



Rail Accident Investigation Branch

# Rail Accident Report



**Container detachments at Scout Green,  
Cumbria, 7 March 2015 and near Deeping St  
Nicholas, Lincolnshire, 31 March 2015**

Report 19/2015  
December 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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# Container detachments at Scout Green, Cumbria, 7 March 2015 and near Deeping St Nicholas, Lincolnshire, 31 March 2015

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## Summary

At around 02:20 hrs on 7 March 2015 an empty 30 ft container became detached from a freight train on the West Coast Main Line at Scout Green, Cumbria. It passed over the adjacent track and came to rest down an embankment. There was no damage to the railway infrastructure or to other trains. A sleeper service had passed the site in the opposite direction about four minutes earlier.

At around 15:22 hrs on 31 March 2015, an empty 40 ft container was blown from a freight train, near Deeping St Nicholas, Lincolnshire. The container was dragged a short distance by the train, causing extensive damage to the infrastructure, before coming to rest on the adjacent track. There were no passenger services in the area at the time although a freight train had passed the site about five minutes earlier.

The container detachments were caused by strong gusting winds combined with the speed of the trains, and a defective design of container retention.

The circumstances of these events were very similar to other container detachments at Hardendale and Cheddington in 2008 which were investigated by the RAIB. That investigation report made a number of recommendations which, had they been implemented, would have prevented these further detachments. This report, therefore, makes no further recommendations. However, three learning points have been identified. These relate to the implementation of the previous recommendations and, where risk is mitigated by procedural measures, to the need for the systematic integration of freight operating companies' operating procedures with Network Rail's procedures.

## 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 which are explained in appendix A. Sources of evidence used in the investigation are listed in Appendix B.

### Organisations involved

- 3 The trains were operated by Freightliner Ltd and GB Railfreight Limited, and the infrastructure is owned by Network Rail. All parties freely co-operated with the investigation.

## Summaries of the incidents

### Scout Green

- 4 At around 02:20 hrs on 7 March 2015, an empty 30 ft container was blown from freight train 4S83<sup>1</sup>, the 23:54 hrs Freightliner service from Basford Hall to Coatbridge, while it was travelling on the down<sup>2</sup> main line of the West Coast Main line at Scout Green, Cumbria (figure 1). The container toppled over the adjacent up<sup>3</sup> main line and came to rest at the bottom of the embankment on the east side of the railway (figure 1). There was no damage to the train or to the infrastructure but some trees on the embankment and a boundary wall at the foot of the embankment were knocked over. There were no passing trains at the time of the detachment although the Glasgow Central to London Euston sleeper service had passed the site of the incident on the adjacent line about four minutes earlier.
- 5 Train 4S83 comprised 26 container carrying vehicles hauled by a pair of class 86 locomotives and was travelling at around 75 mph (121 km/h). The detached container was being carried on an FEA-B type wagon, number 640017, which was the 20th vehicle in the train. The container was one of two empty 30 ft containers carried on the wagon and was located at the leading end (in the direction of travel).



Figure 1: Extract from Ordnance Survey map showing location of incident and photograph of the detached container at Scout Green (Image courtesy of Network Rail)

- 6 The train driver was unaware of what had happened and the train continued to Coatbridge, arriving at 04:47 hrs. At 06:55 hrs a member of the public reported the detached container to Network Rail and subsequent enquiries established which train it had come from.
- 7 Around the time of the container detachment, the wind speed, measured approximately six kilometres away at Shap weather station, was gusting to around 62 mph (100 km/h). The wind was from the south-west, blowing almost perpendicular to the line of the railway.

<sup>1</sup> An alphanumeric code, known as the 'train reporting number', is allocated to every train operating on Network Rail's infrastructure.

<sup>2</sup> The name generally given to lines used by trains travelling away from London.

<sup>3</sup> The name generally given to lines used by trains travelling towards London.

## Deeping St Nicholas

- 8 On 31 March 2015, at around 15:22 hrs, an empty 40 ft container was blown from freight train 4Z33, the 11:21 hrs GB Railfreight service from Felixstowe South to Doncaster Railport. The detachment occurred while the train was travelling at approximately 38 mph (61 km/h) on the down main line, near the village of Deeping St Nicholas, Lincolnshire (figure 2).
- 9 The container fell against the side of the wagon and was dragged a short distance before coming to rest on the adjacent track (figure 2). The train continued for approximately 250 metres until it was brought to a stand by the train's brakes. The brakes were applied automatically when the container struck the handbrake handwheels of several wagons and damaged a brake safety mechanism.
- 10 Train 4Z33 consisted of 34 container carrying vehicles hauled by a class 66 locomotive. The container was being carried on an FEA-S type wagon, number 640650, which was the third vehicle in the train.



Figure 2: Extract from Ordnance Survey map showing location of incident and photograph of the detached container near Deeping St Nicholas (Image courtesy of Network Rail)

- 11 The detached container caused significant damage to the infrastructure, including a trackside telecommunications cabinet, a level crossing surface, sleepers, rail fixings, and signalling equipment. Thirteen vehicles also suffered damage, mainly to handbrake handwheels. There were no trains passing at the time of the incident although another freight train operated by GB Railfreight carrying containers had passed on the adjacent line about five minutes earlier.
- 12 The empty container had been loaded on to the wagon at Doncaster International Railport at around 19:00 hrs on 30 March 2015. It travelled in a train formation to Felixstowe Container Port, arriving around 05:20 hrs on 31 March 2015. On arrival, the weather conditions were deemed too windy for the port's unloading equipment to safely lift the containers from the train and, in accordance with port procedures for controlling congestion, the train was returned to Doncaster at its scheduled time without the containers being off-loaded.

