



Rail Accident Investigation Branch

Rail Accident Report



Incident at Romford station, 4 February 2010

Department for
Transport

Report 20/2010
December 2010

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

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Summary

At about 07:25 hrs on Thursday 4 February 2010, a quantity of stone ballast fell from the bottom doors of a wagon in a freight train, running from Acton, west London, to Ipswich, as it passed through Romford station in Essex at about 59 mph (95 km/h). Stones bounced onto the station platform, and struck three people, two of whom subsequently required treatment for minor injuries.

Subsequent examination of the train found that the wagon doors had not been properly closed when the train departed from the freight yard at Acton.

The RAIB has made five recommendations to the company that operated the freight train, relating to modifications to the type of wagon involved in the incident, instructions and methods for checking that doors are properly closed, training and competence of staff, and the management of safety.

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 All dimensions and speeds in this report are given in metric units, except speed and locations on Network Rail, which are given in imperial dimensions, in accordance with normal railway practice. In this case the equivalent metric value is also given.
- 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 incident

Summary of the incident

- 5 At about 07:25 hrs on 4 February 2010, as train 6L57, the 05:25 hrs freight service from Acton to Ipswich, was passing through Romford station, Essex, a quantity of stone *ballast* fell from one of the wagons on the train. The train was travelling at about 59 mph (95 km/h). Flying stones struck people who were on one of the station platforms.
- 6 After station staff alerted the signalling centre, the train was stopped by signals and examined by its driver and Network Rail staff. It then continued its journey, but more ballast was heard to be falling from it as it passed through Colchester station. The train was finally stopped at its destination, Ipswich, where it was later examined by the RAIB.
- 7 Three people were struck by stones at Romford station, and two of them were subsequently treated for minor injuries by paramedics. There was no damage to the train or the infrastructure.



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

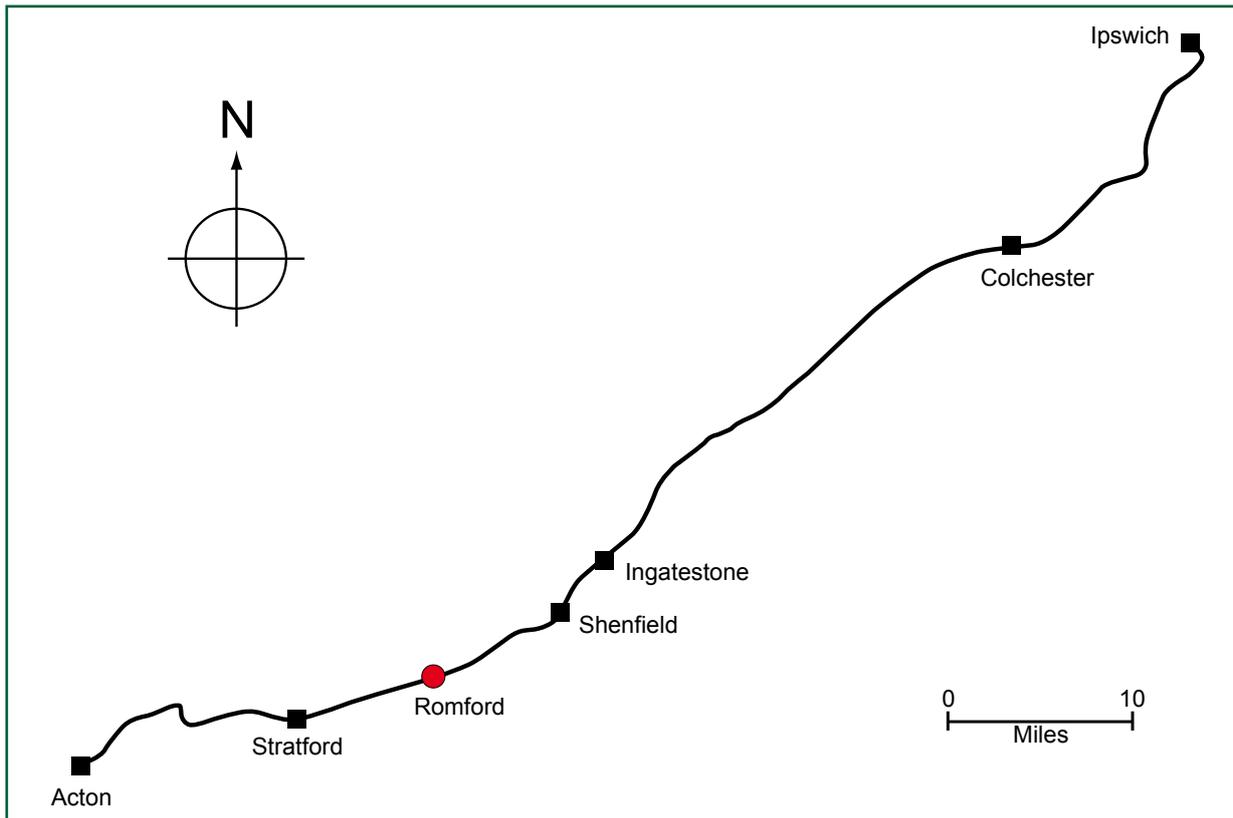


Figure 2: Route of train from Acton to Ipswich

Organisations involved

- 8 The train was owned and operated by DB Schenker Rail (UK) Ltd, who employed the train driver and the staff at Acton yard, London, where the wagons were formed into the train, and the train began its journey. There is a stone and aggregate terminal within Acton yard which is operated by Aggregate Industries (trading as Yeomans).
- 9 The train travelled over Network Rail's Western and Anglia routes, and the signalling and operations staff involved were Network Rail employees.
- 10 Romford station is operated by National Express East Anglia, who employed the station staff.
- 11 DB Schenker, Aggregate Industries, Network Rail and National Express East Anglia freely co-operated with the investigation.

Location

- 12 The train originated at Acton yard in west London. At this yard, trains of ballast, sand, aggregate and other construction materials, from all over the south and west of England, are *marshalled* for despatch to other terminals in London and the south east. The yard includes a terminal operated by Yeomans with a covered area where trains are unloaded, and a ballast stockpile, from which trains can be loaded. The layout of the yard is shown in figure 3.

