RAIB

Rail Accident Investigation Branch

Rail Accident Report

Collision and derailment of a passenger train at North Rode, between Macclesfield and Congleton, 18 December 2008

Department for Transport

Report 33/2009
December 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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The Accident

Summary

1 At 17:58 hrs on 18 December 2008, southbound passenger train reporting number 2K14, the 17:10 hrs service from Manchester Deansgate to Stoke-on-Trent, was running between Macclesfield and Congleton when it struck an unoccupied car that had rolled from a car park down onto the track. The train derailed before braking to a stop (Figure 1).

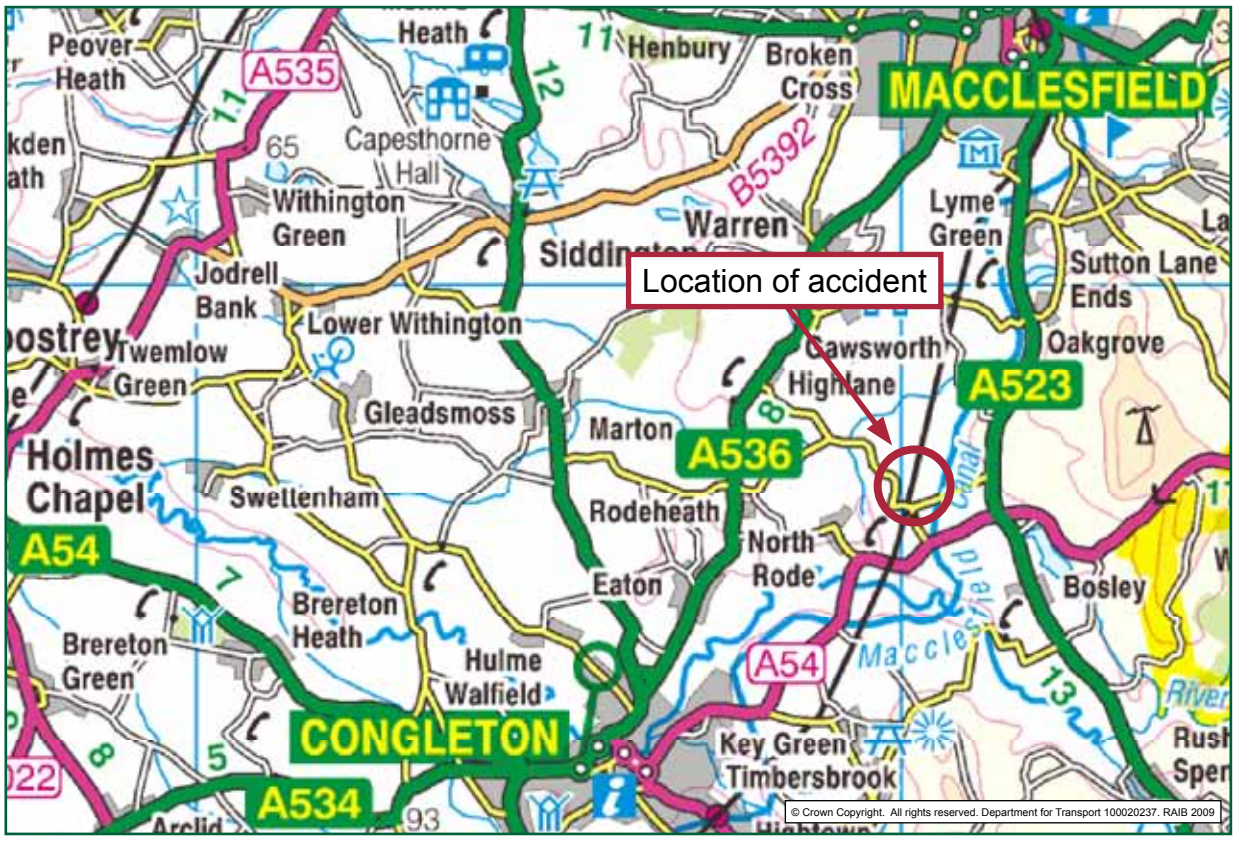


Figure 1: Ordnance Survey map of the location

2 Northbound passenger train reporting number 1M53, the 15:00 hrs service from Bristol Temple Meads to Manchester Piccadilly, passed the stationary train, struck debris from the collision and braked to a stop.

3 The train driver was injured as a consequence of the accident. The infrastructure, the southbound train and the car sustained extensive damage; the northbound train sustained minor damage.

4 In this report, left and right-hand orientations relate to the direction of travel of the trains.

Location of the accident

5 Network Rail is the infrastructure manager and the controller of the track on which the accident occurred.

6 The west coast main line between Macclesfield and Congleton is double track with a maximum speed limit of 125 mph (201 km/h) in both directions. The track on which trains normally travel south towards Congleton is known as the 'up' line; the track on which trains normally travel north towards Macclesfield is known as the 'down' line. At the accident site the railway runs in a cutting.

7 The car park, premises and boundary fence east of the railway belong to UPS, a package delivery company that has occupied the site since 1992 (Figure 2). The access road that leads to the UPS depot belongs to Network Rail and UPS pay Network Rail an annual licence fee for its use (Figure 3).

Figure 2: Aerial view of the accident site (image courtesy of Google Earth)

Figure 3: The UPS site looking south

The trains

8 The southbound train, three-vehicle electric multiple unit number 323231, was operated by Northern Rail.

9 The northbound train, five-vehicle diesel electric multiple unit number 221124, was operated by CrossCountry.

10 At the time of the accident the southbound train was carrying 28 passengers, its driver and conductor; the northbound train was carrying 78 passengers, its driver and two train crew.

Environmental conditions

11 It was raining at the time of the accident, which occurred in darkness. The temperature was well above freezing and the car park was not icy.

Events relating to the accident

12 Closed circuit television camera footage shows a Nissan Terrano four-wheel-drive road vehicle enter the UPS depot car park at 17:53 hrs; the car stopped 20 metres away from and facing the chain-link boundary fence (Figure 4), beyond which is a bank down to the railway. The driver got out of the car, closed the door and the car immediately started to roll forward as he turned to walk towards the UPS office. The car's path across the car park and through the fence is shown in Figure 4.

13 The car passed within a metre of a truck parked to its left, narrowly missed two concrete fence posts, broke through the fence (Figure 5), ran down the bank between two trees (Figure 6) and came to rest over the nearest rail of the southbound track at 17:54 hrs.

