Rail Accident Investigation Branch

Rail Accident Report

Derailment near Waterside, East Ayrshire
21 January 2006

Department for Transport

Report 05/2007
January 2007

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.

Any enquiries about this publication should be sent to:

RAIB
The Wharf
Stores Road
Derby
DE21 4BA

Email: enquiries@raib.gov.uk
Telephone: 01332 253300
Fax: 01332 253301
Website: www.raib.gov.uk

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

Derailment near Waterside, East Ayrshire 21 January 2006

Contents

Introduction

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.

3 This report contains the findings of the RAIB investigation into the derailment on the Chalmerston branch line near Waterside, East Ayrshire on 21 January 2006.

4 Access was freely given by Scottish Coal, English, Welsh and Scottish Railway (EWS) and Network Rail to their staff, data and records for the purposes of this investigation.

5 Appendices at the rear of this report contain glossaries explaining the following:

- acronyms and abbreviations are explained in Appendix A; and
- certain technical terms (shown in *italics* the first time they appear in the report) are explained in Appendix B.

6 References to left hand and right hand rail are as seen by the driver of the derailed train proceeding from Chalmerston towards Dalrymple Junction.

Summary of the report

7 At 03:45 hrs on 21 January 2006, the driver of train 6C64, forming the 03:00 hrs coal train from Chalmerston colliery to Carlisle via Ayr, reported that the rear six wagons of the train had become derailed. The train was stood at Patna, close to the 51¼ milepost, on the single line between Chalmerston and Dalrymple Junction, near Ayr. The train, formed of locomotive 66056 and 21 loaded *HTA* wagons, had come to rest on Network Rail infrastructure, with the derailed wagons lying upright in the ballast.

8 The immediate cause of the derailment was found to be a transverse fracture in the running rail within the section of track owned by Scottish Coal at 53 miles 889 yards. The break, located on the outside rail of a right hand curve, presented an obstruction which allowed the leading wheelset of wagon HTA 310724, positioned 16th in the train, to climb onto the rail head. It continued in this manner for a short distance before derailing to the left. The following five wagons making up the rear section of the train remained on the track and were derailed as the train came to a stand.

9 Over 2 miles (3 kilometres) of track were damaged in the derailment.

10 No-one was injured in the accident, and there was no risk to any part of the system other than the freight-only branch to Chalmerston.

11 Causal factors were:

- Failure of the track support;
- A track inspection regime which was inadequate to identify and rectify track and geometry defects;
- A 4-weekly reporting regime which did not adequately record work required; and
- The lack of a mutual understanding of the arrangements for track inspection and maintenance activities between Scottish Coal and EWS. This resulted in confusion among those undertaking this activity and allowed gaps in responsibility to remain unresolved.

12 In addition, the following factors were considered to be contributory:

- The poor condition of the line overall, leading to a high workload being reported by EWS inspection staff. As a consequence, evidence of sleeper deterioration at the site of the derailment was either not detected or not reported;
- The lack of inspections involving the use of a working cross-level gauge which allowed track geometry defects to remain undetected. This served to increase the loading on the rail in the vicinity of the fracture. Omitting to report that cross-levels were not being measured compounded this issue and led to a significant twist fault developing unnoticed, close to the point of derailment;
- The submission of photocopied inspection reports over an extended period which did not quantify the scale of the defects or record changes to the condition of the track. This was compounded by the EWS engineer signing-off the covering report and served to compromise the effectiveness of the inspection process;
- The postponement of track maintenance activity for a period of at least six months prior to the derailment. This was despite sleeper condition being reported as 'very poor';

- The lack of specialist track maintenance knowledge or experience within, or available to, Scottish Coal. This resulted in a lack of asset knowledge or ability to ensure their requirements were being effected; and
- The decision by EWS to continue to support an arrangement which did not clearly stipulate standards.

13 Seven recommendations are made to improve the standards of infrastructure maintenance. These are contained within paragraph 109.

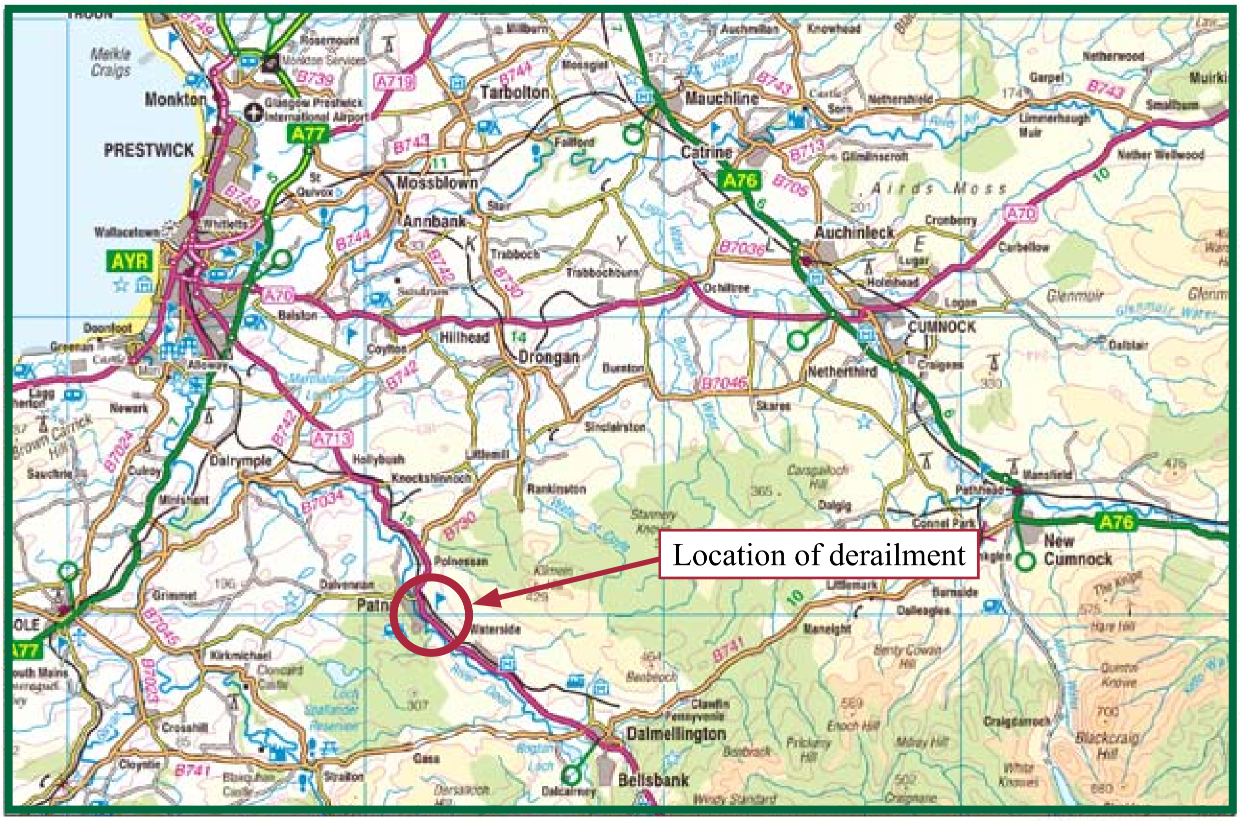

Figure 1: Extract from Ordnance Survey map showing location of incident.

The Investigation

Summary of the incident

14 Train 6C64 travelling from Chalmerston colliery to Ayr became derailed at low speed at 03:19 hrs on 21 January 2006. The train departed Chalmerston bound for Drax power station in Yorkshire and was partially derailed less than a mile into its journey on the section of single line owned by Scottish Coal. The train, comprising 21 loaded HTA bogie hopper wagons hauled by locomotive 66056, continued for 2¼ miles (3 800 m) until being brought to a standstill at 03:29 hrs. The train was halted by the increasing drag experienced when the track disintegrated beneath the rear six wagons as it passed through the village of Patna.

Background

15 The Dalrymple Junction to Chalmerston goods line, also known as the Waterside (Benbane) or Dalmellington branch, runs as a single line south-east from Dalrymple Junction on the Ayr to Stranraer Harbour line for a total distance of 11.5 miles (18.5 km). The line is owned and maintained by Network Rail from Dalrymple Junction to a boundary at Waterside (52 miles 1518 yards from Bridge Street Junction, Glasgow) near Patna. At the boundary, an end-on connection is formed with infrastructure which is privately owned by Scottish Coal (Figure 2). The Scottish Coal section covers the final approach to the colliery loading area and is 2 miles (3 300 m) in length. Chalmerston railhead is located north of the village of Dalmellington and supports a large opencast colliery operation.

16 Passenger services between Ayr and Dalmellington were withdrawn in 1964. When the coal washing and disposal plant at Waterside was closed in 1985/86, track owned by British Coal was taken up and disconnected from the British Rail network. In 1988, a route was surveyed along a former mineral line running parallel to, and above the former passenger line to Dalmellington. The mineral line had connected existing workings with the Waterside Washery, and reinstatement was planned in order to connect a proposed loading point at Chalmerston into the rail network. This led to the decision to install 1.5 miles of track on the new alignment for this purpose, requiring slight raising and slewing of the original track alignment at Waterside.

17 British Coal reinstated this line, which was effectively a private siding with an end-on connection to the national rail network, and a formal agreement for this connection was made with British Rail. This agreement was signed by the British Coal Corporation on 20 December 1988 and British Railways Board on 23 December 1988. In Clause 4 of this document, British Coal agrees to construct maintain repair and renew [their siding] to the satisfaction of the [British Rail] Engineer.

18 The track was laid by a local rail siding contractor using serviceable components reclaimed from other locations, leading to the imposition of a 15 or 20 mph speed limit from the outset. The linespeed on the British Rail section, following reopening, was 40 mph. Since 1988, British Coal has transferred ownership of its rail assets to Scottish Coal and British Rail to Network Rail.

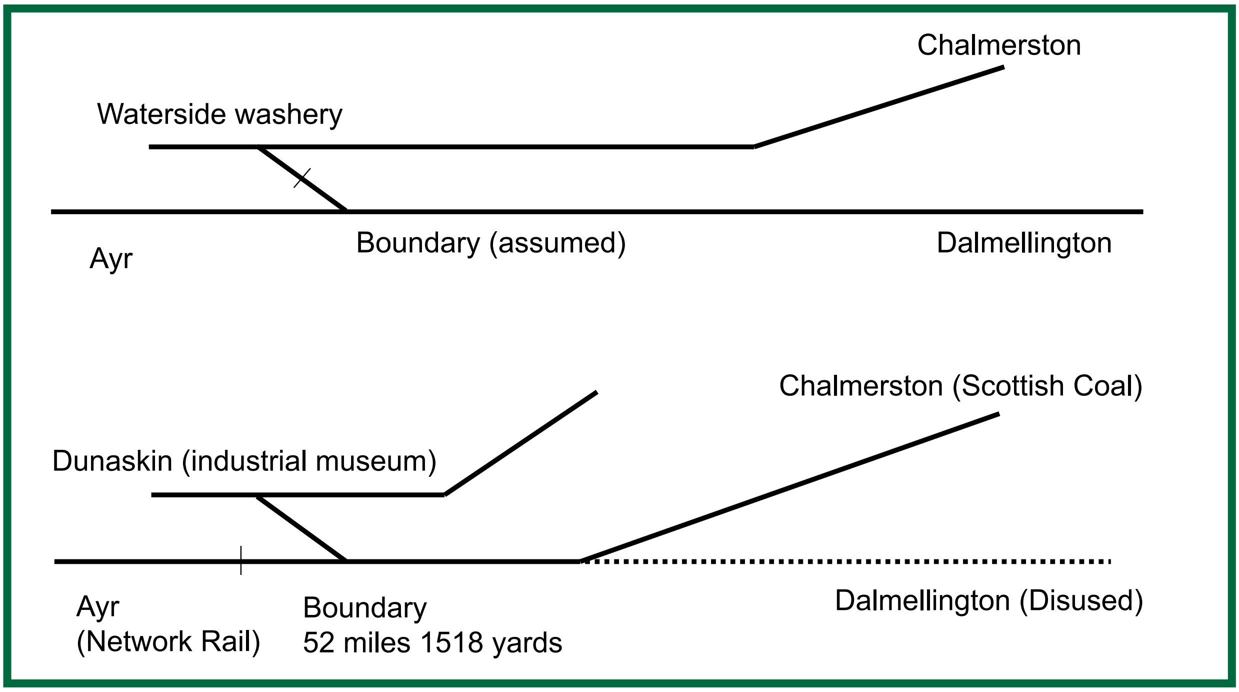

Figure 2: Schematic track layout at Waterside (pre-1964 and present).

