RAIB

Rail Accident Investigation Branch

Rail Accident Report

Serious operational irregularity at Bagillt user worked crossing, Flintshire, involving an abnormally heavy road vehicle
17 August 2018

Report 11/2019
August 2019

This investigation was carried out in accordance with:

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

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Preface

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

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

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

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

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

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

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

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

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

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Summary

At around 11:57 hrs on Friday 17 August 2018, a passenger train passed over Bagillt user worked level crossing, Flintshire, shortly after a very large road vehicle had crossed. Railway signals had not been set to stop trains from approaching the crossing. A person assisting the vehicle driver, who was walking back over the crossing to close the gates behind the vehicle, was alarmed to see the approaching train and ran off the crossing.

The vehicle driver's assistant had telephoned the signaller and obtained his permission before crossing the railway, but the signaller had not stopped trains approaching when a large vehicle needed to cross the railway, as required by the Rule Book. The user had not told the signaller that the vehicle was large, as required by a sign displayed at the crossing. The signaller did not ask questions to establish the size of the vehicle, and did not know that most people using this crossing did so with heavy goods vehicles, although some Network Rail staff were aware of this. Network Rail was unaware that this exceptionally heavy vehicle, subject to special requirements when on public roads, used the crossing regularly.

Underlying factors relate to Network Rail's processes for risk management at this type of level crossing. These did not provide railway staff or road users with a coherent and consistent process for deciding when a vehicle should be treated as 'large', and did not provide an effective interface between signallers, crossing users and railway staff responsible for liaison with users and inspecting level crossings. An observation identifies further shortcomings in the information provided to signallers.

The report contains one recommendation addressed to Network Rail, seeking improvements in its management processes for user worked crossings with telephones.

The report also contains two further observations. One, relating to how signallers decide when it is safe for users to cross the railway at level crossings, provides evidence supporting the need for Network Rail to complete implementation of a previous RAIB recommendation. The other notes poor application of safety critical communication protocols in some training material.

The RAIB has identified five learning points. Four relate to dealing with requests to cross the railway at user worked level crossings. These cover clear communication about the characteristics of road vehicles needing to cross the railway, the circumstances when signal protection is needed, making allowance for differing train speeds when deciding when it is safe for users to cross and achieving safety critical communication standards when speaking with members of the public. The final learning point relates to correct use of safety critical communication protocols in training material.

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 explained in appendix A. Sources of evidence used in the investigation are listed in appendix B.

The incident

Summary of the incident

3 At around 11:57 hrs on 17 August 2018, a passenger train travelled over Bagillt user worked crossing with telephones (UWC-T), near Flint, Flintshire, shortly after a road vehicle weighing 60.5 tonnes had passed over the crossing. Railway signals had not been set to red to protect the crossing from train movements before this permission was given. The train, reporting number 1D34, was the 09:53 hrs Manchester Piccadilly to Holyhead service and was travelling at about 75 mph (121 km/h) when it reached the crossing, probably about one minute after the road vehicle had crossed. A person walking over the crossing to close the gates behind the vehicle was alarmed to see the approaching train and ran clear of the crossing.

Context

Location

4 Bagillt UWC-T is located about 2 miles (3.2 km) north west of Flint on the double track railway between Chester and Holyhead (figure 1). It is 193 miles 52 chains from London (Euston), on a section of line where the railway is generally straight and runs in a south-east to north-west direction. The down line, on the south side of the railway corridor, carries trains going towards Bagillt UWC-T from Flint, Chester and London. The up line carries trains in the opposite direction. The distance between the up and down lines, and the width of the railway corridor, are greater than normally required for a double track railway as there were additional railway tracks in this area serving a nearby colliery and station; both of which are now closed. The railway is equipped with colour light signalling controlled by signallers and computer based interlocking at the Wales rail operating centre (WROC) in Cardiff.

5 The crossing serves a private road linking the A548 dual carriageway to a car spares yard, owned by Bagillt Car Spares, located about 800 metres north west of the crossing, and to the shore of the River Dee estuary (figure 2). An adjacent footbridge provides public access to the shore.

6 The crossing is mainly used by vehicles travelling to and from Bagillt Car Spares that are too tall to pass beneath the railway at a bridge close to the car spares yard. Vehicles travelling from the yard to the crossing use a gravel track which runs near, and generally parallel to, the railway until the track reaches an area in which vehicles can turn to face across the railway before entering the north end of the crossing. As road vehicles exit from the south end of the crossing, they continue for a short distance on a surfaced road which leads to the A548.

Organisations involved

7 Network Rail is the owner, operator and maintainer of the infrastructure, including the level crossing at Bagillt. It employed the signallers and other staff at the WROC, and the level crossing managers responsible for Bagillt crossing.

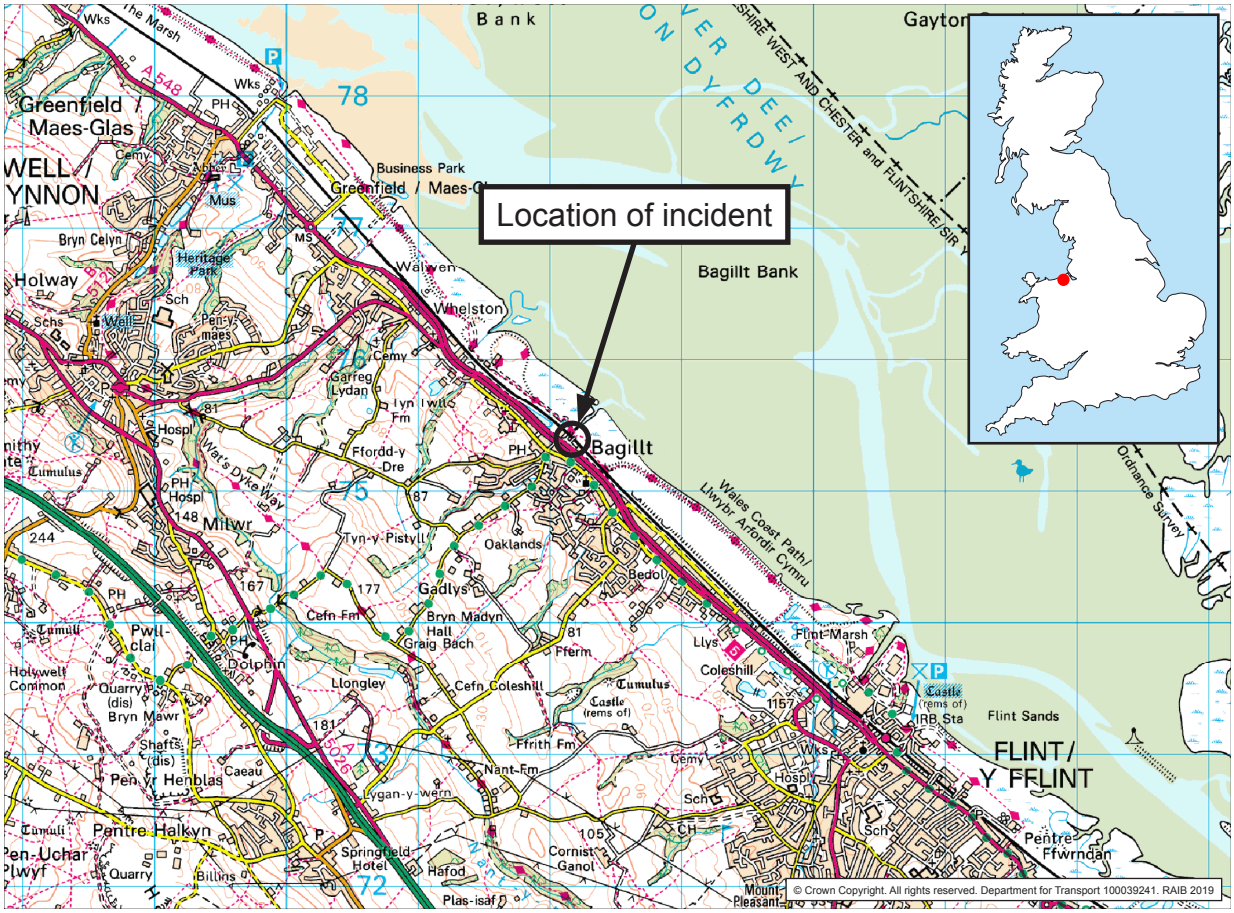


Figure 1: Extract from Ordnance survey map showing location of incident

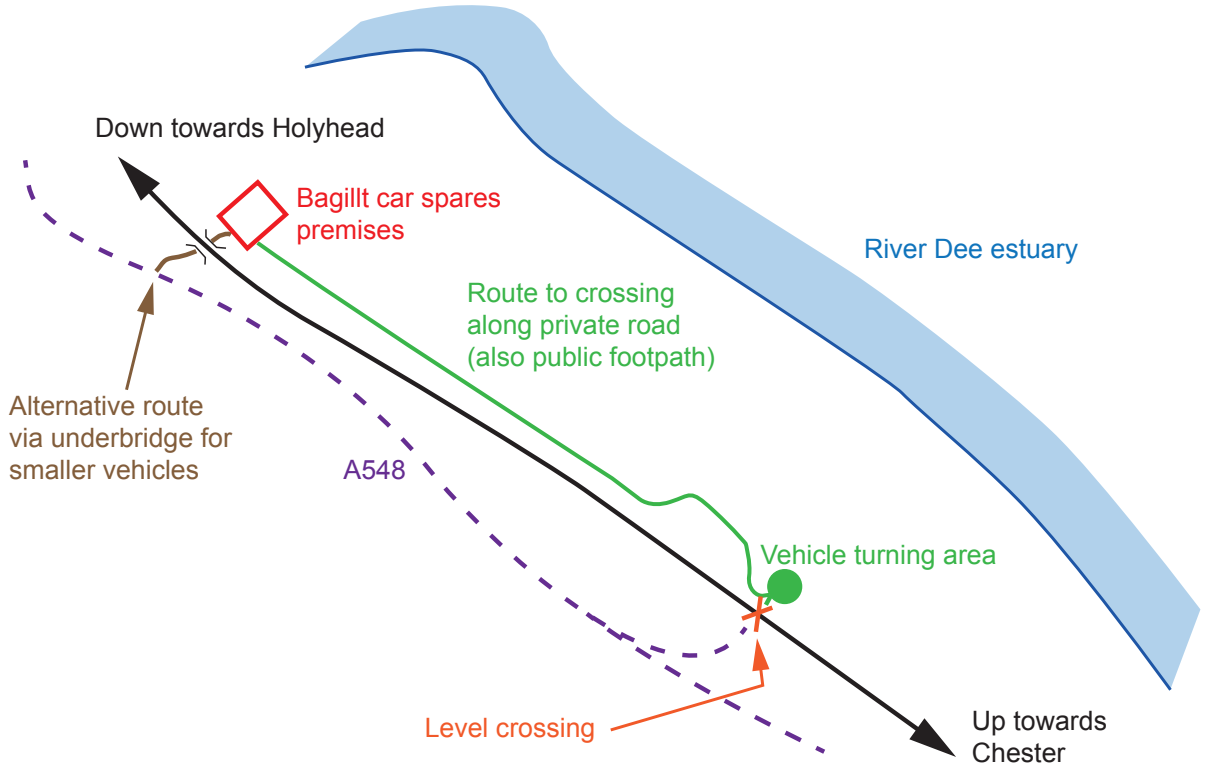


Figure 2: Schematic plan of area around Bagillt UWC-T

8 Arriva Trains Wales held the franchise for operating the train involved and employed the train driver. The franchise ended in October 2018 and equivalent services are now operated by Transport for Wales.

9 Bagillt Car Spares is a business which dismantles cars and sells vehicle parts; it had six employees when the incident occurred. This included one who acted as crossing assistant during the time of the incident. Bagillt Car Spares has a right to use the crossing and the right to permit others to use the crossing when needed to access its land. Network Rail treats Bagillt Car spares as an authorised user, who is expected to provide other people who need to use the crossing to access its land with information about how to do so safely.

10 S Norton & Co Ltd (Norton) provides metal recycling services, which included taking the large road vehicle involved in the incident to and from Bagillt Car Spares. It owned this vehicle and employed the road vehicle driver involved in the incident.