- 13 The nearest weather station at RAF Wittering, about 16 kilometres away, recorded a maximum gust of 54.1 mph (87 km/h) around the time that the container was blown off the wagon. However, wind speed recordings at a nearby wind farm indicate that the wind could have been gusting at speeds of up to 67.8 mph (109 km/h). The wind was from the west or north-west and, in common with the incident at Scout Green, was blowing almost perpendicular to the line of the railway. On the approach to Deeping St Nicholas the railway lies in an area of flat agricultural land.

## Background information

### FEA-B and FEA-S type wagons

- 14 FEA-B wagons run in semi-permanently coupled pairs of vehicles with buffers at the outer ends of each pair. FEA-S wagons are single vehicles and have buffers at each end. The maximum operating speed of both FEA-B and FEA-S wagon types is 75 mph (121 km/h). Both wagon types are designed to carry up to 9 feet 6 inches (2.9 metres) high containers. They have a similar central spine construction with outriggers to support the load (figure 3).



Figure 3: Spine construction of FEA-B and FEA-S wagon types

- 15 The FEA-B and FEA-S wagon types can carry various combinations of 20, 30, and 40 ft containers or a single 45 ft container. They are provided with ten pairs of spigots which can be deployed as required to carry, for example, three 20 ft containers or one 20 ft container and one 40 ft container. The containers carried on FEA-B and FEA-S wagons have corner castings which locate on the spigots. The spigots are designed with inboard hinges so that they can be rotated manually and stowed in recesses in the wagon bed when not in use (figure 4).



Figure 4: Fold-down spigot with inboard hinge, as fitted to FEA-B and FEA-S wagons, deployed (left), stowed (right)

- 16 Freightliner operates 267 FEA-B wagons (ie 534 vehicles). It does not operate any FEA-S wagons (but does operate 66 FEA-E type wagons which are of a similar design to the FEA-S wagon in that they are single vehicles with the same type of inward-hinging spigots). GB Railfreight has 63 FEA-S wagons and 15 FEA-B wagons, making a total of 93 vehicles.

### Operation of UIC spigots

- 17 The design standard that applies to spigots on container wagons is UIC<sup>4</sup> 571-4 'Standard Wagons – Wagons for combined transport – characteristics'. Spigots designed to this standard are generally known as 'UIC' spigots.
- 18 The head of a UIC spigot is shaped to guide the container corner casting on and off the spigot during loading and unloading. A UIC spigot that complies with UIC 571-4 also provides overturning restraint in windy conditions. The principal of operation of a UIC spigot is illustrated in figure 5. Studies<sup>5</sup> have shown that wind forces acting on the windward side of the empty container will first slide the container laterally from its central position relative to the spigots (figure 5a) until the windward corner castings contact the neck of the windward spigot (figure 5b). If the wind is strong enough to cause the windward side of the container to lift, the corner castings on the windward side of the container will engage with the underside of the spigot heads (figure 5c). This engagement provides the necessary vertical restraint to hold the container and stop it from lifting further.

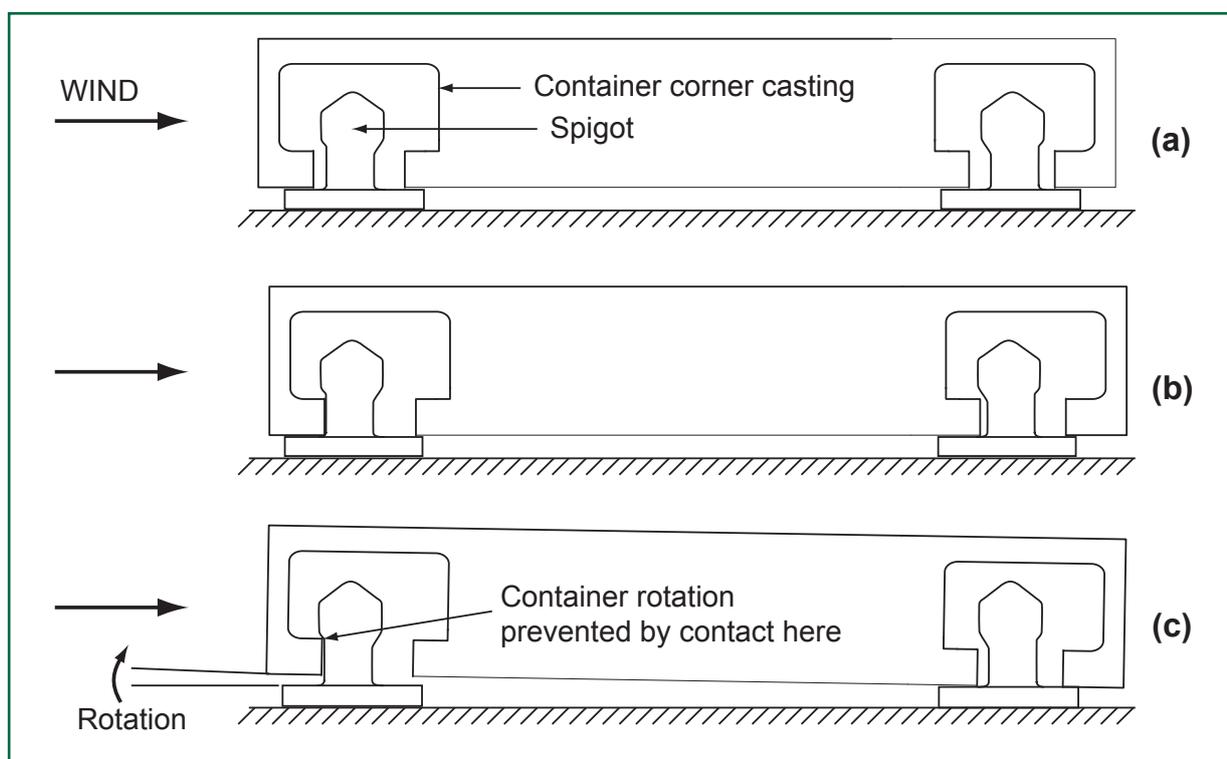


Figure 5: Principle of operation of spigots in windy conditions

<sup>4</sup> Union International Chemins de Fer.