19 From Chalmerston weighbridge, the line drops steeply at an average gradient of 1.4% (1 in 70) to the Network Rail boundary at Waterside. From this point, the line climbs slightly reaching a summit at the 50 milepost north of Patna village, before descending at gradients of up to 1 in 70 down the Doon valley for 6 miles to Dalrymple Junction. The gradient on the Scottish Coal section of line, known locally as the Approach Road, has given an ongoing problem with downhill track *creep* caused principally by the braking effect of loaded trains running downhill at a controlled speed. A map showing mileages is given in Figure 3.

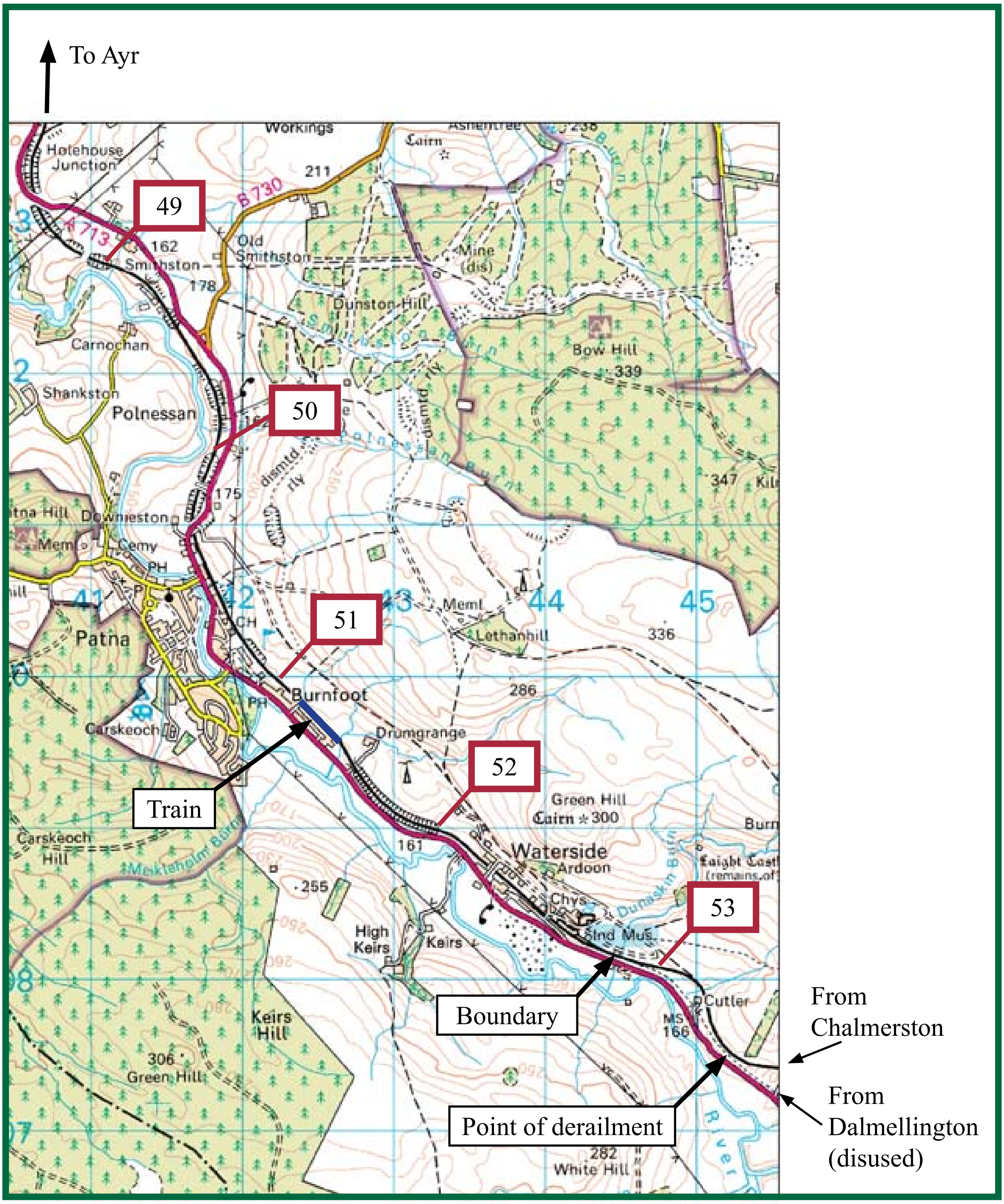

Figure 3: Site map.

20 A loop is provided at Chalmerston with the capacity for 38 HAA (2 axle) hopper wagons or 21 HTA bogie wagons. 2 axle HAA Hopper wagons were in use on this line until early 2005 when they were largely replaced with modern HTA bogie wagons.

21 Line speeds have been lowered to 10mph on Scottish Coal track and to 20 mph on Network Rail track since reconnection. At Burnton viaduct near the village of Dalrymple, a 5 mph permanent speed restriction has been imposed. The condition of this viaduct, which was subject to major repairs in 2002, also restricts the weight of trains using the line, giving a maximum axle load of 22.86 tonnes denoted as *Route Availability* 8 (RA8). Larger HTA wagons were introduced on the line during 2005 (see Figure 4) following work done by EWS to assess the effects of their introduction on track condition nationally. However, it is not clear from EWS records, whether there was a specific load assessment at Chalmerston. The effect of the RA8 weight restriction on this line is to reduce the capacity of these wagons by 10.2 tonnes to 64.6 tonnes, giving a maximum gross weight of 91.4 tonnes. Ownership, or title to the coal transfers away from Scottish Coal to the purchaser at the point at which the coal is loaded on to the wagons. EWS, as a freight operating company, are under contract to the purchaser rather than Scottish Coal for this purpose and have responsibility for the transport of coal from Chalmerston. Tonnage of coal exported via this line has increased since 1988, but has remained static at approximately 500,000 tonnes per annum for the last 5 years.

22 The line is single throughout with movement authority over its infrastructure and across the boundary onto Scottish Coal infrastructure controlled by Network Rail. It is operated under the '*one train working* without *train staff'* system.

23 Since 2002, EWS have been contracted by Scottish Coal to undertake track patrols and inspections. The requirements for patrols and inspections are expanded further in paragraphs 48-56. Records indicate that the track was inspected 10 days prior to the incident on 11 January 2006.

24 There is no record of a regular maintenance programme being in place for the Scottish Coal section of line beyond any minor work undertaken during inspections. Heavier maintenance requirements, identified by the inspection process, are negotiated on a case-by-case basis.

25 A local Scottish Coal manager has described the line as being important. However, the future use of the line is dependent on the demand for coal to supply power stations in England which have been fitted with flue-gas desulphurisation equipment. Scottish Power Stations, lacking this equipment, are supplied with coal imported from eastern Europe which has a lower sulphur content.

26 The driver of train 6C64 had over 10 years experience on the Chalmerston line.

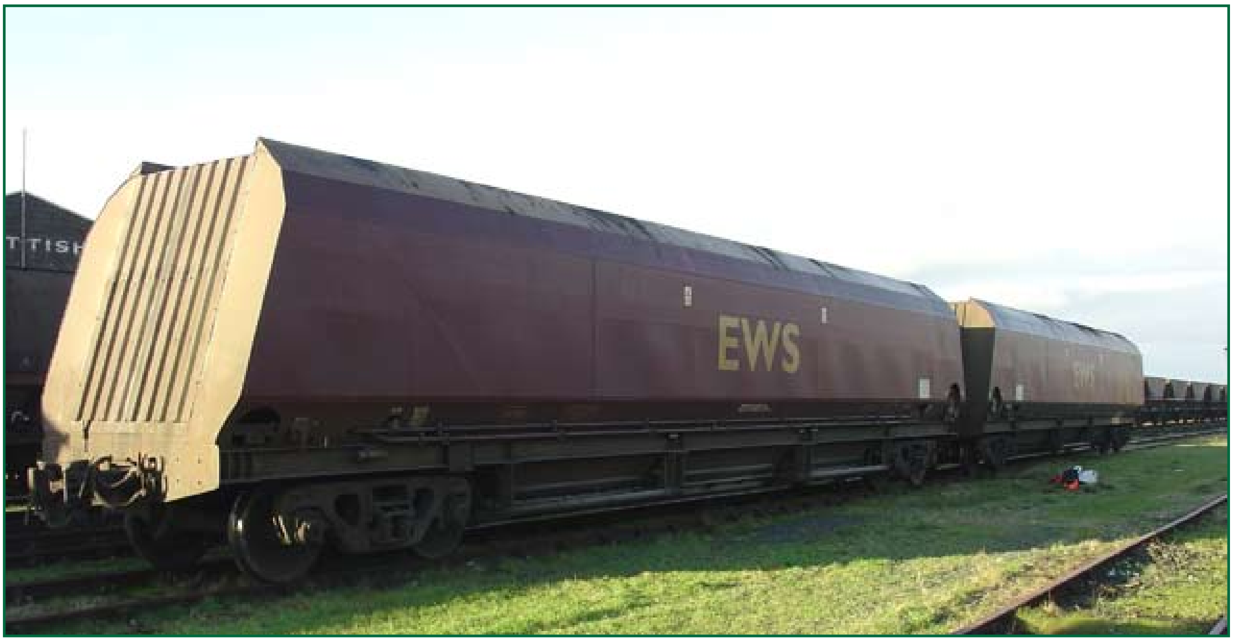

Figure 4: HTA wagons 310724 and 310711 at Falkland Yard, Ayr, following recovery.

Events preceding the incident

27 On the eve of the incident, the locomotive and wagons departed Falkland Yard at Ayr for Chalmerston at 23:25 hrs. An arriving train, by routine, is drawn over a weighbridge and through the loading area to be loaded by a front-end loading shovel fitted with a weighing device starting from the east (uphill) end of the train, with the train position being controlled by Scottish Coal staff directing the train driver by hand-held radio. The final six wagons at the west (downhill) end of the train are loaded after the locomotive has been detached and run-round to the other end of the train. The train is drawn over the weighbridge for a second time before being inspected and dispatched by EWS operational staff.

