Rail Accident Investigation Branch

Rail Accident Report

Collision between a train and a collapsed signal post at Newbury
17 November 2014

Report 15/2015
September 2015

This investigation was carried out in accordance with:

- the Railway Safety Directive 2004/49/EC;
- the Railways and Transport Safety Act 2003; and
- the Railways (Accident Investigation and Reporting) Regulations 2005.

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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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Collision between a train and a collapsed signal post at Newbury, 17 November 2014

Contents

Summary

At about 14:35 hrs on Monday 17 November 2014, a train travelling at 110 mph (177 km/h) struck the top of a signal which had collapsed and fallen across the railway line near Newbury. The signal post completely obstructed one track and partially obstructed a second (the one on which the train was travelling). There were no injuries and the train did not derail, but it did sustain some exterior damage. The outcome could have been much more serious if the first train to encounter the signal had been travelling at speed on the line that the signal had completely obstructed.

The signal collapsed because the base of the post, which was of hollow tubular steel construction, had corroded through, causing an almost complete loss of wall thickness at and just above ground level. Corrosion had occurred to both internal and external surfaces; internally because water had entered the post and there was no drainage for it to escape, while the external corrosion was affected by the base being buried in ballast, which held water around the base and damaged the protective coating on the signal post.

Signal posts are subject to annual visual examinations, but the examinations of this signal did not detect the problem because the main area of corrosion was hidden by ballast, and the examinations regime was vulnerable to missing such defects. A separate examination in 2012 for a resignalling project in the area also did not detect the defect for similar reasons. Because the defect was not detected, it was not subsequently reported and remedied through maintenance.

The investigation also identified possible underlying factors associated with the management of ballast levels around post bases, competence management of structures examiners and corporate knowledge about the original design specifications for signal structures.

The RAIB has identified one learning point and made five recommendations. The learning point relates to the process for conducting visual examinations on structures such as signal posts. Four of the recommendations are addressed to Network Rail and cover the management, examination and resilience of signal structures to such failures. The remaining recommendation is addressed to Amey regarding its competence management arrangements for structures examiners.

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 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.

The accident

Summary of the accident

3 At about 14:35 hrs on Monday 17 November 2014, a High Speed Train (HST) travelling at 110 mph (177 km/h) struck a set of *junction indicators* attached to the top of a signal which had collapsed and fallen across the railway between Newbury and Newbury Racecourse stations (see Figure 1).

4 The signal had fallen across the *Down Westbury* line, but its junction indicators were lying foul of the *Up Westbury* line, on which the train was travelling (see Figure 2).

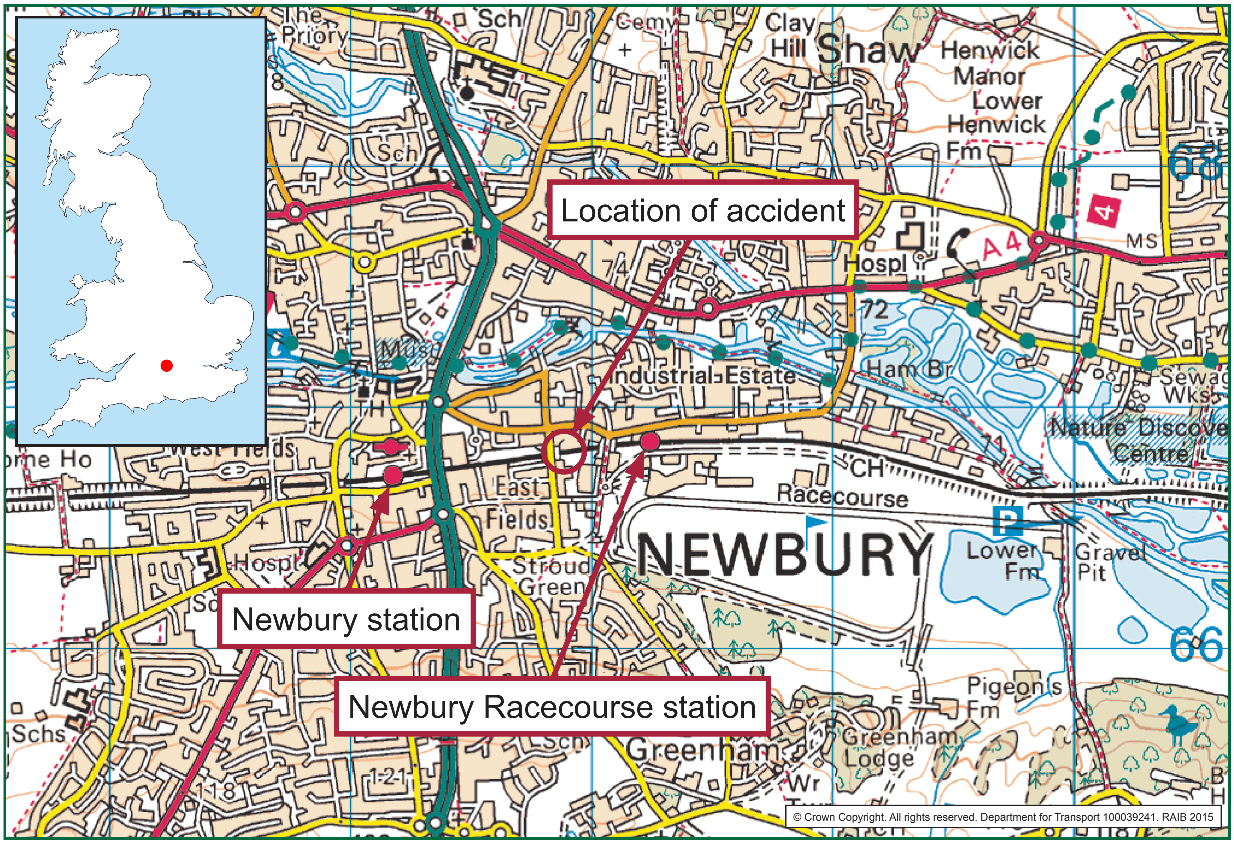

Figure 1: Extract from Ordnance Survey map showing location of accident

5 There were no injuries and the train did not derail, but it did sustain some exterior damage (paragraph 13). The outcome could have been much more serious if the first train to encounter the fallen signal had been travelling at speed on the Down Westbury line (paragraph 83).

Figure 2: The fallen signal post after the accident (courtesy of Network Rail). Down Westbury line is closest to the camera, Up Westbury line is furthest away.

Context

Location

6 The accident occurred at 52 miles 54 chains[1] on the railway line between Reading and Westbury (known as the 'Berks and Hants' line). The railway at this location comprises three tracks: the Up and Down Westbury lines, which form the main through routes, and the Down Newbury Loop (see Figure 3). The maximum permitted speed is 110 mph (177 km/h) for trains travelling on the Up and Down Westbury lines, and 25 mph (40 km/h) for trains travelling on the Down Newbury Loop. The area is controlled by the Newbury workstation at Thames Valley Signalling Centre (TVSC) at Didcot.

Organisations involved

7 Network Rail is the owner and maintainer of the infrastructure, and employs the signaller at TVSC. The location of the accident is within its Western route and is covered by the Swindon *maintenance delivery unit*.

8 First Greater Western Limited operated the train involved in the accident and employs the train driver.

9 Structures examinations on the Western route are carried out by Amey plc on behalf of Network Rail's structures team under its Civil Engineering Framework Agreement (CEFA).

[1] There are 80 chains in a mile. Mileages on this route are measured from a datum at London Paddington station.

