RAIB

Rail Accident Investigation Branch

Rail Accident Report

Freight train derailment at East Somerset Junction
20 March 2017

Report 19/2017
December 2017

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 UK
DE21 4BA

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

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Preface

The purpose of a Rail Accident Investigation Branch (RAIB) investigation is to improve railway safety by preventing future railway accidents or by mitigating their consequences. It is not the purpose of such an investigation to establish blame or liability. Accordingly, it is inappropriate that RAIB reports should be used to assign fault or blame, or determine liability, since neither the investigation nor the reporting process has been undertaken for that purpose.

The RAIB's findings are based on its own evaluation of the evidence that was available at the time of the investigation and are intended to explain what happened, and why, in a fair and unbiased manner.

Where the RAIB has described a factor as being linked to cause and the term is unqualified, this means that the RAIB has satisfied itself that the evidence supports both the presence of the factor and its direct relevance to the causation of the accident. However, where the RAIB is less confident about the existence of a factor, or its role in the causation of the accident, the RAIB will qualify its findings by use of the words 'probable' or 'possible', as appropriate. Where there is more than one potential explanation the RAIB may describe one factor as being 'more' or 'less' likely than the other.

In some cases factors are described as 'underlying'. Such factors are also relevant to the causation of the accident but are associated with the underlying management arrangements or organisational issues (such as working culture). Where necessary, the words 'probable' or 'possible' can also be used to qualify 'underlying factor'.

Use of the word 'probable' means that, although it is considered highly likely that the factor applied, some small element of uncertainty remains. Use of the word 'possible' means that, although there is some evidence that supports this factor, there remains a more significant degree of uncertainty.

An 'observation' is a safety issue discovered as part of the investigation that is not considered to be causal or underlying to the event being investigated, but does deserve scrutiny because of a perceived potential for safety learning.

The above terms are intended to assist readers' interpretation of the report, and to provide suitable explanations where uncertainty remains. The report should therefore be interpreted as the view of the RAIB, expressed with the sole purpose of improving railway safety.

The RAIB's investigation (including its scope, methods, conclusions and recommendations) is independent of any inquest or fatal accident inquiry, and all other investigations, including those carried out by the safety authority, police or railway industry.

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Freight train derailment at East Somerset Junction, 20 March 2017

Contents

Summary

At about 17:49 hrs on Monday 20 March 2017, six wagons of a freight train carrying aggregates from Merehead Quarry to Acton Yard derailed at East Somerset Junction, between Westbury and Castle Cary. The accident blocked the Up Westbury line, and the train stopped when the brakes applied automatically following the parting of a coupling. There were no injuries.

The derailment occurred due to a loss of track integrity: the fixity of the right-hand rail was lost due to progressive failure of the chairscrews under the loads from freight trains traversing the curve, leading to gauge spread. The investigation identified that the design of the track was sub-optimal, following replacement of a set of points with plain line in 2010. The signs of gauge spread were not identified during inspections of the track by staff from Westbury track maintenance depot, and the section of line where the derailment occurred had not been subject to mandatory geometry measurements.

The RAIB has made four recommendations addressed to Network Rail. These cover enhancements to the company's procedures for plain-lining of points, mitigation of risk at locations where points have previously been plain-lined, improvements to planning the operation of track measurement trains and evaluating the delivery of key track maintenance activities in the Westbury area.

The RAIB has also made a learning point, reinforcing the importance of identifying gauge spread on sections of curved track which may be subject to high lateral loads.

Introduction

Key definitions

1 Metric units are used in this report, except when it is normal railway practice to give speeds and locations in imperial units. Where appropriate the equivalent metric value is also given.

2 The terms 'Up' and 'Down' are relative to the direction of travel. The Up Westbury line runs east towards London; distance is measured from Paddington station. Distance on the East Somerset Branch is measured from the former Witham station, 120 miles 63 chains[1] (194.4 km) from Paddington.

3 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. Sources of evidence used in the investigation are listed in appendix C.

[1] One chain is 22 yards (20.1 metres).

The accident

Summary of the accident

4 At approximately 17:49 hrs on 20 March 2017, train number 7Z15 (the 17:05 hrs Mendip Rail freight train from Merehead Quarry to Acton Yard, loaded with aggregates) derailed at East Somerset Junction, between Westbury and Castle Cary (figure 1). The train was joining the Up Westbury line from the East Somerset Branch line (figure 3).

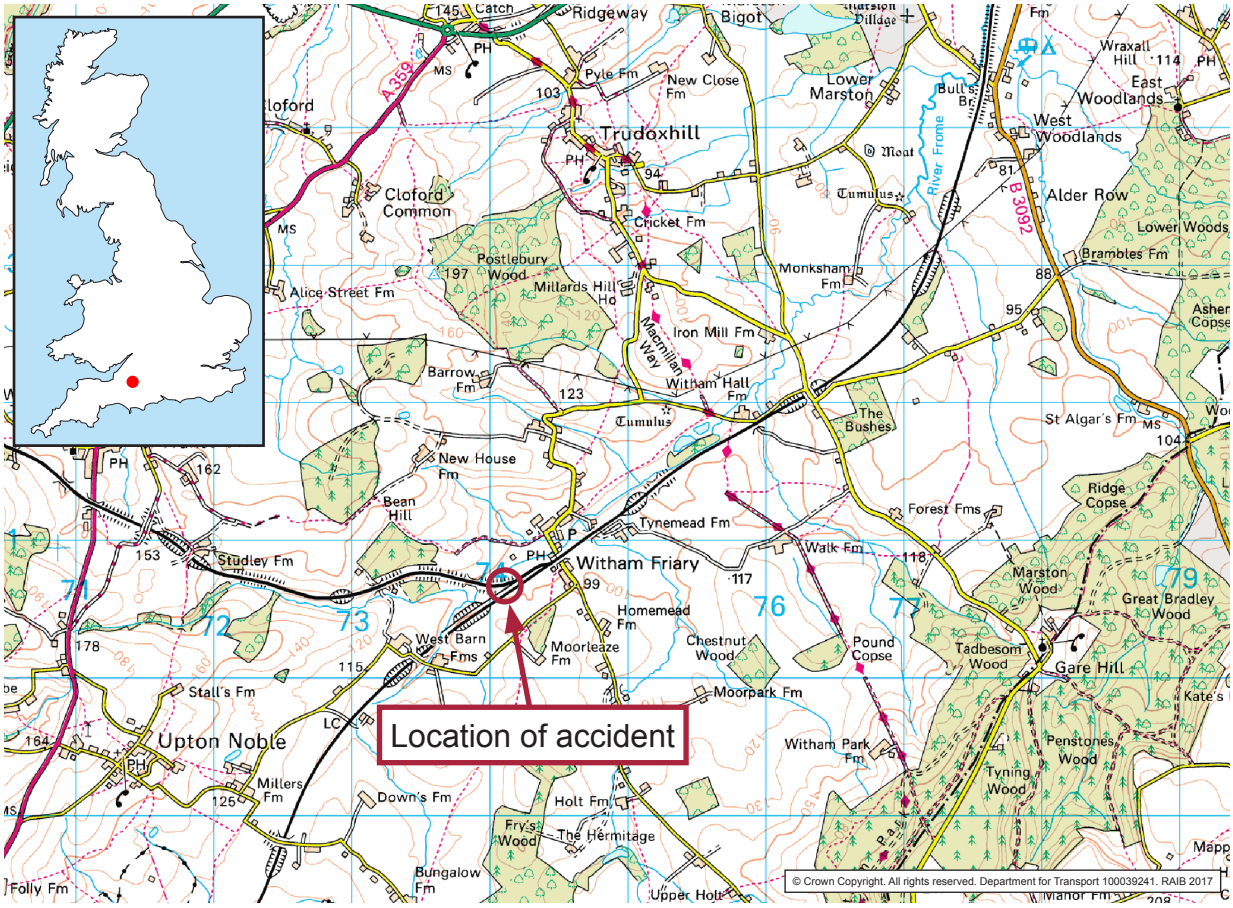

Figure 1: Extract from Ordnance Survey map showing location of accident

5 Six wagons, the 24th to 29th from the front of the train, derailed on the approach to the junction. The 27th and 28th wagons tipped onto their sides (figure 2) and the train divided between the 21st and 22nd wagons. The brakes applied automatically and the front part of the train stopped on the Up Westbury line. There were no injuries.

6 Although the Down Westbury line was not directly affected by the derailment, it was blocked to allow the recovery of the wagons and reinstatement of the damaged track. The Up and Down Westbury lines reopened at 23:01 hrs on 24 March, with trains able to access the East Somerset Branch from 04:49 hrs on 25 March.

Figure 2: General view of accident site, showing the numbering of the wagons from the front of the train

Context

Location

7 Train 7Z15 derailed on a short section of *bi-directional line* at East Somerset Junction, known to local track maintenance staff as the 'Link Line'. East Somerset Junction is 11 chains (221 metres) from the site of the former Witham station; the present track layout dates from around 1983.

8 The East Somerset Branch line (also known as the Merehead Single line) diverges from the Up Westbury line at 943A *points* (figure 3). The branch line has an ELR (*engineer's line reference*) of 'ESB', while the ELR for the Up and Down Westbury lines is 'WEY'. A set of *trap points*, 943B, protects the junction; this was the site of a previous derailment on 10 November 2008 (RAIB report number 28/2009). The derailment on 20 March 2017 occurred at the site of the former 945 points, which used to connect Witham Sidings to the branch line; these had been *plain-lined* in 2010 (see paragraph 32).

9 A second route is available for trains running onto or off the East Somerset Branch. Network Rail's *Sectional Appendix* refers to this as the Up/Down Goods Loop, although it is commonly called the Branch Loop. This line runs from 941A points, at the connection with the Up Westbury line, and merges with the East Somerset Branch at 946 points. It is approximately 760 metres long, which is sufficient to accommodate a 'jumbo train'[2]. The former Witham station lay between the present sites of 941A and 943A points.

[2] Two or three trainloads of aggregates combined into a single train of up to 44 wagons. Such trains are typically hauled by a single class 59 locomotive to Acton Yard in west London, where they are split into separate trains for delivery to depots in London and the South East.

