

Rail Accident Report



**Collision at Buttington Hall user worked
crossing, Welshpool
16 July 2013**

Report 06/2014
March 2014

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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Summary

At 11:44 hrs on Tuesday 16 July 2013 a collision occurred between a passenger train and a farm trailer at Buttington Hall farm crossing near Welshpool on the line between Shrewsbury and Machynlleth. The tractor driver and two other people nearby sustained minor injuries and two passengers on the train were injured and taken to hospital, but were discharged later that day.

The train involved was operated by Arriva Trains Wales and consisted of two 2-car units. It was travelling at 120 km/h (75 mph) at the time of the collision. The train was running from Birmingham International to Aberystwyth and Pwllheli and there were 140 passengers and two crew members on board. On the day of the accident, the farm crossing was being used by tractors bringing in a harvest from fields on the opposite side of the line to the farm. The farmer had appointed a contractor to carry out the harvesting operation, and an attendant had been provided at the crossing to phone the signaller and operate the gates.

The accident occurred because the system of work in use at the crossing was inherently unsafe, leading to ineffective control of road vehicle movements over the crossing and frequent use of the crossing without the signaller being contacted. This system broke down. There were also underlying management factors:

- the harvest contractor did not implement an effective safe system of work at the crossing;
- Network Rail's process for risk assessment of these types of crossing did not adequately deal with periods of intensive use; and
- Network Rail's instructions to users of these crossings did not cover periods of intensive use.

The RAIB has made three recommendations:

- main line infrastructure managers should improve the risk assessment process at these crossings to take into account the increased risk during periods of intensive use;
- main line infrastructure managers should define safe and practical methods of working to be adopted at these crossings during periods of intensive use; and
- RSSB should update the level crossing risk management toolkit to reflect the changes brought about by the second recommendation.

The RAIB has also noted a learning point from an observation made during the investigation concerning the prolonged closure of an adjacent level crossing on a main road after the accident.

Introduction

Preface

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

Key definitions

- 4 All dimensions and speeds in this report are given in metric units, except locations which are given in imperial units, in accordance with normal railway practice. Where appropriate the equivalent metric or imperial value is also given.
- 5 The report contains abbreviations and technical terms (shown in *italics* the first time they appear in the report). These are explained in appendices A and B.

The accident

- 6 At 11:44 hrs on Tuesday 16 July 2013, train reporting number 1J11, the 10:08 hrs passenger train service from Birmingham International to Aberystwyth and Pwllheli, struck a farm trailer on Buttington Hall *user worked crossing* (UWC) near Welshpool, Powys (figure 1).

