RAIB
Rail Accident Investigation Branch

Rail Accident Report

Runaway and derailment of wagons at Ashburys
4 May 2010

Department for Transport

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March 2011

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

Summary

A derailment occurred on the night of 3/4 May 2010 at Ashburys in Manchester. Five wagons loaded with aggregate ran away from a siding for 890 metres before two of them were derailed at trap points. The wagons had been left in the siding three days earlier.

The runaway was caused by ineffective handbrakes on the wagons. The investigation found deficiencies in the maintenance plan for the wagons and raised a concern about the way in which safety related information from other industries was brought to the attention of the rail industry.

The RAIB has made six recommendations, relating to operating instructions, maintenance plans, distribution of safety related information from other industries and improved brake testing.

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 The terms left and right in this report are relative to the direction of travel of the wagons as they left the sidings, which was towards Manchester Piccadilly.

4 The report contains abbreviations and technical terms (shown in *italics* the first time they appear in the report). These are explained in appendices A and B.

The Accident

5 At 00:25 hrs on Tuesday 4 May 2010 five wagons ran away and two of them derailed close to Ashburys station in Manchester (figure 1). The wagons had rolled for 890 metres before derailing at *trap points*.

6 The wagons arrived in Ashburys sidings on Friday 30 April as part of train 6H52, the 12:55 hrs from Dowlow Quarry, near Buxton, to Ashburys. The other wagons in the train were unloaded on the same day and returned to Buxton. The five wagons that ran away were left for unloading after the weekend. Monday 3 May was a Bank Holiday and so the unloading was planned for Tuesday 4 May.

7 Nobody was injured in the derailment.

8 The derailed wagons ended up close to, but not fouling, the *down* goods line, which was closed to rail traffic as a precaution.

The organisations involved

9 The train was operated by DB Schenker Ltd, who also employed the train driver and the shunter who assisted the driver at Ashburys sidings.

10 The wagons were leased from VTG Ltd. VTG employed Axiom Rail Ltd to undertake the maintenance of the wagons. Axiom Rail is a division of DB Schenker.

11 The wagons were built in 1998 by Marcroft Ltd for CAIB UK Ltd. CAIB UK later became part of VTG and Marcroft became Axiom Rail. The *engineering acceptance* for the wagons was carried out by The Engineering Link which was contracted by Railtrack to perform this function in accordance with the *private wagon registration agreement* (PWRA).

12 The track was owned and maintained by Network Rail. It was part of its London and North Western Territory. The aggregate unloading facility in the sidings was operated by Lafarge Ltd.

13 Axiom Rail, DB Schenker, VTG and Network Rail freely co-operated with the investigation. The other organisations mentioned above were not involved.

Location

14 The derailment occurred at Ashburys West Junction. The wagons ran down a 1:173 gradient towards Manchester on the *up* arrival siding. This siding joins the Down Ashburys line at Ashburys West Junction. The railway at this location consists of four tracks; the up arrival siding, *down* goods, up main and down main (figure 2).

15 The exit from the up arrival siding onto the Down Ashburys line was protected by a set of trap points which was set to derail any runaway vehicles. The first two wagons in the set of five were derailed at these trap points.

Figure 1: Extract from Ordnance Survey map showing location of the derailment

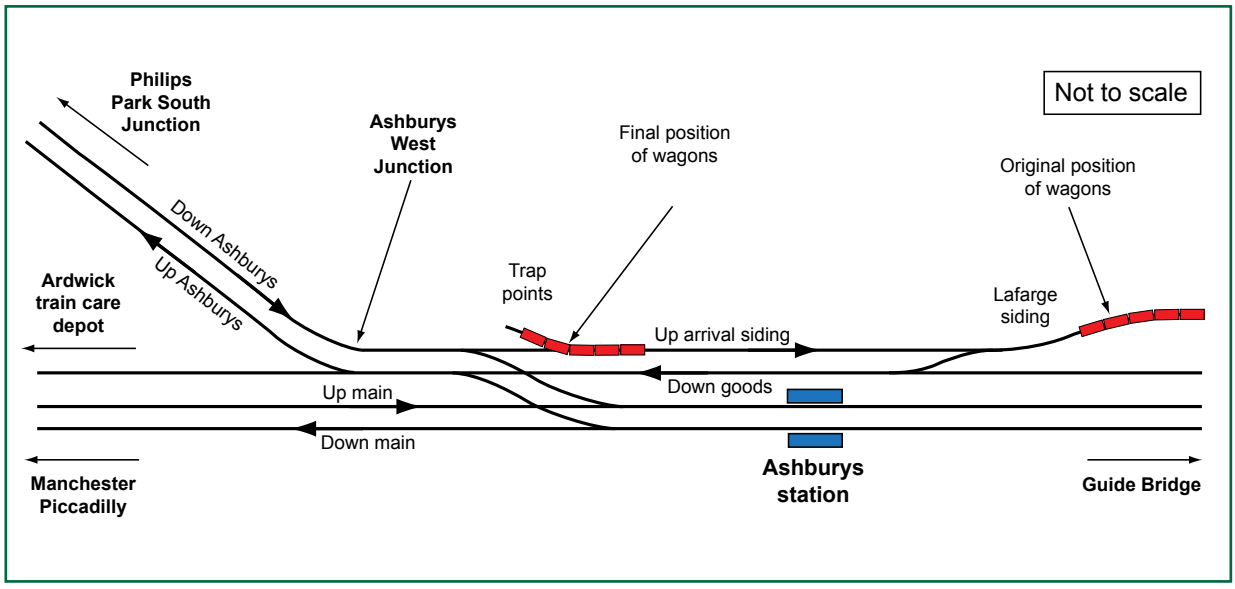

Figure 2: Plan of the area

Equipment

16 The five wagons involved were 102 tonne *gross laden weight* open box wagons of type JNA (figure 3). They were designed to carry ballast and spoil from track renewal projects and latterly were redeployed to carry construction aggregate. The wagons are listed in table 1.

Figure 3: Typical JNA wagon

Position (1 leading)	Wagon No.	Type of brakes
1 (Manchester end)	VTG 3507	Disc
2	VTG 3493	Disc
3	VTG 3478	Disc
4	VTG 3428	Tread
5 (sidings end)	VTG 3510	Disc

Table 1: Runaway wagon details

17 The wagons were constructed in 1998 and consisted of new steel bodies mounted on refurbished bogies. The bogies fitted to the wagons were recovered from a variety of redundant 102 tonne tank wagons and were made by several manufacturers. The tank wagons were built in the mid 1960s and the bogies were new at that time.