28 At 03:11 hrs, train 6C64 comprising 21 loaded HTA bogie hopper wagons hauled by locomotive 66056 departed Chalmerston. The weather was damp with showers, but it was not raining at this time.

Events during the incident

29 The derailment occurred at 03:19 hrs when the leading left wheel on wagon HTA310724 climbed onto the head of the left hand rail on encountering a transverse rail fracture located at 53 miles 889 yards, some 1130 yards (1034 m) before the Network Rail boundary. As the train negotiated a 200 metre radius right-hand curve on a 1:67 downhill gradient, the leading axle on wagon 310724, positioned 16th in the train of 21 wagons, became derailed to the left as it passed over a broken rail.

30 The derailed wheel continued to run on the rail head for a distance of 1.8 metres before becoming derailed to the left onto the *field* (*cess*) side, leaving a flangemark. A corresponding *tread corner* mark, created by the right hand wheel was observed on the opposite railhead (see Figure 7).

31 The following 23 wheelsets, making up the rear section of the train were not derailed and were deflected back onto their correct alignment, resulting in impact damage to the railhead immediately beyond the fracture.

32 Track construction at this location comprises 95lb *bullhead* rail in cast iron rail *chairs*, supported on softwood timber sleepers, some of which had been replaced during 2003.

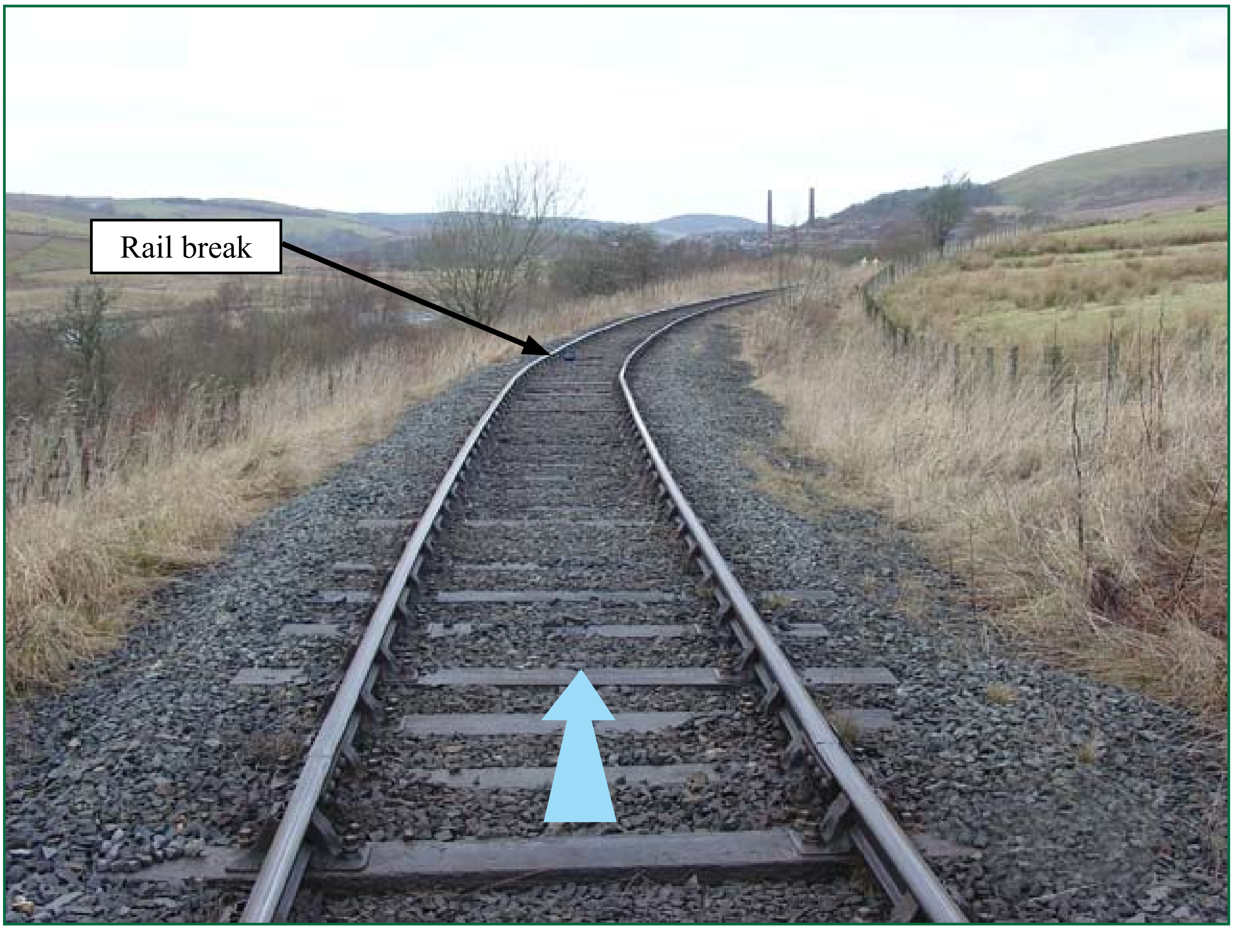

Figure 5: Overview of the point of derailment looking in the direction of travel.

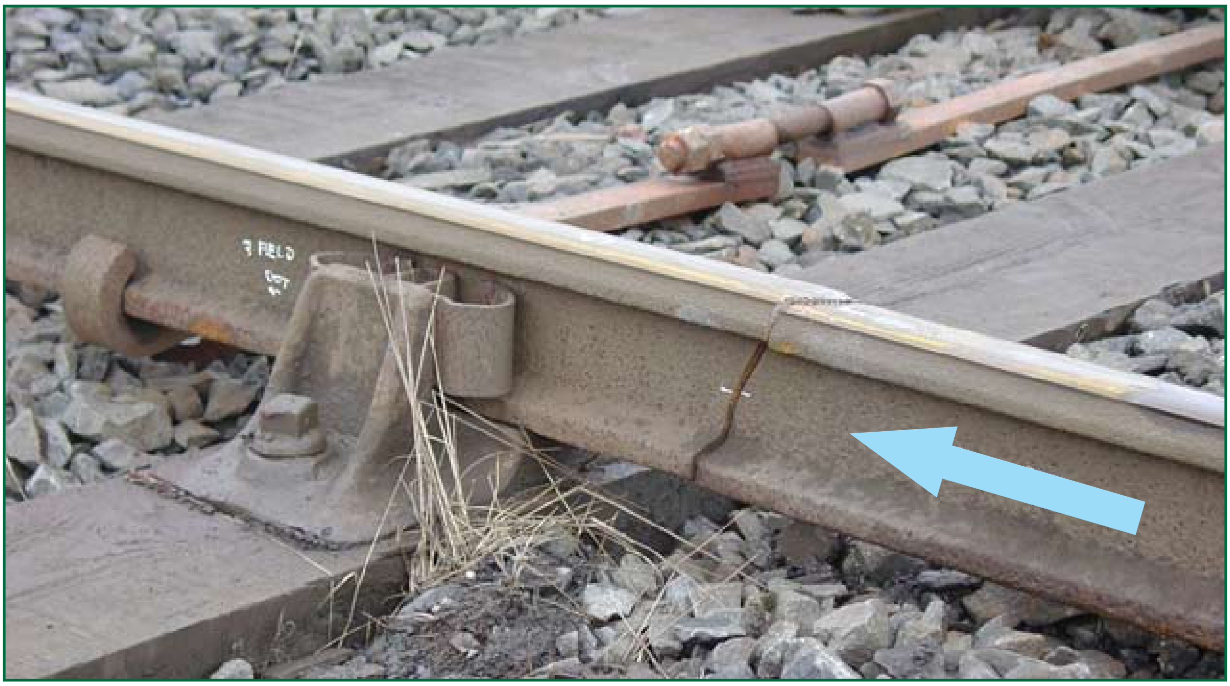

Figure 6: Rail break viewed from the field side.

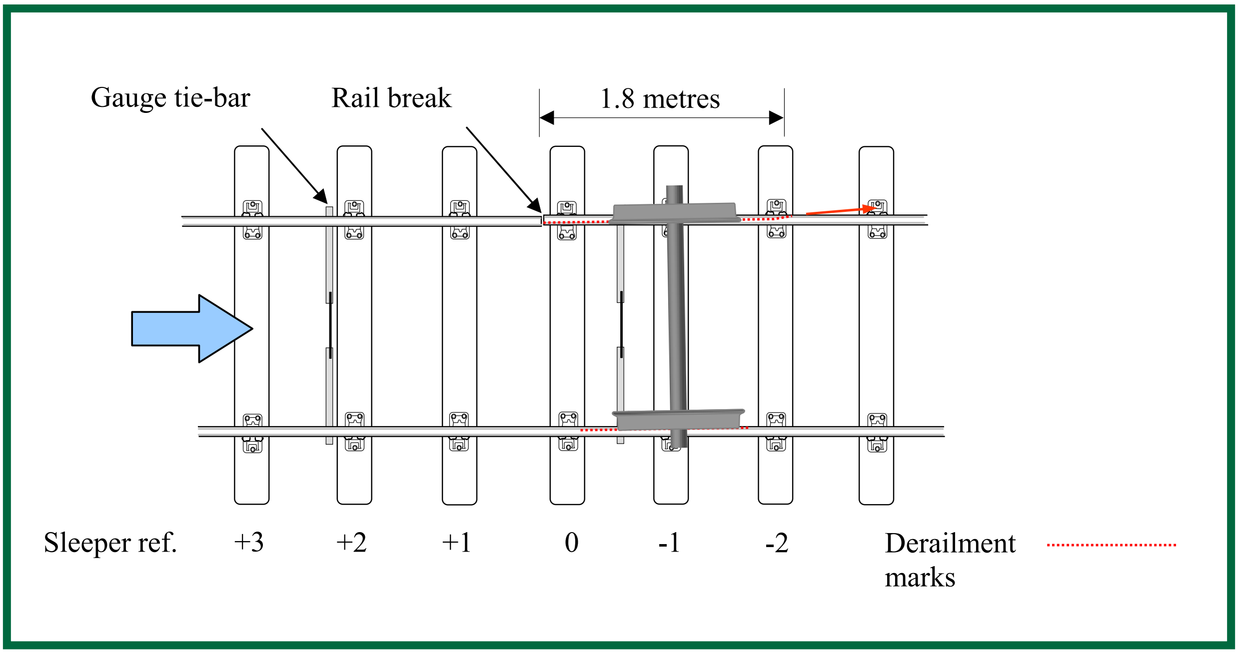

Figure 7: Sketch of rail break and point of derailment showing path of derailing wheelset.

33 After derailing, the leading wheelset of wagon 310724 continued to run to the left, close to the edge of the rail chairs, equating to a bogie rotation (*yaw* angle) of 7-10º. This behaviour continued until *facing points* were encountered at Dunaskin (Figure 2), located immediately before the Network Rail boundary at Waterside, giving access into sidings located to the right of the running line in the direction of travel. Flangemarks and other consequential damage consistent with the position of the derailed wheelset were observed at this location.