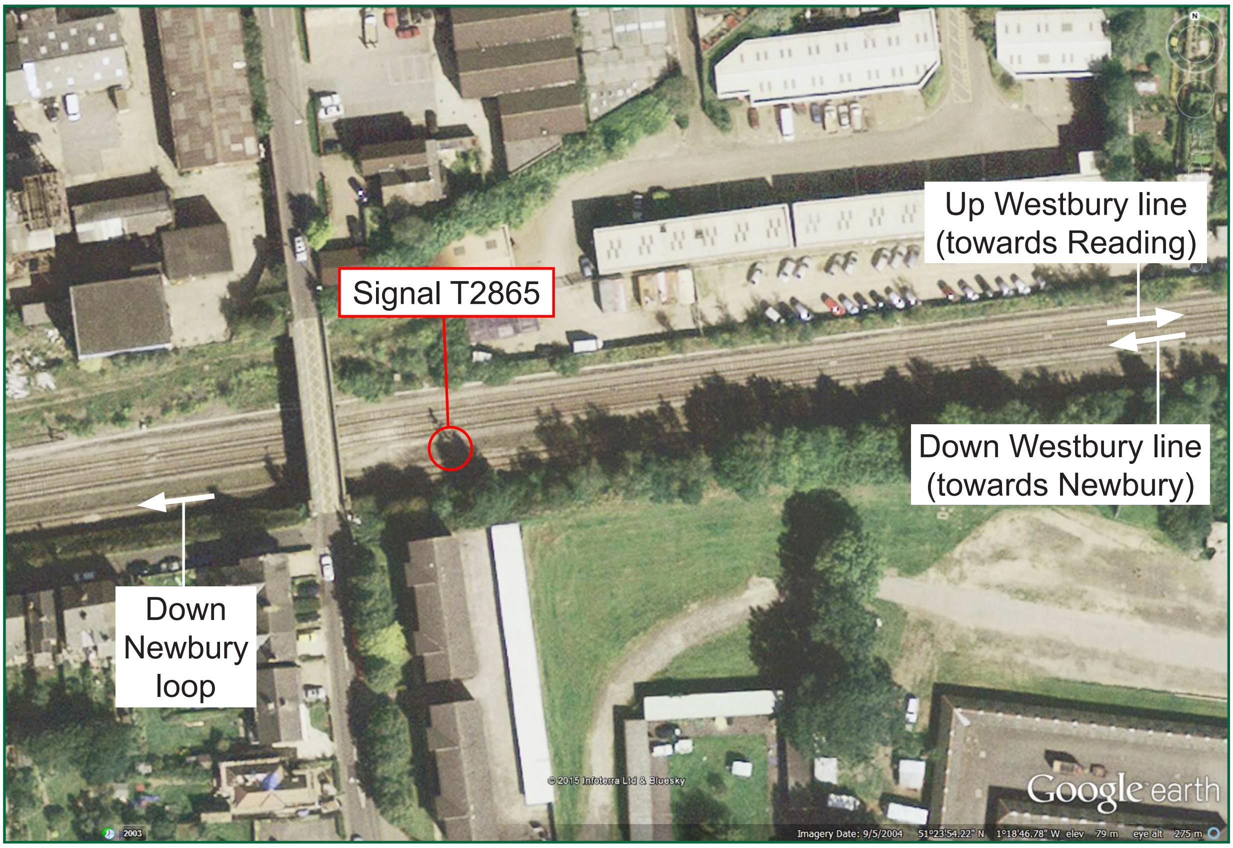

Figure 3: Google Earth image of the location

10 Early stage project works for a resignalling project affecting this location (referred to at paragraph 18) were carried out by Arup, while latter stage works (including replacement of the signal head) were carried out by Siemens Rail Automation.

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

Train involved

12 The train, reporting number 1A83, was the 10:41 hrs First Great Western HST service from Truro to London Paddington.

13 The leading power car, vehicle number 43160, sustained exterior body damage (see Figure 4) and a ruptured air pipe.

Signalling equipment involved

14 Signal T2865 is a simple straight post LED type three-*aspect* signal for the Down Westbury line (see Figure 5). It has three junction indicators and a *position light* signal which is used for *call-on* moves into the platforms at Newbury station as well as wrong-direction shunt moves onto the Up Westbury line.

15 The signal is located in the *ten-foot* between the Down Westbury and Down Newbury Loop lines.

16 The post is of hollow round tubular construction made of carbon steel, with an outside diameter of approximately 168 mm, while the manufactured wall thickness was approximately 6 mm. As a structure, the post is welded into a baseplate assembly which, in turn, is bolted to a concrete foundation (see Figure 6). The signal structure also includes an access ladder which is similarly fixed into the ground.

Figure 4: Damage to power car 43160 (courtesy of First Greater Western)

Figure 5: Photograph of the signal from 2009 (prior to the LED signal head being fitted) (courtesy of Amey)

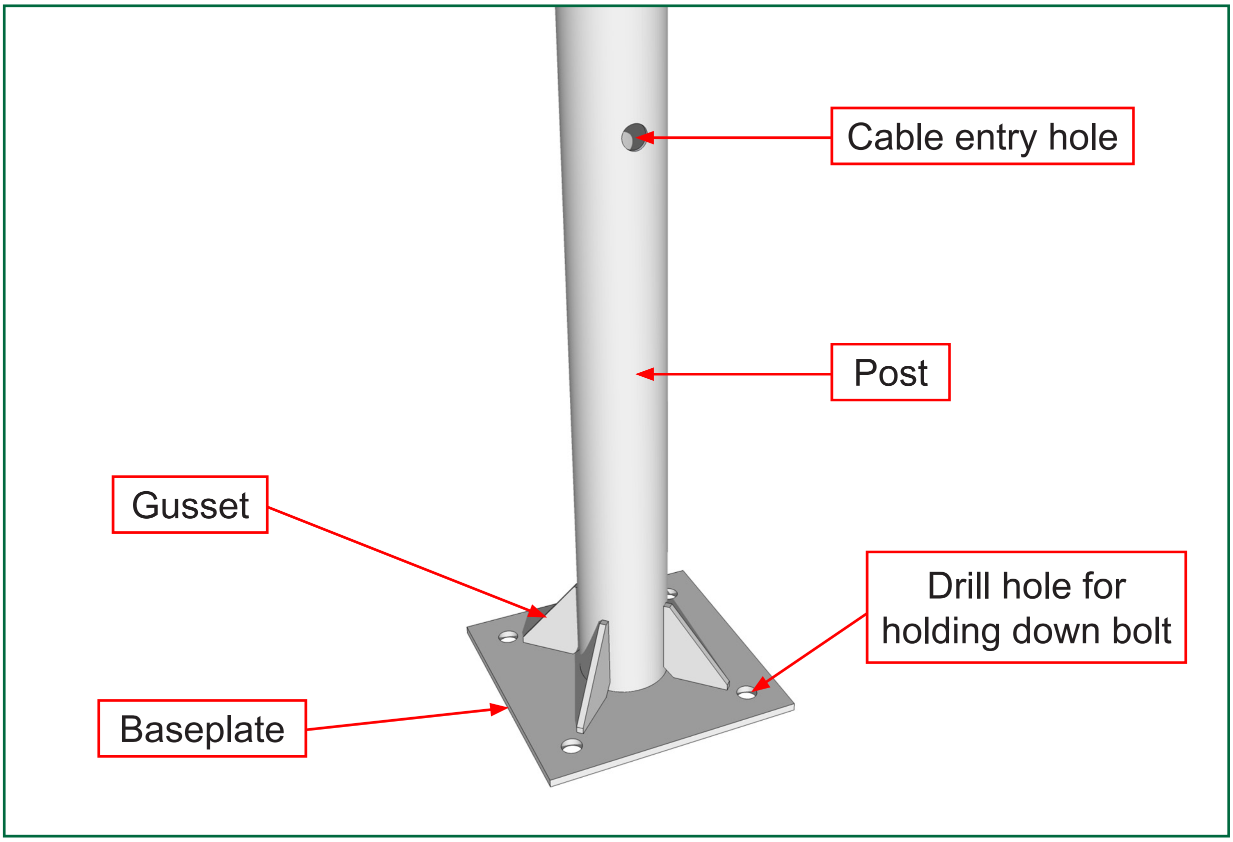

Figure 6: Schematic of post and baseplate assembly (holding-down bolts and concrete foundation not shown)

17 The structure is approximately 40 years old. Standard design drawings were first issued in 1974, while Network Rail believes this particular post was installed in 1978. The design drawings do not specify any protective coating, although a version update in 1993 refers to hot dip galvanisation.

18 Two weeks before the accident, on 3 November 2014, *axle counters* replaced *track circuits* as the means of train detection as part of a resignalling project in the area, which also replaced the older style incandescent signal lamps with LED technology. The signal was originally numbered R824. It became TR824 in 2010, and was redesignated T2865 after the resignalling was commissioned. Since this report discusses different times throughout the life of the signal, the designation correct for the period of discussion will be used in each case.

Staff involved

19 The Structures Examiner responsible for examining the condition of signal TR824 works for Amey.

20 He stated that he had been conducting structures examinations for seven years before this accident, and during that time he received on-the-job training (consisting of work shadowing, mentoring, and monitoring of his reports) for a total period of three years.

21 On 23 December 2013, he passed an assessment for the STE 4 competency (examine the condition of structures) in accordance with Network Rail's standard NR/SP/CTM/017. He had a further annual review for this competency on 1 June 2014.

External circumstances

22 Local weather data shows that the temperature at the time of the accident was 9ºC, with 9 mph (14 km/h) winds.

23 Although the weather was probably not a factor in the accident, Network Rail staff observed that the local ground conditions are generally damp as the railway is in a cutting and the area around Newbury station has a history of flooding.

The sequence of events

Events preceding the accident

24 On 12 June 2014, signal TR824 was passed as 'satisfactory' on its annual examination report. There were no substantive comments relating to this signal in the report. This was the last examination that the signal received before the accident.

25 Overnight on 27-28 September 2014, a team employed by Network Rail's contractor, Siemens, replaced the original three-aspect signal head with one of a more modern LED type.

Events during the accident

26 At around 14:20 hrs on 17 November 2014, a freight train (reporting number 6C74) conveying empty wagons to Whatley Quarry passed signal T2865 on the Down Westbury line without incident. This was the last train to pass the site prior to the accident.

27 At 14:35 hrs, train 1A83 travelling on the Up Westbury line collided with the fallen signal's junction indicators.

Events following the accident

28 The driver of train 1A83 made an emergency brake application and the train stopped between Newbury Racecourse and Thatcham stations. The driver reported the accident by radio to the signaller. Staff in the train's buffet car operated the passenger emergency alarm on hearing the noise under the train arising from the collision.

29 At 14:37 hrs the signaller, upon receiving the driver's message, placed signals on the Down Westbury line to *danger* ahead of the next train due to pass through the area (train 2K62, a stopping service scheduled to terminate at Newbury). After the line had been checked, this train was routed around the collapsed signal (on the Down Newbury Loop line) and arrived at Newbury station at 15:44 hrs.

30 At 15:57 hrs, after the driver of train 1A83 had inspected his train and discussed the situation with the signaller, the train moved on to Thatcham station where it was taken out of service. The passengers alighted and maintenance staff attended the train.