11 Each of these organisations freely co-operated with the investigation.

Train involved

12 The train comprised a class 67 diesel-electric locomotive, four coaches and a driving van trailer (a vehicle allowing the train to be driven from the opposite end to the locomotive).

13 The train was not fitted with forward facing CCTV. It was fitted with an on-train data recorder (OTDR) but no information was available from this (paragraph 45). There is no evidence that the condition or operation of the train contributed to this incident.

Road vehicle involved

14 The large road vehicle involved in the incident, referred to as the 'baler' in the remainder of this report, is an articulated lorry comprising a tractor unit hauling a semi-trailer equipped with a large ram and loading crane which crushes cars into bales of scrap metal (figure 3).

Figure 3: The baler

15 The combined tractor unit and semi-trailer is approximately 60.5 tonnes in weight, 19.1 metres long and 2.7 metres wide. Individual vehicles and vehicle combinations permitted to operate without special restrictions on public roads in the UK are usually limited by UK highway legislation to a maximum weight of 44 tonnes, a maximum length of 18.75 metres and a maximum width of 2.55 metres. Vehicles exceeding these criteria are described in this report as 'abnormal vehicles'.

Rail equipment/systems involved

16 Bagillt UWC-T has a pair of gates on each side of the railway situated 24.5 metres apart (figure 4). The crossing is equipped with a telephone outside each pair of gates which connect to the signaller's workstation supervising the crossing (figure 6, paragraph 19). Signs positioned inside the gates on both sides of the crossing tell users with vehicles or animals that they must telephone the signaller to obtain permission before opening the gates, crossing the railway and closing the gates. Vehicle users are required to obtain permission because sighting distances along the railway are not sufficient for users to see trains in time to determine if it is safe to cross.

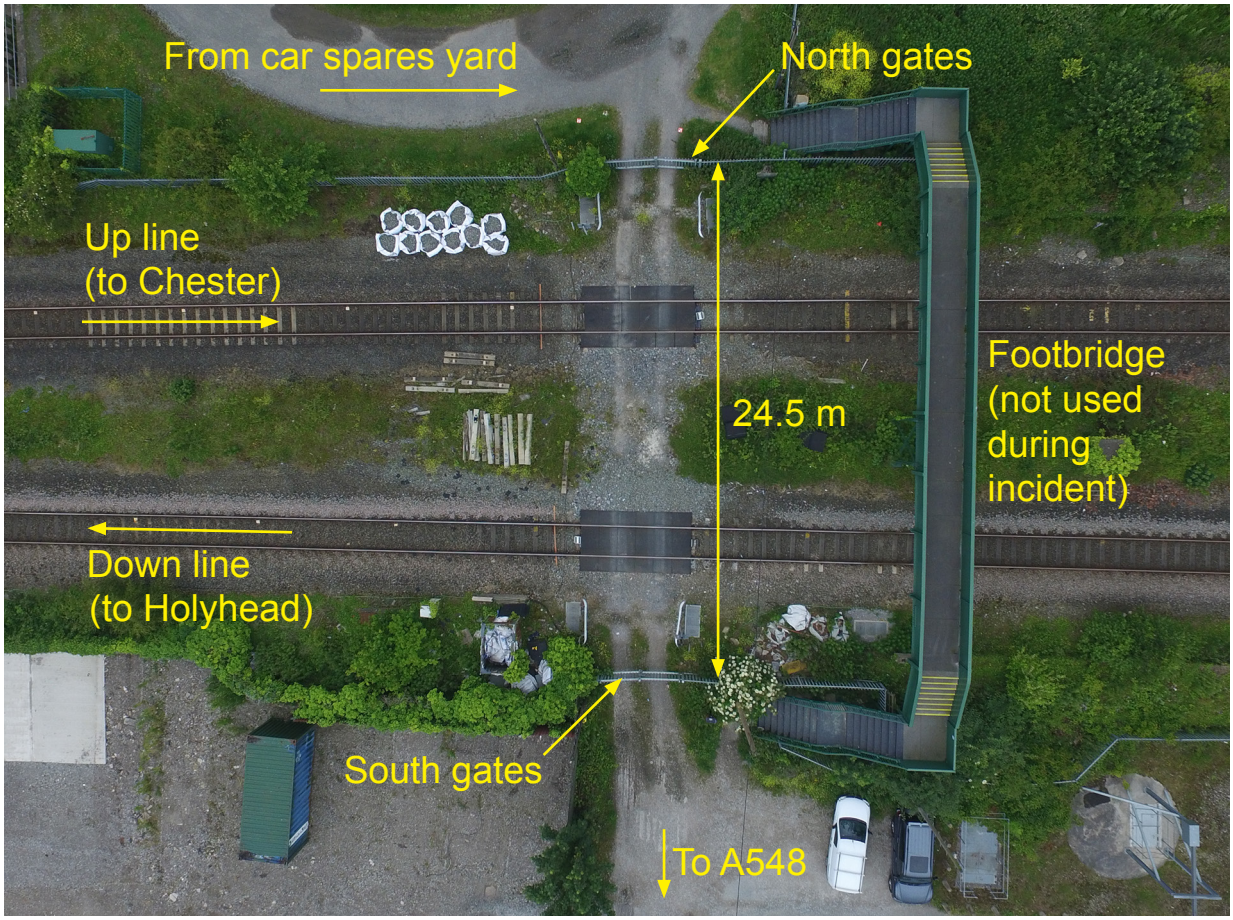


Figure 4: Overview of Bagillt UWC-T

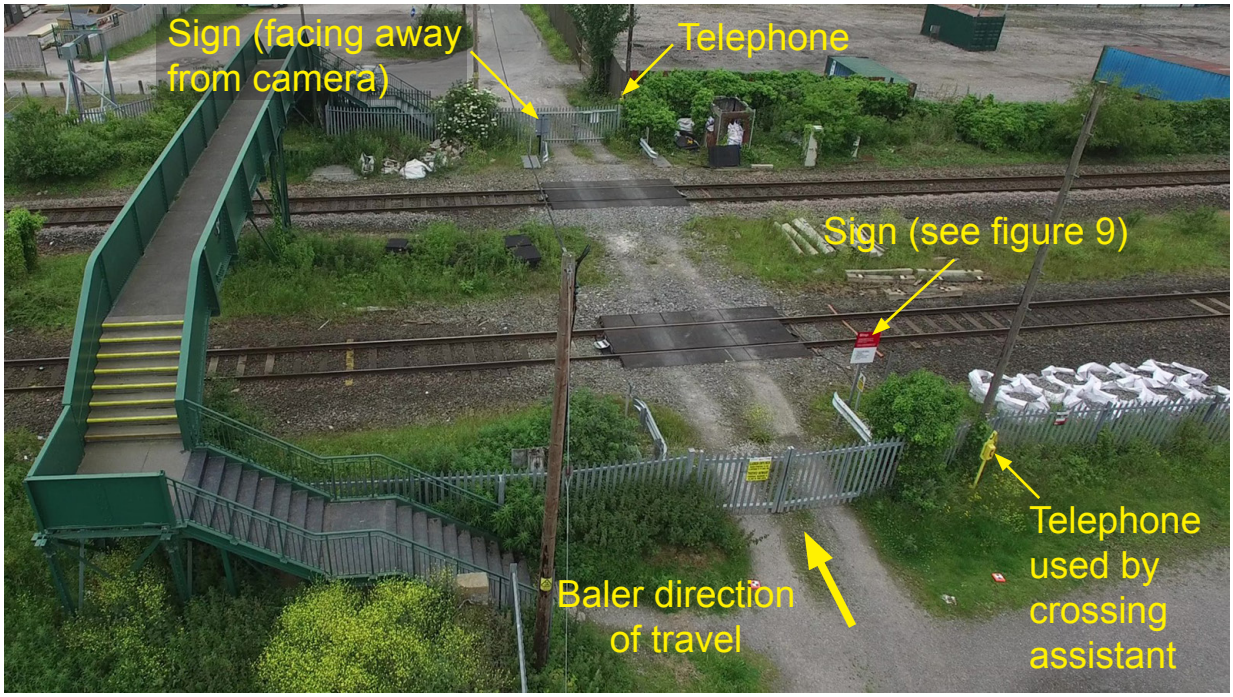


Figure 5: Telephones and signs at Bagillt UWC-T

17 Both the up and down lines at Bagillt are subject to a permanent maximum permitted speed of 90 mph (145 km/h). However, at the time of the incident, both lines were subject to a 75 mph (121 km/h) temporary speed restriction described in the weekly operating notice (information sent to railway staff) as due to 'signalling works'.

18 The railway is operated in accordance with the regulations for signalling by the track circuit block system (Rule Book module TS2). Train detection is by axle counters at the boundaries between sections of track. These allow the computer based signalling system at the WROC to determine when a train enters a section and when the full length of a train has left a section.

19 Bagillt UWC-T is supervised by the signaller at the Rhyl workstation located in the WROC in Cardiff (figure 6). This workstation controls approximately 45 route-kilometres of the Chester to Holyhead railway including Flint station. The signaller controls train movements in both up and down directions by using a pointer to click on symbols in a track layout displayed on display screens. The track layout shows the individual sections of track which change from white to red when occupied by a train (figure 7). The track layout display is not to scale and does not include any indication of distances between features on the display.

20 The Rhyl workstation signallers' duties include responding to telephone requests from users wishing to cross the railway at nine UWC-Ts (including Bagillt).

21 Supervision of Bagillt crossing transferred from Holywell signal box, about 3.7 km from the crossing, in March 2018, when the railway was re-signalled and control transferred to the WROC. The Holywell signaller dealt with 8.7 km of the down line and usually 9.5 km of the up line. The up line distance reduced to 5.0 km if Mostyn signal box was in operation. Signallers at Holywell signal box supervised five UWC-Ts, including the crossing at Bagillt.

Figure 6: Rhyl workstation

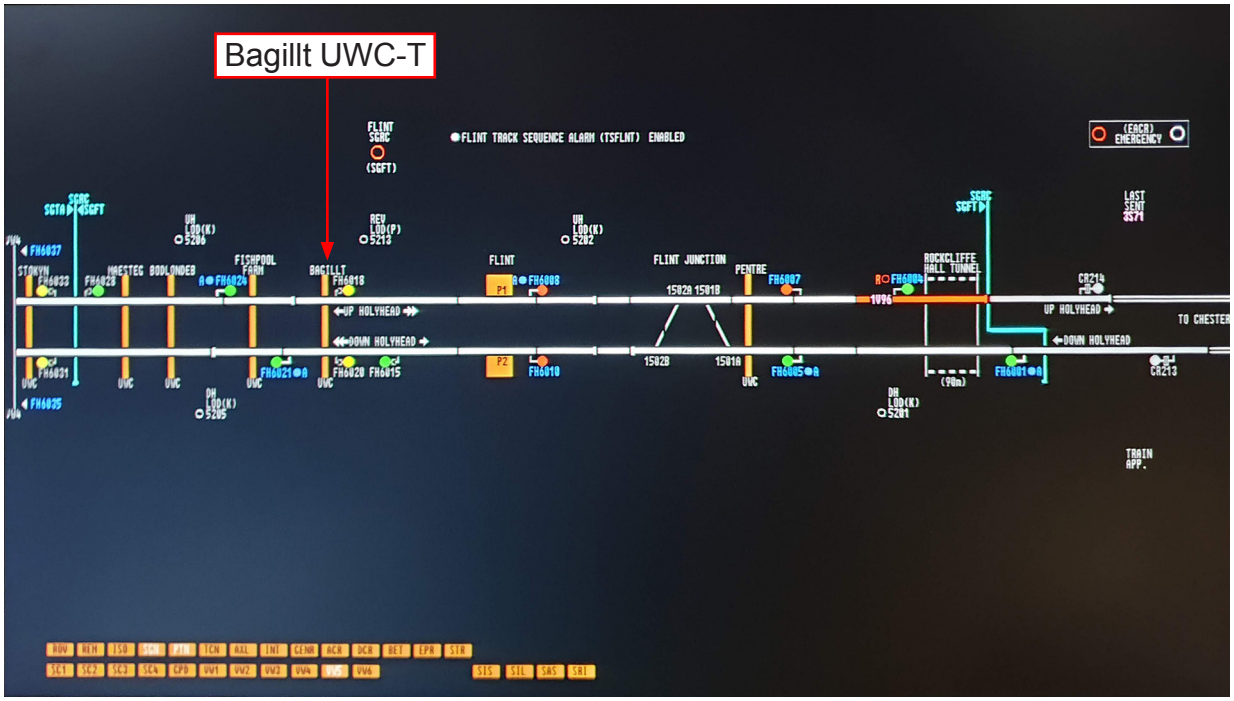


Figure 7: Rhyl workstation display screen showing Bagillt UWC-T (image does not exactly reproduce colours shown on screen)

Staff involved

22 The signaller started signaller training in March 2017 and then worked in two mechanical signal boxes in Norfolk, each controlling a small area. He started working in the WROC in April 2018 and, after a period of training, began operating the Rhyl workstation in June 2018.

