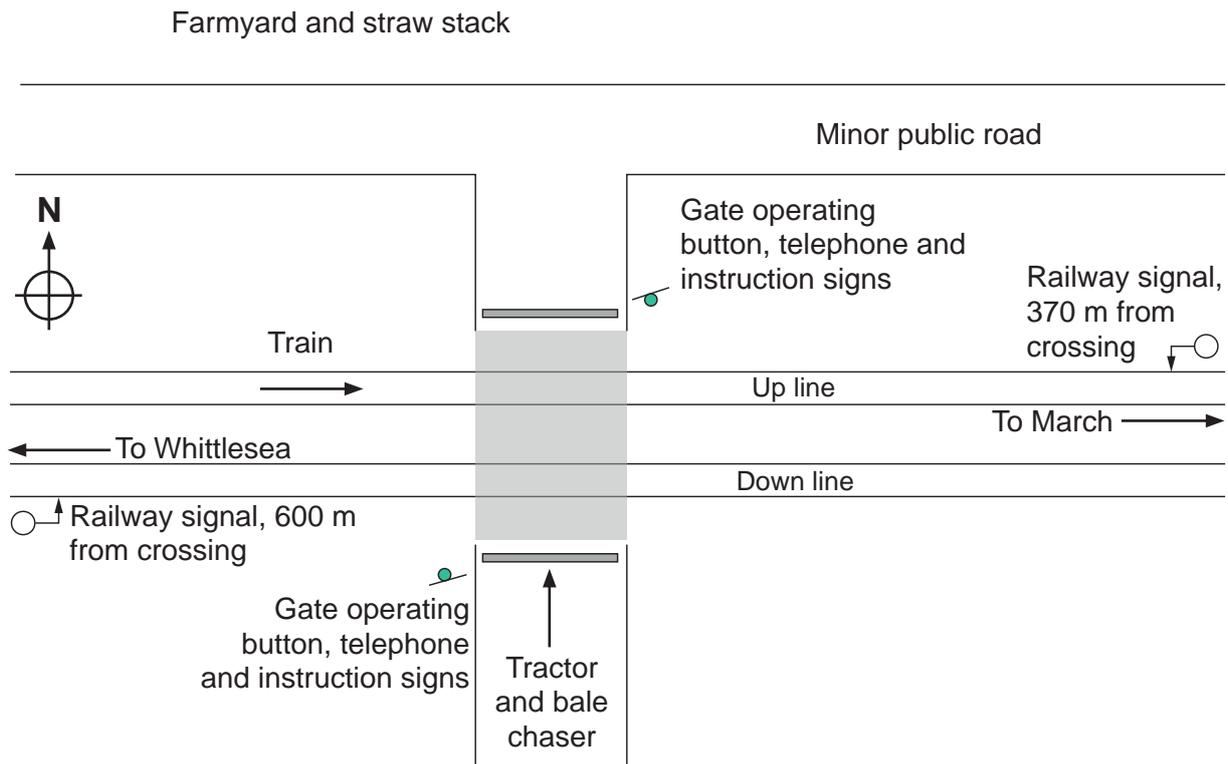


Figure 4: Layout of Kisby level crossing.

- 14 Signs on each approach to the crossing (figure 5) present instructions to users with vehicles and animals. These signs are a variant of the standardised design for a UWC(T), as set out in the Private Crossings (Signs and Barriers) Regulations 1996.
- 15 The main sign providing instructions for road users at Kisby level crossing is defined in the above regulations as a diagram 103 sign. It is divided into two parts. The upper part comprises white text on a red background, instructing users to stop and telephone the signaller before crossing with vehicles or animals, and to tell the crossing operator if the vehicle is large or slow-moving. The lower part of the sign comprises black text on a white background with a numbered list of instructions for opening and closing the gates. These instructions are presented in the following order:
 - push the green button to open the gates
 - cross quickly
 - push the green button to close the gates
- 16 Most user worked crossings, including Kisby, are private crossings with no public right of way and were originally provided to enable landowners to access their land. These landowners and their successors, or those who have either acquired rights of access or who have been given permission to use the crossing, are the 'authorised users' of the crossing. Authorised users are given information by Network Rail about how to use the crossing correctly. They are expected by Network Rail to arrange, as far as possible, to pass this information on to their employees and other people who may have to visit the premises served by the crossing.



Figure 5: Level crossing signs provided at Kisby level crossing.

Agricultural machinery involved

- 17 The agricultural machinery involved in the accident consisted of a tractor hauling a bale chaser (figure 6). The tractor was a John Deere 6155R with a mass of around 7.7 tonnes, which was purchased new in 2021. It had been inspected by its driver at the beginning of the shift on the day of the accident with no faults reported. There is no evidence that the tractor performed other than as expected as it crossed the railway.
- 18 The bale chaser was a Heath Engineering Super Chaser Extra. This type of equipment is a towed, five-wheeled trailer used to pick up straw bales from fields, and then to both transport and stack them. It is designed to handle up to 12 'Heston' sized bales, each measuring around 1.2 x 1.2 x 2.4 metres. These are carried on a metal deck around 1.3 metres above the ground. When configured for travelling, rather than for collecting bales, the bale chaser has a total length of around 9.7 metres, including a 2.2 metres long drawbar.
- 19 When the accident occurred, the bale chaser was fully loaded and configured for travelling. Its total mass of about 13.5 tonnes comprised an unladen mass of around 7.5 tonnes and about 6 tonnes of straw.