Key facts and analysis

Background information

The maintenance and examination regime applied to the signal

31 Maintenance of signal structures within Network Rail is the responsibility of its signalling and telecommunications (S&T) section within each maintenance delivery unit. In turn, the S&T section relies on the structures team to conduct examinations of signal structures. Any reported defects are entered into a maintenance database for action by S&T engineers.

32 Network Rail classifies a straight signal post as an *ancillary structure*. The examination regime for most ancillary structures is based solely on annual visual (ie non-intrusive) examinations[2]. The purpose of a visual examination is to identify any visible changes in condition of the asset since its last examination. Some ancillary structures with certain characteristics or higher risk profiles (such as those in coastal locations and therefore exposed to more arduous environmental conditions) are subject to detailed examinations; this did not apply to signal TR824.

33 Visual examinations are normally reported on a dedicated form for each structure. However, since 2009, the examinations for ancillary structures have been reported collectively on a 'Line of Route' basis using a generic examination report form, which requires defects to be reported by exception only (see Appendix D for examples of Visual Examination and Generic Examination report forms). According to Network Rail, Line of Route reporting is a methodology for reporting the visual examinations for a group of assets (such as signal posts), allowing a higher rate of productivity in terms of recording and reviewing information where there are significant numbers of assets (signal TR824 was one of 92 similar structures on this Line of Route). The contract between Network Rail and Amey states that the Line of Route examination itself is based on the same requirements as other types of visual examination.

34 These examinations are carried out for Network Rail (Western route) by Amey. Network Rail's contract with Amey defines Line of Route examinations as 'Visual Examinations [that] report by exception with Positive Nil Returns (PNR), unless items are specifically instructed to be examined otherwise by the Structures Manager'. The contract further specifies that the examination report should clearly identify the parts of a structure that are examinable and to clearly identify the non-examined parts. Amey's handbook for examiners states that visual examinations of signal posts shall include visible foundations and connections.

[2] Visual and detailed examinations are defined in Network Rail's standard NR/L1/CIV/006/1A as follows: a visual examination is 'an examination of the condition of a structure undertaken from safe observation locations without using special access equipment or arrangements but using permanent access ladders and walkways and, where necessary, binoculars and hand-held lighting', while a detailed examination is 'a close examination of all accessible parts of a structure of sufficient quality to produce a report that includes a record of the condition of all parts of the structure and recommendations for remedial action and other information that when evaluated will permit Network Rail to be able to maintain the safety and performance of the structure'.

35 Amey manages the competence of its examiners in accordance with Network Rail standards. Since 2009 this process, which is applicable to visual examinations of signal posts, has consisted of:

a. where incoming staff have previous relevant experience, an initial assessment to establish their base level of competence against the minimum requirements for their duties;

b. where a person requires training to develop their competence, they receive a minimum of four weeks' introductory on-the-job training with a qualified examiner, followed by a six-week approved training course;

c. on successful completion of the training course, there is an additional period of on-the-job experience during which the trainee examiner works under mentorship, with reviews at intervals of up to three months;

d. after a significant number of examinations have been completed, the trainee may be deemed competent to undertake visual examinations with the mentor auditing 10% of the trainee's reports, while a similar process for detailed examinations then leads to a formal assessment to examine structures unsupervised; and

e. ongoing competence is maintained by minimum requirements for frequency of practising the competency and documented annual reviews.

36 Where the initial competence assessment (paragraph 35a) identifies that the person already possesses the required skills and knowledge, or that they have been previously trained and have been satisfactorily completing such work for more than one year, they can have their previous competencies transferred. In that case, they enter the development process at whichever stage is deemed appropriate based on their initial assessment. Amey's records suggest that a significant number of its examiners hold their competencies through this route (188 out of 234 examiners; the remaining 46 have joined the company since 2009 and subsequently attended and were successful in the training course referred to at paragraph 35b).

37 Network Rail's competence standard defines knowledge and performance requirements for each level of competency, which for STE 4 includes recording any aspects not examined. Amey's presentation slides for its training course on Line of Route visual examinations clearly state that a buried base of a signal post is a defect and should be recorded as such with an accompanying photograph.

Identification of the immediate cause

38 **The Up and Down Westbury lines were fouled by signal T2865 which had collapsed without the signaller being aware that this had happened.**

39 The collapse of the signal was not apparent to the signaller until the driver of train 1A83 reported it. The LED lamp did not fail and, as a result, the signalling system did not detect the fallen post.

Identification of causal factors

40 The signal collapsed because:

a. the base of the post had corroded (paragraph 41);

b. the corrosion was not detected by the routine examination regime (paragraph 52);

c. the corrosion was not detected by additional inspections carried out as part of a resignalling project in the area (paragraph 59); and

d. the corrosion was not addressed through maintenance (paragraph 66).

Each of these factors is now considered in turn.

Corrosion at the base of the signal post

41 The signal collapsed because the base of the post had corroded.

42 The RAIB commissioned specialist laboratory analysis of the corrosion in order to understand the failure mechanism, the progression of corrosion in the post, and the nature of the post material including any coatings it may have had. The analysis consisted of a visual examination and sectioning of the post, optical microscopy and hardness testing, scanning electron microscopy (SEM) and energy dispersive analysis of X-rays (EDX), and chemical analysis. The material in paragraphs 43 to 51 is based on the specialists' analysis.

43 Corrosion around the base of the post and the ladder had caused severe metal wastage and an almost complete loss of wall thickness at and around the ballast in which the base of the post was buried (see Figures 7 and 8). It is likely that localised sites were perforated (rusted through) before the post collapsed.

44 Corrosion had occurred on both the external and internal surfaces of the post, especially within 250 mm of the rupture site. Remaining wall thickness at the thinnest point measured was around 0.1 mm (see Figure 9), as compared with 6 mm when new (paragraph 16).

45 The external surface had a five-layer organic coating system (see Figure 10), although no zinc galvanised coating was detected. The coating was almost certainly designed to prevent atmospheric corrosion. There was little evidence of any remaining coating on the external surface of the affected region.

46 Away from the rupture site, the rest of the external surface (the visible section of post above ground level) was relatively unaffected on a cursory visual inspection. Since the corrosion was particularly focused at ground level, this suggests that the corrosion was not simply due to atmospheric exposure (which the coating was designed to protect against), but was particularly affected by the post being buried in ballast (which, consequently, is an underlying factor: see paragraph 70).

47 The ballast would have affected the integrity of the external coating (through abrasion) as well as holding water around the base of the post. Once the corrosion activity was established, it would progressively undermine the surrounding coating.

Figure 7: Corrosion at the base of the signal post

Figure 8: Corrosion at the baseplate (a) in situ after the accident (left image; note level of ballast) and (b) after removal from site

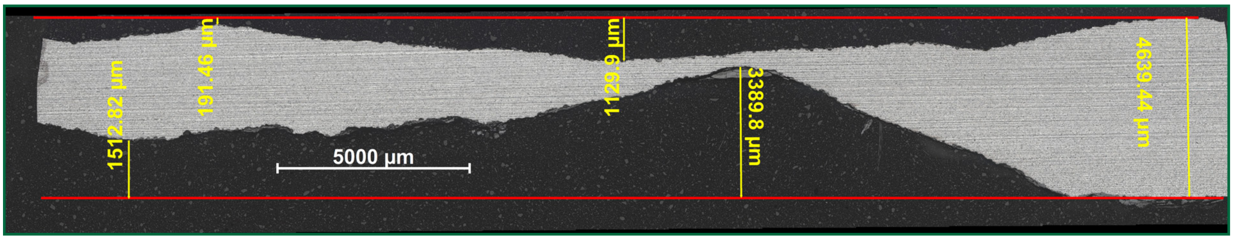

Figure 9: Microscopic cross-section through the signal post (seen in grey against black background) at a severely corroded region (internal surface of the post is the top side of the image). Loss of wall thickness indicated at selected sites; original wall thickness represented by red lines.