<sup>5</sup> Johnson T, 'Overturning mechanisms of unsecured containers on DB', British Rail Research report, September 1990.

- 19 The UIC specifies that the spigot must not be able to tilt inwards (ie toward the centre of the vehicle) by more than 2 degrees from the vertical to prevent excessive rotation of the spigot with the lifting container. The spigots on FEA-B and FEA-S wagons do not comply with this standard because they are designed to rotate inwards beyond the permitted two degrees of rotation.

### Previous container detachments and industry response

- 20 On 1 March 2008 a total of seven containers were blown from FEA-B wagons, five at Hardendale (Cumbria) and two at Cheddington (Buckinghamshire). On 9 March 2008 Freightliner, who operated the train involved at Hardendale and who led the industry response, issued National Incident Report (NIR) 2350<sup>6</sup> to alert the rail industry to emerging concerns about the ability of inward-hinging spigots to provide overturning restraint in high winds. Freightliner also advised of its intention to design and procure spigot pins to mechanically lock empty containers to spigots (figure 7). The train involved at Cheddington was operated by Fastline Freight, which is no longer in business.
- 21 Prior to the introduction of spigot locking pins, Freightliner stated in the NIR that it was implementing a company operating procedure imposing a speed restriction of 60 mph (97 km/h) on trains carrying empty containers on FEA-B wagons if the daily weather forecast summary, issued by Network Rail's National Operations Centre (NOC), indicated winds in excess of 55 mph (89 km/h) over the next 24 hours. If wind speeds of more than 65 mph (105 km/h) were forecast for an area then Freightliner would not load empty containers on FEA-B wagons passing through that area.
- 22 This operating procedure was derived from Freightliner's calculations of the aerodynamic force acting on a container from a cross wind. This force arises from a combination of the train speed and wind speed (called the resultant wind speed) which acts at an angle relative to the track (called the wind angle). It follows that the lower the resultant wind speed, the lower the aerodynamic force on the container. Freightliner reported that the threshold wind speeds which triggered its operating procedure were selected to provide a margin of safety when compared with the likely wind speed experienced at Hardendale.
- 23 To support this procedure Network Rail arranged for its weather forecast provider to send a 'strong wind warning' by email to the NOC whenever wind speeds of more than 55 mph (89 km/h) were forecast or measured in real time within a weather zone (figure 6). The NOC would then forward the email containing the strong wind warning to freight operators. This notification process was in addition to the normal 24-hour national weather forecast issued around 03:00 hrs each day by Network Rail's weather forecast provider for the 24-hour period starting at 06:00 hrs. The daily forecast is broken down into 23 zones and details the expected weather conditions, including wind speeds, for each zone.

<sup>6</sup> The National Incident Reporting (NIR) system is a web-based database managed on behalf of the rail industry by RSSB for the rapid sharing of safety-related information. It was established to meet an obligation on railway bodies to report urgent high-risk defects so that information on the problem and the proposed solution is available to other organisations who may be similarly affected. Such organisations are also required to input to the NIR database any actions they are taking as a result of receiving the NIR.