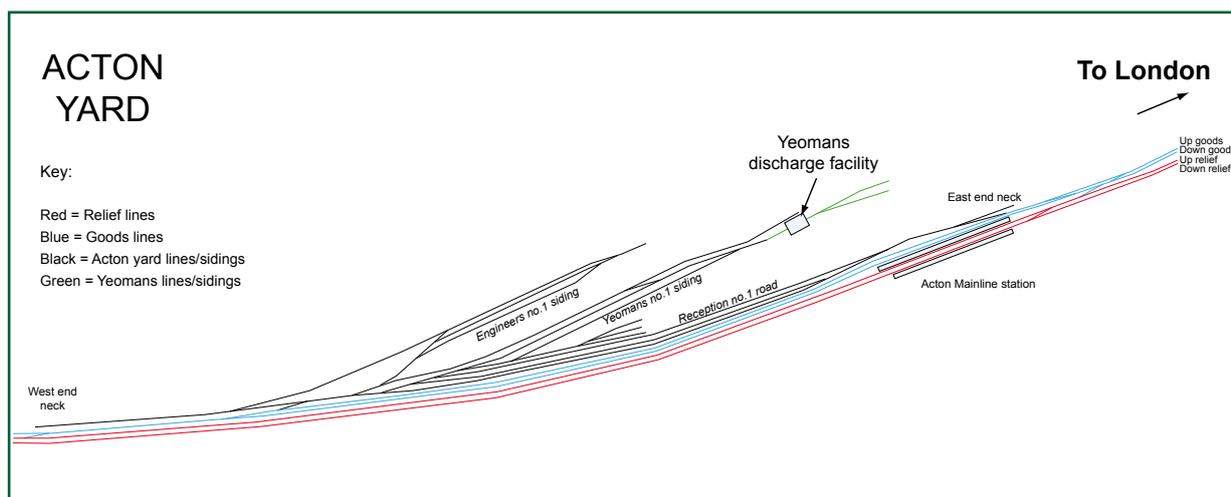


Figure 3: Plan of Acton Yard

External circumstances

- 13 On the night before the incident, when the train was being made up at Acton, the weather was cool (with a minimum temperature of 3°C) and wet. At the time the train left Acton, rain was falling, and this continued until after the train had passed Romford.
- 14 The weather conditions in the weeks before the incident are discussed in paragraph 38.

Train involved

- 15 The train was hauled by a class 66 diesel-electric locomotive and consisted of 34 wagons. The leading 32 wagons were empty. The 33rd wagon, type PGA number 14513, had been loaded with 34.8 tonnes of recovered ballast on 5 December 2009 (figure 4). When the train was examined after the incident, about 15 tonnes of ballast remained in this wagon. The last wagon in the train was loaded with sand.
- 16 PGA wagons are air-braked four-wheeled vehicles, which carry mineral or aggregate material in two hoppers, each with a set of power-operated bottom doors which can be controlled by a person standing on the ground alongside the wagon (figure 4).
- 17 Wagon 14513 was built in 1980. It was originally built for Tilbury Roadstone, and had other owners before it was bought by EWS (which was renamed DB Schenker in January 2009). Two other companies also operate PGA wagons on the national rail network.



Figure 4: Wagon 14513, showing door control and locking handles

Staff involved

18 DB Schenker has a grading structure for 'ground' staff, usually known as shunters (their duties include shunting, preparing trains, and associated tasks connected with freight operations). The base grade is B, and above this is grade A. Production supervisors, who oversee the work of grade A and B shunters as well as carrying out operational duties, are grade TS(5). The staff who were involved in the events at Acton yard leading up to the incident were:

- Production supervisor grade TS(5) (shunter X). He joined DB Schenker at Acton on 5 October 2009, and had not previously worked in the rail industry. He was given five weeks basic training in ground staff duties, and was then assessed as competent in these by a production manager. He was given further on-the-job training, mentored by grade A staff, until the end of 2009, and was then put into post as TS(5) to run the yard on shift with two other TS(5)s who had been recruited at the same time.
- Production supervisor grade TS(5) (shunter Y). He also joined DB Schenker from outside the rail industry in October 2009, and his training, assessment and appointment as TS(5) at Acton yard took place alongside shunter X.

- Shunter grade B (shunter Z). He had started on the railway in 1992, and at the time of the incident he had been at Acton yard for 12 years, 11 of them as a grade A shunter. He had applied for a TS(5) job in 2009, but had not been successful. He was subsequently demoted to grade B when the grade A role was taken over by TS(5) staff (paragraph 56).

Events preceding the incident

- 19 The wagon involved in the incident was loaded with *recovered (or recycled) ballast* at Acton yard on 5 December 2009. On 7 December the wagon formed part of a train from Acton to the roadstone terminal at Harlow Mill, Essex. This train was due to be unloaded at Harlow Mill, but because of a derailment in the yard there, wagon 14513 could not be unloaded and it was returned to Acton with its load still on board. Staff at the Yeoman Aggregates terminal at Acton attempted to unload the wagon on 9 December, because it was needed for another service, but encountered difficulties. One of the two pairs of doors on the wagon would not open, and when the other pair was opened, the material inside would not come out. The Yeomans staff then closed the wagon doors, and informed DB Schenker of the problem.
- 20 DB Schenker did not unload wagon 14513, and it remained attached to a set of wagons which travelled to several locations over the next few weeks (the movements of the wagon in this period are described in detail in paragraphs 35 to 40), until 4 January 2010 when it was returned to Acton yard and detached, still loaded with recovered ballast. It then stood in a siding at Acton until 3 February.
- 21 The evidence of witnesses is that at about 14:00 hrs on 3 February 2010 shunter X was instructed to make up train 6L57, by re-marshalling a set of PGA wagons to remove six vehicles that required repairs, and adding ten other wagons including 14513. Shunting to carry out this task began about 18:30 hrs and took until 21:30 hrs to complete.
- 22 Shunter X, who had been on duty since 10:00 hrs, then had a short conversation with shunter Y, who was just coming on duty, about the current situation in the yard. Shunter X booked off duty at 22:00 hrs and went home. Shunter Y took over the task of *preparing* train 6L57. He entered the details of the train into the *TOPS computer system* (but did not correctly record the order of the wagons in the train).
- 23 On the morning of 4 February, the locomotive for train 6L57 arrived at Acton shortly after 05:00 hrs. Shunter Y signed the *train list* which the TOPS system had generated for train 6L57 (to indicate that the train had been marshalled as shown on the list, and prepared for departure) and gave it to the locomotive driver. The driver, and shunter Z (who had come on duty at 22:00 hrs the previous evening), then shunted the train from the Yeoman Aggregates terminal to number one reception line ready for departure, and the locomotive was then coupled to the east end of the train.
- 24 Shunter Z and the driver carried out a *brake test* on the train, and as shunter Z walked to the back of the train to make the test he noticed that some of the wagons required adjustments to couplings and air pipes, and he carried these out (paragraph 66). The train departed from Acton at 05:58 hrs.