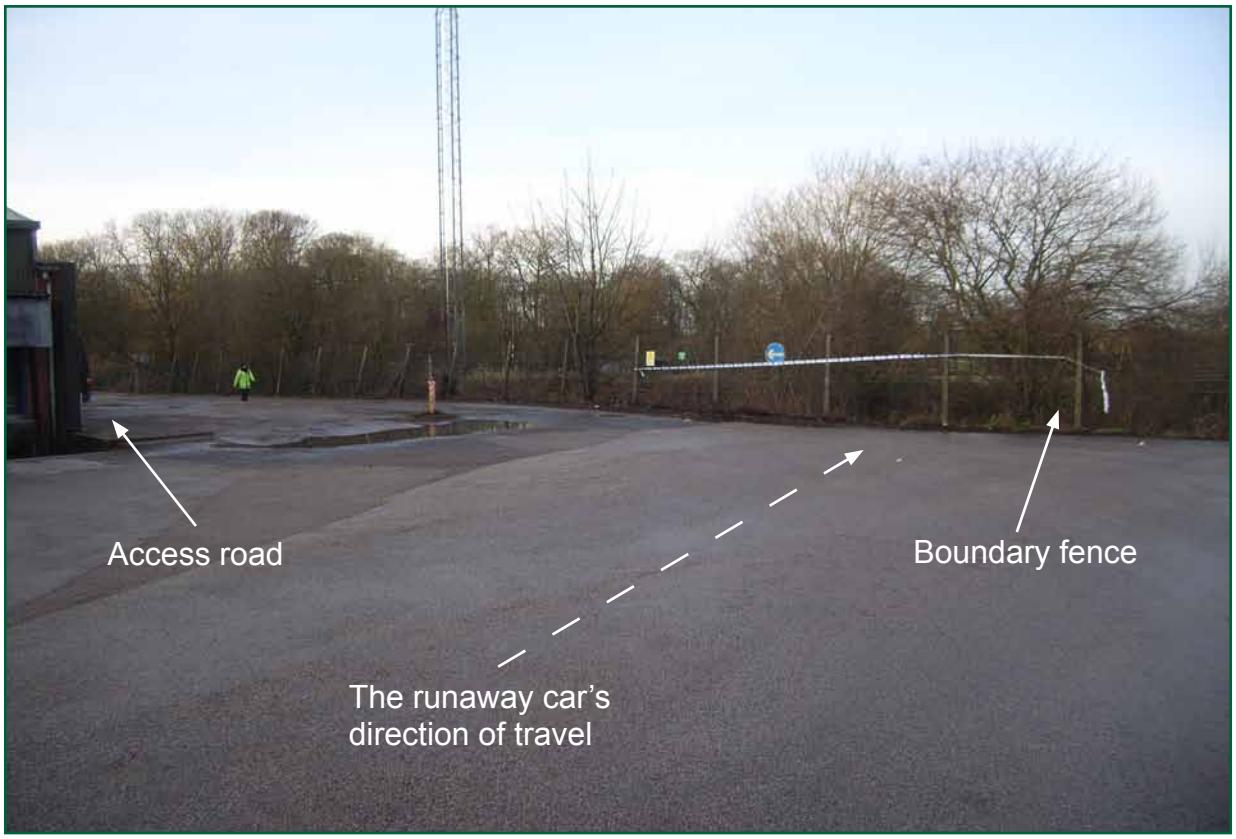


Figure 4: The UPS site looking west towards the railway

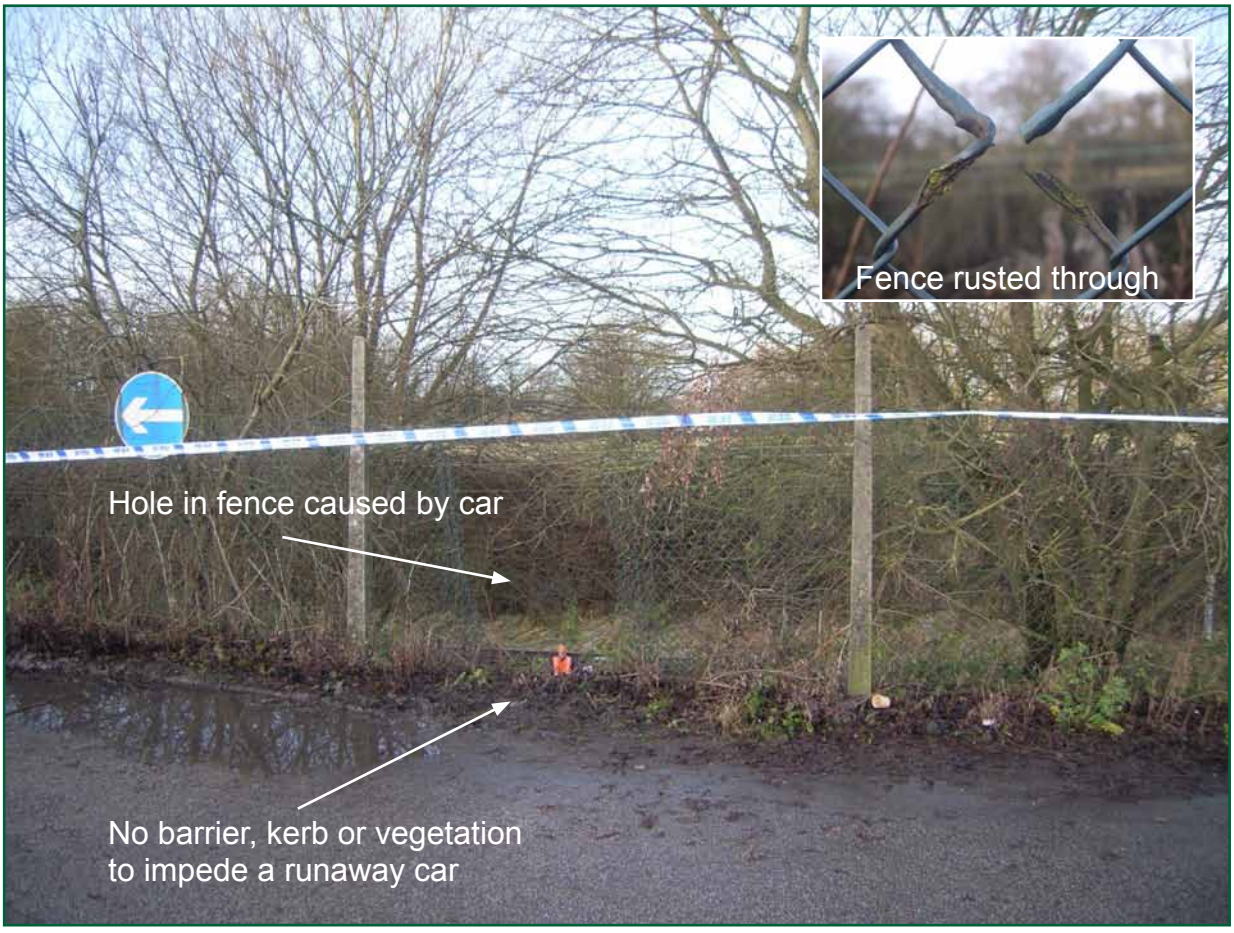


Figure 5: The UPS boundary fence

Figure 6: The UPS site looking east from the railway

14 At this time the southbound train departed Macclesfield station running five minutes late; the northbound train had departed Stoke-on-Trent 30 minutes late and was nearing Congleton. Apart from the delays, both trains' journeys had been uneventful.

15 The car driver returned to the car park and was told what happened by a van driver who had seen the car run away. At 17:56 hrs the car driver went down the bank, started the car and tried to drive it off the tracks while the van driver went to the office to ask a member of staff to call the emergency services.

16 The car driver continued attempting to move his car until, at 17:58 hrs, he saw the headlights of the approaching southbound train; he then abandoned the car, dived onto the bank and heard a very loud bang.

17 The southbound train was travelling at 90 mph (145 km/h) when its driver saw the car on the track immediately ahead of him. The train struck the car and in less than a second pushed it 34 metres into the rubber blocks of an access crossing (used by maintenance vehicles to get onto the railway). The rubber blocks between the rails were 1.8 metres long and weighed 0.241 tonnes (Figure 7).

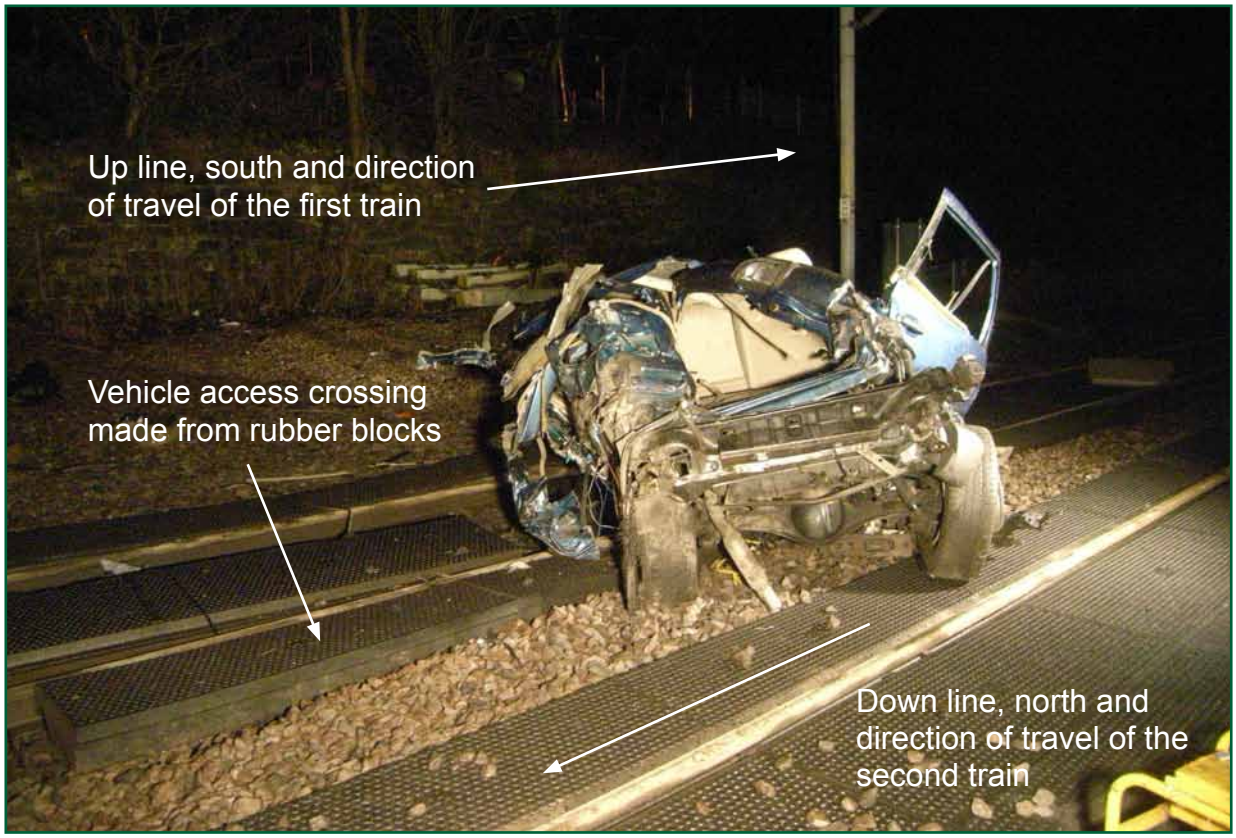


Figure 7: The car on the access crossing

18 The collision happened quickly and the driver did not have time to apply the brake before he felt his train lift as its obstacle deflector and lifeguards crushed the car against the access crossing (Figures 8 and 9). The forces generated during the collision ejected the car to the right (Figure 7), tore four large rubber blocks out of the access crossing and derailed the train's leading four wheels to the left. Damage to the train's braking and electrical systems caused the emergency brake to apply automatically.

Figure 8: Damage to the southbound train caused by striking the car

Figure 9: The leading right-hand wheel, bearing against the left-hand rail (photograph courtesy of British Transport Police)

19 The leading vehicle continued to run derailed, upright, and to the left of the track as it collided with a railway signal (Figure 10) and a footpath handrail that damaged the cab (Figure 11), and tore off its door (Figure 12). The leading two vehicles passed through a road bridge 250 metres from the crossing before coming to a stop 362 metres from where the car had rolled onto the track.

20 The northbound train was travelling at 105 mph (169 km/h) when its driver saw the southbound train to his right with all its lights out and surrounded by a cloud of dust; he applied his train's brake then heard and felt his train striking debris on the track.