People involved

- 20 The authorised user of Kisby level crossing owned and managed the fields on both sides of the level crossing.



Figure 6: A bale chaser similar to that involved in the collision (courtesy of Heath Engineering).

- 21 The employer of the tractor drivers was a neighbouring farmer who had purchased straw which had been baled in the authorised user's fields. He employed tractor drivers 1 and 2 to collect the straw.
- 22 Tractor driver 1 stated that he had six years' experience as a tractor driver and that this was his second harvest season working for the employer. His driving licence showed that he was qualified to drive tractors on public roads at the time of the accident. He was driving the tractor towing the bale chaser which was struck by the train.
- 23 Tractor driver 2 was approaching the level crossing when the accident occurred.
- 24 The level crossing manager was employed by Network Rail and was responsible for undertaking regular inspections and risk assessments of Kisby level crossing. He was also the main point of contact between Network Rail and the authorised user.

External circumstances

- 25 The accident occurred just over two hours after sunrise, when the weather was bright and dry, with a light breeze. The sun was to the right of tractor driver 1 as he used the crossing. This means that its glare would have been unlikely to have affected his view to the left, the direction from which the train approached.
- 26 The crossing is in a quiet rural location and there was no evidence of any abnormal environmental noise being present or that other external circumstances influenced the accident.

The sequence of events

Events preceding the accident

- 27 The authorised user and the employer of the tractor drivers had agreed that the employer would collect straw from the authorised user's fields. The authorised user had a conversation with the employer on the day before the accident, during which they discussed where the straw would be stacked. The authorised user preferred it to be stored at the southern edge of his land, near Whittlesey Road, as he did not like people using Kisby level crossing more than was necessary. However, the employer told the authorised user that, because he had previously suffered arson attacks on straw stacked near main roads, he would prefer to stack the straw in the farmyard.
- 28 After receiving assurances from the employer that the crossing would be used correctly, the authorised user agreed to stacking the straw in the farmyard. The authorised user did not then brief the employer on how to use Kisby level crossing (see paragraph 60).
- 29 On the day of the accident, tractor drivers 1 and 2 were collecting straw bales from the authorised user's fields immediately south of Kisby level crossing and then transporting them over the crossing and stacking them in the farmyard north of the crossing. They had started work at around 07:00 hrs, and, at the time of the accident, had already made several trips over the crossing. Signal box records indicate that nobody had used the telephone at Kisby level crossing during that morning.
- 30 Just before the accident, both tractor drivers were approaching the crossing from the south with full loads of straw. Tractor driver 1 reached the crossing first, with tractor driver 2 following behind. Tractor driver 1 stopped about six metres from the crossing and got out of the tractor, operated the gate opening button, returned to the tractor and then started to drive towards the southern entrance of the level crossing. The second tractor was around 20 metres behind when tractor 1 entered the crossing.

Events during the accident

- 31 The train's forward-facing closed-circuit television (FFCCTV) system and on-train data recorder (OTDR) show that the tractor started moving towards the crossing when the train was travelling at 66 mph (106 km/h), about 8 seconds, and 240 metres, west of the crossing. The train driver could not see whether the level crossing gates were open or closed and stated that he had never seen anyone use this crossing before. He shut off traction power and sounded the train's horn when he saw the tractor starting to move towards the crossing. About 2 seconds later, the driver realised that the tractor was going to cross. He therefore operated the emergency brake plunger² while continuing to sound the horn.
- 32 Tractor driver 1 stated that he made a visual check for trains and then proceeded onto the crossing. Part way over the crossing, tractor driver 1 saw the approaching train and accelerated the tractor in an attempt to avoid a collision.

² A plunger within the driving cab, similar to an emergency stop switch, which cuts traction power and starts a full brake application.

- 33 After making the emergency brake application, the train driver left the driving seat, intending to take shelter in the corridor leading to the engine room in the central part of the locomotive.
- 34 The train struck the front left corner of the bale chaser at around 66 mph (106 km/h), separating it from the tractor. The impact with the bale chaser and its load broke both locomotive windscreens, showering debris onto the train driver who was still at the back of the driving cab, near to the entrance to the engine room corridor (figure 7).



Figure 7: Damage to the front of the class 66 locomotive.

- 35 At the point of impact, the leading wheelset of the locomotive lifted off the rails, landing around two metres beyond the level crossing deck. This wheelset then ran derailed along the sleepers for a distance of 780 metres, until the train stopped.
- 36 All wheels on the sixteenth wagon in the train derailed around 220 metres before the crossing, their approximate location when the locomotive struck the tractor. They then ran derailed until the train stopped. The wagon which derailed was the middle unit of a semi-permanently coupled³ triple-set of FWA wagons.
- 37 The bale chaser rotated through 90 degrees and became entangled with the locomotive. It was dragged along the railway until the train stopped (figure 8).