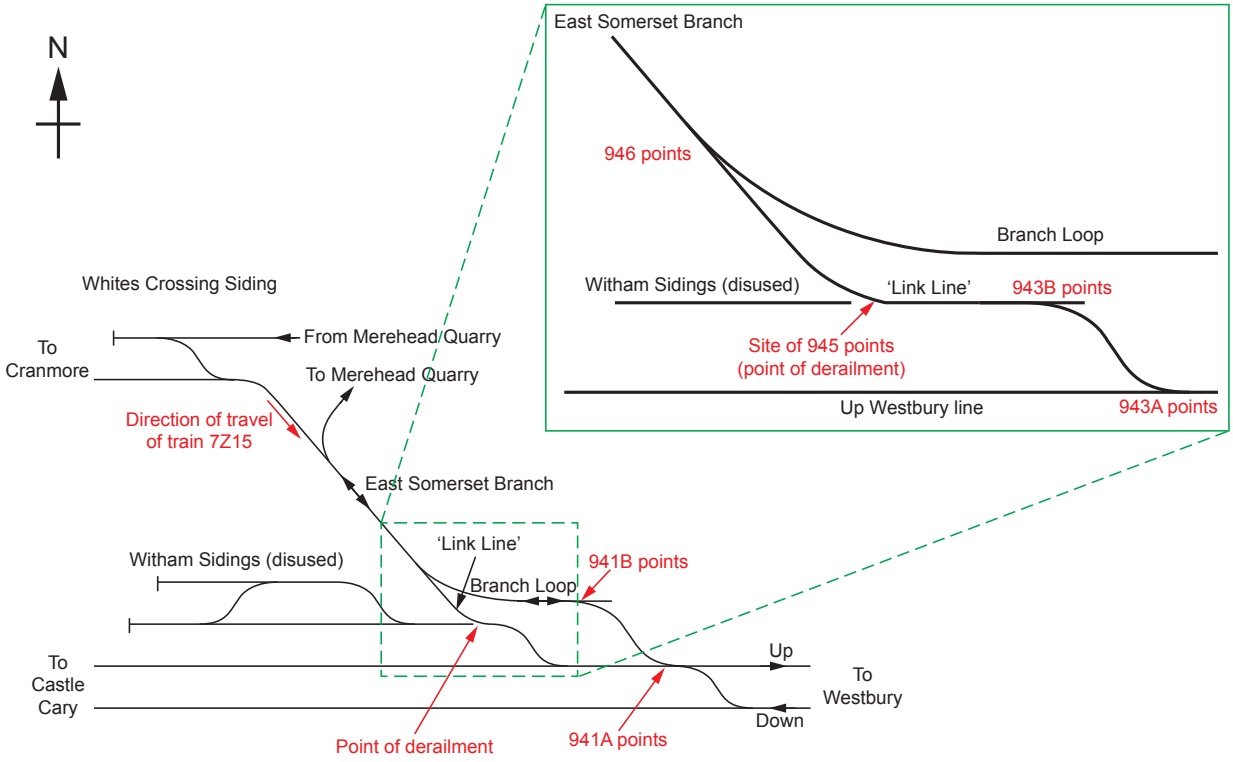

Figure 3: East Somerset Junction schematic layout of track

10 The 'Link Line' is the section of the East Somerset Branch lying between 943A points and 946 points; it is approximately 260 metres long, too short to accommodate a 'jumbo train'. Both the Branch Loop and the Link Line are bi-directional, and trains running to or from Merehead Quarry may be routed along either line.

Organisations involved

11 Network Rail is the owner of the railway infrastructure at East Somerset Junction. It employs the staff who were responsible for maintaining the track in the area where the train derailed.

12 DB Cargo was the operator of train 7Z15 (on behalf of Mendip Rail) and employs its driver.

13 VTG is the owner and maintainer of the first wagon to derail (see paragraph 16).

14 All of the organisations involved freely co-operated with the investigation.

Train involved

15 Train number 7Z15 was a 'jumbo train', carrying 2,800 tonnes of aggregates for the construction industry (the total train weight was approximately 3,900 tonnes). It was formed of locomotive no. 59001 and 38 wagons of types JNA, JHA, HOA and IIA.

16 The first wagon to derail was the 24th from the front of the train; this was a type HOA hopper wagon, no. 706957074-2 (figure 4). The wagon is owned by VTG; it had been manufactured by Astra Rail and was only a few months old at the time of the derailment. It was carrying approximately 77 tonnes of washed sand; weighbridge data from Mendip Rail indicates this was offset so that the load on the left-hand wheels of the leading bogie was 4% higher than the load on the right-hand wheels. This offset is not likely to have been a significant factor in the derailment of the wagon (refer to paragraph 47).

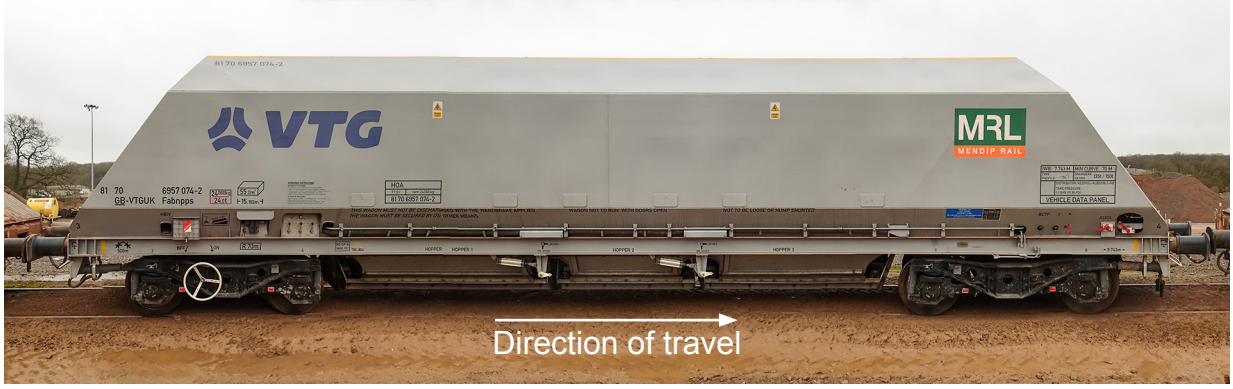

Figure 4: Wagon 706957074-2 (number 24 in train 7Z15) at Merehead Quarry after the derailment

17 Subsequent examination of the wagon identified defects consistent with impact damage caused during the derailment:

- the spacing between the wheels on the wagon's leading axle was 4 mm less than when it was assembled (recorded on 4 April 2016), and 3 mm less than the minimum given in Railway Group Standard GM/RT2466, 'Railway Wheelsets';
- the frame of the leading bogie was twisted by 7.8 mm, compared with 0.9 mm when it was assembled[3] (recorded on 29 April 2016); and
- the frame of the trailing bogie was twisted by 4.1 mm, compared with 0.8 mm when it was assembled (recorded on 28 April 2016).

18 The RAIB has found no evidence that the design or condition of the wagon, or the loading or operation of the train, caused or contributed to the accident.

Staff involved

19 All of the staff from Network Rail's Westbury depot who were involved in maintaining the track at East Somerset Junction have many years' experience and have been assessed as competent by Network Rail in the activities required by their roles.

20 The track maintenance engineer (TME) had worked in the railway industry for approximately 14 years. He started as a conversion engineer with Railtrack, having previously worked as a site engineer on nuclear power stations. He was appointed assistant TME at Westbury in April 2009 and has been TME since August 2009, except for the period from March 2015 to May 2016 when he was seconded into other roles.

[3] The twist of a bogie frame is the distortion that results in the one of the primary suspension connection points being out of plane with the others. The manufacturing limit for the HOA wagon is 1 mm and the maintenance limit is 2 mm.

21 The person holding the position of TME (acting) from March 2015 to May 2016 had worked in the industry since 1987. He was assistant TME at Westbury from March 2012 until March 2015, when he became TME (acting).

22 The track section manager (TSM) had worked in the industry for approximately 14 years, having started working for a contracting organisation. He worked as a supervisor before being promoted to TSM in April 2013. He has worked at Westbury since 2009.

23 The former principal technical officer had worked in the industry for 17 years. He started at Westbury as a senior technical officer in March 2008 and held the post of principal technical officer from May 2012 to March 2015 (since when it has been vacant).

24 The technician [track inspection] had worked in the railway industry for nine years, starting as a trackman. He was promoted to technician in December 2014 and was appointed to his present role in January 2017.

25 The route asset manager [track] (RAM), based at Swindon, started working in the industry before the privatisation of British Rail. He is a qualified civil engineer with experience in maintenance, renewal techniques and asset management. He had been a RAM since the role was created in 2009.

External circumstances

26 Records from a weather station at Yeovilton (16 miles south-west of East Somerset Junction) indicate that the conditions at the time of the accident were 'mostly cloudy'; light rain had been recorded more than three hours before the derailment occurred.

27 External circumstances had no bearing on the causes of the accident.

The sequence of events

Events preceding the accident

28 The wagons forming train 7Z15 had been loaded with limestone aggregates of various grades at Merehead Quarry and were propelled by the locomotive over the Network Rail boundary into Whites Crossing Siding, where the train reversed. The train left the siding, crossing over onto the East Somerset Branch line at 17:34 hrs, and then travelled towards East Somerset Junction.

29 When it reached 946 points, train 7Z15 was routed along the Link Line towards 943A points, which connect the Link Line with the Up Westbury line. The train's data recorder indicates that it was travelling at 20 mph (32.1 km/h).

Events during the accident

30 At around 17:48 hrs, the 24th to 29th wagons derailed as the train passed over the site of the former 945 points, which had connected Witham Sidings to the Link Line; the 27th and 28th wagons turned onto their sides (figure 5). The drag from the derailed wagons caused the coupling between the 21st and 22nd wagons to fail. In turn, this caused the brake pipe to part and the brakes to be applied automatically, stopping the train. The derailed wagons had travelled 79 metres before coming to rest.

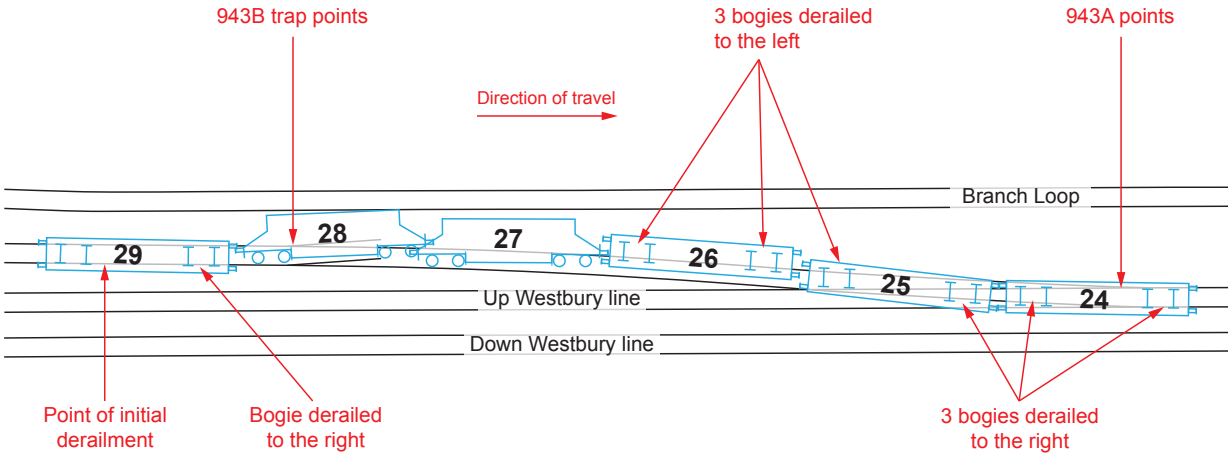

Figure 5: Overview of accident site, showing final resting point of derailed wagons

Events following the accident

31 At 17:50 hrs, the driver of train 7Z15 made an emergency call using the GSM-R cab radio to report that an unsolicited brake application had occurred. The Up and Down Westbury lines were blocked by the signaller.

Key facts and analysis

Background information

History of the Link Line

32 The points connecting Witham Sidings to the Link Line, (945) had been removed on 24 October 2010 and replaced with plain line (a process known as plain-lining). This followed the identification of rail defects in the left-hand[4] *switch* rail (the outer rail for trains traversing the curve onto/off the East Somerset Branch).

33 Network Rail sought approval through the *network change* process on 16 February 2011 not to reinstate 945 points, permanently removing access to the sidings. This change was formally approved on 15 January 2014.

34 When Network Rail's track recording vehicle (TRV) ran over the Link Line on 17 September 2013, a longitudinal track alignment fault that required rectification within 72 hours was identified at the site of 945 points. Network Rail's *Ellipse* asset management system records that manual slewing of the track was carried out to correct the fault at this location on 19 September 2013.