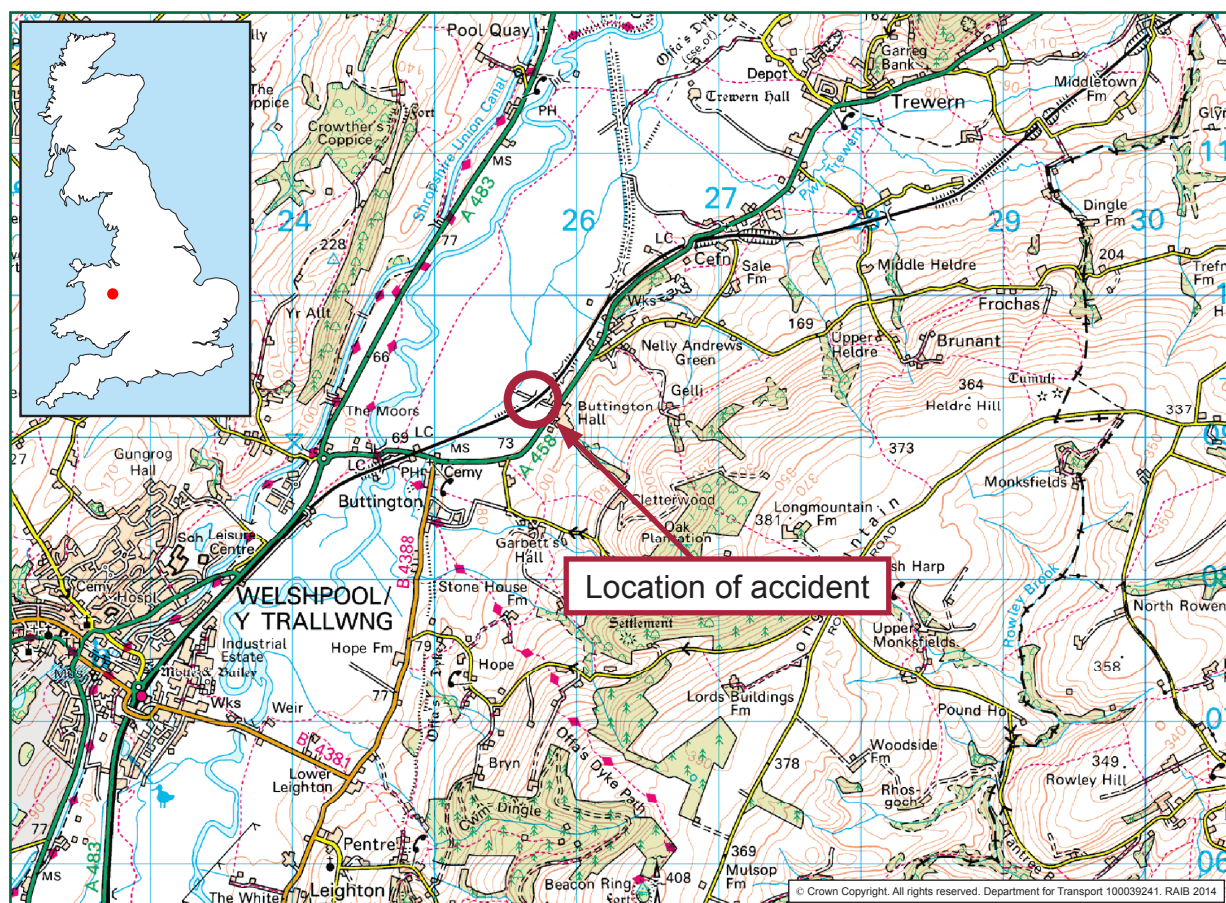


Figure 1: Extract from Ordnance Survey map showing location of accident

- 7 The impact caused extensive damage to the trailer and to the tractor that was pulling it (figure 2). The tractor driver and two other agricultural workers who were standing close by at the time sustained minor injuries.
- 8 Several passengers on the train were injured and two were taken to hospital for treatment, but were discharged later that day.
- 9 The train did not derail, but sustained significant damage to the front end (figure 3). A window in the passenger compartment was broken and some interior panels were dislodged during the impact.
- 10 The railway was closed until 17:30 hrs on the same day for recovery of the train.



Figure 2: Buttington Hall crossing, looking towards the Shrewsbury direction showing the tractor and trailer in their post-accident positions



Figure 3: The front of the train involved

Background

The parties involved

- 11 The train was operated by Arriva Trains Wales, who also employed the driver and conductor. The train was formed of two 2-car class 158 *diesel multiple units* and there were 140 passengers and two crew members on board.
- 12 The infrastructure was owned by Network Rail, who also employed the signaller and the staff who inspected and maintained the crossing equipment.
- 13 The crossing had three *authorised users*. One of these was the farmer of Buttington Old Hall farm. He had hired an agricultural contractor, DM Roberts, to harvest silage from his fields and convey it back to the farm. This work involved crossing the railway at Buttington Hall UWC.
- 14 DM Roberts had carried out harvesting work for Buttington Old Hall farm every year since 2000. It stated that it used a combination of its own and contract staff; the same staff were used each time. Both tractor drivers involved in the sequence of events prior to the accident had worked for DM Roberts before and stated that they were familiar with using UWCs.
- 15 Arriva Trains Wales, Buttington Old Hall farm, DM Roberts and Network Rail all cooperated freely with the investigation.

The crossing

- 16 Buttington Hall crossing is located approximately 16 $\frac{3}{4}$ miles (26.8 km) from Sutton Bridge junction, Shrewsbury, and 2 $\frac{1}{8}$ miles (3.4 km) from Welshpool station on the Cambrian line (figure 1). The railway is single track and is curved to the right in the direction of travel of the train involved. The maximum permitted speed for trains is 120 km/h (74.6 mph).
- 17 The line is controlled by the *European Rail Traffic Management System* (ERTMS), *level 2*, from Machynlleth signalling centre.
- 18 Buttington Hall UWC is an *accommodation crossing* that provides access to fields from Buttington Old Hall and Buttington New Hall farms. The road over the crossing is an unmade farm track. There is also a bridge under the line adjacent to the crossing, but this has restricted headroom and is too low for tractors and trailers to pass beneath. The crossing is provided with gates, which open away from the line, and telephones which connect to Machynlleth signalling centre. There are signs at the crossing instructing users on how to use it. These signs are in both English and Welsh languages (figure 4).



Figure 4: Buttington Hall crossing, looking in the direction that the tractor was travelling, showing the signs and telephone

- 19 The principle of operation of a UWC is that the crossing user must check that the line is clear, open both gates, check the line is still clear, cross the line then close both gates. In order to check that the line is clear, the user has to be able to see far enough along the line, in both directions, to be able to see an approaching train. This sighting distance depends on the speed of trains and the time needed to cross the line. At Buttington Hall, the curvature of the line means that it is not possible to obtain the required sighting distance and so telephones have been provided. The signs at the crossing instruct users to always telephone before crossing with vehicles or animals.