23 Level crossing manager 1 (LCM1) was a Network Rail employee with responsibilities between January 2013 and September 2016 which included inspecting Bagillt UWC-T, liaising with its authorised users and completing risk assessments for the crossing. He became a level crossing manager in January 2013 after working in a variety of signaller roles in Wales since 2003.

24 Level crossing manager 2 (LCM2) was a Network Rail employee who held similar responsibilities for Bagillt UWC-T from September 2016 until, and after, the incident in August 2018. He became a level crossing manager in January 2013 and had undertaken level crossing assessments before this as a mobile operations manager. He had previously worked in a variety of signaller and signaller management roles since 2002.

25 An employee of Bagillt Car Spares, described as the crossing assistant in this report, was assisting the baler to cross the UWC-T when the incident occurred. He had assisted vehicles using this crossing for 15 years.

26 The baler driver had been employed as a lorry driver for seven years by Norton.

External circumstances

27 The incident occurred in daylight. Records from two weather stations within 9 km of the crossing (at Lixwm and 4 km north of Connah's Quay), show it was a dry day with a temperature of 16°C to 18°C, clear visibility and a moderate breeze. There is no evidence that external circumstances influenced the incident.

The sequence of events

Events preceding the incident

28 On 17 August 2018, the signaller started his shift at 06:30 hrs and operated the Rhyl workstation continuously, except for a personal needs break, until the incident. He considered the workload during this period to be normal, including those duties associated with level crossings. Until shortly before the incident he was implementing a 20 mph (32 km/h) emergency speed restriction on one line by cautioning trains, by speaking to the drivers, and was managing track worker access to an area of the railway where staff could not work while trains were operating.

29 Shortly before the incident, the baler driver was in Bagillt Car Spares yard preparing the baler to travel on the public road. He then drove the baler along the gravel track to the turning area with the crossing assistant accompanying him in the baler's cab. The baler driver then turned the vehicle in the turning area to line up with the north crossing gates, and the crossing assistant left the baler's cab and went to the telephone to ask the signaller for permission to cross the railway.

Events during the incident

30 At about 11:54 hrs, the crossing assistant telephoned the signaller and requested permission to cross the railway, saying that he was crossing with a '*wagon*' (the full telephone call is transcribed in table 1). The signaller gave permission to cross, probably between 2 minutes 17 seconds and 2 minutes 30 seconds before the train reached the crossing (the uncertainty relating to this and some other times in this report is explained at paragraphs 36 to 44). The signaller did not set railway signals to red to protect the crossing before he gave permission.

Signaller:	Oh … signaller at Rhyl workstation.
Crossing assistant:	Hi, can we cross over.
Signaller:	Can you confirm where you are please?
Crossing assistant:	Bagillt.
Signaller:	Bagillt, and what are you crossing with please?
Crossing assistant:	Wagon.
Signaller:	Wagon, how long do you require?
Crossing assistant:	2 minutes, if that.
Signaller:	2 minutes, please cross immediately and can you give me a call straight back when you've [got/crossed] over.
Crossing assistant:	Thank you.
Signaller:	Thank you.
Crossing assistant:	Turrah.

Table 1: Transcript of telephone call between signaller and crossing assistant at start of incident

31 The crossing assistant then opened the gates at the north end of the crossing, walked over the crossing to the south end, opened the gates at that end and, while standing at the south end, signalled the baler over the crossing. The baler crossed the railway and exited through the south gates probably about one minute before the train arrived.

Events following the incident

32 The crossing assistant then closed and locked the gates at the south end of the crossing and started to walk over the crossing towards the north gates. As he walked over the line nearest the south gates (the down line), he saw a train approaching him on this line and, alarmed by this, ran to the north side of the crossing.

33 After closing and locking the north gates, the crossing assistant telephoned the signaller to report that the crossing was clear and that the train had arrived unexpectedly at the crossing. The transcript of this conversation is given in table 2.

Signaller:	Signaller at Rhyl workstation.
Crossing assistant:	All clear at Bagillt.
Signaller:	All clear Bagillt, thank you.
Crossing assistant:	Gee, you know there's a train coming across you know?
Signaller:	Oh, is there?
Crossing assistant:	Yeah!
Signaller:	Oh, oh I do apologise.
Crossing assistant:	It just sort of [digged/bipped] on me when I was crossing over.
Signaller:	I do apologise sir [inaudible].
Crossing assistant:	OK thanks bye.
Signaller:	Right, bye.

Table 2: Transcript of telephone call between signaller and crossing assistant after the incident

34 A manager at Bagillt Car Spares called Network Rail control to report the incident at 12:17 hrs, 20 minutes after it had occurred.

Key facts and analysis

Estimated timings of key events

35 The RAIB has established the most likely sequence of events during the incident, and the approximate timings of these, using data recorded from the signalling system, recordings of the telephone calls made from the crossing, witness statements and a reconstruction of the event using the same baler crossing Bagillt UWC-T (table 3). The most likely timings take account of a probable difference between the time stamps used by the signalling data recorder and the voice communication recorder at the WROC, the absence of OTDR data from the train and conflicts in witness evidence. The main findings of this investigation are not dependent on the exact sequence and timings, so are not affected by these uncertainties.

Event	***Time after permission to cross given (min:sec)***
Start of call from telephone at north end of crossing requesting permission to cross (see table 1).	-00:17
Signaller completes giving permission to cross	00:00
Level crossing handset replaced in telephone cabinet (end of call)	00:02
Crossing assistant unlocks and opens north gates; walks over crossing; unlocks and opens south gates; and signals baler onto crossing	
Front of baler enters crossing at north gates	00:52
Rear of baler leaves crossing at south gates	01:20
Crossing assistant closes and locks south gates before beginning to walk over crossing towards north gates	
Crossing assistant sees train as he walks over down line and begins to run	01:47
Crossing assistant completes closing and locking north gates (earliest time train reaches the crossing)	02:17
Crossing assistant picks up telephone handset at north end of crossing to report that the crossing is now clear	02:22
Nominal duration of telephone ringing at Rhyl workstation (actual time may differ, paragraph 36)	
Latest time front of train reaches crossing (train takes 4 seconds to pass over crossing and voice recording would probably have included noise from rear of train if train had arrived later)	02:30
Signaller answers telephone (voice recording starts and latest time rear of train passes over the crossing)	02:34
Crossing assistant reports crossing clear and unexpected arrival of train	
End of telephone call	02:52

Table 3: Approximate timings for likely sequence of events during the incident

36 A reconstruction of the baler using the crossing, observed by the RAIB, provided timings of events between the crossing assistant replacing the telephone handset after receiving permission to cross and the crossing assistant picking up the telephone handset to report that the crossing was clear. Timings related to the telephone calls were taken from voice recordings made by equipment at the WROC when the incident occurred. The equipment records the start time of each call using a clock linked to the recording equipment; the times at which words are spoken and the end of the call were obtained by listening to the recordings. The reconstruction timings and voice recorder clock were synchronised at the point where the handset was replaced at the end of the first call.

37 The actual length of time for which the telephone then rang before the signaller answered it would match the nominal duration shown in table 3 only if the time between replacing the handset at the end of the first call and picking it up at the start of the second call was the same on the day of the incident and during the reconstruction. In practice there is likely to be a small variation reflecting variability in human behaviour associated with events before the handset was picked up. There could also be some variation depending on what other duties the signaller was performing when the telephone began to ring at his workstation.

38 Network Rail initially reported that the signalling data and voice recorders were synchronised to the same time clock but subsequent enquiries, initiated by the RAIB in response to witness evidence, found that the voice recorder timings were probably not synchronised correctly. There was no Network Rail requirement for the installer to check that the voice recorder timing equipment was set to the correct time when the equipment was installed before the WROC became operational in March 2018, and no requirement for periodic checks after commissioning. Further, a defective part of the timing equipment was identified and replaced after the incident. However, uncertainty about correlation with other time clocks does not invalidate the recorded duration and interval between the two telephone calls made from Bagillt UWC-T at the time of the incident.

39 The crossing assistant believed he first saw the train, and began to run over the crossing, when the train was at a location subsequently measured as being about 345 metres from the crossing. He also reported locking the north side gates before the train arrived. The reconstruction found the train would have reached the crossing before he completed locking the north gates if it was only 345 metres from the crossing when he first saw it. The RAIB considers it most likely that the train arrived after the north gates were locked and the crossing assistant misjudged its position when he first saw it. This is plausible because it is difficult to judge the position of a train when it is moving directly towards an observer, and it is likely that the crossing assistant perceived an immediate threat to his safety and so did not spend time making a detailed assessment of the situation before taking rapid action to protect himself.

40 The crossing assistant could not recall whether the train had passed over the crossing when he was speaking with the signaller to report that the crossing was clear, and the words spoken on the recording of this call do not clarify this. Trains can normally be heard during telephone calls made close to the railway, and there is no train noise on the recording. It is unlikely that the train arrived after this call was complete, as it would mean the crossing assistant had perceived an imminent threat to his safety when he was on the crossing with the train more than 2 km away from him.

41 It is therefore most likely that the train arrived at the crossing after the crossing assistant locked the north gates and before the signaller answered the second telephone call. On this basis, the rear of the baler had cleared the south end of the crossing between 57 seconds and 1 minute 10 seconds before the train arrived (table 3). This is described as about one minute in this report.

42 The time taken by the train to travel to the crossing from each section of track on the approach has been calculated using signalling data. This records the time at which the front of a train occupies, and the time at which the rear leaves, each section of track. The layout and designation of track sections on the down line approaching the crossing Bagillt UWC-T are shown on figure 8.

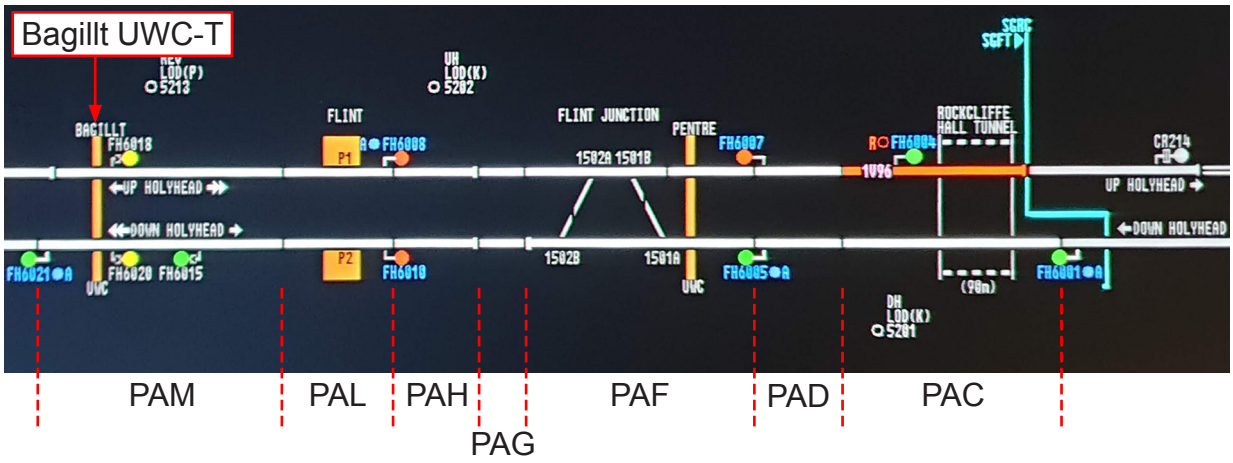


Figure 8: Rhyl workstation display annotated to show track section designations

43 On the basis of the most likely sequence of events (table 3), the evidence indicates that the signaller gave the user permission to cross between 2 minutes 30 seconds and 2 minutes 17 seconds before the front of the train arrived at the crossing. Signalling data shows that the first of these times corresponds to the rear of the train being in section PAC and the front in section PAD. The second time corresponds with the entire train being in section PAD.