34 Once onto Network Rail infrastructure, the derailed wheelset continued to run to the left, the displacement increasing to 450 mm as the train's speed increased to 20 mph equating to a bogie yaw of 14º. The track at this location is constructed of flat bottom rail mounted on a mix of timber or concrete sleepers.

35 Between the 52 and 51½ mileposts, the derailed wheelset encountered deep ballast laid across the track (see Figure 8). This resulted in a ploughing action developing, forcing the bogie further to the left until a yaw angle estimated at 18º was realised, contrasting with a normal maximum of 5.2º (corresponding to the displacement when negotiating a 70m radius curve). At this angle, both right hand wheels on this bogie came into contact with the wagon's underframe causing damage and reducing their ability to rotate freely.

36 In the vicinity of the 51½ milepost, the sleepers are predominantly concrete with occasional intermittent timber sleepers. Each timber sleeper encountered in this area was destroyed by the action of the derailed wheelset hitting it at its mid-point and remote from any lateral support offered by either the rail fixings or from the loosely compacted ballast. Concrete sleepers also suffered damage but the extent was limited by the depth of ballast.

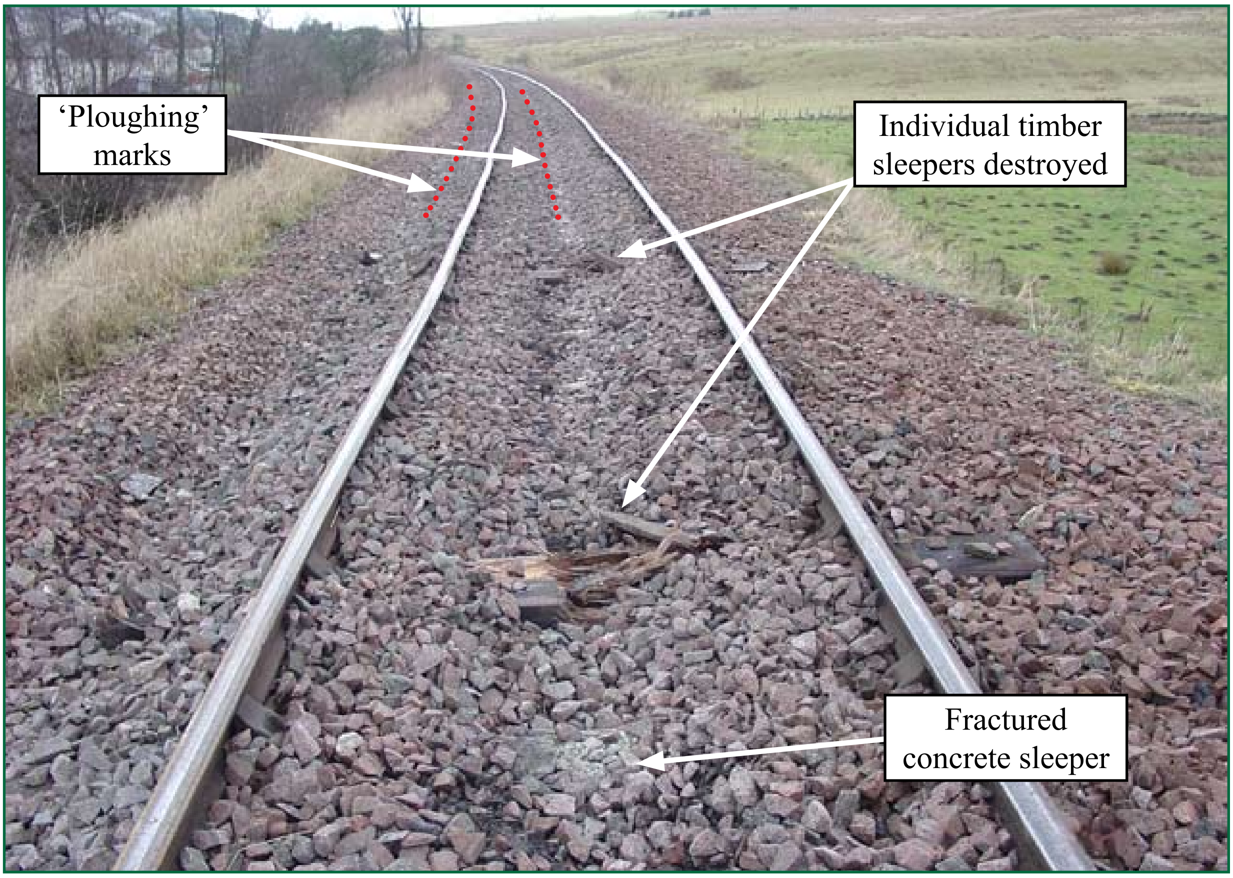

Figure 8: Track damage on the approach to Patna village near the 51½ milepost.

37 At the 51¼ milepost near the village of Patna, the track construction changed from predominantly concrete to all timber sleepers. On encountering this section of track, the derailed wheelset destroyed every sleeper leading to immediate loss of *gauge* and the disintegration of the track. The remaining wagons in the train displaced the rails and dug into the ballast rapidly slowing the train. A length of the right hand rail became trapped between the wheel and bogie frames of wagons 310176 and 310386, and was transported forwards with the train for a distance of 18 metres (see Figure 9). This led to the buckling of the rail in advance, and the complete loss of a rail for the following vehicles.

38 The train was slowed to a stand by the increasing drag experienced by the locomotive which was unable to haul the train beyond this point despite maximum power being applied. On investigation by the driver, the final 6 wagons of the train were found to be derailed and standing upright in the ballast at the 51¼ milepost, after the break-up of a 90 metre length of track beneath the train. The derailment was reported to Network Rail at Paisley signalling centre at 03:45 hrs.

39 There were no injuries caused by this accident.

40 There is no evidence that the train was overloaded or had exceeded the applicable linespeed.

Events following the incident

41 The driver was routinely tested for drugs and alcohol following the incident and was found to be clear.

42 An emergency response team, provided by EWS under a separate contract with Network Rail, was employed to recover the derailed wagons. Rerailing commenced with the leading bogie of wagon HTA310724 with agreement from RAIB and after essential photographs and other evidence had been secured. Recovery was progressed by reconstructing the track beneath each wagon in turn and then hauling forwards onto undamaged infrastructure, and took 4 days to complete due to the restricted access at the site.

43 Following repairs to track damage and the completion of other remedial work, the line was reopened on 27 February after a closure of 38 days.

Figure 9: Derailed wagons and track damage viewed in direction of travel alongside the wagon positioned 3rd from the rear of the train. The buckled rail has been dragged forward with the train.

44 The following diagram indicates the numbers and positions of critical vehicles in the train.

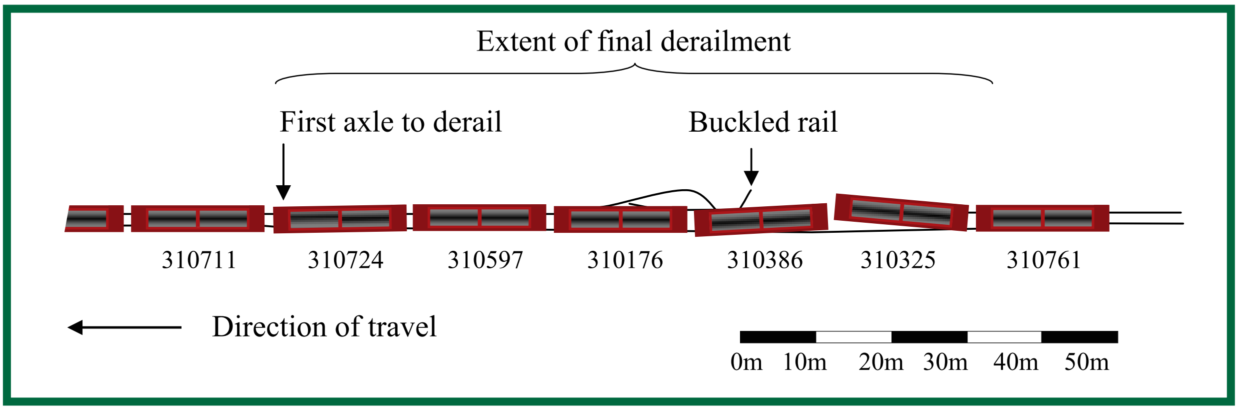

Figure 10: Sketch indicating the final positio of last seven HTA wagons in train formation. Wagon 310711 (front) and the trailing bogie of wagon 310761 (rear) were not derailed.

Analysis

45 The immediate cause of the derailment was clearly the transverse rail fracture. The following sections outline factors which contributed to the incident.

Track Inspections

46 Scottish Coal are reliant on contractors to provide guidance on track related issues as they do not have in-house competency on rail. EWS have undertaken track inspections since September 2002, initially for a period of one year, then subsequently extended until April 2005 when the inspection frequency increased from quarterly to four-weekly as described in the following paragraphs.
EWS divided the site at Chalmerston into six inspection areas; the line between the colliery and the national rail network, on which the derailment occurred, is known as the Approach Road. EWS employed staff with a certificate of competence for patrolling and at least 10 years permanent way experience to undertake the inspections preceding the derailment. Evidence was given that during these visits, loose components were replaced or secured. **Recommendation 3 refers.**

47 Rail fixings, particularly *chair keys* and fishplate bolts are regularly dislodged due to the tendency of the track to creep downhill. This phenomenon is a result of the gradient and braking action from loaded trains, and is aggravated if the tapered keys are installed incorrectly. The workload during inspection visits was dependent on the amount of minor maintenance required and this was reported by EWS as being high. Witness evidence states that numerous keys were displaced, baseplates broken and that there have been 5 rail fractures in the past 5 years. At least one of these fractures led to the immediate blocking of the line. However, Scottish Coal state that they are only aware of one of these incidents.

48 Until April 2005 there was no formal agreement to set out detail of the services to be provided or standards to be applied. During 2004, EWS approached Scottish Coal and presented them with a Track Maintenance Agreement (TMA). This agreement was intended to commence in April 2005, and EWS indicated to Scottish Coal that this was the basis on which they were prepared to continue to inspect and maintain the line. The document proposed an increase in the frequency of inspections and the introduction of the following EWS Standards for the inspection and maintenance of the track:

- 'Inspection of Permanent Way' EWS/ES/0190 Issue 1
- 'Maintenance of Permanent Way' EWS/ES/0017 Issue 2
- 'Renewal of Permanent Way' EWS/ES/0018 Issue 1

EWS Standard 0190 (inspection) and 0017 (maintenance) both make reference to, and are based on Railway Group Standard GC/RT5021 'Track Systems Requirements'. Standard 0190 divides track into four categories with Category A the most heavily trafficked. On this basis, the lines at Chalmerston fall into Category C as 'freight line or sidings', the only lower category being for lines which are out of use. Category C lines are subject to a two weekly Patrol, an eight weekly *Inspection* when additional checks are made including the measurement of track defects, and an annual *Examination* by a track foreman or track engineer.

49 The level of inspection undertaken by EWS staff at this site was purely visual and parameters such as the track's cross-level *(cant)* was not measured. This is classified as a '*Patrol*' under EWS Standard 0190. The inspection team were therefore unaware of shortfalls with the track's geometry at the site of the derailment which are discussed further in paragraphs 74 to 83. This activity was supplemented by occasional condition surveys which indicated the general condition of the track and need for more significant maintenance. Any urgent items identified in the resulting reports were normally actioned under purchase orders issued to EWS and other contractors.

