RAIB

Rail Accident Investigation Branch

Rail Accident Report

Collision between a train and a fallen bridge parapet at Froxfield, Wiltshire 22 February 2015

Report 02/2016
January 2016

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

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

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.

This page is intentionally left blank

Collision between a train and a fallen bridge parapet at Froxfield, Wiltshire, 22 February 2015

Contents

Summary

On 22 February 2015, at around 17:31 hrs, a high speed passenger train (HST), the 16:34 hrs First Great Western service from London Paddington to Penzance, struck and ran over part of the fallen masonry parapet of an overline bridge at Froxfield, Wiltshire.

The train was fully loaded with around 750 passengers and was travelling at a speed of 86 mph (138 km/h) when the driver saw the obstruction. He applied the emergency brake but there was insufficient distance to reduce the speed significantly before the train struck the parapet. The train did not derail and came to a stop around 720 metres beyond the bridge. There were no injuries. The leading power car sustained damage to its leading bogie, braking system, running gear and underframe equipment.

The immediate cause of the collision was that the eastern parapet of Oak Hill Road overline bridge had been pushed off the bridge and onto the tracks by a heavy goods vehicle which had reversed into it. The train had not been stopped before it collided with the debris because of delays in informing the railway about the obstruction on the tracks.

The RAIB has also identified two learning points, one for police forces regarding the importance of contacting the appropriate railway control centre immediately when the safety of the line is affected and the other for road vehicle standards bodies and the road haulage industry about the benefits of having reversing cameras or sensors fitted to heavy goods vehicles.

As a result of its investigation, the RAIB has made four recommendations which relate to the following:

- installation of identification plates on all overline bridges with a carriageway unless the consequence of a parapet falling onto the tracks or a road vehicle incursion at a particular bridge are assessed as likely to be minor;
- enhancing current road vehicle incursion assessment procedures to include consideration of the risk from large road vehicles knocking over parapets of overline bridges (two recommendations); and
- introduction of a specific requirement in a Railway Group Standard relating to the onward movement of a train that is damaged in an incident, so that the circumstances of the incident and the limitations of any on-site damage assessment are fully considered when deciding a suitable speed restriction, especially when there are passengers on board.

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 around 17:31 hrs on 22 February 2015, passenger train 1C89, the 16:34 hrs First Great Western service from London Paddington to Penzance, struck a bridge *parapet* which had fallen onto the railway. It had fallen from an *overline bridge* on Oak Hill Road, an *unclassified* road off the A4 near the village of Froxfield, between Hungerford and Bedwyn (figures 1 and 2).

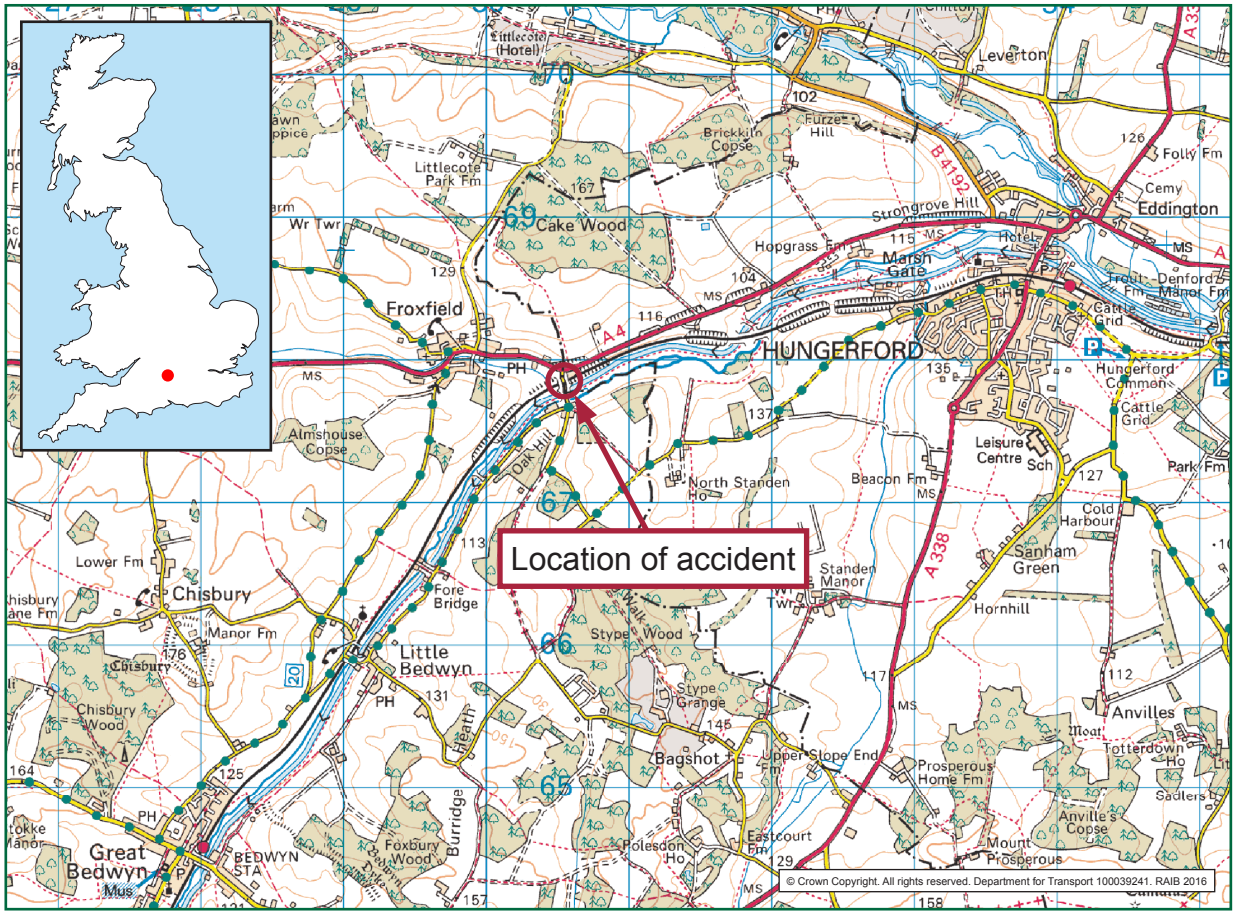

Figure 1: Extract from Ordnance Survey map showing location of accident

4 The train was travelling at 86 mph (138 km/h) when the driver first saw the debris ahead and applied the train's emergency brake. There was insufficient time to stop the train before it collided with the parapet debris (figure 3) and it came to a stop after a further 720 metres. The train did not derail and there were no injuries.

5 Eleven minutes before the train arrived at the bridge, a reversing articulated heavy goods vehicle (HGV) struck the eastern parapet of the bridge. The lorry driver had turned off the nearby A4 at the junction just north of the railway bridge, and crossed over the railway before encountering a canal bridge which he considered too narrow to pass. The lorry driver was attempting to reverse back over the railway bridge when the rear of his trailer struck the eastern parapet and pushed it off the bridge. The entire brick parapet, weighing around 13 tonnes, fell onto the railway, obstructing both tracks.

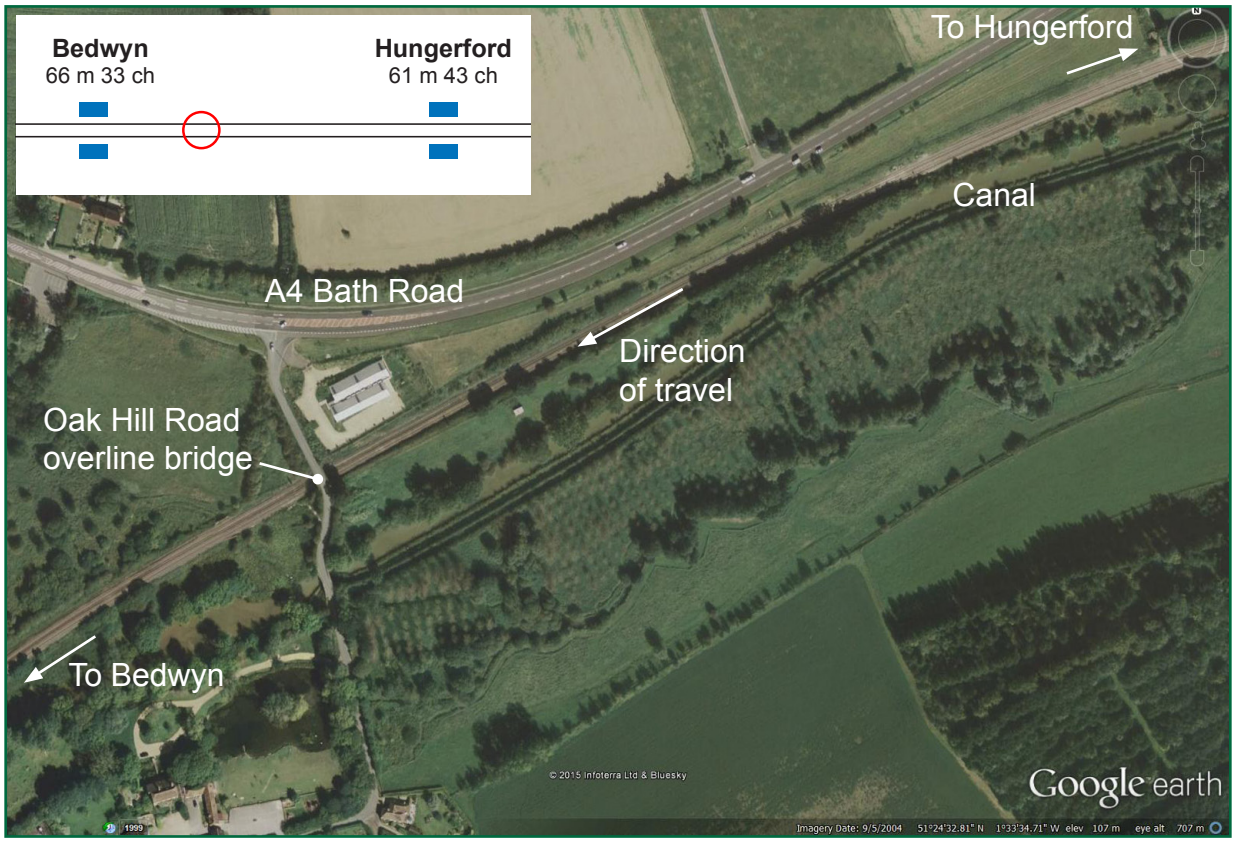

Figure 2: Schematic diagram and Google Earth images of the location of the accident