18 When the JNA wagons were built the brake gear mounted on the bogies was reused along with the other air brake components. The *handbrake* hand wheels and the linkage to the bogie were new.

19 Four of the wagons were fitted with wheel mounted *disc brakes* and one with *tread brakes*. On the disc braked wagons only one wheel on each axle was fitted with disc brakes. On the tread braked wagon there were two brake blocks to each wheel. On all of the wagons a handbrake applied the brakes on one of the bogies.

Events preceding the accident

20 The loaded wagons arrived at the Lafarge siding at Ashburys on the afternoon of Friday 30 April. The wagons were carrying crushed limestone aggregate for the construction industry. The train was planned to be unloaded and then to return to Buxton.

21 During the unloading operation the excavator unloading the wagons became defective and was unable to continue with the work. Five wagons remained to be unloaded.

22 The DB Schenker shunter detached the five loaded wagons from the remainder of the train and applied the handbrakes to three of the five wagons in accordance with DB Schenker's procedure and the joint DB Schenker/Lafarge method of working document for the sidings. These were the three wagons at the Manchester end of the group. They were all fitted with disc brakes. The wagons were uncoupled from the train at 19:00 hrs on 30 April.

23 The locomotive and the empty wagons then returned to Buxton.

Events during the accident

24 At 00:25 hrs on Tuesday 4 May the signaller at Ashburys heard a train passing the signal box unexpectedly. The only other train in the vicinity was train 5W74, an out of service passenger train from Liverpool to Ardwick train care depot. The signaller raised the alarm with the Network Rail control office and requested that an emergency *National Radio Network* (NRN) broadcast be made to warn the driver of that train.

25 The driver of train 5W74 responded to the emergency broadcast and reported that five wagons had rolled past his train on an adjacent line.

26 The wagons encountered the trap points at Ashburys West Junction which were correctly set to derail runaway vehicles.

Consequences of the accident

27 Nobody was injured in the derailment.

28 The leading wagon, VTG 3507, was completely derailed and partially overturned. All wheels of the leading bogie of wagon VTG 3493 were derailed but the trailing bogie remained on the track. The derailed wagons were close to, but not fouling, the down goods line, which was closed to traffic as a precaution.

29 There was no damage to signalling cables or *overhead electrification equipment* (OLE). Delays were caused to empty passenger trains to and from the nearby Ardwick train care depot due to the closure of the down goods line.

Figure 4: The derailed wagons, looking towards Ashburys station. The track closest to the camera is the connection between the down Ashburys line from Philips Park South Junction and the up main line

Events following the accident

30 A Network Rail mobile operations manager was sent to the site and reported that five wagons had run away and two were derailed. He reported that the down goods line was obstructed by the derailed wagons but that all other lines were clear.

31 The derailment was reported to the RAIB at 01:08 hrs. The initial report of the incident to the RAIB stated that a collision between the wagons and train 5W74 had been narrowly avoided and that the derailed wagons were obstructing a passenger running line.

32 The RAIB immediately deployed inspectors to the site to conduct a preliminary examination of the derailment. Upon arrival at site it was apparent that the derailed wagons were not obstructing a passenger line.

The Investigation

Sources of evidence

33 Evidence was obtained from the following sources:

- evidence gathered from examination and testing of the wagons at the site and at Peak Forest sidings, near Buxton, following their recovery;
- photographs taken by the RAIB and by British Transport Police;
- wagon maintenance procedures and records supplied by VTG;
- operating documents and procedures supplied by DB Schenker;
- wagon construction records supplied by Axiom Rail (successor to Marcroft);
- vehicle acceptance certificates and supporting information supplied by Network Rail, Delta Rail (successor to The Engineering Link) and the Railway Safety and Standards Board (RSSB) (custodian of historic Vehicle Acceptance Body (VAB) records);
- maintenance information from Haldex Ltd, the manufacturer of the *slack adjusters* used in the brakes of the wagons;
- reports of tests done on similar wagons between 1969 and 1989 by the British Rail chief mechanical and electrical engineer's (BR CMEE) test section;
- BR CMEE maintenance documents; and
- Information provided by the Vehicle and Operator Services Agency of the DfT (VOSA) on the inspection and maintenance of slack adjusters on road vehicles.

Previous occurrences of a similar character

34 The railway industry incident database, *Safety Management Information System* (SMIS), records that there have been 16 previous reported incidents since 1999 where wagons have run away despite having their handbrakes applied. The handbrakes were found to be defective in all of these cases.

35 One of the incidents, at Toton on 20 April 2001, involved a wagon of the same type as at Ashburys. DB Schenker reported that there was also a runaway of a wagon of the same type (JNA) at Dagenham Dock on 27 May 2009 due to a seized handbrake cable, but this incident was not recorded in the SMIS database.

36 Four of the other incidents involved wagons that are sometimes fitted with the same type of slack adjuster as the wagons involved in the Ashburys incident. The type of slack adjuster fitted was not recorded in any of these cases, nor its condition. Seven of the incidents did not record the type of wagon involved.

37 Following the incident at Dagenham Dock on 27 May 2009, VTG carried out a fleet check of all of its JNA wagons. This check was intended to identify seized handbrake cables and one other case was found and rectified. The wagons involved in the Ashburys incident were not tested as part of this activity because they were in store at the time. However, the test was done when the wagons received their *vehicle inspection and brake test* (VIBT) before returning to traffic.

Key facts and analysis

Identification of the immediate cause[1]

38 **The immediate cause of the runaway and derailment was that the wagon handbrakes were defective on the three wagons whose brakes were applied; they were unable to hold the five wagons on the falling gradient after the air brakes had leaked off.**

39 Air brakes are designed to be used to stop the wagon when it is running as part of a train. They will also stop the wagon when it is uncoupled from a train, either deliberately (for example when the locomotive is running round its train) or accidentally (if a coupling breaks). The brakes rely on air pressure to apply them and this air will leak off with time, causing the brakes to release. The maximum rate of leakage is specified in the VTG Brake Test Manual and all of the wagons at Ashburys met the specification when tested at their VIBT in March 2010. The air brake is not intended to be used to hold the brakes on indefinitely; the handbrake is provided for that purpose.