44 The signaller stated that, when considering down direction trains, he normally gave permission to cross at Bagillt if a train had not yet reached section PAD or had just entered this section. The signalling data is consistent with him applying this criterion. It is however inconsistent with the signaller's statement that, on this occasion, the train was in track section PAC (and had not yet reached section PAD) when he spoke the words giving the user permission to cross. It is probable that the train was still in section PAC during the first part of the telephone conversation and possible that the signaller mis-remembered the actual circumstances of the incident.

45 The OTDR data was not downloaded from the train by Arriva Trains Wales before it was overwritten by more recent data, because staff competent to do this were absent at the relevant time. Signalling data has therefore been used to determine the approximate train speed.

Identification of the immediate cause

46 An abnormally large vehicle was permitted to use Bagillt level crossing without signal protection.

47 The railway Rule Book, published by RSSB[1] as document GE/RT8000, includes, as section 2.1.2 of module TS9 'Level crossings – signallers' regulations', the following instruction to signallers in relation to dealing with telephone calls from level crossing users:

> *'Before you authorise anyone to use the crossing with … a large, low or slow-moving road vehicle … you must make sure that the protecting signals are placed or kept at danger'*.

48 The baler was an abnormally large vehicle weighing 60.5 tonnes (paragraph 15), which should have been given signal protection, to stop trains approaching the crossing, in accordance with this instruction.

Identification of causal factors

49 The incident occurred due to a combination of the following causal factors:

- the crossing user did not describe the road vehicle as large when speaking with the signaller (paragraph 50);
- the signaller did not establish the size of the road vehicle during his conversation with the user (paragraph 60); and
- information provided to the signaller before the incident did not identify the high probability that users of Bagillt UWC-T would be crossing with large vehicles, in part because only some of the relevant information had been obtained by level crossing managers (paragraph 68).

Each of these factors is now considered in turn.

50 The crossing user did not describe the road vehicle as large when speaking with the signaller.

51 Signs on each side of the crossing, located inside the crossing gates, give instructions to people using the crossing, including an instruction to *'tell the crossing operator if the vehicle is large or slow moving'* (figure 9). The crossing assistant stated that he was aware of this phrase on the sign and that he considered the baler to be both large and slow-moving. He used the term *'wagon'* when speaking to the signaller, but did not say *'large'* or *'slow-moving'*. He stated that he expected the signaller to understand a '*wagon'* to be a large lorry.

52 There is no definition of *'large or slow-moving'* on the signs and no clear definition elsewhere in Network Rail's UWC-T processes (paragraph 79). The crossing assistant routinely assisted articulated lorries used to carry scrap metal over Bagillt UWC-T (figure 10). Although these do not require special precautions when driven on the public highway (and are not abnormal vehicles as described at paragraph 15), the crossing assistant also considered these to be 'large' and 'slow-moving'.

[1] A not-for-profit body whose members are the companies making up the railway industry. The company is registered as Rail Safety and Standards Board Ltd, but trades as RSSB.

Figure 9: Instruction sign at Bagillt UWC-T

Figure 10: Typical heavy goods vehicle 'HGV' used on Bagillt UWC-T (not subject to special restrictions on the public highway)

53 Observations at Bagillt UWC-T showed that the crossing time for scrap metal lorries were only slightly less than the crossing time for the baler. A laden scrap metal lorry took 21 seconds and the baler took 28 seconds to travel from north to south over the crossing.

54 The crossing assistant stated that he usually described large vehicles as '*wagons*' and that Network Rail staff had not asked him to clarify the size or weight of vehicles when they had previously observed him using the crossing. He also stated that no signaller and no Bagillt Car Spares staff had asked him to clarify the weight or size of the vehicle he was assisting to cross. No one had instructed him to treat the baler differently to the other vehicles used on the crossing, which were not abnormal vehicles.

55 Both Bagillt Car Spares and Norton had duties under health and safety legislation to assess and manage risks associated with their activities, including their use of the level crossing. In practice Norton relied on Bagillt Car Spares to manage the operation of the crossing.

56 Bagillt Car Spares stated that it had received a copy of Network Rail's risk assessment for the crossing and had not prepared a risk assessment of its own. It stated that it followed guidelines provided to it by Network Rail and was aware of the sign at the crossing giving requirements for using the crossing. Bagillt Car Spares described its undocumented procedure for using the crossing as:

- provide a member of Bagillt Car Spares staff to assist the vehicle driver;
- call the signaller and follow his instructions;
- once given permission to cross from the signaller, open both sets of gates;
- once both gates are open, signal vehicle across;
- once vehicle has exited the crossing, close and lock both gates; and then
- call signaller back to let them know the crossing is clear.

57 The crossing assistant, the authorised user (Bagillt Car Spares), other Bagillt Car Spares staff and Norton staff were all unaware that, when requesting less than 3 minutes to cross the railway, using 'large' or similar words to describe a vehicle would result in the signaller applying signal protection when this would not be provided for a smaller vehicle requiring a similar time to cross.

58 The authorised user and other staff at Bagillt Car Spares, including the crossing assistant, believed that contacting the signaller and following his instructions would prevent a collision between a train and a road vehicle of any size. This belief is consistent with the Bagillt Car Spares procedure requiring its staff to telephone the signaller to provide positive confirmation that road vehicles are no longer on the crossing, and that it is now available for safe use by trains. Voice recordings show that this call was made after the baler crossed during the incident. These recordings also show that the signaller had requested a call back when giving permission to cross (table 1). Requesting a call back was not required by Network Rail procedures and could have incorrectly suggested to the user that trains would not reach the crossing until after the call back. The signaller stated he would generally only ask a user to call back if he was providing signal protection.

59 Norton stated that, in accordance with UK highway legislation and because of the weight and length of the baler, it gave notice (through an agent) to relevant authorities about the baler's movements on public roads and bridges. This included giving advance notice to Network Rail when the baler needed to use a bridge carrying a road over the railway. There was no legal or Network Rail requirement to give advance notice of intent to use level crossings (although the signaller's permission was needed immediately before crossing).

60 The signaller did not establish the size of the road vehicle during his conversation with the user.

61 The signaller was aware of the Rule Book requirement to provide signal protection for large, low or slow-moving vehicles on UWC-Ts, and stated that he would have done so if he had been aware of the baler's weight. He did not apply signal protection during the incident because he understood the user's request to cross with a *'wagon'* to mean a 7.5 tonne flatbed lorry or a van. He did not check this understanding with the user by asking further questions.

62 There is no definition of large, low or slow-moving in the Rule Book or in other information provided to signallers by Network Rail (paragraph 79). The signaller stated that, in addition to lorries which he considered to be large, he would have applied signal protection for some other vehicles, for example a combine harvester.

63 Section 2.1.1 of Rule Book module TS9 (paragraph 47), and a prompt card distributed to signallers (figure 11), require them to ask:

a. where the user is calling from (the name of the crossing);

b. what they are crossing with; and

c. how long it will take.

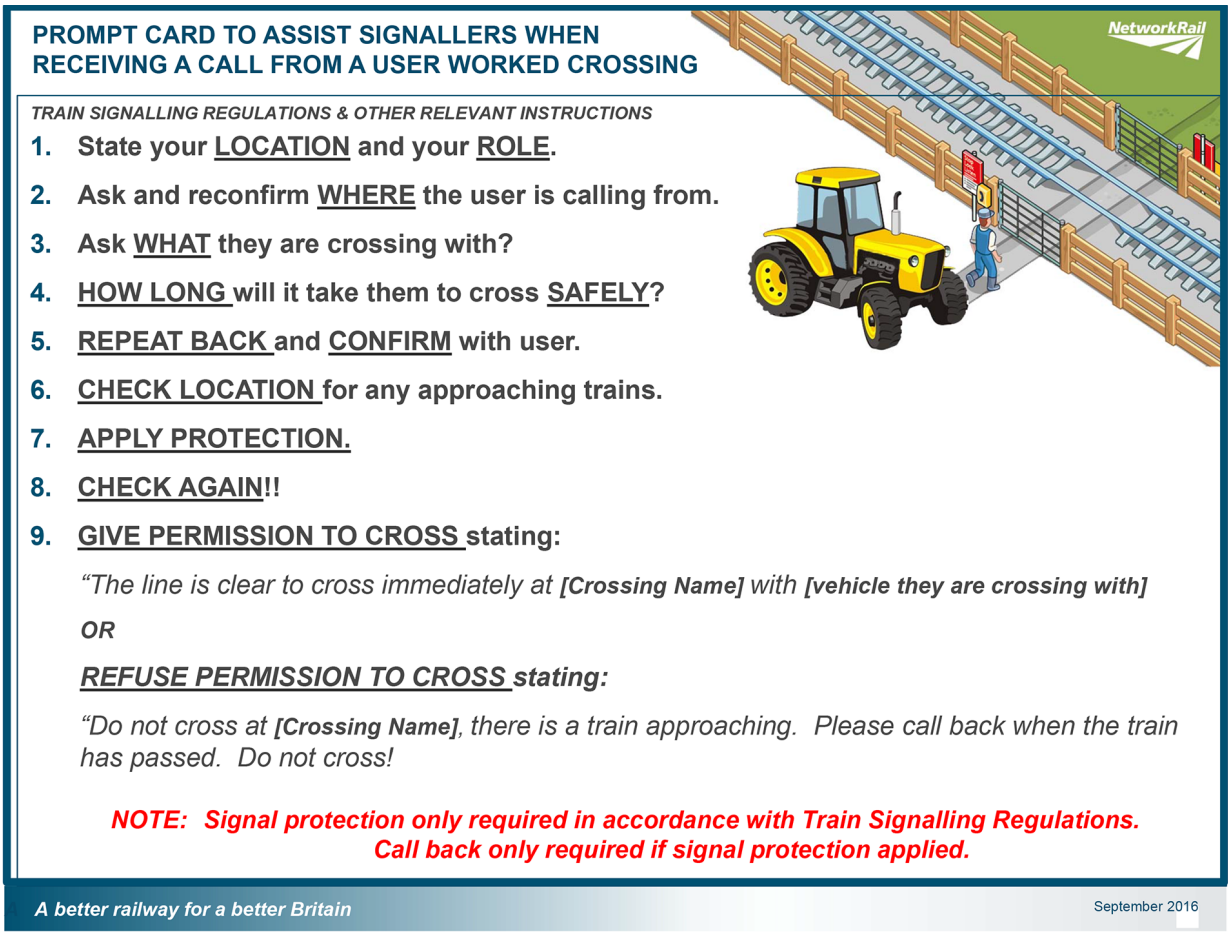


Figure 11: Prompt card provided for use by signallers

64 Network Rail stated that the prompt card (dated September 2016) was sent to signallers in 2017 to remind them of the questions they should ask when considering user requests for permission to cross. The signaller stated he was familiar with the prompt card and a copy of it was displayed at Rhyl workstation. Neither the prompt card, nor the Rule Book, suggest that the signaller should probe a user's answers by asking further questions, although witness evidence confirms that signallers would ask further questions if the initial answers appeared unusual or unrealistic.

65 The RAIB has analysed recordings of calls relating to 36 instances in which users crossed the railway at Bagillt UWC-T from 20 April 2018 to 17 August 2018. The calls involved several different signallers working on the Rhyl workstation and, in some instances, approaching trains meant that more than one call was required before permission to cross was given. The analysis found that the three specified questions were usually asked by signallers in a perfunctory manner. Signallers did not determine details of the vehicle when the user used ill-defined terms, such as '*wagon', 'truck'* or *'lorry'.* These findings are consistent with witness evidence from a shift signalling manager at the WROC and show that the conversation between the user and signaller at the time of the incident was typical of conversations conducted by other signallers.