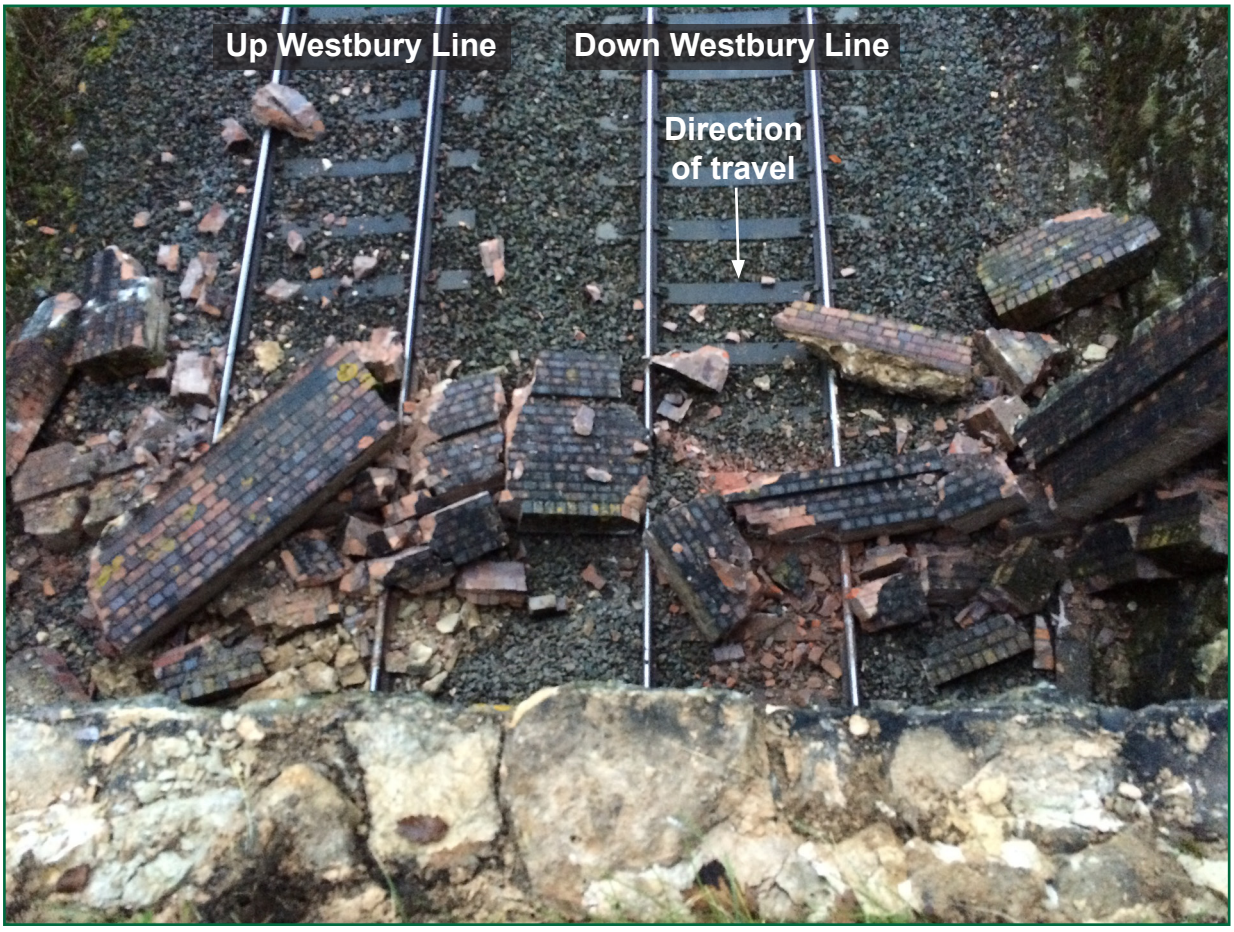

Figure 3: The fallen parapet on the tracks just before the collision (image supplied by Mr John Brown)

Context

Location

6 Oak Hill Road overline bridge is located at 63 miles 64 *chains* from London Paddington on the Great Western Main Line between Hungerford and Bedwyn. The railway at this location comprises the *Up* Westbury (towards London) and *Down* Westbury main lines. The line speed is 90 mph (145 km/h). The road also crosses the Kennet and Avon canal just south of the railway.

7 Oak Hill Road is an unclassified road, which runs from the A4 Bath Road, just east of Froxfield, across the railway and canal by means of masonry arch bridges (figure 4). It then runs parallel to the railway in a south westerly direction to the village of Little Bedwyn. The county boundary between West Berkshire and Wiltshire lies to the west and south of Oak Hill Road. The section of the road between the southern end of the canal bridge and the A4 Bath Road lies in the jurisdiction of West Berkshire Council (WBC) and the remainder of the road, south of the canal bridge, lies in the jurisdiction of Wiltshire Council.

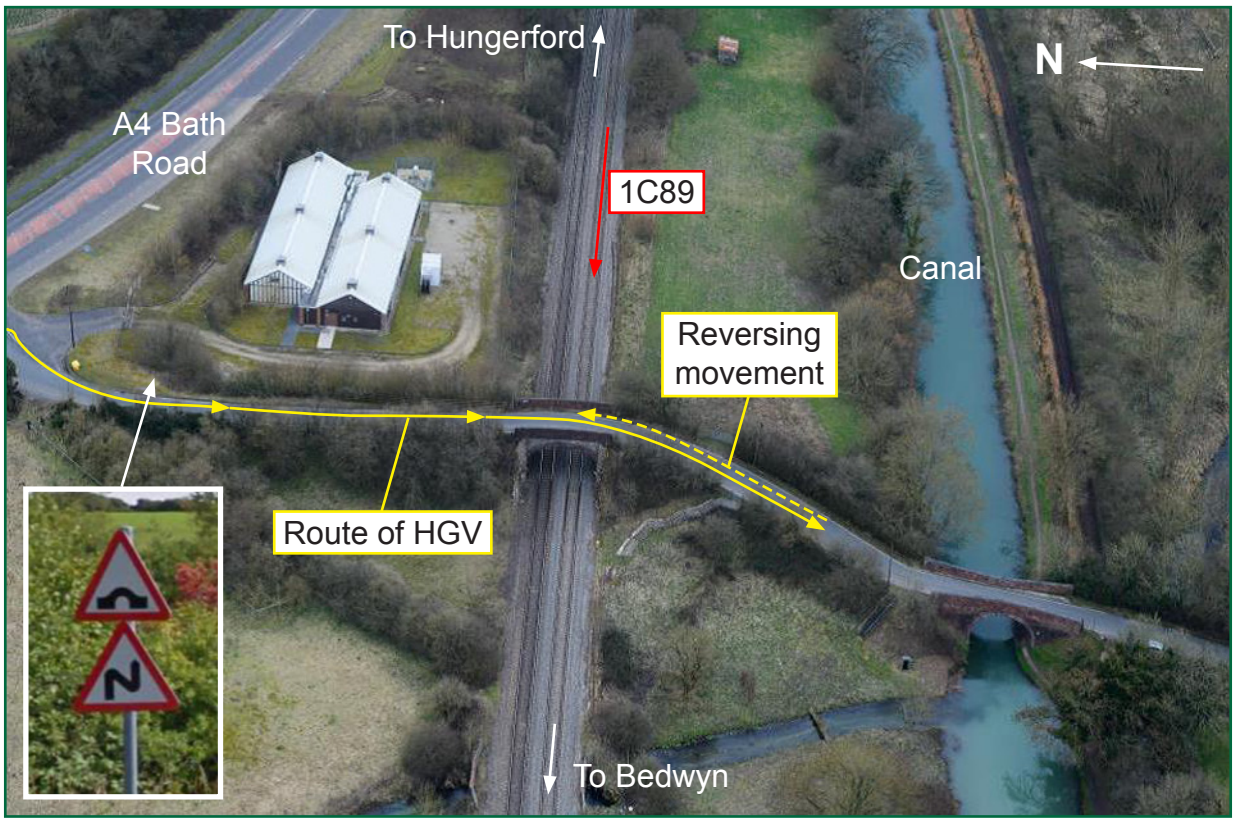

Figure 4: Oak Hill Road and the route taken by the HGV (image courtesy of Network Rail)

Organisations involved

8 Network Rail is the owner and maintainer of the Great Western Main Line and Oak Hill Road overline bridge.

9 First Great Western (FGW) was the operator of train 1C89 and employer of the train driver and fitter (paragraph 37). FGW subsequently changed its name to Great Western Railway on 20th September 2015. In this report, its name at the time of the accident is used.

10 Eddie Stobart Ltd was the owner of the HGV and the employer of the lorry driver.

11 West Berkshire Council is responsible for signage on Oak Hill Road and its approaches at the northern end.

12 Wiltshire Council is responsible for signage on the southern approach to the canal bridge.

13 Thames Valley Police (TVP), which covers West Berkshire, received the emergency (999) call from a member of the public who witnessed the HGV reversing into the parapet.

14 British Transport Police (BTP) was the first police force to be informed by TVP of the accident on the bridge and the hazard on the railway line, and was the first force to inform Network Rail. It dispatched officers to site.

15 Wiltshire Police was the second police force to be informed by TVP of the accident on the bridge and the hazard on the railway line, and it also dispatched officers to the site.