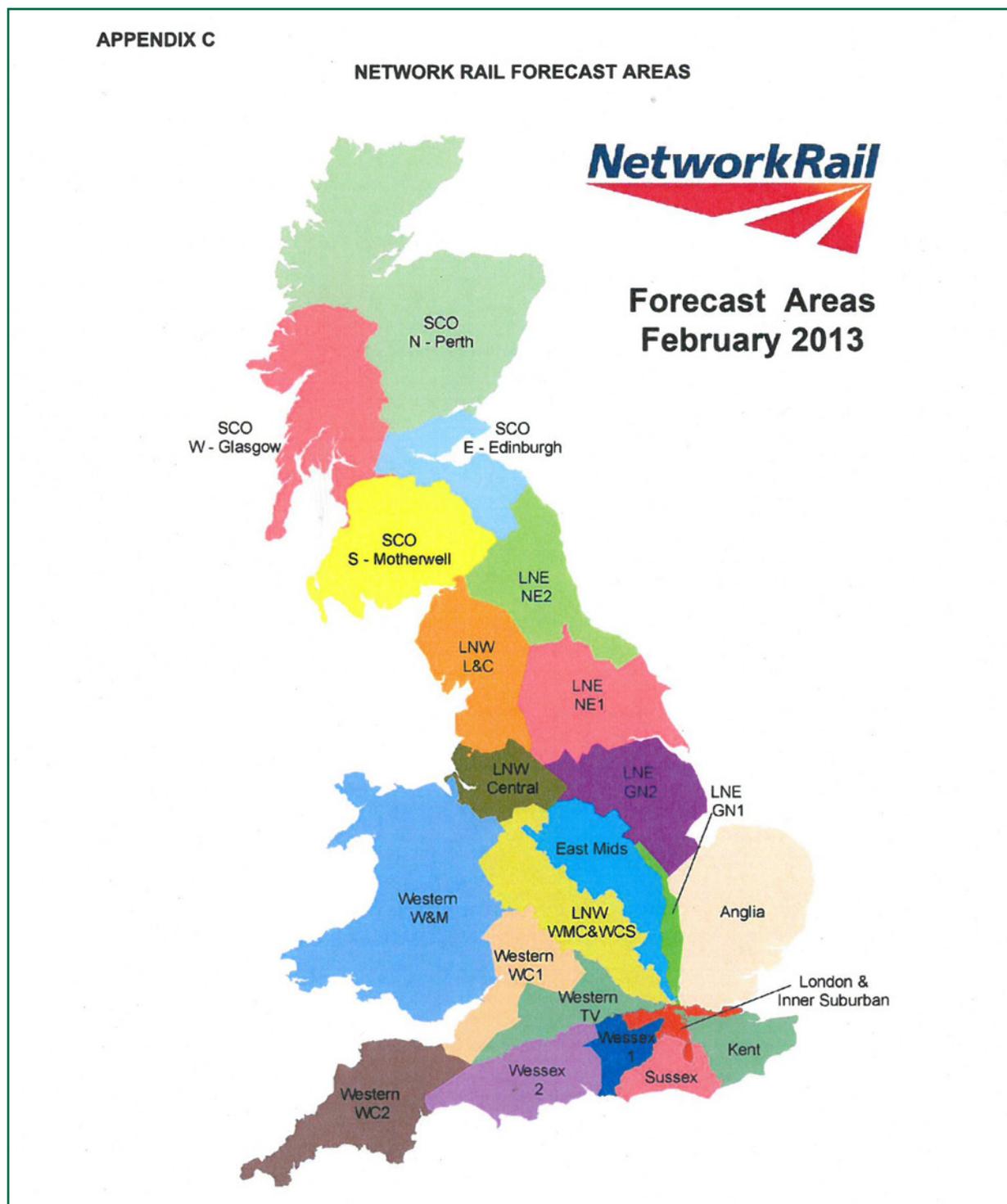


Figure 6: Network Rail's weather zones<sup>7</sup> (image from Network Rail standard NR/L3/OCS/043/7.1 Issue 6 National Control Instructions, courtesy of Network Rail)

- 24 In April 2008 GB Railfreight recorded its response to the receipt of NIR 2350 (paragraph 20) indicating that it had adopted the operating procedure outlined by Freightliner (paragraph 21) to control the risk of container detachment in high winds.

<sup>7</sup> At the time of the incidents, 'Western W&M' had been renamed 'Wales' and divided into Wales North and Wales South.

- 25 Freightliner reported that it began using spigot locking pins (figure 7) in June 2008 to secure empty containers to the spigots of FEA-B wagons (and also on its FEA-E wagons, which have the same design of inward hinging spigots) when wind speeds of over 55 mph (89 km/h) were forecast, removing the need to restrict the train speed to 60 mph (97 km/h) in high wind conditions.
- 26 GB Railfreight reported that it had considered the use of spigot locking pins to attach empty containers to spigots but dismissed this as an option, on the grounds that the risks outweighed the benefits. Its assessment was that the adverse wind conditions requiring the securing of empty containers on non-compliant spigots were so infrequent that the lack of familiarity of staff with the need to use, check and remove the pins, could result in a container being lifted from a wagon while it was still attached. This in turn could damage the crane and result in the wagon being derailed. GB Railfreight told the RAIB that there were also cost considerations arising from extended dwell times at Felixstowe port as a result of the additional time required to remove the spigot locking pins before unloading containers.

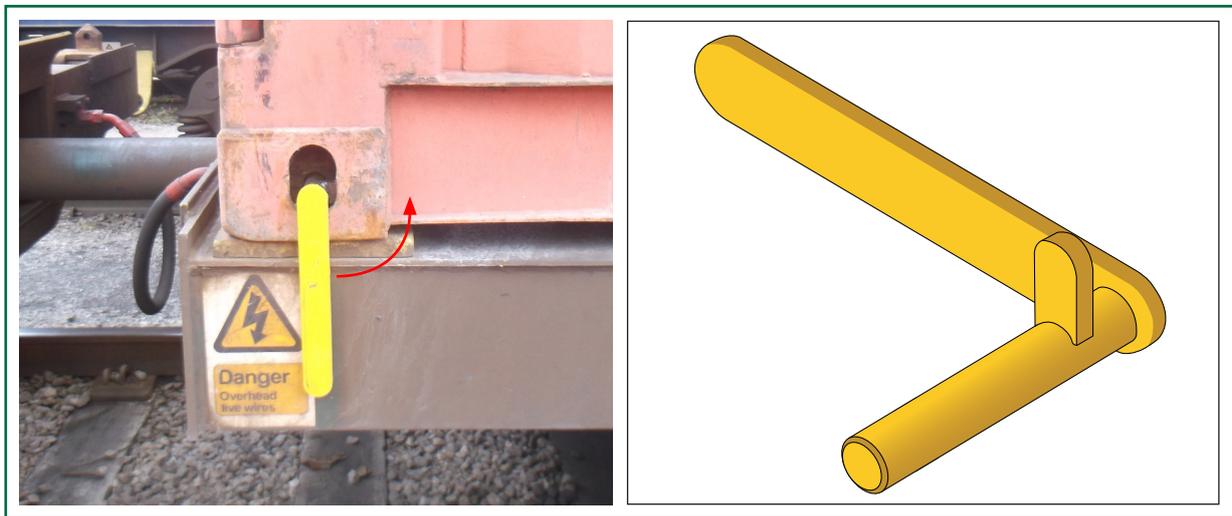


Figure 7: Pin used to secure the container corner casting to the spigot head (images courtesy of Freightliner)

### Previous RAIB recommendations

- 27 In May 2009 the RAIB published its investigation report into the container detachments at Hardendale and Cheddington ([RAIB report 12/2009](#)). The investigation found that spigots with inboard hinges do not comply with UIC 571-4 because the spigot is free to tilt inwards towards the centre of the vehicle by more than the permitted two degrees of rotation (paragraph 19). Once a container starts to lift on the windward side and engages with the neck of the spigot, the spigot rotates on its inboard hinge with the container and cannot prevent the container from overturning (figure 8).