³ Rail vehicles which are designed to be operated as a fixed formation but which can be uncoupled for maintenance.



Figure 8: The bale chaser entangled with the class 66 locomotive.

Events following the accident

- 38 After the train stopped, the driver attempted to use the in-cab GSM-R⁴ radio to contact the signaller, using the railway emergency call (REC) function. Although the call connected to the signaller, as the handset of the radio was damaged, the driver was unaware of this. The driver then walked to a telephone attached to a nearby signal where he spoke with the signaller to report the accident and to request that all trains in the area be stopped.
- 39 The train driver suffered minor physical injuries from flying debris during the accident and also reported experiencing significant shock and trauma. The driver stated that he suffered many months of pain and distress during his recovery. Tractor driver 1 was uninjured.
- 40 The accident caused extensive damage to railway infrastructure. This included multiple broken rails and a distorted track alignment which required the replacement of several hundred metres of track. Damage was also caused to the level crossing surface, level crossing control equipment and signalling equipment.
- 41 The locomotive sustained damage to the front and side, including damage to the leading wheelset, windscreens and in-cab equipment. The derailed FWA wagon sustained damage to its wheels, braking system and drawbars. The headstocks⁵ of the FWA wagons forming the front and rear units of the FWA triple-set were also damaged.

⁴ Global System for Mobile Communications – Railway.

⁵ The horizontal beam forming the end of a rail vehicle, used to attach couplings and buffers*. (All definitions marked with an asterisk have been taken from Ellis's British Railway Engineering Encyclopaedia © Iain Ellis. www.iainellis.com).

- 42 The bale chaser was separated from the tractor and damaged beyond economic repair. A combine harvester parked adjacent to the crossing was also damaged by flying debris. The tractor remained at the crossing during the accident and was undamaged.
- 43 Both lines were closed to rail traffic until 24 August, five days after the accident.

Analysis

Identification of the immediate cause

44 The tractor and bale chaser entered the crossing as a train was approaching.

- 45 The tractor and bale chaser were driven onto Kisby level crossing as the train was approaching (paragraph 31). Tractor driver 1 was unaware of the approaching train until the tractor was part way over the crossing, when he accelerated the tractor in an attempt to avoid a collision.
- 46 The train driver applied the emergency brakes as soon as he realised the tractor was moving into the path of the train. At this point, the train was travelling at 66 mph (106 km/h). The brakes had not had time to reduce the train's speed when, around six seconds later, it collided with the bale chaser. The train then travelled a further 780 metres before stopping.

Identification of causal factors

- 47 The collision occurred due to a combination of the following causal factors:
- Tractor driver 1 did not use the telephone before crossing the railway, as he was required to do by the crossing's signage (paragraph 48).
 - The authorised user was not briefing crossing users in a way which resulted in correct use of the crossing, and this was not identified by Network Rail's level crossing manager until shortly before the accident. This was a probable factor in the accident (paragraph 64).

Each of these is considered in turn.

Use of the crossing

48 Tractor driver 1 did not use the telephone before crossing the railway, as he was required to do by the crossing's signage.

- 49 There is no evidence that the telephone at the crossing was used on the day of the accident by tractor driver 1 (or tractor driver 2). This arose due to a combination of the following factors, each of which is considered in turn:
- a. Tractor driver 1 believed he could safely use the crossing by looking along the railway (paragraph 51).
 - b. Tractor driver 1 was not briefed correctly on how to use the crossing and stated that he did not read the signs instructing users how to use it (paragraph 57).

Each of these is considered in turn.

- 50 Although RAIB recognises that there are shortcomings in the signage at Kisby and similar level crossings, there is insufficient evidence to treat this as a causal factor in this accident because tractor driver 1 did not read the signs before using the crossing. Signage issues are addressed separately at paragraph 87.

Method of crossing

51 Tractor driver 1 believed he could safely use the crossing by looking along the railway.

- 52 Tractor driver 1 stated that he thought it was safe to cross the railway because, before crossing, he looked both ways along the railway and did not see, or hear the noise of, an approaching train.
- 53 A post-accident site visit by RAIB found that a train approaching the crossing from the west on the up line would have been visible from the southern entrance of the level crossing for around 80 seconds. RAIB's inspection of the crossing concluded that the distances involved meant that the train would have probably been difficult for crossing users to see until around 50 seconds before its arrival at the crossing. This means it would have been clearly visible from the crossing when the tractor driver stopped to open the gates using the powered gate control (paragraph 12). This is consistent with the train driver stating that he saw the tractor stop and the driver get out of the cab.
- 54 From the crossing, visibility of trains approaching from the west would not in itself have triggered a requirement for all users with vehicles to contact the signaller before crossing (as required in Network Rail level crossing guidance LCG01). The requirement for users to do this was driven by the lesser distance at which trains approaching from the east can be seen.
- 55 It is uncertain why tractor driver 1 did not notice the train before he started to drive over the crossing. It is possible that he:
- did not look for trains immediately before deciding to cross
 - looked but did not notice the presence of the train.
- 56 There is no evidence that tractor driver 1 believed opening of the powered gates indicated that the crossing was safe to use. He did, however, state that he thought that green lights displayed by the railway signals away from the crossing (paragraph 6) were an indication that it was safe to cross. These signals do not, however, apply to crossing users.