21 The train's leading right-hand lifeguard struck one of the large rubber blocks and pushed it along the track until a section of the block was torn off and both parts were ejected to the track side, 88 metres back from the access crossing (Figures 13 and 14). The train came to a stop 714 metres from where the car had entered the railway (Figure 15).

22 The drivers of both trains contacted the signaller to advise of the accident, confirmed that the tracks were blocked to other trains and requested the attendance of the emergency services.

23 The police, paramedics, and the fire and rescue service attended the accident. Passengers were assessed by paramedics while still on the southbound and northbound trains, before being taken to the UPS depot and Macclesfield station respectively to continue their onward journeys.

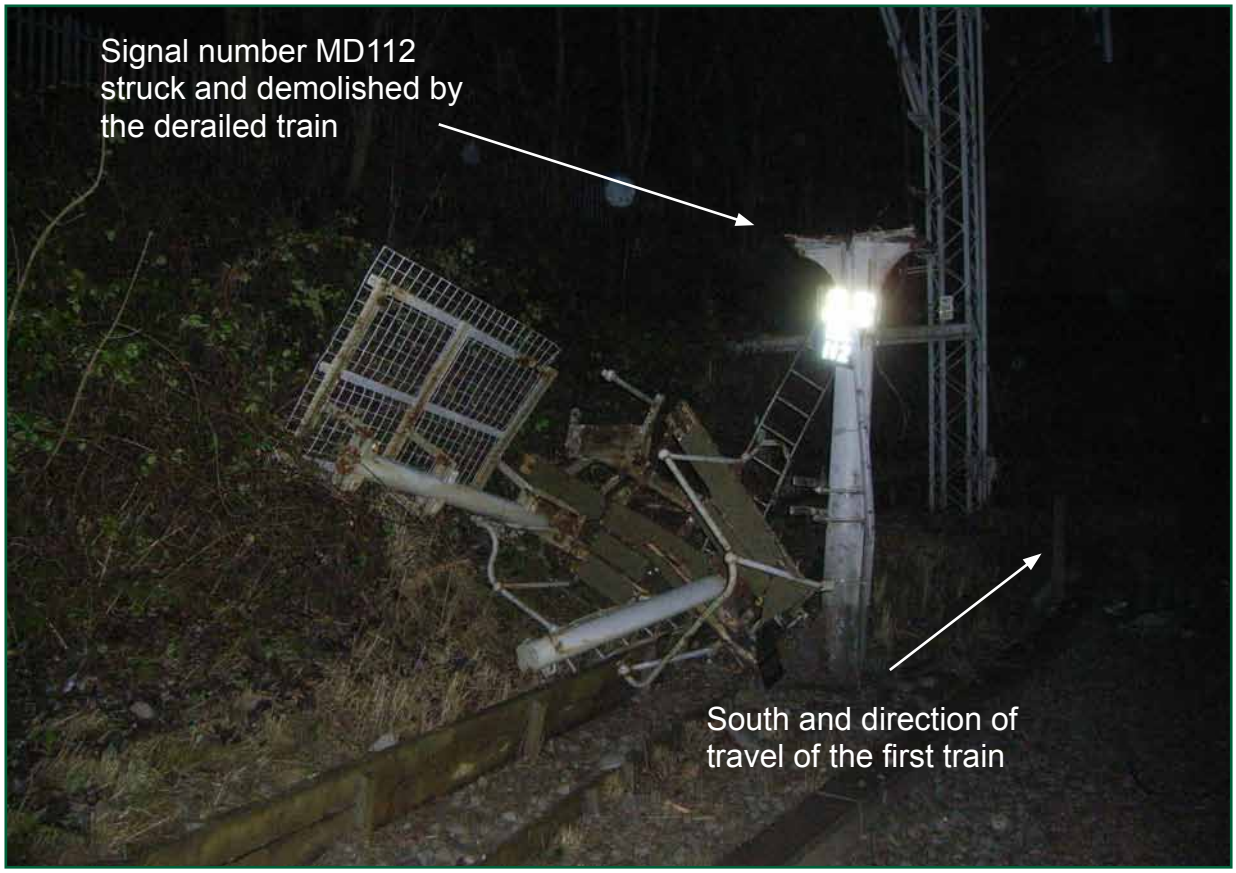


Figure 10: Signal number MD112

Figure 11: The driving cab of the southbound train

Figure 12: Damage to the southbound train

Figure 13: The driving cab of the northbound train and (inset) damage to the right-hand lifeguard

Figure 14: The rubber block damaged by the northbound train (the pieces were placed together for the image)