Management of the crossing

- 20 Network Rail's process for managing UWCs mandates the following activities:
- An inspection, by operations staff, of the crossing every six months (Network Rail standard NR/L2/SIG/19608 'Level Crossing Infrastructure: Inspection and Maintenance').
 - An annual inspection of the vertical profile of the road to assess the risk of vehicles grounding on the crossing (NR/L2/SIG/19608).
 - The level crossing manager to write to the authorised users at intervals of 3 years or less to remind them of the correct method to use the crossing safely and the obligation that they, and other authorised users, must do this (Network Rail standard NR/L2/OPS/100 'Provision, Risk Assessment and Review of Level Crossings'). The authorised user is also asked about their level of use of the crossing and their willingness to consider its closure.

- d. Periodic risk assessments of the crossing using the All Level Crossing Risk Model (ALCRM, paragraph 24), supported as necessary by expert judgement or additional risk assessment processes where appropriate (Standard NR/L2/OPS/100).
 - e. The telephones at UWCs to be tested by Network Rail signalling and telecommunications maintenance staff every 3 months (Standard NR/SIG/10661 'Signalling Maintenance Task Intervals').
- 21 The last six-monthly inspection of Buttington Hall UWC prior to the accident was on 25 March 2013 and the inspector noted some minor defects which were prioritised and input to Network Rail's work planning system. They were rectified on 11 April 2013.
 - 22 Network Rail had not carried out an inspection of the road profile over the crossing at the time of the accident and stated that this was due to limited resources. It has subsequently carried out this inspection. However, the road profile was not a factor in this accident.
 - 23 Network Rail last wrote to the authorised users of the crossing on 6 February 2012. Network Rail enclosed with this letter the leaflet 'Stop, Look and Read. A guide to using your user-worked level crossing' and a questionnaire for the user to record their usage of the crossing. The farmer at Buttington Old Hall farm completed the questionnaire and returned it to Network Rail on 9 February 2012. The instructions on the questionnaire asked the user to record average usage throughout the year and the farmer recorded that tractors and trailers used the crossing once an hour. He indicated that he was not willing to consider closure of the crossing.
 - 24 The most recent risk assessment of the crossing was carried out on 21 May 2012. This interval complied with Network Rail's contemporary requirement for a risk assessment to be completed at least every 3 years for UWCs (this has now changed so that the intervals are based on the risk score of the crossing and this requires that the next risk assessment is undertaken by October 2015). The risk assessment was based on data collected at the crossing and entered into the ALCRM. This is a computer-based application used by Network Rail to assist in the risk management of level crossings. It takes the features and usage of the crossing into account to calculate a risk score. This is made up of two parts, a collective risk and an individual risk. The collective risk is an estimate of the total risk generated by the crossing for all users of the crossing and the occupants of trains, whereas the individual risk is an estimate of the risk of death for a notional regular crossing user (this is an annual risk of death based on 500 transits of the crossing per annum). The risk score from ALCRM is intended to support and inform an assessor in considering the risk mitigation options for the crossing. The results of the risk assessments are discussed in paragraphs 76 to 80.
 - 25 The telephones at the crossing were last tested prior to the accident by Network Rail signal and telecommunications maintenance staff on 22 May 2013 and found to be working correctly. Records of calls from the crossing to the signaller showed that the phone on the field side of the crossing was working normally at the time of the accident. Network Rail tested both of the phones, under RAIB supervision, after the accident and found that they were working correctly.

Sequence of events

Events preceding the accident

- 26 The farmer at Buttington Old Hall farm stated that he had asked DM Roberts to provide an attendant at the crossing during the harvest operation. The farmer stated that the purpose of the attendant was to call the signaller to get permission for tractors to cross the line and to operate the crossing gates. DM Roberts stated that they had been given a leaflet about the crossing when they were first contracted to do the work, but there had been no specific instructions given to them in 2013. DM Roberts provided the attendant who was in place at the crossing by 08:51 hrs on 16 July when he made his first call to the signaller to ask for permission for a tractor and trailer to cross.
- 27 The crossing attendant continued to make calls asking for permission for tractors to cross the line. The signaller granted these requests until 09:02 hrs, when he told the attendant that the tractor could not cross as a train was approaching from the Welshpool direction. The telephone voice recording of the conversation shows that it finished with the signaller stating "*there's one on its way from Welshpool, let him get past first please*". This message may have given the impression to the attendant that the tractor could cross after the train had passed without needing to contact the signaller again. This message only applied to the tractor waiting to cross; the attendant should have phoned for permission for subsequent tractors to cross.
- 28 The attendant saw the train pass and he stated that he knew that it would be at least 20 minutes until the next train, so he allowed tractors to continue to cross without calling the signaller. He next phoned the signaller for permission to cross at 09:32 hrs and made four more calls during the following 20 minutes, the last being at 09:51 hrs. The signaller granted permission on all of these occasions.
- 29 A train passed heading towards Welshpool at 09:59 hrs and the attendant called at 10:04 hrs for permission to cross. The signaller offered the attendant use of the crossing for a 'block' of time, which the attendant accepted, and they agreed that this would run until 11:00 hrs. The signaller did not ask the attendant to call back at the end of this time.
- 30 At 11:02 hrs, the time 'block' having expired, the attendant called for permission for a tractor to cross. The signaller granted this permission but told the attendant that a train would soon pass in the Shrewsbury direction and asked for the gates to be closed after the tractor had crossed the line. The train passed the crossing at 11:09 hrs but there is no evidence that the gates were closed.
- 31 After the train had passed, the attendant allowed tractors to cross the line, but did not phone the signaller. Analysis of witness statements shows that the last crossing prior to the accident would have been at approximately 11:35 hrs. This was a loaded tractor and trailer heading towards the farm. The trailer was unloaded at the farm and the tractor and trailer started back towards the crossing.
- 32 The journey from the farm to the fields included crossing the A458 road as well as the railway. This road was very busy at the time and the tractor caught up with the previous one waiting to cross the road. Both tractors crossed the road at the same time and approached the level crossing following one behind the other.