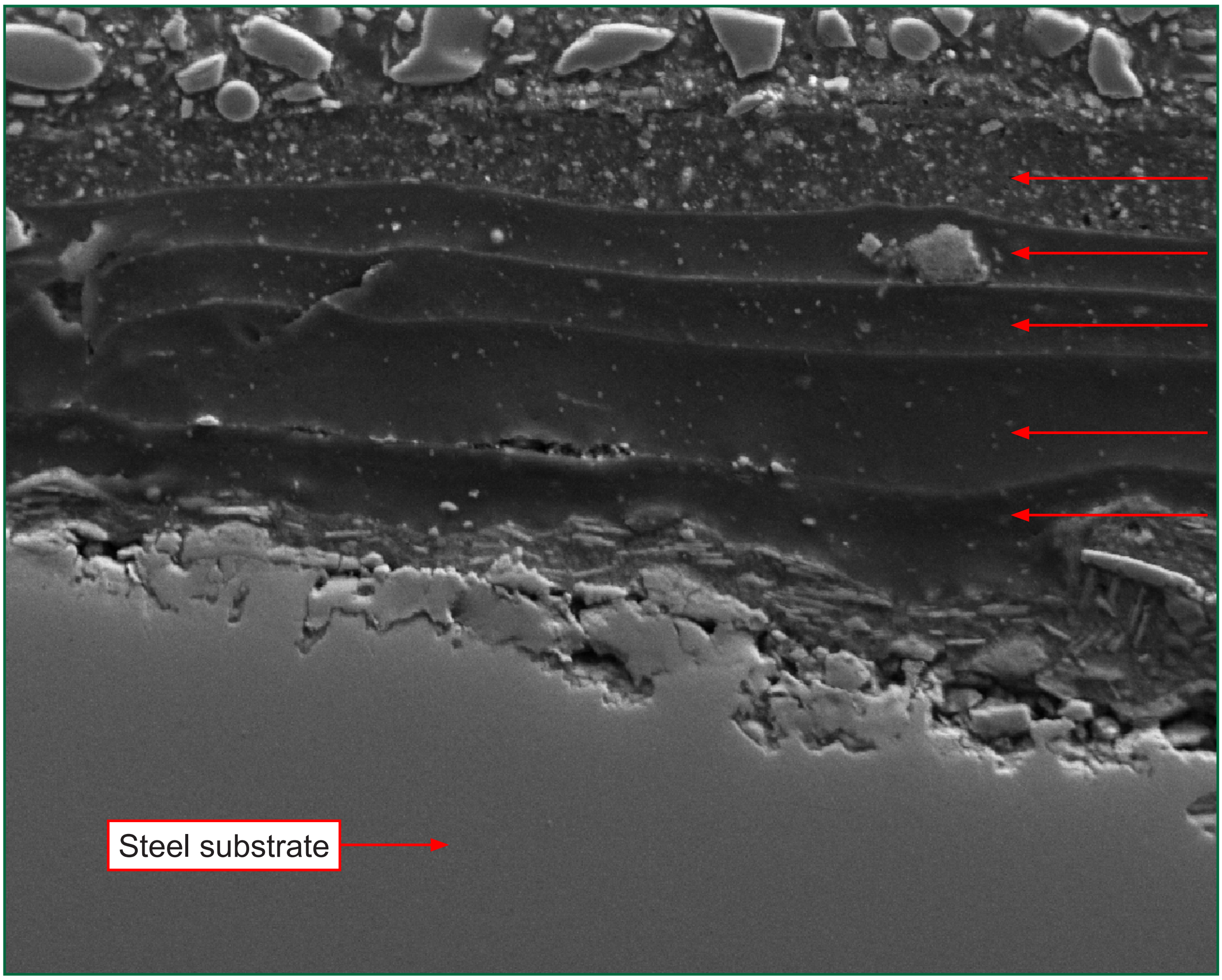

Figure 10: SEM micrograph showing cross-section through the signal post illustrating the five layers of the external coating system

48 There was no evidence of any coating on the internal surface, although there was nothing to prevent water getting in (there are several holes in the sides of the post for cable access and there is no cap at the top of the post where the signal head is attached). Corrosion scales (ie rust flakes) were unevenly distributed around the interior of the post, varying from 70 mm to 400 mm above the failure, while metal loss on the internal surface tapered up to around the same point (Figure 11).

49 By design, there is no drainage at the bottom of the post where it interfaces with the concrete foundation. It is therefore likely that the internal corrosion occurred due to continual exposure to stagnant rainwater which had entered through the cable holes and the top of the post, and had pooled inside the base. Upon inspection after the accident, the base was full of rust flakes, which would have further impaired the ability of the water to escape.

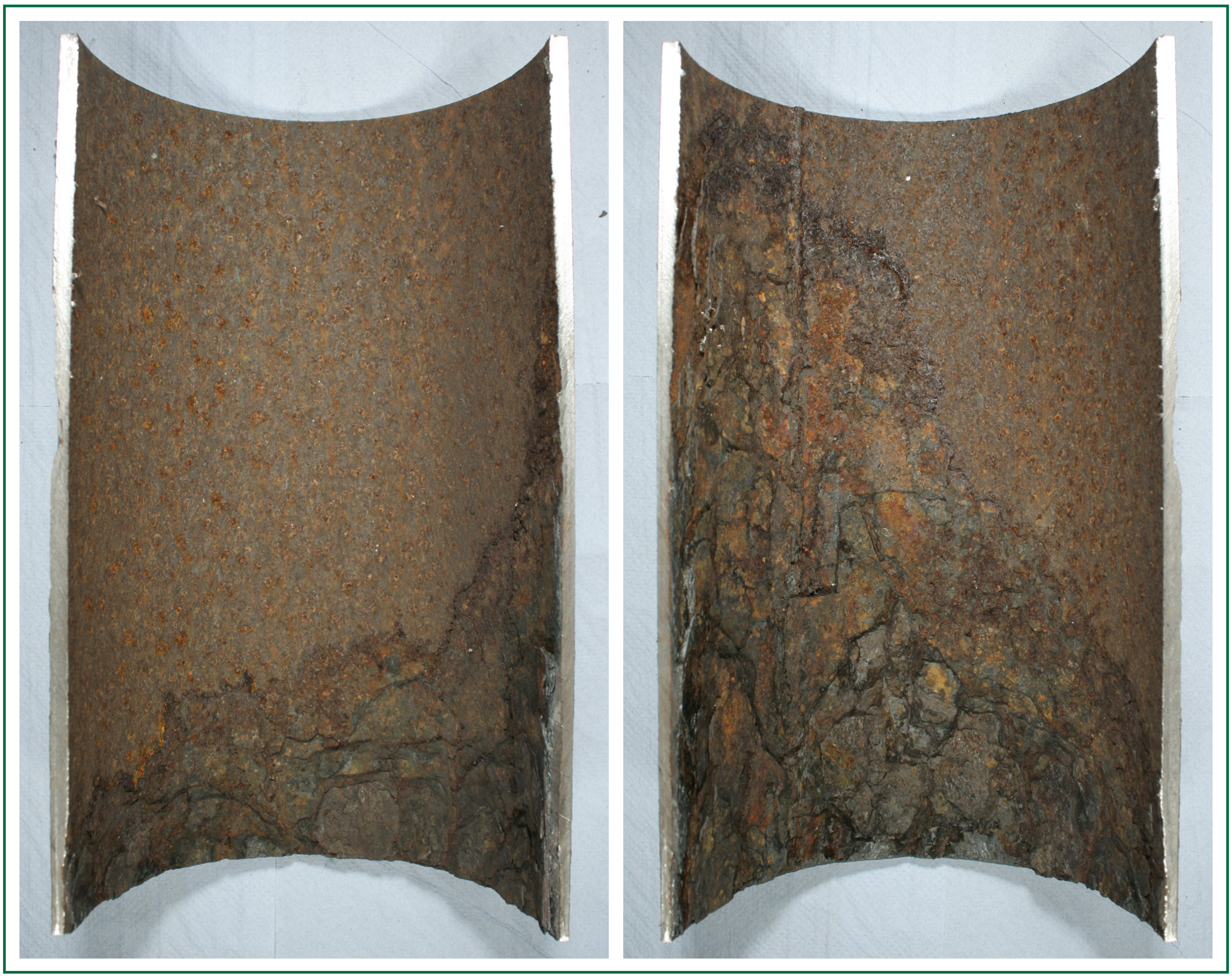

Figure 11: Internal corrosion of post

50 Typical corrosion rates for carbon steel in fresh water are between 0.02 mm and 0.1 mm per year. Over the 40 year lifetime of the post, it is therefore plausible that almost complete wastage of its 6 mm section could occur if the both internal and external surfaces were corroding simultaneously. The analysis revealed that the corrosion appeared to be worse on the external surface; internal corrosion scale build up may have had the effect of slowing down the corrosion process, while the external surface was more exposed to weather and ballast movement which could have removed corrosion scales, exposing fresh metal and thereby accelerating corrosion.

51 There was no significant evidence of any potentially corrosive chemicals in the samples analysed. There was also no evidence of any latent defect with the manufacture of the post.

Examinations of the signal post

The routine examination regime

52 The corrosion was not detected by the routine examination regime.

53 The most recent Line of Route examination of signal TR824 before the accident was conducted in June 2014. The report considered the structure to be satisfactory. Similarly, the four previous Line of Route examination reports for this signal going back to 2010, all conducted by the same examiner, also considered it to be satisfactory.

54 The visual examination reports from 2008 and 2009 both recorded deterioration of the post's surface protection but neither recommended that action should be taken. The 2009 examination was conducted by the same examiner as the subsequent Line of Route examinations.

55 The Line of Route report form allows the examiner to enter comments about the examination for each structure, as well as submitting any relevant photographs. For the examination in June 2014, the examiner entered 'POST' in the comments box for TR824, and did not submit a photograph of the signal.

56 The cover sheet for the Line of Route examination report (see Figure 12), which encompasses all of the structures in the report, includes a box stating 'Complete Examination' (marked 'Yes' in the 2014 report) and a table for 'hidden parts not examined (excluding foundations)' which expands when populated with data (empty – and thus the table was collapsed – in the 2014 report). Visual examination reports use a similar format but in addition specifically ask 'Has all of the structure been examined?' Because visual examinations produce one report for each structure, this question specifically relates to the individual structure under examination.