16 All the above organisations freely co-operated with the RAIB investigation.

Train involved

17 Train 1C89 was an HST set, comprising a Class 43 power car at each end and eight Mk 3 coaches. Figure 5 shows an FGW HST set of the type involved in the accident.

Figure 5: An HST set of the type involved in the accident (image courtesy of Great Western Railway)

18 The train had around 750 passengers on board when it departed from Paddington station. It ran non-stop to Reading, which was its last station stop before the accident. On departure from Reading the train was still full of passengers, with a considerable number standing.

19 In the collision with the parapet debris, the leading power car suffered significant damage, as follows:

- both *lifeguards* were bent back and the left-hand lifeguard became detached (figure 6);
- braking system components on the leading bogie were severely damaged resulting in a complete loss of air in the braking system which rendered the train immovable;
- the aerial for the *train protection and warning system* (TPWS), which was mounted on the leading bogie, was knocked off; and
- there was impact damage to the axles, wheels, and various other running gear and underframe equipment.

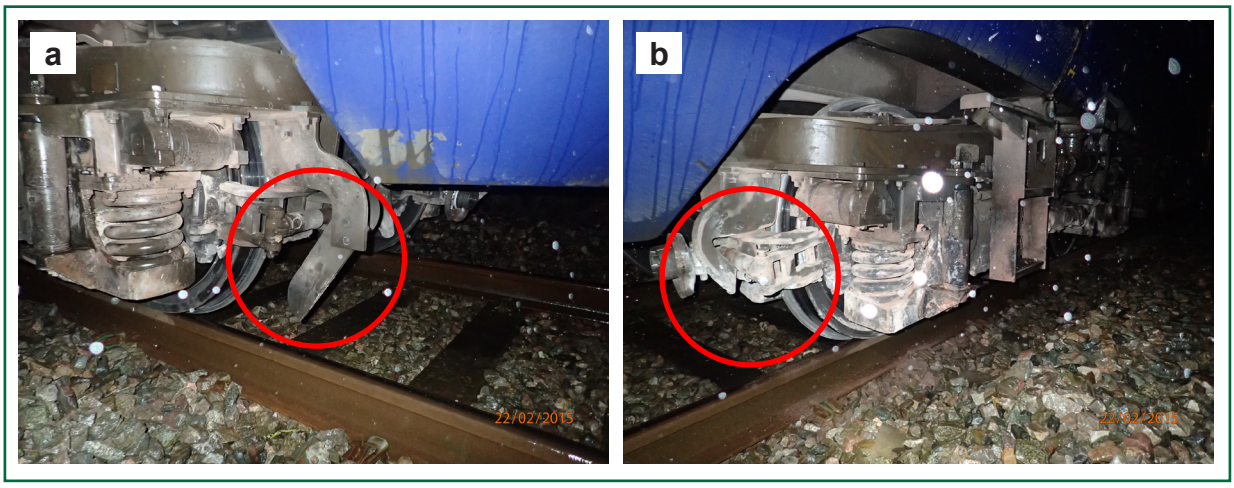

Figure 6: The damaged right-hand (a) and missing left-hand (b) lifeguards of the leading power car

HGV involved

20 On the day of the accident, the HGV left an Eddie Stobart depot in Stoke-on-Trent at 13:08 hrs. It was bound for Andover, where it was scheduled to arrive at 06:00 hrs the following morning (23 February). It comprised a three-axle tractor unit and a three-axle trailer (figure 7). The laden weight of the HGV was 23.6 tonnes. The HGV was not fitted with a satellite navigation system or reversing camera/sensor. The lorry driver has stated to Eddie Stobart that he was using his own personal portable satellite navigation system and maps for the journey.

External circumstances

21 The collision occurred around sunset when the visibility was poor due to the fading light, and the overcast, drizzly conditions at the time.

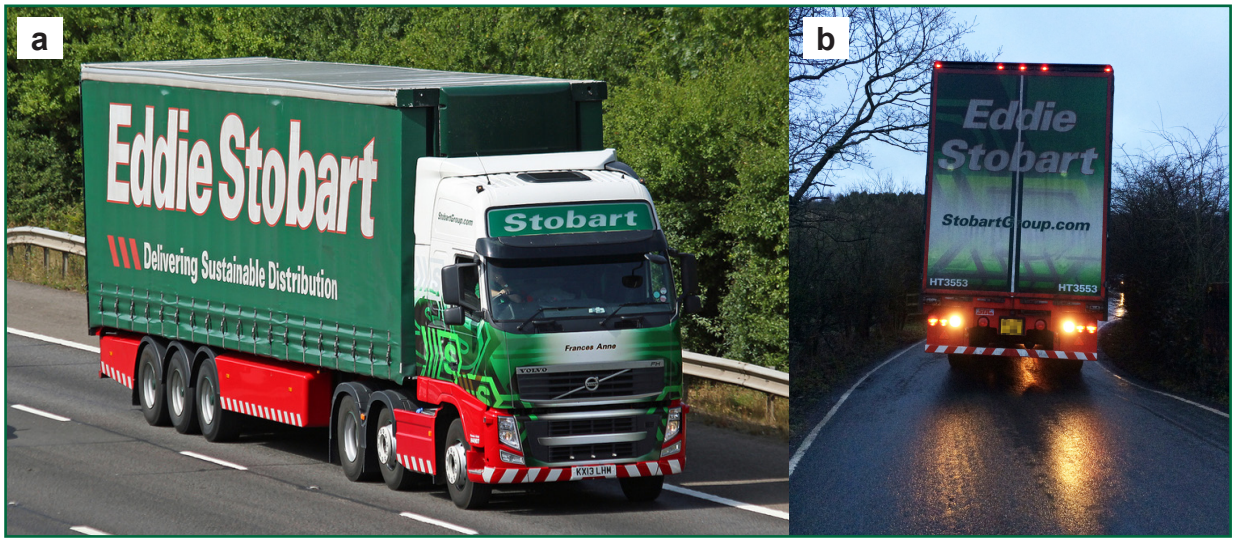

Figure 7: An HGV of the type involved in the accident (a) and the HGV on Oak Hill Road after the accident (b). (Left-hand image courtesy of Mr Paul Evans, right-hand image supplied by Mr John Brown.)

The sequence of events

Events preceding the accident

22 Train 1C89 departed from London Paddington on time at 16:34 hrs, and travelled without incident to its first station stop at Reading, arriving at 17:07 hrs. It left Reading at 17:11 hrs, running around 3 minutes late. Its next planned station stop was Castle Cary (located at 115¼ miles from Paddington) at 18:04 hrs.

23 Meanwhile, the HGV was heading towards Andover. Although the driver was familiar with the route, he has stated that he missed a turning due to being distracted by a diversion sign. He then drove for around 7 miles, eastbound along the A4 from Marlborough (which was the wrong route), looking for a suitable location to turn around or a road to re-join his intended route.

24 After passing through the village of Froxfield on the A4, the lorry driver decided to take a right turn into Oak Hill Road to try and get back to his intended route. He was not directed that way by the satellite navigation system which was switched on at the time. This road has quite a wide entry from the A4 but it then narrows rapidly towards the railway bridge. He proceeded over the railway bridge without incident and then saw the canal bridge ahead. He judged he could not get the lorry over the canal bridge which is narrower than the rail bridge, and has an angled approach. Vehicle tracker information indicates that he stopped the lorry at around 17:18 hrs.

25 The driver then attempted to reverse back over the railway bridge without assistance. During this manoeuvre the left rear corner of the trailer made contact with, and then pushed over, the brick parapet on the east side of the railway bridge. The entire parapet, weighing around 13 tonnes, fell onto the railway and broke up, obstructing both tracks. The precise time this occurred is not known, but is estimated from witness evidence to have been around 17:20 hrs.

26 The incident was witnessed by a car driver who had stopped behind the lorry. He left his car, alerted the lorry driver and then contacted the emergency services by dialling 999 on his mobile phone at around 17:21 hrs. He requested the police and was routed to TVP's control room, where the call was taken by a member of the control room staff at 17:22:09 hrs. The car driver reported that an HGV had reversed into a bridge parapet and knocked the whole wall onto the railway, and he gave the correct location. The call ended at 17:23:22 hrs.

27 The car driver helped the lorry driver to reverse his lorry off the railway bridge, which took several attempts. The lorry driver then parked it in a nearby layby on the A4 road.

28 At 17:23:23 hrs TVP reported to BTP that a lorry was stuck on a rail bridge and had pushed the wall off onto the tracks. The call was taken by BTP's London control room and the conversation included a discussion on the exact location of the incident as there was some uncertainty about this (paragraph 66). BTP recorded in its control room log that the lorry had knocked some bricks onto the railway line. The telephone conversation ended at 17:26:45 hrs.

29 Immediately after the call ended, BTP contacted Network Rail's Wessex *Route Control* office to report the incident. However, Froxfield lies in Network Rail's Western Route and so, at 17:28 hrs, BTP contacted Network Rail's Western Route Control office in Swindon on a non-emergency number and notified it that a lorry on the road between Little Bedwyn and Froxfield had got stuck and knocked some bricks onto the railway line. This call lasted 1 minute and 32 seconds. Then, at around 17:30 hrs, BTP transferred control of the incident from London to its Birmingham control room.

30 At 17:28 hrs, the TVP control room notified Wiltshire Police control about the HGV striking the bridge parapet and knocking it onto the railway.

Events during the accident

31 At around 17:30 hrs, train 1C89 rounded the left-hand bend approaching the Oak Hill overline bridge on the Down Westbury line while travelling at a speed of 86 mph (138 km/h). The driver reported that he observed what he initially thought were shadows on the line near the bridge but quickly realised that there was an obstruction on the line. He immediately applied the train's emergency brake.

32 Train 1C89 struck the parapet debris at around 75 mph (121 km/h). The driver reported that the impact caused the cab end of the power car to lift but it did not derail. The train came to a stop around 720 metres from the bridge.