Events during the accident

- 33 As the tractors approached the crossing a van was on the other side. This was driven by a member of DM Roberts' staff who was to relieve the attendant so that the attendant could leave for a pre-arranged appointment.
- 34 The first tractor driver (tractor driver one) stopped when he got to the crossing to check that the road on the far side was clear (the crossing is only wide enough for one vehicle at a time). Tractor driver two stopped behind tractor driver one's trailer but stated that he could not see past it.
- 35 The relief crossing attendant parked his van at the side of the road before reaching the crossing and walked up to the crossing to speak to the attendant. The attendant told the RAIB that he had seen the tractors stop and assumed that they would remain there. He knew that a train was due shortly.
- 36 Tractor driver one saw that the van was parked clear of the road beyond the crossing and the gates were open and he crossed the line. The crossing attendant had not formally agreed with the tractor drivers whether or not a positive indication would be given to show that it was clear to cross (paragraphs 52 to 57).
- 37 The *on train data recorder* (OTDR) indicated that the train was travelling at 120.7 km/h¹ (75 mph) as it approached the crossing. It was not possible for the driver to see the crossing until the train was approximately 274 metres from it due to the curvature of the line and the lineside vegetation. When the crossing came into view he saw that a tractor and trailer were just moving clear and he sounded the horn as a warning.
- 38 Tractor driver two stated that he could not hear the train horn in his cab and he started to follow tractor one over the crossing. As he was on the crossing he noticed that the train was approaching. He tried to accelerate the tractor and trailer to get clear of the line before the train arrived, but could not move completely clear in time and the train collided with the rear of the empty trailer.
- 39 The train driver saw the second tractor start to move onto the crossing and applied the emergency brake. The train's OTDR and the *juridical recording unit* showed that the brake was applied when the train was approximately 125 metres from the crossing. The train speed had reduced to 120.2 km/h (74.7 mph) at the time of impact.

Events following the accident

- 40 The train came to rest 380 metres from the crossing and the driver made an emergency radio call to the signaller at Machynlleth to report the collision. The signaller reported the accident to the control office and called the emergency services.
- 41 The driver was not injured but was trapped in his cab by the gangway door which had become pushed back from the front of the train. The conductor checked that the driver was not injured and went through the train checking on the passengers. Some of the passengers helped the driver to move the pushed back door that was obstructing his exit from the cab.

¹ This speed is above the speed limit of 120 km/h, but the RAIB does not consider this is significant as it is within the 3 km/h tolerance band allowed by ERTMS.

- 42 A doctor who was travelling on the train attended to some of the passengers who were injured. When the emergency services arrived, ambulance paramedics attended to injured passengers and two were taken to hospital but were released later that day.
- 43 Road coaches were brought into the field adjacent to the line. Network Rail staff made a gap in the fence to allow the passengers to be led from the train to the coaches for onward transport.
- 44 Tractor driver two was treated at the scene by paramedics. The crossing attendant and his relief were shocked by the accident but did not ask for treatment on site and did not go to hospital.

Identification of the immediate cause²

45 **The immediate cause of the accident was that the tractor and trailer crossed the line when a train was approaching.**

- 46 The crossing attendant stated that he had assumed that, having stopped on the approach to the crossing, the tractors would remain there. However, the tractors had only stopped because the driver of the first one was checking that his exit from the crossing was clear. When he saw that the van was at the side of the road he could see that the road was clear for the tractors to pass.
- 47 The crossing gates had been left in the open position and the crossing attendant was standing near to the phone at the side of the road. The tractor driver saw that the gates were open and the attendant was not standing in the road to signal him to stop, and took this to mean that it was safe to cross (paragraphs 52 to 57).

Identification of causal factors³

- 48 The accident occurred due to a combination of the following causal factors:
 - a. the system of work in use at the crossing was inherently unsafe (paragraph 51); and
 - b. the system of work broke down (paragraph 66).
- 49 The following underlying management factors were also identified:
 - a. DM Roberts did not implement an effective safe system of work at the crossing (paragraph 73);
 - b. Network Rail's existing process for calculating risk at UWCs averages usage over the year and does not recognise the increased risk at periods of intensive use (paragraph 76); and
 - c. Network Rail's instructions to authorised users on the safe use of UWCs did not cover periods of intensive use (paragraph 81).
- 50 Each of these factors is now considered in turn.