Events during the incident

- 25 The train ran from Acton towards Romford via Stratford, where another driver took over the train. After leaving Stratford 6L57 ran on the *Down Main line*, passing through platform 3 at Romford station at 07:25 hrs, at about 59 mph (95 km/h). CCTV from the station showed that ballast was discharging from underneath wagon 14513, and some stones rebounded onto platform 2 (the *Up Main line* platform), where they struck three people who were walking along the platform after getting off a train.
- 26 The station staff called an ambulance to attend to the people who had been struck, and telephoned the signalling centre at Liverpool Street (where this line is controlled from) to inform the signaller of what had happened.
- 27 The signaller used signals to stop the train before it reached Shenfield station (eight miles (13 km) from Romford), and spoke to the driver via the telephone at the signal. He told the driver what had been reported, and instructed him to proceed a further three miles (5 km) to Ingatestone at 20 mph (32 km/h). There is a loop at Ingatestone, where the train could be examined clear of the main line.

Events following the incident

- 28 Two of the three people who had been struck by flying stones at Romford station were treated by paramedics from the ambulance which had been called to the station, and did not need to go to hospital. The third person declined treatment.
- 29 At Ingatestone loop, the train was met by a Network Rail mobile operations manager, who, together with the driver, examined the train. They found that most of the wagons were empty, but they swept some loose stone off flat surfaces on the 33rd and 34th wagons (which were loaded, respectively, with recovered ballast and sand (paragraph 15)). They took down the numbers of the wagons, and noted that there were some differences from the TOPS list. The driver telephoned the correct order of the wagon numbers to DB Schenker's control office. Neither the driver nor the mobile operations manager noticed an open door on wagon 14513.
- 30 The signaller at Liverpool Street then authorised the train driver to proceed at normal speed. The train left Ingatestone at 09:10 hrs. As it passed through Colchester station, 28 miles (45 km) further on, at 09:46 hrs, staff in the signal box there heard ballast flying from the train, and took action to stop it by the use of signals. The signaller at Colchester contacted the train driver and instructed him to proceed at 20 mph (32 km/h) to the train's destination, Ipswich (17 miles (27 km) from Colchester), where the train was impounded for examination by the RAIB.

The investigation

Sources of evidence

31 The following sources of evidence were used:

- witness statements;
- examination of conditions at Acton yard;
- data from the train locomotive's on-train data recorder;
- CCTV recordings of Romford station;
- meteorological records;
- examinations and tests carried out by the RAIB on the wagon involved; and
- review of DB Schenker documents and procedures.

Key facts and analysis

Identification of the immediate cause¹

- 32 **The immediate cause of the incident was that ballast fell through an open door on wagon 14513, and ricocheted off the track onto the platform.**
- 33 When the RAIB examined the train at Ipswich, one of the two sets of doors on wagon 14513 was found to be almost fully open. The other doors were closed, but not fully locked.
- 34 The CCTV from Romford station shows that as the train passed through, it generated a cloud of dust. After they had dealt with the injured people, the station staff searched the area and found a quantity of ballast spread along platform two, and saw that there was some more that appeared to have been recently dropped on the track.

Identification of causal² factors and contributory factors³

The wagon

Open wagon doors

- 35 **The leading bottom discharge doors on wagon 14513 were open when the train left Acton and when it passed through Romford. This was a causal factor.**
- 36 Wagon 14513 was given an annual vehicle inspection and brake test on 21 October 2009. No defects were found at that time. The wagon was loaded with recovered ballast, which was probably damp (because it had been dug out of a site where track was being renewed, and would have retained moisture), at Acton on 5 December 2009. At that time, for the reasons discussed in the next paragraph, it is likely that both sets of bottom doors were closed. Following its abortive journey to Harlow Mill (paragraph 19) the wagon was returned to Yeoman Aggregates at Acton, and an attempt was made to unload it on 9 December. This was not successful, as only one set of doors could be opened, and the load stuck in the wagon and would not come out of the open set of doors. The load may have remained stuck in the wagon because of moisture-induced adhesion between the particles of the recovered ballast: the load was in this state when examined by the RAIB after the incident, and discharge terminals are equipped with vibrators to assist in releasing wet loads.

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.



Figure 5: Remaining load in wagon 14513, after the incident

- 37 From 5 to 16 December, the air temperature was above freezing. It is not feasible that, in those conditions, the wagon could have run with the doors open without some of the load coming out during transit, because of the vibration that a wagon experiences when it moves. Between 9 and 16 December, the wagon was in trains which ran from Acton to Ipswich, then to Watford, Acton, Dagenham, Bow and back to Acton again.
- 38 On 16 December, the temperature dropped sharply. It is likely that the load in the wagon was frozen from 16 December to 23 December, a period in which the wagon travelled twice from Acton to Dagenham and back, then to Bow and back to Acton, and then to Marks Tey (Essex) and Hayes (Middlesex). The wagon remained at Hayes over the Christmas and new year period, and did not move again until 4 January, when it was taken back to Acton and placed in a siding. Although the temperature rose significantly after 23 December, by 4 January it was below freezing again.
- 39 Attempts may have been made to unload the wagon on three occasions after 16 December: twice at Bow and once at Hayes. Neither of these terminals was expecting a delivery of recovered ballast (they were due to receive other minerals), but it is possible that unloading of 14513 may have been begun in error, following the successful discharge of other wagons in the train, and then halted when the operator saw the nature of the load. Closing the doors, especially if the load was still coming out, may not have been fully effective (paragraph 50).