66 It is possible that the perfunctory nature of the telephone calls reflected, at least in part, a focus by signallers on the crossing time requested by the user. Although not specified in the Rule Book, Network Rail's standard form for signallers to record telephone calls relating to UWC-Ts (figure 12) includes a footnote stating: *'Note: Any request to cross that shall take more than 3 minutes shall be treated as a large / low / slow vehicle'*. The Rule Book requires signal protection to be provided for vehicles being treated as large, low or slow-moving. Although the form states '*more than 3 minutes'*, witness evidence indicates it was normal practice to also apply signal protection for requests of exactly 3 minutes.

67 This focus on the time required to cross is reinforced by a Network Rail paper briefed to signallers between December 2014 and March 2015. This paper, discussed further at paragraph 92, included the following text:

> *'Given that defining [large, low and slow-moving] by vehicle type is fraught with difficulties …. the general consensus was that it would be more effective to provide guidance about how long a user will take to cross. What the operations experts have decided is that anything that takes more than 3 minutes to cross at a user worked crossing should be treated as long, low and slow'*

NATIONAL OPERATING PROCEDURES
LEVEL CROSSINGS – KEEPING A RECORD OF TELEPHONE CALLS

Procedure: 3.01
Issue: 01
Date: 02/09/17

APPENDIX A

EXAMPLE OF RECORDING TELEPHONE CALLS

NetworkRail

HORNBY JUNCTION LC Occurrence Book
[Insert signal box and level crossing boxes/panel]

Level Crossing Name	Date	Time of Call	Nature of Request (e.g. car, horse, tractor, trailer, pedestrian, routine road maintenance)	Time Required for Movement (minutes)	Time Permission Refused	Time Permission Granted	Time Reported Clear (if applicable)	Time Next Train Cautioned Together with its Reporting No. (if applicable)
Stumps	20/11/2006	20:13	Sheep	4 minutes		20:13	20:17	
Hilltop	02/12/2006	10:15	Low loader	5 minutes	10:16	10:28		10:38 by 1A56
Stumps	04/01/2007	09:23	Sheep	4 minutes		09:23	09:27	
Lostum	12/02/2007	16:17	Low loader	5 minutes	16:17	16:28		16:42 by 1T43

Page No. 1

NOTE: *Any request to cross that shall take more than 3 minutes shall be treated as a large / low / slow vehicle.*

System Operations – NOP 3.01 Page: 4 of 5

Figure 12: Form for signallers to record requests to use UWC-Ts (red oval is RAIB annotation)

68 **Information provided to the signaller before the incident did not identify the high probability that users of Bagillt UWC-T would be crossing with large vehicles, in part because only some of the relevant information had been obtained by level crossing managers.**

69 The signaller was not aware that the majority of vehicles using Bagillt UWC-T were large, and that most usage was concentrated into periods of a few days which occurred at intervals of typically five or six weeks when the baler visited Bagillt Car Spares to crush scrapped vehicles. During each of these periods, the baler crossed the railway twice, and large lorries made several crossings in both directions, carrying a heavy load of scrap steel when travelling away from the car spares yard. Network Rail level crossing managers had recorded that the predominant use was by 'HGVs' but did not record details of these. There is no evidence that any Network Rail staff were aware of use by the exceptionally heavy and long baler.

70 The signaller was aware of information about Bagillt UWC-T that was included in the Rhyl workstation box instructions (the location specific instructions for signallers), the workstation training plan (figure 13) and a local knowledge sheet relating to the workstation (figure 14). None of these documents correctly described the types of road vehicles used on the crossing, and none accurately reflected the vehicle usage information obtained by level crossing managers during their inspections of level crossings and liaison with authorised users as part of Network Rail's level crossing risk management process (paragraph 101).

Bagillt Level Crossing

Bagillt, Flintshire

Crossing Data

- **Name:** Bagillt
- **Crossing Type:** Private User worked Crossing with Telephone
- **Location:** Bagillt Community
- **Postcode:** CH6 6AF
- **Route:** Wales
- **ELR:** CNH3
- **Distance:** 193 miles 51 chains
- **Individual risk rating:** B (Very High)
- **Collective risk rating:** 7 (Moderate)
- **Last assessment:** December 2015
- **Next assessment due:** March 2018
- **Types of trains:** Passenger & Freight
- **Line speed:** 90 mph
- **Trains per day:** 95 (inc freight paths)
- **Usage:**
- Infrequent Vehicle use
- Infrequent Pedestrian Use
- **Misuse history:** Nil incidents in year prior to assessment date (Dec-2015), - Nil incidents since.
- **Near-miss history:** Nil incidents in year prior to assessment date (Dec-2015), - Nil incidents since.
- **Accident history:** Nil incidents in year prior to assessment date (Dec-2015), - Nil incidents since.
- **Key risk factors:**
- Low Sighting Time
- Sun Glare
- Frequent Trains
- **Current protection arrangements:**
- Telephones provided for vehicle users
- Gates
- Signage

Notes

- **Individual Risk Rating** is the risk to individual users of the crossing. It is presented as a single letter, with A being the highest risk and M being the lowest.
- **Collective Risk Rating** is the overall risk of any incident involving any person or vehicle on the crossing, including train staff and passengers as well as users of the crossing. It is presented as a number, with 1 being the highest risk and 13 being the lowest. This is the most important rating when prioritising safety measures at level crossings.
-

Rhyl Workstation Training Plan
Version 3: 13 February 2018 T&C Department (CW)
28

Figure 13: Rhyl workstation training plan, extract relevant to Bagillt UWC-T

User Worked Crossings

Pentre : Services a farm – occasional use
Bagillt: Not very busy. Some history of misuse
Fishpool Farm : Regular user, but not very busy
Bodlondeb : Very busy in the summer – agricultural use – potato fields. Users can be challenging
Maesteg: Very busy in the summer – agricultural use – potato fields. Users can be challenging
Stokyn : Occasional use
Mostyn : Used occasionally to move abnormal loads that will not fit on the bridge to the docks – eg transformers – see below. Arranged through [redacted], so plenty of notice, and likely to need Pway on site to check the track – this information will be added to box instructions. A line blockage is currently taken to allow these movements to happen.

Sandy Lane : no specific information
MIllars Cottage : Used by a fun fair for access when there are rides to be moved – so occasional use but will be slow vehicle crossing.

Figure 14: Rhyl workstation local knowledge, extract relevant to UWC-Ts supervised by signallers operating Rhyl workstation

71 The only information about Bagillt UWC-T in the box instructions related to its location and the signals to be used when signal protection was required. This document was prepared by a member of the project team responsible for re-signalling work and transferring control to the WROC, a project which did not include any modifications to the crossing itself (paragraph 21). The Rhyl workstation box instructions included information from the box instructions for the signal boxes that had been replaced by Rhyl workstation, including those for Holywell signal box whose signallers had previously supervised Bagillt UWC-T.

72 The training plan for the Rhyl workstation, prepared before the WROC was commissioned in March 2018, described vehicle usage as '*infrequent'* and gave no other details about this usage (figure 13). There is no documented record of the authorship and approval of the training plan, but witness evidence indicates it was prepared by two WROC trainers, reviewed by a local operations manager (a manager of signallers) and approved by an operations manager.

73 There is no formal record of the data sources used to prepare the training plan, but witness evidence indicates that it was based on the Rhyl workstation box instructions, information from a Network Rail mobile operations manager based in north Wales and route maps providing by the re-signalling project. Witness evidence suggests that the people preparing the training plan obtained the December 2015 level crossing risk assessment (paragraph 75), but probably did not use it to determine the size of vehicles used on the crossing.

74 The local knowledge sheet, also prepared before the WROC was commissioned, described usage as: '*Not very busy. Some history of misuse'*. Again there is no formal documented record of authorship and approval, but witness evidence indicates that this sheet was probably prepared by the two WROC trainers who had prepared the training plan. Witness evidence indicates that it included input from the mobile operations managers in north Wales, and possibly information from other sources.

75 The risk assessment for Bagillt UWC-T available when the training plan was developed was completed by LCM1 in December 2015. This records '*weekly HGV usage with few or no crossings by other users'.* It is uncertain why this information was not included in the information provided to Rhyl workstation signallers.

76 A later risk assessment, prepared by LCM2 and dated January 2018, had been undertaken before the Rhyl workstation was commissioned but possibly after preparation of the training plan. This risk assessment stated '*Average usage per month between 10 and 20 traverses some months the crossing is used with a lower frequency, all received requests was made for HGV/Lorries to cross the line'*. This information does not differ significantly from that available when the training plan was developed. There is no evidence that the training plan was reviewed before the August 2018 incident to establish whether changes were needed to reflect the more recent risk assessment.

77 Neither risk assessment mentions use of Bagillt UWC-T by the baler or other abnormal vehicles, almost certainly because this was not apparent to the level crossing managers from the crossing usage information they obtained. The risk assessment and witness evidence show that both level crossing managers relied on information given by the authorised user and contained in to the crossing occurrence book (a record maintained by signallers which includes details of requests made by crossing users). This was in accordance with Network Rail's level crossing guidance 02 'Census good practice' dated July 2017.

78 LCM1 and LCM2 stated that they were unaware of any Network Rail guidance indicating what should be considered as a large or slow-moving vehicle in the context of UWC-T usage, and were unaware of any Network Rail requirement to identify use of abnormal vehicles at UWC-Ts. This reduced the likelihood of the level crossing managers recognising the significance of crossings by the baler when discussing the crossing with the authorised user.

Identification of underlying factors

79 **Network Rail's level crossing risk management process does not provide signallers, other railway staff or crossing users with a coherent and consistent process for deciding whether a vehicle should be treated as large, low or slow-moving when using a UWC-T.**

80 The Rule Book and Network Rail operating practice require signal protection to be provided for large, low or slow vehicles and if the user requests three or more minutes to cross the railway. Signal protection is not required by these processes (although it is sometimes required by local arrangements) if users request less time to cross. In that situation signallers give permission to cross if the signaller judges any approaching trains are sufficiently far from the crossing. The RAIB notes that two minutes is a very short time for users to cross at a typical UWC-T as, unless assisted by a second person, they normally have to open gates on both sides of the railway, return to their vehicle drive across the line, and then close the gates on both sides of the railway. This involves crossing the railway five times.

81 Signal protection mitigates the risk of trains arriving at the crossing before a vehicle has cleared the railway corridor. However, when permitting users to cross with signal protection, signallers need to find a much larger gap between trains (to avoid stopping a train at a signal and subsequently disrupting train services) than when they permit users to cross without signal protection. For UWC-Ts on busier lines these larger gaps can be infrequent and users may have to wait a long time before they are granted permission to cross. The longer users spend waiting to cross, the greater the likelihood that they will become impatient and choose to cross without permission from the signaller. Network Rail's processes must therefore balance between the benefits of providing signal protection and the increased risk of crossing misuse caused by users having to wait a long time for permission to cross.

82 Network Rail has stated that it considers the decision on whether to provide signal protection for a vehicle crossing should be based on the user's assessment of how long the vehicle will take to cross and the likelihood of it taking longer than expected (for example, when negotiating a tight turn at the end of a crossing and/or because the vehicle becomes stuck). The requirement for users to inform the signaller if a vehicle is large or slow-moving is therefore intended to provide the signaller with an indication that the vehicle is more likely to take an unexpectedly long time to cross the railway.

83 The effect of road vehicle weight on the consequence of an accident at a level crossing was illustrated by the accident at Hixon level crossing in 1968 in which 11 people were killed and 45 injured when a train struck a lorry carrying a 124 tonne (122 ton) electrical transformer (paragraph 136). Similar consequences could arise from a collision involving a lorry weighing up to 44 tonnes but not considered to be an abnormal vehicle, for example a laden scrap metal lorry such as those which use Bagillt UWC-T (figure 10).

84 Historical data shows that trains collide with cars on level crossings much more frequently than with heavy lorries. Although large numbers of fatalities and injuries are rare when a train collides with a small road vehicle, they can occur. This was last shown at Ufton Nervet in November 2004 when 6 people were killed and 71 injured when the train they were travelling on struck a car on a level crossing. The consequences were particularly severe because of the track layout at this location (paragraph 137).