33 At around 17:32 hrs, the train driver made an emergency call to Network Rail's Thames Valley Signalling Centre in Didcot on his *GSM-R radio* from the cab. The driver reported that he had collided with bridge debris at Froxfield and gave the location of his train and the bridge. The signaller told him there was a train approaching Bedwyn (which was train 1A85, the 11:55 Penzance to Paddington) and that he had put the signal in front of that train to red and once it had stopped, he would ring the driver back so that he could then safely inspect his own train. The driver of train 1A85 had already heard the emergency call made by the driver of 1C89 and was bringing his train to a stop. Also, at this time, Wiltshire Police contacted Network Rail's Western Route Control office to inform them of the incident involving the HGV colliding with the parapet.

34 Meanwhile, the car driver who witnessed the collapse of the parapet made another emergency call to TVP to report that a train had collided with the bridge debris and that any other trains travelling in the opposite direction (ie towards London) were in danger.

35 At 17:38 hrs TVP contacted Network Rail's Western Route Control to report the collision. Network Rail confirmed it was already aware. At this time, the train driver also informed FGW's control room of the collision.

Events following the accident

36 By 18:04 hrs, both Wiltshire Police and BTP were on site. Although the bridge is on the border between Wiltshire Police and TVP jurisdictions, the location of the damaged train was in Wiltshire Police territory. Initially Wiltshire Police believed the bridge was in their jurisdiction and confirmed to TVP that they were on site and dealing with BTP. Subsequently, at 18:34 hrs, Wiltshire Police contacted TVP to advise that although the bridge was just inside TVP's jurisdiction, Wiltshire Police would continue dealing with the incident.

37 Between 18:20 hrs and 21:30 hrs, FGW deployed a fitter to the train, and made arrangements for a rescue locomotive to be sent to site in case it was needed. During this period, FGW also dispatched other staff to the train, to provide refreshments for passengers, and to Bedwyn station to deliver food and to assist passengers there. At 18:31 hrs the fitter reported to FGW control that there was damage to the front bogie and a complete loss of air in the train's braking system, which made it immovable. The fitter then set about making various repairs to stop the air leaks. FGW developed various contingency plans for detraining passengers and arranged care for the train driver. Meanwhile, the London-bound train 1A85, moved to Bedwyn at around 18:05 hrs, crossed over and ran back towards Westbury and then via Swindon to London Paddington, where it arrived at 21:06 hrs, around 160 minutes late.

38 By 21:30 hrs, the brakes on the leading bogie of the power car had been isolated and the train was ready to move forward to Bedywn with a relief driver, the fitter and another driver in the cab. The relief driver was not aware of the extent of the damage to the lifeguards. He took the train up to a maximum speed of 42 mph (68 km/h) to carry out a *running brake test,* which he had agreed with the signaller, in order to check the braking system and assess if the train was fit to be taken forward to Westbury. FGW's initial plan was to detrain passengers at Bedwyn station but it became apparent that this was not feasible due to the large number of passengers on board the train. FGW decided that it would be better to detrain passengers at Westbury.

39 At 22:00 hrs the train arrived at Bedwyn station and some passengers, who had people there to meet them, were detrained. The relief driver reported to FGW control that the train was fit to travel to Westbury at a maximum speed of 10 mph (16 km/h) below the line speed (paragraph 89). Extra provisions were loaded onto the train and it departed for Westbury at 22:30 hrs, arriving at 22:53 hrs. FGW detrained all the passengers at Westbury and transferred them to a replacement HST set which then went forward to Penzance, arriving at 04:30 hrs. The damaged HST set ran empty to St Phillips Marsh depot, Bristol.

Key facts and analysis

Identification of the immediate cause

40 **The eastern parapet of Oak Hill Road overline bridge had been pushed off onto the tracks below, and the driver of the approaching train was unaware of the obstruction ahead.**

Identification of causal factors

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

a. an HGV reversed into the eastern parapet, pushing it over onto the tracks below (paragraph 42);

b. the train was not stopped before it collided with the debris due to delays in informing the railway about the obstruction (paragraph 61); and

c. the train driver was not able to stop the train within his sighting distance of the obstruction ahead (paragraph 83).

Each of these factors and their associated underlying factors are now considered in turn.

Collision of the HGV with the bridge parapet

42 **An HGV on the bridge reversed into the eastern parapet, pushing it over onto the tracks below.**

43 Having driven over the rail bridge, the driver of the HGV judged that he could not safely go forward over the canal bridge. He stopped short of the canal bridge and decided to reverse back round a left-hand bend (relative to the direction of the movement) and over the rail bridge. He undertook the manoeuvre without assistance.

44 The lorry driver misjudged the manoeuvre, resulting in the trailer pushing up against the parapet. RAIB has noted the following factors which may have played a part in his misjudgement:

- the driver was not familiar with Oak Hill Road;
- the road between the rail and canal bridges was curved and uphill for the reverse move;
- contact with the parapet would have been in a blind spot, due to the relative angle between the tractor unit and trailer (figure 4);
- dusk was approaching and the light was failing; and
- the HGV was not fitted with reversing aids or sensors.

45 The collision between the HGV and the eastern parapet of the bridge occurred at slow speed and was witnessed by the driver of a car which was following the HGV (paragraph 26). The details of what happened were subsequently corroborated by the driver of the HGV in a statement to his employer.

46 Marks on the trailer indicated that the left rear corner of the HGV contacted the parapet around 1 metre above road level. Tyre marks in the grass verge adjacent to the parapet indicated that contact with the parapet occurred at the portion directly above the Down Westbury line.

47 WBC undertook a survey of the road from the northern end of the rail bridge to the southern end of the canal bridge to establish its precise geometry. The survey, which was witnessed by the RAIB, was used in a computer model to determine if it was possible for the HGV to pass both bridges. The analysis indicated that it would be possible but that clearances would be tight in places, to the extent that contact with kerbs and roadside foliage would be likely.

48 Oak Hill Road is an unclassified road, and because of this, WBC does not carry out any traffic census on the road nor does it hold any data on its usage. However, WBC reported that it is not aware if the road has been previously used by HGVs. It is known to be used by farm machinery and farm delivery vehicles.

49 WBC also reported that its road accident database does not contain any records of previous accidents on Oak Hill Road which have resulted in injury. WBC is not aware of any previous incidents of road vehicles becoming stuck between the bridges.

The rail bridge

50 The rail bridge is a brick arch structure constructed in 1847. The parapets are 1.35 metres high, 0.35 metres thick and 12 metres long. The estimated weight of each parapet is 13 tonnes.

51 The bridge was subject to a regular examination regime by Network Rail to detect and record changes in the condition of its structure. The examinations were undertaken by specialist contractors for Network Rail.

52 Detailed examinations of the bridge were carried out in April 2001 and August 2006 and simpler 'visual' examinations were undertaken in each of the other years, in accordance with Network Rail standards. In September 2009 Network Rail adopted a risk based approach to bridge examination, such that detailed examinations from then on were undertaken at intervals dependent on the actual condition of the bridge, using a scoring system defined in its company standard NR/CIV/006, 'Handbook for the examination of structures' (in several parts). Based on the condition of the bridge in 2006, Network Rail set the detailed examination interval for the bridge to 12 years. The annual visual examinations remained unchanged, and the last of these prior to the accident was undertaken on 12 June 2014.

53 The first detailed examination for which records are available took place in April 2001. It noted that there were full height vertical cracks in the eastern parapet on each of the road and track faces around 1 - 2 mm in width and located about 5 metres from the down side end (figure 8). Similar cracks were also noted on the western parapet. The examination also found that both parapets were leaning outwards (by between 10 - 15 mm over a measured height of 900 mm) along their length. The last detailed examination in August 2006 also examined the cracks in the parapets. No deterioration in the condition of these cracks was noted and no repairs to these cracks were recommended. Between the last detailed examination and the accident there had been eight visual examinations, none of which reported any deterioration of the cracks.

Figure 8: Crack in the eastern parapet (circled) as recorded in Network Rail's visual examination report of 12 June 2014

54 The parapets on Oak Hill Road overline bridge were constructed from bricks, bedded down with mortar onto the stone blocks of the bridge *spandrel*. There was no steel reinforcement to the wall nor any steel anchors to tie the base of the parapet down to the spandrel. The parapet, which was constructed as part of the original bridge in 1847, was intended to prevent pedestrians, livestock and horse drawn carts from falling onto the railway. Its ability to contain impacts with road vehicles would be modest compared to a more modern reinforced parapet. To resist the force applied by an impacting road vehicle, the parapet would be reliant on a combination of the mechanical strength of the brickwork and its large mass.

55 Examination of the parapet debris and the top of the spandrel indicated that the mode of failure under the loading from the HGV was by toppling of the whole parapet about its base joint to the spandrel (figure 9). The HGV would have applied a concentrated load to the parapet at a height of around 1 metre above the road surface. The way in which the whole parapet, on both sides of the pre-existing crack (paragraph 53) toppled over, indicates that there was sufficient remaining structural connection between the parapet sections either side of the crack, to allow the force applied by the HGV to be transferred across the cracked section. Had the crack separated the parapet into two disconnected sections, only that section of the parapet that had been struck would have toppled over. Therefore, the mode of failure indicates that, for the loading applied by the HGV in this case, the pre-existing crack did not cause a premature failure of the parapet because the whole of the parapet mass and its connection to the spandrel was involved.

Figure 9: Location of failure of the parapet

Road Signage

56 **In accordance with WBC's policy on fitting road signage, there were no road signs to warn drivers that Oak Hill Road was not suitable for HGVs. This was an underlying factor.**

57 The entrance to Oak Hill Road from the A4 Bath Road is relatively wide compared to the width of the rail bridge (figure 2). There was no signage such as 'Unsuitable for HGVs' on the approach to Oak Hill Road from the A4 Bath Road and none just before the rail bridge. Furthermore, there was no signage on the approach to the rail bridge to warn drivers that the road narrowed further on. Had signage been in place, it is unlikely the driver of the HGV would have turned into Oak Hill Road and proceeded on to the rail bridge. The only signs that were in place on the approach to the rail bridge were a 'double bend' bend sign and a hump-back bridge warning (figure 10).