² The condition, event or behaviour that directly resulted in the occurrence.

³ Any condition, event or behaviour that was necessary for the occurrence. Avoiding or eliminating any one of these factors would have prevented it happening.

The system of work in use at the crossing

- 51 The system of work that was adopted at the crossing resulted in:
- ineffective control of road vehicle movements over the crossing (paragraph 52); and
 - frequent use of the crossing without the signaller being contacted (paragraph 58).

Control of road vehicle movements over the crossing

- 52 The control of vehicle movements over the crossing was ineffective. The following factors contributed to this:
- there was no clear signal agreed to indicate to tractor drivers that it was safe to cross the line;
 - the gates were not closed to prevent tractors from crossing the line when it was unsafe to do so; and
 - a crossing attendant was employed who was not sufficiently fit to be able to operate the gates.
- 53 The crossing attendant was employed by DM Roberts for this contract and had done this job for them two or three times a year for the previous five years. He stated that his task was to phone the signaller when a tractor needed to cross the line so that the tractor drivers did not have to stop and get out of their tractors. The RAIB found no documentary evidence of an assessment of his competence.
- 54 There were five tractors and trailers employed in carrying the silage from the fields to the farm. Each tractor had to cross the line in each direction on every trip and DM Roberts estimated that the work required a total of approximately 150 trips in each direction over the two day harvest period. This frequency of usage meant that there was limited time between tractors crossing for the gates to be closed and opened.
- 55 The crossing attendant stated that he found it difficult to operate the gates as he was recovering from a recent hip operation, so left them in the open position and stood in the road to stop tractors crossing when it was unsafe. The latches which held the gates open were not effective and the attendant had used an old tyre to hold the gate open on the field side. The need to move this tyre to operate the gate increased the work needed for the task.
- 56 The tractor drivers were aware that the attendant was making phone calls to the signaller to get permission to cross, but witness evidence was unclear as to how the outcome of the call was to be communicated to the tractor driver. Some witnesses stated that the gates were closed to show that it was not safe to cross, and some stated that the attendant would stand in the road to signal that it was not safe to cross. All agreed that if there was no attendant at the crossing they would stop and phone for permission to cross, and a phone call made at 15:56 hrs the day before suggests that they did this (paragraph 61).
- 57 The method of stopping tractors whereby the attendant stood in the road was prone to failure if the attendant was using the crossing phone or was otherwise distracted.

Use of the crossing without the signaller being contacted

58 The crossing attendant employed a method of working in which he did not call the signaller for permission to cross if he believed that a train was not due.

- 59 The railway between Sutton Bridge junction and Welshpool is single track and the only places that trains travelling in opposite directions can pass are in Welshpool station or beyond Sutton Bridge junction. This means that if a train passes the crossing travelling towards Shrewsbury, the train has to reach Sutton Bridge junction before another train can pass it travelling in the opposite direction. The crossing attendant had worked at this crossing before and knew that the minimum time between trains in these circumstances was 20 – 25 mins.
- 60 This was not a safe assumption as the ERTMS can allow two trains to follow one another in the same direction over this section of line, in which case the time interval between trains could be as little as 7 minutes. The normal timetable does not call for this to happen, but it is possible if an additional train was scheduled.
- 61 The crossing attendant had also been in place at the crossing the previous day, he started work at the crossing at approximately 15:30 hrs. The first phone call to request permission for a van to cross that day was at 11:18 hrs, but the first of the calls for permission for tractors and trailers to cross was at 15:23 hrs. When the attendant called at 15:49 hrs to request permission for a tractor to cross, the signaller offered him a 'block' of time to 16:50 hrs. There was also a call from a tractor driver at the crossing asking for permission for a tractor to cross at 15:56 hrs. This was shortly after the time 'block' had been granted and so the call was not necessary. It is likely that, knowing that it was clear for tractors to pass for an hour, the attendant had taken a short break and left his post. The tractor drivers stated that if they could not see the attendant as they approached the crossing they would call the signaller themselves.
- 62 A train passed the crossing heading towards Shrewsbury at 17:15 hrs and the attendant called the signaller for permission for a tractor to cross at 17:18 hrs. The signaller offered a time 'block' until 17:35 hrs and no further calls were made until after that time. The next train to pass in this direction was at 19:12 hrs and the crossing attendant's next call for permission to cross was at 19:22 hrs, implying that at this time he was not making assumptions about when the next train was due.
- 63 After the last train towards Shrewsbury had passed, at 21:06 hrs, the crossing attendant did not call again for permission until 21:31 hrs. During this period the harvesting operation continued and witness evidence was that there was no hold up to the constant flow of tractors between field and farm. It is likely that the crossing attendant had applied his method of working at this time.
- 64 The attendant also used his method of working on 16 July after the first train he saw go towards Shrewsbury had passed (paragraph 28) and used it again after the next train in that direction at 11:09 hrs (paragraph 31).
- 65 The crossing attendant did not make assumptions about how long it would be before the next train passed for trains heading towards Welshpool, as the station at Welshpool was only a short distance away, and a train could arrive from that direction a few minutes after the previous train.