35 The Link Line was taken out of use on 31 October 2013, because the TME was concerned about the condition of the track between the site of 945 points and 946 points (a distance of 176 metres). All trains running onto or off the East Somerset Branch were then routed via the Branch Loop. Witnesses have referred to a subsequent proposal to seek approval through network change to plain line 943A points, permanently closing the Link Line. However, Network Rail has been unable to locate any formal proposal and, although this may have been discussed informally, no submission was made. This was probably because Network Rail took the view that closure of the Link Line would not be acceptable to its customers.

36 Witnesses report that the RAM encouraged the acting TME to reopen the Link Line soon after he took up the TME role in March 2015. Ellipse records that 77 sleepers were changed and 94 metres of continuously welded rail was replaced on the Link Line in the period March – September 2015. The Link Line was reopened to traffic on 9 September 2015.

[4] As recorded in the GEOGIS database – this was the right-hand rail for trains travelling away from Merehead Quarry.

Network Rail's track design requirements

37 NR/L2/TRK/2102, 'Design and construction of track', specifies the design principles and minimum standards for the construction of new or relayed track, including the materials to be used. It also specifies acceptance criteria for new or relayed track in terms of workmanship and geometry. The scope of the standard includes the replacement of components of the track system, as part of normal maintenance that significantly changes its design or configuration. This covers the work to plain line 945 points. Specific provisions include:

6.1 *Designs of layouts and special track forms shall be subject to the approval processes specified in NR/L2/TRK/2500.*[5]

6.7.4 *On running lines, horizontal alignments shall consist of lengths of straight track and curves connected by cubic transition curves. Curves shall consist of one or more circular curves each of constant radius ... [Cant] shall be applied to horizontal curves to take account of curvature, different traffic types and speeds.*

Identification of the immediate cause

38 **The right-hand rail at the site of 945 points was insufficiently restrained, allowing it to move laterally and rotate under the load from train 7Z15, such that the leading wheels of the 24th wagon derailed due to *gauge spread*.**

Site observations

39 Examination of the track components after the derailment on 20 March 2017, revealed that *chairscrews* on the right-hand rail had failed to secure the rail, either because they had snapped or because they had been pulled out of their timber *bearers* (figure 6).

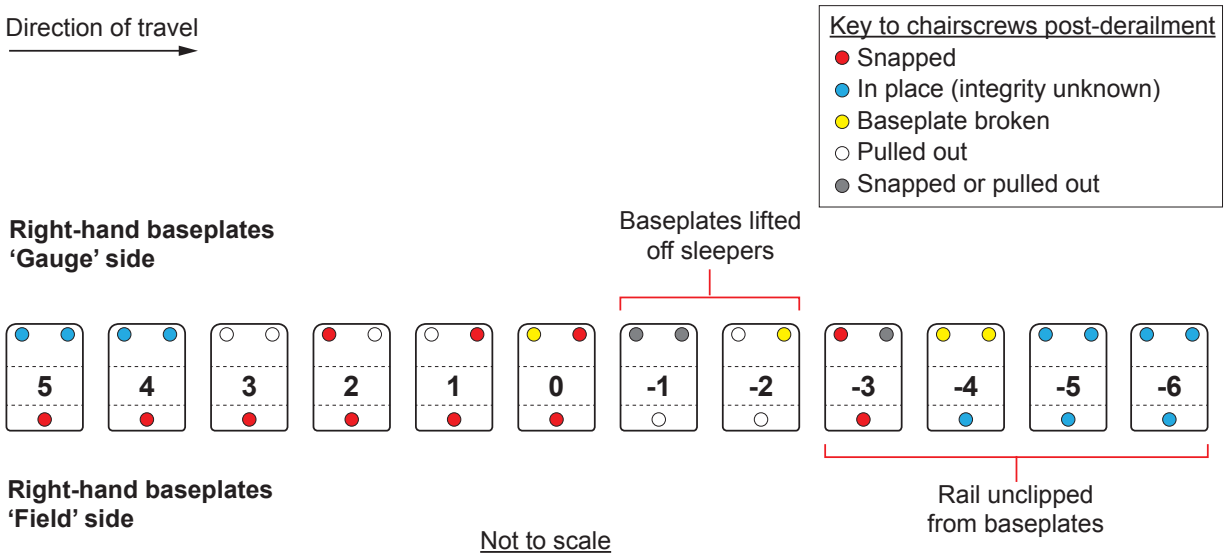

Figure 6: Right-hand baseplate fixings post-derailment

[5] The version of this standard that was current when 945 points were plain-lined in October 2010 (which was entitled 'Technical approval in the design of track infrastructure') was not applicable to routine permanent way maintenance, provided no significant realignment was required.

40 The bearers were numbered by the site investigation team: bearer no. 0 coincided with a short *flange mark* where the right-hand wheel flange had crossed from the *gauge side* of the rail to the *field side* (figure 7). The left-hand baseplate was also broken at bearer no. 0. Another short flange mark was present close to bearer no. -6, approximately four metres beyond bearer no. 0.

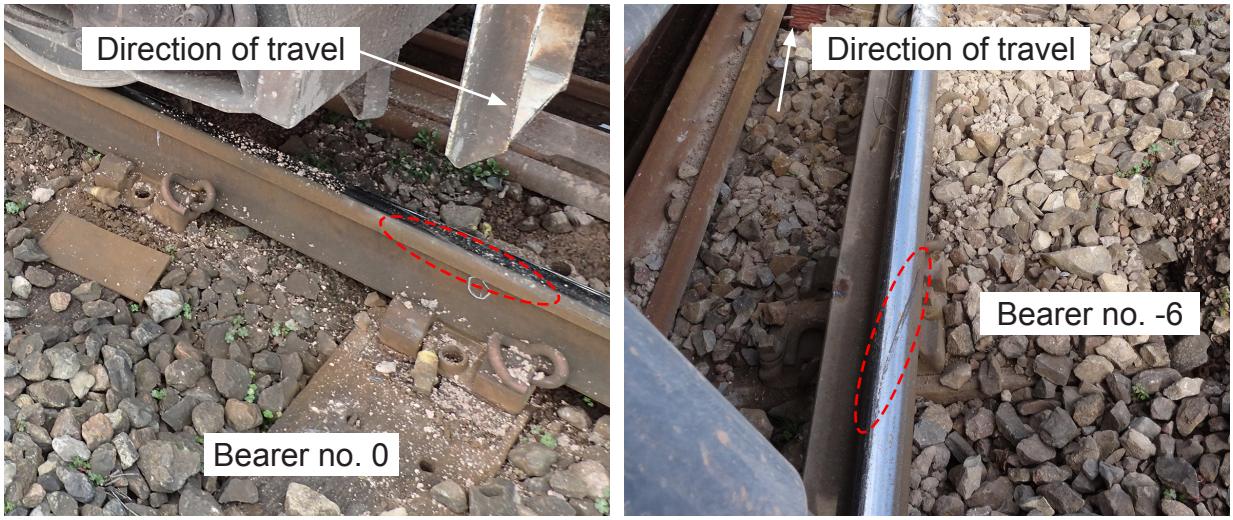

Figure 7: Flange marks on right-hand rail head at bearer nos. 0 and -6

41 Evidence of *baseplate shuffle* was visible at all of the baseplates shown at figure 6, causing an increase in track gauge. Some of the shuffle would have occurred dynamically due to the loading from passing trains and some would have remained as static gauge spread (approximately 40 mm at bearer no. 0, figure 8). Further movement of the baseplates occurred during the course of the derailment.

Figure 8: Views before and after removal of right-hand baseplate at bearer no. 0

42 Witness marks from wheel flanges riding along the gauge corner of the right-hand rail were found at bearer no. -2. Multiple marks from the wheels of the derailed wagons dropping into the *four foot* were present on the left-hand rail in the vicinity of bearer nos. -2 and -4 (figure 9).

Figure 9: Drop-in marks on the gauge corner of the left-hand rail at bearer nos. -2 and -4 (courtesy Network Rail)

43 The right-hand baseplates at bearer nos. 3 through to -2 had lifted and pivoted around the edge on the field side of the rail. From bearer no. -3 onwards the rail had become unclipped from the baseplates, which remained in place on the bearers (figure 10).

Figure 10: View showing outwards rotation of the right-hand rail

Probable derailment sequence

44 Although it is not possible to be certain about the exact sequence, the RAIB has concluded that the derailment was probably initiated when the leading left-hand wheel of the 24th wagon dropped into the four foot close to bearer no. -4 as a result of gauge spread. The forces exerted on the outer (right-hand) rail, in conjunction with its lack of fixity (paragraph 39), caused it to move laterally and also to rotate outwards, pivoting about the field side edge of the baseplates. The derailment occurred once the track gauge had increased to approximately 1520 mm; figure 11 shows the relationship between lateral displacement of the right-hand rail and its outwards rotation at which this threshold is reached.

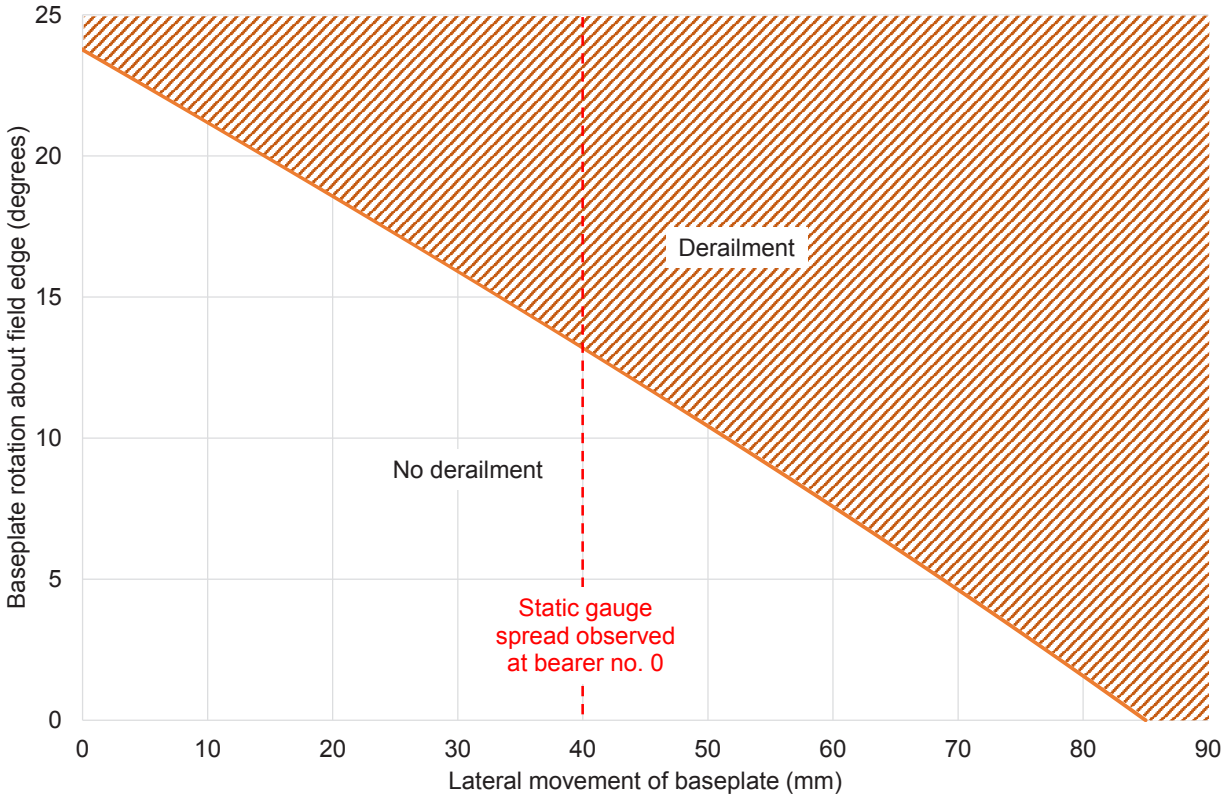

Figure 11: Conditions required for gauge spread derailment (gauge ≥ 1520 mm)

45 Once the first wheel had dropped in, the wheels on the leading axle of the 24th wagon exerted a further spreading force on the rails. The right-hand wheel, which had initially remained on the rail head, was subsequently forced over it to the field side, as the gauge tightened again with increasing track fixity beyond the initial *point of derailment*. This is consistent with the flange mark close to bearer no. -6 (paragraph 40).