58 WBC generally undertakes annual maintenance of its road signs and markings, which includes signage replacement as necessary. It does not undertake routine assessments of the adequacy of existing road signage. The installation of new road signage is undertaken only if there is a specific request or requirement to do so. As a result, new road signage is usually instigated by other parties contacting the Council to request a particular sign.

Figure 10: Extract from 'Google Street View', showing signage on the approach to Oak Hill Road overline bridge from the A4 Bath Road

59 Generally, there is pressure on councils to minimise road signage, especially in rural areas, in order to maintain the environment. Consequently, WBC was reluctant to install new signage unless necessary. Because there were no records of previous accidents on the Oak Hill Road bridges, WBC had not previously undertaken an assessment of whether there ought to be signage on the approach to Oak Hill Road to warn drivers that the road was not suitable for HGVs.

60 The HGV driver reported to Eddie Stobart Ltd that he had his own personal satellite navigation system switched on for the journey but that he was not directed along Oak Hill Road by it. Any system he was using was unlikely to have alerted him to any weight, height or length restrictions on Oak Hill Road because there were none at the time of the accident. Official road signage warnings about weight, height and length restrictions are usually only captured in dedicated satellite navigation system for hauliers and not in systems designed for private cars. Even if the driver had been using a dedicated 'truckers' satellite navigation system it is unlikely that it would have warned him that Oak Hill Road was not suitable for HGVs, unless the system had been updated with information from other drivers of large vehicles. The RAIB carried out a test with a well-known satellite navigation system used by lorry drivers; it did not advise of any restrictions when a route was planned through Oak Hill Road.

The delay in informing the railway of the danger on the track

61 **The train was not stopped before it collided with the debris, due to delays in informing the railway about the obstruction.**

62 The parapet fell onto the track at around 17:20 hrs (paragraph 25). The witness who saw this happen and alerted the HGV driver, promptly rang 999 and was routed to TVP who received the call at 17:22 hrs (paragraph 26). TVP informed BTP who in turn informed Network Rail's Western Route Control at 17:28 hrs (paragraph 29). The call ended at around 17:30 hrs, which was about the time that the collision occurred (paragraph 67).

63 There was therefore a delay of around eight minutes between receipt by TVP of the first 999 call and Network Rail's Western Route Control being informed about the debris on the line. Had the emergency message been passed directly to Network Rail, it is likely that the train could have been stopped before the collision, either by using the signalling system or by means of the GSM-R radio system fitted in the train cab. The delay in informing Network Rail arose for the reasons discussed in the following paragraphs.

64 The bridge did not have any signage to provide members of the public with a direct number to call the relevant railway control centre in the event of an emergency that endangered the railway. This is discussed further at paragraph 68.

65 The handling of the initial call from the witness did not comply with TVP's procedures for handling a railway related emergency call. After taking the call from the witness, the TVP call taker, who understood that the safety of the railway was at risk, called BTP first (at 17:23 hrs), thinking this would be the quickest way to inform the railway. However, this was contrary to TVP's procedure in force at the time of the accident, which states that the first step in the event of any incident on or immediately adjacent to a railway line is to inform the inspector in charge of, and located in, TVP's control room. It is the control room inspector's responsibility to ensure that Network Rail is contacted immediately and to set up a command structure if necessary.

66 TVP has reported to the RAIB that its control room inspector was in the control room at the time but was not informed of the incident immediately. This was because the call taker initially contacted BTP. The conversation with BTP lasted 3 minutes and 15 seconds, partly because of the uncertainty as to the exact location of the bridge involved; whether it was Froxfield, Wiltshire or Froxfield, Hampshire (which is not on a railway route). The correct location was eventually mutually understood and the BTP controller agreed to pass on the message to Network Rail. Had TVP's first call gone to Network Rail's Western Route, in accordance with its procedures, there would have been about five or six minutes in which to stop the train which should have been sufficient.

67 BTP subsequently called Wessex Route Control first at 17:26 hrs. However, this was the wrong route control and so BTP then rang Western Route Control at 17:28 hrs. This call was made to the Western Route Control manager's non-emergency number and lasted 1 min and 32 seconds. It did not convey the severity of the risk to the railway (discussed further at paragraph 98). The next action by Western Route Control would have been to confirm the location and send an emergency broadcast 'stop' message to all trains in the area of Bedwyn and inform the signaller. However, by the time the call ended (at around 17:30 hrs), train 1C89 was close to colliding with the debris and it was too late for the collision to be averted.

Lack of bridge identification plates

68 **Network Rail's procedure for fitting identification plates to overline bridges did not apply directly to the Oak Hill Road overline bridge, because it had no prior history of bridge strikes. This was an underlying factor.**

69 Identification plates like those now fitted to Oak Hill overline bridge following the accident (figure 11), provide details of the name of the bridge, its location (expressed as an *engineer's line reference* and mileage) and a telephone number to contact the relevant route control centre directly in the event of an emergency that endangers the safety of the railway. Had such plates been fitted to Oak Hill Road overline bridge at the time of the accident, the witness would have been able to contact Network Rail's Western Route Control directly, and the accident could have been averted. Given the witness's presence of mind throughout the incident, it is highly likely that he would have done so.

Figure 11: Bridge identification plate fitted to Oak Hill Road overline bridge after the accident

70 Network Rail standard NR/L3/CIV/076 'Management of the risk of bridge strikes from road vehicles and waterborne vessels', Issue 4, 04/09/10 states that:

- the Route Structures Engineer is responsible for maintaining a register of bridges at risk from strikes (from road and waterborne vehicles), and installing identification plates on such bridges;
- the register is required for all bridges likely to be subject to a bridge strike; and
- identification plates for use by the public may be installed on bridges at risk from bridge strikes.

71 Network Rail also has a guidance note, NR/GN/CIV/202 Issue 2, 04/09/10, which relates to the above standard and states that identification plates should be installed on (among others) 'overline bridges which carry road vehicular traffic'. The guidance document is not mandatory and the above statement was marked 'No longer mandatory – July 2012'.

72 It was the practice on Network Rail's Western Route at the time of this accident to install bridge identification plates on parapets when there was knowledge or suspicion of bridge strikes by road vehicles. Oak Hill Road overline bridge did not have a prior history of bridge strikes and therefore had not been fitted with identification plates. This was in accordance with Network Rail standards. Following this accident, Network Rail installed identification plates to Oak Hill Road overline bridge on 16 April 2015.

73 Although there was no Network Rail standard that mandated identification plates to be routinely installed on the parapets of overline bridges, the Western Route had initiated a work stream for the Thames area, prior to this incident, to install identification plates on its overline bridges if there was knowledge or suspicion of bridge strikes by road vehicles. That decision was taken after the accident at Oxshott, Surrey on 5 November 2010 (paragraph 106, RAIB report 13/2011), in which a lorry collided with a parapet of the Warren Lane (A244) road bridge. Having broken through the parapet, the lorry fell onto the roof of a passing train. Following the accident at Oxshott, Western Route instigated a programme of fitting identification plates on all overline bridges, prioritised according to the risk of incursion by road vehicles. The risk of incursion for each bridge was assessed using a prescribed method summarised at paragraph 76. Bridges with a risk score greater than 80 were targeted for installation of identification plates during 2015/16 and the remainder were planned for installation during 2016/17.

Assessment of Road Vehicle Incursion (RVI) risk

74 **The Department for Transport (DfT) and Network Rail procedures for assessing the risk from RVI do not specifically address the risk of incursion of bridge debris from a road traffic accident on an overline bridge. This was an underlying factor.**

75 On 28 February 2001, a train struck a road vehicle on the railway at Great Heck, North Yorkshire, resulting in ten fatalities (paragraph 100). Following this accident, the DfT published guidance in February 2003 entitled, 'Managing the accidental obstruction of the railway by road vehicles'.

76 The DfT guidance describes a two-stage assessment process to determine a numeric risk ranking of a site, and then to consider possible mitigation measures for those sites scoring above specified risk rankings. The guidance estimates that, nationally, about 95% of the risk of road vehicle incursions will occur at sites that have been scored above 100 and this value is generally taken as the threshold of a 'high' risk site, where significant expenditure might be justified. For sites with scores between 90 and 100, the guidance recommends further investigation, but points out that only relatively low cost improvements are likely to be justifiable. For sites scoring below 90, the guidance expects that highway and rail authorities should at least consider the practicability of low cost improvements, such as road markings or signage. Three risk ranking techniques are included to cover the differing situations of:

a) a single carriageway road passing over a railway on an overbridge (completed on a form 1a);

b) a dual carriageway road (including a motorway) passing over a railway on an overbridge (completed on a form 1b); and

c) a neighbouring (or parallel) site (eg a road that runs parallel to a railway) (completed on a form 2).

77 Network Rail also has a guidance note, NR/GN/CIV/202 Issue 2, 04/09/10, which relates to the above standard and states that identification plates should be installed to (among others) 'overline bridges which carry road vehicular traffic'. The guidance document is not mandatory and the above statement was marked 'No longer mandatory – July 2012'. The guidance note is consistent with Network Rail document NR/GPG/CIV/007 titled; 'Response to a Bridge Strike over the Railway, a protocol for Highway and Road managers, police and bridge owners, April 2008', which states that 'Network Rail is carrying out a programme to install identification plates at all bridges over the railway'.

78 Assessments are undertaken jointly by Network Rail and the relevant highways authority. The process of risk ranking is carried out by scoring 14 different factors specified on relevant forms, depending on the type of site ((a) – (c) in paragraph 76). The individual scores of the factors are then summed to derive the risk ranking total. The guidance also includes a mitigation spreadsheet which calculates whether a proposed mitigation measure would be cost effective. A copy of the form which applied to Oak Hill Road overline bridge is at appendix D.