- 40 While the wagon was stationary in Acton yard, from 4 January to 3 February, most of the load is likely to have stuck in the wagon even though one set of doors was open: initially because the load was frozen, and latterly for the reasons discussed in paragraph 36. However, when the wagon was moved some of the load did come out, and several tonnes were found on the tracks in the yard where the wagon was shunted on 3 February. This suggests that a wagon door was open on or after 4 January when the wagon arrived at Acton.
- 41 After the incident, when the RAIB examined the train at Ipswich, the leading pair of doors on wagon 14513 was found to be open, and the other pair, although closed, was not fully locked. One of the two hoppers was empty, and the other was almost full (figure 5).

The design of the door operating and locking mechanisms

- 42 The position of the lock handles on the PGA wagon can lead staff to believe that the doors are closed and locked when the doors are actually partially or fully open. The design of the mechanism permits this condition to exist. This was a causal factor.**
- 43 The hopper doors on PGA wagons are power-operated, and are opened and closed by air cylinders (figure 6). These are controlled by red-painted handles below the *solebar* of each wagon. There is a separate lock mechanism which acts on both ends of each pair of doors, and is operated mechanically by white-painted handles below the solebars⁴.
- 44 The lock mechanism uses a hooked cam which engages with a pin on each door (figure 7). Closing the doors should cause the lock to engage, but friction in the linkages and obstruction by stones may mean that the lock is not fully secure until the white handles have been forcibly operated by the person unloading the wagon. Witness evidence suggests that staff were in the habit of kicking the white handles to secure the locks. Once the doors are locked, the design of the mechanism means that it is not possible for them to be unlocked without deliberate action by an operator.
- 45 The lock handles are designed to be nominally vertical when the lock is engaged and secure, and to stick out at an angle if it is not. However, the RAIB's tests found that, because of the design of the cam, and wear and distortion in the rodding linking the handles to the cam, the variation in the position of the handles was very small, and could not be relied on to indicate the state of the lock (figure 8). Handles could appear to be vertical with the doors both locked and unlocked. This is a probable causal factor, because witness evidence indicates that staff making visual checks relied on the position of the handles to indicate the condition of the doors.

The ability to detect the position of the doors

- 46 The difficulty in detecting that the doors are properly closed and locked after a wagon has been discharged was a possible causal factor.**

⁴ The current Railway Group Guidance Note GM/GN2589 'The Design and Construction of Freight Wagons' (Issue one, April 2004) says that 'hopper doors should be fitted with primary and secondary locking systems to prevent a single point failure causing doors to open'. The PGA type wagon was designed many years before this guidance was produced, but the RAIB considers that the arrangement of power-operated doors with a separate mechanical cam and pin lock meets the intention of the guidance.