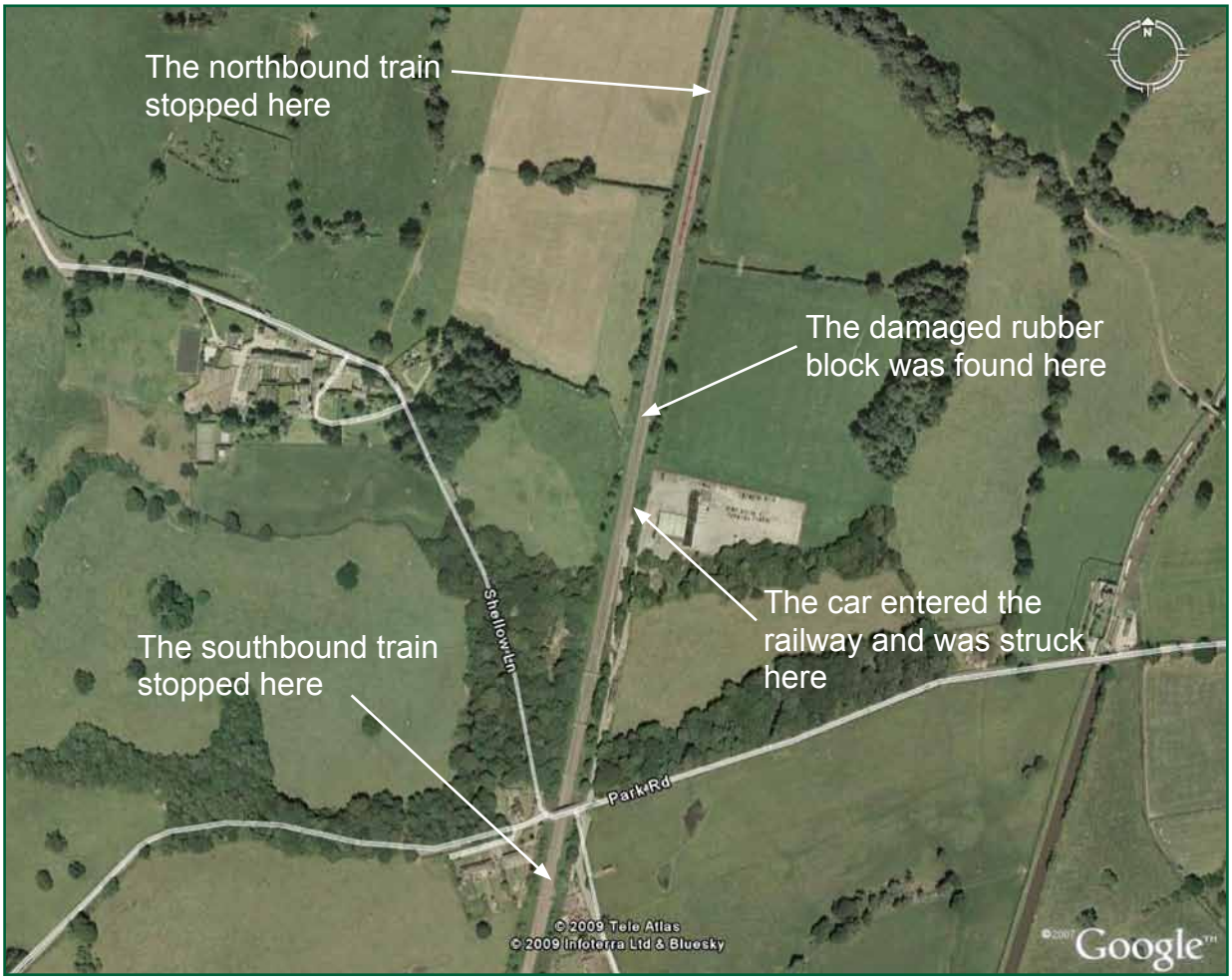


Figure 15: Aerial view of the accident site (image courtesy of Google Earth)

The Investigation

24 During the investigation the RAIB considered the following sources of evidence:

a) a survey of the accident site;

b) UPS car park closed circuit television camera footage;

c) train data recorder downloads;

d) witness statements;

e) the examination report on the car; and

f) records of other accidents and incidents.

Recent occurrences of a similar character

Incursions from public roads

25 The accident at Great Heck in 2001 was not a recent occurrence but was of a similar character and had serious consequences; it is covered separately in paragraphs 32 to 38.

26 Copmanthorpe, Monday 25 September 2006: a driver lost his life after his car went through a boundary fence and onto the railway where it was struck by a train travelling at 100 mph (161 km/h). The train derailed after striking the car. The RAIB investigated this accident (Report 33/2007[1]) and made three Recommendations, none of which would have affected the North Rode collision and derailment.

27 Sylfaen on the Welshpool & Llanfair Light Railway: on Monday 19 October 2009 a car went through a hedgerow and 10 metres down a bank, crossed the track and came to rest in woodland below the railway. On Saturday 19 September 2009 a car towing a loaded trailer went through the same hedgerow and down the bank, coming to rest on the railway below. Another similar accident occurred at Sylfaen on 5 July 2008. No trains were involved in any accident.

28 Broken Cross near Salisbury, Tuesday 22 September 2009: a car ran down a bank and onto the railway. The driver abandoned his car before it was struck by a train (Figure 16). The RAIB conducted a preliminary examination of this accident and did not investigate further, as there were no issues beyond those identified in this report and the report into the collision and derailment at Great Heck in 2001. Another similar accident occurred at Broken Cross in 2003 (Figure 17).

29 Ipswich, Thursday 12 November 2009: a car went through a chain link boundary fence and onto the railway where it struck and derailed a wagon in a passing freight train. There were no injuries as a consequence of this accident; the infrastructure, the wagon and the car sustained damage. The accident was the result of the car not negotiating the sharp bend on the adjacent road.

[1] RAIB reports are available at www.raib.gov.uk

Figure 16: The accident at Broken Cross, near Salisbury, 2009

Figure 17: The accident at Broken Cross, near Salisbury, 2003

Incursions from private land

30 English Welsh & Scottish Railways depot, Toton, Wednesday 18 April 2007: an inadequately braked car rolled away from a car park and onto a goods line. No train was involved in this accident.

31 National Exhibition Centre, Birmingham, Wednesday 21 May 2008: a coach rolled away from a car park and damaged several metres of chain link fencing. No train was involved in this accident.

The accident at Great Heck

32 Wednesday 28 February 2001: a car with a loaded trailer ran off a bridge on the M62 and onto the railway where the car was struck by a southbound passenger train. The train's leading vehicle derailed and ran upright on a straight path until a track feature caused it to diverge into the path of a northbound freight train. Ten people lost their lives and 82 people were taken to hospital, many with serious injuries. The car driver was convicted of causing death by dangerous driving.

33 The Health and Safety Executive's report into the accident made many recommendations, including:

a) improving the collection of data on road vehicle incursions;

b) identifying vulnerable locations on public roads and adjoining private land from where vehicles may gain access to the railway;

c) providing signs at sites identified in (b) that state their location and how to contact the infrastructure controller;

d) determining which sites in (b) present the highest risk; and

e) taking measures to reduce those risks.

34 In February 2003 the Department for Transport published 'Managing the accidental obstruction of the railway by road vehicles'. The report considers sites where public roads and the railway run nearby; it does not consider sites where vehicles may gain access to the railway via adjoining private land.

35 The report addresses some of the Great Heck recommendations for public roads by providing:

a) methods to assess the risk of vehicle incursion and identify high priority sites;

b) a calculation to determine the cost effectiveness of improvements at individual sites; and

c) a protocol for sharing the responsibilities and costs of improvements between rail infrastructure authorities and highway authorities.