Identification of causal[2], contributory[3] and underlying factors[4]

Defective handbrakes

40 **The handbrakes on the wagons with brakes applied were prevented from applying the full brake force by the following defects within the mechanism:**

- **wrongly adjusted force limiting bolts; and**
- **defective slack adjusters.**

A combination of these defects was a causal factor in the incident.

41 The handbrake had been applied on three of the five wagons; all three were disc braked. The handbrakes on two of the three wagons were restricted in their application by a force limiting bolt in the mechanism being wrongly adjusted. The handbrake on the third vehicle was found to be not fully effective when tested at site after the derailment. Figure 5 shows the arrangement of the brake unit. The brakes were applied by rotating the shaft ('S' in figure 5) in an anti-clockwise direction. This was achieved by applying a force to the top of the slack adjuster 'T'. This can be done either by the air brake actuator or by the handbrake arm 'B'. If the force limiting bolt contacts the brake unit at 'X' before the brakes have been fully applied, the handbrake force will be limited.

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

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

[3] Any condition, event or behaviour that affected or sustained the occurrence, or exacerbated the outcome. Eliminating one or more of these factors would not have prevented the occurrence but their presence made it more likely, or changed the outcome.

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

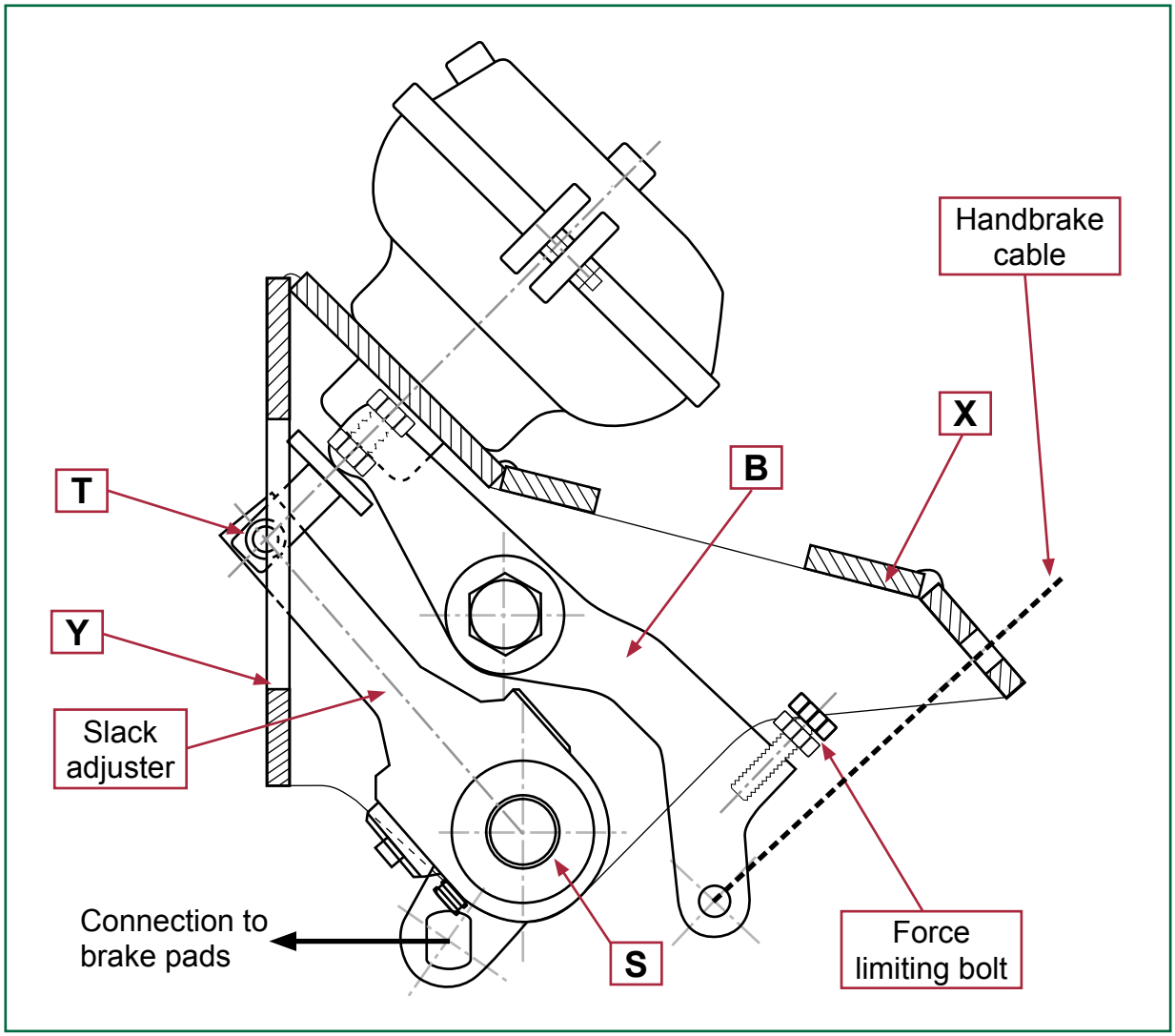

Figure 5: Diagram showing brake unit

42 Similarly, the slack adjuster body may strike the edge of its slot at point 'Y' before the full brake force has been applied. This would restrict the service brake as well as the handbrake but will only occur if the slack adjuster is not working correctly. When tested after the incident some of the slack adjusters were found to not be working correctly and had contacted the edge of the slot.

43 The brake slack adjusters on some of the wagons were not fully effective and allowed the brake pads' clearance from the brake discs to become greater than the maximum allowed in the maintenance specification. This increased the distance through which the brake linkage had to move and, in one case, caused the linkage to reach its limit before the brakes had fully applied.

44 Table 2 is a summary of the condition of the handbrakes when examined after the incident. Either defect, the force limiting bolt or the failure of a slack adjuster, could have caused the handbrakes not to fully apply. The RAIB investigation did not attempt to distinguish which of the two defects was more significant on each wagon.