46 The right-hand rail, already loosened, was moved further by the forces resulting from the derailment. It rotated outwards and became unclipped from the baseplates from bearer no. -3 onwards. Because of this, subsequent axles of the train derailed progressively earlier (closer to bearer no. 0).

47 Although rotation of the right-hand rail would also have reduced the angle of contact of the wheel flange and the rail, the RAIB has concluded that such rotation is likely to have been insufficient to result in a *flange climb* derailment[6] before gauge spread caused the 24th wagon to derail. The 2% reduction in the vertical load at the leading right-hand wheel of the 24th wagon (paragraph 16) is also likely to have been insufficient to result in a flange climb derailment. The flange marks on the gauge corner of the right-hand rail at bearer no. -2 (paragraph 42) were probably made by the wheels of later derailed axles, once their left-hand wheels had dropped in. At some point in the derailment sequence, a right-hand wheel climbed over the rail, making the flange mark at bearer no. 0; the left-hand baseplate at this bearer was probably damaged as the left-hand wheel dropped in.

[6] The angle of contact between the flange and the rail is a key factor in flange climb derailments.

48 As shown in figure 5, the first three bogies of the train to derail did so to the right, whereas later bogies came to rest with the wheels displaced to the left. This is likely to have happened as the track was progressively destroyed during the derailment. It is possible that the later derailed wheels were guided to the left when they encountered 943B trap points.

Identification of causal factors

49 The accident occurred due to a combination of the following causal factors:

- The risk from plain-lining 945 points was not recognised and managed (paragraph 50).
- There was a loss of rail fixity due to the track configuration at the site of 945 points (paragraph 55).
- The loss of rail fixity at the site of 945 points was not identified during track inspections (paragraph 59).
- Network Rail's track recording vehicle had not run over the Link Line since 2013 (paragraph 66).

Each of these factors is now considered in turn.

The configuration of the track

50 **The risk from plain-lining 945 points was not recognised and managed.**

51 The horizontal alignment of switches is sub-optimal compared with a curve designed in compliance with NR/L2/TRK/2102 (paragraph 37). When 945 points were plain-lined, the new rail was installed to follow the line of the curved switch rail that was being replaced. As a result, the curvature varied through the curve and there was no installed *cant*. While the RAIB cannot be certain, it is likely that the sub-optimal track geometry led to higher lateral forces than may otherwise have occurred. In most cases points are plain-lined for the straight route, usually resulting in straight temporary track.

52 Network Rail has a track work instruction Ref. TWI 3S105, 'How to plain-line S&C [points] in an emergency', which is applicable when 'replacement S&C units are not immediately available and a section of plain rail is fitted to one route to enable trains to pass in one direction only'. This work instruction explicitly assumes that plain-lining is a temporary measure, whereas the network change submission (paragraph 33) resulted in the work at 945 points becoming permanent. Although this work was within the scope of NR/L2/TRK/2102 (paragraph 37), it did not fall within the scope of the assurance process set out in NR/L2/TRK/2500, on the basis that it was routine maintenance. There was therefore no independent check on the suitability of the final track configuration.

53 A request to renew track infrastructure that the maintenance organisation is unable to deliver is normally submitted to the RAM's organisation (the 'RAM team') as a *problem statement*. Submission of a problem statement for the work to plain line 945 points would probably have led to 'refurbishment' or renewal of the track within a period of three to five years. However, no such submission was made because track maintenance staff carried out the work themselves. Although the RAM team was aware that the points had been plain-lined (paragraph 33), it did no follow-up to confirm the suitability of the installation as a permanent change. Although there is no requirement for the RAM team to have inspected the asset once it was decided the repair would become permanent, if it had done so it might have identified that the geometry and components were insufficiently robust and were likely to deteriorate under heavy traffic.

The condition of the track

54 **There was a loss of rail fixity due to the track configuration at the site of the former 945 points.**

55 The baseplates that were installed when 945 points were plain-lined were of type PV; these supported the rail in a vertical position[7] and had three screw holes. They replaced the *slide baseplates* that had previously supported the switch and stock rails and had four screw holes. These baseplates were probably used as they enabled a 'like for like' substitution of the points with plain line, although their normal application is within a set of points. Network Rail has advised that PV baseplates should be installed with two chairscrews on the gauge side and one on the field side. The baseplates on the right-hand rail at the site of 945 points were oriented this way round (figure 6), although those on the left-hand rail had been installed with one chairscrew on the gauge side and two on the field side. The baseplates were fixed to the original hardwood timber bearers dating from 1983; witness evidence indicates that this was because these were deemed to be in good condition when the points were plain-lined.

56 When 945 points were plain-lined, the single chairscrew on the field side of each of the new baseplates was inserted into a freshly-bored hole. The two chairscrews on the gauge side were in some cases inserted into the existing holes that had been used for the previous baseplates; this would have provided a degree of unwanted movement compared to the new fixing of the chairscrew on the field side. NR/L2/CIV/140 'Model clauses for civil engineering works', section 215.015, states that when chairscrew holes have become enlarged and the timber or sleeper is no longer capable of gripping the chairscrew, maintenance liners or coils may be inserted. There was no evidence that maintenance screws were used in the existing holes, probably because the timber bearers were assessed as being in good condition.

57 The RAIB considers that the geometry of the curve at the site of 945 points (paragraph 51), coupled with the relative rigidity of the field side chairscrews, probably led to these being subjected to disproportionately high lateral forces as trains traversed the curve. Examination of the sheared field side chairscrews from bearer numbers 5 to 1 indicated that they had all failed some time prior to the derailment on 20 March 2017. The field side chairscrew from bearer 0 had fatigue *beach marks* and a final fracture surface consistent with failure having occurred immediately before or during the derailment.

[7] NR/L2/TRK/2102 requires rails on plain line track to be inclined at 1 in 20 towards the track centre line.

58 The failure of chairscrews allowed the outer rail on the curve to move, leading to dynamic gauge spread. This enlarged the clearance between the wheel flange and gauge face allowing an increased 'angle of attack' (the angle of the wheel relative to the rail) of the leading outer wheel on each bogie, and hence the lateral force on the rail, leading to further chairscrew failures and ultimately to the derailment. The *sidewear* that was evident on the outer rail approaching the point of derailment[8] (figure 12), was consistent with wheels traversing the curve with high lateral contact forces acting between the flange and rail.

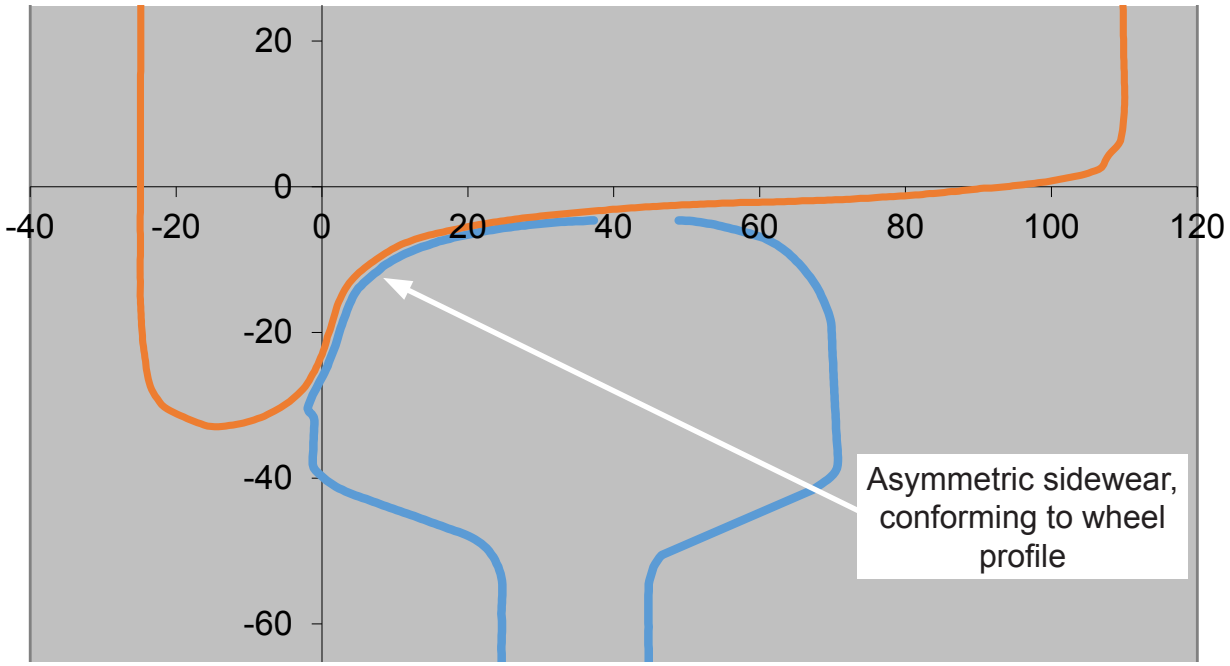

Figure 12: Cross-section of right-hand rail head and leading wheel of the 24th wagon at bearer no. 0 (view towards front of train)

Track inspections

59 **The loss of rail fixity at the site of the former 945 points was not identified during track inspections, probably because staff were focused on the poor condition of adjacent sections of track.**

60 Network Rail specifies track inspection frequencies in NR/L2/TRK/001/mod02, 'Track inspection'. For the applicable track category, these are:

Type of inspection	Frequency
● Basic visual inspection (BVI) of plain line jointed track	Once per week
● BVI of plain line continuously welded rail	Once per 2 weeks
● Track section manager (TSM) inspection of plain line jointed track	13 weekly
● Track section manager (TSM) inspection of plain line continuously welded rail	16 weekly
● Track maintenance engineer (TME) inspection	2 yearly

Records indicate that recent inspections of the Link Line were compliant with these timescales.

[8] This did not exceed the limits specified in NR/L2/TRK/001/mod09, 'Loss of rail section'.

61 Network Rail staff who carry out BVIs are trained to look for signs of gauge spread, including broken and/or sheared chairscrews, severe sidewear and baseplate shuffle[9]. Witness evidence indicates that the patroller who carried out the BVIs leading up to the derailment on 20 March 2017 was familiar with the signs of gauge spread.

62 TSM inspections are carried out in accordance with NR/L3/TRK/002/A02, 'Supervisor visual track inspection'. This requires the person carrying out the inspection to verify the data from the TRV by referring to the track geometry trace during the inspection. They should also measure track twist and track gauge at intervals along the track.

63 None of the routine track inspections identified any signs of gauge spread at the site of 945 points. Based on its examination of the track components after the derailment, the RAIB considers that evidence of gauge spread could have been detected in the weeks beforehand. Several of the chairscrews were broken and baseplate shuffle would have been visible, unless the baseplates had moved outwards to cover the marks. In this case, measurements of static gauge would have revealed the gauge widening; witnesses report that no such measurements had been routinely carried out on the Link Line.