50 The inspections have generally commenced at the Network Rail boundary at Waterside. At the location of the rail break, there is low ballast and no walkway (cess) on the outside of the curve and a steep drop to a drainage ditch immediately below. This means that the outer rail would not normally be viewed from the cess side.

51 An Inspection Report detailing the condition of the six track inspection sections was submitted by EWS after each visit, although delays of up to two months occurred between the inspection date and the report being received by Scottish Coal. Informal arrangements were in place to progress urgent notifications separately by telephone and email. Although Scottish Coal were aware of these arrangements, they state that they have no record of EWS doing this in the 9 months prior to the derailment.

52 Inspection reports for the Approach Road were submitted using a reporting format taken from the EWS Standard for inspection (Form ISM/TIR/02). Use of this form did not result in information being recorded in sufficient detail to enable the effective planning or prioritisation of remedial work, or to identify the location where work was required. In all cases, cross-levels were reported as being 'Fair' despite the fact that these measurements were being taken using a cross-level gauge which was known to be defective.
The 4-weekly reports for each inspection area were submitted under cover of an Inspection Summary Report (ISM/ISR/01) signed by the EWS Area Track Engineer. Summary reports provided from August onwards indicate that site activity was restricted to 'Inspection only', although the later reports did make reference to additional work that was in the planning stages (refer to paragraph 60). **Recommendation 5 refers.**

53 The five 4-weekly reports for the Approach Road covering the period September 2005 to January 2006 were identical, the reports all being photocopies of an earlier document dating from April 2005 with only the dates and names amended each month (Appendix C). The EWS Area Track Engineer accepted each set of copied reports by signing-off the Inspection Summary Report without redress or verification. There is therefore no contemporaneous record of any changes to the condition of the track in the vicinity of the derailment for an extended period, although the signing-in records at Chalmerston do show that EWS staff named on the reports attended site on each occasion. **Recommendation 4 refers**.

54 Following presentation of the TMA document by EWS during 2004, there was a discussion between Scottish Coal and EWS concerning the rates that would be charged. The discussion covered the contract period from 01 April 2005 until 31 March 2006, and the original proposals were declined by Scottish Coal due to cost. During these discussions, Scottish Coal were not provided with, and did not request, copies of the EWS Standards referenced in the document (see paragraph 48). In the subsequent negotiations, the contract prices were reduced. EWS stated they achieved this by paring back the scope of the proposal to the minimum acceptable to them, but there is no documentary evidence of any scope change. However, there remains dispute over whether the price or programme of work were agreed; EWS stated to RAIB that the amendments reduced the effectiveness of the inspection regime. There is no evidence that this concern was communicated to Scottish Coal.

At the time of the incident, the TMA had not been signed by Scottish Coal. While the frequency of inspections was increased from April 2005, as proposed in Schedule 1 (scope and specification) of the TMA, EWS state that this was done to address their professional concerns and to protect their trains using the line rather than because of the implementation of the new agreement. There is no evidence that EWS applied for payment under the terms of the TMA prior to the derailment.

55 The TMA includes a list of the specification of services included, which under item 1, 'track inspection, patrolling and minor maintenance, reports produced', provides for:

1(a) 4-weekly frequency (i.e. 12 visits per annum)

1(b) Minimum 4 hours on site per inspection/visit

1(c) Minor maintenance work [specified elsewhere] and as much as can be accommodated in the 2 hours on site without compromising the inspection process.

From this clause, it is unclear how long the TMA required EWS staff to be on site due to the contradiction between 1(b) and 1(c). However, it is noted that full compliance with EWS Standard 0190 (Inspection) for a Category C line with jointed track requires a 2-weekly Patrol (paragraph 48).

56 The TMA document required the adoption of EWS Standards for inspection and maintenance from April 2005. However, in the absence of a clear understanding on the status of the agreement, EWS report that their staff had continued to use engineering judgement based on a background of working on EWS controlled infrastructure to which EWS standards apply rather than apply the EWS standards directly. No maintenance activity was recorded in the six reports from August 2005 to January 2006 and there is evidence that local EWS staff continued to believe that full implementation of the Track Maintenance Agreement with its adoption of EWS standards was in abeyance. **Recommendations 1 and 2 refer.**

57 Network Rail has no involvement with the management of Scottish Coal's infrastructure. As a result they are unable to understand or manage any risk imported onto their rail network. It is noted that the Office of Rail Regulation publishes a Model Connection Contract, Document #209695.03, which requires the private siding owner to conform to Railway Group Standards. **Recommendation 7 refers.**

<u>Track Condition</u>

58 The track forming the Approach Road was constructed of serviceable components of differing age and origin when the line was reinstated in 1988/89. This has resulted in differing rates of deterioration.

59 A re-sleepering project was undertaken on the Approach Road, commencing in November 2003, by an EWS subcontractor. This resulted in the renewal of four sleepers close to the site of the derailment, but did not include replacement of the rail or tamping of the track, and there is no evidence that a comprehensive track survey was undertaken on completion of these works.

60 The rails and sleepers on the Approach Road had consistently been recorded as being in 'poor' or 'very poor' condition respectively by EWS. In an attempt to address this, Scottish Coal asked EWS to prepare a condition report and highlight priority areas during 2005. The report divided the site into 19 sections, of which 12 were on the Approach Road, and made maintenance proposals for each. Scottish Coal asked EWS to prioritise work from the report to be undertaken over eight weeks.

The priority list of eight sites included five sections on the Approach Road. A site meeting was held between Scottish Coal and EWS in November 2005 at which the report was reviewed and the need for a programme was identified by EWS. This project had progressed beyond the planning stage at the time of the incident, and Scottish Coal had purchased sleepers and *ferrules*, although work on site had not commenced.

61 The November 2005 condition report indicated that the section of the Approach Road where the derailment occurred was in 'fair to poor' condition and recommended lifting the track and packing the ballast to improve track support, and ferrule renewal throughout the section to tighten rail fixings. EWS considered this to be one of the better sections of track, possibly as a result of the re-sleepering work in 2003, and it was not included on the priority list.

62 Several wooden sleepers in the vicinity of the rail break were renewed during 2003. This allowed *tie-bars*, previously fitted to maintain track gauge, to be removed. Many were left in the track in a slackened condition, but these did not contribute to the derailment.

63 However, the wooden sleeper immediately before the rail break was not new. Whilst generally sound, inadequate ballast support had allowed movement to occur during loading by the passing of trains, but this went unrecorded in the 4-weekly inspection reports. This movement caused the chairscrews to ratchet upwards and become loose, allowing moisture to ingress beneath the chair and resulting in gradual loss of support due to softening of the wood. When removed from the track following the derailment, a 45 mm deep indentation was identified, together with evidence of up to 15 mm lateral movement (Figure 11). Whilst masked by the chair, the securing chairscrews had been partially ejected giving a visual clue as to the presence of this void and making it possible for track inspection staff to detect. When loaded by the weight of a train, the void would have caused the supporting chair to drop and move laterally. The reduced lateral and vertical support in this instance is a causal factor in the failure of the rail. There is no evidence that ballast under the old sleeper was packed when new sleepers were installed on either side of it during 2003. The November 2005 condition report recommended the renewal of ferrules throughout this section, which requires the removal of chairscrews and would have resulted in the sleeper defect being identified. However, as this section was not on the priority list, it is not known when this work would have been done.

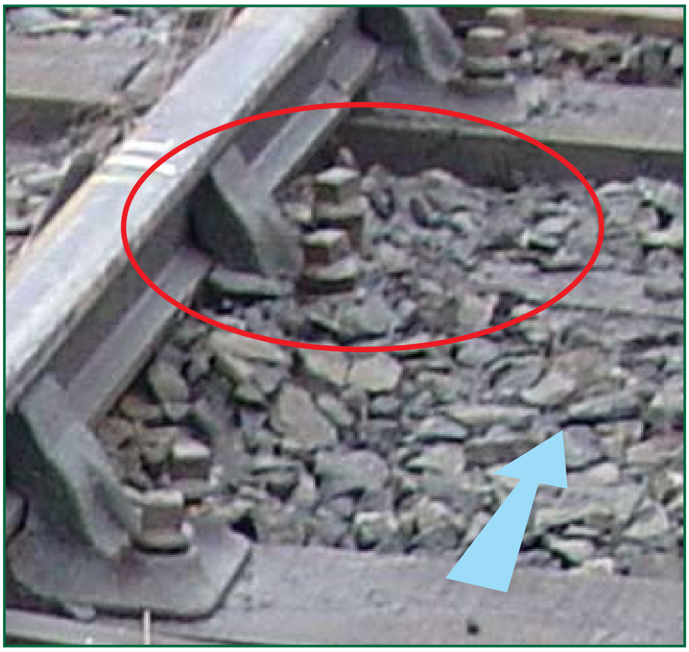

Figure 11: 45 mm indentation in sleeper preceeding rail break following its removal from the track. The lack of support offered by this sleeper was significant. The displaced chairscrews and broken rail can be seen in the right hand picture.

64 The fractured rail was measured, examined visually and analysed physically and chemically to determine the cause of failure. Mechanical properties were also assessed and a summary of the findings is given in paragraphs 65 to 73 below.

65 Measurements of the rail depth give an average of 136.0 mm excluding the sleeper positions. The minimum rail depth allowed for 95lb bullhead rail specified in the EWS Standard for maintenance is 131 mm plus the amount of *side wear* or lateral head loss, assessed in this instance at 3-4 mm. The rail is therefore 1-2 mm above the minimum allowable depth.

66 At the sleeper position the rail depth was measured at 133.1 mm. The reduced figure is due to the effects of wear and corrosion where the rail is seated in a chair and is referred to as rail *gall*. The maximum gall allowed according to the same standard is 3 mm putting the rail at the wear limit in this instance.

67 The railhead shows signs of crushing and back edge *lipping*. However, the wear pattern is not unusual and it is not considered to have had a significant contribution to this failure. Lateral head loss, at 3-4 mm, is within the 12 mm limit laid down in the EWS Standard for maintenance and is therefore acceptable.

68 Marks made by the chair on the seating faces suggested that rail creep of up to 65 mm had occurred.

69 Examination of the fracture face indicates that the rail failed from fatigue cracks that initiated from pitted areas on the underside of the rail on the field side. Multiple fatigue cracks had initiated from two pitted areas on the underside of the rail foot. These cracks had propagated by fatigue on a transverse path until they joined to form two single crack fronts on a slight plane to each other. Once the cracks had reached a critical size, the rail cracked rapidly upwards and stopped when the head section was reached. Based on an assessment of the impact damage due to wheels passing over the broken section and the amount of corrosion on the fracture surface, it is considered most likely that the final break occurred under train 6C64. This opinion is supported by the relatively rust free fracture surface of the head and the fact that if the previous train had broken it, then the running-on side of the fracture would be expected to have suffered more extensive damage.

70 The lack of branding on the rail has prevented identification of the age, weight and manufacturer. Assuming that the rail was produced before branding was required by British Standard BS9:1935, the rail is likely to be more than 70 years old.