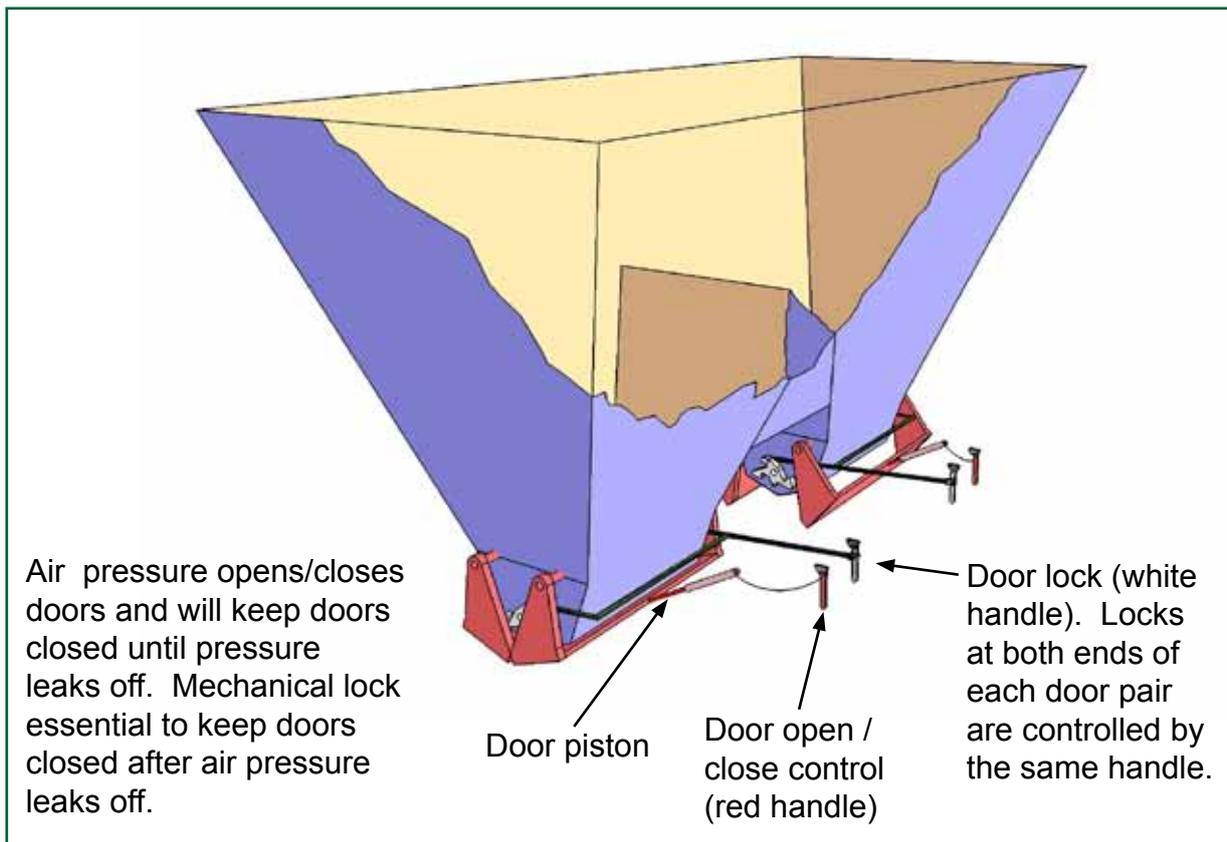


Figure 6: Door arrangements on PGA wagons

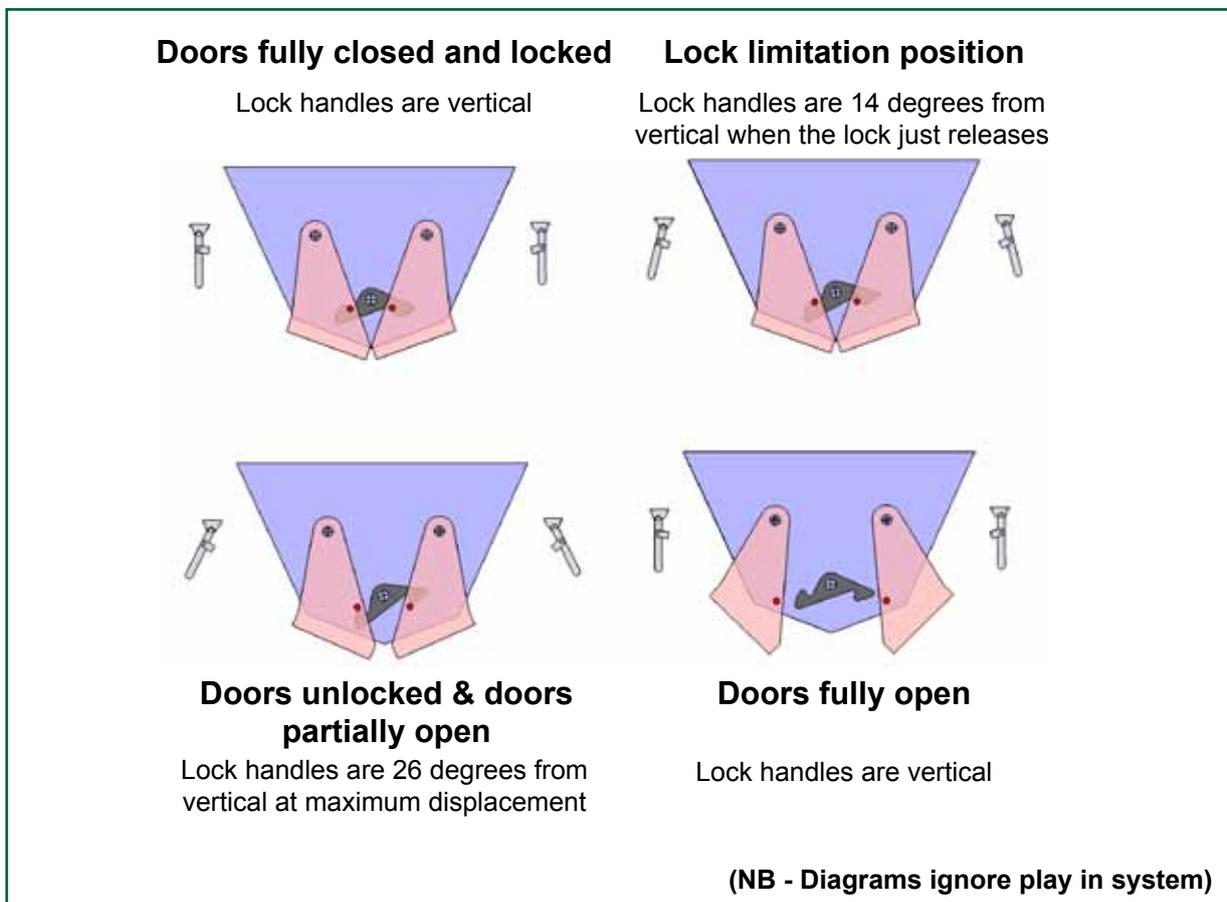


Figure 7: Door locking handles



Figure 8: Variations in handle position between doors locked and unlocked

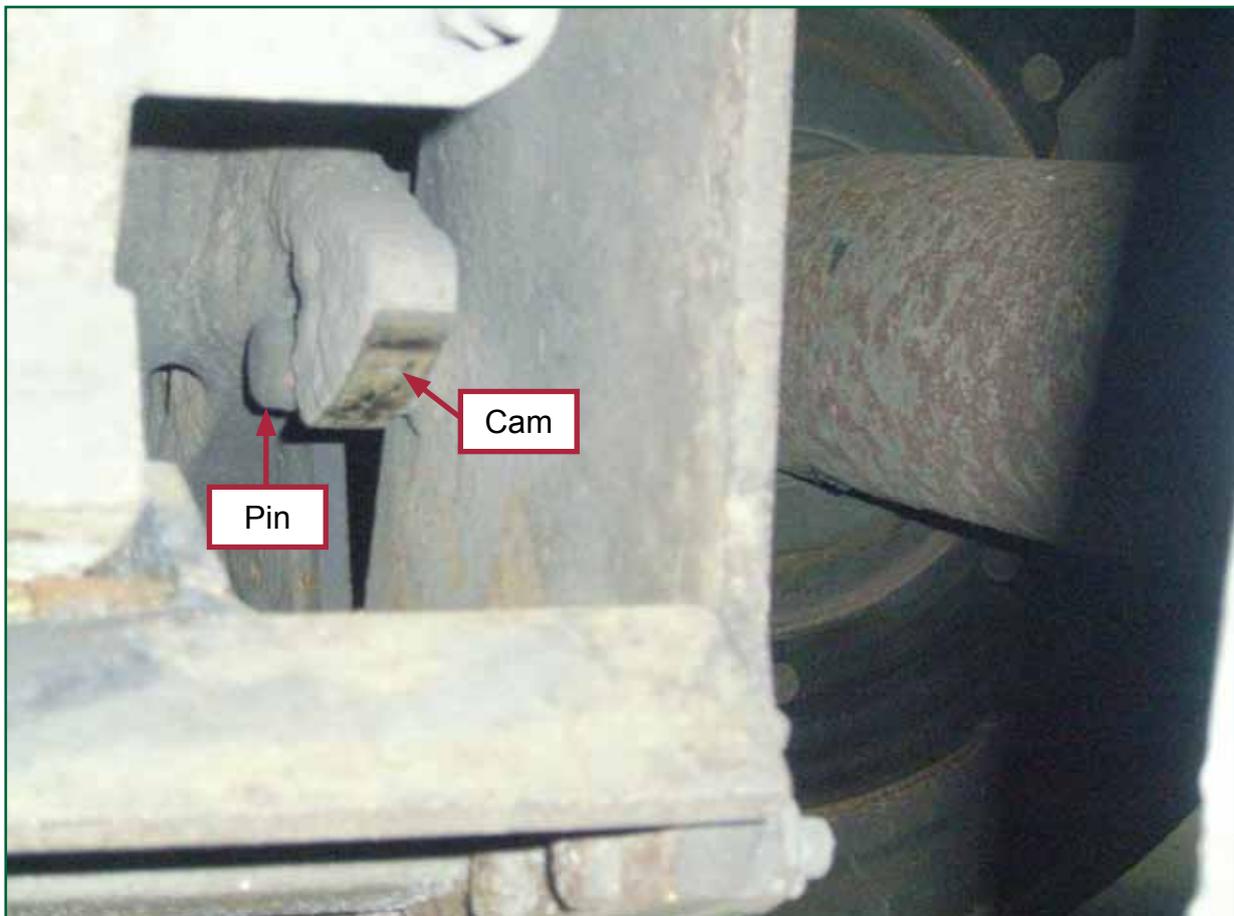


Figure 9: View of lock mechanism, between doors and hopper, showing cam not fully engaged with pin

- 47 The only way to be certain that the lock is secure is to confirm that the cam has engaged with the door pin by looking through the gap between the ends of the doors and the hopper (figure 9). This is not easy to do: it is awkward and time-consuming, and requires a torch, sometimes even in daylight.
- 48 Evidence from yard and terminal staff at Acton was that they looked at the lock handles to check the security of the doors, and did not specifically check the cam/pin lock position. A DB Schenker instruction for closing the doors of PGA wagons, issued in November 2009, did not mention checking the cams and pins.
- 49 Wagons are normally fully discharged each time they are unloaded. The doors should then close without difficulty, as there is no obstruction to the free movement of the doors and the locks. This is the usual time for the doors to be closed and locked, and for this to be checked.
- 50 However, if a wagon is not fully discharged, attempts to close the doors while the load is coming out may result in the doors not closing fully, because stones between the door leaves obstruct their movement. Witness evidence and the RAIB's examination and testing of the wagon indicate that this is feasible. In this situation it may be possible for the operator to kick the lock handles so that they hang vertically, without either the lock being fully engaged or the operator being aware of this.
- 51 Witness evidence suggests that the DB Schenker staff who marshalled and prepared trains at Acton relied on the hopper doors being closed by Yeomans staff after wagons had been unloaded, and did not normally check these doors again when trains were being prepared, although this was part of the preparation process, and should have been identified by management checks.
- 52 The difficulty of observing the position of the wagon doors, and the absence of a reliable indicator that the doors were locked (paragraph 45), is considered to be only a possible causal factor, because the Yeomans and DB Schenker staff on duty at Acton yard on 3 February had not been trained on door operation on PGA wagons, and did not know that it was necessary to look closely at the doors to confirm their condition: they relied on the position of the handles (paragraph 45).
- 53 At the Yeomans discharge terminal at Acton, which is under cover, the only source of artificial light was from lamps in the roof of the building. These cast deep shadows, making it very difficult to see the mechanism on the underside of wagons.
- 54 The staff at the Yeomans terminal at Acton had no written instructions or guidance on the closing and checking of wagon doors.

The management of operations at Acton yard

Competence of DB Schenker staff

- 55 The shunters were inexperienced and not adequately trained, in particular in relation to PGA wagons. This was a probable causal factor.**