85 According to RSSB's Annual Safety Performance report 2017/18, there were 93 collisions between trains and road vehicles at level crossings between April 2008 and March 2018. Of these, the only accidents to involve significant damage to the train involved large vehicles such as tractors and trailers (Hockham Road, RAIB Report 04/2017) or lorries (Llanboidy, RAIB Report 20/2012).

86 RSSB's safety risk model (SRM) is intended to quantify the overall level of risk on the UK railway network using an index of fatalities and weighted injuries (FWI) to represent the harm caused to people by various events. This index treats 10 serious injuries or 100 minor injuries as equivalent to a single fatality and a FWI of 1.0. The model gives the following FWI as the average consequence for an accident at a UWC-T:

- small vehicle (such as a car) struck by a train: 0.350 FWI; and
- large vehicle (such as a lorry) struck by a train: 0.396 FWI.

87 Network Rail assesses level crossing risk using the all level crossing risk model (ALCRM), which also assesses risk in terms of FWI. RSSB's research project T737 'Documenting the all level crossing risk model (ALCRM)', published in 2010, documents the key factors that are allowed for in Network Rail's modelling of risk at level crossings. This confirms that the ALCRM makes allowance for the greater probability of derailment when striking a heavy vehicle on a level crossing, hence the increased potential for harm to persons on the train.

88 At RAIB's request, Network Rail provided FWI data used in the ALCRM for collisions between a train travelling at 90 mph (145 km/h) and vehicles on a level crossing with similar features to Bagillt. The train speed is higher than the speed at many UWC-Ts, so the consequences are expected to be more serious than for the average level crossing accident reported in the RSSB data. The increased consequence of increasing road vehicle size is apparent from this ALCRM data (table 4). As the data represents averages, it can be inferred that the consequence of striking particularly large vehicles (including abnormally heavy lorries) will be greater than the 'average' HGV used for the ALCRM analysis.

	Smaller vehicles (such as cars)	***HGVs***
Road vehicle occupants	0.63	0.13
Train occupants	0.69	1.75
Total	1.32	1.88

Table 4: FWI for train striking vehicle at level crossing similar to Bagillt UWC-T

89 The increased consequence is due to a significant increase in risk to train occupants arising from an increased derailment risk, partly offset by a reduced risk to road vehicle occupants (HGVs typically contain fewer passengers than smaller vehicles). The likelihood of a train derailment in the ALCRM is about 7 times greater if a train strikes a HGV than if it strikes a small vehicle. This indicates a much increased likelihood of the substantial loss of life and large numbers of serious injuries which can follow a train derailment.

90 There is no definition of 'large, low or slow-moving vehicles' in the railway Rule Book (paragraph 47) or in other information provided by Network Rail in the context of UWC-Ts. Roadside signs on the approach to automatic half barrier level crossings define large and slow in the context of using these crossings as vehicles exceeding 18.75 metres length and/or 2.9 metres width and/or 44 tonnes and/or travelling at 5 mph (8km/h) or less. The length and weight criteria correspond to the maximum values for vehicles usually permitted on UK public roads (paragraph 15), and the maximum width corresponds to the abnormal load definition in UK road traffic legislation.

91 The basic training given by Network Rail to all its signallers relating to vehicles using UWC-Ts, refers to obtaining the three items of information required by the Rule Book (crossing location, vehicle type and crossing time) before using appropriate words to permit or refuse the use of the crossing. The training does not include further questioning to ascertain details such as the size of a lorry.

92 Network Rail prepared a paper, briefed to signallers between December 2014 and March 2015 titled '*Dealing with the long, low and slow! Brief for Signallers'* and stating that its aim was to '*provide clarification to signallers … when deciding whether to treat…a…vehicle as a large, low or slow-moving*'. The paper is described as the 2014/2015 briefing paper in this report.

93 The paper states that (in 2014) the definition of long, low and slow used at UWC-Ts was the same as that applied at automatic half barrier crossings (paragraph 90). This is consistent with the findings of an RAIB investigation relating to an accident in 2013 at a user worked crossing not fitted with telephones (Collision at Jetty Avenue level crossing, RAIB Report 28/2014). The briefing paper also refers to a survey of signallers and states:

> *'93% [of] signaller's surveyed believe refuse lorries, boats, lorries, caravans, transporters, tankers, combine harvester and trucks constitute either large, slow, long or low vehicles or combinations thereof. It should be noted that none of these vehicles fall into the current definition of large and slow as used at [automatic half barrier crossings].'*

94 The paper concludes that:

> *'Given that defining [large, low and slow-moving] by vehicle type is fraught with difficulties …. the general consensus was that it would be more effective to provide guidance about how long a user will take to cross. What the operations experts have decided is that anything that takes more than 3 minutes to cross at a user worked crossing should be treated as long, low and slow and the Rule Book requirements in TS9 Module TS9 Level Crossings – Signaller's Regulations, Section 2.1.1 should apply.'* [actually section 2.1.2 as given at paragraph 47]

95 The paper justifies this approach stating: *'… trying to define a long, low and slow vehicle by vehicle type is difficult and just going to continue to cause confusion with the arrangements that are in place for [automatic half barrier crossings] … we have this rule about additional protection … to control the risk that they might take longer to cross than normal'.*

96 The inference that signallers should concentrate on crossing time, rather than the size of vehicle is reinforced in the paper by example conversations between signallers and users requesting permission to cross (figure 15). These concentrate on determining a robust estimate of crossing time rather than probing the characteristics (size, weight or risk of grounding) of the vehicle.

97 Although the paper's wording suggests that requested crossing time rather than vehicle size should be used by signallers to decide whether signal protection is required, Network Rail's Professional Head of Operations has stated that the intention of the paper was to retain signal protection for *'long, low or slow'* vehicles and, in addition, to provide signal protection for some additional users who may present an additional risk because of the time it takes them to cross.

Example Conversation

MOP: Hi, I'm at Low Gates crossing…is it ok to cross?

Signaller: Hi, well first, how long do you need to cross?

MOP: Ummm, not that long, a couple of minutes?

Signaller: Ok, can I just check that you have taken into account the time needed to open and close both sets of gates? Is your vehicle unusually long or more difficult to manoeuvre through the crossing?

MOP: Yes, yes, I'm just crossing with my tractor and the trailer

Signaller: Ok, is the trailer loaded?

MOP: No, I can nip across quickly

Signaller: Ok, you have asked for two minutes to cross with your tractor and trailer…you have permission to cross…cross immediately

OR

MOP: Hi, I'm at Low Gates crossing…is it ok to cross?

Signaller: Hi, well first, how long do you need to cross?

MOP: Ummm, I'm not sure…a couple of minutes?

Signaller: Ok, can I just check that you have taken into account the time needed to open and close both sets of gates?

MOP: Oh yes, well maybe a bit longer?

Signaller: Have you taken into account what you are crossing with: are you towing anything, will you be moving slowly, will it be difficult to manoeuvre through the crossing?

MOP: Oh ok, I probably need 3 or 4 minutes?

Signaller: Ok, you have asked for more than 3 minutes to cross

…cross immediately and call back when you are clear of the crossing

Or

…please wait and call back in 5 minutes as there is a train approaching

Figure 15: Example conversations in UWC-T paper briefed to signallers (MOP means member of public)

98 Network Rail's Head of Level Crossings stated that authorised users should apply structured judgement at UWC-Ts when deciding whether they should inform the signaller that the user's vehicle is *'large or slow-moving'.* This judgement should consider the characteristics of their vehicles in the context of the crossing's length, restrictions on the approach, crossing surface, crossing topography and gate widths. However, there is no process which ensures all users are aware of this expectation.

99 **Network Rail's level crossing management processes do not provide an effective interface between signallers and UWC-T users.**

100 Safe use of UWC-Ts requires:

- level crossing managers and authorised users (for example, the owner of Bagillt Car Spares) to communicate effectively so that the level crossing manager understands likely crossing usage and the authorised user understands how to use the crossing safely;
- level crossing managers to collect information about the layout of the crossing, its approaches and usage information to complement that provided by the authorised user;
- the transfer to signallers of relevant information collected by level crossing managers so that signallers understand the context (crossing layout, likely usage, etc) in which they should consider individual requests to use the crossing;
- authorised users and individual users (such as the crossing assistant at Bagillt) to communicate effectively so that individuals know how to use the crossing safely;
- appropriate signage at the crossing; and
- signallers to speak by telephone to individual users requesting permission to cross; a conversation which should take place in the context of relevant information included in the preceding bullet points.

Risk assessments

101 Network Rail's level crossing risk assessment processes (NOP 3.08, 'Risk assessing level crossings', September 2017) require level crossing managers to undertake risk assessments at each crossing in their area. These are triggered by a requirement for a maximum interval of 3.25 years between risk assessments and the need for an assessment if some types of incident occur or if significant changes occur. The last two risk assessments at Bagillt UWC-T were routine, and were undertaken in 2015 and 2018. Both recorded that the most vehicle crossings would be by 'HGVs' although neither explicitly stated 'large' and/or 'slow-moving' vehicles. Neither noted that heavy abnormal vehicles used the crossing regularly.

102 There are no explicit Network Rail instructions requiring level crossing managers to identify large or slow-moving vehicles which would require signal protection. However, Network Rail stated that level crossing managers are expected to engage with their authorised users to determine vehicle types using the crossing including whether they are large and/or slow-moving. A template letter/questionnaire is provided by Network Rail to assist this process.

103 LCM2 stated that he had stopped using the template more than a year before the incident, due to the inaccuracy of information returned. Instead he spoke directly to authorised users to establish frequency of usage and vehicle types. There are no formal records of these conversations but witness evidence indicates that they took place without LCM2 becoming aware that the crossing was sometimes used by a heavy abnormal vehicle.

104 Network Rail expects that signallers will use their professional judgement to assess whether crossing times requested by users are reasonable. In addition to knowing about the vehicle types likely to use a crossing, this judgement requires signallers to know about local circumstances such as the layout of crossings and their approaches. The lack of this information for the signallers responsible for Bagillt UWC-T is discussed at paragraph 115, and is partly a consequence of local information not being included in the level crossing managers' risk assessments. For example, both the 2015 and 2018 risk assessments follow a Network Rail standard format and so do not give the actual vehicle traverse distance of 24.5 metres, the distance between the gates. As required by the Network Rail format, both refer to a vehicle traverse distance of 16.8 metres in a scenario not relevant to actual use of the crossing.

Training plan and local knowledge sheet

105 The training plan and local knowledge sheet for Bagillt UWC-T omit information available from the level crossing managers' risk assessments that is needed by signallers. This includes the predominant usage by HGVs, and some information about crossing layout (paragraphs 73 and 115). It is likely that this arose because of a lack of detail in Network Rail processes concerning the content of these documents and/or the competencies required by staff preparing them.

106 For training plans, Network Rail's national operational procedure entitled 'Signalling location training plans' (NOP 2.17, issue 1, dated September 2017) includes some guidance on what information should be provided to signallers about the level crossings they supervise. This includes a requirement to include *'road traffic pattern'.* There is no indication of what should be covered by this.

107 Road traffic pattern could include one or more of the following: types of vehicle, sizes of vehicles, vehicle speeds, likely crossing durations and/or factors such as crossing layout affecting this, frequency of use, nature of user (for example, whether regular users have a disability extending the time needed to cross), whether a crossing assistant is provided by the authorised user, seasonal variation, etc. Without better guidance, staff preparing training plans are unlikely to deliver the amount of detail expected by Network Rail.

108 Network Rail's Professional Head of Operations stated that he expected *'Road traffic pattern'* to include the types of vehicles used on the crossing. On this basis the plan for Bagillt should have mentioned the predominant usage by HGVs, as this information was available from the level crossing manager's risk assessment.

109 Network Rail has stated that there is no task specific training for staff responsible for developing location specific training plans for signallers, (the proposed future training arrangements are described at paragraph 152). It also stated that the procedure adopted would depend on a professional operational manager deciding the appropriate information to include. The RAIB notes that, particularly when establishing a new facility such as the WROC, experienced staff can still benefit from reminders concerning the material to be included in training plans.

110 The local knowledge sheet was not part of the suite of formal documents controlled by Network Rail processes and there were no standards relating to its content or how it should be prepared.