Wagon No. and position in group	VTG 3507 (1)	VTG 3493 (2)	VTG 3478 (3)	VTG 3428 (4)	VTG 3510 (5)
Type of brake	**Disc**	**Disc**	**Disc**	**Tread**	**Disc**
Handbrake applied at time of incident	Yes	Yes	Yes	No	No
Force limiting bolts in contact with stops	Yes, both axles	Yes, both axles	No		Yes (one axle), no bolt on other axle unit, but handbrake cable bolt fouling bracket
No. of turns of handbrake wheel (specification is 5 +/- 1)	5 before stop bolts adjusted, 6 after	5 ½ before stop bolts adjusted, 6 after	8 ½		6 ½ after adjustment of slack, 7 after removal of stop bolts
Slack adjuster operation (air brake application)	Not tested – slack adjuster moved when wheels replaced	Operating	Not operating		Not operating
Anchor bracket bolt worn	Yes, both axles	No	Yes, both axles		No
Anchor bracket *grommet* missing	Yes, both axles	No	Yes, both axles		No
Handbrake[5] effectiveness during post-incident pull test	Not tested as wagon derailed	Not tested as wagon derailed	Poor	Good	Poor

Table 2: Condition of handbrakes after the incident

Disc brake unit force limiting bolts

45 **The lack of consideration of the force limiting bolt in the maintenance plan for the wagons was a contributory factor.**

46 The braking system of the wagons on which the handbrake was applied consisted of a disc brake unit on each axle braking one of the wheels. Each disc brake unit was made up of a pair of brake pads, their operating linkage, an air actuator and a slack adjuster (figure 5). The disc brake units fitted to the wagons were manufactured by SAB Ltd and fitted to the bogies when new in the 1960s. The unit included a bolt labelled in the maintenance documentation as a 'handbrake force limiting bolt'. The reason for limiting the handbrake force was not documented. The maintenance document described how to adjust this bolt. The procedure was as follows:

- apply the power brake fully;
- apply the handbrake to remove all slack in the mechanism;
- turn the handbrake wheel another ½ turn; and
- adjust the bolt so that its head just contacts the bracket.

[5] Effectiveness of handbrake was assessed on the following basis: the wagon was pulled with the handbrake on and the locomotive brake was used to quickly stop the train. The effectiveness of the handbrake was then assessed from the way in which the wagon stopped. If it stopped immediately, it was recorded as 'good' in the table. If the wagon bounced back and forth on the buffer and coupling springs it was recorded as 'poor'.

47 The bogies were refurbished by Marcroft before being fitted to the new JNA wagons. This refurbishment was carried out in accordance with Marcroft quality plan SPEC-038 . This stated that the handbrake force limiting bolts were to be adjusted by one of two methods, depending on whether air brake test equipment was available. If air brake equipment was available, the method was the same as described in paragraph 46. If equipment was not available, the method was to adjust the bolt so as to give the maximum clearance from the bracket.

48 The adjustment of this bolt was not included in the VTG master maintenance plan and so was not included in any maintenance plan for these vehicles. When examined by the RAIB at Peak Forest, these bolts were found to be contacting the brake unit housing during the application of the handbrake and therefore restricting the brake force on three of the disc braked wagons (figure 6).

Figure 6: Handbrake cable and attachment to arm. Stop bolt (arrowed) in contact with bracket

Brake slack adjusters

49 **The omission of the manufacturer's current instructions for inspection of the slack adjusters from the maintenance plan was a probable contributory factor to the incident.**

50 The manufacturer of the slack adjusters had issued revised instructions for the inspection of slack adjusters but this information had not been incorporated into the maintenance plan for the wagons and was not carried out. The slack adjusters were type 'AA1' units manufactured by Haldex Ltd. They were supplied to the rail industry by Sabre Rail Ltd. The original supplier, at the time the wagons were constructed, was SAB Ltd. The maintenance instructions issued by SAB did not include the revised instructions from Haldex and Sabre Rail did not issue maintenance instructions. The revised maintenance instructions were, however, available on Haldex's website.

51 The disc brake unit included an air actuator to provide the force on the friction pads. The unit was arranged so that the brakes could be applied by either air pressure or the handbrake, as described in paragraph 41.

52 The lever attached to the air actuator was formed by the slack adjuster, so that the slack adjuster was effective for both handbrake and air brake. This design of slack adjuster has been used on railway wagons since the late 1960s and is also used on heavy goods road vehicles. The slack adjuster works by sensing the clearance between the disc pads and disc as the brakes are released and adjusting this down to a constant preset value. In order to do this, the unit requires a fixed reference point which is provided by an anchor bracket attached to it (figure 7).

Figure 7: New AA1 slack adjuster showing anchor bracket (arrowed)

53 Haldex identified an issue with wear of the anchor bracket in the early 1990s following reports of slack adjusters not working on road vehicles and introduced a plastic grommet to improve the fixing to the anchor bolt (figure 7). All AA1 units supplied after this date included the plastic grommet. At this time the bogies of the JNA wagons were in use on tank wagons. The RAIB has been unable to locate a copy of the maintenance plan for these wagons to confirm whether the importance of securing the anchor bracket was identified.

54 If the anchor bracket is loose on its anchor point, the effect is to increase the clearance between the brake pads and the disc. If this clearance becomes too great, the slack adjuster arm or another part of the brake operating mechanism can reach the end of its travel before the brakes have been fully applied (figure 8).

Figure 8: Brake unit on wagon VTG 3510 showing (arrowed) handbrake cable bolt fouling brake unit housing

55 When examined by the RAIB at Peak Forest, the slack adjuster arm on wagon VTG 3510 was contacting part of the bogie frame limiting the travel of the air brake and the handbrake cable bolt was contacting the brake unit housing preventing the handbrake from being fully applied (figure 8). The slack adjuster grommet was missing from the slack adjusters on wagons VTG 3478 and VTG 3507 and the anchor bolts were worn (figures 9 and 10).

56 Following a fatal road accident in 2004 involving brake failure of a heavy goods vehicle, the Coroner recommended that heavy goods vehicle operators be warned of the importance of correct functioning of brake slack adjusters. As a result, VOSA worked with the manufacturers of the various designs of slack adjusters to produce a 'guide to the maintenance and assessment of automatic slack adjusters' (VOSA/PSP/1111/March 05) as a reminder of how to inspect and maintain them. This document drew together existing published maintenance instructions and included Haldex AA1 slack adjusters. It described the checks that should be carried out to ensure that the unit was functioning correctly. The document was circulated to vehicle operators and made available in MOT test centres. The rail industry was not included in the circulation and was unaware of its existence. The VOSA guide emphasised the importance of securely locating the anchor bracket.