- 56 Shunters X and Y joined DB Schenker from outside the rail industry on 6 October 2009. They were given five weeks basic training and passed out by the production manager at Acton as 'core' ground staff. They were then given ad-hoc mentoring by grade A shunters until the end of 2009. Evidence suggests that there was some friction between the new shunters and the existing staff during this process, because the new staff were due to become production supervisors (grade TS(5)), over the head of the existing staff, who would be moved to a lower grade as a result.
- 57 During the period of mentoring, the TS(5) staff gained some experience of the types of wagon which passed through Acton yard, and the mentors showed them how Acton yard staff carried out train preparation. This did not cover the full list of operational pre-departure checks required by section C4.1 of the Working Manual for Rail Staff (Railway Group Standard GO/RT3056). The new staff were not trained on specific types or assessed on their knowledge of wagons.
- 58 From January 2010 the recently recruited TS(5) staff took over supervisory duties in Acton yard from grade A staff, and the grade A staff were downgraded to grade B (this reorganisation, and the reasons for it, is described in detail in paragraphs 70 to 72).
- 59 None of the yard staff who were on duty at the time of the incident had been trained on the door systems on specific types of wagons, such as the PGA, and did not fully understand the operation or the mechanism of the doors, or what to look for to check the security of the doors. They did not have sufficient knowledge to deal with the range of vehicle types passing through Acton, or the operational requirements of the yard. This was a probable causal factor in the incident because the staff did not take action that might have enabled them to identify the insecure doors on wagon 14513.
- 60 The TS(5) staff lacked experience in the operation of the yard, and this may have led to the omission of the pre-departure preparation of train 6L57.

Management of the yard

- 61 **The support for the staff of the yard was inadequate, which may have resulted in the absence of proper pre-departure preparation for train 6L57. This was a possible contributory factor in the incident.**
- 62 The area manager had asked the Acton production managers to ensure that they provided 24 hour support for the new TS(5) staff, but the production managers did not have the resources to give continuous cover, and were not usually present during the night. In the week beginning 1 February 2010, some of the grade B staff at Acton were away from the yard on a training course, and for most of the time, only TS(5) staff were available for shunting duties. On 3 February one of the production managers was told by the area manager that the yard was becoming congested with wagons, and that empty wagons which had been standing there for some time should be put into trains and sent away for revenue earning service. He gave instructions for this to be done, but he was not aware that wagon 14513 contained recovered ballast.