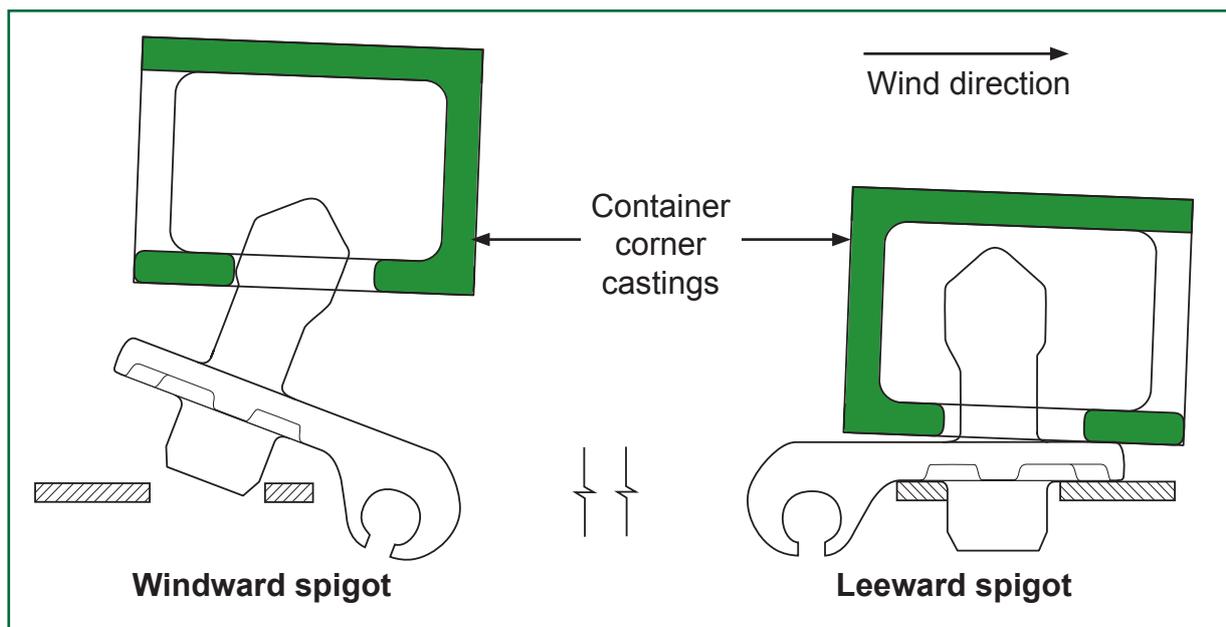


Figure 8: Mechanism of container detachment on spigots mounted on inboard hinges (not to scale)

- 28 Two of the ten recommendations made by the RAIB report were specifically addressed to freight operating companies running wagons fitted with non-compliant UIC spigots.

#### Recommendation 1

Freight Operating Companies running wagons fitted with non-compliant UIC spigots, should review the threshold speeds in NIR 2350 above which special measures are taken when conveying empty or lightweight containers in windy conditions and check that the following factors are taken into account:

- local wind acceleration effects due to topography, on routes they cover;
- minimum container weights and container sizes being transported; and
- design of the wagons used (eg conventional or spine type underframe).

#### Recommendation 3

Freight Operating Companies running wagons fitted with non-compliant UIC spigots, should develop and implement solutions to reliably retain empty or lightweight containers in windy conditions, in order to eliminate the need for special measures in the long term.

- 29 Recommendation 1 was made because the maximum gust speed measured by the local weather station at the time of the container detachments at Cheddington was around 48 mph (77 km/h), ie below the 55 mph (89 km/h) wind speed threshold for implementing the operating procedure in NIR 2350. The RAIB had also found that the threshold wind speeds did not allow for localised acceleration of the wind when it encounters topographical features, such as embankments. The RAIB calculated that the seven metre high embankment on which the train was running at Hardendale increased the ambient wind speed by approximately 30%. In addition, the wind speed thresholds in the NIR did not take account of the remoteness of some weather stations from the railway and the potential for actual wind speeds at the railway to be higher than those measured some distance away.

- 30 The reasoning behind recommendation 3 was that an engineered solution to remedy the design defect inherent in the inward folding spigot and achieve compliance with UIC 571-4, would provide a reliable and permanent higher level of safety than dependence on the consistent application of special measures in an operating procedure.

### **Actions taken by industry in response to RAIB recommendation 1**

- 31 Freightliner acted on RAIB recommendation 1 to review the wind speed thresholds in NIR 2350 and, in June 2009, issued a revised company operating instruction, implementing a lower wind speed threshold of 50 mph (80 km/h). Freightliner reported that its reduced wind speed threshold took account of wind acceleration due to topographical features on the routes it used. The actions mandated by the revised operating procedure were to be triggered by forecast wind speeds in the daily forecast and not by the issue of a strong wind warning, which continued to be issued for forecast wind speeds of more than 55 mph (89 km/h).
- 32 In October 2011, Freightliner updated its report in NIR 2350 (see footnote 6) detailing the revised remedial action it was taking to mitigate the risk of container detachment in high winds. Freightliner's updated entry advised the rail industry of its adoption of a wind speed threshold of 50 mph (80 km/h) at which spigot locking pins would be used. It also stated that its wagons would be modified to comply with UIC 571-4 when they were given a major overhaul. This is currently planned to take place in 2016.
- 33 GB Railfreight did not carry out an independent review of the threshold wind speeds in NIR 2350, as recommended by the RAIB. GB Railfreight stated that it followed the industry lead taken by Freightliner because Freightliner was the main operator of container services at that time, and the container overturning risk for the FEA-B wagon types, mainly operated by Freightliner, was the same for the FEA-S wagons operated by GB Railfreight.
- 34 GB Railfreight continued to apply the wind speed thresholds in the original (2008) NIR 2350 (paragraph 21) because it considered these to adequately control the risk of container detachment. GB Railfreight reported that it was not aware that Freightliner was using a lower wind speed threshold of 50 mph (80 km/h) to trigger additional mitigation measures (paragraph 31). However, unlike Freightliner which was employing spigot locking pins to secure containers to non-compliant spigots when a wind speed of 50 mph (80 km/h) was forecast, GB Railfreight was solely reliant on a train speed reduction to 60 mph (97 km/h) to control the risk of container overturning when winds speeds of more than 55 mph (89 km/h) were forecast.