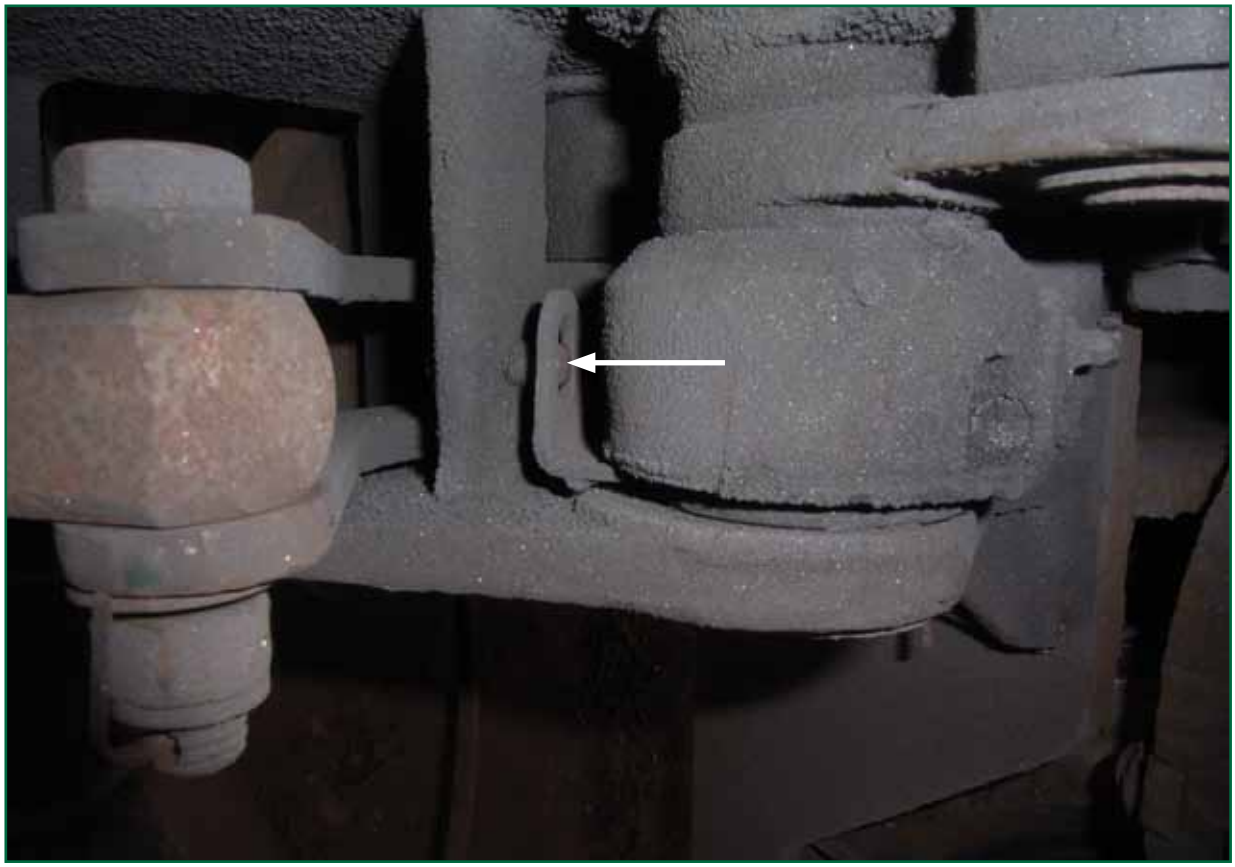

Figure 9: View of brake unit from below showing (arrowed) slack adjuster anchor bolt on VTG 3478

