RAIB
Rail Accident Investigation Branch

Rail Accident Report

Fatal accident at Wraysholme crossing, Flookburgh, Cumbria 3 November 2008

Department for Transport

Report 26/2009
October 2009

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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Contents

Preface

1 The sole purpose of a Rail Accident Investigation Branch (RAIB) investigation is to prevent future accidents and incidents and improve railway safety.

2 The RAIB does not establish blame, liability or carry out prosecutions.

Key definitions

3 Unless otherwise stated, in this report:

a. orientations relate to the direction of travel of the car and train at the time of the accident; and

b. road features, for example warning signs and road traffic signals, are those on the south of the crossing, the direction from which the car approached at the time of the accident.

Summary of the report

Key facts about the accident

4 At 12:30 hrs on Monday 3 November 2008, the 09:27 hrs service from Carlisle to Lancaster struck a car on Wraysholme level crossing, Flookburgh, Cumbria (Figure 1). The car driver was fatally injured.

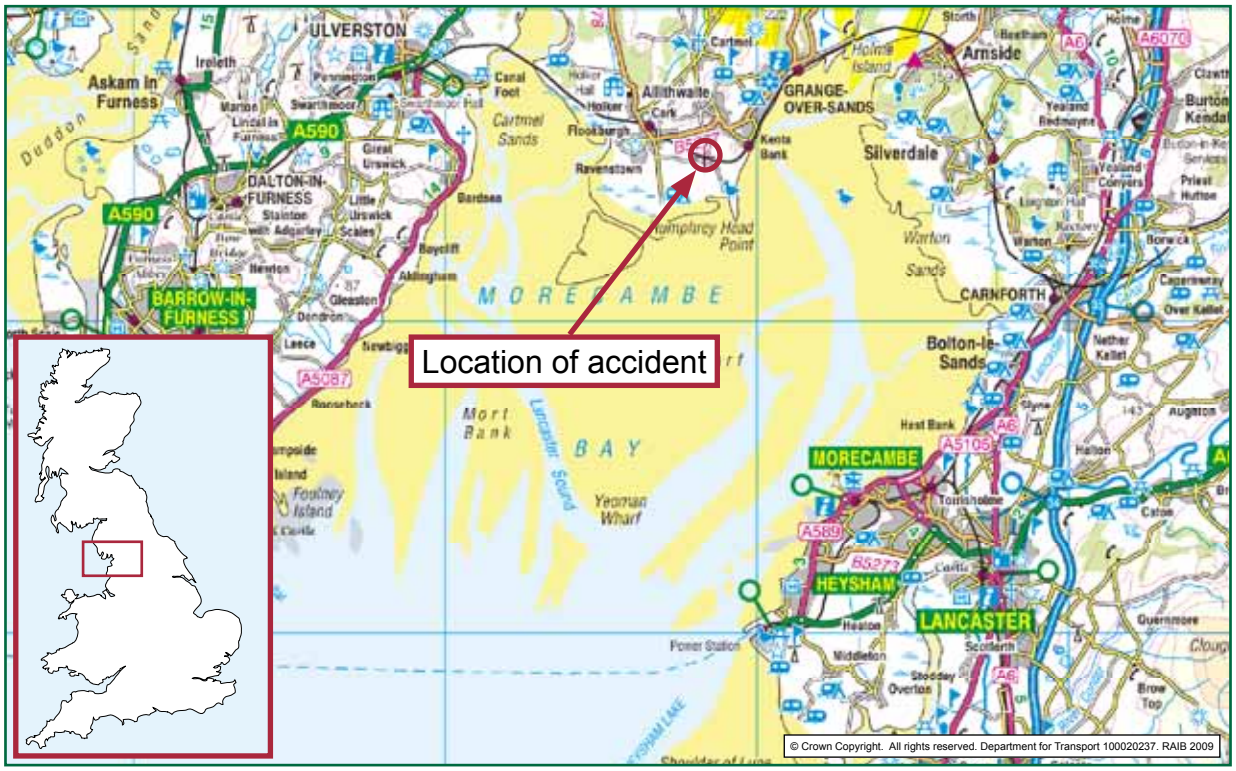

Figure 1: Extract from Ordnance Survey map showing location of accident

Immediate cause, causal and underlying factors

5 The immediate cause of the accident was that the car was driven onto the track as the train approached the crossing.

6 Possible causal factors were that the car driver:

a. did not see the red lights show; or

b. did not understand their instruction to stop; or

c. ignored their instruction.

7 An underlying factor was that Network Rail and its predecessors had not upgraded Wraysholme to comply with level crossing requirements and recommendations.

Severity of consequences

8 Following the accident, Network Rail twice made an emergency broadcast to all trains in the area instructing them to stop. A train approaching the accident on the other track did not receive the emergency broadcasts. The severity of consequences of this accident may have been different had the driver of the approaching train not seen the obstruction or the warning from the other train's driver in sufficient time to stop.

9 Fatalities and serious injuries arising from level crossing collisions are few where trains travel slowly but increase significantly with train speed. The severity of consequences of this accident may have been different had the train crossing speed been lower.

Recommendations

10 Recommendations can be found in paragraph 152 and relate to the following areas:

a. improving automatic level crossings which have road traffic signals that are difficult to discern;

b. ensuring that Network Rail complies with industry standards, recommendations and its own processes and procedures;

c. removing the 'STOP' road markings on the north and south approaches to Wraysholme crossing;

d. replacing the 'ANOTHER TRAIN COMING' signal at Wraysholme crossing with an improved signal or other method to better inform road users; and

e. revising Office of Rail Regulation guidance for automatic open locally monitored crossings or AOCLs[1].

[1] AOCL: Approaching trains **automatically** start the signal sequence to stop road traffic and audible warning devices to sound. The crossing is **open** to road and rail as its approaches have neither gates nor barriers. Train drivers monitor the **crossing locally** and stop short of it unless they see that (i) the crossing is clear and (ii) the signal shows a flashing white light, indicating that the crossing equipment is functioning correctly.

The accident

Summary of the accident

11 At 12:30 hrs on Monday 3 November 2008, the 09:27 hrs service from Carlisle to Lancaster struck a northbound car on Wraysholme crossing, Flookburgh, Cumbria (Figure 2). The car driver was fatally injured.

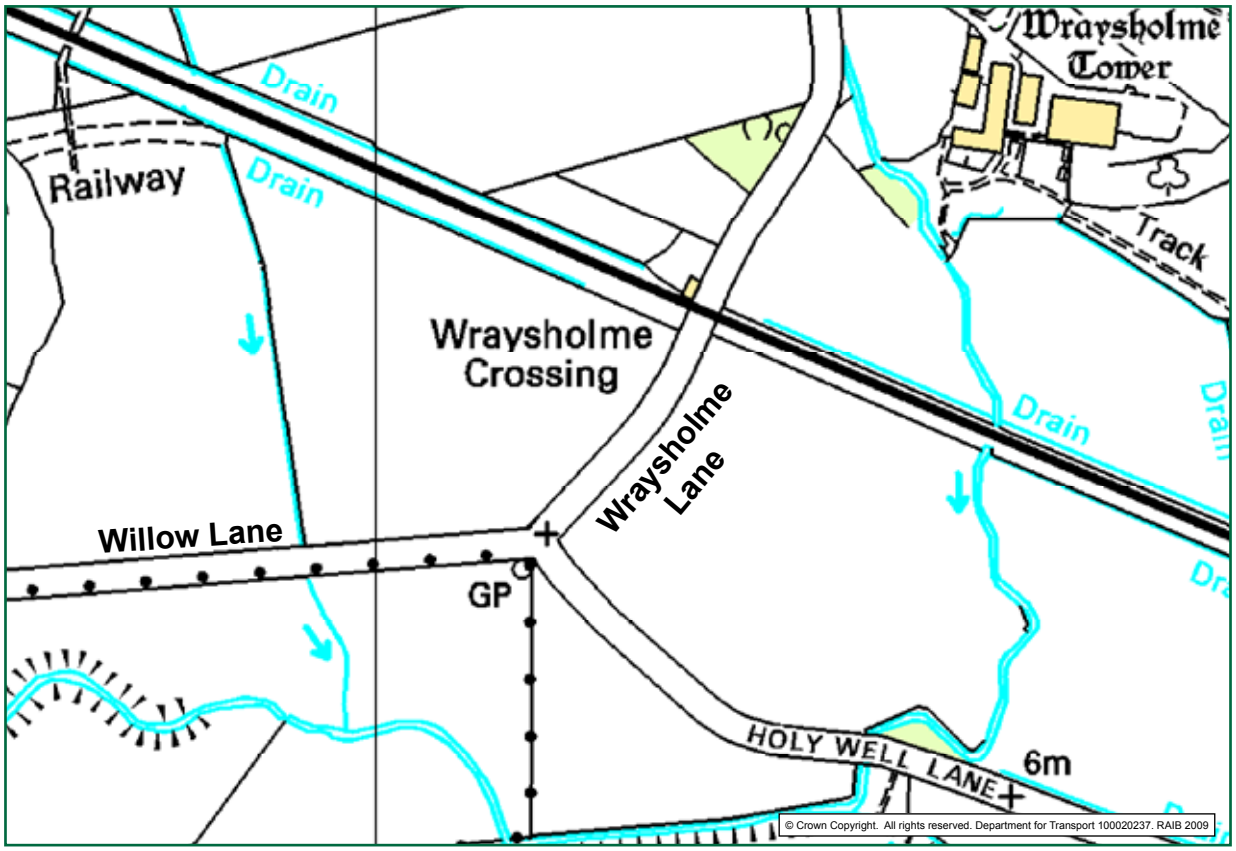

Figure 2: Map showing the layout of the road and railway

The parties involved

12 The car driver, 41 year-old Jonathon Crabtree, was employed at a nearby leisure park.

13 Northern Rail was the operator of the train, the employer of the train driver and the employer of the conductor.

14 Network Rail is the infrastructure manager, the controller of the track on which the accident occurred and the operator of the crossing.