Factors that led to the system of work breaking down

66 The system of work that had been established probably broke down due to the crossing attendant becoming distracted by the arrival of his relief.

- 67 The crossing attendant was due to go to a personal appointment that afternoon and had arranged to be relieved at midday. The person due to relieve him had been working on the harvest in the fields beyond the railway during the morning and drove to the crossing in a van. It was this van which the first tractor driver saw approaching the crossing, which may have caused him to stop.
- 68 The attendant stated that he had seen the tractors stop and believed that they would remain there until he, or his relief, had checked with the signaller that it was clear to cross.
- 69 When the relief attendant walked up to the crossing he spoke to the attendant. Witness evidence states that they were standing at the side of the road near to the crossing phone at this time.
- 70 Tractor driver one took this to mean that, as the attendant was not standing in the road and the gates were open, it was safe to cross. Tractor driver two followed him (paragraph 58).
- 71 The attendant stated that he was unaware that the tractors had started to cross until the first tractor passed him. He did not have time to try and stop them before the collision occurred.
- 72 The distraction of the attendant may have been a factor in this accident. It would not have been a risk had he closed the gates, as he was asked to do by the signaller.

Underlying management factors

The system of work used at the crossing

73 DM Roberts did not establish an effective safe system of work.

- 74 Witness evidence suggests that the farmer had asked that an attendant be provided at the crossing to call Network Rail and follow its instructions regarding operation of the crossing (paragraph 26). The system of work to be used was not written down or formally briefed by DM Roberts to their staff. Instead, DM Roberts placed reliance on the appointment of an individual with previous experience to act as a level crossing attendant but allowed him to implement his own system of work.
- 75 The farmer did not contact Network Rail to inform it of the period of planned intensive use of the crossing, and Network Rail had not asked him to do so. The farmer did, however, mention that the crossing was used intensively at harvest time in the questionnaire that he returned to Network Rail in February 2012 (paragraph 23).

Network Rail's level crossing risk assessment process

- 76 **The output of a risk assessment using the ALCRM is based on an estimate of the road traffic, averaged over the whole year. This does not separately identify and mitigate the risk at times of intensive use, such as at harvest time.**
- 77 The input to ALCRM includes information on the number and type of vehicles using the crossing. This information is based on the questionnaires that the authorised users complete, or on a census carried out by the level crossing inspector. During the inspection for the ALCRM assessment in May 2012 the inspector did not see anyone use the crossing, so the census information in ALCRM was estimated from the authorised users' questionnaires. The operations risk control coordinator (ORCC⁴), when inputting the data, noted that the crossing sees intensive use during harvest time and input a second set of census data to reflect this, based on the information in the authorised users' questionnaires. ALCRM allows for an alternative set of census data and asks for the percentage of the time that each census applies. The ORCC specified that the 'harvest' census applied for 10% of the time and the 'normal' census for 90% of the time.
- 78 The risk assessment made on 21 May 2012, with the 90/10 split of census data, assessed the risk as D6. This represents a collective risk of 6 on a scale from 1 (highest risk) to 13 (lowest). The individual risk, D, is in fourth place on a scale from A to M. Risk rating D6 is relatively low and would be unlikely to lead to detailed consideration of risk reduction measures.
- 79 The risk score calculated by ALCRM is heavily influenced by the level of usage of the crossing and, in cases where more than one set of census data is input, as here, it calculates the average usage over time. An alternative approach would be to calculate the risk for each set of census data separately. If this was done for Buttington Hall the result for the 'normal' census would still be D6 but the result for 'harvest' use would be D2. The difference between these risk scores reflects the sensitivity of the ALCRM score to the volume of road traffic. The 'harvest' use score would probably justify additional risk mitigations during the period of intensive use.
- 80 Network Rail standard NR/L2/OPS/100 states that ALCRM should be supported by expert judgment or additional risk assessment processes where required. Such additional considerations could well encompass issues associated with periods of intensive use. No additional risk assessment was done during the May 2012 assessment at Buttington Hall.

Network Rail's instructions to authorised users

- 81 **Network Rail's instructions to authorised users on the safe use of UWCs did not explain how to use the crossing during periods of intensive use.**
- 82 Network Rail wrote to the authorised users of Buttington Hall UWC in February 2012 to remind them how to use a UWC safely (paragraph 23). This letter included Network Rail's information leaflet '*Stop, Look and Read. A guide to operating your user-worked level crossing.*' The method of use described in the leaflet catered for the situation where the user needed to cross the line on an isolated occasion. It did not cover the situation where there was intensive use over a short period, as at harvest time.