71 The rail was ultrasonically tested in the laboratory using techniques defined in Network Rail standard RT/CE/S/055. The position of the original fatigue crack in the foot of the rail means that it would not have been identifiable either visually or ultrasonically until it had propagated into the web shortly before the rail failed completely. It is considered that ultrasonic testing of the rail as part of the Approach Road inspection regime would be unlikely to have identified this failure.

72 Brinell hardness tests were carried out in the rail head, giving results in the range 187 – 197HB. The required range for modern rails is 220 – 260HB and therefore the rail has failed to achieve the current minimum value. The rail achieved the minimum requirement in BS11 in a tensile test by a small margin, but it is noted that it would fail modern Network Rail standards for rail. However, it is not considered that material strength was a significant factor due to the fact that the level of corrosion suggests that the rail remained significantly cracked in the track for several days before finally failing; if the material were inferior it would not be expected to survive such loading.

73 Chemical analysis of the fractured rail section indicates that the carbon and manganese levels are slightly below the requirements of BS11, whilst the sulphur and phosphorous levels are high by modern standards. Although the rail has technically failed the requirements of the modern standards, this is not considered to have had a significant influence on the failure.

Track Geometry

74 A gauge and cross-level survey was undertaken following identification of the broken rail and point of derailment. The survey covered a 10 metre length either side of the rail break and identified sub-standard values for gauge, cant and *twist* (for twist see paragraph 81).

75 *Static* track gauge was found to be generally within the limits prescribed in the EWS Standard for maintenance; i.e. 1435 mm to 1465 mm as indicated in Figure 13. This Standard also requires corrective action to be taken when gauge exceeds 1455 mm. The maximum gauge on the Approach Road is given as 1455 mm in the most recent EWS 4-weekly reports which is 12 mm less than that recorded on undamaged track immediately after the derailment. Whilst some gauge widening may be resultant rather than causal, there is no record that the gauge had been checked in the five months prior to the derailment (see paragraph 53). The wheel-wear pattern, or running band, on the opposite rail gives a visual indication of the areas of wider gauge and highlights the presence of a long-standing track geometry defect.

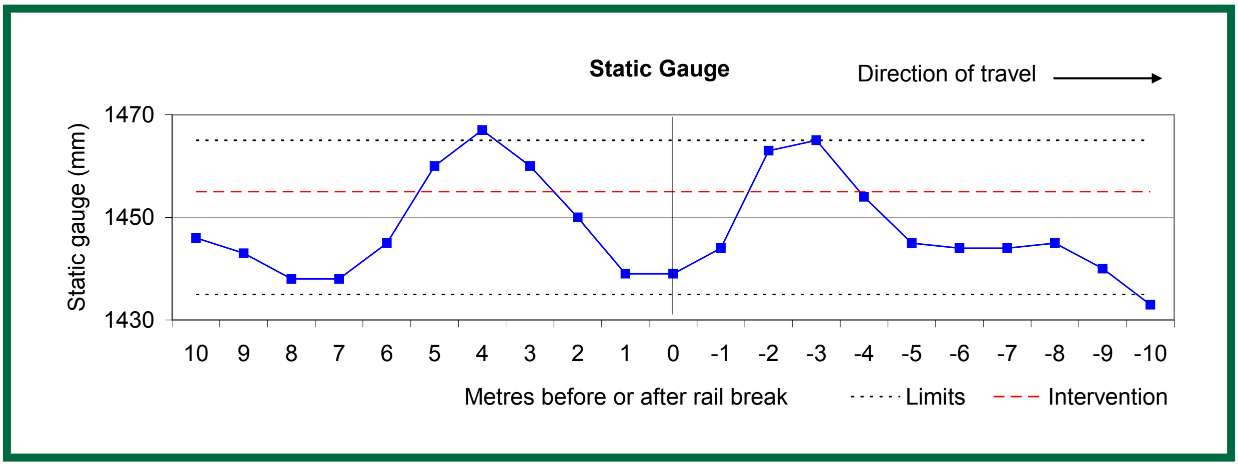

Figure 12: Graph of static gauge showing that this remained largely within limits, but required corrective action where the limit for initiating intervention measures (1455 mm) was exceeded.

76 The variation in track gauge over a 3 metre length is not specifically addressed by the EWS Standard for maintenance. By comparison, Network Rail Standard NR/SP/TRK/001 Appendix E gives an intervention limit of 8 mm over a 3 metre length for a 10 mph line speed. Site measurements indicated gauge variation of up to 32 mm in 3 metres as illustrated in Figure 13. Gauge irregularities over short lengths of track can lead to bad riding and can develop into a state of cyclic *sidewear* increasing the stress imposed on the rails and the rate at which the asset dilapidates.

77 The variations in track gauge occurred despite the high incidence of new sleepers in this area. The new sleepers are understood to have been installed during the 2003 re-sleepering programme. With the lack of hand-back records to confirm the cant and gauge of the track on completion of these works, it is not possible to ascertain whether the track was installed correctly, or if it was, why such marked deterioration occurred.

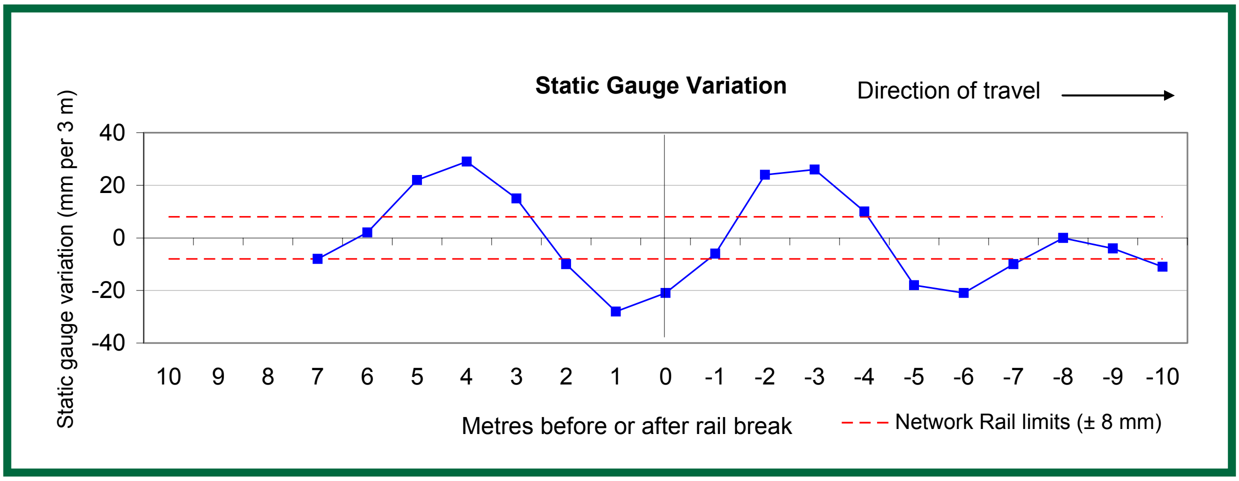

Figure 13: Graph of gauge variation over 3 meters. The Network Rail limit of 8 mm over a 3 m length is indicated by the dashed lines.

78 The cross-level (or cant) at the site was found to be predominantly negative, meaning that the outer rail was, unusually, lower than the inner rail of the curve. This will have had the effect of forcing vehicles to the outside of the curve. At 10 mph, this does not significantly increase the *dynamic loading* or *cant deficiency* but will have increased the rate of rail wear. Figure 14 shows the static cant for 10 metres either side of the break.

79 The EWS Standard for maintenance prohibits adverse cant on curves and requires negative values in excess of 10 mm to be rectified.

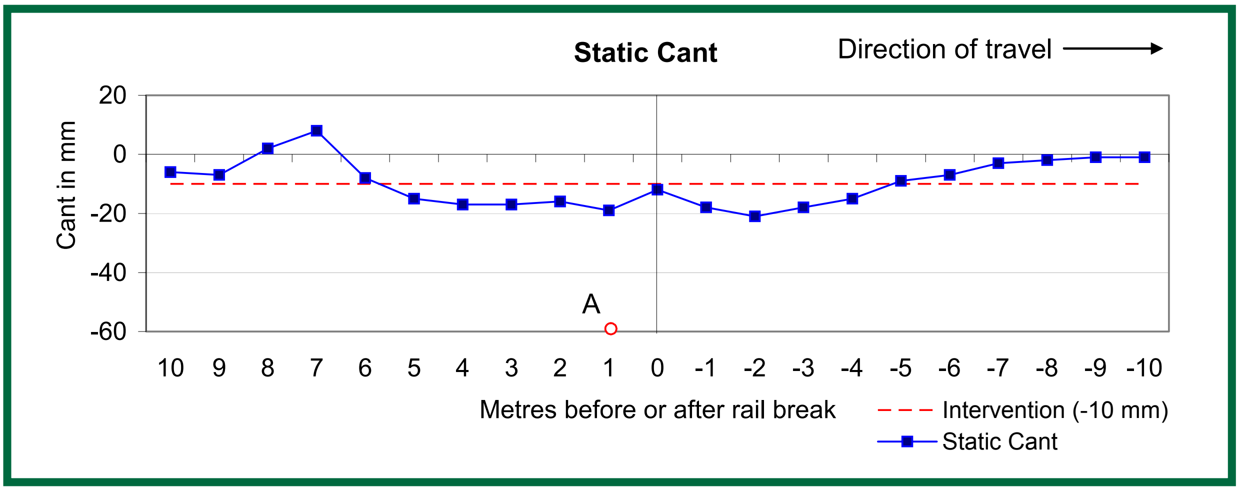

Figure 14: Graph of static cant showing negative values for the section leading up to the rail break.

80 Point A in Figure 14 represents a theoretical dynamic cant value that shows the effect of the 45 mm deep indentation discovered beneath the left-hand rail chair in the sleeper immediately preceding the rail break (see paragraph 63) when superimposed on the measured values. This assumes the left-hand rail deflected by the full 45 mm. The adjacent sleepers on both sides were installed new in 2003 and had no corresponding indentation marks.

81 Twist measures the rate of change of cant over a 3 metre length, with values below 1 in 90 requiring all traffic to be stopped in accordance with the EWS Standard 0190. The static twist values at the site remained compliant although in need of immediate attention as detailed in paragraph 83. When the dynamic effects are considered, as would be experienced by the wheels of a loaded train, the effects of the indentation at the sleeper would become apparent. The rail dip at this point would be compounded once the break propagated to the surface, and this will have contributed to the leading axle of wagon HTA310711 climbing onto the rail head.

82 Figure 15 shows the static twist (solid markers) superimposed with theoretical dynamic twist values (hollow markers). The theoretical values assume the left-hand rail deflected fully into 45 mm deep indent in the sleeper preceding the rail break.