15 Cumbria County Council is the authority responsible for Wraysholme Lane. The maintenance and management of the road is undertaken by Cumbria Highways, a partnership between Cumbria County Council, Capita Symonds and Amey.

16 Cumbria Constabulary, British Transport Police and the Office of Rail Regulation attended the scene of the accident; they, Northern Rail, Network Rail and Cumbria Highways co-operated freely with the RAIB during this investigation.

Location

17 Wraysholme Lane in Flookburgh, Cumbria, crosses the railway tracks between Kent's Bank station and Cark and Cartmel station. Wraysholme crossing is an automatic open locally monitored crossing; it is referred to from this point as 'the crossing'.

18 The railway at this location is double track: the track on which trains normally travel east towards Lancaster is the 'up' line; the track on which trains normally travel west towards Carlisle is the 'down' line (Figure 3). The maximum speed over the crossing is 50 mph (80 km/h) for passenger trains and 30 mph (48 km/h) for freight trains.

19 At the time of the accident, up to 45 trains passed the crossing each day. They consisted of 40 passenger trains, two empty passenger trains that were not in service and two freight trains, with a path provided for a third freight train that ran irregularly.

20 Wraysholme Lane is a single carriageway country road on which the national speed limit applies. For cars this is a maximum of 60 mph (97 km/h), although approaching the crossing at this speed in a northbound direction would not be safe because the lane is narrow and has the following features:

a. an unmarked junction with Willow Lane and Holy Well Lane;

b. a left-hand bend where drivers may encounter other road users;

c. a steep gradient up to the level crossing and a concealed dip beyond; and

d. signs warning of the level crossing.

21 In 1981 British Rail designed Wraysholme crossing in accordance with the 1981 Requirements for Level Crossings[2] for a road on which 85% of traffic approached at 30 mph (48 km/h) or slower. The crossing was installed to comply with the requirements of its level crossing order which mandates its provision and method of operation. Wraysholme crossing was one of the first automatic open locally monitored crossings to span two running lines.

22 Advance warning signs on the road indicate the presence of the crossing and read 'STOP when lights show'. At the crossing, signs read 'KEEP CROSSING CLEAR' and 'ANOTHER TRAIN COMING if lights continue to show'. A solid white stop line and the 'STOP' road marking are painted on the road adjacent to the crossing (Figure 3).

23 Also at the crossing are audible warning devices for pedestrians and road traffic signals known as 'wig wags' (Figure 4). This report refers to the road traffic lights as 'signals' from this point. While the audible warning is provided for pedestrians, it may also be heard by other crossing users.

[2] Department of Transport Requirements for Construction and Operation of Level Crossings ISBN 0 11 550540 7.

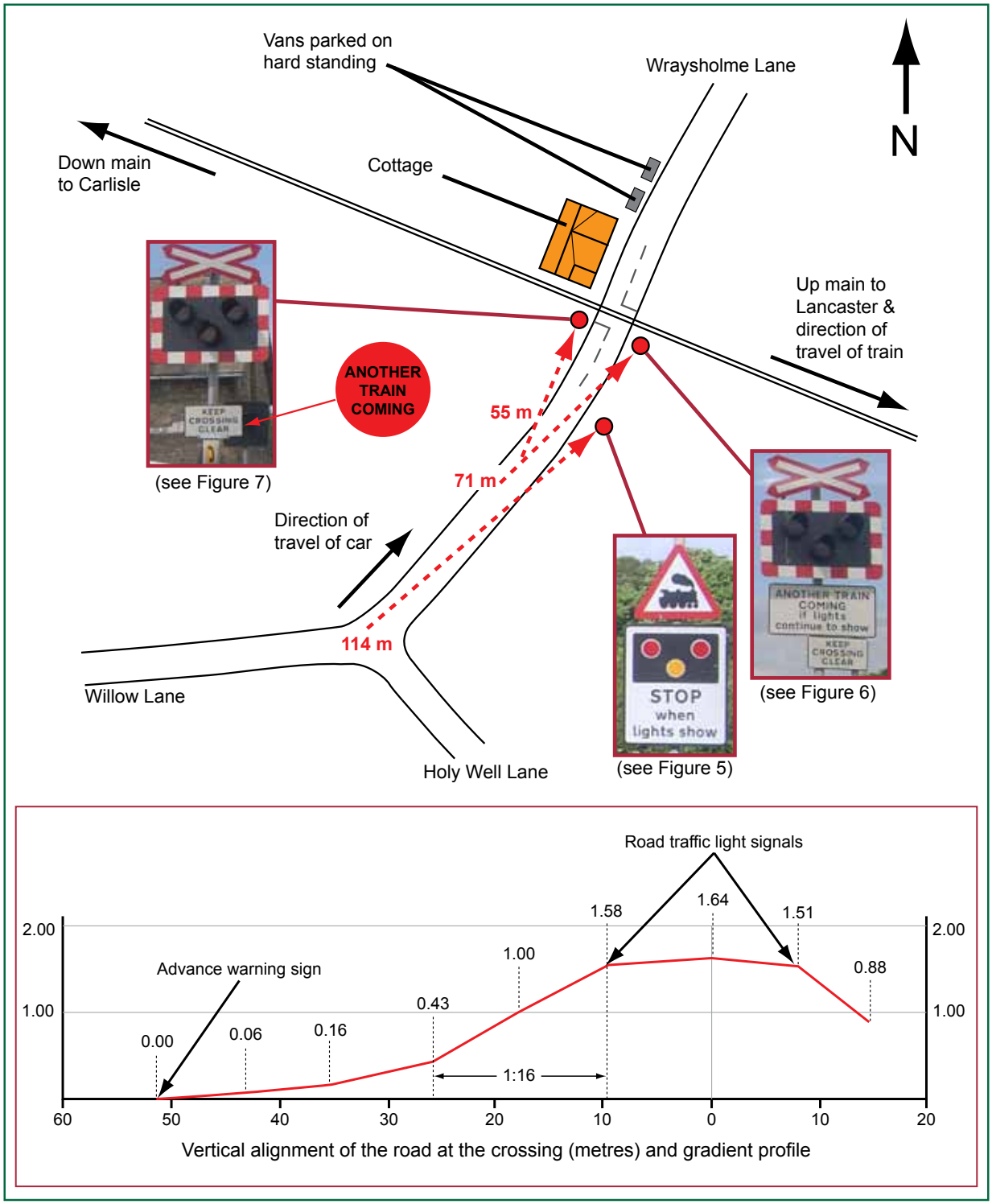

Figure 3: The crossing, its warning signs and road traffic signals

Flashing red lights

Alternately flashing red lights mean
YOU MUST STOP

At level crossings, lifting bridges, airfields, fire stations, etc.

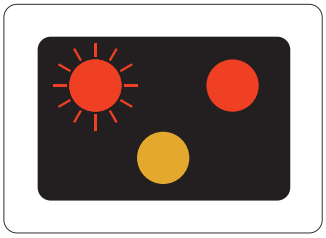

Figure 4: Signal details extracted from the Highway Code

24 Wraysholme level crossing operates as follows:

a. approaching trains automatically operate the crossing equipment and train drivers control the speed of their trains to comply with that shown on the speed restriction board as they pass it;

b. train drivers confirm the crossing is clear and the white railway signal light is flashing to indicate that the crossing functions correctly; if either condition is not met, they must stop before they reach the crossing;

c. the road traffic signals each show a steady amber light for 3 seconds which then goes out, after which two red lights flash alternately;

d. when the red lights show, their meaning is for all users to stop and not pass under any circumstances;

e. the road traffic signals show for no less than 27 seconds for a passenger train travelling at 50 mph (80 km/h) and no less than 52 seconds for a freight train travelling at 30 mph (48 km/h);

f. while the lights show, an audible tone sounds to warn pedestrians;

g. after a train passes the lights go out, the audible warning stops and road users may again cross the railway; unless

h. another train has operated the crossing equipment again, in which case the red lights continue to show, the audible warning changes tone and an additional road traffic signal shows, stating the words 'ANOTHER TRAIN COMING'.

25 Apart from fitting the road signal backing boards with red and white borders to improve visibility in 1993, Network Rail and its predecessors maintained, repaired and operated Wraysholme crossing to its original design.

External circumstances

26 The accident occurred on a bright, sunny day; the road and railway were dry, uncontaminated and free of ice or frost.

The train

27 Passenger train reporting number 2C34, the 09:27 hrs service from Carlisle to Lancaster, was operated by diesel multiple unit number 156 448. At the time of the accident, it was travelling eastbound over the crossing at 49 mph (79 km/h) and had 32 passengers, the train driver and the conductor onboard.