63 This created a large amount of marshalling work on 3 February, which was carried out by shunter X. Marshalling of the wagons involved in the incident took from about 18:30 hrs until after 21:30 hrs, when shunter X was coming to the end of his shift, and did not leave him time to prepare the train for departure. Neither of the production managers was present during the evening, because their normal practice was to work office hours as far as possible.

The preparation of the train

64 Shunter X did not finish the preparation of train 6L57 for departure before he went off duty at 22:00 hrs on 3 February. When he handed over to shunter Y, he expected that the preparation would be completed overnight by shunter Y, but the communication between the two men was not clear enough to convey this. At 06:45 hrs the following morning, shunter X realised that there might have been a misunderstanding, and telephoned from his home to the yard. By that time train 6L57 had already departed.

65 Preparing a train for departure includes the operational pre-departure check specified in section C4 of the Working Manual for Rail Staff. This covers, among other things:

- examination of doors to ensure that they are closed and secured;
- checking that the 'instanter' couplings between the wagons have been placed in the short, or running, position; and
- checking the connection, between the wagons, of the hoses which supply air for the door operating system.

None of these things were done on train 6L57 when wagons were coupled during the marshalling operation.

66 Shunter Y had gained the impression from his conversation with shunter X that the wagons to form train 6L57 had already been prepared. He did not carry out an operational pre-departure check of the train. He instructed shunter Z, who came on duty at 23:00 hrs, to carry out a brake test on the train when it was ready to leave. Shunter Z carried out the brake test when the locomotive had been coupled to the train, at about 05:30 the next morning. As he walked alongside part of the train before carrying out the brake test, shunter Z adjusted two 'instanter' couplings and connected two sets of air hoses. Subsequent examination found that there were other couplings and hoses which he had not dealt with.

67 The result of these actions was that train 6L57 departed from Acton without having been properly prepared, in that one set of doors on wagon 14513 were partly open, some 'instanter' couplings were not correctly set, and some air hoses (for operating the wagon doors) were not connected. However, this factor is not considered to be causal to the incident, because even if the train had been prepared, it is likely (for the reasons given in paragraphs 47 and 48) that the insecure doors on wagon 14513 would not have been identified. However, the looseness caused by the 'instanter' couplings being incorrectly set would have increased the shocks that the wagons were subject to when the train was running, and may have caused more product to spill out, and is therefore a contributory factor in the incident.

Identification of underlying factors⁵

68 The RAIB identified one underlying factor. This was:

69 The organisation of the staff in Acton yard was changed in the months before the incident without an adequate risk assessment or safety validation.

70 The grade TS(5) shunters had been recruited in late 2009 to act as supervisory staff at Acton, because DB Schenker wished to reorganise operations in the yard to improve its efficiency, in line with the way in which the management of yards elsewhere had previously been revised.

71 The change was implemented in January 2010, after the new staff had completed their training. At that time the grade A shunters were reduced to grade B.

72 DB Schenker did not carry out any safety validation exercise (to assess the risks that could result from changes in organisation and working practices, and identify any necessary control measures) before making this change. As a result of this the new arrangements did not clearly allocate the responsibilities within the yard, and the new staff were put in charge of the yard while they were still inexperienced.

Previous occurrences of a similar character

73 During 2009, there were two incidents in which trains operated by DB Schenker were stopped for examination after reports of mineral products leaking out of four-wheel hopper wagons. On 1 September 2009, sand leaked from two PAA type wagons (similar to PGAs) at Littleport, Cambridgeshire. The wagons were found to be defective and were detached from the train.

74 On 30 October 2009 a train departing from Marks Tey, Essex, was observed to have sand falling from one PGA type wagon. The train was stopped and one set of doors was found to be slightly open because sand was preventing them from closing.

75 The RAIB has investigated other incidents in which inadequate preparation of freight trains has been a factor. These include:

- The derailment at Hatherley, near Cheltenham, on 18 October 2005. A train departed from the yard where it had been prepared with the handbrake on one wagon left 'on' (RAIB report number 08/2006)⁶.
- Rails at Urchfont and Kennington were broken by the passage of a freight train on 5 January 2006. The train had departed from the quarry where it originated, with substantial 'flats' on one set of wagon wheels (report number 27/2006).
- A train carrying track panels was despatched from Basford Hall yard, Crewe, with an insecure load on 21 February 2006 (report number 06/2007).

⁵ Any factors associated with the overall management systems, organisational arrangements or the regulatory structure.

⁶ RAIB reports are available at http://www.raib.gov.uk/publications/investigation_reports.cfm

- A stanchion (upright steel bar) on a freight train fractured and struck a passenger train travelling in the opposite direction on an adjacent track near Burton-on-Trent on 1 August 2007, causing damage to the train (report number 01/2008).
- An over-height container on a freight train struck and damaged a platform canopy at Basingstoke station on 19 December 2008 (report number 21/2009).

In all of these cases there were deficiencies in the preparation and/or examination of the train before departure from the yard or terminal where it originated. The RAIB made recommendations about aspects of freight train operations in each the investigation reports, but none of them are directly relevant to the circumstances of the incident at Romford.

Observations⁷

DB Schenker's response to reports of defects

- 76 On 9 December 2009, staff at Yeomans terminal at Acton attempted to unload wagon 14513, but found that they were not able to do so because one set of doors would not open and the load was stuck and would not come out of the other set (paragraph 36). Yeomans reported the defective wagon to DB Schenker.
- 77 DB Schenker had no procedure for dealing with reports of defective wagons made by its customers, and because of this, no action was taken to investigate the report or repair the wagon.

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.

Summary of conclusions

Immediate cause

78 The immediate cause of the incident was that ballast fell through the open doors of wagon 14513 and ricocheted onto the platform at Romford station as train 6L75 passed through (**paragraphs 33 and 34**).