Briefings

57 Tractor driver 1 was not briefed correctly on how to use the crossing and stated that he did not read the signs instructing users how to use it.

- 58 Tractor driver 1 stated that he had not previously seen a crossing similar to that at Kisby and had not received any instruction on how to use it. He had been working with tractor driver 2 at a different user worked crossing the day before the accident, which was not fitted with power operated gates and had poor sighting of approaching trains. Tractor driver 1 stated that tractor driver 2 told him while they were working at this other crossing that you should always use the telephone 'if not sure'. Signal box records show that, between them, the two tractor drivers had made three calls to the signaller at this other crossing. The actions of tractor driver 1 on the day of the accident suggest that he believed, contrary to the required method of use explained on the signage, that use of the telephone was not necessary at Kisby level crossing before crossing the railway as visibility was good.

- 59 Network Rail required the authorised user to brief crossing users about how to use it safely. The authorised user was not aware that tractor driver 1 was on site until after the accident had occurred but was aware that drivers working for the employer would be using the crossing.
- 60 The authorised user and employer both stated that, when agreeing the method of working to be adopted on the day of the accident (paragraph 27), the employer had not been briefed by the authorised user on the correct use of the crossing. The employer had also previously grown potatoes on land which required access over Kisby level crossing for a period of several years and the authorised user could not remember a specific time when he had briefed the employer on correct use of the crossing during that time. However, the employer stated that he knew the correct method of crossing operation. The authorised user also stated he believed that the employer understood how to use the crossing correctly.
- 61 The authorised user stated he was in the habit of approaching people using the crossing to ascertain their business and instruct them on correct crossing use. He had briefed tractor driver 2 around 10 days before the accident when this driver was working for the employer at the crossing on his own. The authorised user and tractor driver 2 both stated that this briefing included the need to always use the telephone, but there is no record of telephone use on that day. The authorised user was not aware that tractor driver 2 would be working with tractor driver 1 on the day of the accident.
- 62 The employer did not brief either tractor driver and stated this was because he believed that the signage was clear and that the tractor drivers were responsible for their own actions.
- 63 RAIB has previously discussed the potential weaknesses in the authorised user concept in its class investigation into safety at user worked crossings ([RAIB report 13/2009](#)) and its reports into the accident at Oakwood Farm, Knaresborough in 2015 ([RAIB report 07/2016](#)) and Frognaal Farm, Kent, in 2017 ([RAIB report 12/2018](#), see paragraph 95). These findings relate to situations where it is not practical for an authorised user of a crossing on a private road to brief everybody who needs to use it (such as delivery drivers) before they encounter it for the first time. However, the circumstances of the accident at Kisby level crossing are different, as those using the crossing were doing so as part of a planned work activity, which was known about by the authorised user.

Management of Kisby level crossing

64 The authorised user was not briefing crossing users in a way which resulted in correct use of the crossing, and this was not identified by Network Rail's level crossing manager until shortly before the accident. This was a probable factor in the accident.

- 65 Network Rail's management system for level crossings includes periodic risk assessments produced in accordance with work instruction NR/L3/XNG/308, 'Risk Assessing Level Crossings'. This covers the frequency of assessments and the process to be used, including requirements for data collection, a site visit and interaction with the authorised user. Data to be collected includes crossing usage (sometimes described as census data) and the work instruction provides several methods for doing this.

- 66 The data collected is entered into Network Rail's all level crossings risk model (ALCRM) which numerically generates a comparative risk for each level crossing. This is known as the risk score and is made up of a letter, A (high) to M (low), representing the individual risk to the 'most exposed' crossing user, and a number, 1 (high) to 13 (low), representing the collective risk. The collective risk is an estimate of the total risk to all crossing users and the occupants of trains. The ALCRM risk score for Kisby level crossing at the time of the accident was A4, which placed it in the top 1% nationwide of ALCRM risk scores for UWC(T)s.
- 67 The work instruction also describes the process required as part of all risk assessments to assess risk control options to improve a crossing's safety. This considers the risk score for the crossing, a cost-benefit analysis of possible changes that could be made, and a qualitative assessment. This qualitative assessment can include expert judgement, to identify and recommend possible level crossing improvements. The process is concluded with a narrative risk assessment for each crossing which describes the identified risks and their management, together with supporting information and the proposed risk control options.
- 68 Compliance with work instruction NR/L3/XNG/308 was required from September 2020 when it replaced National Operating Procedure 3.08. The requirements of both standards are similar.
- 69 At the time of the accident, risk assessments at Kisby level crossing were required at intervals of 15 months and usage was being determined from estimates provided to the level crossing manager by the authorised user. The estimates provided during risk assessments in March 2019, June 2020 and July 2021 indicate at least 500, and possibly more than 1000, crossings with vehicles each year. However, signal box records show that the telephone at the crossing was used only nine times to make requests to cross in the almost three-year period from August 2018 to July 2021.
- 70 In addition to comparison with the authorised user estimates, there was other evidence available to Network Rail staff that showed that it was likely that a significant proportion of crossings were being made at Kisby level crossing without users first contacting the signaller. For example, the small number of calls to the signaller was inconsistent with:
- the considerably higher number of crossings that might be expected given the 250 acres of arable land served by the crossing (land use was visible to the level crossing manager on his regular visits to the crossing)
 - the higher number of crossings which took place when the railway had previously provided a crossing attendant to open and close the gates manually during harvest seasons (a practice discontinued after installation of the power operated gates which significantly reduced the time needed to manually open both gates and the authorised user stated that they were happy to manage the crossing without an attendant)
 - the higher number of crossings typically occurring at other UWC(T)s providing field-to-field access (data for 13 of these crossings showed recorded call numbers ranging from 0 to 55 calls per crossing in the four-week period from 24 July to 21 August 2021, with an average of around 10 calls).