Network Rail

GENERIC STRUCTURE EXAMINATION REPORT

GENERIC EXAMINATION

amey

ELR: BHL	*Structure Type* Signal Posts						
Examination Type:	Generic Exam	NR ID:	20093679	Exam Date:	2-Jun-2014		
Area:	Thames Valley	BRS:	0	OS Ref:			
Structure Name:	SSP - BHL	Type:	ASS P	Exam ID	2519126		
Route:	BERKS & HANTS LINE	Complete Examination:	Yes				

Section A: To Be Completed By The Examining Organisation

HIDDEN PARTS NOT EXAMINED (EXCLUDING FOUNDATIONS)	Part	Reason

ITEM	DESCRIPTION	LOCATION	Est. Cost £ +/- 20%	Priority Within	Quantity	Severity	Probability	Risk Score	Works Category
1	Prepare and re-paint the following posts TR834 DN 53m 341yds, DW54 DN 54m 0968yds, UW55 UP 55m 0000yds, TRK100 DN 55m 1584yds, TRK105 UP 56m 0550yds, TRK103 UP 59m 0330yds, DW59 DN 59m 1188yds, TR856 DN 60m 1518yds and TR847 UP 60m	9 No posts	45000.00	1yr	90 m2	2	3	M6	Painting
2	Prepare and re-paint the following cantilever	TR838 Upside 53m 341yds	12500.00	1yr	25 m2	2	3	M6	Painting

Engineers Notes

Figure 12: Cover sheet for the 2014 Line of Route examination report encompassing signal TR824. Relevant elements noted in paragraph 56 are highlighted in red.

57 Witness evidence suggested a perception within Amey that Line of Route examinations were essentially a reduced version of a visual examination – contrary to Network Rail's intention that it is just the reporting format that differs between these types of examination regime. The RAIB's review of other Line of Route and visual examination reports supports this suggestion, as there were more occasions when the 'Complete Examination' box was marked 'No' and the 'hidden parts not examined (excluding foundations)' table was populated for visual examinations than there were for Line of Route examinations.

58 The examiner stated that he understood, for Line of Route examinations, that he should only examine the parts of the structure that he could see. If the base of the post was buried by ballast, he would not necessarily report it unless there was another defect with the base. For visual examinations, though, he said that he would report non-examined parts because of the specific question 'Has all of the structure been examined?' on the visual examination report form. However, Network Rail's structures managers presume that, unless the Line of Route report states otherwise, the whole of the structure has been examined, including the base.

Additional examinations

59 The corrosion was not detected by additional inspections carried out as part of a resignalling project in the area.

60 A resignalling project in the Reading area known as RORI (Reading Outer Relock and Immunise) involved an examination of the signal by Arup in early 2012. The examinations for the RORI project lay outside the baseline examinations and maintenance regime, but nevertheless this work presented an additional opportunity for the corrosion on the signal post to be detected.

61 Part of the project remit from Network Rail asked Arup to determine, based on engineering judgement, whether the structures that the project was considering re-using were serviceable for a further 15 years. Each structure received a risk rating according to the severity and extent of defined defects, including corrosion, paint condition and foundation condition.

62 Arup employed a 'Link-up'[3] approved and competent sub-contractor to conduct its site examinations. Its examiners gave the post of signal TR824 a yellow risk rating (meaning 'reuse suitable with minor repair works to structure') for corrosion and for the ladder, and a green risk rating ('suitable for reuse in existing form') for paint condition. Upon later review of the report and its associated photographs, Arup decided that the problems appeared more severe, and so changed the ratings for the paint condition and for the ladder to red ('reuse not recommended on existing structure; recommend renewal'). However, these ratings did not get transferred to a summary table in Arup's report. Since the summary table was used by Network Rail as the basis for prioritising further actions, it was the less severe ratings that were used to determine whether actions were completed or deferred in the later stages of the project.

[3] A scheme used by Network Rail, its contractors, London Underground and some train operators to support their procurement and risk management activities.

63 Arup's report noted areas of corrosion to the post and to the ladder, particularly the foot of the ladder which was badly corroded. It also noted that the paint had begun to deteriorate badly at the bottom of the post, but that the base plate and foundations were not inspected because they were buried by ballast (see Figure 13) and were consequently outside of Arup's contractual remit. The report concluded that signal TR824 was serviceable for a further 15 years subject to the paintwork being renewed and the access ladder being replaced.

Figure 13: Photograph from Arup's RORI examinations report showing the base of signal TR824

64 Arup caveated its recommendations based on its contractual remit, which stated that a separate contractor, who was involved in later stages of the RORI project, would conduct more detailed examinations (including the assessment of hidden parts) to verify the issues identified in its report. However, misunderstandings at project management level within Network Rail meant that such work was never carried out.

65 As a result of these misunderstandings and the error in transferring the amended risk ratings into the summary table (paragraph 62), Network Rail was satisfied that the signal was serviceable for a further 15 years. The only work specified for signal TR824/T2865 was 'repaint and replace access ladder'. Network Rail did not consider this work to be urgent and had scheduled it to take place after commissioning the new signalling scheme (paragraph 18).

Maintenance of the signal

66 **The corrosion was not addressed through maintenance.**

67 The RAIB found no evidence of any maintenance work to address the condition of the structure. This was because:

a. the routine examinations regime did not detect the corrosion and so did not report a defect for the post into the maintenance database (paragraph 52); and

b. although the RORI project did generate a maintenance requirement for the post, Network Rail did not consider this work to be urgent and so it was not prioritised (paragraph 65).

68 Network Rail's S&T team in the Swindon maintenance delivery unit conducts cyclical maintenance on its signals, which includes a visual inspection of the structure as part of a risk assessment before climbing it. The S&T visual inspections did not determine that any work was necessary because the engineers concerned did not consider that the level of corrosion on the signal post was unusual.

Identification of underlying factors

69 One underlying and one possibly underlying factor have been identified:

a. Network Rail's management of ballast conditions around the bases of ancillary structures was ineffective (paragraph 70); and

b. there were inconsistencies in Amey's competence management arrangements – a possible underlying factor (paragraph 74).

Each of these factors is now considered in turn.

Ballast conditions

70 **Network Rail's management of ballast conditions around the bases of signal structures was ineffective.**

71 The base of the signal post had become buried by ballast. The post and its coating were not designed to operate in such conditions. The ballast had the dual effect of increasing the post's susceptibility to corrosion (paragraph 47) and increasing the risk that the hidden corrosion would be overlooked under a non-intrusive examination regime (paragraph 52).

72 It is likely that the level of ballast in this area had risen over time as a result of maintenance and renewal work to the track. Work undertaken by Network Rail (Western route) since the accident has revealed a significant number of other signal structure bases that are also buried by ballast (see paragraph 101).

73 Ballast boards, which would have prevented the base of the post from becoming buried, were not installed around signal T2865 because there had been no recommendation to install them. Nevertheless, the RAIB has seen evidence from Network Rail that recommendations to install ballast boards at other signals were still outstanding several years after those recommendations were made.

Competence management

74 There were inconsistencies in Amey's competence management arrangements that constituted a possible underlying factor in the accident.

75 The examiner worked on an understanding that did not necessarily reflect Network Rail's expectations regarding buried bases (paragraph 58). Because of his previous experience, the examiner was trained and mentored on the job and, at the time of the examination of the signal post, he was deemed by Amey to be competent (paragraph 20). However, there is no evidence that he attended Amey's training course on Line of Route examinations that refers to the requirement to report buried bases as defects (paragraph 37).

76 According to Amey, as well as the STE 4 competency (paragraph 21), the examiner has also been a competent Bridge Strike Examiner since 2012, and had been assessed in 2007 for visual only examinations ('VIS'). However, Amey could not produce documentation for either of these qualifications. Moreover, the 'VIS' competency does not appear as a separate level in Network Rail's relevant competence standard (NR/SP/CTM/017).

77 Both the examiner and the examining engineer (who reviews the examiner's reports before submitting them, with any recommendations for action, to Network Rail's structures managers) believed that the reporting format restricted the length of comments and the number of photographs that could be submitted with each Line of Route report (paragraph 55 refers). However, the RAIB reviewed a sample of one hundred other Line of Route reports from Network Rail's Western route, and found wide variation between examiners in the level of detail in the comments as well as the number of photographs that were included.

78 Whilst a more rigorous competence management process may have increased the probability of the corrosion being detected, it does not necessarily mean that the defect would have been remedied and, ultimately, that the accident would have been prevented. The RAIB has seen evidence that defects on other structures reported through the examinations process were not corrected by Network Rail. Therefore, this remains a possible underlying factor.

Factors that were not causal to the accident

Replacement of the signal head

79 The RAIB has considered the relevance of the work to replace the signal head on 27-28 September 2014, some seven weeks before the accident (paragraph 25). Although it is impossible to discount this factor entirely, the RAIB has found no evidence to suggest that it was causal to the failure of the signal post.

80 Witness evidence from those involved in the work indicated that they had no concerns about the condition or stability of the signal post. The work activity was captured on video; the RAIB has viewed this evidence and noted that there was no apparent shock imparted to the post during the replacement of the signal head.

The signalling system

81 The RAIB has also considered whether the replacement of track circuits with axle counters (paragraph 18) affected the ability of the signalling system (and hence the signaller) to identify a problem with the signal before the accident occurred. Although track circuits are not designed to detect the presence of obstructions across the rails, there is a theoretical possibility that track circuits might have detected the fallen signal post on the Down Westbury line. In that case, the signaller would have become aware of the problem and, according to the railway Rule Book[4], would have been required to stop and caution the first train to pass on a line adjacent to the affected area (in this case train 1A83 on the Up Westbury line) if the affected line had not yet been examined.