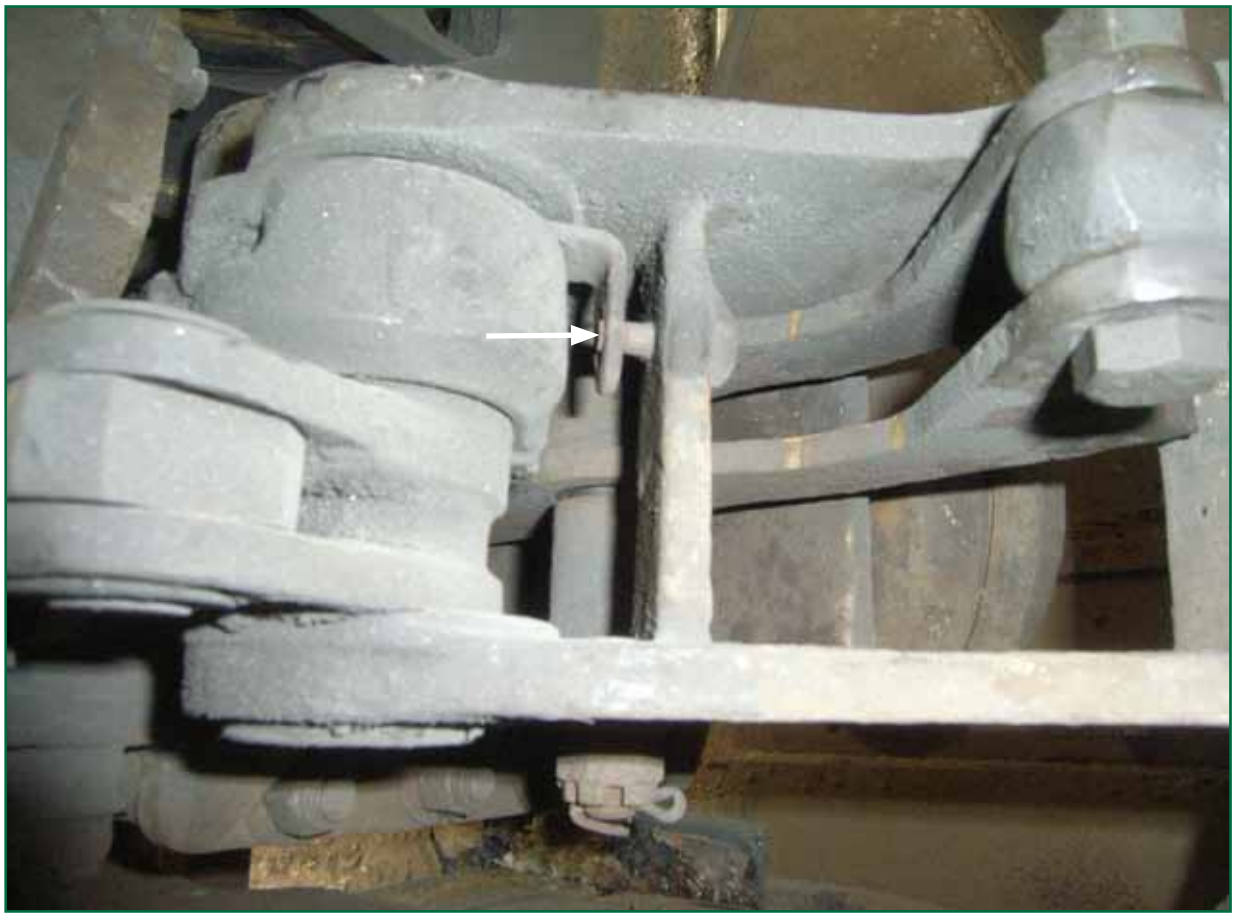

Figure 10: View of brake unit on VTG 3507 from below showing worn anchor bolt (arrowed)

57 The railway industry has a system for notifying rail industry bodies of urgent safety advice, the National Incident Report (NIR) system. Only operators and maintainers of vehicles can input information to the NIR system. Manufacturers of components do not have a means of directly inputting to the system. The rail industry does not have a mechanism for circulating important safety information arising from the use of components in other industries. The lack of a means to inform the rail industry of safety advice from other industries was a probable contributory factor to this incident.

DB Schenker operating procedures

58 **The DB Schenker supplementary operating instructions for uncoupling wagons from a locomotive did not include testing the effectiveness of the handbrakes. This was an underlying factor to the incident.**

59 The DB Schenker supplementary operating instructions specify the procedure to be used when a locomotive is detached from a train. In the case where the locomotive driver is not assisted by a shunter, a simple test is carried out with the wagon handbrakes applied to confirm that the handbrakes are effective (this is known as the 'pull test'). The procedure when a shunter assists the driver is shorter than the driver-only procedure and does not include the 'pull test'.

60 The DB Schenker procedure 'A2 a) Procedure when coupling or uncoupling a locomotive – Uncoupling a locomotive from a train' specifies actions that must be undertaken by the driver and by the shunter. The procedure includes the following steps (the resulting status of the brakes is shown in square brackets):

1. stop the train and apply the locomotive *direct air brake* [locomotive brakes fully applied, wagon brakes may also be, depending on whether the driver used them to stop the train];
2. create 5 bar air train pipe pressure [locomotive brakes fully applied, wagon brakes fully released];
3. shunter applies handbrakes on required number of wagons[6] [locomotive brakes fully applied, handbrakes applied on some wagons];
4. driver makes a train air brake application [locomotive brakes fully applied, wagon brakes fully applied, handbrakes applied on some wagons];
5. shunter opens brake cocks on locomotive and first wagon and uncouples pipes and coupling [locomotive brakes fully applied, wagon brakes fully applied, handbrakes applied on some wagons]; and
6. shunter closes brake cock on locomotive and tells driver uncoupling is complete [locomotive brakes fully applied, wagon air brakes fully applied and handbrakes applied on some wagons].

[6] The number of wagons that should have their brakes applied is specified in the local instructions for each location.

61 If the driver is not assisted by a shunter then procedure A2 details what the driver must do in the section 'Driver only uncoupling a locomotive from a train being stabled'. This procedure includes the following steps (status of the brakes shown in square brackets):

1. bring the train to a stand and apply the locomotive direct air brake and parking brake and remove master key, ensuring train air pipe gauge falls to zero [locomotive brakes fully applied, wagon brakes fully applied];
2. on each wagon where the handbrakes are to be applied, pull the *distributor cord* to release the air brake then apply the handbrake [locomotive brakes fully applied, handbrakes applied on some wagons, air brakes applied on the rest];
3. create 5 bar air train pipe pressure and release locomotive direct air brake and parking brake [locomotive brakes released, all wagon brakes released other than the handbrakes that were applied];
4. apply minimal traction power to see if train will move (perform a pull test);
5. apply locomotive direct air brake and parking brake, remove master key and ensure train air pipe falls to zero [locomotive brakes fully applied, air brakes applied on all wagons, handbrakes also applied on some wagons]; and
6. uncouple the brake pipe and coupling [locomotive brakes fully applied, air brakes applied on all wagons, handbrakes also applied on some wagons].

62 In both cases the wagons are left in the state where the handbrakes are applied on some of the wagons and the air brakes are fully applied on all of them. However, in the driver-only case (paragraph 61) the pull test (step 4) provides an indication that the handbrakes are effective (ie they resist the pulling force exerted by the locomotive). If this test had been carried out at Ashburys, the defective handbrakes would have been revealed.

63 The number of wagons in the train whose handbrakes were applied (three out of five) was in accordance with the DB Schenker local operating instructions for Ashburys yard. The RAIB makes no comment on whether this proportion of braked wagons is sufficient as it was not causal to the incident.

Vehicle maintenance plans

64 **The significance of the stop bolts was not considered when drawing up the maintenance plan for the new JNA wagons. This was a possible contributory factor to the incident.**

65 A maintenance plan was prepared by Marcroft for CAIB when the wagons were built in 1998. Any relevant maintenance information regarding the stop bolts from the bogies' previous use was not referred to, though it is unclear whether the previous maintenance information actually referred to the stop bolts.

66 BR CMEE test section report 219/3 from September 1969 describes braking tests done on a 100 ton tank wagon fitted with these brake units. The air brakes were found to meet the specified stopping distance but the handbrakes did not meet the specification to hold the vehicle on a 1 in 40 gradient. The report described how a number of wagons were examined and found to have the handbrake force limiting bolts poorly set. When these bolts were correctly adjusted, the handbrakes met the specification. The report did not make recommendations and it is not known whether this information was incorporated into the maintenance plan for the wagons.