64 Witness evidence indicates that track maintenance staff at all levels believed that the Link Line was generally in poor condition, but their focus was on the adjacent section of track (between the site of 945 and 946 points, refer to figure 3). They believed that the track at the site of 945 points was in relatively good condition because it consisted of continuously welded rail that had been installed fairly recently on good condition timber bearers (paragraph 32). It is possible that this perception led them to overlook the signs of gauge spread.

65 An additional inspection was carried out when the Link Line was reopened in September 2015 in order to confirm that it was safe for the passage of trains. Witnesses report that the results of this were recorded using a 'Form G' (Infrastructure Conformance Certificate), Ref. TEF 3203. However, Network Rail has been unable to provide a copy of this certificate.

Train-based geometry measurement

66 **Network Rail's track recording vehicle had not run over the Link Line since 2013.**

67 Network Rail routinely makes track geometry measurements using a train known as the track recording vehicle (TRV), in order to find track defects such as dynamic gauge faults that occur under the weight of a train. The nominal planning interval for geometry recording is defined in NR/L2/TRK/001/mod11, 'Track geometry - Inspections and minimum actions'. For category 4 track, such as the Link Line, this is 24-weekly (with a maximum interval of 52 weeks). The standard requires that manual measurement should be undertaken where it is not practicable to operate train-borne systems. The TRV last ran over the Link Line on 17 September 2013, 183 weeks before the derailment on 20 March 2017 (the Link Line was closed for 97 weeks during this period). The TRV had not run on the Link Line since it reopened in September 2015.

[9] The training material refers to track work instruction 2G061, 'How to recognise gauge spread'.

68 The routes over which the TRV operates are defined in computer files known as RSTs (route setting tapes). The network data team, based at Network Rail's Milton Keynes offices, act as custodians of the RSTs, which are used by the asset inspection services (AIS) team in Derby for train planning. A representative of AIS attended a meeting at Westbury depot in August 2014, at the request of the principal technical officer, in order to optimise the TRV routing in the Westbury area. At the time of this meeting, staff at Westbury believed that the Link Line was not included in scheduled TRV routes[10]. The amendments to the East Somerset Branch RSTs that were made following this meeting are explained at appendix D.

69 When the TRV ran on 23 September 2014, it could not be routed along the Link Line, because it had been closed (paragraph 35). AIS then suggested that the RST covering the Link Line, 852/2, should be deleted as they understood that the closure of the Link Line was to be permanent. The principal technical officer advised AIS that the associated network change had been 'rejected' (paragraph 35), and that the RST would be required once the Link Line reopened.

70 AIS was expecting to be advised when RST 852/2 should be reinstated. However, witnesses report that track maintenance staff at Westbury were unaware that they needed to provide this advice, so the TRV ran in November 2015 and May 2016 without including the reopened Link Line (the TRV run that would normally have taken place in September 2016 did not happen).

71 Data from the TRV is uploaded into a track geometry reporting system and is then supplied to the TME. The TME is required by NR/L2/TRK/001/mod11 to review this data within three weeks of issue, and to make a record of the review by annotating a copy of the track geometry trace. At Westbury, this is normally achieved by convening a 'trace review' meeting. However, the trace review meetings that were scheduled to take place after the TRV runs in November 2015 and May 2016 did not take place, so the opportunity to identify that the Link Line had not been recorded was missed.

72 As NR/L3/TRK/002/A02 requires the person carrying out supervisor's track inspections to refer to the track geometry trace during the inspection (paragraph 62), this should have provided further opportunities to identify that the Link Line had not been recorded by the TRV. However these opportunities were missed, possibly because the inspections of the Link Line were carried out without reference to track geometry traces.

73 AIS publishes weekly track geometry reports, known as 'black hole' reports, enabling identification of sections of track that were not covered by train-based geometry measurements. These reports showed that the Link Line[11] was missing from the measurement runs. These reports would normally have been reviewed by the principal technical officer on behalf of the TME, although this post at Westbury has been vacant since March 2015. Consequently this opportunity to identify that the Link Line was not being recorded by the TRV was also missed.

[10] Diagrams dated 7 August 2014, of the routes not covered by the TRV, incorrectly showed the Link Line as 'recorded manually'.

[11] Identified as ELR 'ESB'; track I/D '3100' from 0 miles 240 yards to 0 miles 440 yards.

Manual geometry measurement

74 No manual geometry measurement had been carried out. This is a possible causal factor.

75 As stated above, track maintenance staff were unaware that train-based geometry measurements had not been made after the Link Line reopened in September 2015, and did not carry out alternative manual geometry measurements as required by NR/L2/TRK/001/mod11 (paragraph 37).

76 Although no manual measurement was carried out, track maintenance staff witnesses have since questioned whether it would have revealed static gauge spread at the derailment site. However, the RAIB considers that either manual geometry measurement would have revealed the gauge spread or the evidence of baseplate shuffle would have been apparent during the BVI and TSM inspections (paragraphs 61 and 62).

Identification of possible underlying factor

The pressures on staff at Westbury track maintenance depot

77 It is possible that the pressures on staff at Westbury track maintenance depot were affecting their ability to carry out their duties effectively.

78 Increasing freight traffic added to the track maintenance workload at Westbury due to the wear and tear on the track. Witnesses report that track damage in the Westbury area is principally caused by loaded stone trains travelling on the Up line.

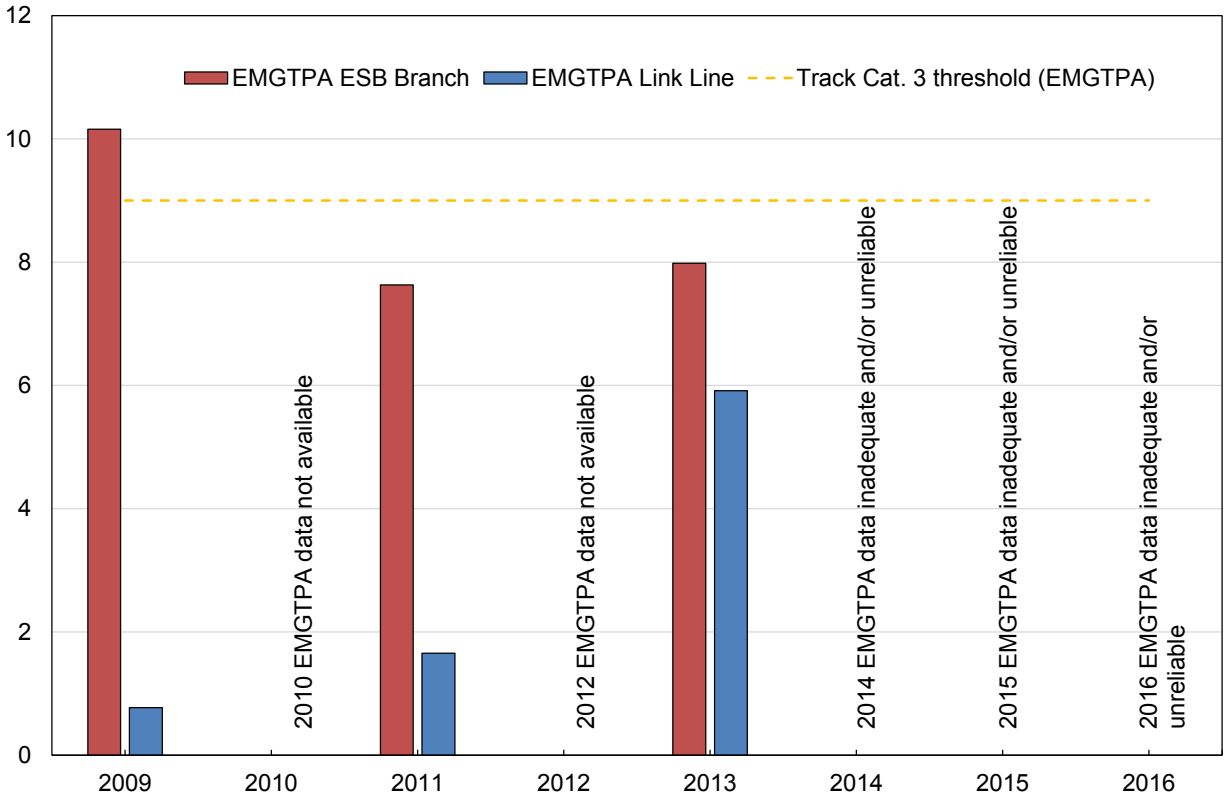

Figure 13a: Equivalent million gross tonnes per annum (Network Rail data)

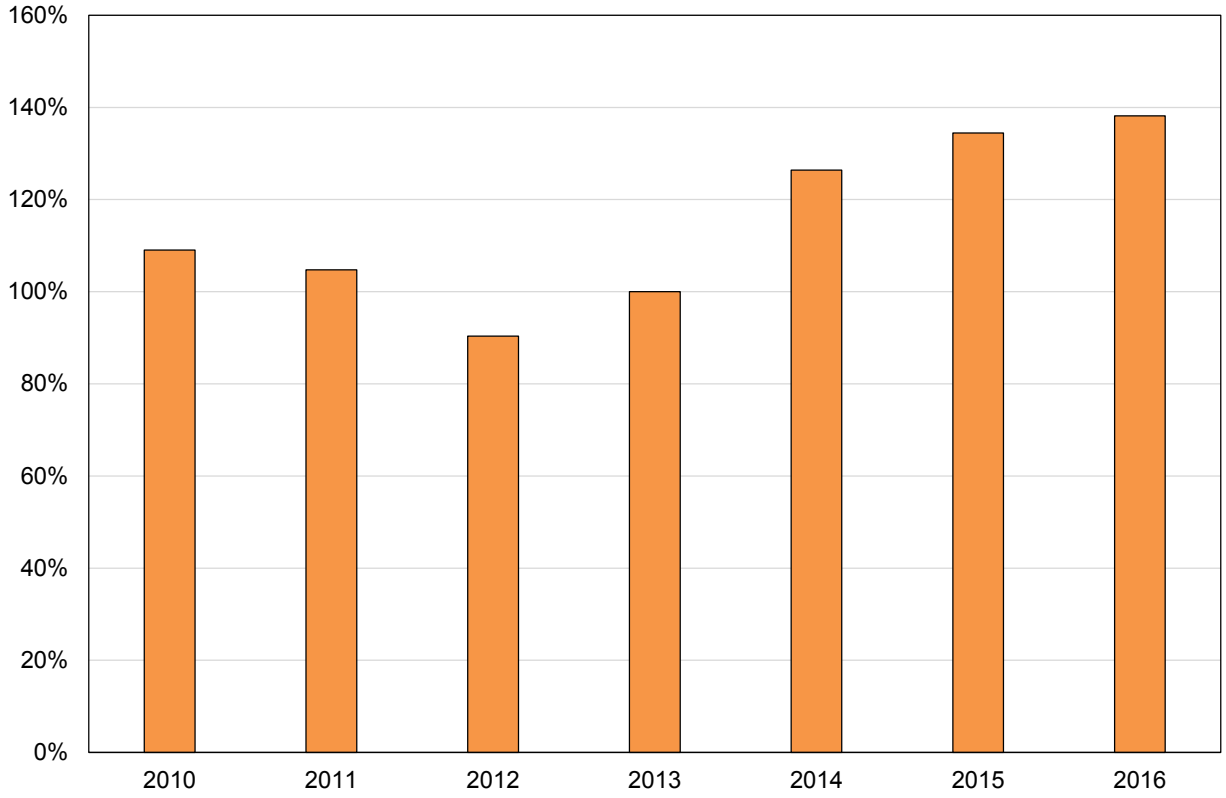

Figure 13b: Net tonnage from Merehead Quarry (Mendip Rail data, normalised at 2013 value)

79 The RAM team publishes figures that enable each section of track to be categorised for inspection purposes, based on the tonnage carried (expressed as equivalent gross tonnes per annum (EMGTPA)). At the time of the derailment on 20 March 2017, no EMGTPA figures had been published for the Western Route since 2013 (figure 13a). Data from Mendip Rail show the tonnage carried from Merehead Quarry in 2016 was 38% higher than in 2013 (figure 13b). Although there is no direct correlation between the Mendip Rail data and EMGTPA, the increase in traffic would probably have raised the inspection category of the East Somerset Branch from Cat. 4 to 3. The increased tonnages would also probably have resulted in the track categories for both the Link Line and the Branch Loop being Cat. 4 (at the time of the derailment they were Cat. 4 and Cat. 6). These changes in category would not have made any practical difference to the required inspection frequencies for the East Somerset Branch, although they might have drawn attention to the associated increase in the wear and tear on the track.