36 Infrastructure authorities and highway authorities may use the report's methods to assess the risk of incursions from public roads. The methods consider a range of factors including:

a) the relative level of the railway to its surroundings;

b) the volume, speed and type of rail traffic; and

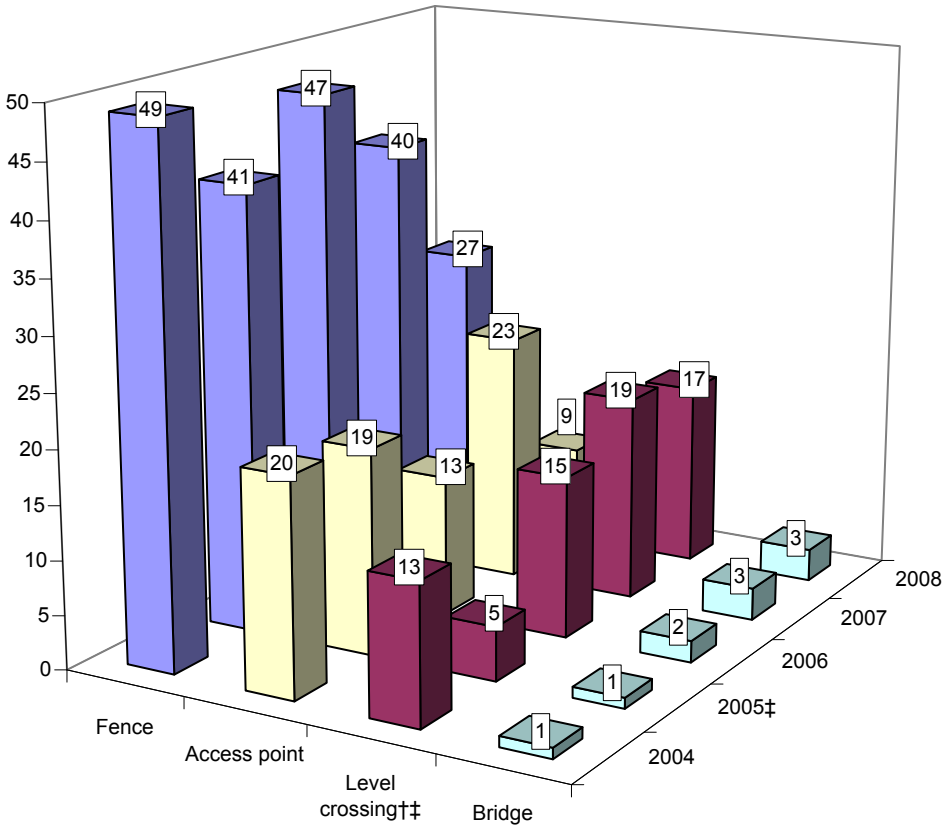
c) the road alignment, speed and volume of road traffic.

37 Factors are scored according to their significance; the two most significant factors are (i) the effectiveness of the barrier at the boundary and (ii) the speed of trains.

38 A site's total score may range from 13 to 159 (the report indicates that the maximum score is likely to be 130); after the accident the RAIB assessed the UPS depot at North Rode and it scored 105 (see paragraph 57).

Road vehicle incursions onto Network Rail infrastructure

39 Road vehicle incursions onto Network Rail infrastructure are summarised in Figure 18. Although incursions are a frequent occurrence, only a small number of the vehicles that enter the railway are subsequently struck by trains.



† Incursion of vehicles that left the crossing accidently or deliberately; incidents that occurred on level crossings are excluded
‡ Data includes the incursion of a light aircraft at Holme Level Crossing on 28 August 2005; the aircraft was not foul of the line

Figure 18: Incursions onto the railway - from the Rail Safety and Standards Board's Annual Safety Performance Report 2008

Analysis

Identification of the immediate cause[2]

40 The immediate cause of the accident was that the car rolled onto the track as the train approached.

Discounted factors

The trains and their operation

41 The trains' data recorders confirmed that they travelled below the maximum permitted speed as they approached North Rode. Both trains performed satisfactorily before the accident and were found to have no relevant faults when examined.

42 As with most railway operations, trains at North Rode are controlled by signals because they may not be able to stop in the distance a driver can see to be clear. With a full service brake application, the southbound train would take almost 1000 metres to stop from 90 mph (145 km/h).

43 During the hours of darkness the southbound train's headlights illuminated its immediate environment and adjacent railway signs; the driver of the train stated that he saw the car only when it was immediately in front of him and the collision occurred before he had time to brake.

Identification of causal[3] factors

44 The causal factors were that:

a) the car was left inadequately braked;

b) a gradient in the car park caused it to roll away;

c) the boundary fence was not able to prevent the car's incursion onto the railway; and

d) the railway controller was not alerted to the presence of the car on the track in time to stop trains.

The car

45 The driver stated that he left his keys in the ignition but could not remember if he applied the handbrake. Closed circuit television camera footage shows that the car started to roll forward immediately after the driver got out and closed the door.

46 A UPS employee stated that there had been several occasions of uncontrolled vehicle movement in the car park because brakes had been inadequately applied; on several occasions he had intervened to stop moving vehicles.

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[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 car park gradient

47 The path of the car across the car park and through the fence is shown in Figure 4. The RAIB surveyed the area and found that the path taken by the car falls towards the railway on a 1 in 36 gradient; to the left of this path and towards the access road, the car park is flat or falls away from the railway.

The boundary

48 The car park is bounded by a chain link fence which comprises a plastic coated steel wire mesh secured to concrete posts (Figure 5). Its purpose is to deter trespassers; it was not designed to prevent vehicle incursion onto the railway. At the time of the accident the fence was in a poor state of repair: the mesh steel wire had rusted through, the plastic coating had perished away and the fence leant towards the railway because several of the concrete posts were cracked at their base (Figures 3 and 5).

49 Closed circuit television camera footage shows the car passing through the fence without slowing as it tears a hole through the wire mesh. There were no features between the car park and the railway that could contain the car, for example a kerb, a crash barrier, a ditch or a mound (Figure 5).

50 The UPS depot car park is 5.6 metres above the railway and the bank down to the railway falls away on a 1 in 2 gradient. Although there was dense vegetation on the bank, it was not sufficient to stop the car as it picked up speed.

Alerting the railway controller to the presence of the car on the track

51 The railway controller needs to be notified of an obstruction immediately so that it can take steps to stop trains. However, when an obstruction occurs there is often no information available locally on how best to advise the controller of an obstruction's location.

52 For this reason, witnesses to an obstruction on the railway normally telephone the emergency services. Once the event is reported a member of the local police force contacts British Transport Police, it then contacts Network Rail control which in turn contacts its local members of staff (controllers or signallers) who are in a position to take action to stop trains. This process introduces delay.

53 The van driver saw the car obstruct the nearest track four minutes before the car was struck by the train. If Network Rail's local control had been notified immediately of the obstruction and its location, the southbound train could have been held at Macclesfield station or at a signal before the obstruction. As the car was not in the path of the northbound train, the accident could have been avoided by this action.