82 However, track circuits are used to prove that a section of track is clear of trains when there is no electrical path between the running rails (such as that offered by a train's axles)[5]. For the signal post to cause a track circuit to show as occupied on the signaller's display, it would have had to fall in such a way that a conductive surface was in contact with both rails simultaneously. The RAIB considers that while this may have been possible, it is not especially likely given the shape and construction of the post as well as the corrosion and remaining coatings that were present on its surface. Furthermore, even if the collapsed signal post had operated track circuits, it is not known whether the signaller would have had time to stop train 1A83 before it reached the site of the accident (see paragraph 83).

Factor affecting the severity of consequences

The timing of the failure

83 The final failure of the structure was unpredictable; the consequences were dependent on which train encountered the collapsed post first.

84 It was not possible to establish the final trigger that caused the signal post to collapse. The last train to successfully pass signal T2865 was a freight train (paragraph 26), so it is possible that vibration and/or turbulence from this train disturbed the signal post enough to overcome what remained of its structural integrity.

85 Once it had fallen, the signal was still capable of displaying a green aspect, meaning that the preceding signals on the Down Westbury line could also show green and any approaching train would not have had its speed checked.

86 After the passage of train 1A83 on the Up Westbury line, the next train on the Down Westbury line was train 2K62, a stopping service which terminated at Newbury (paragraph 29). Following train 2K62 on the Down Westbury line was a high speed train which was not scheduled to stop at Newbury and could have been travelling at or close to the maximum permissible speed of 110 mph (177 km/h).

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[4] GE/RT8000 TS1 'General Signalling Regulations', clause 20.6.2.

[5] Axle counters achieve the same purpose by counting the axles on a train as it passes one axle counter installation and counting them again when it passes the next installation, thus proving that the train has passed safely and completely between the two points.

87 A set of *facing points* beyond signal T2865 for routes to the left and right of the through route could have caused or exacerbated the derailment of a train travelling on the Down Westbury line.

88 Equally, the signal post could have fallen away from the railway line with little or no risk to safety.

Observation

Site health and safety

89 **As well as the risk of a train accident, there was a potential risk to anyone climbing or working on the signal.**

90 The team who replaced the signal head on the weekend of 27-28 September 2014 (paragraph 25) were working on the assumption that the routine examination regime had passed the structure as being in a safe condition.

Previous occurrences of a similar character

91 There have been 11 similar reported instances of signal structure failures on the national rail network since 2003 (nine of which have occurred in the last five years). None of the incidents resulted in an accident and they were not investigated by the RAIB. Six incidents involved corrosion, of which the following were most relevant to the accident at Newbury:

a. Thetford (Anglia), 2010: near failure of a 1950s colour light signal post (signal T2) due to corrosion and loss of section at a water trap between the post and the base;

b. Wymondham (Anglia), 2010: a mechanical signal, approximately 80 years old, was felled on safety grounds due to corrosion at the base of the post (see Figure 14);

c. Blackpool North (London North West), 12 February 2014: an older mechanical signal post (signal BN2 23/24) which snapped in a gale following reports of some corrosion in its 2012 Line of Route examination (this signal was exposed to a coastal environment);

d. Craigendoran (Scotland), 3 October 2014: severe corrosion discovered to the top of a 1980s colour light signal post (signal YC635) which, although in a coastal area, only received Line of Route examinations and in its last examination (dated March 2014), corrosion to the gantry and base was reported but no action had been recommended; and

e. Cantley (Anglia), 29 March 2015: semaphore signal (C1), a *planted post*, collapsed away from the railway due to corrosion at the base just below ballast level (see Figure 15).

Figure 14: Photograph of the failed signal post at Wymondham (courtesy of Network Rail)

Figure 15: Photograph of the failed signal post at Cantley (courtesy of Network Rail)

92 In response to the incident at Craigendoran, Network Rail (Scotland) stated that it would consider enhancing the examination regime for signal posts of a similar age that were in coastal locations, the findings of which would be shared with other routes and incorporated into a proactive maintenance regime where appropriate.

93 Following the incident at Cantley, Network Rail stated that signal posts on the Anglia route were due for renewal and had been under monitoring. In response to the failure of the structure, Network Rail's Anglia route has accelerated its follow-up actions (also taking account of the Newbury accident) and planned to complete enhanced examinations (including removal of ballast from around the base) on all of its signal posts by the end of June 2015. At the time of writing, this work was still in progress but had already identified several signal posts in need of urgent remedial action.

Previous RAIB investigations addressing factors similar to those identified in this investigation

94 Although the RAIB has not investigated the structural failure of a signal post prior to the accident at Newbury, it has investigated several incidents involving failures of bridges and other complex structures. Whilst the recommendations arising from those investigations do not directly apply to the causal factors for the Newbury accident, they cover areas related to the effectiveness of the structures examination regime and are included here for information:

a. On 5 February 2011 near Dryclough Junction, Halifax, a passenger train derailed on rubble that had fallen onto the railway after a retaining wall had collapsed (RAIB report 17/2011). In its investigation report, the RAIB recommended that Network Rail and Amey should review the effectiveness of the existing structures examination regime, including consideration of why examiners do not always report persistent defects.

b. A freight train derailment near Stewarton, Ayrshire, on 27 January 2009 was caused when a bridge that the train was crossing collapsed beneath it (RAIB report 02/2010). The RAIB made several recommendations, including five for Network Rail regarding the examination of hidden critical structural elements of bridges, the identification of bridges that could be at risk of hidden corrosion, managing historic information on bridges, exposing hidden critical elements and tracking reported defects and intervention actions.

c. The RAIB's investigation into a bridge failure between Whitton and Feltham on 14 November 2009 (RAIB report 17/2010) resulted in a recommendation on Network Rail to review the information submitted to examining engineers by bridge examiners, including positive confirmation that the requirements of examinations have been considered, and a suitable variety and number of photographs.

Summary of conclusions

Immediate cause

95 The Up and Down Westbury lines were fouled by signal T2865 which had collapsed without the signaller being aware that this had happened (paragraph 38).

Causal factors

96 The causal factors were:

a. The signal collapsed because the base of the post had corroded (paragraph 41, **Recommendations 1, 2 and 5**).

b. The corrosion was not detected by the routine examination regime (paragraph 52, **Learning point 1** and **Recommendation 3**).

c. The corrosion was not detected by additional inspections carried out as part of a resignalling project in the area (paragraph 59, no recommendation).

d. The corrosion was not addressed through maintenance (paragraph 66, **Recommendation 3**).

Underlying factors

97 The underlying and possible underlying factors were:

a. Network Rail's management of ballast conditions around the bases of signal structures was ineffective (paragraph 70, **Recommendation 2**).

b. There were inconsistencies in Amey's competence management arrangements that constituted a possible underlying factor in the accident (paragraph 74, **Recommendation 4**).

Factors affecting the severity of consequences

98 The final failure of the structure was unpredictable; the consequences were dependent on which train encountered the collapsed post first (paragraph 83, **Recommendation 1**).

Additional observation

99 Although not linked to the accident on 17 November 2014, the RAIB observes that as well as the risk of a train accident, there was a potential risk to anyone climbing or working on the signal (paragraph 89, **Recommendation 3**).

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

100 The ORR (see appendix A for definition) served an Improvement Notice on Network Rail (Western route) on 5 December 2014, which required it to examine all of the straight signal posts on the route and amend its examinations process. The Improvement Notice had a deadline of 1 June 2015, but this was subsequently extended to 1 October 2015 in the light of the need to consider internal corrosion, as identified in the corrosion analysis commissioned by the RAIB. The ORR is also pursuing the issue of internal corrosion at a national level with Network Rail.

101 Network Rail (Western route) responded to the accident with the following actions:

a. As an immediate response, local inspections were carried out on 35 signal posts in the Newbury area by the end of November 2014. Nine signal posts were found to have their bases buried by ballast, of which two showed signs of corrosion.

b. A wider exercise involving closer examination of all 1,754 straight signal posts on the route was implemented, including multiple photographs of the structure and the base. The purpose of the exercise was to determine whether the bases of these structures were buried by ballast and, if so, to assess the condition of the base. At the same time, ballast boards would be installed where necessary. As of 30 July 2015, 1,704 signal posts have been examined while an additional 13 were not inspected as they were recently installed. A proportion of these revealed the need for supplementary examination and/or minor works – for the Swindon maintenance delivery unit, this amounted to 85 out of 404 structures requiring some level of ballast removal (as at 7 September 2015). In total across the route, 407 structures need to be revisited (as at 30 July 2015) and one signal post required follow up action to ensure its structural integrity.

c. Network Rail (Western route) has also commissioned a retrofit design to strengthen any weak assets.

102 At a national level, Network Rail has reported the following actions:

a. A briefing note about the accident was issued on 23 December 2014, which included a number of recommendations for action at both route and central (ie national) level. These actions covered a review of all straight signal posts to confirm the condition of hidden components followed by risk-based remedial actions where necessary, processes for managing the effects of track work on structures, and a review of management controls for ancillary structures. As of 30 July 2015, all of the central actions had been completed and most of the route actions were either complete or on target to be completed by their nominal deadline. Where these actions have not yet been completed, Network Rail has reported difficulties in gaining track access as the reason and completion dates have been rescheduled.

b. A workshop was held on 29 January 2015 to understand the limitations of the existing examination process. The workshop produced a high-level failure analysis of various forms of structure, which then fed into the development of a new examination methodology and report form for all ancillary assets that currently only receive visual examinations. At the time of writing, this methodology is still in development.