Events preceding the accident

28 The car driver spent the morning of the accident at his place of work, 1 mile (1.6 km) south of Flookburgh. He planned to visit Grange-over-Sands, 5 miles (8 km) away, before driving back to start his afternoon shift at 13:00 hrs.

29 The train driver reported for duty at Northern Rail's Barrow-in-Furness depot at 05:15 hrs. His journey from Carlisle had been uneventful prior to the accident.

Events during the accident

30 As the train driver approached the crossing, he slowed the train to 49 mph (79 km/h), observed that the crossing was clear and the white light was flashing, and continued towards the crossing at this speed.

31 At 12:30 hrs, two men were sitting in separate vans parked on hard standing to the north of the crossing; both vans were facing south (Figure 3). The occupant of the van nearest the crossing stated that he saw the red lights show and heard the audible warning on his side of the crossing. Five to ten seconds later he saw a car on the road on the far side of the crossing, coming towards him at what he described as 'normal speed'. He observed that the car did not stop or slow as it drove along the road and onto the crossing. Figures 5, 6 and 7 show the car driver's approach to the crossing.

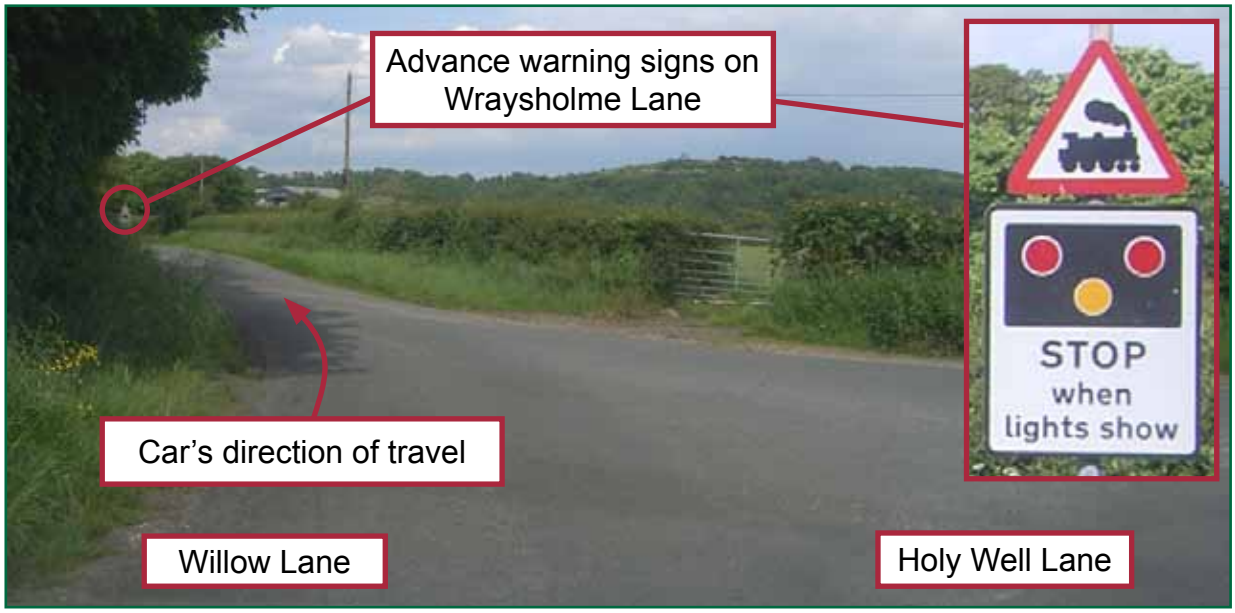

Figure 5: The advance warning sign

Figure 6: The right-hand signal

Figure 7: The left-hand signal

32 Having already established that the crossing was clear and functioning correctly, the train driver was not required to observe traffic approaching the crossing. In any case, his visibility of the crossing's approaches was limited by track and roadside vegetation, the low level of the road compared with the railway and the cab gangway (Figure 8). He stated that he did not see the car as it approached the crossing from his right and was not aware that it was on the crossing until he heard and felt the impact.

33 The collision with the car damaged the train's braking system and caused some of its electrical systems to fail temporarily. Because of this, the train's brakes applied automatically, bringing the train to a stand 261 metres from the crossing.

34 The driver looked out of his right-hand side window, saw the car trapped beneath the train and obstructing the other track, then used the cab radio to call Network Rail and report the accident. On the train driver's instructions, the conductor called the emergency services using his mobile phone. After speaking with the train driver, Network Rail twice made an emergency broadcast to all trains in the area instructing them to stop. The train driver stated that he heard these broadcasts over his cab radio.

35 The driver got down from his train to check on the occupant of the car and while doing so a member of the public alerted him to the approach of a train on the other track. The train driver ran toward this oncoming train waving a red flag to instruct it to stop. The driver of the approaching train, Serco test train 4Q08, stated that he had not received the emergency broadcasts but had seen the obstruction and the other train driver waving a red flag; he made a normal brake application and brought his train to a stand 300 yards (274 metres) from the obstruction.

Consequences of the accident

36 The car driver suffered immediately fatal injuries and his car sustained damage to its front left-hand side. The driver's two dogs were travelling in the car's boot at the time of the accident and survived the collision. The train sustained damage to its bodyside and obstacle deflector (Figure 8).

Figure 8: The train and its leading cab

Events following the accident

37 Service on the line resumed at 21:25 hours.

The investigation

Investigation process and sources of evidence

38 The investigation process focused on the following areas:

a. the condition of Wraysholme level crossing at the time of the accident, including its road traffic signals and layout;

b. the testing, inspection, risk assessment and maintenance of the crossing;

c. the human, vehicle and environmental issues relating to the car and the car driver;

d. the condition and operation of the train prior to and during the accident;

e. the operation of the train that approached immediately after the accident.

39 Sources of evidence included:

a. an examination of Wraysholme crossing, the car and the train involved in the accident;

b. witness statements;

c. train data recorder downloads;

d. signal box records and voice recordings;

e. meteorological reports;

f. Network Rail's level crossing file;

g. level crossing maintenance, inspection and risk assessment records and their associated standards and procedures;

h. a human factors study;

i. road traffic signal optical performance tests;

j. the Cumbria Constabulary collision investigation report, including the examination report on the car involved in the accident; and

k. reports of previous incidents and accidents at Wraysholme and similar crossings.

Key information

Railway fatalities involving members of the public

40 In 2008 there were fourteen railway fatalities involving members of the public[3], not including those due to trespass or suicide. Eleven fatalities occurred on level crossings and involved one car driver and ten pedestrians. Of the remainder, two fatalities occurred through falls from bridges and one through electrocution.

Level crossings and train accident risk

41 In 2008, there were almost 7000 level crossings of many different types on Network Rail infrastructure, of which 120 were automatic open locally monitored crossings. While collisions between trains and road vehicles on crossings are rare, they account for more than a third of the total train accident risk, with most collisions occurring because of crossing user error[3].

Automatic open crossings – chronology of standards, accident recommendations and research

42 Of the different types of crossing on Network Rail infrastructure, automatic open crossings have been found to have the highest risk per crossing[4]. The following paragraphs explain the industry's knowledge of this type of crossing through a chronology of standards, recommendations and research.

43 1963: automatic open crossings were first introduced onto the infrastructure.

44 1969: British Rail published BR908[5], the specification for filament bulb light units used in road traffic signals at level crossings.

45 26 July 1986: a passenger train struck a van as it drove across Lockington crossing and derailed. Eight train passengers and a passenger in the van lost their lives. The accident report[6] concluded that:

a. there had been comments and complaints about the 'poor output' of the red lights at the crossing;

b. under certain circumstances motorists did not notice the flashing red traffic light signals or they did not understand the message given by them; and

c. some form of barrier should be provided at the crossing.

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[3] Rail Safety and Standards Board, 2008 Annual Safety Performance Report.

[4] Rail Safety and Standards Board, Road-Rail Interface Safety Performance Report, January 2008.

[5] BR908 (provisional 1969): Light Unit for use in Level Crossing Road Traffic Signals.

[6] Department of Transport: Report on the Collision and Derailment at Lockington Level Crossing. HMSO 1987. ISBN 0 11 550832 5.

46 1987: the Department of Transport published the Stott report[7], a review of safety at automatic open level crossings. The report concluded that:

a. collisions between road vehicles and trains were at least 20 times more likely at automatic open crossings than they were at half barrier crossings for the same traffic loading;

b. road casualties were six times greater than rail casualties in collisions at crossings;

c. fatalities were few where trains travelled slowly but they increased significantly with train speed;

d. the light output of level crossing signals was only half that of conventional road traffic signals and was susceptible to the 'sun phantom' effect[8]; and

e. in some instances, drivers had not understood the message of the warning systems.

47 The report recommended that British Rail should modify its higher risk automatic open crossings, either by conversion to half barrier crossings or by reducing the speed at which trains pass to reduce the consequences, but not the likelihood, of collisions.

48 The report also recommended that there should be an increase in the size and conspicuity of the road traffic signal's backboard and an investigation into improving the performance of its optical system.

49 1991: British Rail revised BR908 and published it as a specification for light units with 50 Watt quartz halogen bulbs, which have an optical performance identical to that of the regular road traffic signals of the time.