### **Actions by industry in response to RAIB recommendation 3**

- 35 Greenbrier, the manufacturer of the FEA wagons, informed the RAIB that it had actively worked with Freightliner to develop an engineered solution and a concept design dated August 2009 was prepared for Freightliner. However, Freightliner advised the RAIB in November 2015 that it considered Greenbrier's proposed solution to be impractical and did not pursue it further.

- 36 In July 2014 Freightliner commissioned an engineering consultancy to design a means of securing inward-hinging spigots when in their deployed position to enable the spigots to retain a container under wind loading. This work was on-going at the time of the container detachment at Scout Green.
- 37 GB Railfreight reported to the RAIB that it had consulted with the companies from whom it leased its FEA-B and FEA-S wagons to consider the options for modifying the design of non-compliant UIC spigots. GB Railfreight were of the view that the spigots had been non-compliant with UIC 571-4 since the wagons were built and it therefore expected the cost of any remedial work to be subject to a financial arrangement with the owners of the vehicles. Discussions were to continue but at the time of the container detachment on 31 March 2015, GB Railfreight had no plans to modify the spigots on its FEA-B and FEA-S wagons.

### Response of the safety regulator

- 38 In September 2012 the safety regulator, the Office of Rail Regulation (ORR)<sup>8</sup>, reported to the RAIB that the freight industry had implemented recommendations 1 and 3 (paragraph 28).
- 39 With regard to recommendation 1, ORR reported that Freightliner had carried out the review of wind speed thresholds in NIR 2350 (paragraph 31) and, taking account of factors such as wind acceleration due to topographical features, had decided that a reduction in the wind speed threshold was needed to minimise the risk. However, the information submitted by GB Railfreight to ORR on the actions it had taken on this recommendation stated that GB Railfreight considered that the use of the operating restrictions in its company procedure were sufficient to manage the risk (paragraph 24).
- 40 With regard to recommendation 3, ORR advised the RAIB that Freightliner had consulted with the wagon owner, and was unable to identify an acceptable long-term solution to the issue of non-compliant spigots. As a result, Freightliner proposed to continue to pin empty or lightweight containers in windy conditions. On the basis of the information provided, ORR considered that Freightliner had done all that was reasonably practicable to get the wagon owner to modify the vehicles and deemed that the recommendation had been implemented. Although ORR had provided the RAIB with an interim report on 26 May 2010 advising on the progress made by other freight operating companies (including GB Railfreight), it did not specifically report to the RAIB whether the other companies had implemented the recommendation or provide an updated ORR response on the other companies' positions.

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<sup>8</sup> In October 2015, the Office of Rail Regulation formally became the 'Office of Rail and Road'.

## RAIB investigation findings

### Events leading to the container detachment at Scout Green

- 41 At around 03:00 hrs on 6 March 2015, the daily weather forecast was issued by Network Rail's NOC to freight operating companies. This forecast, which applied from 06:00 hrs on Friday 6 March to 06:00 hrs on Saturday 7 March, indicated that there were no weather hazards expected in the next 24 hours in the Lancashire and Cumbria weather zone.
- 42 At 02:58 hrs on 6 March 2015, Network Rail's weather forecast provider issued a strong wind warning for rail freight for the Glasgow, Edinburgh and Perth weather zones, warning of strengthening winds overnight between Friday and Saturday with gusts expected to slightly exceed 50 mph (80 km/h). Although the 55 mph (89 km/h) wind speed threshold in the NIR 2350 was not expected to be reached, the weather forecaster issued a strong wind warning for rail freight, reportedly to be on the side of caution. At 03:10 hrs this was forwarded by the NOC to freight operating companies, including Freightliner, and contained the standard instruction that any train including FEA-B wagons conveying empty containers was to adhere to a maximum speed of 60 mph (97 km/h), in accordance with the operating procedure in NIR 2350.
- 43 The strong wind warning, however, did not apply to the route of train 4S83 in Scotland. The route to Coatbridge was within the Motherwell weather zone (figure 6) which was not subject to operating restrictions.
- 44 At 22:09 hrs on 6 March 2015 Network Rail's NOC received an email from its weather forecast provider advising that gusts of just over 50 mph (80 km/h) had been recorded in Cumbria and that further gusts of up to 50 to 55 mph (80 to 89 km/h) were possible through the rest of the night. Although the forecast wind speeds were higher than those forecast for the Scotland weather zones (paragraph 42), which had earlier prompted the issue of a strong wind warning for freight, the weather forecast provider did not issue a strong wind warning for Cumbria as the wind speeds were not expected to exceed 55 mph (89 km/h).
- 45 From the time that 4S83 departed Basford Hall at 23:54 hrs, there were no strong wind warnings applicable to its route. At around 02:20 hrs it was travelling at 75 mph (121 km/h) on an embankment about 2.5 miles (4 km) south of Shap summit.
- 46 Wind speed measurements recorded by the Met Office weather station at Shap show that wind gust speeds rose steadily from around 40 mph at 18:00 hrs on 6 March to around 63.3 mph (102 km/h) at 02:00 hrs. The RAIB has calculated that the resultant wind speed for the train (paragraph 22) at 02:20 hrs on 7 March 2015 was in the region of 97 mph (156 km/h), acting at a wind angle of 38 degrees to the track. Under these conditions the critical overturning wind speed<sup>9</sup> would be exceeded, and container overturning could be expected to occur.

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<sup>9</sup> The resultant wind speed for a given angle of wind relative to the train's direction of travel, at which an unrestrained container would be expected to be blown off a wagon. The critical overturning wind speed is based on research done by British Rail Research in 1990 using test data measured on containers in Germany by Deutsche Bundesbahn in 1989.

- 47 The RAIB has discounted any contribution from the track in causing the container to detach. The last recording of track geometry by a measuring train on 3 March 2015 found no actionable defects on the approach to the site of the incident.