111 It is unclear why the content of the box instruction, local knowledge sheet and training should differ in respect of the location specific information provided to the signaller. It is also unclear why a local knowledge sheet is required in addition to box instructions. Having multiple sources of information covering operation of the same crossing carries the risk of misunderstandings, possibly resulting in accidents. A consistent and readily accessed set of information, updated as appropriate, is needed.

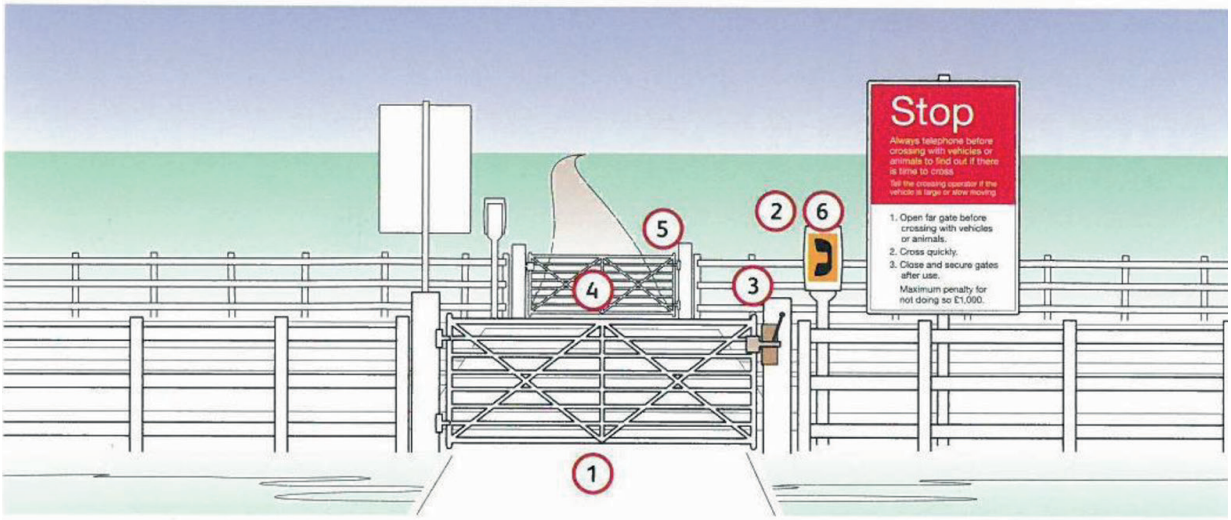
Interface with the user

112 Current Network Rail signs instruct users to tell the crossing operator (ie the signaller in most instances, including at Bagillt UWC-T) if they are crossing with a large or slow-moving vehicle. However, unlike signs provided for automatic half barrier crossings (paragraph 90), signs at UWC-Ts provide no guidance on what constitutes a large or slow-moving vehicle. This issue is not considered further in the present report as the content of signs at user worked level crossings is addressed by an existing RAIB recommendation (paragraph 156). Network Rail guidance provided to authorised users, for example the instruction sheet provided to Bagillt Car Spares (figure 16), does not provide this information.

113 The 2014/2015 briefing paper includes detailed questions intended to help the signaller determine, when speaking with crossing users, whether a vehicle should be considered as long, low or slow-moving (paragraph 92, figure 15). These detailed questions are not being asked at present (paragraph 65) and, if asked, would result in conversations considerably longer than the 20 seconds allowed by the re-signalling project when assessing signallers' workload.

114 Following RSSB research project T983 'Research into signs at private level crossings', dated May 2015, Network Rail has trialled a new sign for use at UWC-Ts (figure 17). The prompt for users to tell the signaller if they are crossing with a large or slow-moving vehicle (figure 9) has been omitted on this new sign. If adopted, this sign will increase the reliance on briefings to authorised users and/or briefings to signallers to ensure that signallers are told when a request to cross relates to a large or slow-moving vehicle.

User worked crossing with telephone



How to use the crossing

1. Stop, look both ways and listen to make sure a train is not coming. If a train is coming wait in a safe place.
2. You must use the telephone to get permission to cross if crossing with vehicles or animals.
3. When you have permission to cross, open the gates on both sides of the railway.
4. Cross quickly and stay alert, do not stop on the crossing.
5. Close both gates after crossing, never leave them open.
6. You must telephone railway staff back after crossing if they asked you to.

Pedestrians

- Stop, look both ways and listen.
- Ensure you have enough time to cross safely, cross quickly and stay alert.
- Close the gates behind you, never leave them open.

Figure 16: Instruction sheet provided by Network Rail to Bagillt Car Spares

Figure 17: New UWC-T sign being trialled by Network Rail

Observations

115 The signaller lacked information needed to assess the reasonableness of crossing times requested by users.

116 Network Rail has stated that it expects its signallers to use their professional judgement to assess whether the users' estimated time to cross is reasonable, without removing the users' responsibility for doing this correctly. This expectation is supported by example conversations in the 2014/2015 briefing paper (figure 15, paragraph 92). A signaller undertaking this assessment requires an understanding of the layout of the crossing and can be assisted by information about the types of vehicles likely to be used. Signallers operating Rhyl workstation did not have key elements of this information.

117 One of the differences between Bagillt crossing and typical UWC-Ts is the distance between the gates at each end of the crossing. This is 24.5 metres, considerably more than the approximately 13 metres found at typical crossings over two track railways. The RAIB has calculated that the additional distance adds up to about 45 seconds to the time needed for a vehicle crossing, mainly due to the additional time taken by people walking over the crossing to open and close the gates. The actual additional time depends on variables including whether the gates are operated by the vehicle driver or by another person.

118 The training plan and local knowledge sheet contained no indication that Bagillt crossing was about 25 metres in length and the signaller believed it was a typical crossing. He stated that he treated all UWC-Ts on Rhyl workstation in the same way and assumed one person operation by vehicle drivers unless telephone calls showed otherwise. He believed a vehicle using a typical crossing without a driver's assistant would take around 2 minutes to cross and that this would increase to 4 minutes for a crossing with a length similar to that at Bagillt.

119 Network Rail's Professional Head of Operations stated that, although not specified in Network Rail standards, local training plans usually include a pictorial guide to level crossings. The only photograph included in the training for Bagillt UWC-T (figure 13) shows the gates at one end of the crossing viewed from outside the railway. This gives no indication of the unusual crossing length. In addition, the image does not allow a signaller to establish whether the crossing has any other unusual characteristics, for example an uneven surface with the risk of a road vehicle grounding and/or a tight corner requiring vehicles to travel slowly at the opposite end of the crossing (neither are actually present).

120 A manager at the WROC stated that he believed signallers at the WROC lacked the local knowledge of crossings needed to make safe decisions (knowledge including crossing layout, crossing surface and types of vehicles used). He also stated that signallers had not been specifically briefed about longer crossings such as Bagillt UWC-T. The RAIB considers that this reflects the shortcomings in the training plan, box instructions and local knowledge sheet and are a consequence of the underlying factor described at paragraph 99.

121 Training for signallers operating Rhyl workstation also included a DVD showing a train driver's view of the route and an optional cab ride along the route. Although these can assist signallers' understanding of train signalling issues, they do not provide the detail needed for them to assess crossing time estimates provided by users at UWC-Ts.

122 **The signaller intended to use a decision point which was inappropriate.**

123 When signallers respond to crossing user requests to cross the railway at a UWC-T, they usually assess whether approaching trains have passed a particular location (known as the *'signallers' decision point'*). Permission is given if the train has not yet reached this position and refused if it has passed it. When observing train movements using a display screen, train positions relative to decision points must be recognisable on the display, and so signallers' decision points are typically a boundary between track sections or a maximum time period for which a track section has been occupied.

124 During the incident at Bagillt, the crossing user requested two minutes to cross the railway. The signaller stated that his decision point for a down train in these circumstances would be just after the train had entered section PAD (figure 8). This is when a train is approaching signal FH6005 and before it reaches Flint station and then Bagillt UWC-T, which is 3.2 km (2 miles) beyond the station.

125 The signaller believed that his decision point would give about 4 minutes (or more) before a down train reached Bagillt UWC-T. This was correct for trains which stopped at Flint. However a small proportion of trains (5 of the 29 down trains during a signaller's 12 hour day shift) do not stop at Flint; this included the incident train which reached the crossing about 2 minutes 35 seconds after entering section PAD. The signaller therefore had few opportunities to understand the timings associated with trains not stopping at Flint. The signaller's decision point was consistent with his incorrect understanding that signal FH6005 is around 5 miles (8 km) from Bagillt crossing; the distance is actually 2.9 miles (4.7km).

126 There is no evidence suggesting that the signaller's actions were influenced by fatigue. He had taken a personal needs break between starting his shift at 06:30 hrs and the incident, which occurred just before his meal break which started at about 12:00 hrs. He stated that he had been drinking water during his shift and was not feeling fatigued.

127 Network Rail stated that signallers normally gain an understanding of their decision points for UWC-Ts through working on their workstation with more experienced signallers and building up an awareness of how trains traverse track sections. This was not possible for signallers who worked at the WROC when each new workstation was first commissioned. They were given five days training on operation of the signalling equipment and at least four days training specific to each workstation they would operate. The signaller involved in the incident had received the general training and, as he was only required to operate the Rhyl workstation, his specific training had focused on this.

128 Witness evidence indicates that it was possible that training for Rhyl workstation signallers did not cover the effect of trains not stopping at Flint in the context of deciding appropriate decision points for Bagillt UWC-T. The evidence suggests that some of the training scenarios were developed by staff who did not appreciate that most down direction trains stopped at Flint, but a small proportion did not.

129 The signaller involved in the incident started working on the Rhyl workstation only around two months after it was commissioned, so mentoring would have been provided to him by signallers with only limited practical experience on the workstation. At the time of the incident, the signaller's practical experience of operating the Rhyl workstation comprised 26 day shifts, 18 night shifts and 3 shifts relieving other signallers during their meal breaks. Each shift was 12 hours long.

130 Network Rail undertook a survey of Rhyl workstation signallers which included asking '*how far do you look to check whether there are any approaching trains when judging whether a train stopping at Flint was far enough away to provide a user with the time need to cross safely when the user asked for two minutes to cross*'.

131 The wide variation of responses (table 4) indicates that Network Rail staff are not applying a consistent approach. In addition to the obvious risk of providing too little safety margin, an excessive margin introduces the risk of users crossing without speaking to the signaller if they have previously been asked to wait for an excessive time before a train arrived (paragraph 81).

	Decision point *(specific locations or range)*						
	Bagillt UWC-T	***Track section PAL***	***Track section PAC***	***Signal FH6001***	***Signal CR213***	***Shotton Station or at/near signal CR211***	***Saltney Junction***
Approximate distance from Bagillt UWC-T (kilometres)	0	3.4	5.1 to 7.3	7.3	9.6	~11.0	19.8
Time from crossing for a typical train stopping at Flint station (min:sec)	00:00	3:08	4:24 to 5:26	5:26	Greater than 6 minutes		
Number of signallers using decision points at location or within range shown	0	1	5	2	2	6	1

'Decision points' a considerable distance from the crossing possibly indicate a signaller intending to apply signal protection and aiming to avoid this delaying trains because they encounter a yellow or red signal. Although this is not a Network Rail requirement for a crossing time request of two minutes, some signallers do so as they are concerned about road vehicles taking longer than expected to cross the railway.

The questionnaire responses used to compile this table do not include the names of the signallers taking part in the survey and do not include a response referring to section PAD.

Table 4: Signallers' decision-points for stopping trains at Bagillt UWC-T

132 Probable reasons for the wide variation in the location of signallers' decision points for Bagillt UWC-T include shortcomings in training (a consequence of the underlying factor at paragraph 99) and individual signallers making differing allowances for the margin needed between a user completing their crossing and a train arriving. This margin needs to allow for inaccuracies in users' estimates of crossing time and the need to avoid alarming users and train drivers by trains being relatively near a crossing while the user is still on the crossing. There is no Network Rail guidance on appropriate margins.