50 1992: British Rail published STDG 025, design guidlines for quartz halogen level crossing road traffic signals. It stated that automatic open locally monitored level crossings that are to remain in use shall have road signals retrospectively fitted with 50 Watt quartz halogen light units.

51 The Rail Safety and Standards Board manages standards and leads development of long-term strategy for the industry; it and its predecessors have published many documents on the subject of automatic open crossings, including those described in paragraphs 52 - 54 and 58.

52 October 2002: Railway Group Standard GI/RT7011[9] was published following the accident at Blaxhall[10] and required the upgrading of all automatic open crossings to a safer type by February 2013; the strategy for this work was to be in place by February 2004.

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[7] P F Stott: Automatic Open Level Crossings - A Review of Safety. HMSO 1987. ISBN 0 11 5508317.

[8] The reflection of sunlight back through a lens. It may give the impression that a light is showing or reduce a viewer's ability to discern it flashing.

[9] GI/RT7011: Provision, Risk Assessment and Review of Level Crossings.

[10] A passenger train stuck a lorry at Blaxhall on 14 April 2002 and derailed; ten passengers and two train crew were injured. The inquiry recommendations included that Railtrack should seek ways of reducing the cost of converting from open to barrier crossings and produce, by means of cost benefit analyses, a prioritised list of crossings for conversion.

53 January 2004: Road Vehicle Level Crossings, a Special Topic Report, concluded that automatic open crossings had the highest level of risk of all crossings; it supported GI/RT7011's requirement for their upgrading or removal by 2013 and stated that in the meantime, consideration be given to interim risk reduction measures such as better signage, rumble strips etc.

54 August 2004: Railway Group Standard GI/RT7012[11] stated that substantial crossing renewal provides a reasonable opportunity to improve the safety performance of crossings.

55 May 2006: Network Rail approved LED (light emitting diode) lamp units for use in road traffic signals at level crossings. The light units comply with European Standard BS EN 12368[12].

56 October 2006: the Rail Safety and Standards Board withdrew GI/RT7011 as part of its strategy for standards management. The strategy expects measures that affect only one entity to transfer to that entity; in the case of GI/RT7011, the measures transferred to Network Rail.

57 December 2006: Network Rail published specification NR/SP/OPS/100[13]. This specification, based on GI/RT7011, permits the continued use of automatic open crossings with no requirement for their upgrading or removal. This specification and Network Rail technical guidance[14] permit the installation of new automatic open crossings, providing they cross only one running line.

58 2009: the Rail Safety and Standards Board's Annual Safety Performance Report for 2008 concluded that automatic open crossings have the highest risk per crossing of all the different types of crossing on Network Rail infrastructure.

Occurrences of a similar character at Wraysholme crossing

59 Tuesday 4 May 2004: there was a near miss at the crossing involving a car. From this date until 2008, there were no reported accidents or incidents. However, during the course of this investigation, a train driver familiar with the route stated that occasionally road users jump the lights.

60 Wednesday 27 February 2008: at 10:22 hrs on a bright, sunny day, a westbound passenger train was travelling at 49 mph (79 km/h) when it struck a northbound car as it drove over the crossing. There were two people in the vehicle, the driver and his passenger; both were employees of a nearby water treatment plant.

61 The train driver stated that he was about 5 yards (4.6 metres) away when he saw the vehicle drive onto the crossing from his left. He applied the emergency brake at the same time as his train struck the vehicle. As a consequence of the accident, the vehicle driver and his passenger sustained serious injuries; the car and the crossing's lineside control cabinets were destroyed.

[11] GI/RT7012: Requirements for Level Crossings.

[12] BS EN 12368: Traffic Control Equipment, Signal Heads, ISBN 0 580 48348 7.

[13] Network Rail: NR/L2/OPS/100 Provision, Risk Assessment and Review of Level Crossings.

[14] Network Rail: Signalling and Operational Telecommunications Design, Technical Guidance. NR/GN/SIG/11600.

62 The car driver stated that he had no recollection of the accident or the events leading up to it. His passenger recalled that the sun was 'blazing' and that only when he was some 10 metres and a second away from the crossing could he just about see the warning lights flashing and did not hear any warning noise.

63 Both the passenger and the driver held provisional driving licences at the time of the accident. The driver's full licence had been revoked following two offences.

64 Friday 17 October 2008: at 14:43 hrs on a bright, sunny day, an eastbound passenger train narrowly missed a car that was travelling southbound over the crossing. The train driver applied the emergency brake immediately he saw the car on his left; the car driver did not stop and was not identified.

65 Friday 5 December 2008: at 13:50 hrs, a westbound passenger train narrowly missed a van that was towing another van northbound over the crossing. The train driver applied the emergency brake immediately he saw the vans on his left.

66 The van driver was an employee of the nearby water treatment plant. He stated that he had seen the red lights flashing but still crossed because he thought the lights had to be a steady red to require road users to stop.

67 Wednesday 16 September 2009: at 08:35 hrs, a Network Rail employee observed a large van that stopped at the road traffic signals as they displayed a steady amber. When the amber light went out and the red lights began to flash, the van drove over the crossing. The driver of the freight train saw the van pass and reported the incident to Network Rail control.

Analysis

Identification of the immediate cause[15]

68 The immediate cause of the accident was that the car was driven onto the track as the train approached the crossing.

Discounted factors

Factors that did not affect the outcome of the accident

69 The following factors (paragraphs 70 - 79) were analysed and found not to have affected the accident; they are discounted for this reason and the report does not consider them in detail.

The train driver, the train and its operation

70 Northern Rail certified that the driver was medically fit and competent for his duties. Immediately after the accident, a member of the Cumbria Constabulary breathalysed him for the presence of alcohol; the test result was negative.

71 The train's data recorder confirmed that the train travelled at 49 mph (79 km/h) as it approached and passed the crossing. The train driver did not sound the warning horn or apply the train brake before impact as he was not aware of the car's presence until after the accident. The train performed satisfactorily before the accident; the following day it was the subject of post incident testing in the presence of the RAIB, with no relevant faults found.

The crossing's operation

72 The witness in the van parked north of the crossing stated that he saw the red lights show on his side of the crossing and heard the audible warning as it sounded. Later in the day of the accident, the crossing was the subject of post incident testing in accordance with Network Rail procedures and in the presence of the RAIB, with no faults found.

Crossing signs

73 Construction and operation requirements required that advance warning signs were placed to the left of the road, no less than 45 metres from the stop line. The signs were placed to the left but, because the bend in the road restricted their visibility, additional signs were placed on the right. The signs remain in these positions, 40 metres from the stop line. If the signs were 45 metres or more from the crossing as required, road users would have more warning of its presence. However, they are well placed for the bend in the road, they first come into view 114 metres away and they provide adequate warning of the crossing.

[15] The condition, event or behaviour that directly resulted in the occurrence.

The audible warning device

74 The audible warning device and the road traffic signals warn pedestrians and road users respectively of a train's approach[16]. In the February 2008 accident, the passenger did not hear the warning as he and the driver approached the crossing (paragraph 62); in the November 2008 accident, the occupant in the parked van did hear the warning as the crossing operated (paragraph 31). It is an additional benefit when road users other than pedestrians hear the audible warning; it is not known whether the car driver heard the warning at the time of the accident.

The car driver's eyesight

75 Drivers must be able to read old and new style number plates at 20.5 and 20 metres respectively, and drivers that require sight correction to achieve this are legally required to wear their glasses or corrective lenses every time they drive.

76 The car driver was required to wear sight correction when driving and wore spectacles made to a recent prescription. After the accident, his spectacles were recovered by the police; they had sustained damage consistent with impact so it is reasonable to conclude that he was wearing his spectacles at the time of the accident and that his eyesight was satisfactory for driving. He was not wearing anything on or around his head that would impair his sight or hearing.

77 The advance signs are visible from 114 metres; however, a driver who could not read them until only 20 metres away still had adequate time to bring his vehicle to a stop before the crossing itself.

The car and its operation

78 The car was the subject of post incident examination by Cumbria Constabulary's collision investigation unit. They found that the braking system was intact and serviceable, and the appearance of its components was consistent with recent use. They concluded that there were no defects, faults or failures that could have had any bearing on the cause of this particular incident and found nothing to suggest that the driver's view from the vehicle had been obscured.

79 The occupant of the parked van saw the car driven at 'normal speed' without stopping or slowing as it drove over the crossing (paragraph 31). The RAIB surveyed the site and found that there were no car tyre skid marks from braking on the road or on the crossing.

Factors of unknown effect on the accident

80 It cannot be established beyond doubt whether some factors did or did not affect the car driver's behaviour at the time of the accident. The report describes these factors of unknown effect in paragraphs 81 and 82, and does not consider them further.

The car driver's competence

81 The driver passed his test in May 1989 and held a full driving licence intermittently from that time until it was revoked in 2005 for a motoring offence committed in 2000; at the time of the accident, he did not hold a driving licence and was therefore not legally entitled to drive.

[16] Office of Rail Regulation Railway Safety Guidance and Principles Part 2 Section E Guidance on Level Crossings.