Vehicle acceptance

67 **The lack of a check by the VAB that the maintenance plans for re-used components were incorporated in the maintenance plan for the new wagons was a possible contributory factor to this incident.**

68 Before the wagons involved in this incident could be operated on Railtrack infrastructure, they were the subject of a process of engineering acceptance. The engineering acceptance process for vehicles that was current at the time of introduction of the JNA wagons was specified in Group Standard GM/RT2000 issue 1 'Engineering acceptance of rail vehicles'. The acceptance policy in the standard stated that Railtrack, the infrastructure manager at that time, needed to be assured that the vehicles that operated on its infrastructure were safe and that train operators were to provide evidence that their trains met the mandatory requirements. The process to be followed was laid down in section 5 of the standard but, for wagons covered by the PWRA (as the wagons in this incident were), clause 4.6 stated that the wagons 'shall be deemed to have met the requirements of this standard where it can be demonstrated to the satisfaction of Railtrack that the vehicles have been subjected successfully to processes that follow the principles of those listed in section 5'.

69 Section 5 of the group standard listed five separate stages leading to the final engineering acceptance certificate. These were vehicle design, vehicle construction, acceptance testing, maintenance and overhaul policy and safety examination. The vehicle design and construction stages of the JNA wagons were reviewed by a *conformance certification body* and certificates issued. Acceptance testing was noted as not being required and the VAB stated on the engineering acceptance certificate 'PWRA applies' in the space where the maintenance and overhaul policy would normally be stated. A maintenance plan was, however, prepared by Marcroft for CAIB and was referred to on subsequent engineering acceptance certificates issued as a result of changes to the vehicle found necessary in the light of service experience.

70 The records of design conformance checking of the wagons deal with the braking system. They show that handbrake tests were carried out on two of the wagons to prove that the design met the requirement in Group Standard GM/RT2043 'Braking System and Performance for Freight Trains', ie to hold the vehicle stationary on a 1 in 40 incline. The records state that braking calculations for the service (ie air) brake were not submitted as the design of the brakes was unchanged from the bogies' previous use. The VAB was therefore aware that the bogies were being reused, however it appears that they did not check whether all relevant information had been carried over into the maintenance plan. This lack of checking was possibly contributory to the incident.

Vehicle inspection and brake test (VIBT)

71 **The lack of a test of the handbrake effectiveness at VIBT was an underlying factor in the incident.**

72 The wagons underwent a VIBT in March 2010 before returning to service after a period in store. The VIBT included a test of the handbrakes. The handbrake test consisted of turning the handbrake wheel to fully apply the handbrake. The pads were then examined to see whether they were in contact with the discs. The test did not check whether the pad force was being limited by mechanical obstruction in the brake mechanism.

73 The wagons were covered by VTG maintenance and overhaul specification VTG MAINT-0248. This included a check sheet for each of the various types of maintenance intervention planned for the vehicles. These were planned preventative maintenance, VIBT and balanced maintenance. The check sheets specified which maintenance operations were to be undertaken at each intervention. Details of the maintenance operations were given in the VTG master maintenance specification VTG TI-PPM-VIBT 001. The version current at the time of the Ashburys incident was version 1A dated April 2008.

74 The handbrake was dealt with in section 9.7 of the VTG master maintenance specification. This required the maintenance operative to count the number of turns of the hand wheel to fully apply the handbrake and to check that the blocks/pads apply to the wheels. The effectiveness of the handbrake would not be checked by this process as the force between pad and disc was not measured.

Vehicle operating restrictions

75 DB Schenker staff told the RAIB that an operating restriction applied to wagons with this type of disc brake. This arose from a runaway incident at Sheffield in 1989 when a train of PGA wagons with single disc brakes (ie one disc brake unit per axle) was unable to stop when running down the gradient approaching Sheffield station. The train had a clear run through the station and stopped beyond it having passed a signal at danger. As a result of this incident, British Rail applied an operating restriction to wagons with only one brake disc per axle operated on trains from Buxton. The restriction stated that trains of these wagons should be limited to a maximum of 50% of the vehicles with disc brakes and the remainder should have tread brakes. Wagons with isolated brakes were not permitted in the train.

76 At the time of the incident, this operating restriction no longer appeared in any operating publications, the PGA type of wagons involved having been withdrawn, but DB Schenker staff understood that it still applied to wagons with only one disc brake per axle (such as the JNA type). The mix of brake types within the set of wagons at Ashburys was not causal to the incident but the lack of clarity over the existence of an operating restriction is noted here as an observation.

Conclusions

Immediate cause

77 The immediate cause of the derailment was that the handbrakes on the wagons whose brakes were applied were defective and unable to hold the set of wagons on the gradient once the air brakes had leaked off (**paragraph 38**).

Causal factors

78 The following factors were identified as causal:

- The handbrake force limiting bolts were wrongly adjusted on the wagons whose handbrakes were applied (**paragraphs 40 and 84**); and
- Some of the slack adjusters were defective on some of the wagons (**paragraph 40 and Recommendation 3**).

Contributory factors

79 The maintenance plans for the bogie brakes, and in particular the slack adjuster, were possibly contributory to the accident in that neither the manufacturer's recommendations for the brake slack adjusters (**paragraph 49**) nor experience of the stop bolt adjustment from previous use of the bogies (**paragraph 64**) were included in the maintenance plan for the wagons and so were not carried out (**Recommendation 2**). Furthermore the VAB not checking that maintenance information from the previous use had been carried forward to the new maintenance plan was also possibly contributory to the accident (**paragraph 67 and Recommendation 2**). The lack of consideration of the force limiting bolts in the maintenance plan (**paragraph 45**) was contributory.

80 The lack of a system for the rail industry to be made aware of safety information concerning equipment arising from its use in other industries (**paragraph 57 and Recommendation 4**) probably contributed to the lessons learnt in the automotive industry not being known about by the railway industry.

Underlying factors

81 The lack of a requirement for the VIBT to check that the handbrake applied the full force to the brake pads (**paragraph 71 and Recommendation 5**) was an underlying factor.

82 The DB Schenker procedure for detaching wagons did not require verification that the handbrakes were effective when a shunter assists with the detachment (**paragraphs 58, 85 and Recommendation 1**). This was an underlying factor.

Observation[7]

83 It was observed during the investigation that DB Schenker staff understood there to be a restriction on operating wagons with one disc brake per axle on trains from Buxton. This restriction was not recorded in any Network Rail documentation and may no longer be relevant (**paragraph 76 and Recommendation 6**).