133 **Example conversations provided to signallers by Network Rail do not follow appropriate safety critical communication protocols.**

134 The 2014/2015 briefing paper includes two example conversations between a signaller and a crossing user (paragraph 92, figure 15). The signaller's input to these conversations does not follow the safety critical communication protocols promoted by Network Rail to improve railway safety. These protocols are included in RSSB's publication 'safety critical communications – the manual', reference T1078, dated November 2017 and available on Network Rail's web-based system for communicating with railway staff. Network Rail procedures require that signallers lead conversations with crossing users and so should seek additional information from them when necessary. This principle helps mitigate the fact that most crossing users are not expected to follow safety critical communication protocols.

135 The shortcomings in the signaller's contribution to the example conversations are that they:

- do not repeat back the crossing location,
- ask the user multiple questions at once; and
- do not confirm vehicle type during the second example conversation.

Previous occurrences relevant to this investigation

136 A train struck a lorry carrying a 124 tonne (122-ton) electrical transformer at Hixon automatic half barrier level crossing in Staffordshire on 6 January 1968 resulting in the death of 11 people and injuries to 45 others. The road vehicle started to cross before the red stop lights were displayed to road traffic and there was then insufficient time for the long and slow vehicle to complete crossing the railway before the train arrived. The road users had not contacted the signaller before using the crossing although there were signs indicating the need for this. Unlike the method of operation at Bagillt UWC-T, operation of Hixon crossing was triggered automatically by the approaching train. This accident is relevant to the present investigation because it demonstrates the potential consequences of a train striking a heavy, abnormal vehicle (paragraphs 15 and 83).

137 A train struck a car which had been deliberately stopped by its driver on Ufton Nervet automatic half barrier level crossing, near Aldermaston, on 6 November 2004. Six people travelling in the train were killed and 71 people were injured. The car driver was also killed. The consequences were particularly severe because, after the front bogie alone was derailed by the train hitting the car, the train encountered a set of points located shortly after the crossing and this caused a more severe derailment with some coaches overturning. This demonstrates that, in certain circumstances, a train hitting a small car on a level crossing can have severe consequences (paragraph 84).

138 On 19 December 2011 a train travelling at 38 mph (61 km/h) struck a lorry on Llanboidy automatic half barrier level crossing, near Whitland (RAIB Report 20/2012). The train was not derailed and the lorry driver was uninjured. However, 29 people on the train were injured, including one passenger who was seriously hurt.

139 On 10 April 2016 a train struck a tractor on Hockham Road UWC-T, near Thetford, after the tractor driver was given permission to cross when the approaching train was only about one minute from the crossing (RAIB Report 04/2017). A recommendation from the RAIB's investigation of this accident relates to providing signallers with location specific decision point guidance and improved information to assist their decision making (paragraph 154). This recommendation therefore addresses the observation relating to the event at Bagillt UWC-T (paragraph 122).

140 A train collided with a parcel delivery van at Frognal Farm user worked level crossing, near Teynham, in Kent on 23 October 2017 resulting in the van driver suffering serious injuries (RAIB Report 12/2018). The van driver believed it was safe to cross the railway after the power-operated crossing gates opened when he pressed a control button provided for road vehicle users. Multiple signs associated with the crossing, including an instruction to telephone the signaller before using the crossing, were placed in a way that meant they did not stand out to the van driver.

141 The driver of an articulated lorry using Bagillt UWC-T with the signaller's permission on 31 October 2017 stated that he noticed a train approaching on the up line and stopped his vehicle about five feet before reaching this line, to avoid a collision. The fact that the train driver reported that they did not see the lorry, and the limited availability of evidence means that the precise circumstances could not be established with certainty. However, the level 1 ('informal') Network Rail investigation resulted in recording of the correct signaller's decision point in the Holywell signal box instructions. This supports the need for implementation of the RAIB recommendation made after the Hockham Road accident (paragraph 154).

142 The RAIB has also considered an incident at Bagillt UWC-T on 10 December 2014 and concluded that the circumstances differ significantly from those of the incident in August 2018. During the 2014 event, the driver of a lorry was given permission to cross the railway but did not do so because they could see an approaching train. The Network Rail investigation found that the cause was a misunderstanding during a telephone conversation in which the signaller spoke to the user about the number of trains which the user had watched go over the crossing.

Summary of conclusions

Immediate cause

143 An abnormally heavy vehicle was permitted to use Bagillt level crossing without signal protection (paragraph 46).

Causal factors

144 The causal factors were:

a. the crossing user did not describe the road vehicle as large when speaking with the signaller (paragraph 50, **Recommendation 1, Learning point 1**);

b. the signaller did not establish the size of the road vehicle during his conversation with the user (paragraph 60, **Recommendation 1, Learning points 2 and 3**); and

c. information provided to the signaller before the incident did not identify the high probability that users of Bagillt UWC-T would be crossing with large vehicles, in part because only some of the relevant information had been obtained by level crossing managers (paragraph 68, **Recommendation 1**).

Underlying factors

145 The underlying factors were:

a. Network Rail's level crossing risk management process does not provide signallers, other railway staff or crossing users with a coherent and consistent process for deciding whether a vehicle should be treated as large, low or slow-moving when using a UWC-T (paragraph 79, **Recommendation 1**); and

b. Network Rail's level crossing management processes do not provide an effective interface between signallers and UWC-T users (paragraph 99, **Recommendation 1**).

Additional observations

146 The signaller lacked information needed to assess the crossing time requested by the user (paragraph 115, **Recommendation 1**).

147 The signaller intended to use a decision point which was inappropriate (paragraph 122; existing recommendation paragraph 154; **Learning point 4**).

148 Example conversations provided to signallers by Network Rail do not follow appropriate safety critical communication protocols (paragraph 133, **Learning point 5**).

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

149 Network Rail reports that signallers at the WROC have been instructed to provide signal protection for all vehicle crossings at Bagillt UWC-T, and a written procedure for using Bagillt UWC-T has been agreed between Bagillt Car Spares and Network Rail.

150 Network Rail staff report better engagement between level crossing managers and signalling staff at the WROC since the incident at Bagillt UWC-T in August 2018. Network Rail has informed the Office of Rail and Road (ORR) that level crossing managers will have greater engagement with developing training plans for WROC signallers (paragraph 105).

151 Network Rail's Wales route asset manager (signalling) reports that he has taken steps intended to ensure time clocks used by signalling systems in the WROC are checked and maintained so they remain synchronised (paragraph 38).

152 Network Rail reports that work is in progress to develop training for operations staff which will include the development of operational instructions and training plans (paragraph 109). It also reports that this work is due for publication in December 2019.

Previous RAIB recommendations relevant to this investigation

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

Recommendations that are currently being implemented

Collision between a train and tractor at Hockham Road user worked crossing, near Thetford, 10 April 2016, RAIB report 04/2017, Recommendation 1

154 The following recommendation relates to identification of signallers' decision points. It deals with the issue identified in the observation at paragraph 122 of this report and so no new recommendation is made on this topic.

Network Rail should undertake a review of its measures for the protection of user worked crossings with the objective of identifying means of reducing the likelihood that an accident will be caused by signaller error. Options for consideration should include:

- *improved information for signallers (including consideration of ways of better enabling signallers to judge the time needed for a movement over a crossing and the time available before a train arrives at a level crossing);*
- *increased use of automatic warning systems; and*
- *closure of UWCs or their replacement by automatic crossings.*

The review should also identify criteria for the prioritisation of improvements taking into account both risk and the opportunities presented by planned signalling upgrades. The findings of the review should be incorporated into Network Rail's level crossing strategy and the standards used to prepare specifications for new signalling schemes.

Implementation of this recommendation is likely to be assisted by trials which Network Rail state it is carrying out to determine how decision points can be worked out.

155 The ORR reported to the RAIB on 13 March 2018 that Network Rail was only considering the option of providing improved information for signallers. The ORR had therefore asked Network Rail to address all the options identified in the recommendation and to provide it with information on any measures being taken to make increased use of automatic warning systems and closure or replacement of user worked crossings.

Collision at Frognal Farm User Worked Crossing 23 October 2017, RAIB report 12/2018, Recommendation 1

156 The following recommendation relates to signage and other aspects of interaction between users of user worked crossing and railway staff. It is supported by a second recommendation, not reproduced here, relating to legal issues associated with changing the information given on signs at these locations.

Network Rail, with Office of Rail and Road and Department for Transport support, should review and revise the information offered to users of private level crossings, including consideration of signage wording and diagrams, the conspicuity and placement of signage, and the actions that the user needs to take, including operation of the gates or barriers, and communication with the signaller. The review should also consider, alongside the presentation of information, practicality and feasibility of the current arrangements by which authorised users are expected to brief and inform other potential users of the crossing, in view of the increased dependence of occupiers on delivered goods and services from a plethora of sources, and other factors which may increase the number of crossing users.

157 The recommendation is relatively recent and the ORR has not yet provided the RAIB with a report on the actions being taken in response to this recommendation. However, the trial sign mentioned in paragraph 114 shows that Network Rail is taking action to address at least some of the issues raised in this recommendation.

Recommendation and learning points

Recommendation

158 The following recommendation is made[2]:

1 *The intent of this recommendation is to ensure that Network Rail has a coherent and consistent process for managing the risks associated with large, low or slow-moving vehicles at user worked crossings with telephones.*

Network Rail should, if necessary assisted by RSSB, carry out a review of the way that it manages the risk of large, low and/or slow-moving road vehicle movements across user worked crossings that are equipped with telephones (UWC-T). This review should include consideration of:

- information that should be collected at crossings, and from authorised users, as part of Network Rail's risk management process, including:
  - the crossing layout and other features likely to affect user crossing times; and
  - the types of vehicle likely to use the crossing and the frequency of this use;
- how information collected at crossings should be communicated to signallers;
- the types and characteristics of vehicles which necessitate signal protection;
- the means by which signallers can obtain sufficient detail of vehicle characteristics and likely crossing time to make an informed decision about whether it is safe for the vehicle to cross, and whether signal protection is required; and
- the information and instructions provided to users to help them judge whether their vehicle is 'large, low or slow-moving', and to give them a clear method of communicating this to the signaller.

[2] 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 ORR 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.

The findings of this review should be used to prepare a coordinated and time bound plan to implement improvements, including any necessary changes to standards and the Rule Book, revised training and guidance for signallers, and revised information and instructions to users. These improvements should seek to increase safety at UWC-T crossings, whilst also recognising the need to minimise unnecessary delays to crossing users (paragraphs 144, 145 and 146).

Learning points

159 The RAIB has identified the following learning points[3]:

1 People requesting permission to take a road vehicle over a user worked level crossings should carefully explain the type of vehicle, state when it is large or slow moving, and provide a realistic crossing time.

2 A road vehicle should not be permitted onto a user worked level crossing without signal protection unless signallers have satisfied themselves it can cross quickly, is unlikely to become stuck and is not large (not heavy, long and/or wide).

3 Conversations between signallers and members of the public should achieve the standards of clear and unambiguous communication required by safety critical communication protocols, with signallers leading the conversations to achieve this.

4 Differences in the time taken for different types of train to reach a level crossing (for example, whether a train stops at a station) should be taken into account when signallers decide whether to give permission for a user to cross the railway at a user worked level crossing.

5 Training material should conform with safety critical communication protocols even when the use of this protocol is not the subject of the training material. This is essential to avoid suggesting inappropriate protocols are sometimes acceptable.

[3] 'Learning points' are intended to disseminate safety learning that is not covered by a recommendation. They are included in a report when the RAIB wishes to reinforce the importance of compliance with existing safety arrangements (where the RAIB has not identified management issues that justify a recommendation) and the consequences of failing to do so. They also record good practice and actions already taken by industry bodies that may have a wider application.

Appendices

Appendix A - Glossary of abbreviations and acronyms

ALCRM	All level crossing risk model
HGV	Heavy goods vehicle
LCM	Level crossing manager
ORR	Office of Rail and Road
UWC-T	User worked crossing with telephones
WROC	Wales rail operating centre

Appendix B - Sources of evidence

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

- information provided by witnesses;
- information provided at meetings with organisations involved in the incident;
- site photographs and measurements
- a reconstruction involving use of the baler and timings of other lorries crossing at Bagillt UWC-T;
- signalling data;
- telephone voice recordings;
- weather reports;
- rail industry documents including standards, procedures etc.;
- Network Rail investigation reports relating to previous incidents at Bagillt UWC-T;
- crossing user documents; and
- a review of previous RAIB investigations that had relevance to this accident.

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