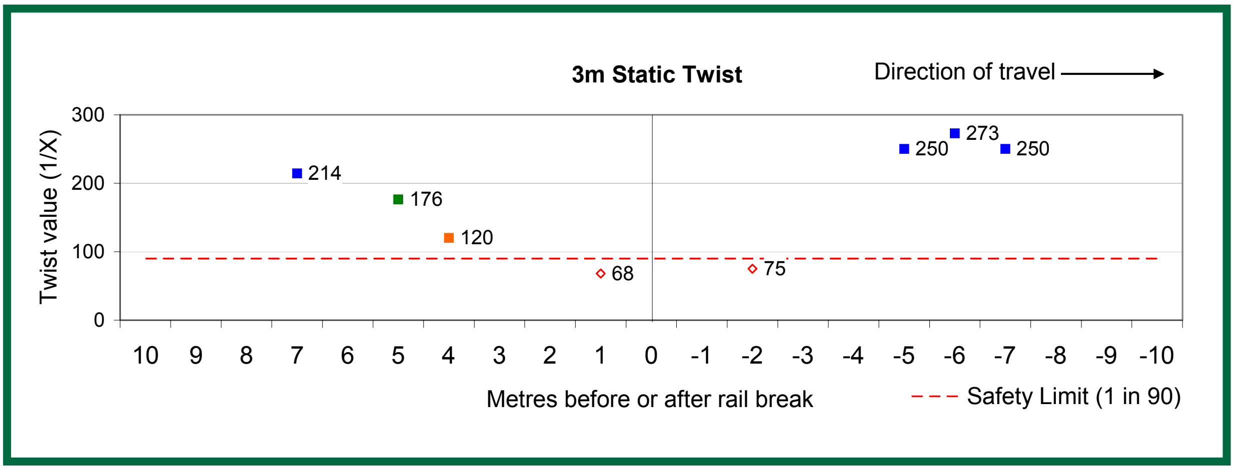

Figure 15: Twist measured over 3 metres showing values below 1 in 300.

83 Action mandated by EWS Standard 0190 on discovery of a Twist fault (measured over 3 metres) is detailed below. The measurement of twist faults requires a working cross-level gauge, so was not detected.

- ◇ *Below 1 in 90: Stop all traffic and correct immediately (Note: values shown are theoretical)*
- ■ *Between 1 in 91 and 1 in 125: Correct within 36 hours of discovery*
- ■ *Between 1 in 126 and 1 in 199: Radius < 400m: Correct within 1 week of discovery*
- ■ *Over 1 in 199: No action required.*

Train Handling

84 Locomotive 66056 is fitted with a Q-Tron *OTMR* data recorder which has provided detailed information on the speed and brake applications for the whole journey, including the critical section between the start of the return journey at Chalmerston and Patna where the train was halted.

85 The driver booked on at Ayr slightly early for the shift and was allocated locomotive 66056. The locomotive was and coupled to the rake of wagons in Falkland Yard No 1 reception siding, before departing the yard at 23:25 hrs. It was an uneventful run to Chalmerston colliery, other than some slight wheel slip being recorded on the final approach. On arrival, the train was positioned and loaded. The train departed at 03:11 hrs. The weather was damp but with no rain.

86 The line from the colliery within Scottish Coal infrastructure is restricted to 10 mph (16 km/h) and runs downhill at an average gradient of 1.4 % (1 in 70). The driver therefore required no power to be applied to start the train and maintained the speed of the train below 10 mph using the train's brakes.

87 At the boundary between Scottish Coal and Network Rail Infrastructure, the driver set the *train-length button* to later indicate when the rear of the train had passed the boundary; thereafter the train accelerated up to the Network Rail speed restriction of 20 mph (32 km/h). At around the same time, the line changes from a falling to a gently rising gradient. The driver used various levels of throttle, up to and including full power, to maintain line speed. The electronic control system on a Class 66 locomotive controls power applied to the wheels to limit slip. Around three and a half miles after the run started, the train suffered a number of large jerks and started to slow down rapidly despite full power being applied. These (retarding) jerks started to occur 0.035 miles (57 metres) before the train stopped, over the last 12 seconds of the run.

88 As the train slowed, the driver shut off the power controller and the train stopped quickly without the brakes being applied. This corresponds to the point at which additional wheelsets derailed and dug into the ballast. The power was shut-off around 9 seconds before the train stopped indicating that the driver had then perceived the problem. The fact that the brakes had not been applied made no significant difference to the outcome. After stopping, the locomotive rolled back slightly.

89 Throughout the entire period of the driver applying power, the locomotive continually deposited sand on the rails and automatically varied the power output to control wheel slip.

90 The primary issue is whether the driver of the train could reasonably have been expected to notice that a single axle on the train had derailed 16 wagons back from the locomotive and stopped the train at an earlier time, thus reducing the extent of damage. There are two means by which the driver may perceive that a wheelset near the rear of the train is derailed; by seeing sparks or other signs in the locomotive's mirrors or by the train "feeling" different. Mirrors are fitted to the EWS class 66 fleet and the driver reports using these two or three times within Scottish Coal infrastructure and twice after crossing onto Network Rail infrastructure. Despite this, the curvature of the line would have made it difficult to see the rear of the train, particularly in darkness.

91 The driver states that while approaching Patna, where the train was finally halted, he felt he was applying more power than usual. The train had felt slow to accelerate from 10 to 20 mph (16 to 32 km/h) once it had crossed the boundary, and this was attributed to the heavy train and damp rail conditions. The driver had experience of driving this route regularly for 10 years, and would have encountered such conditions previously. The driver became aware that the train was not behaving normally, and checked the brake pipe pressure to ensure that the train had not become divided. He observed the amp meter fluctuating more than usual. After shutting off power, he felt the train grind to a halt.

92 Examination of OTMR data from the locomotive of a comparative train suggests that the only obvious difference in the way the incident train was handled and behaved was the much higher levels of applied throttle and locomotive power output on the slightly rising 20 mph (32 km/h) section after crossing the Network Rail boundary. This can be attributed to hauling one derailed wheelset.

93 The driver controlled the train within the speed limits throughout the incident journey.

The derailed wagons

94 The final seven wagons in the train were examined by the RAIB following recovery. The inspection and weighing of the critical wagons involved in the derailment revealed no defects which could have caused this incident.

95 Wagon 310724 travelled for over 2¼ miles (3,800m) with the leading axle derailed to the left. As the bogie's rotation, or yaw angle, increased beyond the permitted maximum, both right hand wheels on the leading bogie came into contact with the wagon's underframe causing damage and reducing their ability to rotate freely. The trailing wheelset eventually became jammed, preventing rotation of this axle. The trailing left hand wheel, which remained on the track, suffered deep gouging to its flange as it was forced against the rail head at an angle but without being able to rotate. Figure 16 refers.

Figure 16: Left trailing wheel on leading bogie of wagon HTA 310724 showing deep flange damage.

96 Loading records for all wagons forming the train have been examined (Figure 17). Wagons 310711 and 310724 were reweighed following the incident prior to transhipping their loads. There is no evidence that any wagon in this train was overloaded, although it was noted that wagon 310724 was relatively lightly loaded compared with most other wagons in the train. This is not considered to be a significant factor, however.

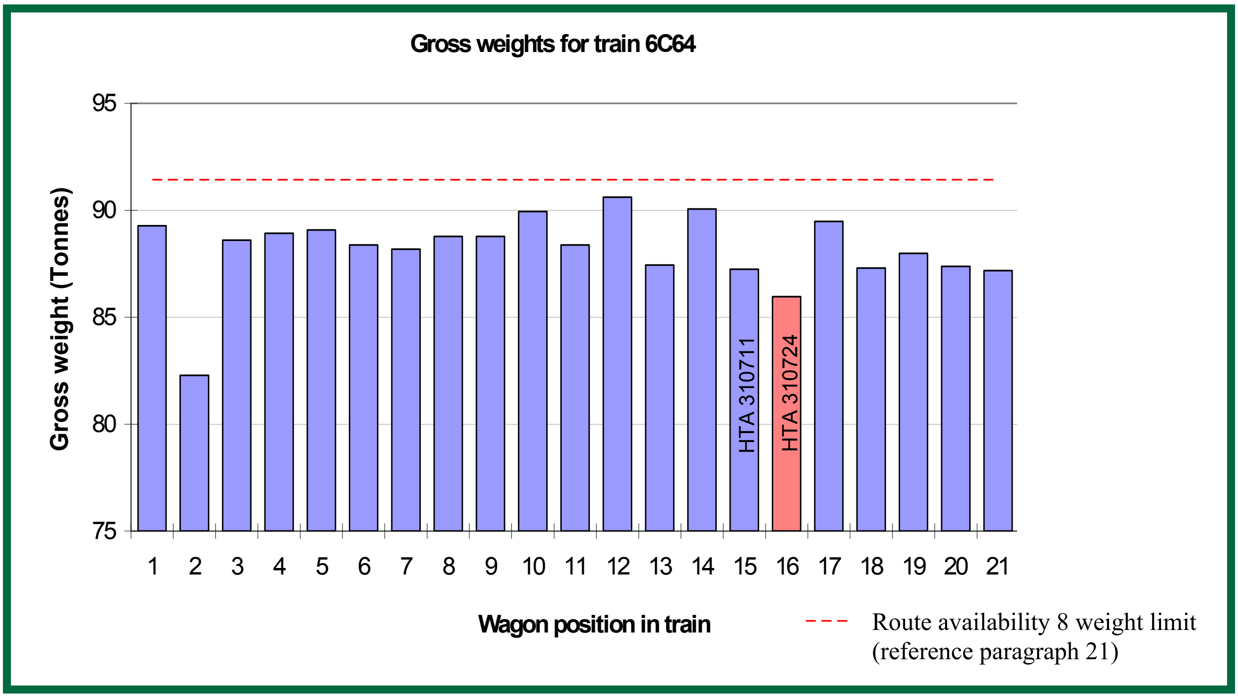

Figure 17: Gross loaded weights for each wagon forming train 6C64. The position of the first derailed wagon, HTA 310724, is highlighted.

Conclusions

97 The immediate cause of the incident was a transverse fracture to the running rail, presenting an obstruction. This allowed a wheel to climb onto the rail head and derail.

98 Causal factors were:

a) Failure of the track support;

b) A track inspection regime which was inadequate to identify and rectify track and geometry defects. (**Recommendation 2 refers)**;

c) A 4-weekly reporting regime which did not adequately record work required. **(Recommendation 5 refers)**; and

d) The lack of a mutual understanding of the arrangements for track inspection and maintenance activities between Scottish Coal and EWS. This resulted in confusion among those undertaking this activity and allowed gaps in responsibility to remain unresolved. (**Recommendations 1 and 2 refer).**

99 In addition, the following factors were considered to be contributory:

a) The poor condition of the line overall, leading to a high workload being reported by EWS inspection staff. As a consequence, evidence of sleeper deterioration at the site of the derailment was either not detected or not reported (paragraph 63). **(Recommendations 2 and 5 refer)**;

b) The lack of inspections involving the use of a working cross-level gauge which allowed track geometry defects to remain undetected. This served to increase the loading on the rail in the vicinity of the fracture. Omitting to report that cross-levels were not being measured compounded this issue and led to a significant twist fault developing unnoticed, close to the point of derailment (paragraph 52). **(Recommendation 4 refers)**;

c) The submission of photocopied inspection reports over an extended period which did not quantify the scale of the defects or record changes to the condition of the track. This was compounded by the EWS engineer signing-off the covering report and served to compromise the effectiveness of the inspection process (paragraph 53). **(Recommendation 4 refers)**;

d) The postponement of track maintenance activity for a period of at least six months prior to the derailment. This was despite sleeper condition being reported as ‘very poor’(paragraphs 52 and 60);

e) The lack of specialist track maintenance knowledge or experience within, or available to, Scottish Coal. This resulted in a lack of asset knowledge or ability to ensure their requirements were being effected (paragraph 46). **(Recommendation 3 refers)**; and

f) The decision by EWS to continue to support an arrangement which did not clearly stipulate standards (paragraph 56). (**Recommendation 6 refers)**.