Causal factors

79 Causal factors were:

- a. The leading bottom discharge doors on wagon 14513 were open when the train left Acton and when it passed through Romford (**paragraphs 36 to 41**).
- b. The position of the lock handles on the PGA wagon can lead staff to believe that the doors are locked when the doors are actually partially or fully open. The design of the mechanism permits this condition to exist (**paragraphs 43 to 45, Recommendations 1 and 2**).

80 It is probable that the following factor was causal:

- The yard staff were not adequately trained, in particular in relation to PGA wagons (**paragraphs 56 to 59, Recommendation 3**).

81 It is possible that the following factor was causal:

- The difficulty in detecting that the doors are properly closed and locked after a wagon has been discharged (**paragraphs 47 to 54, Recommendations 1 and 2**).

Contributory factors

82 A possible contributory factor was that the support for the staff of Acton yard was inadequate, which may have resulted in the absence of proper pre-departure preparation for train 6L57 (**paragraphs 61 to 67**).

Underlying factors

83 An underlying factor was that the organisation of the staff in Acton yard was changed in the months before the incident without an adequate risk assessment or safety validation (**paragraphs 70 to 72, Recommendation 4**).

Additional observations

84 Although not linked to the incident on 4 February 2010, the RAIB observes that DB Schenker had no procedure for dealing with reports of defective wagons made by its customers (**paragraph 77, Recommendation 5**).

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

85 DB Schenker has:

- issued a national instruction to ground staff that the person who prepares the train must also sign the TOPS train list;
- re-trained all staff at Acton on the preparation of PGA wagons, including the requirement to check the cam/pin lock arrangement on each door; and
- reviewed and improved the lighting arrangements at Acton yard, and equipped staff at all yards with improved personal lighting equipment to enable them to check wagon doors.

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

86 DB Schenker has:

- revised the organisational arrangements at Acton yard so that the grade TS(5) staff are supervised by the more experienced staff (who have been re-graded from B to A); and
- appointed two experienced staff to oversee the working of Acton yard.

87 In the light of this action addressing the factor identified in paragraph 82, the RAIB has decided not to issue a further recommendation.

Recommendations

88 The following recommendations are made⁸:

Recommendations to address causal and contributory factors

- 1 *The intention of this recommendation is that the PGA wagon fleet should be modified to enable wagon discharge operators to have a clear indication of the state of the doors.*

DB Schenker should investigate the design and the maintenance arrangements of the hopper doors of PGA type wagons and their control gear, and evaluate whether it is feasible to devise a means by which the open, closed or locked status of the door can be more clearly indicated to the operator than is the case at present, and implement this change if it is reasonably practicable to do so (paragraphs 79b and 81).

- 2 *The intention of this recommendation is that staff at terminals served by DB Schenker should have guidance on how to operate wagon doors and check they are secure, and adequate light to enable them to do this.*

DB Schenker should issue to its staff and relevant customers guidance and instructions on how to correctly operate the doors of all the types of wagons in use by the company, and how to check that the doors of wagons are secured closed. As part of this work, DB Schenker should review the visibility of wagon doors and the means of ensuring suitable levels of lighting to enable staff to check them (paragraphs 79b and 81).

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 www.raib.gov.uk.

- 3 *The intention of this recommendation is to improve the competence of DB Schenker ground staff.*

DB Schenker should carry out a review of the training, monitoring and competence of all ground staff, with particular reference to the use of PGA wagons and the supervision and operation of yards. This review should include:

- The training of staff in the preparation and examination of trains before departure; and
- Instructions to staff on when train preparation and examination should be done.

The results of this review should be implemented as appropriate (paragraph 80).

Recommendation to address underlying factors

- 4 *The intention of this recommendation is to learn lessons from the incorrect application of DB Schenker's safety management system.*

DB Schenker should investigate the reasons why formal safety validation of organisational changes (including risk assessment) did not take place in respect of the changes implemented at Acton Yard in 2009-10, and implement any recommendations arising from this investigation (paragraph 83).

Recommendation to address other matters observed during the investigation

- 5 *The intention of this recommendation is to introduce a procedure within DB Schenker for responding to reports of defective wagons that come from outside the company.*

DB Schenker should devise and implement a procedure for handling reports of defective wagons that are received from sources outside the company (paragraph 84).

Appendices

Appendix A - Glossary of abbreviations and acronyms

EWS	English, Welsh & Scottish Railway (renamed DB Schenker in January 2009)
TOPS	Total Operations Processing System

Appendix B - Glossary of terms

All definitions marked with an asterisk, thus (*), have been taken from Ellis's British Railway Engineering Encyclopaedia © Iain Ellis. www.iainellis.com.

Ballast	Crushed stone, nominally 48 mm in size and of a prescribed angularity, used to support sleepers both vertically and laterally. The stone used is generally granite. Not to be confused with the traditional construction grade of ballast, which is largely ungraded.*
Brake test	(brake continuity test) A test to confirm the application and release of brakes on the locomotive and other rail vehicles in a train when demanded by the driver.*
Down Main line	The Down Main is the second from the south side of the four lines passing through Romford station, and is used by trains going away from London.
Instanter	A chain-like assembly of two standard oval links connected by a special pear shaped link, used to connect the coupling hooks of two adjacent rail vehicles. The special middle link allows the chain to be shortened once it is fitted, which reduces slack in the coupling thereby reducing buffing and draw loads.*
Marshalling	Shunting wagons into a train formation (including putting the couplings and pipes into their correct position).
Preparing	Examining a train and verifying that a train is ready to depart, including signing the train list.
Recovered (or recycled) ballast	Material which has been removed from the track bed during track renewal work, and then processed to make it suitable for use in road construction, consisting of a mixture of different sized stones.
Solebar	The longitudinal structural members forming the spine of a rail vehicle, located below the carbody. The solebar is supported by the bogies or other running gear.*
TOPS computer system	Total Operations Processing System, a mainframe based computer system used to track rail vehicles. It deals with destination, load, location and maintenance information for all vehicles on the network. Vehicle data is entered for every movement, allowing virtually real time updates.*
Train list	Document generated by the TOPS system, giving information about a train, including the locomotive and rolling stock numbers and types, load classification and weights, maximum speeds, and overall length.
Up Main line	The Up Main is the southernmost of the four lines passing through Romford station, and is used by trains going towards London.

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

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