79 Oak Hill Road overline bridge had four RVI assessments between 2002 (an initial assessment undertaken by WBC) and February 2015, just before the accident, with the following scores:

- May 2002 (WBC): Score 97.
- November 2006 (Network Rail & WBC): score 92.
- October 2010 (Network Rail): score 91.
- February 2015 (Network Rail & WBC): score 75.

80 The reduction in the risk scores between 2010 and 2015 assessments were due to:

- the introduction of a steel palisade fence at the north eastern corner of the bridge, by the owners of the buildings adjacent to the railway (figure 4), and an increasing amount of vegetation on the approach to the bridge, both of which mitigate the risk of road vehicle incursion; and
- the introduction of road markings, double bend and hump-back bridge signs by WBC following the 2010 assessment.

81 Although there is an element of subjectivity involved in attributing scores to each factor in the assessment process, the Oak Hill Road overline bridge assessments were undertaken in accordance with the DfT guidance and simple mitigation measures were applied, in line with the guidance.

82 The methodology set out in the DfT guidance for RVI assessments (and reflected in the assessments made by Network Rail and WBC) does not specifically address a Froxfield-type accident, where the major incursion hazard to the railway is large amounts of parapet debris, rather than road vehicles. Sections of bridge parapet on the tracks could pose a greater risk to trains than a road vehicle. The guidance states that factor f5 (see appendix D), relating to site topography, is not intended to include any assessment of the risk of sections of parapet being displaced onto the track following a road traffic accident as that is considered in factor f8. The notes relating to factor f8 state that 'parapet resilience (containment) is considered of importance due to the reduction in the effect of an incident, if the parapet is capable of constraining an RTA on the bridge deck'. The risk of the whole parapet or large sections of it being dislodged onto the track below because a large vehicle has to negotiate a difficult road geometry is not specifically catered for. Therefore mitigation, such as road signage to warn lorry drivers about the unsuitability of certain roads for large vehicles, is unlikely to be considered as part of the RVI assessment.

Sighting distance

83 **The train driver was not able to stop the train within his sighting distance of the obstruction.**

84 The train driver reported that visibility at the time was poor (it was dusk and the sky was overcast) and he did not initially recognise there was an obstruction ahead because it looked like a shadow across the tracks. When he recognised there was an obstruction, he immediately applied the emergency brake.

85 The RAIB has assessed that as the train rounded the left-hand curve on the approach to the bridge, the driver's sighting distance of the obstruction would have been around 300 metres. Although the driver reacted quickly, this was too short a distance for the train to have been stopped or slowed significantly by the application of the emergency brake. Therefore there was nothing the driver could have done to avoid a collision at speed with the bridge debris on the track.

Factors affecting the severity of consequences

86 This accident had the potential to be very serious had the fully laden train derailed at the estimated impact speed of around of 75 mph (121 km/h). The RAIB noted the following factors which mitigated the consequences of the collision.

- The leading bogie did not derail even though it reportedly lifted as it ran over the debris. A derailment was therefore only narrowly averted. The damage to the lifeguards was severe and indicated they probably played an important role in averting a derailment.
- The fallen parapet had broken up into sections. Those on the down line on which the train was travelling, were smaller than those that had fallen on the up line (figure 3).
- No train passed on the up line (towards London). Train 1A85 was approaching Bedwyn at the time but was alerted in time to stop before it reached the site (paragraph 33).

Observations

The post-accident running of the train

87 **The train was allowed to run between Bedwyn and Westbury at a maximum speed of up to 100 mph (160 km/h) with a missing lifeguard and damage to the bogies.**

88 Once the braking system on the leading bogie had been isolated and other repairs completed on site, train 1C89 ran at cautionary speeds up to 42 mph (68 km/h) from Froxfield to Bedwyn. In addition to the driver, there was also a second driver in the cab (paragraph 38), who was acting as a designated *competent person*, and the fitter. The journey to Bedwyn was completed without incident.

89 For the further journey from Bedwyn to Westbury, the train's speed restriction was revised upwards and it was allowed to run at up to 10 mph (16 km/h) below the line speed. The maximum line speed between these two stations is 110 mph (177 km/h) and therefore the train was authorised by FGW control to run at a maximum speed of 100 mph (160 km/h). The average speed for the 35 mile journey between Bedywn and Westbury, obtained from signalling data, was around 75 mph (121 km/h). The driver reported that he travelled to Westbury at no more than 100 mph (160 km/h). It was not possible to verify the maximum running speed between Bedwyn and Westbury from the train's OTDR because by the time this was requested, it was no longer available.

90 When a train develops faults or defects in service, its subsequent safe operation is governed by procedures in the train operating company's defective on-train equipment (DOTE) plan. This plan addresses the requirements of Railway Group Standard GO/RT3437, Issue 7, September 2013 ('Defective on-train equipment') and the railway Rule Book (GE/RT8000, module TW5).

91 FGW's DOTE plan (SMS1640-10, 'Appendix A, Matrix for trains with Defective on-train equipment', Issue 1, 6 December 2013) specified the operating restrictions for 104 different defects which may be encountered in service. It required that when a controller became aware of an incident, accident or occurrence of defective on-train equipment affecting a train, he/she must refer to the DOTE plan to establish the actions required.

92 Several defects arose as a result of the accident. Among the defects identified on site by the FGW staff who attended the train, were the following:

a) the braking system on the leading bogie was leaking air and had to be isolated to allow the train's brakes to be released;

b) the TPWS aerial mounted on the leading bogie had been knocked off; and

c) one of the lifeguards on the leading bogie was missing and the other had been bent back but was still attached.

93 FGW's DOTE plan at the time of the accident permitted the train to run at 10 mph (16 km/h) below the line speed for defect (a), and at line speed for defect (b) provided a second competent person was riding in the cab. However, for a missing lifeguard, defect (c), the DOTE plan stated that 'The train must be returned to a depot with a speed restriction if deemed appropriate'. The DOTE plan did not prohibit running with a missing lifeguard at the front of the train but did indicate that a speed restriction might be appropriate. Both the DOTE plan and the Rule Book prohibit bringing trains into service with a loose, damaged or missing lifeguard. This is because the lifeguards are designed to deflect obstacles which might otherwise get under the train's wheels and cause a derailment.

94 FGW reissued its DOTE plan on 28 February 2015 with the following additional clarification regarding missing lifeguards: 'The train may enter or remain in service with a missing lifeguard providing that the defective vehicle will not be leading for any movement that the train is required to make. Similarly, the train may continue to run normally if the defective vehicle can be boxed in or can remain trailing'. Neither of these conditions applied to the planned onward movements of train 1C89, in which the damaged and missing lifeguards were at the leading end of the train.

95 The Rule Book, GE/RT8000, module TW5 ('Preparation and movement of trains, defective or isolated vehicles and on-train equipment'), Issue 5, March 2014, states that if a driver becomes aware that a lifeguard is missing, loose or damaged when in service, they should tell the signaller immediately, not move until instructed to do so, and carry out the instructions given. It goes on to say that if there is any doubt about whether the movement can be made safely, the driver must get the authority of a rolling stock technician. At the time the driver contacted the signaller (immediately after stopping the train) he would not have known that the lifeguards were damaged and therefore he did not mention it. Subsequently, an FGW fitter arrived and examined the train. As the evening wore on, it was appropriate that the FGW Control office, in consultation with the fitter and relief driver, made the decisions about restrictions on the forward movement of the train, rather than the signaller.

96 The damaged power car continued to lead during the journey to Bedwyn and then Westbury, with passengers still on board and while travelling at high speed. Neither the DOTE plan nor the Rule Book provide specific advice on speed restrictions for post-accident running. Although the train reached its destination safely, the RAIB considers that the way FGW's DOTE plan was applied to the circumstances of the Froxfield collision (heavy impact, high speed, full train and limited facility to do detailed inspections) was not appropriate and lacked adequate consideration of the nature of the accident and the potential for undetected faults to cause further hazards to the train.

Reporting the nature of the hazard

97 **The description of the hazard on the tracks below Oak Hill Road overline bridge changed during the transmission of the emergency message to the railway.**

98 TVP's control room, which took the initial emergency call from the witness (paragraph 26) about the parapet, rang BTP's London control centre at 17:23 hrs and correctly relayed that a bridge wall had fallen onto the tracks. However when BTP informed Network Rail at 17:28 hrs, the message that it conveyed was that a lorry had become stuck on the bridge and "knocked some bricks on the tracks". The revised description of the hazard was not as accurate and would not have properly conveyed the actual severity of the hazard.

Previous occurrences of a similar character

99 RSSB[1] provided data to the RAIB on previous accidents involving trains running into debris from parapets of overline bridges during the 10 year period from 1 January 2005 to 14 January 2015. There were 100 reported incidents involving road vehicles running into the parapets of overline bridges. Of these, 79 cases involved debris falling on the track(s) below. In 11 of these cases, trains ran into the debris but none resulted in derailment, although the trains involved sustained different levels of damage.

100 Previous accidents such as those listed below have shown that trains can be vulnerable to derailments following high speed collisions with obstructions on the line.

- Ufton Nervet, Berkshire, 6 November 2004[2]: an HST set collided at high speed with a stationary car which had been stopped by its driver on a level crossing. One pair of wheels derailed and the train ran on upright and in line until it came to a set of *facing points* which led to the catastrophic derailment of the whole train. As a consequence of the collision, 7 people died and 71 were injured, 18 seriously.

[1] Formerly called the Rail Safety and Standards Board.

[2] Formal Inquiry final report: Ufton Level Crossing Passenger train collision with a road vehicle and subsequent derailment on 6 November 2004; Rail Safety and Standards Board; 21 June 2005.