- 71 Network Rail's work instruction NR/L3/XNG/308 includes the following requirement:
- Risk assessors shall prepare for the site visit. As a minimum this shall include:[...]*
- b) a review of previous census data;*
 - c) deciding which type of census will be undertaken and which equipment shall be used;*
 - d) obtaining crossing usage information held by the controlling signal box e.g. records of requests to use the crossing entered in the occurrence book⁶ for user worked crossings, drivers of long or slow moving vehicles, herding animals;*
- 72 The level crossing manager stated that, when undertaking a risk assessment at a user worked crossing, he would visit the controlling signal box, if time allowed, and photograph the occurrence book. Alternatively, he would telephone the signal box and ask for a summary of the occurrence book and for information about any issues concerning the crossing. The level crossing manager also stated that he would not obtain call data from the occurrence book if the authorised user seemed trustworthy.
- 73 The level crossing manager stated that he could not recall ever collecting signal box information for calls relating to usage of Kisby level crossing. He was not able to provide any evidence that this type of information had been obtained for his risk assessments of other UWC(T)s, possibly because there was no Network Rail requirement for level crossing managers to keep records of this activity.
- 74 Network Rail's level crossing risk assessments had, since at least February 2017, recorded that the phone was not always being used when vehicles crossed at Kisby level crossing. However, witness evidence indicates that Network Rail staff, including the level crossing manager, were unaware of the full extent of this problem until June 2021, two months before the accident. The level crossing manager stated that, until this point, he had accepted the assurances of the authorised user, given when they met as part of the risk assessment process, that the crossing was being used correctly.
- 75 In June 2021, the level crossing manager requested recordings of recent phone calls between users of Kisby level crossing and the controlling signallers. These were requested as part of routine checks undertaken by Network Rail's Anglia route on the quality of telephone communications. The level crossing manager was told that no calls had been made recently from Kisby, a response which led him to recognise that there was significant use of the crossing without users contacting the signaller.

⁶ A book in which signallers record requests to cross the railway at user worked crossings.

- 76 The next routine risk assessment of Kisby level crossing included a site visit on 13 July 2021. As part of this assessment, the level crossing manager recorded *'Contact made with signal box, very few requests to cross made, unable to visit signal box due to COVID 19 restrictions'* and that telephones were *'sometimes'* used when users wished to cross. He also recorded *'authorised user on site during risk assessment, usage and concerns discussed'*. The level crossing manager stated that the discussion included him explaining to the authorised user that correct use of the telephone was a safety issue and that the authorised user provided assurances that this would happen in the future.
- 77 Between speaking to the authorised user on 13 July 2021 and the accident on 19 August 2021, signal box records show that only one call was made from users of Kisby level crossing seeking permission to cross.

Identification of underlying factors

78 Network Rail did not effectively manage the safe use of Kisby and some other Anglia route user worked crossings with telephones. This is a possible underlying factor.

- 79 At the time of the accident, Network Rail remained reliant on users contacting the signaller by telephone to find out if it was safe to cross the railway at Kisby level crossing, until a plan to replace this process with miniature stop lights was implemented (see paragraph 84). Relying on users to contact the signaller was in part dependent on there being an effective interaction between level crossing managers and authorised users. Network Rail's reviews of risk assessments did not identify that this interaction with authorised users was potentially ineffective. This is a possible underlying factor for both the accident at Kisby and for two other UWC(T)s seeing significant usage without the signaller first being contacted.