54 Network Rail's licence for the use of its access road did not require UPS to assess and, if necessary, mitigate the risks of its activities to the railway and Network Rail had never contacted UPS to advise them of the actions to take in the event of a vehicle incursion onto its railway; for these reasons, the van driver went to the office, asked a member of staff to call the emergency services, and the collision occurred before Network Rail's local control were notified.

Identification of underlying[4] factors

55 The underlying factors were that:

a) UPS did not identify the risk of vehicle incursion from its car park; and

b) Network Rail did not consider the risk of vehicle incursions from adjoining private land.

Network Rail's process for assessing the risk of road vehicle incursion

56 Network Rail's process for assessing the risk of road vehicle incursion, NR/GN/CIV/00012[5], is based upon the Department for Transport report 'Managing the accidental obstruction of the railway by road vehicles'. Neither document considers the requirement to assess the risk of incursion from adjoining private land, so the foreseeable risk of incursion from the UPS depot was neither identified nor assessed.

57 Although the Department for Transport report does not consider adjoining private land, its methods to assess risk could be applied to private land to give some indication of comparative risk. After the accident the RAIB assessed the site using the 'neighbouring road vehicle incursion risk ranking scoring' spreadsheet and found that it had a score of 105. The Department for Transport report describes sites that score 100 or more as high priority sites that require attention as they are likely to have inadequate arrangements and a high probability of injury following incursion. See Appendix A for a summary of the assessment.

The UPS risk assessment

58 UPS has a duty under the Health and Safety at Work, etc Act, 1974, to protect the health and safety of its employees and others that it may affect[6]. It also has a duty under the Management of Health and Safety at Work Regulations 1999 to make a suitable and sufficient assessment of risks to employees and non-employees; to apply the principles of prevention to its findings; and to make arrangements for effective control of the risks.

59 Before the accident, the most recent risk assessment of the car park at North Rode was carried out for UPS on 19 June 2008. The assessment considered vehicle hazards including speeding, collision and entrapment but did not identify the risks arising from vehicle incursion through the boundary fence and onto the railway, so this foreseeable risk was not assessed.

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

[5] NR/GN/CIV/00012. June 2003. Guidance Note - Road Vehicle Incursions: Risk Assessment of Bridge and Neighbouring Sites

[6] Part I section 3: 'It shall be the duty of every employer to conduct his undertaking in such a way as to ensure, so far as is reasonably practicable, that persons not in his employment who may be affected thereby are not thereby exposed to risks to their health or safety'.

Severity of consequences

The time and day of the accident

60 The sun set before 16:00 hrs on 18 December 2008 and by 17:58 hrs the railway was in total darkness. The southbound train was travelling at 90 mph (145 km/h) when its driver saw the car on the track ahead of him and the train struck the car before he had time to brake.

61 The severity of consequences may have been different if the accident had occurred during daylight. The southbound approach to North Rode is straight; the train driver would have been able to see in excess of 1000 metres ahead and could have brought the train to a stop before the obstruction.

The performance of the southbound train

62 During the collision, the train's obstacle deflector and lifeguards performed as designed: they deformed to absorb energy and prevented large debris from going under the train (Figures 8 and 9). As a result, only the leading four wheels derailed; the leading vehicle ran upright and to the left of the track as its leading right-hand wheel was restrained by the left-hand rail (Figure 9).

63 The severity of consequences may have been different if the train had derailed further to the left and struck the bridge, jack-knifed, or if the train had derailed to the right and moved into the path of the northbound train.

The performance of the northbound train

64 The train's lifeguard performed as designed as it struck the rubber block and pushed it along the track; the lifeguard deformed to absorb energy and prevented the block from coming between the wheel and rail until a section of the block was torn off and both parts were ejected to the track side (Figures 13 and 14). The severity of consequences may have been different had the rubber block caused the train to derail, as happened in the September 2006 derailment at Croxton. This accident resulted in a train running foul of an adjacent line at speed, causing damage to itself and the infrastructure (see RAIB report 11/2008).

Conclusions

The immediate cause

65 The immediate cause of the accident was that the car rolled onto the track as the train approached.

Causal factors

66 The causal factors were that:

a) the car was left inadequately braked;

b) a gradient in the car park caused it to roll away;

c) the railway controller was not alerted to the presence of the car on the track in time to stop trains (Recommendation 1 and 2b); and

d) the car park had no features that could prevent the car's incursion onto the railway (Recommendation 2a).

Underlying[7] factors

67 The underlying factors were that:

a) UPS did not identify the risk of vehicle incursion from its car park; and

b) Network Rail did not consider the risk of vehicle incursions from adjoining private land (Recommendation 3).

Observations

Vehicle incursions from public roads

68 Network Rail assessed its infrastructure in accordance with the Department for Transport report 'Managing the accidental obstruction of the railway by road vehicles'. It identified public roads of high risk for vehicle incursion and improved many sites, sharing responsibility and costs with the highway authorities in accordance with the protocol.

69 Network Rail continues to work with most of the authorities to secure agreed solutions and planned completion dates, and is supported in its efforts by the Office of the Rail Regulator and the Department for Transport. See paragraphs 72 and 73.

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

Actions reported as already taken and relevant to this report

Vehicle incursions from North Rode depot

70 Network Rail carried out a formal investigation into the accident and published its report in March 2009. The investigation made several recommendations, including:

a) Recommendation J1.2 which stated that a private land controller should assess and if necessary mitigate the risks of its activities as a condition of Network Rail granting a licence for access over its land. Network Rail reported that this recommendation was accepted and implemented.

b) Recommendation J2.1 which stated that Network Rail should liaise with the Office of Rail Regulation and the Health and Safety Executive to ensure that UPS consider risks to the railway when assessing their depot at North Rode. Network Rail reported that this recommendation was accepted, and was raised as a matter of national importance with the Office of Rail Regulation and the Health and Safety Executive.

71 UPS repaired the hole in the fence; however, the repaired fence has little more resistance to a runaway vehicle than the original one. See Figure 19.