- Great Heck, Yorkshire, 28 February 2001[3]: an IC225 passenger train travelling at 125 mph (200 km/h) on the East Coast Main Line, struck a four-wheel drive vehicle and trailer which had strayed onto the line from an overline bridge on the M62 motorway. The leading bogie became derailed and the train ran for around 500 metres. Then, the derailed bogie encountered a set of trailing points which guided the leading vehicle towards the northbound line and into collision with a coal train travelling in the opposite direction. Ten people suffered fatal injuries and a further 82 were taken to hospital, many of them with serious injuries.
- Croxton, Norfollk, 12 September 2006[4]: a two-car class 170 diesel multiple unit struck a rubber level crossing panel (weighing around 260 kg) at Croxton level crossing on the line from Norwich to Cambridge. The panel had been dislodged by a lorry less than ten minutes earlier. The train was travelling at 87 mph (140 km/h) when the leading bogie derailed, and the train ran on for over 400 metres in a derailed condition. There were no casualties on the train.

[3] The track obstruction by a road vehicle and subsequent train collision at Great Heck, 28 February 2001; a report of the Health and Safety Executive investigation, ISBN 0717621634, published 2002.

[4] Derailment of a train at Croxton Level Crossing, 12 September 2006, RAIB Report 11/2008, May 2008.

Summary of conclusions

Immediate cause

101 The eastern parapet of Oak Hill Road overline bridge had been pushed off onto the tracks below and the driver of the approaching train was unaware of the obstruction ahead (**paragraph 40**).

Causal factors

102 The causal factors were:

a. An HGV on the bridge reversed into the eastern parapet, pushing it over onto the tracks below (**paragraph 42, Recommendations 2 and 3, Learning point 2**).

b. The train was not stopped before it collided with the debris, due to delays in informing the railway about the obstruction (**paragraph 61, Recommendation 1, Learning point 1**).

c. The train driver was not able to stop the train within his sighting distance of the obstruction (**paragraph 83, no recommendation**).

Underlying factors

103 The underlying factors were:

a. In accordance with WBC's policy on fitting road signage, there were no road signs to warn drivers that Oak Hill Road was not suitable for HGVs (**paragraph 56**, see paragraph 110).

b. Network Rail's procedure for fitting identification plates to overline bridges did not apply directly to the Oak Hill Road overline bridge, because it had no prior history of bridge strikes (**paragraph 68, Recommendation 1**).

c. The DfT and Network Rail procedures for assessing the risk from RVI do not specifically address the risk of incursion of bridge debris from a road traffic accident on an overline bridge. This was an underlying factor (**paragraph 74, Recommendations 2 and 3**).

Observations

104 Although not linked to the causes of this accident, the RAIB observes that:

a. The train was allowed to run between Bedwyn and Westbury at a maximum speed of up to 100 mph (160 km/h) with a missing lifeguard and damage to the bogies (**paragraph 87, Recommendation 4**).

b. The description of the hazard on the tracks below Oak Hill Road overline bridge changed during the transmission of the emergency message to the railway (**paragraph 97, Learning point 1**).

Factors affecting the severity of consequences

105 The consequences of this accident could have been much more serious had the train derailed or had the parapet debris not broken up to the extent that it did or had a train passed on the London bound, Up Westbury line (paragraph 86).

Previous RAIB recommendations relevant to this investigation

106 The RAIB has previously carried out an investigation of an accident involving a lorry striking and breaking through the parapet of an overline bridge and falling onto the roof of a passing train near Oxshott station, on 5 November 2010 (RAIB report 13/2011, August 2011). Recommendation 4 from that investigation has some relevance to this accident:

Recommendation 4

The purpose of Recommendation 4 is to promote the development of guidance which could enhance safety at bridges over railway lines where the Department for Transport's road vehicle incursion assessment process does not already address this.

The Department for Transport, with highway authorities, should prepare guidance for highway authorities on identifying local safety hazards at bridges over railways which could be mitigated by measures such as signage, hazard marking, white lining or safety barriers, and include consideration of previous accident history and the causes of those accidents. This should include guidance on when the assessment should be undertaken and when such measures should be applied.

107 DfT's draft response to Oxshott recommendation 4 (June 2015) contains advice to highway authorities to:

- Check that vegetation does not obscure road signs, visibility at junctions, access points and bends.
- Check each overbridge for hazards and where appropriate apply mitigations such as signage, hazard markings, white lines or safety barriers.

108 Implementation of Oxshott recommendation 4 would not necessarily be expected to prevent the type of accident which occurred at Froxfield. Therefore the RAIB has decided to make an additional recommendation relating to the road vehicle incursion assessment process (**Recommendation 2**).

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

109 On 16 April 2015, Network Rail fitted bridge identification plates to each end of the remaining parapet of Oak Hill Road overline bridge (figure 10). The plates contain the railway telephone number to contact in the event of a road vehicle striking the bridge.

110 On 28 May 2015, the RAIB wrote to WBC and advised that it should install signage on the approaches to the section of Oak Hill Road between and including the overline and canal bridges as soon as possible, to warn HGV drivers that the road ahead was unsuitable for HGVs. WBC liaised with Wilshire Council about the installation of the signs and on 17 December 2015, WBC reported to the RAIB that it had installed 'unsuitable for HGV' signs within its own jurisdiction and that Wiltshire Council was due to fit its own signs on 19 January 2016.

111 TVP reported to the RAIB on 22 May 2015 that it had:

- briefed relevant staff to reiterate the correct actions to be taken when dealing with incidents on railways and that the first call should always be to the relevant railway authority; and
- reviewed its procedures on dealing with incidents on the railway to check that they were fit for purpose, and concluded that they were.

112 BTP reported to the RAIB on 29 October 2015 that it had reviewed the communications to and from its control room in relation to the accident. As a result of this, it had implemented various improvements, including re-briefing relevant staff on the actions to be taken when a call is received from another police force about an incident affecting railway safety. Additionally on 2 November 2015, the Deputy Chief Constable of BTP wrote to the Chief Officers of the Home Office police forces about the importance of informing the railway immediately of any potential hazard in any railway-related incident. A copy of the letter is at appendix E.

Learning points

113 The RAIB has identified the following learning points[5]:

1 For police forces, this accident reinforces the importance of ensuring that their enquiry and control room:

- procedures are clear about immediately informing the relevant railway control centre on its emergency number, with an accurate description of the hazard, when the safety of the railway is affected, before informing other police forces or agencies; and
- staff are fully briefed on the procedures and practised in their use.

2 For road vehicle standards bodies and the road haulage industry, this accident demonstrates the benefit of having reversing sensors or cameras on HGVs and other lorries, to assist drivers when manoeuvring their vehicles in unfamiliar, restricted spaces.

[5] '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

114 The following recommendations are made[6]:

1 *The intent of this recommendation is that members of the public have immediate access to the contact details for the railway in the event of an accident on an overline bridge that endangers the railway.*

Network Rail should develop and implement a programme for the timely installation of identification plates on all overline bridges with a carriageway for which it is responsible (unless the consequence of a parapet falling onto the tracks or a road vehicle incursion at a particular bridge are assessed as likely to be minor). Installation should be prioritised so that those bridges assessed as being at highest risk are fitted first. Network Rail should also modify its standards relating to the installation of identification plates accordingly (paragraph 103b).

This recommendation may also apply to other infrastructure managers.

2 *The intent of this recommendation is that the RVI assessment process should include specific consideration of the risk of road vehicles on an overline bridge knocking a parapet onto the tracks below.*

The Department for Transport should include in its guidance for assessing the risk of road vehicle incursion (RVI), a method for specifically assessing the risk of road vehicles damaging a bridge parapet and knocking debris onto the track below, so that proportionate mitigation can be considered by both railway and highway RVI assessors (paragraph 103c).

continued

[6] 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, Recommendations 1, 3, and 4 are addressed to the Office of Rail and Road, and Recommendation 2 to the Department for Transport, to enable them to carry out their 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 that Network Rail's RVI assessment procedures take into consideration the risk of a large vehicle on an overline bridge knocking over a parapet onto the tracks below.*

Network Rail should:

a) include a requirement (aligned with any revised DfT guidance arising from recommendation 2) in its RVI assessment procedures for overline bridges, to specifically assess the risk of road vehicles damaging a bridge parapet and knocking over debris onto the track below so that proportionate mitigation (eg road signage) can be considered by its RVI assessors; and

b) brief its RVI assessors accordingly (paragraph 103c).

4 *The intent of this recommendation is that when trains are permitted to run following a collision, there is a mandated requirement to consider the circumstances of the collision carefully, and impose an appropriate speed restriction for the onward movement, especially when there are passengers on board*.

RSSB, in consultation with industry, should propose, and then promote, the introduction of an additional specific requirement in an appropriate Railway Group Standard, so that in the event a train is damaged in an incident (including striking objects on the track) and is to be moved (with or without fitter attention), the conditions of any such movement, including the maximum permissible speed, are subject to a full consideration of:

a) the circumstances of the incident (including the train speed and nature of any obstacle struck);

b) the limitations of any on-site assessment of damage; and

c) whether or not there are passengers on board (paragraph 104a).

Appendices

Appendix A - Glossary of abbreviations and acronyms

BTP	British Transport Police
DfT	Department for Transport
DOTE	Defective on train equipment
FGW	First Great Western
GSM-R	Global system for mobile communications - railway
HGV	Heavy goods vehicle
HST	High speed train
OTDR	On train data recorder
RTA	Road traffic accident
RVI	Road vehicle incursion
TPWS	Train protection and warning system
TVP	Thames Valley Police
WBC	West Berkshire Council

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.

Chain	A unit of length, being 66 feet or 22 yards (approximately 20.117 metres). There are 80 chains in one standard mile.*
Competent person	A person who is required to travel with a train driver, due to defective on-train equipment, who is passed as being qualified and has the required knowledge and skills to carry out a particular rule, regulation, instruction or procedure (Railway Group Standard GO/RT3451 Issue 3, December 2011).
Down line	A railway line that is predominately used by trains travelling in a direction away from London.
Engineer's line reference	A unique alphanumeric label given to a section of railway to aid identification of civil engineering assets on that line.
Facing points	A set of points or set of switches installed so that two or more routes diverge in the direction of travel.
GSM-R radio	A digital railway communication system for communication between drivers and signallers, being rolled out nationally in Great Britain.
Lifeguard	A heavy metal bracket fitted vertically immediately in front of the leading wheels of a train. Their purpose is to prevent obstacles getting under the leading wheels.
Overline bridge	A bridge which carries a carriageway over the railway.
Parapet	A wall constructed along the outside edges of a bridge, or along the top of a retaining wall, whose purpose is to contain vehicles and pedestrians within the roadway/footway.
Route	Organisationally, the Network Rail system is divided up into a number of 'Routes' responsible for the operation and maintenance of their respective areas.
Route Control	The Network Rail organisation in each Route responsible for monitoring the operation of the railway and coordinating any action required when out-of-course events occur.
Running brake test	A brake test performed by the driver whilst the train is in motion.*
Spandrel	The part of an arch bridge which forms the side wall and retains the fill material between the arch and road surface.
Train protection and warning system	An automatic trackside and train-borne system which safely stops trains that pass signals at danger so as to avoid a collision.