⁴ The ORCC reports to the level crossing manager, who is responsible for the management of a number of level crossings in a defined geographic area. Prior to 1 April 2013, the ORCC reported to the Operations Risk Advisor.

- 83 The method described in the leaflet was the same as that given by the instructions on the signs at the crossing. It instructed the user to phone for permission to cross, then open the gates, drive over the crossing and close the gates after use. The instructions did not acknowledge that during periods of intensive use the time between crossings can become so short that it is difficult to open and close the gates in the time available.
- 84 The lack of a clearly defined alternative system for times of intensive use was probably a factor in the crossing attendant adopting an unsafe system.

Observations⁵

Signaller's method of working

- 85 **The system of work in use at the crossing that day did not include a call to the signaller to confirm that the crossing was clear for the passage of trains after a series of crossings by tractors.**
- 86 The signaller only became aware that the crossing was to be intensively used when he started to receive frequent calls from its phones. When the signaller perceived that this was the case he asked the crossing user if he needed to make a number of crossings. When he did, the signaller offered him a 'block' of time. When this 'block' of time had been granted the signaller placed reminders on the *block markers* each side of the crossing to prevent him from inadvertently signalling a train over the crossing.
- 87 The signaller gave the user a time until which he was free to cross the line but did not ask the crossing user to call back at that time. The signaller removed the reminders when the agreed end time had been reached. The crossing attendant did not ring back at the end of the time 'block' to say the crossing was clear but rang back when the next tractor needed to cross.
- 88 The Rule Book, GM/RT8000, module TS9 gives instructions to signallers on how to deal with calls from level crossing users. Clause 2.1.1 tells the signaller to ask the user how long he needs to cross the line. If there is enough time before the next train passes over the crossing the signaller must '...except as shown in regulation 2.1.2, tell the user to cross immediately.' Clause 2.1.2 deals with the situation where the user wants to cross with animals or with slow moving vehicles. In this case the signaller must also make sure that the protecting signals are kept at danger and ask the user to call back when they are clear of the crossing.
- 89 When giving the crossing user a time 'block' the signallers at Machynlleth applied the principle described in 2.1.1, but also applied part of 2.1.2 in that they maintained the protecting 'signal' at danger (there are no signals as such on ERTMS fitted lines, as block markers perform this role), however they did not ask for a call back. The signallers considered that this method of working was in line with clause 2.1.1. Without a call back the signaller had no means of knowing that the crossing was clear when signalling the next train over it. This method of working was therefore reliant on the crossing attendant keeping track of the time.

⁵ An element discovered as part of the investigation that did not have a direct or indirect effect on the outcome of the accident but does deserve scrutiny.

Closure of adjacent AHB crossing for 50 minutes in consequence of the accident

- 90 **After the collision the train stopped in a position which kept the barriers down and *wig-wags* flashing at the nearby automatic half barrier (AHB) crossing at Buttington. The crossing remained closed across the busy A458 road for 50 minutes during which time witness evidence stated that many road users zig-zagged round the barriers.**
- 91 AHB crossings are arranged so that if a crossing is triggered spuriously and no train is approaching it, the circuit times out after a few minutes and the barriers are raised and the wig-wags extinguish. However, if a train triggers the crossing but stops before reaching it, as happened here, the crossing remains in the activated state with the barriers down and wig-wags flashing.
- 92 The crossing was triggered by the train before the accident and the barriers remained lowered with the wig-wags flashing until Network Rail arranged for a suitably qualified member of their staff to go to the crossing and switch it onto local control. The crossing remained closed until 12:35 hrs. During this time road traffic could not pass the crossing without ignoring the wig-wags and zig-zagging round the barriers. Witness evidence stated that many vehicles did this. Some road users called the signaller from the phone at the crossing, but he was not legally allowed to authorise them to pass the wig-wags because they are road traffic signs.

Previous occurrences of a similar character

- 93 A passenger train struck a tractor and trailer on White House Farm UWC near Kings Lynn on 25 September 2011 (RAIB report 06/2012). The crossing was being intensively used at the time during the harvest of sugar beet. The farmer had discussed this with Network Rail's mobile operations manager and they had agreed a modified method of working. However, they did not reach a clear understanding of the method to be used and miscommunication between the signaller and the crossing user led to the collision.
- 94 The RAIB report identified key learning points for the railway industry, but none were directly relevant to this accident.

Summary of conclusions

Immediate cause

- 95 The immediate cause of the accident was that the tractor and trailer crossed the line when the train was approaching (**paragraph 45**).

Causal factors

- 96 The accident occurred due to a combination of the following causal factors:
- a. The system of work in use at the crossing was inherently unsafe (**paragraph 51**). This resulted in:
 - ineffective control of road vehicle movements over the crossing (**paragraph 52**); and
 - use of the crossing without the signaller being contacted (**paragraph 58**).
 - b. The system of work broke down (**paragraph 66**).
- 97 The following underlying management factors were also identified:
- DM Roberts did not establish an effective safe system of work at the crossing (**paragraph 73**).
 - The output of a risk assessment using the ALCRM is based on an estimate of the road traffic, averaged over the whole year. This does not separately identify the risk at times of intensive use, such as at harvest time (**paragraph 76, Recommendation 1**).
 - Network Rail's instructions to authorised users on the safe use of UWCs did not cover periods of intensive use (**paragraph 81, Recommendation 2**).