The review of risk assessments

- 80 Witnesses stated that, on Anglia route, all level crossing risk assessments completed by level crossing managers were reviewed by:
- a different level crossing manager to identify 'obvious' errors and errors in data entry
 - a route level crossing manager, to check factual accuracy and appropriate consideration of risk control options
 - a multi-disciplinary panel at which risk control options were discussed.
- 81 These reviews did not consider current risk assessments in the context of previous historic risk assessments and a requirement to do this was not included in NR/L3/XNG/308. If a review of this nature had been done for Kisby level crossing, it is possible that this would have identified:
- that there was historic evidence that the crossing was being used without users first contacting the signaller
 - the need to quantify the extent of this incorrect usage, an action which may have identified that signal box records had not been obtained by level crossing managers and/or had not been compared with authorised user's estimates

- that interaction between the level crossing manager and the authorised user was not achieving correct use of the crossing, given the proportion of crossings without contacting the signaller which would have been identified
 - the need for consideration of additional action to enhance the effectiveness of interaction between Network Rail and the authorised user.
- 82 After the accident, Network Rail compared level crossing telephone usage recorded at signal boxes in September 2021 with expected usage from census data collected as part of the routine risk assessment process. Excluding Kisby, the comparison considered 192 UWC(T)s, and found significant inconsistencies between phone calls and census data at six of these crossings. In five instances, this was due to recent changes in use not being reflected in census data, or to inconsistencies between crossing names used by signallers and those used on the risk assessment forms. However, at one location there were significantly fewer calls than expected from census data. Further enquiries by Network Rail found that, in this instance, there had been a recent change in authorised user and that a significant number of crossings had been made without first obtaining permission from the signaller. Different level crossing managers were responsible for Kisby and this other location.
- 83 The above findings suggest that interaction between authorised users and some level crossing managers did not always result in the correct use of these user worked crossings. Had these interactions led to the correct use of each of these crossings, it is possible that the accident at Kisby would have been avoided.

Installation of miniature stop lights

- 84 Network Rail's long-term plan for managing risk due to relatively high use of Kisby level crossing was to install miniature stop lights. These lights, which are linked to a train detection system, display a red or green light to crossing users depending on whether it is safe for them to cross the railway. The need for these lights was identified and accepted during the routine risk assessment which was undertaken for the crossing in 2019. This records that they met the required cost benefit criteria, and that installation was planned to take place in Network Rail's control period 6 (1 April 2019 to 31 March 2024). The 2020 risk assessment states that construction was due in the final year of this control period.
- 85 Network Rail needed to fit miniature stop lights at a significant number of crossings on the Anglia route. The timing of installation was prioritised according to the risk profile of these crossings and taking account of an improvement notice issued by the Office of Rail and Road (ORR) in response to near misses that had occurred at user worked crossings with telephones.⁷ The improvement notice required Network Rail to identify signal boxes on Anglia route where signallers received a substantial number of calls from crossing users, and to identify user worked crossings with telephones where the signaller had an imprecise knowledge of the location of the train when a request to cross was made. The notice required Network Rail to identify control measures to reduce the risk. A second improvement notice required the changes identified to be implemented by the end of March 2021.

⁷ <https://orrprdpubreg1.blob.core.windows.net/docs/I-DTHM-23012018%20Network%20Rail%20improvement%20notice.pdf>.

- 86 Kisby level crossing was not affected by the issues highlighted by this improvement notice. This meant that Network Rail scheduled the installation of miniature stop lights at other crossings before scheduling their installation at Kisby.

Observation

Signage

87 The signs provided at the crossing did not provide clear guidance on how to use the crossing correctly.

- 88 The RAIB reports into the 2017 accident at Frogna Farm level crossing ([RAIB report 12/2018](#), see paragraph 95) and the 2020 near miss at Coltishall Lane level crossing ([RAIB Report 03/2022](#), see paragraph 96) discussed a number of issues with the design of the diagram 103 sign, which is the main sign instructing users how to use the crossing correctly (paragraph 15). These included issues seen at Kisby level crossing such as:

- The signage does not make it clear to the user that it is not safe to cross the railway without permission from the signaller.
- The instructions are not concise, and they do not capture the reader's attention.
- The most important instruction on the sign, to contact the signaller for permission to cross, is not a numbered instruction, and it is therefore easy to overlook. In addition, this instruction is difficult to pick out in the white text on the red background.
- At crossings with power operated gates, the signage does not explain that there may be a train coming even if the gates move to the open position.

Consequences of the accident

Damage to the locomotive

89 Both of the locomotive's front windscreens were pushed into the cab on impact with the bale chaser.

- 90 The impact with the bale chaser resulted in both of the locomotive's front windscreens, each with a mass of about 50 kilograms, being pushed into the cab, along with some straw. This resulted in damage to cab equipment. It is likely that this would also have caused serious injury to the train driver had he remained in his seat during the collision rather than moving towards the corridor entrance at the rear of the cab (figure 9).



Figure 9: Driver's side of class 66 cab after the accident.

91 Railway Group Standard GM/TT0122 Issue 1 'Structural Requirements for Windscreens and Windows on Railway Vehicles' (June 1993) was current at the time the locomotive was built.⁸ This required consideration of two separate loading conditions when designing windscreens on locomotives, such as class 66 locomotives. The loading conditions given are a uniform 2.5 kN/m² pressure over the full area of the windscreen and an impact from a sharp-cornered hollow steel cube. RAIB calculations show that, when struck at the train's speed of 66 mph (106 km/h), the loading from the straw bales would have exceeded these requirements and those in current standards by a very large margin.