Distraction

82 The car driver's two dogs were in the boot of the car with no access to the passenger compartment so it is unlikely they were able to distract him. The police searched the car after the accident and found no mobile phone or other similar device; in addition witnesses stated that the car driver did not usually listen to the radio or to music while driving, so it is unlikely he was subject to other distractions.

Identification of causal[17] factors

83 After considering and discounting the factors that related to the operation of the train, the crossing and the car, the remaining possible causal factors for why the car drove onto the track were that the driver:

a. did not see the red lights show; or

b. did not understand the signals' instruction to stop; or

c. ignored the instruction.

The car driver did not see the red lights show

84 Feasible explanations for why the car driver did not see the red lights show include the effects of sunlight, signal misalignment and signal performance. While this report explains the effects separately in paragraphs 85 to 92, they were present at the same time and may collectively have resulted in the car driver not seeing the lights.

Sunlight on the signals

85 When the sun is bright, low in the sky and shining onto a signal, 'phantom' effects[18], washout[19], or reflection off the backboard may impair a person's ability to discern its aspect (Figures 9 and 10). All signals are fitted with hoods to reduce the sun's effects, and signals with an orientation that is susceptible to the sun's effects may be fitted with longer hoods. At the time of the accident, the Wraysholme signals were fitted with standard hoods.

86 The passenger involved in the accident on 27 February 2008 stated that the sun was 'blazing' and that only when he was some 10 metres and a second away from the crossing could he just about see the warning lights flashing. At 10:22 hrs, the time of the accident, the sun was shining on the signals (Figure 11) and was low in the sky at 22 degrees above the horizon.

87 Monday 3 November 2008 was bright and sunny as the car driver travelled northbound toward the crossing. After the accident, a member of the Cumbria Constabulary stated that the sun was low, bright in the sky and shining directly onto the south facing signals (Figures 9 and 11). At 12:30 hrs, the time of the accident, the sun was low in the sky at 20 degrees above the horizon.

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

[18] The reflection of sunlight back through a lens. It may give the impression that a light is showing or reduce a viewer's ability to discern it flashing.

[19] 'Washout' is the reduction in contrast between a light that is showing and one that is not.

Figure 9: Sunlight reflected off the right-hand signal backboard and warning signs (photograph courtesy of Cumbria Constabulary)

The red signal is illuminated **The green arrow is illuminated**

Figure 10: The effect of sunlight on signals (taken from Traffic Control System Design for All Purpose Roads, Department for Transport publication MCH 1969 published December 2003)

Signal light performance

88 At the time of the accident, Wraysholme level crossing had road traffic signals fitted with 36 Watt filament lamps. As part of this investigation, a rail industry optical specialist measured the lamp units' performance and found that they did not comply with their specification, BR908 (provisional 1969); the lamp units produced light that was less bright and of a less deep red colour than required. Comparative tests found that their performance was significantly inferior to that of the 50 Watt quartz halogen and LED light units.

Signal light misalignment

89 British Rail designed the type of signal lamps originally installed at Wraysholme crossing to cast a narrow, intense beam of light. The signal becomes more difficult and finally impossible to discern as the angle between the beam and the road user increases. At 25 degrees from alignment, a lamp's luminous intensity can fall by 98% and still comply with its performance specification.

90 Network Rail specifies the standard alignment of road traffic signals in NR/GN/SIG/19044[20]. The left-hand signal is required to align to a point 1.5 metres above the centre of the road and 100 metres from the stop line; the right-hand signal is required to align to a point 1.5 metres above the centre of the road and 50 metres from the stop line (Figure 11).

91 NR/GN/SIG/19044 states that the Railway Inspectorate (now the Office of Rail Regulation) may alter standard signal alignments at inspection. If this is the case, the ground plan[21] should record the final alignments as a reference for those who subsequently inspect and maintain the signals. While this is stated within the Network Rail standard, the Office of Rail Regulation does not provide criteria for alignment, and considers that ensuring the optimal sighting of signals remains the responsibility of the duty holder (in this case Network Rail).

92 Network Rail could not position the Wraysholme signals to its standard alignment; if it had, the left-hand signal would align behind vegetation in the field to the left of the road because of the bend on Wraysholme Lane (Figures 7 and 11). At the time of the accident, Network Rail had no procedure for optimising signal alignment so it aligned left and right-hand signals at 48 - 50 metres and 22 - 25 metres from the stop line respectively, and did not record their alignments on the ground plan as required.

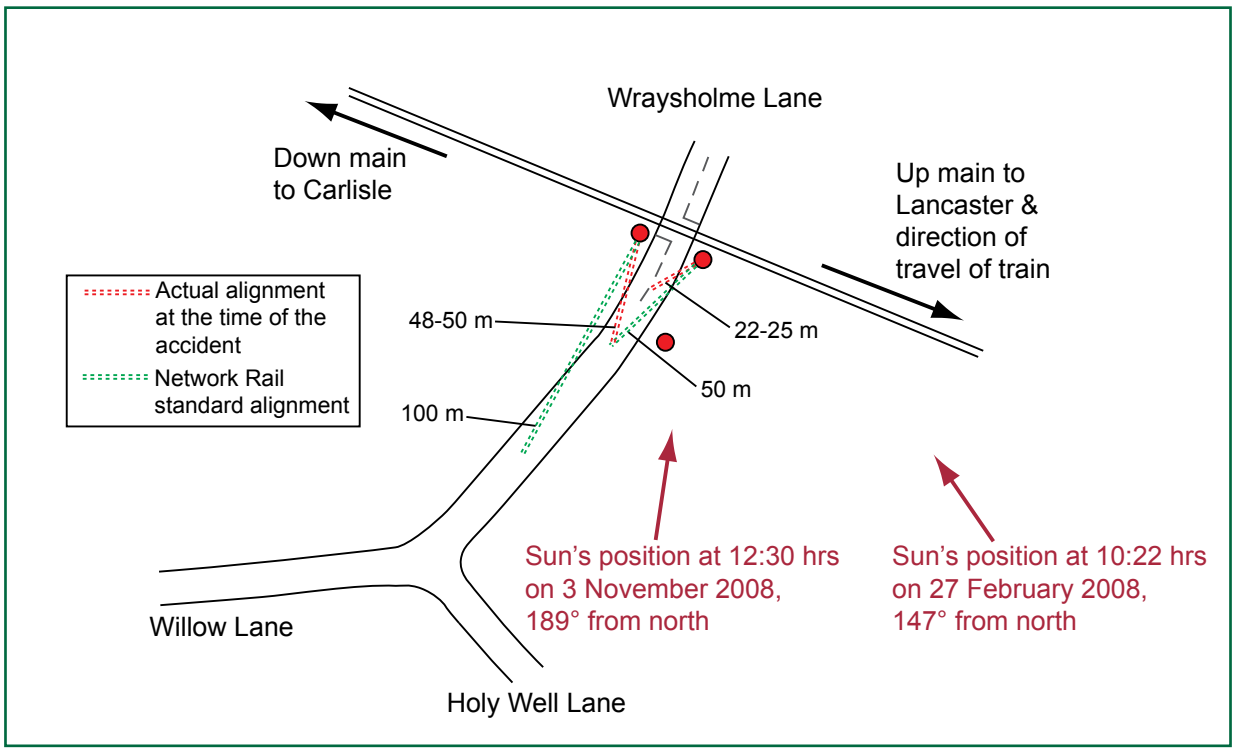


Figure 11: The standard and actual alignment of signals at Wraysholme crossing on 3 November 2008

[20] Network Rail: Signalling Equipment Technical Advice Notice NR/GN/SIG/19044, Level Crossings.

[21] A drawing containing sufficient detail to allow for the installation, testing, commissioning and maintenance of a crossing.

93 Since the accident, Network Rail has issued an instruction on how to align road traffic signals to the point at which they first come into view, allowing road users to see them at the earliest opportunity (paragraph 150).

The driver did not understand the stop instruction

94 A feasible explanation for why the car driver did not understand the stop instruction follows in paragraphs 95 to 98.

95 There are 307 rules in the 2007 edition of the Highway Code[22] and all road vehicle drivers require an understanding of them at the time of their test. Rule 293 describes the type of signal used at Wraysholme crossing. Road users encounter this type of signal far less frequently than other signals such as traffic lights.

96 The report into the accident at Lockington and the Stott report concluded that accidents had occurred because some motorists did not understand the instruction given by the flashing red traffic light signals (paragraphs 45b and 46e). The Stott report also stated that this type of signal was an unfamiliar part of the road scene.

97 The van driver involved in the near miss in December 2008 stated that he had seen the red lights flashing but still crossed because he thought the lights had to be a steady red to require road users to stop. He may have confused their instruction with that given by the flashing aspect of a pelican crossing[23].

98 The van driver involved in the near miss in September 2009 stopped at the road traffic signals as they displayed a steady amber. When the amber light went out and the red lights began to flash, the van drove over the crossing.

The driver ignored the instruction to stop

99 Feasible explanations for why the driver saw the red lights show but ignored the instruction to stop follow in paragraphs 100 to 109.