### Events following the container detachment at Scout Green

- 48 On 9 March 2015 Freightliner issued a revised operating instruction mandating the pinning of empty containers on its FEA-B and FEA-E wagons at all times, irrespective of the wind forecast. Freightliner reported this was because of the unreliability of the wind warnings it had received prior to the container detachment at Scout Green.
- 49 On 18 March 2015, following discussions with Network Rail on improving the procedures for communicating wind forecast information, Freightliner rescinded the requirement to pin empty containers at all times and replaced it with an operating instruction to pin empty containers when a wind speed of 41 mph (66 km/h) or more is forecast during the following 24 hour period. This was accompanied by more detailed instructions on applying a speed restriction of 60 mph (97 km/h) to trains with unpinned empty containers already in service when a strong wind warning is received. Freightliner has stated that it selected the reduced wind speed threshold of 41 mph (66 km/h) to allow for inaccuracies in wind forecast data based on its experience at Scout Green.
- 50 During this period Freightliner kept the industry informed of its initial and revised response by issuing NIR 3124.
- 51 On 25 March 2015, Network Rail issued an instruction on the operation of FEA wagons in high winds to all freight operating companies. This reproduced the procedure agreed with Freightliner and advised the industry that strong wind warnings would in future be issued when wind speeds of more than 40 mph (64 km/h) were forecast. The strong wind warning would require trains conveying empty containers on FEA-B and FEA-E wagons to run at a maximum speed of 60 mph (97 km/h) through the affected areas. However, where containers on FEA-B or FEA-E wagons were secured with spigot locking pins, normal train speeds would apply. The requirement not to load empty containers on FEA-B and FEA-E wagons when wind speeds in excess of 65 mph (105 km/h) were forecast remained unchanged. This instruction was current at the time of the container detachment near Deeping St Nicholas on 31 March 2015.
- 52 On 25 March 2015, the RAIB issued an Urgent Safety Advice to Network Rail and freight operating companies, advising them to carry out an urgent review of the adequacy of operating procedures to manage the risk of container loss from wagons with non-compliant spigots (Appendix C). It reiterated recommendation 3 from the Hardendale and Cheddington report (paragraph 28), urging industry to move more quickly from a situation where the risk was being managed by special operating procedures to one where it could be more reliably controlled by engineering design. The Urgent Safety Advice did not specifically mention the container overturning risk from FEA-S wagons but did refer to the risk from wagons with non-compliant UIC spigots in general.

- 53 GB Railfreight reported to the RAIB that, in response to the container detachment at Scout Green, it had decided that it would no longer load empty containers on its FEA-B and FEA-S wagons when a relevant strong wind warning was in place. This was GB Railfreight's policy at the time of the container detachment on 31 March 2015.

### Events leading to the container detachment near Deeping St Nicholas

- 54 On Tuesday 31 March the daily weather forecast summary, issued by Network Rail at 03:42 hrs, indicated that wind speeds of up to around 65 mph (105 km/h) were widely forecast for the areas of the route to be followed by train 4Z33.
- 55 A strong wind warning for rail freight was also issued at 04:05 hrs, in accordance with Network Rail's revised procedure on the operation of FEA wagons in high winds, dated 25 March 2015 (paragraph 51). The strong wind warning required trains including FEA-B and FEA-E wagons conveying empty containers to operate at a maximum speed of 60 mph (97 km/h).
- 56 GB Railfreight's operations control centre received the strong wind warning but because it did not specifically mention FEA-S wagons, the control centre decided that operating restrictions did not apply to train 4Z33. The train was therefore permitted to depart from Felixstowe conveying unsecured empty containers without a 60 mph (97 km/h) speed restriction being applied because, as far as GB Railfreight was concerned, there was no strong wind warning in place for this train. In the event, the locomotive hauling the train was experiencing a loss of traction power and as a consequence, the journey from Felixstowe was mainly made at speeds of less than 60 mph (97 km/h). The RAIB has confirmed this by analysis of the train's data recorder. It is noted that the GB Railfreight train that passed train 4Z33 in the opposite direction shortly before the container detached (paragraph 11) also included four FEA-S wagons conveying empty containers. None of these detached.
- 57 The locomotive hauling train 4Z33 was fitted with forward and rear facing closed circuit television (CCTV) cameras. These recorded an apparent deterioration in weather conditions around the time of the detachment; the sky darkened and strong gusts of wind blew debris across the track from adjacent fields. Images from the rear facing camera captured the third container in the train overturning about its leeward spigots and falling from the wagon (figure 9). It was struck by a wagon outrigger and swung across the adjacent track before being pulled into line and dragged by the train for about 60 metres.
- 58 Taking the worst case wind gust speed of 67.8 mph (109 km/h) measured near the site of the container detachment, and a train speed of 38 mph (61 km/h) the RAIB has calculated the resultant wind speed to be 78 mph (125 km/h) at a wind angle of around 61 degrees (paragraph 22). These figures indicate that a container overturning could theoretically occur, but there is no record of any containers previously detaching in these conditions. It is possible that the wind gust speed was higher at the railway than that measured at the wind farm. It is also possible that the gap in the line of containers immediately in front of the container that detached may have had some bearing on the aerodynamics around the container (there were similar gaps preceding the first containers to detach at Hardendale, Cheddington, and at Scout Green).

- 59 The RAIB has discounted any contribution from the track in causing the container to detach. The last recording of track geometry by a measuring train on 2 March 2015 found no actionable defects on the approach to the site of the incident.