103 In addition, Amey has responded to the accident as follows:

a. A technical brief was issued in December 2014 offering guidance on examining the interface between post and ground, positively reporting its condition and any parts not examined, and removing ballast.

b. Examiners have been briefed that Line of Route reports should include a clear statement of where the structure was examined from and whether there were any parts not examined.

c. A change has been made to the method of examining and reporting information on straight signal posts, by providing more photographs and including parts not examined on the examination form, as well as restricting examinations to cover only those where the structure can be directly approached.

Learning point

104 The RAIB has identified the following learning point[6]:

1 Those involved in managing and undertaking the Line of Route examinations of ancillary structures are reminded that the actual examination process for each structure is no different from that for ordinary visual examinations. While the reporting format is abbreviated, the examination itself is not (paragraph 96b).

[6] '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.

Recommendations

105 The following recommendations are made[7]:

1 *The intent of this recommendation is to reduce the risk of failure of ancillary structures across the national rail network.*

Network Rail should review its asset management strategy with the objective of improving the examination and maintenance of its ancillary structures (paragraphs 96a and 98). The review should consider:

- identification of structures at greatest risk of failure (eg by age of the structure, those of hollow section, those without galvanised or otherwise treated surfaces, those in hostile environments) and the possible consequences of failure in the context of wider safety risks to the railway;
- steps to mitigate the risk (such as periodic replacement); and
- specific measures to deal with planted posts as well as those structures fixed to foundations.

2 *The intent of this recommendation is to reduce the risk of corrosion at the base of ancillary structures and to allow examination of baseplates fixed to foundations.*

Network Rail should develop and implement a risk assessment process to determine when it is necessary for the critical elements of ancillary structures to be exposed for the purposes of examination and/or to mitigate the risk of corrosion. The process should take into account the specific risk of corrosion of buried metalwork on hollow section ancillary structures that are fixed to foundations (paragraphs 96a and 97a).

continued

[7] Those identified in the recommendations have a general and ongoing obligation to comply with health and safety legislation, and need to take these recommendations into account in ensuring the safety of their employees and others.

Additionally, for the purposes of regulation 12(1) of the Railways (Accident Investigation and Reporting) Regulations 2005, these recommendations are addressed to the Office of Rail Regulation (also known as 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.

3 *The intent of this recommendation is to reduce the vulnerability of the routine examination and maintenance regimes to missing failures of ancillary structures that are currently subject to visual examinations only.*

Taking account of the emerging findings from the implementation of Recommendation 1, Network Rail should review its examination and maintenance regimes for ancillary structures and make any necessary improvements to ensure that its processes are commensurate with the risk arising from the failure of those structures (paragraphs 96b, 96d and 99). The review should include, but not be limited to, consideration of the following areas:

- a regime of periodic enhanced examinations for ancillary structures (such as the Detailed Examination regime applied to bridges and other complex structures);
- consideration of the special requirements for examination of the buried elements of planted posts;
- a means for assessing the internal condition of hollow section structures as well as their external condition;
- re-designing the examination forms (whether electronic or paper versions) to improve usability for the examiners, to clarify the need to report hidden critical elements that were not examined and to improve reporting lines between Network Rail and its examinations contractors;
- revising the competence standards for staff involved in the examination of structures to ensure consistency in the level of training received both by those who are new to the industry as well as experienced examiners; and
- cyclical maintenance of any surface treatments on ancillary structures.

Changes made as a result of the review should be re-briefed to all those involved in structures examinations and relevant company standards and other documents should be updated as appropriate.

4 *The intent of this recommendation is to reduce the risk of structure defects being missed on examinations due to the variability in standards being applied by different examiners.*

Without waiting for Network Rail's actions in response to Recommendation 3 above, Amey should immediately review and revise its competence management processes for its staff involved in structures examinations in accordance with the findings from this investigation (paragraph 97b). The revised processes should allow for further adjustments to be made as necessary once Network Rail has completed its response to recommendation 3.

continued

5 *The intent of this recommendation is to prevent the risk of internal corrosion to hollow signal posts in future.*

Network Rail should develop a specification for a new signal post, or a modification to existing posts, that eliminates or mitigates the risk of internal corrosion (eg, preventing water ingress, improving drainage, internal surface treatments), taking account of whether the galvanisation specified since 1993 (paragraph 17) is adequate and applicable to other designs of post (paragraph 96a). The specification should be implemented on new installations or to replace existing structures where opportunities arise to do so and where risk assessments indicate that it is necessary and appropriate.

Appendices

Appendix A - Glossary of abbreviations and acronyms

CEFA	Civil Engineering Framework Agreement
EDX	Energy Dispersive analysis of X-rays
HST	High Speed Train
LED	Light Emitting Diode
ORR	Until 1st April 2015 ORR was known as the 'Office of Rail Regulation'. It has used the name 'Office of Rail and Road' for operating purposes with effect from 1 April 2015. Legal force is expected to be given to this name from October 2015
RORI	Reading Outer Relock and Immunise
SEM	Scanning Electron Microscopy
TVSC	Thames Valley Signalling Centre

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.

Ancillary structures	A category of structures defined in Network Rail standard NR/L1/CIV/032 that includes straight signal posts and other signal structures as well as other structures supporting communications / overhead line power equipment, for example.
Aspect	The indication of a colour light signal that the driver sees.*
Axle counters	A track-mounted device that accurately counts passing axles to determine whether the section is clear or occupied.*
Call-on	A route class by which the signaller can permit a train to enter an occupied section.*
Danger	A signal indication meaning that the driver must stop. Universal term for a red aspect.*
Down Westbury	The line between Reading and Cogload Junction via Westbury normally used by trains travelling away from London.
Facing points	A set of points installed so that two or more routes diverge in the direction of travel.*
Junction indicators	An arrangement of lines of white lights mounted above a colour light signal which, when lit, displays the diverging route through a junction to the driver.*
Maintenance delivery unit	A unit consisting of staff responsible for the maintenance of an area of a railway.*
Planted post	A post that is embedded in the ground rather than being bolted down to a concrete base.
Position light	A signal that conveys its instructions by means of light positions, generally used to control shunting and other non-running movements.*
Ten-foot	A wide space provided between two railway lines when there are three or more lines on the route. Not necessarily measured at ten feet wide.
Track circuits	An electrical or electronic device used to detect the absence of a train on a defined section of track using the running rails in an electric circuit.*
Up Westbury	The line between Reading and Cogload Junction via Westbury normally used by trains travelling towards London.

Appendix C - Investigation details

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

- information provided by witnesses;
- examination of the failed section of signal post;
- site photographs, observations and geology samples;
- voice recordings of communications between the driver of train 1A83 and the TVSC signaller;
- weather reports at the site;
- a specialists' report on the corrosion analysis commissioned by the RAIB;
- a review of a sample of structures examination reports on Network Rail's Western route;
- relevant Network Rail standards;
- documents regarding Amey's structures examinations contract;
- documents associated with Amey's competence management for its structures examiners;
- documents associated with the RORI project;
- a review of similar incidents; and
- a review of previous RAIB investigations that had relevance to this accident.

Appendix D - Examination report forms

Example of visual examination report form – 2009 examination for signal TR824 (formerly known as R824)

BRIDGE & STRUCTURE EXAMINATION REPORT

STRUCTURES VISUAL

ELR: BHL	*Contract Mileage:*	052 *m*	1199 *yds*	54.50 *ch*	*Struc. Ref*		
Examination Type:	Structures Visual	NR ID:	20074244	Exam Date:	10-Jun-2009		
Area:	Thames Valley	BRS:	163	OS Ref:	SU 480669		
Structure Name:	R824	Group:	G	Exam ID	2039937		
Route:	BERKS & HANTS LINE	Complete Examination:	Yes				

Section A: To Be Completed By The Examining Organisation

HIDDEN PARTS NOT EXAMINED (EXCLUDING FOUNDATIONS)	Part	Reason

ITEM	DESCRIPTION	LOCATION	Est. Cost £k +/- 20%	Priority Within	Quantity	Severity	Probability	Risk Score	Works Category
1	NO ACTION								

Signed [redacted] For Employer	Name [redacted]	Date 30-Jun-2009

Version 3.3 28-04-08

Version 1.2 05-09-06

1 of 3

Network Rail	BRIDGE & STRUCTURE EXAMINATION REPORT STRUCTURES VISUAL	amey

ELR: BHL	*Contract Mileage:* 052 *m* 1199 *yds* 54.50 *ch*		*Struc. Ref*
Structure Type GS	Network Rail ID 20074244	Rpt ID 7557	Exam ID 0

OS Ref: *SU 480669*	BRS:	*Name:* *R824*	**Exam Date**
Line: *BERKS & HANTS LINE*			**10/6/2009**
Height m	Length m	Span m	Last Detailed Last Visual 13/6/2008

The examiner should record any deterioration in condition or development of defects or other factors, which might place at risk the rail traffic, customers, staff or the public at large. Special reference should be made to those structures or parts of structures whose condition may require action before the next examination.

Examiner General Comments

Engineers recommendations.
No action

New defects
This signal post R824 is located in the ten foot general deterloratlon throughout surface protectlon. see photo 1.