100 The following factor affected the severity of the derailment:

- The driver of train 6C64, remaining unaware of the derailment, continued to apply power until being brought to a halt by track failure after travelling approximately 3,800 metres with a derailed wheelset.

101 Additional observation:

- Network Rail have no awareness of the condition of Scottish Coal's infrastructure. Clause 4 in the 1988 agreement has therefore not been enacted (paragraph 17). **Recommendation 7 refers.**

Actions reported as taken or in progress that are relevant to this incident

102 Significant track upgrade work has been undertaken as part of the reinstatement operation. Within Scottish Coal's area, work has included the renewal of damaged sleepers and some rail, together with tamping of the track to improve its geometry.

103 A full dilapidation survey has been undertaken by Jarvis Rail on Scottish Coal's behalf during which other voided sleepers were identified. A significant amount of work has been done to correct track defects, and use was made of a shutdown of the colliery during July 2006 to renew a life-expired crossing.

104 Atkins Rail have undertaken a baseline survey of Chalmerston and five other Scottish Coal railheads. This survey involved recording the gauge, cant, rail depth, sidewear, and rail gall at 10 metre intervals. During this survey, life expired rail was identified and necessary remedial works costed.

105 Lineside markers have been installed, allowing the location of track features to be accurately recorded and located.

106 Patrolling of the Chalmerston line has been undertaken weekly, and supplemented by a daily walkthrough by a Scottish Coal surveyor looking for any obvious infrastructure faults.

107 EWS have completed a review of their operations nationally to better manage the risk of infrastructure which is not fully compliant with their Standards. **Recommendation 6 refers.**

108 There remains no common understanding of the status and authority of the TMA between Scottish Coal and EWS, although EWS continue to patrol and inspect the site on an interim basis.

Recommendations

109 The following safety recommendations are made[1]:

Recommendations to address causal and contributory factors

1 Scottish Coal should establish and specify the standards to which they require their infrastructure to be inspected and maintained. This should be in accordance with the Railway Group Standard 'Track Systems Requirements' GC/RT5021 and a risk assessment undertaken to justify the frequency and level of inspections if they are reduced below the minimum specified in this standard (paragraphs 56 and 98d).

2 Scottish Coal should ensure that arrangements are in place to allow the inspection and maintenance of their railway assets to be effected to the standards specified in Recommendation 1 (paragraphs 56 and 98b).

3 Scottish Coal should put in place arrangements such that they, independent of their track maintenance contractors, can oversee management of their railway assets (paragraphs 46 and 99e).

4 EWS should review its internal quality assurance processes to ensure that the sign-off of safety critical reports is accompanied by a review of the content. The submission of photocopied data should be prohibited unless the summary sheet confirms that conditions have been checked and previous readings are fully replicated (paragraphs 53 and 99c).

5 EWS should enhance the level of information arising from inspection reports to provide quantative information and guidance for maintenance planning, for example: prioritisation of defects and timescales for non-urgent action (paragraphs 52 and 98c).

6 EWS should review its private-party activities nationally and take immediate steps to correct any situations where local inspection or maintenance arrangements have allowed infrastructure condition to fall below the applicable standards (paragraphs 99f and 107).

Continued

[1] Responsibilities in repsect of these recommendations are set out in the Railways (Accident Investigation and Reporting) Regulations 2005 and the accompanying guidance notes, which can be found on the RAIB's web site at www.raib.gov.uk

Recommendation to address observation:

7 Network Rail should review the agreement which exists between it and Scottish Coal. This agreement should require Scottish Coal, as the adjacent facility owner, to ensure that any part of the adjacent facility which is directly connected to the NR Network is compatible with the NR Network and complies with applicable Railway Group Standards. Alternatively, the existing agreement should be replaced with a contract based on the Model Connection Contract published by the Office of Rail Regulation Document #209695.03 which contains this requirement. (paragraphs 57 and 101).

Appendices

Glossary of abbreviations and acronyms — Appendix A

EWS	English Welsh & Scottish Railway Limited
HAA	Type of 2-axle hopper wagon
HTA	Type of bogie hopper wagon
OTMR	On-train monitoring recorder
TMA	Track Maintenance Agreement

Glossary of terms

Approach Road	Section of track between Waterside and Chalmerston and owned by Scottish Coal on which the derailment occurred.
Bullhead	A rail section commonly installed in the UK between 1850-1960.
Cant	The dimension by which the outer rail on a curve is raised above the inner rail
Cant deficiency	For a train travelling faster than the equilibrium speed on a curve, the theoretical dimension by which the outer rail would need to be raised to reinstate equilibrium.
Chair	A metal casting which retains bullhead rail on wooden sleepers
Cess	Area at side of line normally used as a walking route
Chair keys	A specially shaped piece of timber or steel that is used to hold Bullhead rails securely in the supporting chair.
Chairscrew	Metal screw providing fixing between chair and sleeper.
Creep	Longitudinal movement (forwards or backwards) of rails because the fastenings or ballast conditions are deficient.
Cross-level	See 'cant'
Dynamic	Loaded track condition
Examination	EWS Engineering Standard EWS/ES/0190: Track examination on foot by Track Foreman or Track Engineer.
Facing points	Points where two routes diverge in the direction of travel
Ferrule	Nylon or plastic collar between chairscrew and chair
Field side	The non-running edge of the rail
Flange mark	The mark impressed onto the rail by the flange of a wheel in the process of derailing.
Gall	The wearing away and indentation of the rail foot where it is in contact with the chair or baseplate.
Gauge	Distance between the inner running faces of two rails on the same track.
Inspection	EWS Engineering Standard EWS/ES/0190: Visual inspection on foot by Inspector to check for significant track defects. Track measurements are required at locations where there are concerns.
Lipping	Permanent deformation of the rail head due to wheel loading
One-train working	Signalling on a single line with or without a train staff where only one train is permitted on the line at any time.

Patrol	EWS Engineering Standard EWS/ES/0190: Visual patrol on foot by Inspector to check for significant track defects. No track measurements are required.
Route Availability	Category of track based on maximum permitted axle weight
Side bearer	Pad or plate provided on either side of the central pin of a bogie on which the weight of the vehicle is borne.
Static	Track in its unloaded condition (i.e. no train present)
Side wear	The reduction in railhead width due to wear caused by flange contact with the rails as trains run round a curved track
Track recording coach	A track geometry recording vehicle
Train-length button	A means of automatically measuring the length of a train as it passes a fixed marker. This enables the driver to determine when the rear of the train is clear of a restriction.
Train staff	A labelled and distinctive piece of wood or metal carried by the driver of a train in a one train working section of line. The train can only be admitted to the section when the driver is in possession of the staff
Tread corner mark	The mark impressed onto the rail by the outside of a wheel in the process of derailing.
Twist	A defect in the track level where there is a difference in cross levels over a short distance which may cause one or more wheels of a vehicle to lose contact with the running surface of a rail.
Yaw	Horizontal rotation of a vehicle or component such as a bogie

Examples of photocopied Infrastructure Inspection Reports for the Approach Road dated September 2005 and January 2006 (reference paragraph 53). Names have been removed for the purposes of this report.

Infrastructure Inspection Report
PLAIN LINE

Location: CHALMERSTON | Siding / Rd No: APPROACH ROAD
Inspected by: | Date: 11. 1. 06
Road | Open: YES | Closed: NO

RAILS	Type: B/H	Poundage: 95	Condition: G F P VP — P ✓

Comments: WORN, CORRODED, LIPPED.

SLEEPERS	Type: WOOD	Condition: G F P VP — VP ✓

Comments: REQUIRES RE-SLEEPERING THROUGHOUT. SOME NEED RELIGNING WERE SEEN.

CHAIRS / BASEPLATES	Type: AS1	Condition: G F P VP N/A — F ✓

Comments:

BUFFERS	Type: N/A	Condition: G F P VP N/A — N/A ✓

Comments:

FASTENINGS	G	F	P	VP	N/A	Comments:
KEYS / CLIPS			✓			PANLOCKS REQUIRED THROUGH OUT.
FERRULES		✓				
SPIKES / SCREWS		✓				
FISHPLATES			✓			RAIL CREEP CAUSING BAD JOINTS
FISHBOLTS			✓			SOME FLY-FIXED, EMERGENCY CLAMPS FITTED

GEOMETRY	G	F	P	VP	N/A	Comments:
ALIGNMENT		✓				
TOP			✓			TIE-BARS FITTED THROUGHOUT.
CROSSLEVEL		✓				
DRAINAGE		✓				OPEN CATCH-DRAINS.
FORMATION		✓				
VEGETATION			✓			WEEDS THROUGHOUT YARD.
WALKWAYS			✓			

GAUGE	1428	1430	1435	1440	1445	1450	1455	1460	1465	1470+
WIDEST							✓			
TIGHTEST			✓							

GRADE	poor 1	(2)	3	4	5 good

Page of ISM / TIR / 02

Infrastructure Inspection Report
PLAIN LINE

Location: CHALMERSTON | Siding / Rd No: APPROACH ROAD
Inspected by: | Date: 28·9·05
Road | Open: YES | Closed: NO

RAILS	Type: B/H	Poundage: 95	Condition: G F P VP — P ✓

Comments: WORN, CORRODED, LIPPED.

SLEEPERS	Type: WOOD	Condition: G F P VP — VP ✓

Comments: REQUIRES RE-SLEEPERING THROUGHOUT. SOME NEED RELIGNING WERE SEEN.

CHAIRS / BASEPLATES	Type: AS1	Condition: G F P VP N/A — F ✓

Comments:

BUFFERS	Type: N/A	Condition: G F P VP N/A — N/A ✓

Comments:

FASTENINGS	G	F	P	VP	N/A	Comments:
KEYS / CLIPS			✓			PANLOCKS REQUIRED THROUGH OUT.
FERRULES		✓				
SPIKES / SCREWS		✓				
FISHPLATES			✓			RAIL CREEP CAUSING BAD JOINTS
FISHBOLTS			✓			SOME FLY-FIXED, EMERGENCY CLAMPS FITTED

GEOMETRY	G	F	P	VP	N/A	Comments:
ALIGNMENT		✓				
TOP			✓			TIE-BARS FITTED THROUGHOUT.
CROSSLEVEL	✓					
DRAINAGE		✓				OPEN CATCH-DRAINS.
FORMATION		✓				
VEGETATION			✓			WEEDS THROUGHOUT YARD.
WALKWAYS			✓			

GAUGE	1428	1430	1435	1440	1445	1450	1455	1460	1465	1470+
WIDEST							✓			
TIGHTEST			✓							

GRADE	poor 1	(2)	3	4	5 good

Page of ISM / TIR / 02

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

Any enquiries about this publication should be sent to:

RAIB
The Wharf
Stores Road
Derby UK
DE21 4BA

Telephone: 01332 253300
Fax: 01332 253301
Email: enquiries@raib.gov.uk
Website: www.raib.gov.uk