80 Witnesses have reported a number of other factors that increased the pressure on staff at Westbury track maintenance depot:

- The technical team at Westbury was under-resourced; in particular, the principal technical officer post was unfilled. This partly explains why depot management was unaware of the absence of track geometry measurements for the Link Line (paragraphs 66 to 75).
- There are limited access opportunities to carry out maintenance work during mid-week nights, partly due to traffic from the Merehead and Whatley quarries, and partly due to traffic that has been diverted to facilitate the electrification of the Great Western main line. As a result, planned work is carried out predominantly on Saturday nights.

- Work associated with *deferred renewals*. Such work may include the need to carry out 'mitigations' (interim refurbishment of assets such as points)[12], as well as managing the poorer reliability of life-extended assets. Although Network Rail has been unable to provide data on trends in the overall number of deferred renewal sites in the Westbury area, it has provided data on the rate of numbers of sites added each year (figure 14); this increased in 2015/16 and again in 2016/17. This data does not include renewals that have been identified as being necessary but which have not been given a planned delivery date (Network Rail does not regard these as 'deferred renewals' even though the TME may have indicated when they should be delivered).
- The Swindon works delivery unit was unable to deliver some minor works, such as deferred renewal mitigations, effectively. As a result, it had been restricted to delivery of simple, plain line, mitigation works and led to some jobs being carried out by track maintenance staff.

81 Western Route management regularly reviews data on the performance of its maintenance teams. One of the measures used is the numbers of repeated 'level 2' track faults, for which the performance of Westbury track maintenance depot is comparable with other depots. Other measures cover poor track geometry, good track geometry and the 'black hole' reports (paragraph 73).

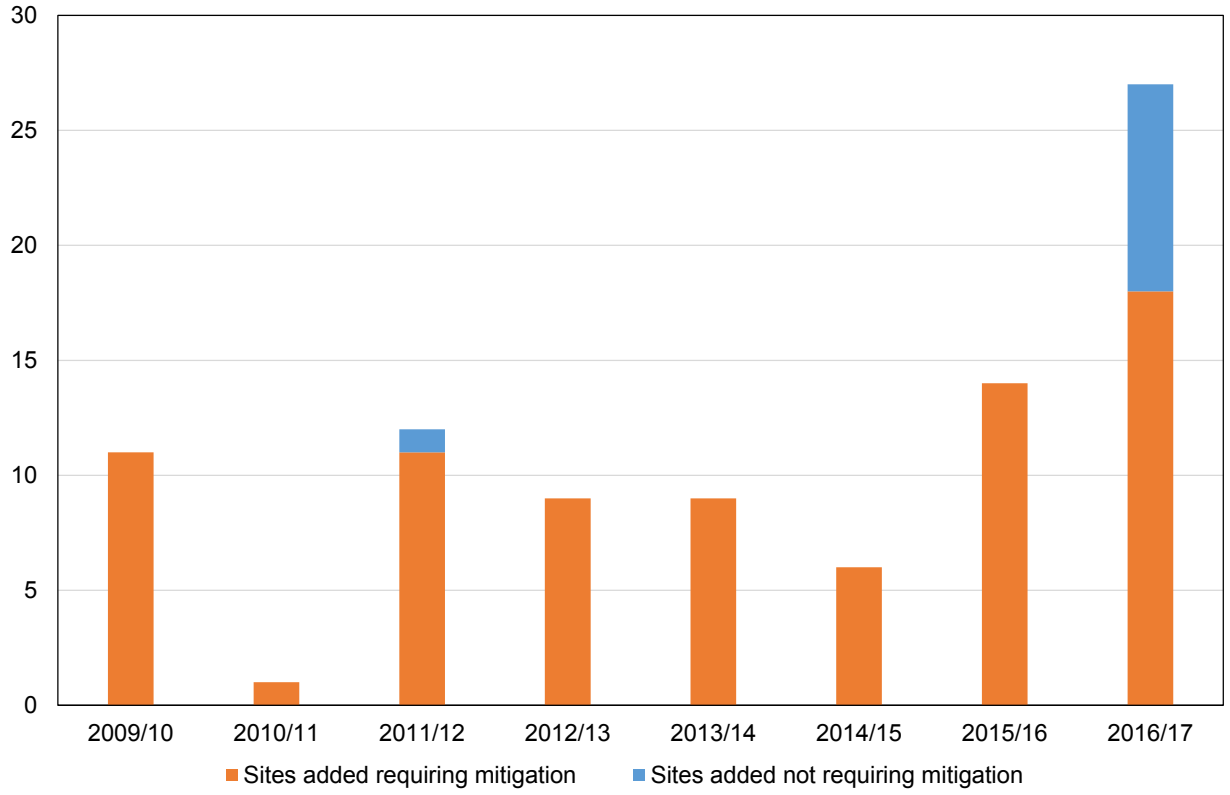

Figure 14: Additional deferred renewal sites, Westbury track maintenance depot

[12] This work is normally assigned to the works delivery organisation in the first instance. However, in some cases it is then passed on to the relevant track maintenance depot for implementation.

82 The numbers of Ellipse items that are overdue (in 'backlog') are tracked daily. However, there is less visibility of items that have been reprioritised and given a new completion date. These are controlled by the TSM in accordance with NR/L3/MTC/MG0176/11, 'Prioritisations, reprioritisations and cancellations', and must be approved by the TME on every sixth occasion. Westbury has the highest number of Ellipse work items that have been repeatedly reprioritised for any track maintenance depot on Western Route (normalised by track km, figure 15; this includes backlog items). This is an indication that staff at Westbury track maintenance depot may have been struggling with the volume of work. Had this not been the case, it is possible that depot management would have identified that track geometry of the Link Line was not being measured.

83 Following the derailment, and in recognition that Westbury track maintenance depot faced some specific challenges (paragraph 80), the Swindon infrastructure maintenance delivery manager has established a special track asset stewardship review meeting, with the intention that this would meet on a six-weekly basis. This is intended to 'support an improving and sustainable asset condition in the Westbury TME area'.

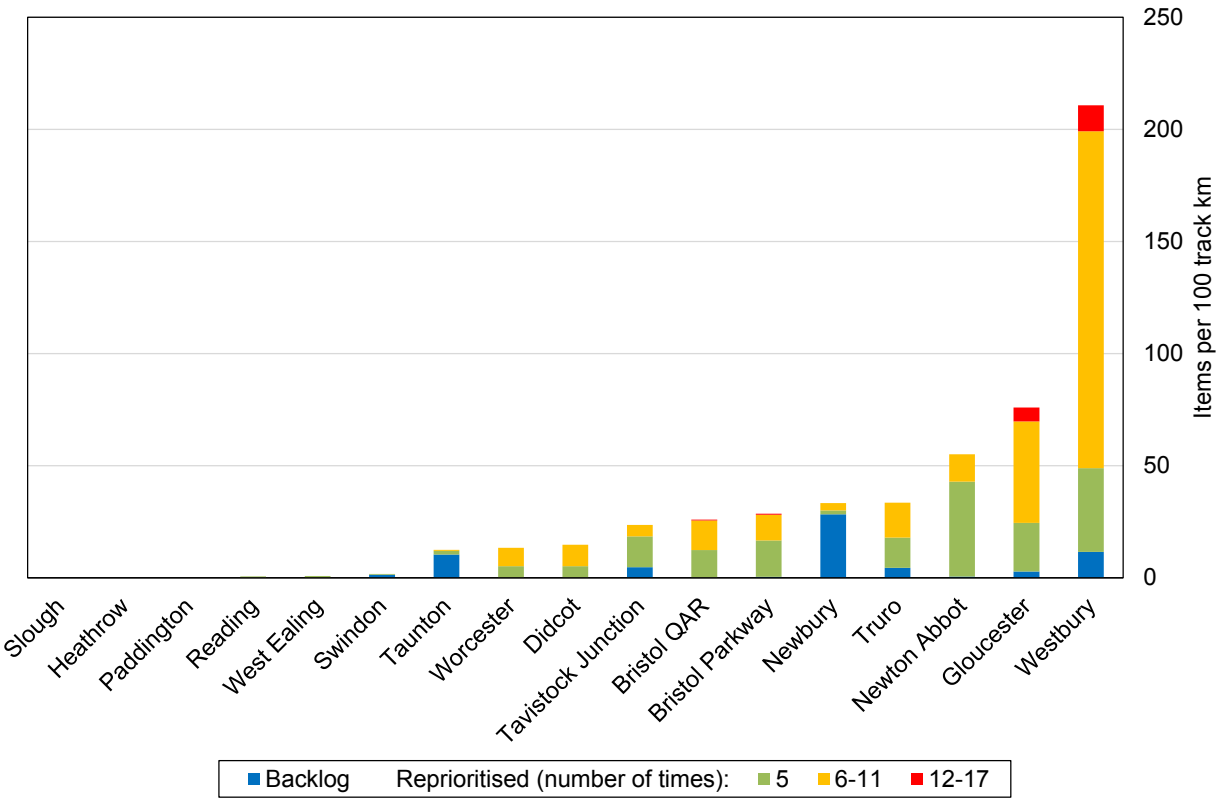

Figure 15: Reprioritised and backlog items in Ellipse by track maintenance depot (Western Route) as at 9 July 2017

Previous occurrences of a similar character

84 On 26 October 2005, a passenger train from West Kirby derailed on the approach to Liverpool Central Station (RAIB report 14/2006). The train derailed due to widening of the train gauge during the passage of the train because of the poor condition of the track.

85 On 11 October 2009, a charter service from London Waterloo derailed at Windsor and Eton Riverside station as it approached the buffer stops (RAIB report 11/2010). The derailment occurred as a result of gauge spread. Recommendation 1 of the RAIB's report is relevant to the current investigation (see paragraph 92).

86 On 12 May 2010, an engineering train derailed between Gloucester Road and Earl's Court stations on the Piccadilly Line (RAIB report 05/2011). The train derailed because the track was not able to maintain gauge within safe limits as the train passed over it.

87 On 23 January 2013, a passenger service from London to Norwich derailed and re-railed itself just after it left Liverpool Street station (RAIB report 27/2014). The train derailed on a tight curve because the track fixings had deteriorated over a period of time and the lateral forces from the train caused gauge spread.