Additional observations

- 98 The signaller's method of working did not involve asking the crossing attendant to call back to confirm that the crossing was clear after a series of crossings by tractors (**paragraph 85, Recommendation 2**).
- 99 Although not linked to the cause of the accident on 16 July, the RAIB observes that the prolonged closure to road traffic of the nearby Buttington AHB crossing on the A458 road may have led many road users to ignore the wig-wags and barriers (**paragraph 90, Learning point 1**).

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

- 100 Network Rail staff at Machynlleth have defined a method of working for use when a UWC is to be intensively used in their area. They have applied this to a UWC which is being used by civil engineering contractors working at a sewage works and have also written to the authorised user of another UWC which has a history of misuse to ask that it be used.
- 101 The method of working is based on that given in Rule Book module TS9 clause 2.1.2 (paragraph 88), but also requires the crossing user to post an attendant at the crossing to call the signaller for permission to cross. The signaller then gives a call back time by which the attendant must call the signaller to confirm that they are clear of the crossing and the gates have been closed. The signaller applies reminders to the block markers each side of the crossing during the time between granting permission and receiving the call back.

Learning point

102 The RAIB has identified the following key learning point⁶ for the railway industry:

Learning point 1

It is important that infrastructure managers, in conjunction with the police, ensure that, when an automatic crossing is closed across the road for an extended period due to a mishap, suitable measures are promptly taken to manage the traffic, reopen the road and discourage road users from passing the illuminated wig-wags without proper authorisation.

⁶ 'Learning points' are intended to disseminate safety learning that is not covered by a recommendation. They are included in a report when the RAIB wishes to reinforce the importance of compliance with existing safety arrangements (where the RAIB has not identified management issues that justify a recommendation) and the consequences of failing to do so. They also record good practice and actions already taken by industry bodies that may have a wider application.

Recommendations

103 The following recommendations are made⁷:

- 1 *The intent of this recommendation is that main line railway infrastructure managers understand the true risk at times of intensive use of user worked crossings.*

Network Rail and Northern Ireland Railways should review and improve their processes for assessing the risk at user worked crossings so that the increased risk during periods of intensive use (eg during harvest) is properly taken into account.

This recommendation may also be applicable to other infrastructure managers.

- 2 *The intent of this recommendation is to reduce the risk at user worked crossings during periods of intensive use.*

Network Rail and Northern Ireland Railways should define one or more safe and practical methods of working that may be adopted at user worked crossings during periods of intensive use; and provide clear information to their staff and authorised users on how and when they should be applied. They should also ensure that any such methods of working are suitably reflected in instructions and training given to railway staff.

This recommendation may also be applicable to other infrastructure managers.

- 3 *The intent of this recommendation is that the revised method of working devised in response to recommendation 2 is included in the level crossing risk management toolkit⁸ as a potential mitigation measure.*

RSSB⁹ should review, and improve where appropriate, measures in the level crossing risk management toolkit that are designed to mitigate the risk at user worked crossings at times of intensive use.

⁷ Those identified in the recommendation, 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, this recommendation is addressed to the Office of Rail Regulation and the Department of Regional Development (NI) to enable them to carry out their duties under regulation 12(2) to:

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

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

⁸ The level crossing risk management toolkit (lxrmtk.com) is an online resource provided by the RSSB to support the level crossing risk assessment process.

⁹ The company is registered as 'Rail Safety and Standards Board' but trades as RSSB.

Appendices

Appendix A - Glossary of abbreviations and acronyms

ALCRM	All level crossings risk model
ERTMS	European Rail Traffic Management System
ORCC	Operations risk control coordinator
UWC	User worked (level) crossing

Appendix B - Glossary of terms

Accommodation crossing	A private railway crossing which is provided to give landowners access between parts of their land which have been split by the railway.
Authorised user	A person who has legal authority to use a user worked crossing.
Block marker	A sign at the side of the track and on the signaller's display on lines equipped with ERTMS which shows the extent of each section of track. The system only allows one train at a time into each section.
Diesel multiple unit	A type of train that is powered by diesel engines and can operate in conjunction with other similar trains
European Rail Traffic Management System, level 2	A European standard system of rail traffic control which involves radio communication between train and signalling centre and does not require line side signals.
Juridical recording unit	A recording device fitted to trains as part of the ERTMS equipment which records information relevant to the operation of the ERTMS.
On train data recorder	A device fitted to the train which records key operational information, such as speed and position of controls.
User worked crossing	A type of level crossing where the gates are opened and closed by the user. Includes accommodation crossing.
Wig-wag	The flashing red lamps fitted at level crossings requiring road traffic to stop.

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