Wagon derailment

92 An empty wagon situated part way down the train derailed before reaching the crossing.

93 As loads generated by the impact with the bale chaser passed along the train, the sixteenth wagon derailed about 220 metres before the level crossing. This was the unloaded middle wagon of a triple unit (figure 10).

94 RAIB is considering the mechanism which caused this wagon to derail as part of its investigation into the derailment of a similar FWA wagon approaching London Gateway on 24 December 2021. It is not considered further in this report.

⁸ Railway Group Standards are published by RSSB <https://www.rssb.co.uk/en/standards-catalogue>.



Figure 10: Derailed FWA wagon after the accident.

Previous occurrences of a similar character

[Accident at Frognal Farm, 23 October 2017 \(RAIB report 12/2018\)](#)

95 On 23 October 2017, a passenger train collided with a parcel delivery van at Frognal Farm user worked crossing, near Teynham, in Kent. The train was travelling at 89 mph (143 km/h) and the van driver suffered serious injuries. The crossing was equipped with power operated gates and, when these opened in response to the van driver pressing the open button, he drove onto the crossing believing it was safe to cross. The van driver had received no briefing on the correct use of the crossing and the signage provided was not effective at communicating the need for them to contact the signaller before crossing.

[Near miss at Coltishall Lane, 21 January 2021 \(RAIB report 03/2022\)](#)

96 At 17:21 hrs on 21 January 2021, a passenger train narrowly avoided a collision with two cars at Coltishall Lane UWC(T), on a public road near Hoveton, Norfolk. Road traffic over the crossing was higher than usual because of an earlier road traffic accident on a nearby main road.

97 The near miss occurred because the car drivers did not telephone the signaller before using the crossing, possibly in part because the signs at the crossing were ineffective at prompting users to cross safely.

Summary of conclusions

Immediate cause

98 The tractor and bale chaser entered the crossing as a train was approaching (paragraph 44).

Causal factors

99 The causal factors were:

- a. Tractor driver 1 did not use the telephone before crossing the railway, as he was required to do by the crossing's signage (paragraph 48, **Recommendation 2** and letters to organisations representing the farming industry, appendix C). This factor which arose due to a combination of the following:
 - i. Tractor driver 1 believed he could safely use the crossing by looking along the railway (paragraph 51).
 - ii. Tractor driver 1 was not briefed correctly on how to use the crossing and stated that he did not read the signs instructing users how to use it (paragraph 57).
- b. The authorised user was not briefing crossing users in a way which resulted in correct use of the crossing, and this was not identified by Network Rail's level crossing manager until shortly before the accident. This was a probable a factor in the accident (paragraph 64, **Recommendation 1**).

Underlying factor

100 Network Rail did not effectively manage the safe use of Kisby and some other Anglia route user worked crossings with telephones. This is a possible underlying factor (paragraph 78, **Recommendation 1**).

Observation

101 The signs provided at the crossing did not provide clear guidance on how to use the crossing correctly (paragraph 87).

Previous recommendation that had the potential to address an observation identified in this report

[RAIB investigation into safety at user worked crossings, RAIB report 13/2009, recommendation 8](#)

102 RAIB considers that completion of the actions being implemented to address recommendation 8 in report 13/2009 could have addressed the issue of unclear signage at user worked crossings.

103 This recommendation reads as follows:

The Department for Transport, in consultation with the Office of Rail Regulation,⁹ should review the requirements for signs prescribed by law for use at private crossings, and revise them as necessary, taking into account the need to convey information and instructions clearly and unambiguously to diverse users.

104 In its report into the collision at Frogna Farm user worked crossing (paragraph 95), RAIB stated that the implementation of this recommendation could have resulted in the provision of signage which alerted unfamiliar users to the correct way to use the crossing, potentially addressing one of the causal factors of that accident.

105 In response to this recommendation, the Department for Transport has informed RAIB that it has worked with Network Rail, ORR and RSSB since 2016 to develop new signs based on RSSB's research project T983 'Research into signs at private level crossings' and has subsequently created a new suite of signs to replace the older 1996 signs. These signs have undergone human factors trials to understand how unfamiliar users would potentially react to them in a realistic setting. The proposed signage has also been tested at two existing user worked crossings. Network Rail reported that users at these locations have indicated that the new signs are easier to understand than the older versions.

106 The proposed set of new prescribed signs is intended to be comprehensive enough to cover the vast majority of user worked crossings currently on the rail network or expected to be in use in the future. However, it will not be possible to cater for all circumstances within a single set of regulations, given the diverse nature of the UK rail network and the uniqueness of individual user worked crossings, so there will be exceptional cases where a non-prescribed sign is needed. These non-standard signs would, as now, still require individual authorisation by the relevant authority.

107 On 6 April 2022 the Department for Transport began a consultation on a proposal to make changes to signage at private level crossings. The proposed changes would revoke the existing Private Crossings (Signs and Barriers) Regulations 1996 and introduce new regulations which would replace the existing signs authorised for user worked crossings on private roads with the proposed set of new prescribed signs. The proposed changes set a target for these new signs to be installed at all private level crossings by 2029. It would not carry forward the concept of the authorised user into legislation, which the department states is 'an outdated term without a proper legal basis'. This public consultation closed on 1 June 2022; final design decisions are expected to be made in 2023.