88 On 5 November 2016, a passenger charter train from London Waterloo to Fawley became derailed on the single line between Northam Junction and Southampton Eastern Docks (RAIB safety digest 04/2017). The derailment occurred on track which was wide to gauge; several sleepers appeared to have been defective and the rail fastenings were worn.

Summary of conclusions

Immediate cause

89 The right-hand rail at the site of 945 points was insufficiently restrained, allowing it to move laterally and rotate under the load from train 7Z15, such that the leading wheels of wagon no. 24 derailed due to gauge spread (paragraph 38).

Causal factors

90 The causal factors were:

a. The risk from plain-lining 945 points was not recognised and managed (paragraph 50, **Recommendations 1 and 2**; see also paragraph 97).

b. There was a loss of rail fixity due to the track configuration at the site of the former 945 points (paragraph 55, **Recommendations 1 and 2**; see also paragraph 97).

c. The loss of rail fixity at the site of the former 945 points was not identified during track inspections, probably because staff were focused on the poor condition of adjacent sections of track (paragraph 59, Learning point 1).

d. Network Rail's track recording vehicle had not run over the Link Line since 2013 (paragraph 66, **Recommendation 3**).

e. No manual geometry measurement had been carried out (paragraph 74, **Recommendation 4**, Learning point 1).

Possible underlying factor

91 A possible underlying factor was that the pressures on staff at Westbury track maintenance depot were affecting their ability to carry out their duties effectively (paragraph 77, **Recommendation 4**; see also paragraphs 96 and 97).

Previous RAIB recommendations relevant to this investigation

92 The following recommendations, which were made by the RAIB as a result of its previous investigations, have relevance to this investigation.

Previous recommendation that had the potential to address one or more factors identified in this report

Accident at Windsor and Eton Riverside station on 11 October 2009, RAIB report 11/2010, Recommendation 1

93 Recommendation 1 in RAIB report 11/2010 related to improvements in the competence of staff carrying out track inspections in order improve the detection of gauge spread. The recommendation read as follows:

Recommendation 1

The purpose of this recommendation is to improve the skills of all staff involved in track inspection (including managers and supervisors) in identifying excessive dynamic gauge widening. Taken in conjunction with their existing competence in identifying chair shuffle the enhanced skills should increase the ability and confidence of staff in deciding if a dynamic derailment risk is evident.

Network Rail should revise its current competency training programme for all staff involved in track inspection to include reference to the visual identification of abnormal running band and its relationship with chair shuffle and wide gauge as an indication of dynamic gauge problems and potential risk of derailment.

94 Network Rail advised ORR in June 2011 that it had reviewed its training material and revised its competency training modules covering track patrolling and track geometry.

95 ORR advised the RAIB on 17 October 2013 that it had concluded Network Rail had taken the recommendation into consideration and taken action to implement it.

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

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

96 Network Rail's Swindon infrastructure maintenance delivery manager has established a special track asset stewardship review meeting (paragraph 83), including the head of maintenance for Western Route, in order to oversee issues affecting Westbury track maintenance depot.

97 The ORR served an improvement notice on Network Rail's Western Route on 24 May 2017, requiring it to develop a process to ensure that work initiated by track maintenance teams resulting in a change of layout or configuration of an asset is subject to a suitable and sufficient process covering initiation, design, verification, installation and commissioning and that this is recorded. The original completion date was 31 July, later extended to 31 October, 2017.

Recommendations and learning point

Recommendations

98 The following recommendations are made[13]:

1 *The purpose of this recommendation is to reduce the risk from sub-optimal track configurations resulting from plain-lining of S&C.*

Network Rail should enhance its procedures covering the emergency and/or temporary replacement of switches and crossings with plain line. Appropriate measures should be included to manage the risk where the newly-installed plain line is curved. Consideration should be given to limiting the duration of such installations without an independent inspection, permanent design and/or track renewal taking place (paragraphs 90a and 90b).

2 *The purpose of this recommendation is to reduce the risk from sub-optimal track configurations that may exist as a result of plain-lining of S&C.*

Network Rail should identify existing locations where switches and crossings have been replaced with curved plain line on an emergency and/or temporary basis. A time-bound plan should be drawn up to implement appropriate measures to mitigate the risk at such locations, taking account of the findings of this report (paragraphs 90a and 90b).

3 *The purpose of this recommendation is to reduce the probability that sections of track might inadvertently be missed from train-based track inspections.*

Network Rail should improve its processes for specifying and controlling the configuration of the route definitions used by its track measurement trains. The improved arrangements should take account of the needs of all relevant stakeholders and clarify ownership of the data. Where temporary closures of sections of line are necessary, the steps to reactivate train-based measurement should be clearly defined (paragraph 90d).

[13] 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 and Road 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 200 to 203) can be found on RAIB's website www.gov.uk/raib.

4 *The purpose of this recommendation is to ensure that there are adequate resources to maintain the track in the Westbury area.*

Network Rail Western Route should identify key track maintenance activities at Westbury and evaluate the extent to which these can be reliably delivered by the existing workforce. A time-bound plan should be drawn up to implement any resulting changes in responsibilities or resourcing (paragraph 91).

Learning point

99 The RAIB has identified the following key learning point[14]:

1 Track maintenance staff are reminded of the importance of identifying sections of curved track which may be subject to high lateral loads, leading to possible rapid deterioration of fastenings; risk factors include an increase in the number of heavy trains and unusual track geometry, including a lack of cant. Particular attention should be given to identification of gauge spread (as per Track Work Instruction 2G061), as well as ensuring that dynamic measurements of track geometry are taken at the intervals specified in NR/L2/TRK/001/mod11.

[14] 'Learning points' are intended to disseminate safety learning that is not covered by a recommendation. They are included in a report when the RAIB wishes to reinforce the importance of compliance with existing safety arrangements (where the RAIB has not identified management issues that justify a recommendation) and the consequences of failing to do so. They also record good practice and actions already taken by industry bodies that may have a wider application.

Appendices

Appendix A - Glossary of abbreviations and acronyms

AIS	Asset Inspection Services
BVI	Basic visual inspection
ELR	Engineer's line reference
ESB	The ELR for the East Somerset Branch
GSM-R	Global System for Mobile Communications – Railways
RAM	Route Asset Manager, Track
RST	Route setting types
S&C	Switches and crossings [referred to as points in this report]
TME	Track Maintenance Engineer
TRV	Network Rail's track geometry measurement train, usually referred to as the Track Recording Vehicle
TSM	Track Section Manager
WEY	The ELR for the Up and Down Westbury lines

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.

Baseplate	Metal casting which supports and holds a flat bottomed rail on a sleeper or concrete base.
Baseplate shuffle	The tendency of inadequately maintained baseplates and chairs on long timbers, switch and crossing timbers and wood sleepers to move laterally under traffic, so wearing the wood away from under them. Eventually the baseplate or chair disappears into the sleeper altogether.*
Beach marks	Marks indicating the progressive development of a fatigue crack. Sometimes called striations.
Bearer	A term used to describe a wooden or concrete beam used to support the track. The term generally applies to long switch and crossing timbers, longitudinal timbers and waybeams, but can be used to describe any sleeper used in a switch and crossing layout.
Bi-directional line	A line on which the signalling allows trains to run in both directions.
Cant	The designed amount by which one rail of a curved track is raised above the other rail, measured over the rail centres. Cant is applied to negate lateral forces caused by curved track.*
Chairscrew	A specialised type of screw used to secure chairs and baseplates to timbers and bearers. The term chairscrew is commonly used irrespective of what it is used to secure.*
Deferred renewal [from NR-L3-TRK-02201]	A renewal item that has not been delivered by the agreed engineering target year (the date at which the asset or system becomes unsustainable by maintenance activity/ intervention).
Ellipse	A computer based asset management system used by Network Rail to record and prioritise what maintenance is work required to be done and when it needs to be done by.
Engineer's line reference	A three or four character identification code used to specify a route or section of a route. Introduced in the 1980s, most ELRs are either three letters or three letters with a single digit suffix.*
Field side	The side of a rail facing the cess, and so nearest the fields.
Flange climb	A fault condition in which the lateral force exerted on a rail wheel is sufficient to force the rotating wheel up the gauge face of the rail. Once the flange tip clears the rail head a derailment normally occurs. Flange-climb can be caused by a twist, excessive speed or severe sidewear.*

Flange mark	The marks made in the rail crown by a wheel flange, normally during a derailment.*
Four foot	The area between the running rails of a railway track.
Gauge side	The side of a rail facing the opposite rail across the four foot.
Gauge spread	The tendency of the gauge of inadequately maintained track to become greater, eg the rails move away from each other. This is a prime cause of low speed derailments in depots and sidings, which are traditionally places considered low maintenance priorities. Major causes are baseplate shuffle, chair shuffle, rotten sleepers and chairscrews losing their grip in the sleepers.*
GEOGIS	A former British Railways database holding information such as age, construction and responsibility for track nationally.*
Network change	The formal procedure by which the infrastructure controller, Network Rail, gains assent from the train operating companies and freight operating companies for alterations to the facilities it provides, eg the closure of a route or relocation of a loop.*
Point of derailment	In a derailment, the precise point where the first wheel derailed. The sleeper closest to this point on site is normally designated as sleeper zero.
Points	a) An assembly of switches and crossings (S&C) designed to divert trains from one line to another b) Another name for a set of switches. The term points is preferred by signalling and railway operations staff, switches by permanent way types.*
Plain-lined	When a set of points is taken out of use and replaced by a section of plain line.
Problem statement (taken from NR/L3/TRK/6001)	The document which highlights that a renewal may be the most cost-effective form of maintaining track asset integrity.
Sectional Appendix	The publication, produced by each Network Rail (NR) Route, containing layout and location details for running lines, stations, permanent speed restrictions (PSR), tunnels etc.*
Sidewear	A progressive removal of rail metal generally afflicting the high rail on curves, due to the high lateral forces produced when a train negotiates a curve with insufficient cant or high cant deficiency. Eventually the rail head assumes a profile complimentary to the passing wheelsets, increasing the likelihood that wheelsets will climb the rail.*
Slide baseplate	A baseplate for a flat bottom switch having a horizontal flat surface upon which the switch rail can be moved laterally.*

Switch	The movable rail which forms part of a set of points.
Trap points	A set of points intended to derail vehicles in the event of an unauthorised movement. They are often employed to protect against conflicting movements onto running lines or on the exits from sidings.*

Appendix C - Investigation details

The RAIB used the following sources of evidence in this investigation:

- information provided by witnesses;
- information taken from the train's on-train data recorder (OTDR);
- site photographs and measurements;
- records provided by Network Rail;
- information on tonnages shipped provided by Mendip Rail Ltd;
- reports on the acceptance and post-derailment testing of wagon no. 706957074-2;
- weather reports and observations at the site; and
- a review of previous RAIB investigations that had relevance to this accident.

Appendix D - Diagrams showing track identification and RSTs

D1 Figure 16 is a schematic representation of East Somerset Junction. The ELR for both the Link Line and the Branch Loop changes from 'WEY' to 'ESB' in line with 943A points. The Link Line has the same *GEOGIS* track I/D as the rest of the East Somerset Branch (3100), whereas the Branch Loop has a unique I/D (3500).