Unclassified (road)	A local road intended for local traffic. The vast majority (around 60%) of roads in the UK fall within this category.
Up line	A railway line that is predominately used by trains travelling in a direction towards London.

Appendix C - Investigation details

The objectives of the RAIB's investigation were:

- Determine the sequence of events leading up to, during and after the collision.
- Review the assessments that were undertaken by Network Rail and West Berkshire Council to determine the risk to the railway from road traffic using Oak Hill Road overline bridge, including the suitability of the road and bridge signage.
- Review the handling of the emergency call made by a member of the public before the collision.
- Review the restrictions placed on the onward movement of the train after the incident.
- Consider the history of any previous similar incidents on Network Rail infrastructure.
- Identify and review the applicability of any previous relevant RAIB or other recommendations.
- Identify learning points and, if appropriate, make recommendations to improve safety and prevent a recurrence.

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). The train was not fitted with forward facing CCTV.
- Site photographs and measurements.
- Network Rail and First Great Western control office logs.
- Control room logs from British Transport Police, Thames Valley Police, Wiltshire Police and associated communications.
- Inspection records of the damaged train.
- Eddie Stobart Ltd information on the HGV, its driver and operation.
- Network Rail procedures related to assessing road vehicle incursions and bridge strikes, and the use of bridge plates.
- Network Rail and West Berkshire Council RVI assessments for Oak Hill Road overline bridge.
- Network Rail's bridge examination reports for Oak Hill Road overline bridge.
- Information supplied by West Berkshire Council about Oak Hill Road.
- West Berkshire Council's survey of Oak Hill Road rail and canal bridges and its swept path analysis of an HGV movement between the bridges.
- Consultant's assessment of the possible effect of the crack in eastern parapet on its collapse mechanism, prepared for the RAIB.
- Historical data on previous similar accidents on Network Rail infrastructure provided by RSSB and Network Rail.
- A review of previous RAIB investigations relevant to this accident.

Appendix D - RVI assessment form for Oak Hill Road overline bridge

DfT - Managing the Accidental Obstruction of the Railway by Road Vehicles

Form 1a - Single Carriageway Road Vehicle Incursion Risk Ranking Scoring Spreadsheet

Site Location: BHL 63m 64ch - Oak Hill

Factor	Options	Score
f1 (see Note A)	**Road Approach Containment** Score 1 for acceptable (safety fence and/or heavily wooded side approaches, buildings or brick wall thicker than 450mm Score 12 for inadequate (imperfect fencing and/or medium/lightly wooded approaches, 225mm thick brick wall) Score 24 for non-existent (No fencing, or only post and rail/wire, no significant vegetation)	12
f2	**Road Alignment (Horizontal)** Score 1 for straight road with at least 7.3m carriageway Score 3 for straight less than 7.3m carriageway or curved at least 7.3m carriageway Score 7 for curved road less than 7.3m carriageway Score 10 for reverse curve less than 7.3m carriageway	7
f3	**Road Alignment (Vertical)** Score 1 for level or constant grade Score 2 for slight hump back Score 3 for hump back where vehicles are inter-visible Score 5 for hump back where vehicles are not inter-visible	5
f4	**Actual Speed of Approaching Road Traffic** Score 1 for <10mph Score 3 for <30mph Score 5 for <50mph Score 7 for <70mph Score 9 for >70mph	3
f5	**Site Topography** Score 1 if vehicle/debris very unlikely to foul track Score 4 if vehicle/debris unlikely to foul track Score 6 if vehicle/debris can be reasonably expected to foul track Score 8 if vehicle/debris likely to foul track Score 10 if vehicle/debris very likely to foul track	4
f6 (see Note B)	**Site Specific Hazards Increasing Likelihood of RTA** Score 1 for no obvious hazards Score 5 for single site specific hazard Score 9 for multiple minor hazards, or single major hazard (e.g. school, hospital or major factory access)	5
f7 (see Note C)	**Site specific hazards increasing consequences of event** Score 1 for no obvious hazards Score 3 for single site specific hazard Score 5 for multiple site specific hazards and/or railway infrastructure likely to increase severity of an accident	5

Note A Score f1 on the basis of the corner of the bridge with the least containment.

Note B Site specific hazards increasing the likelihood of a RTA include the following features in proximity to the bridge: farm access, road junction, private driveway, lay-by, bus stop, school, hospital, etc.

Note C Site specific hazards increasing the consequences of the event include the following features in proximity to the bridge: exposed gas or chemical pipelines etc. Railway infrastructure likely to increase the severity of incident to include pointwork, platforms, bridge piers and abutments and tunnel portals etc within 800m of structure.

Sheet ref:

Factor	Options	Score
f8	**Parapet Resilience** Score 1 for P6 parapet or welded steel half through type Score 2 for P1 to P5 parapet or riveted steel/wrought iron half through type Score 5 for 450mm brickwork/masonry parapet Score 7 340mm brickwork/masonry parapet Score 11 for cast iron or corrugated sheet parapets	7
f9	**Road Verges and Footpaths** Score 1 for at least 2m both sides Score 2 for at least 1m both sides Score 3 for one or both verges less than 1m	3
f10 (see Note D)	**Road Signage/Carriageway Markings** Score 1 for signage/markings fit for purpose and clearly visible, or not needed Score 4 for unfit, non-existent, or obscured signage/markings, where considered to be required	1
f11 (see Note E)	**Volume of road traffic** Score 1 for 0 to 10 HGVs (<200 vehicles) per day (generally green lane or farm access) Score 2 for 11 to 100 HGVs (<2000 vehicles) per day (generally unclassified) Score 3 for 101 to 500 HGVs (<7150 vehicles) per day (generally C or B class) Score 4 for 501 to 1000 HGVs (<12500 vehicles) per day ("Other Strategic" roads) Score 5 for over 1001 HGVs (>12500 vehicles) per day (generally "Primary Routes")	2
f12 (see Note F)	**Permissible Line Speed and Track Alignment** Score 1 for straight track up to 45mph Score 4 for straight track up to 75mph or curved up to 45mph Score 8 for straight track up to 90mph or curved up to 75mph Score 12 for straight track up to 100mph or curved up to 90mph Score 16 for straight track up to 125mph or curved up to 100mph Score 20 for straight track up to 140mph or curved up to 125mph Score 24 for straight track above 140mph to curved above 125mph	8
f13 (see Note G)	**Type of Rail Traffic** Score 1 for non-dangerous goods freight Score 3 for loco-hauled stock Score 5 for sliding door multiple units (up to 100mph) or dangerous goods freight Score 7 for slam door multiple unit or sliding door multiple units (over 100mph) Score 11 for light rail (see definition in guidance notes)	5
f14 (see Note H)	**Volume of Rail Traffic** Score 1 for seldom used route (fewer than 500 trains per year) Score 3 for lightly used route (501 to 3000 trains per year) Score 5 for lightly used route (3001 to 10000 trains per year) Score 8 for heavily used route (10001 to 50000 trains per year) Score 12 for very heavily used route (more than 50000 trains per year)	8

Total
75

Note D If score = 4 sign/marking deficiencies to be brought to attention of Highways Engineer.

Note E Equivalent traffic flows for all vehicles types may be substituted, depending on the units of measurements used by the relevant highway authority.

Note F If f8 scores 2 or less, score f12 on the basis of outermost tracks of a multi-track railway.

Note G If f8 scores 2 or less, score f12 on the basis of outermost tracks of a multi-track railway.

Note H Volume of rail traffic to be provided by Rail Infrastructure Controller, see guidance notes

Appendix E - Emergency Services Rail Incident Protocol

BRITISH TRANSPORT POLICE

29 October 2015

To Commissioners, Chief Constables, Chief Officers

Emergency Services Rail Incident Protocol

A review of railway-related incidents reported to British Transport Police control rooms through Home Office forces has identified that on a number of occasions, whilst incidents have been referred promptly to BTP for on-going action, the receiving force did not *immediately* inform the relevant Network Rail Control Centre in line with the Action 1 of the National Rail Incident Protocol.

It is imperative that Network Rail is made aware of any potential hazard by the receiving force at once so that there is no misunderstanding of what has occurred and its location. This allows Network Rail to make a prompt assessment of whether to put to full or partial stop on the line or switch off power.

Timing is crucial. In one recent case a lorry struck a bridge and pushed the parapet onto the tracks below and despite this danger being reported to the emergency services immediately, there was a seven minute delay in informing Network Rail by which time a high-speed train collided with the bricks. It is fortunate that on this occasion there were no personal injuries; however the resultant damage to the train and cost of delays to the rail industry was immense.

I have met the Chief Inspector of the Rail Accident Investigation Board to review this incident and have agreed to remind all forces of the national agreement that has been introduced to help ensure that we work together in a consistent manner in order to achieve a high level of safety and respond effectively to rail incidents.

I have included a copy of the protocol with this letter and would request that you share this with the relevant lead in your force and ensure that all emergency operators are made aware of the obligations set out in it.

Yours sincerely

Adrian Hanstock
Deputy Chief Constable

This page is intentionally left blank

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

Any enquiries about this publication should be sent to:

RAIB
The Wharf
Stores Road
Derby UK
DE21 4BA

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