⁹ Before April 2015, when it assumed responsibility for monitoring and enforcing the performance and efficiency of National Highways, the Office of Rail and Road was known as the Office of Rail Regulation.

Actions reported as already taken relevant to this report

- 108 Network Rail updated the business process NR/L2/XNG/001 'Provision and risk management of level crossings' to include a detailed list of requirements for the content of narrative risk assessments, and some guidance on their preparation. The updated standard does not include requirements to review previous risk assessments in order to identify safety issues which continue, despite actions intended to address them. It also does not require all data sources to be compared when assessing the use of UWCs.
- 109 A new process introduced by Anglia route as a result of the accident at Kisby level crossing requires that:
- All risk assessments should take account of a nine-day camera census taken within the last 12 months.
 - Signal box call records should be obtained for all UWC(T)s, and compared with expected usage, every March and September, with further action if inconsistencies are found.
- 110 Once repairs to the crossing were complete, but before it was reopened, Network Rail's level crossing management team and the authorised user signed an agreement detailing how the crossing should be used. To help the level crossing manager confirm that this is being observed, Network Rail fitted the crossing with a CCTV camera which can be remotely monitored. The level crossing manager is also making regular checks of the signaller's records of telephone use at the crossing.
- 111 RAIB has written to several organisations representing the farming industry to ask that they circulate information about this accident to their members as a reminder of the importance of using level crossings correctly. This letter and the organisations involved are given in appendix C.

Recommendations

112 The following recommendations are made:¹⁰

- 1 *The intent of this recommendation is that Network Rail improves the effectiveness of its risk management of user worked crossings.*

Network Rail should review and improve its risk assessment and assurance processes for user worked crossings to ensure that:

- All appropriate data sources are considered and, where appropriate, compared during risk assessments.
- Previous risk assessments are considered to ensure that risk mitigation is effective at addressing historical safety issues.
- Level crossing managers are effectively monitoring user worked crossings for evidence of incorrect use.

- 2 *The intent of this recommendation is that farmers and farm workers understand the importance of following safety instructions at user worked crossings. HSE could include this in its published guidance on health and safety in agriculture.*

The Health and Safety Executive, working with the Office of Rail and Road, Network Rail and other railway infrastructure managers, should review its guidance to people working on farms to ensure that it contains appropriate advice about the need to follow the required procedures at user worked crossings. The Health and Safety Executive should revise the relevant guidance as appropriate, based on the findings of this review.

¹⁰ 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, Recommendation 1 is addressed to the Office of Rail and Road (ORR) and Recommendation 2 is addressed to the Health and Safety Executive 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.

Appendices

Appendix A - Glossary of abbreviations and acronyms

ALCRM	All level crossing risk model
FEA	A type of 8-wheeled container flat wagon
FFCCTV	Forward-facing closed-circuit television
FWA	A type of 8-wheeled container flat wagon
GSM-R	Global System for Mobile Communications - Railway
KFA	A type of 8-wheeled container flat wagon
ORR	Office of Rail and Road
OTDR	On-train data recorder
POGO	Power operated gate opener
RAIB	Rail Accident Investigation Branch
REC	Railway emergency call
RSSB	Rail Safety and Standards Board
UWC(T)	User worked crossing with telephones

Appendix B - Investigation details

RAIB used the following sources of evidence in this investigation:

- information provided by witnesses
- information taken from the train's OTDR
- FFCCTV recordings taken from the train
- site photographs and measurements
- weather reports and observations at the site
- a review of level crossing risk assessments
- a review of standards and procedures
- a review of previous RAIB investigations that had relevance to this accident.

Appendix C - Letter to organisations representing the farming industry

National Farmers Union

Country Land and Business Association

Tenant Farmers Association

National Association of Agricultural Contractors

Scottish Tenant Farmers Association

The Rail Accident Investigation Branch (RAIB), the independent investigation body for rail accidents in the United Kingdom, has completed its investigation of the collision between a train and agricultural machinery at Kisby level crossing, near March in Cambridgeshire on 19 August 2021. A copy of our report accompanies this letter.

As part of this investigation, RAIB identified that people were routinely crossing the railway at this location without contacting the railway signaller, as required by signs at the crossing, to ensure that it was safe to cross. On the day of the accident, this resulted in a train, travelling at 66 mph, striking agricultural equipment being towed over the railway by a tractor.

[Image of bale chaser against locomotive, as figure 8]

Incidents such as this can result in serious injury or death of level crossing users, railway staff and passengers. They can also have serious financial and legal implications for people, including some of your members, responsible for use of the crossing. RAIB therefore asks that you make your members aware of the accident at Kisby level crossing, highlighting the dangers of using level crossings without following required operating procedures.

I would appreciate a copy of any publicity sent to your members in response to this request, and ask that you let me know the date(s) on which it was sent.

Please do not hesitate to get in touch if you would like to discuss the contents of the report or this request.

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Any enquiries about this publication should be sent to:

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