The car driver's speed and its effect on stopping distance

100 As speed increases, a road user has less time to observe, understand and react to an environment and its signals. As part of this investigation, a road traffic specialist assessed the accident site and concluded that the maximum safe speed limits over Wraysholme Lane were 15 mph (24 km/h) at its junction with Willow Lane, 37 mph (60 km/h) at a distance 50 metres from the crossing and 50 mph (80 km/h) over it. Wraysholme crossing was laid out for a road on which British Rail expected 85% of traffic to travel at 30 mph (48 km/h) or slower. For this speed, the construction and operation requirements recommend a minimum distance of 70 metres for signal visibility; the left and right-hand signals at Wraysholme are visible at 55 metres and 71 metres respectively (Figure 3). Stopping distances in the Highway Code show that a driver can stop in 53 metres from speeds up to and including 50 mph (80 km/h) (Figure 12).

101 These stopping distances are achievable in good conditions; if conditions deteriorate, then drivers should adjust their driving accordingly. Figure 13 summarises the maximum safe speed limits along Wraysholme Lane and the Highway Code stopping distances. For these reasons, the crossing's layout is satisfactory if a road user can discern its signals' aspects at distance.

[22] Department for Transport Driving Standards Agency the Official Highway Code 2007 Edition. ISBN 9780115528149.

[23] A pelican crossing has a flashing amber phase that follows the red stop phase; it instructs drivers to give way to pedestrians or if there are none, then to proceed.

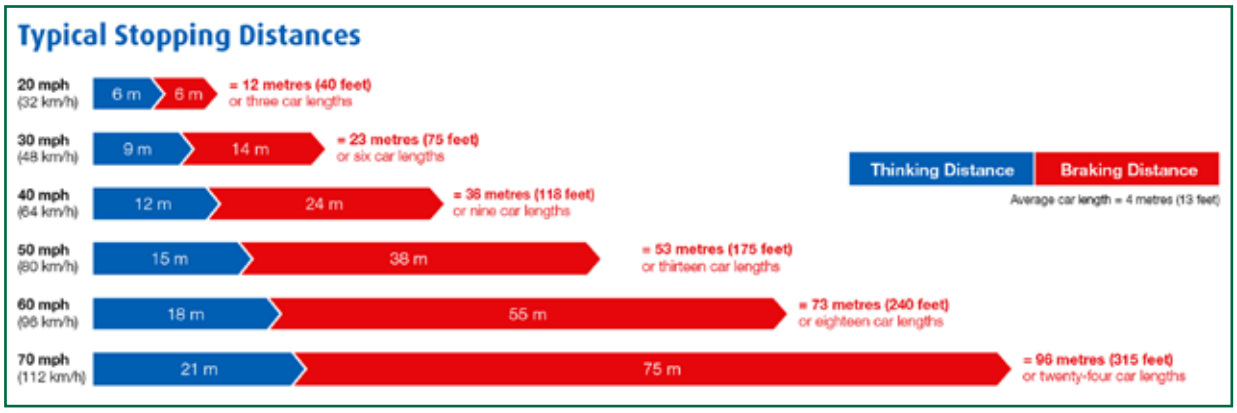
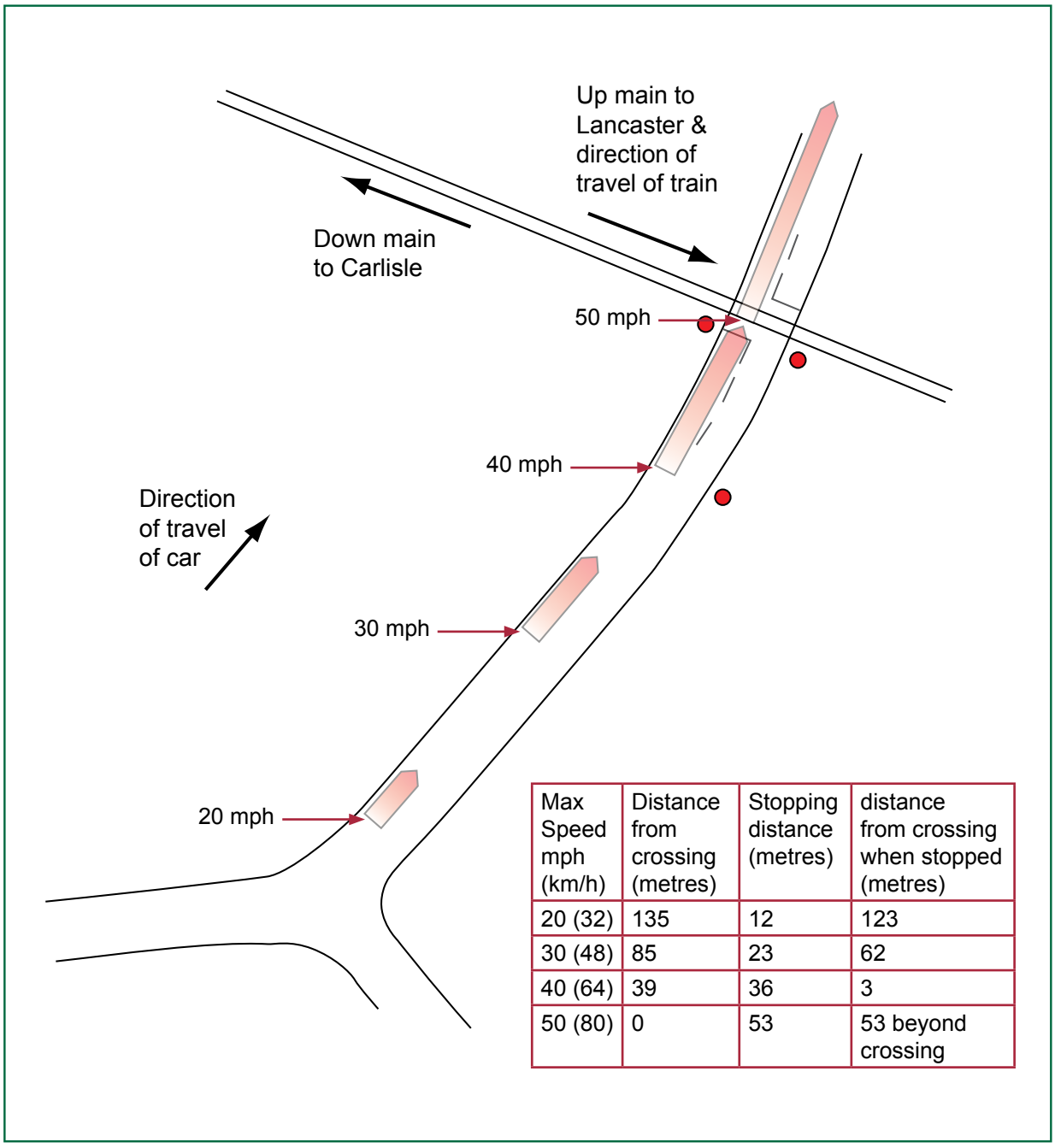


Figure 12: Stopping distances extracted from the Highway Code



Max Speed mph (km/h)	Distance from crossing (metres)	Stopping distance (metres)	distance from crossing when stopped (metres)
20 (32)	135	12	123
30 (48)	85	23	62
40 (64)	39	36	3
50 (80)	0	53	53 beyond crossing

Figure 13: Stopping distances from maximum safe speed on the approach to Wraysholme crossing

102 However, because the signals were affected by substandard brightness, colour, misalignment and sunlight, the car driver may not have discerned them until he was close to the crossing. He may then have ignored them, believing that it was safer to continue in an attempt to clear the crossing rather than to attempt to stop.

The car driver's familiarity with the crossing

103 At the time of the accident up to 45 trains passed Wraysholme crossing each day, activating the signals and audible warning devices for a minimum of 27 seconds each time. A road user driving at very low speed, for example 15 mph (24 km/h) throughout, would see the advance warning signs, its signals, then pass the crossing in 17 seconds; for this reason even regular users are unlikely to see the crossing in operation.

104 People who encounter circumstances they recognise or perform familiar actions, such as using a level crossing, may generalise these circumstances and then miss external cues from their surroundings. Their behaviour can become habitual, resulting in a failure to look for or react to unexpected information, leaving them susceptible to errors of judgement[24]. The drivers involved in the February 2008 accident and the December 2008 near miss were both employees of the nearby water treatment plant; both were familiar with the crossing.

105 The car driver's supervisor at the nearby leisure park stated that the car driver was familiar with the area and with Wraysholme Lane as an alternative route to Grange-over-Sands. He may have used the crossing many times and never encountered a train. At the time of the accident, and with the crossing in operation, he may have made an error of judgement and driven over it as usual without stopping.

The time and day of the week

106 Risk taking behaviour at crossings increases on weekdays, during rush hours and at midday; at weekends, behaviour at crossings improves[25]. Without exception, all the known accidents and near misses at Wraysholme crossing happened on weekdays. The fatal accident happened just after midday on Monday 3 November 2008, a weekday.

The car driver's fitness to drive

107 The post mortem biochemistry report found that the car driver tested negative for commonly abused drugs, but had 65 milligrammes of alcohol in 100 millilitres of blood; this alcohol level is below the UK legal drink drive limit of 80 milligrammes of alcohol in 100 millilitres of blood. It is not known how this level of alcohol affected the driver. The Highway Code states that even below the legal drink drive limit, alcohol reduces driving ability, gives a false sense of confidence, reduces co-ordination, slows down reactions and affects judgement of risk.

[24] Rail Safety and Standards Board Report T335: Development of a Level Crossing Risk Management Toolkit. The toolkit is used by the rail industry to identify human factors by crossing type.