No of Spans	
Carrying	
Over	
Avonguards	
Plumbing Points	
Date Tabs	

Has all of the structure been examined? Yes

(If no, state reasons below)

SIGNED [redacted]

EXAMINERS NAME

DATE **11 Jun 2009**

Amey Comments & Recommendations

Notes for attention

See attached Summary Sheet ☐

Further action required / query ☐

No action required at present ☒

Signed [redacted]

Engineer

Date **30-Jun-2009**

Network Rail Comments & Actions

Signed __________

SME __________

Date __________

Version 1.2 05-09-06

2 of 3

BRIDGE & STRUCTURE EXAMINATION REPORT

STRUCTURES VISUAL

ELR: BHL	Contract Mileage: 052 m 1199 yds 54.50 ch	Struc. Ref

photo 1

Version 1.2 05-09-06

Abridged[8] example of Line of Route (Generic) examination report form – 2009 examination including signal TR824 (highlighted)

Network Rail	GENERIC STRUCTURE EXAMINATION REPORT GENERIC EXAMINATION	amey

ELR: BHL	*Structure Type* Signal Posts						
Examination Type:	**Generic Exam**	**NR ID:**	**20093679**	**Exam Date:**	**2-Jun-2014**		
Area:	**Thames Valley**	**BRS:**	**0**	**OS Ref:**			
Structure Name:	**SSP - BHL**	**Type:**	**ASS P**	**Exam ID**	**2519126**		
Route:	**BERKS & HANTS LINE**	**Complete Examination:**	**Yes**				

Section A: To Be Completed By The Examining Organisation

HIDDEN PARTS NOT EXAMINED (EXCLUDING FOUNDATIONS)	Part	Reason

ITEM	DESCRIPTION	LOCATION	Est. Cost £ +/- 20%	Priority Within	Quantity	Severity	Probability	Risk Score	Works Category
1	Prepare and re-paint the following posts TR834 DN 53m 341yds, DW54 DN 54m 0968yds, UW55 UP 55m 0000yds, TRK100 DN 55m 1584yds, TRK105 UP 56m 0550yds, TRK103 UP 59m 0330yds, DW59 DN 59m 1188yds, TR856 DN 60m 1518yds and TR847 UP 60m	9 No posts	45000.00	1yr	90 m2	2	3	M6	Painting
2	Prepare and re-paint the following cantilever	TR838 Upside 53m 341yds	12500.00	1yr	25 m2	2	3	M6	Painting

Engineers Notes

Signed For Employer [redacted]	**Name** [redacted]	**Date** 14-Jul-2014

Version 3.4 29-11-12

Version 3.0 11-02-08 **1 of 15**

[8] Photographs and results for other signals removed for brevity

Network Rail	GENERIC STRUCTURE EXAMINATION REPORT GENERIC EXAMINATION	amey

ELR: BHL	*Structure Type* Signal Posts							
Rpt ID	1377	Exam ID	2519126	Exam Date	2/6/2014	SADID:	20093679	

Name: ***SSP - BHL***

Line: ***BERKS & HANTS LINE***

Examiner General Comments

Widespread loss of protective coating to posts.

Widespread loss of protective coating to cantilevers

SIGNED [redacted]

EXAMINERS NAME

DATE **09/07/14**

Amey Comments & Recommendations

Notes for attention

See attached Summary Sheet [X]

Further action required / query [ ]

No action required at present [ ]

Signed [redacted]

Engineer

Date **14/07/2014**

Network Rail Comments & Actions

Signed ____________

SME ____________

Date ____________

Version 3.0 11-02-08

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GENERIC STRUCTURE EXAMINATION REPORT

GENERIC EXAMINATION

ELR: **BHL** ***Structure Type*** **Signal Posts**

Structure Identity	Side of track / Headspan	Mls	Yds	Considered Satisfactory	Paint Defect	Spall to top of Concrete Base	Post Planted	Date	Comments
R 369	UP	38	0440	Y				3/6/2014	POST
DW39	DN	39	0198	Y				3/6/2014	POST
UW 39	UP	39	0968	Y				3/6/2014	POST
TR800	DN	40	1259	Y				3/6/2014	POST
TR 895	UP	40	1496	Y				3/6/2014	POST
TR893	UP	41	0126	Y				3/6/2014	POST
TR 802	UP	41	0572	Y				3/6/2014	POST
FY4	UP	41	0660	N	Y			3/6/2014	Widespread loss of protective coating to post see photo 1
TR 891	UP	41	0660	N	Y			3/6/2014	Widespread loss of protective coating to cantilever see photo 2.
FY3	UP	41	0880	N	Y			3/6/2014	Widespread loss of protective coating to post see photo 3.
FY2	UP	41	1144	N	Y			3/6/2014	Widespread loss of protective coating to post see photo 4.
STOP	UP	41	1276	Y				4/6/2014	POST
FY1	UP	41	1298	N	Y			4/6/2014	Widespread loss of protective coating to post see photo 5.
STOP	UP	41	1298	Y				4/6/2014	POST
STOP	UP	41	1430	Y				4/6/2014	POST
TR 497	UP	41	1518	Y				4/6/2014	POST
TR 499	UP	41	1540	Y				4/6/2014	OFF STE SIG
TR 804	DN	41	1738	Y				4/6/2014	POST
TR806	UP	42	0088	Y				5/6/2014	POST
TR 887	UP	42	0577	N	Y			5/6/2014	Widespread loss of protective coating to post see photo 6.
TR 808	DN	43	0660	N	Y			5/6/2014	Widespread loss of protective coating to post see photo 7.
TR 885	UP	43	1166	Y				5/6/2014	POST
TR 810	DN	44	0088	Y				10/6/2014	POST
TR 883	DN	44	0418	Y				10/6/2014	POST
DW 45	DN	45	0088	Y				10/6/2014	POST
TR 881	UP	45	0418	Y				10/6/2014	POST
TRC 100	DN	46	0902	Y				10/6/2014	POST
TRC105	UP	46	1254	Y				10/6/2014	CANTILEVER
UW 48	UP	48	0099	Y				11/6/2014	POST
TRC102	DN	48	0506	N	Y			11/6/2014	Widespread loss of protective coating to post see photo 8.
TR 877	UP	49	0660	Y				11/6/2014	POST
TRC104	DN	49	1034	N	Y			11/6/2014	Widespread loss of protective coating to cantilever see photo 9.
TR 875	UP	50	1650	Y				11/6/2014	POST
DW 51	DN	51	0088	Y				11/6/2014	POST
TR 822	DN	51	1562	N	Y			11/6/2014	Widespread loss of protective coating to post see photo 10 .

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Network Rail	GENERIC STRUCTURE EXAMINATION REPORT GENERIC EXAMINATION	amey

ELR: **BHL** | ***Structure Type*** **Signal Posts**

TR 869	DN	52	0363	Y				12/6/2014	POST
TR 871	DN	52	0506	Y				12/6/2014	POST
TR 828	DN	52	0858	Y				12/6/2014	POST
TR 824	DN	52	1199	Y				12/6/2014	POST
STOP	DN	52	1408	Y				12/6/2014	POST
TR 830	DN	52	1480	Y				12/6/2014	POST
TR 863	UP	52	1628	Y				12/6/2014	POST
TR 865	UP	52	1672	Y				16/6/2014	POST
TR 867	UP	52	1674	Y				12/6/2014	POST
TR 836	DN	53	0341	Y				16/6/2014	Cantilever
TR 838	UP	53	0341	N	Y			16/6/2014	Widespread loss of protective coating to cantilever see photo 11.
TR 834	DN	53	0341	N	Y			16/6/2014	Widespread loss of protective coating to post see photo 12.
TR 873	UP	53	0506	Y				12/6/2014	POST
TR 861	UP	53	1056	Y				16/6/2014	POST.
DW 54	DN	54	0968	N	Y			16/6/2014	Widespread loss of protective coating to post see photo 13.
UW 55	UP	55	0000	N	Y			16/6/2014	Widespread loss of protective coating to post see photo 14.
TRK 100	DN	55	1584	N	Y			16/6/2014	Widespread loss of protective coating to post see photo 15.
TRK 105	UP	56	0550	N	Y			16/6/2014	Widespread loss of protective coating to post see photo 16.
DW 57	DN	57	0264	Y				17/6/2014	POST
UW 57	UP	57	1166	Y				17/6/2014	POST
TR 848	DN	58	0726	Y				17/6/2014	POST
TRK 103	UP	59	0330	N	Y			17/6/2014	Widespread loss of protective coating to post see photo 17.
DW 59	DN	59	1188	N	Y			17/6/2014	Widespread loss of protective coating to post see photo 18.
TR 849	UP	60	0363	Y				17/6/2014	POST
TR 856	DN	60	1518	N	Y			17/6/2014	Widespread loss of protective coating to post see photo 19.
TR 847	UP	60	1540	N	Y			17/6/2014	Widespread loss of protective coating to post see photo 20.
TR 845	UP	62	0506	Y				19/6/2014	POST
DW 62	DN	62	0506	Y				19/6/2014	POST
UW 63	UP	63	1001	Y				19/6/2014	POST
DW 63	DN	63	1001	Y				19/6/2014	POST
UW 64	UP	65	0000	Y				23/6/2014	POST
TR 862	DN	65	0198	Y				23/6/2014	POST
TR 864	UP	66	0528	Y				23/6/2014	POST
TR 841	DN	66	0858	Y				23/6/2014	POST
TR 839	UP	67	1452	Y				23/6/2014	POST
DW 67	DN	67	1606	Y				23/6/2014	POST
DW 69	DN	69	0396	Y				25/6/2014	POST

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