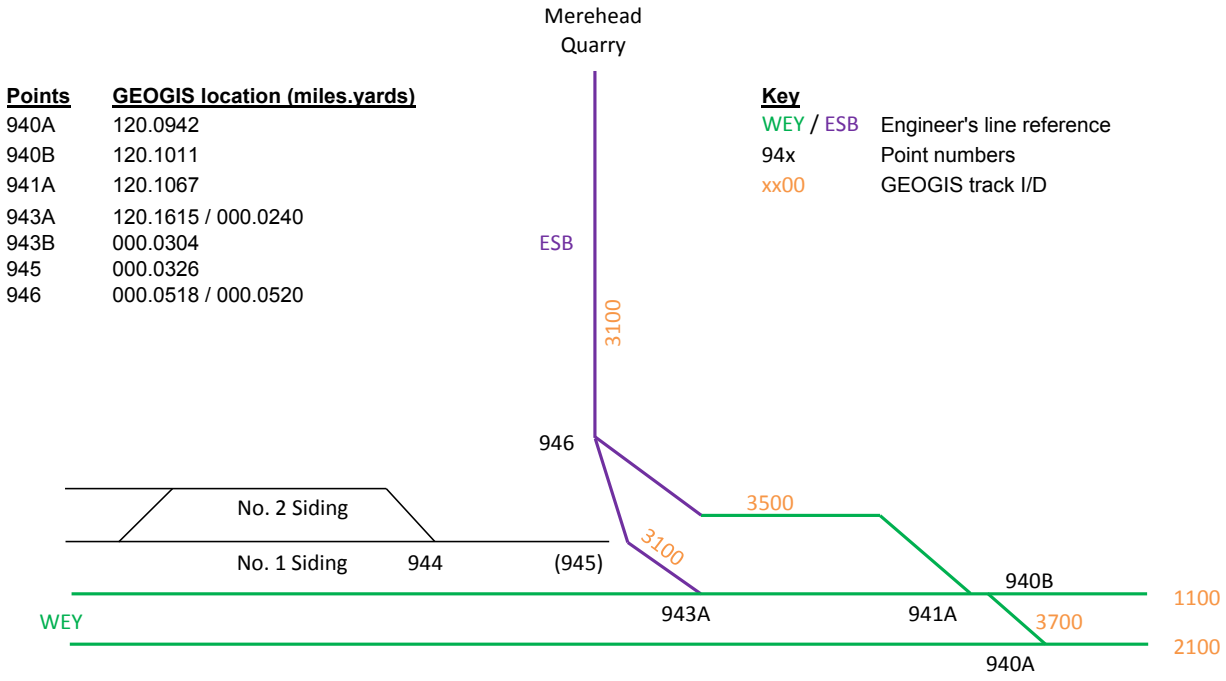

Figure 16: Track identification

D2 Figure 17 shows the RSTs for the East Somerset Branch before they were changed to optimise the routing of the TRV in the Westbury area. RST 852/1 recorded the geometry of the Link Line (which had an incorrect GEOGIS track I/D in the RST), leading onto the Branch. RST 852/2 covered the Branch Loop.

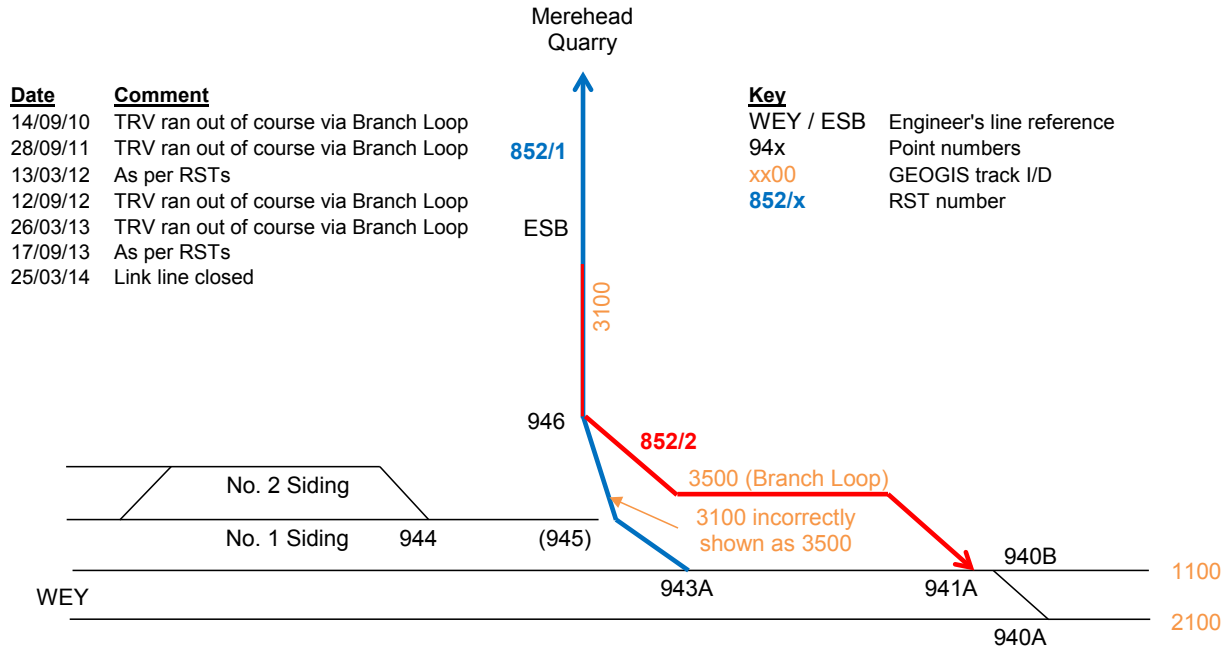

Figure 17: East Somerset Branch RSTs prior to August 2014

D3 The TRV was planned to run using both RSTs. However, four of the six runs that took place in the three years from September 2010 ran in both directions over the Branch Loop and therefore did not measure the geometry of the Link Line.

D4 Figure 18 shows the changes requested diagrammatically by the principal technical officer following the meeting at Westbury during August 2014. In practice, the only significant change was to include the crossover from the Down to Up Westbury lines (940 points). The principal technical officer believed the changes to the RSTs were more significant than the diagrams show: he believed the Link Line was not previously included (paragraph 68), possibly because of the incorrect track I/D in RST 852/1. On receipt of the principal technical officer's diagram, AIS translated the change into text and recorded it in their change log, incorrectly transposing the RSTs.

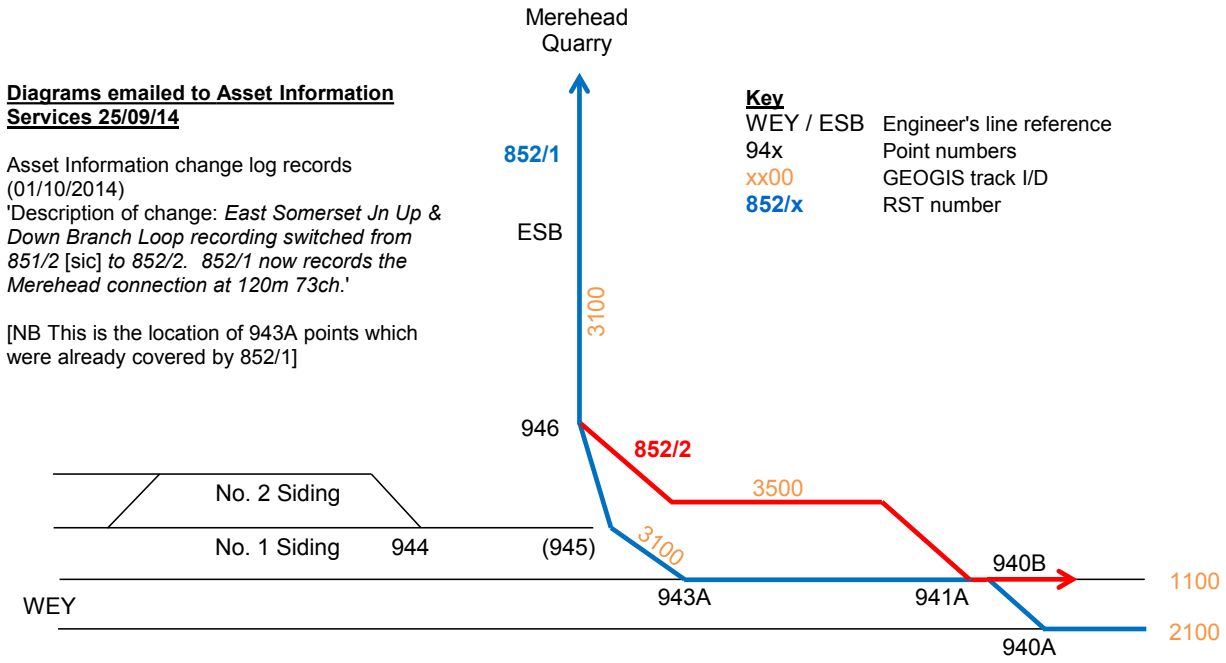

Figure 18: East Somerset Branch RSTs as requested by the PTO September 2014

D5 Figure 19 shows the RSTs as amended by AIS in September 2014; these do not reflect the change log record as shown in figure 18 (the Link Line was now covered by RST 852/2 not 852/1).

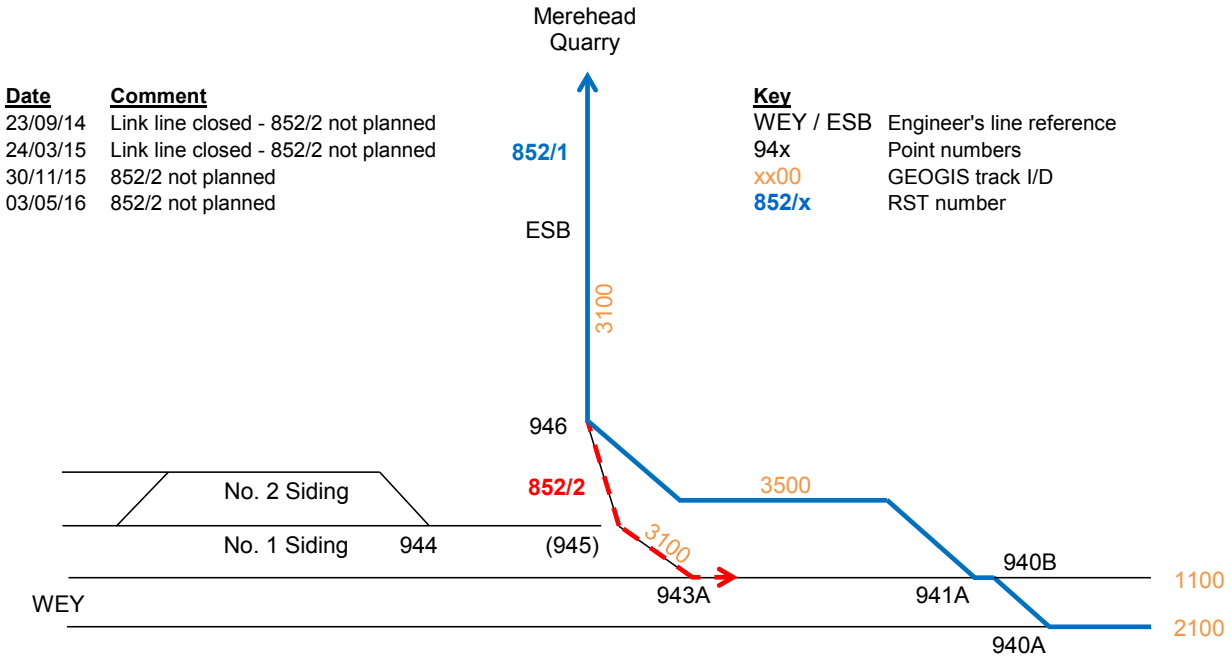

Figure 19: East Somerset Branch RSTs as at March 2017

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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.gov.uk/raib