[25] Research accounted for reduced crossing use and frequency of trains at weekends and its effect on lower incident rates. Reduced exposure was not the main factor in the decrease in crossing accidents at weekends.

Time pressure and short cuts

108 Road users who are under pressure to reach their destination at a specific time may increase their risk-taking behaviour and take short cuts, as their mindset is to maintain movement at all costs. The supervisor stated that the car driver was a punctual employee who usually arrived 15 minutes before his shift. At 12:30 hrs, the time of the accident, he was on his way to Grange-over-Sands, a round trip of 10 miles (16 km) from his place of work, before he started his afternoon shift at 13:00 hrs.

109 Allowing for a ten minute stop at Grange-over-Sands the car driver needed to complete his round trip at an average speed of 30 mph (48 km/h) to arrive back at his place of work for 13:00 hrs. It would be difficult to maintain this average speed over the back roads to and from Grange-over-Sands; it would not be possible to complete this journey fast enough to arrive 15 minutes early. For this reason, the car driver was likely to have been under pressure to make it to work on time.

Identification of underlying factors[26]

Compliance with level crossing requirements and recommendations

110 From its construction in 1981 to the accident in November 2008, Network Rail and its predecessors had not upgraded Wraysholme to comply with level crossing requirements and recommendations. Examples are given in paragraphs 111 to 126.

Signal lamp performance

111 The industry has known for many years of the poor performance of signals fitted with 36 Watt filament bulbs. The report into the accident at Lockington acknowledged comments and complaints made about the 'poor output' of the red lights. The Stott report concluded that their light output was only half that of conventional road traffic signals.

112 STDG 025 stated that automatic open locally monitored level crossings that were to remain in use were to have road signals fitted with 50 Watt quartz halogen light units. Upgrading a signal's lamps from 36 Watt filament to 50 Watt quartz halogen bulbs requires replacement of the lamp units and their electrical control equipment. Contrary to STDG 025, the infrastructure controllers did not fully carry out this work; in July 2009, there were 55 automatic open crossings fitted with 36 Watt filament bulb light units. Wraysholme crossing's signals were fitted with 36 Watt filament bulbs at the time of the accident.

Crossing upgrade

113 Stott recommended that British Rail modify its high risk crossings, either by conversion to automatic half barrier crossings, or by reducing train speed. Fifteen years later and following the accident at Blaxhall, GI/RT7011 required the upgrading of all automatic open crossings to a safer type by 2013. When the Rail Safety and Standards Board withdrew this standard in October 2006, Network Rail replaced it with NR/L2/OPS/100. This specification permits the continued use of automatic open crossings if periodic assessments demonstrate their use to be safe, so far as is reasonably practicable. For this reason, Wraysholme crossing and others of this type continue to operate as originally designed.

[26] Any factors associated with the overall management systems, organisational arrangements or the regulatory structure.

114 Group standard GI/RT7012 and NR/L2/OPS/100 state that substantial renewal of a crossing provides an opportunity to improve its safety performance. This opportunity arose when the crossing's lineside control cabinets were destroyed in February 2008 and the crossing was out of use for several weeks. However, Network Rail did not analyse or assess the crossing at this time, but instead made a like-for-like repair to spare the work, delay and risks associated with the design, installation and approval of new equipment and the making of a new level crossing order. For this reason, the crossing reopened in April 2008 and continued to operate as originally designed.

Crossing closure

115 NR/L2/OPS/100 states that Network Rail should pursue a crossing's closure or reduction in status (for example, from a vehicle to a footpath crossing) when the opportunity arises. The opportunity to close the crossing arose after the February 2008 accident. However, Network Rail did not consider closure or reduction in status and so the crossing reopened and continued to operate as originally designed.

Crossing inspection and maintenance

116 Network Rail's records confirmed that it inspected and maintained Wraysholme crossing in accordance with the following schedules:

a. every four weeks in accordance with NR/L2/SIG/19608[27] (the standard requires inspection at seven week intervals or less);

b. every three months in accordance with Network Rail company standard NR/L3/SIG/10663[28] part B; and

c. annually in accordance with NR/L3/SIG/10663 part D.

117 Network Rail is required to check signals at every inspection to ensure that they align with standard requirements or the ground plan (paragraphs 90 and 91); if a signal does not comply with its alignment, the crossing inspector is required to raise the matter as a defect for rectification. In practice the inspectors routinely noted that the left-hand signal was not correctly aligned because of the bend in the road and no further action was taken, as they did not consider misalignment to be a defect. Had the inspector raised the matter as a defect it may not have been satisfactorily rectified, as Network Rail had no procedure for optimising signal alignment at the time of the accident.

118 Network Rail inspected the crossing 30 minutes before the accident; at this time and in accordance with past practice, the inspector noted that the left-hand signal was misaligned due to the bend in the road and did not raise the matter as a defect.

[27] Level Crossing Infrastructure: Maintenance and Inspection.

[28] Signal Maintenance Specifications.

Crossing site visits and risk assessments

119 Network Rail's mobile operations managers[29] make annual site visits to crossings to gather information in accordance with NR/L2/OCS/041[30]. This information includes:

a. its approach and any obstructions to visibility;

b. its orientation, particularly if it lies north-south or east-west which may give rise to problems with the sun;

c. the number of road users and their speed of approach; and

d. the numbers, types and speeds of passing trains.

120 At three-yearly intervals (or more frequently if triggered by a change or event) Network Rail's operations risk control co-ordinators[31] use information gathered from site visits and the All Level Crossing Risk Model to assess crossings. A risk control co-ordinator should reassess a crossing within a month following a near miss or an accident, unless an assessment has been carried out in the preceding three months.

121 The All Level Crossing Risk Model (also known as ALCRM) is Network Rail's means of assessing risk at all its level crossings. It calculates the risk associated with each crossing and gives the result in alphanumeric form: letters 'A' to 'M' describe the risk to an individual using a crossing; numbers '1' to '13' describe the collective risk (the risk to the railway). 'A' and '1' are the highest individual and collective risks respectively.

122 Network Rail currently requires that its operations risk control co-ordinators carry out a site visit and identify risk reduction measures at any crossing that has a collective risk rating from '1' to '3'. In July 2009 there were 787 such crossings on Network Rail infrastructure, 52 of which were automatic open locally monitored level crossings. The operations risk control co-ordinators use their expertise and aids including the level crossing toolkit[32] to identify measures for reducing risks; those that pass cost benefit analysis are selected and a business case made to the Network Rail investment panel. If the panel approves a measure, they implement it and recalculate the crossing risk.

123 Network Rail first used the All Level Crossing Risk Model to assess Wraysholme crossing in September 2007. The site visit information incorrectly stated that sun risk was not an issue and estimated that the approach speed of road traffic was less than 30 mph (48 km/h). Cumbria Highways carried out a round the clock road traffic survey of the crossing from 25 June to 1 July 2009 and found that some road users passed the crossing at higher speeds; some in excess of the road speed limit of 60 mph (97 km/h).

[29] Network Rail's front-line staff who deal with operational matters in a particular area.

[30] Network Rail Operations Manual.

[31] Network Rail staff overseeing the management of level crossings. The job title previously was level crossing risk control co-ordinator.

[32] Rail Safety and Standards Board Report T335: Development of a Level Crossing Risk Management Toolkit. The toolkit is used by the rail industry to identify human factors by crossing type.

124 The crossing ranked C3 and required a risk control co-ordinator to conduct a site visit and identify risk reduction measures. The risk control co-ordinator stated that he carried out the visit but then lost the notes documenting his findings. He also did not update the crossing's risk assessment to show a nil return as required. However, he recalled that he had not identified any options to reduce the crossing risk.

125 Network Rail renewed the crossing following the accident in February 2008 and carried out a site visit in April 2008. The mobile operations manager identified: approach speed of road traffic as less than 30 mph (48 km/h); increased road traffic associated with construction work at the nearby water treatment plant; and sun risk. The Network Rail Operations Manual requires that the Level Crossing Risk Management Toolkit is consulted to identify measures to reduce sun risk; however, this was not done and no action was taken.

126 The risk control co-ordinator used the information from this site visit to carry out a second ALCRM assessment and submitted it for review in July 2008; it was not approved until 31 October 2008 as there were no other risk control co-ordinators to undertake the task earlier. On this occasion, the crossing ranked C2, a higher risk than its previous assessment due to increased road traffic use, which again required a risk control co-ordinator to conduct a site visit to identify options for reducing risk. The site visit had not taken place before the fatal accident on 3 November 2008.

Issue status of documents

127 On 3 November 2008, NR/L2/SIG/19608 issue 3 was in force. However, the inspector who carried out the site visit earlier that day worked to NR/L2/SIG/19608 issue 2, the version he was given when he was trained to carry out site visit duties; he was not aware of issue 3. The issue status of this standard had no relevance to the accident.

Additional observations

When to stop at the crossing

128 In accordance with the Traffic Signs Regulations[33], road users must stop at the solid white line and give way each time they approach a 'STOP' road marking and octagonal 'STOP' sign (Figure 14). There is no octagonal 'STOP' sign at Wraysholme crossing and the 'STOP' road marking is there in error. It contradicts the normal instruction to proceed over the crossing, stopping only when the red lights show, and confuses road users.