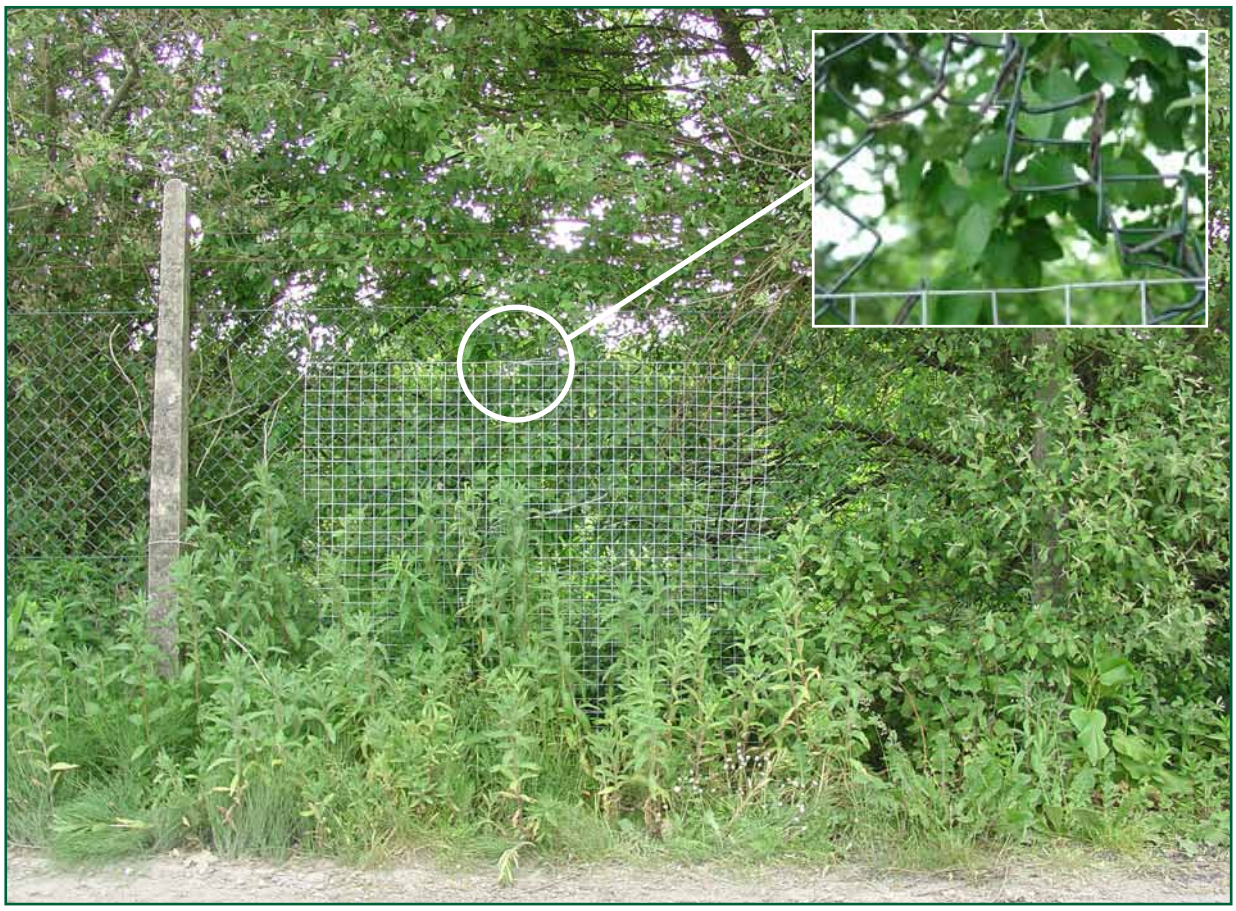

Figure 19: The repair to the hole in the fence

Vehicle incursions from public roads

72 The Department for Transport, the Office of Rail Regulation, and the Scottish and Welsh Assembly Governments are liaising with road and highway authorities and Network Rail to complete improvements on high risk road and highway sites. The Office of Rail Regulation and the Health and Safety Executive are working to bring clarity to the management of vehicle incursion risk from public roads and the enforcement responsibilities at the road-rail boundary.

73 A small number of authorities have made little to no progress in assessing, identifying and improving high risk sites and Network Rail is considering how it may utilise its own resources to carry out this work.

Recommendations

74 The following safety Recommendations[8] are made:

The intention of Recommendations 1 and 2 is to reduce the likelihood and consequences of vehicle incursion from North Rode depot onto the railway.

1 Network Rail should advise UPS of the arrangements to inform it immediately a road vehicle enters the railway from the depot (paragraph 66c).

2 UPS should assess the risk of vehicle incursion from the depot onto the railway and make arrangements so that:

a) those risks are eliminated or reduced, by placing a barrier at the railway boundary that is sufficient to prevent vehicle incursion onto the track, or other equally effective measures (paragraph 66d); and

b) its emergency procedures require its staff to inform Network Rail immediately a road vehicle enters the railway (paragraph 66c).

The intention of Recommendation 3 is to reduce the risk of incursion from private land onto Network Rail infrastructure (paragraph 67b).

3 Network Rail should:

a) establish a method for assessing its infrastructure to identify the sites where the risk of incursion from private land is highest; and

b) liaise with private land controllers, the Health and Safety Executive and local authorities to secure the improvement of the identified sites by those responsible for them.

[8] 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 in the case of Recommendations 1 and 3, and the Health and Safety Executive in the case of Recommendation 2 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.

Appendices

Appendix A – North Rode vehicle incursion risk assessment

Form 2: 'neighbouring road vehicle incursion risk ranking scoring spreadsheet' for the car park at North Rode. See the Department for Transport report 'Managing the accidental obstruction of the railway by road vehicles' for an explanation of factors, options and scoring.

Factor	Option	Score	Factor	Option	Score
f1	**Relative level**: rail >2 metres below road	10	f8	**Rail hazards**: passing trains; bridge; access point	5
f2	**Site character**: downhill, 5-15 metres to rail	12	f9	**Parallel section**: 101-501 metres	3
f3	**Interface**: wire mesh chain link fence; cannot contain road vehicles	24	f10	**Kerb**: no	5
f4	**Alignment**: no bends	1	f11	**Traffic volume**: 11-100 HGVs/day	2
f5	**Speed**: <10 mph (16 km/h)	1	f12	**Line speed**: 125 mph (201 km/h)	16
f6	**Hazards**: the site is a car park	5	f13	**Rail vehicles**: sliding door multiple units	5
f7a	**Traffic incident history**: several roll away events reported in the UPS car park	4	f14	**Rail traffic**: very heavily used route	12
f7b	**Long distance route:** no	0			

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This report is published by the Rail Accident Investigation Branch,
Department for Transport.

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