[7] 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

84 Following the examination of the wagons after the derailment, Axiom Rail issued 'Safety Critical Instruction HRD-051' on behalf of VTG on 19 May 2010. This instruction required a check on the whole fleet of wagons with this type of brake to ensure that the handbrake force limiting bolts were fully retracted, the AA1 slack adjusters were functioning correctly and their anchor brackets were securely located. The fleet check was completed by 20 June 2010 for all but four wagons, which were checked in August 2010. VTG also issued a maintenance supplement which required the stop bolts to be wound fully in or removed.

Actions reported that address factors which otherwise would have resulted in an RAIB recommendation

85 DB Schenker has revised its supplementary operating instructions for uncoupling wagons from a locomotive so that a pull test is done if the wagons are to be left to rely on their handbrakes, regardless of whether a shunter is present.

Recommendations

86 The following safety recommendations are made[8]:

Recommendations to address causal and contributory factors

1 *The purpose of this recommendation is to make a 'pull test' with the power brake released a requirement when leaving wagons on their handbrake regardless of whether the driver is on his own or is working with a shunter.*

Freight operators should ensure that their operating instructions include a 'pull test' when wagons are to be left to rely on their handbrakes for a time (DB Schenker reports that it has already taken this action).

2 *The purpose of this recommendation is to ensure that the manufacturers' maintenance requirements for components are incorporated in the maintenance plan for the whole vehicle and that this is kept up to date.*

VTG should check that its maintenance plans incorporate the latest maintenance recommendations of suppliers of safety critical components used on the vehicles and update as necessary.

3 *The purpose of this recommendation is to ensure that other wagons with the SAB/Haldex AA1 type slack adjuster are correctly inspected and maintained, including wagons covered by the PWRA.*

Operators of wagons fitted with SAB/Haldex AA1 type slack adjusters should, in conjunction with the maintainers and owners as appropriate, ensure that the maintenance plans are reviewed to confirm that they incorporate the manufacturer's current recommendations on their inspection and maintenance. Network Rail PWRA should issue a *private owners circular letter* to this effect to PWRA members.

continued

[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 to enable it to carry out its duties under regulation 12(2) to:

(a) ensure that recommendations are duly considered and where appropriate acted upon; and

(b) report back to RAIB details of any implementation measures, or the reasons why no implementation measures are being taken.

Copies of both the regulations and the accompanying guidance notes (paragraphs 167 to 171) can be found on RAIB's website at www.raib.gov.uk.

4 *The purpose of this recommendation is to find out whether it is practicable to put in place some means for rail organisations to be made aware of relevant component safety information arising from other industries.*

RSSB should investigate the practicability of distribution of safety information from other industries to the rail industry with regard to components that are common to both industries.

5 *The purpose of this recommendation is to include a step in the VIBT procedure to examine the handbrake mechanism to check that it operates correctly and fully applies the brakes.*

Operators of freight wagons should, in conjunction with the maintainers and owners as appropriate, review their VIBT procedures for handbrake testing to ensure that they include checking that the handbrake is fully effective. Network Rail PWRA should issue a private owners circular letter to this effect to PWRA members.

Recommendation to address factor observed during the investigation

6 *The purpose of this recommendation is to investigate whether wagons with single disc brakes pose a risk when operating on long gradients and arrange to have any operating restrictions found necessary to be published in the operating instructions, in accordance with Group Standard GE/RT8270 'Assessment of Compatibility of Rolling Stock and Infrastructure'.*

DB Schenker should confirm whether the operating restriction on wagons with only one brake disc per axle is still required and, if so, arrange for the restriction to be published.

Appendices

Appendix A - Glossary of abbreviations and acronyms

BR	British Rail
CMEE	(British Rail) Chief Mechanical and Electrical Engineer
NIR	National Incident Report
NRN	National Radio Network
PWRA	Private Wagon Registration Agreement
RSSB	Rail Safety and Standards Board
SMIS	Safety Management Information System
VAB	Vehicle Acceptance Body
VIBT	Vehicle Inspection and Brake Test
VOSA	Vehicle and Operator Services Agency

Appendix B - Glossary of terms

Conformance certification body	An organisation appointed by RSSB to check that certain aspects of a vehicle (eg its design or construction) conforms to mandatory standards.
Direct air brake	A type of brake fitted to locomotives where the driver operates a control to allow compressed air directly into the brake actuators.
Disc brake	A brake where friction pads are pressed onto a rotating disc to provide the retardation force.
Distributor cord	A length of cord attached to the brake system on a wagon which, when pulled, releases the air in the brakes causing the brake to release.
Down	The name generally given to lines used by trains travelling in the direction away from London. In this case it is towards Manchester Piccadilly station.
Engineering acceptance	The process of checking whether a rail vehicle is safe to be operated on Network Rail tracks.
Grommet	A plastic insert put into a hole to cushion contact between a pin and the hole.
Gross laden weight	The total weight of a wagon, including the weight of its load.
Handbrake	A brake fitted to a vehicle that can be applied manually and will remain applied indefinitely until manually released.
National Radio Network (NRN)	The national radio network is a railway network for communication between trains and controllers.
Overhead electrification equipment	The system of masts, gantries and wires above the track to provide power for electric trains.
Private owners circular letter	The means by which the Network Rail PWRA management group communicate technical requirements to PWRA members.
Private wagon registration agreement	A legal agreement between BR and private wagon owners to allow them to operate their wagons on the BR network. After rail privatisation the agreement was between Railtrack (subsequently Network Rail) and the private wagon owners.
Safety management information system (SMIS)	A railway industry computer system for recording accidents, incidents and the follow up actions.
Slack adjuster	A mechanical device incorporated into a brake system whose function is to take up the slack caused by wear of the brake pads.
Trap points	A set of points designed to derail a vehicle that is not authorised to pass them.

Tread brake	A brake where the retardation force is provided by blocks pressing on the wheel tread.
Up	The name generally given to lines used by trains travelling in the direction of London. In this case it is towards Sheffield.
Vehicle acceptance body	An organisation appointed by RSSB to undertake engineering acceptance for vehicles.
Vehicle inspection and brake test (VIBT)	A periodic maintenance activity to ensure that a rail vehicle is in a serviceable condition and its brakes are functional.

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