129 The RAIB and the Office of Rail Regulation assessed the use of the crossing on several occasions; each time they observed road users who slowed or stopped at the crossing and then crept over it looking out for trains when they were required to proceed. Network Rail observed and recorded the same behaviour at the crossing while conducting site visits.

[33] Traffic Signs Regulations and General Directions 2002. Statutory Instrument 2002 No. 3113. ISBN 0110429427.

Figure 14: Extract from Highway Code

'ANOTHER TRAIN COMING' signal

130 Road users sometimes focus on a train coming from one direction, unaware that another train may come from the opposite direction. After the first train passes, they may proceed into the path of the other train. In this event, the 'ANOTHER TRAIN COMING' signal shows to reinforce the message given by the red lights as they continue to show. At Wraysholme, the south facing 'ANOTHER TRAIN COMING' signal is difficult to discern in bright sunlight. Network Rail has been aware of this matter since early in 2008 but has not yet acted upon it. The performance of this signal had no relevance to the accident.

131 There have been other occasions when Network Rail has identified issues and then not taken action to address them. The RAIB has observed this in its investigation reports into accidents at West Lodge level crossing (report 01/2009) and Moor Lane (report 27/2008)[34].

Severity of consequences

Train speed over Wraysholme crossing

132 The Stott report concluded that fatalities increased significantly with train speed (paragraph 46c) and recommended that the infrastructure controller identified and modified its higher risk open crossings either by conversion to automatic half barrier crossings or by reducing the speed at which trains pass. The infrastructure controller calculates Stott's 'traffic moment' by multiplying the effective number of road users[35] and the number of trains per day; train speeds should be decreased in stages as traffic moments increase.

[34] Available at www.raib.gov.uk

[35] The effective number of road users daily is adjusted from the actual number counted. For low traffic flows accidents are proportional to traffic flow; for higher flows the risk of accidents decreases as traffic ceases to flow continuously. For very low traffic flows, Network Rail carry out the calculation using the actual number of road users per day. For a detailed explanation of the calculation and its derivation, see Automatic open level crossings - A review of safety by Professor P F Stott.

133 Network Rail used information gathered in a November 2008 site visit, with 122 road users and 44 trains, to calculate a traffic moment of 5368 and a train crossing speed of 45 mph (72 km/h). Cumbria Highways carried out a round the clock road traffic survey from 25 June to 1 July 2009; during this time between 142 and 177 road users passed the crossing daily, which results in train crossing speeds of 40 mph (63 km/h) and 35 mph (56 km/h) respectively. Wraysholme crossing's road use peaks during Morecambe Bay's cockle season and when events take place at nearby Cark Airfield; the road use identified here does not consider those peaks and the Network Rail method of calculation is not prescriptive on whether it should use the maximum, average or observed number of road users per day.

134 In the February and November 2008 accidents, both trains were travelling at 49 mph (79 km/h) when they struck road vehicles, resulting in serious injuries to both car occupants and a fatality respectively. The severity of consequences of the accidents may have been different had the train crossing speed been lower.

The emergency broadcast instructing trains to stop

135 The control room's log confirmed that the control room made two emergency broadcasts to trains; due to the design of the system, it could not confirm that trains received them. The driver of test train 4Q08 stated that he did not receive the emergency broadcasts.

136 Visibility was good at the time of the accident. The driver of the test train saw the obstruction, saw the other train driver waving a red flag, made a normal brake application and brought his train to a stand 535 metres from the crossing, adjacent to the crossing's speed restriction board.

137 The severity of consequences of this accident may have been different had the accident occurred in darkness or poor visibility and the driver had not seen the obstruction or the other train driver; missing the broadcasts would then have been a contributory factor.

138 The radio system used for the emergency broadcasts is due to be replaced by the 'global system for mobile communications – railway' (GSM-R) radio system. Scheduled for nationwide completion in 2013, this system will enable the control room to call trains directly.

Conclusions

Immediate cause

139 The immediate cause of the accident was that the car was driven onto the track as the train approached the crossing (paragraph 68).

Causal factors

Possible causal factors were that:

140 The driver did not see the red lights show (paragraph 84 and Recommendation 1). Feasible explanations for this were the effects of sunlight, signal misalignment and signal performance.

141 The driver saw the red lights show, but did not understand the instruction to stop. Feasible explanations for this include the large number of rules within the Highway Code compared with one rule relating to the road traffic signals at level crossings and drivers not understanding these signals (paragraph 94).

142 The driver saw the red lights show, but ignored their instruction to stop. Feasible explanations for this include not discerning the lights until close to the crossing, becoming accustomed to driving over the crossing without stopping, being under the influence of alcohol and being under time pressure (paragraph 99).

Underlying factors

143 An underlying factor was that Network Rail and its predecessors had not upgraded Wraysholme to comply with level crossing requirements and recommendations (paragraph 110 and Recommendation 2).

Additional observations[36]

144 The 'STOP' road marking was incorrectly applied to the road approaching Wraysholme crossing (paragraph 128, Recommendation 3).

145 The south-facing 'ANOTHER TRAIN COMING' signal at Wraysholme crossing is difficult to discern in bright sunlight (paragraph 130, Recommendation 4).

146 In the February and November 2008 accidents, both trains were travelling at 49 mph (79 km/h) when they struck road vehicles, resulting in serious injuries to both car occupants and a fatality respectively. The severity of consequences of the accidents may have been different had the train crossing speed been lower (paragraph 134, Recommendation 5).

[36] 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.

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

147 On 21 November 2008, the Office of Rail Regulation issued an improvement notice for Wraysholme crossing; it required Network Rail to (a) correctly align the wig wag lamps; (b) fit longer hoods; and (c) replace the existing signal lamps with LED (light emitting diode) lamps.

148 On 1 December 2008 Network Rail optimised the alignment of the signals at Wraysholme crossing, on 9 December 2008, it fitted longer hoods and on 18 January 2009, it installed LED light units.

149 On 19 February 2009, the Office of Rail Regulation concluded that Network Rail had complied with the improvement notice.

150 In April 2009, Network Rail published Technical Instruction TI 136 'Alignment of Level Crossing Road Traffic Signals (Wig Wags)'. This instruction requires level crossing inspectors to check that road traffic signals are aligned to the point at which they first come into view, allowing road users to see them at the earliest opportunity. If road traffic signals are not aligned in this way, then they are required to raise a defect for rectification. Network Rail has stated that it intends to place a similar requirement in future issues of signal maintenance and testing procedures.

151 Cumbria Highways removed the 'STOP' road marking from the road approaches adjacent to Wraysholme crossing. However, this action was only partially successful; the 'STOP' road markings remain visible in outline and continue to convey incorrect information to road users.

Recommendations

152 The following safety recommendations are made[37]:

Recommendations to address causal and underlying factors

1 *The intention of this recommendation is to ensure that road users are able to discern the aspects of road traffic signals that protect automatic level crossings in all foreseeable conditions (paragraph 140).*

Network Rail should:

a. revise its method of automatic level crossing inspection and assessment so that it identifies road traffic signals that are difficult to discern because of the effect of sunlight, lamp unit performance and alignment; and

b. draw up and implement a programme to improve the identified crossings, with those presenting the highest risk improved ahead of those of lower risk.

2 *The intention of this recommendation is to ensure that Network Rail complies with industry standards, recommendations and its own processes and procedures for level crossing inspection and assessment, so far as is reasonably practicable (paragraph 143).*

Network Rail should review and revise its management systems to confirm that it carries out its level crossing inspections and assessments correctly and completely. It should pay particular attention to making certain that it:

a. issues its staff with the appropriate versions of the standards, documents and procedures they require;

b. upgrades crossings when required to do so, and considers upgrade or closure when the opportunity arises;

c. identifies high risk crossings where the required site visits have not taken place;

continued

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

Additionally, for the purposes of regulation 12(1) of the Railways (Accident Investigation and Reporting) Regulations 2005, these recommendations are addressed to the Office of Rail Regulation, and in the case of Recommendation 3, to Cumbria County Council, 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 167 to 171) can be found on RAIB's web site at www.raib.gov.uk.

d. carries out the site visits arising from 2(c) to identify and assess measures to reduce risk; and

e. implements those measures that are approved, improving the crossings presenting the highest risk ahead of those of lower risk.

Recommendations to address other matters observed during the investigation

3 *The intention of this recommendation is to provide clear instruction to road users that they should continue normally over Wraysholme crossing, and only stop when the road traffic signals show (paragraph 144).*

Cumbria County Council should have the 'STOP' road markings entirely removed from the road surfaces adjacent to the crossing's north and south approaches.

4 *The intention of this recommendation is to ensure that northbound road users of Wraysholme crossing are made aware of the approach of another train in all foreseeable conditions (paragraph 145).*

Network Rail should replace the south facing 'ANOTHER TRAIN COMING' signal at Wraysholme crossing with an improved signal or other method that is discernible by users in all foreseeable conditions.

5 *The intention of this recommendation is to ensure that train speed is appropriate for foreseeable road vehicle use at automatic open locally monitored level crossings (paragraph 146).*

The Office of Rail Regulation should revise its guidance on automatic open locally monitored level crossings to:

a. recognise that local and seasonal events may result in temporarily increased road vehicle use; and

b. advise on how any such increased road vehicle use should be considered when calculating maximum train speed.

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