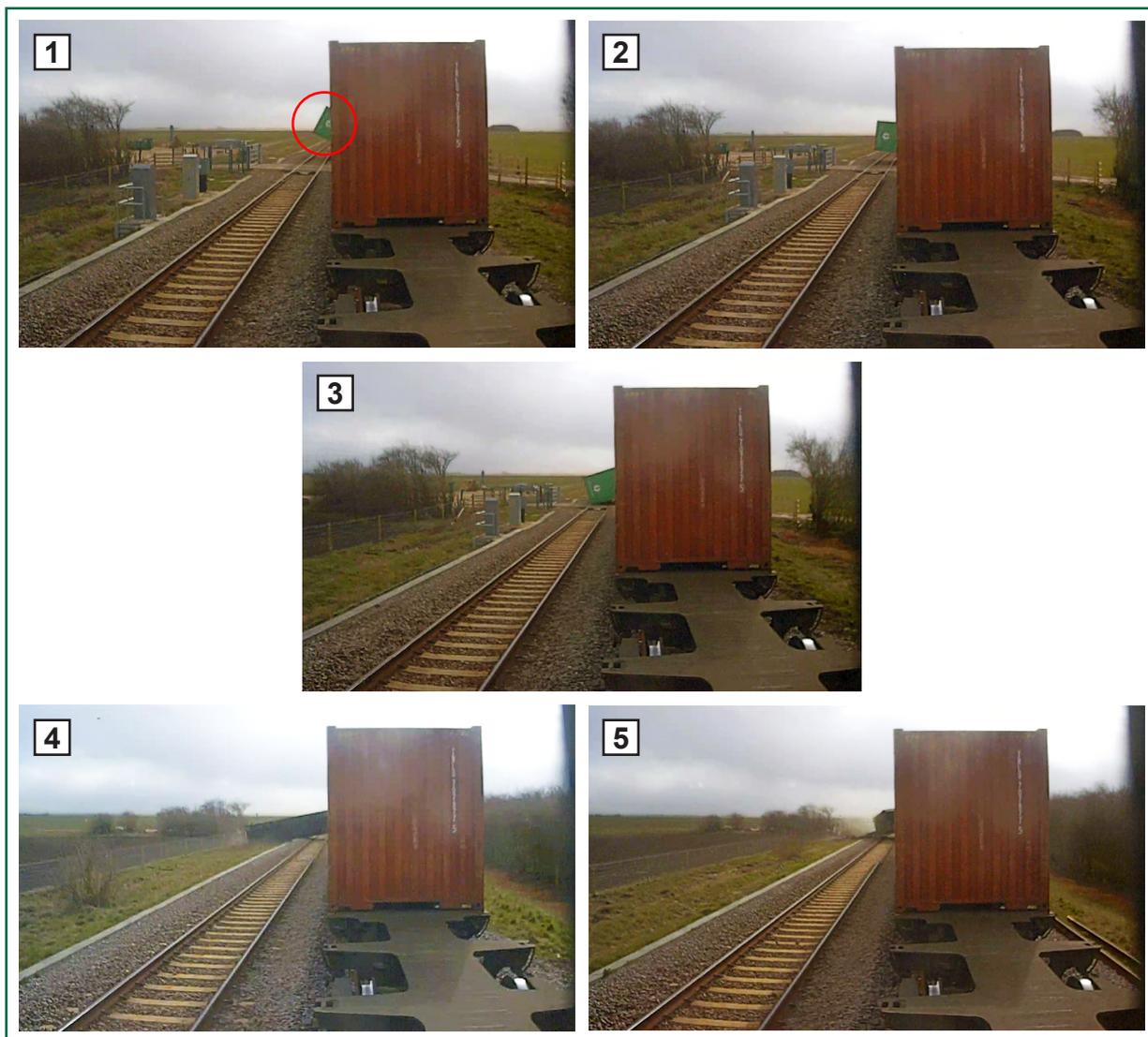


Figure 9: Series of images recorded by the rear facing camera on the locomotive of train 4Z33 to show the container detachment (images courtesy of GB Railfreight)

### Events following the container detachment near Deeping St Nicholas

- 60 On 2 April 2015 Network Rail issued an instruction to all freight operating companies prohibiting, with immediate effect, the carriage of empty containers on FEA type wagons with non-compliant UIC spigots (ie FEA-B, FEA -E and FEA-S wagon types) unless they were mechanically secured to the wagons. This instruction, which applied irrespective of wind speeds, was to remain in place until investigations into the container detachments at Scout Green and near Deeping St Nicholas were concluded and any actions arising implemented.

- 61 Network Rail has reported to the RAIB that it took this immediate action because the container detachment at Deeping St Nicholas occurred at a train speed of 38 mph (61 km/h), which was significantly below the previously understood safe operating speed for conveying empty containers in strong winds.
- 62 This instruction was subsequently relaxed by Network Rail to require the securing of empty containers on FEA-B, FEA-E and FEA-S type wagons when wind speeds of more than 40 mph (64 km/h) were forecast. The option of limiting the maximum speed of the train to 60 mph (97 km/h) to control the risk was removed.
- 63 GB Railfreight reported to the RAIB on 19 May 2015 that its decision not to pin empty containers was unchanged because of the difficulty it would face in managing the process. It would instead manage the risk in other ways. However, this position was reviewed shortly afterwards and a programme to implement the pinning of empty containers on its FEA-B and FEA-S wagons was put in place with a completion date of 6 July 2015. The pinning of containers will now take place when winds over 40 mph (64 km/h) are forecast, in accordance with Network Rail's instruction (paragraph 62).
- 64 Meanwhile, Freightliner has maintained its policy of pinning all empty containers on its wagons with non-compliant UIC spigots regardless of the forecast wind speed. This is because of the practical difficulties it would face should a strong wind warning be issued for a train already in service; trains would have to be recessed in sidings until wind speeds reduced.

### Deficiencies in the industry operating procedure

- 65 The industry procedures, which were intended to mitigate the risk of containers being blown from wagons with non-compliant spigots, were deficient for the following reasons:
- the wind speed thresholds adopted by freight operating companies were not based on the best available technical data on critical overturning speeds for containers at that time; and
  - risk mitigation measures were not applied to all wagon types with non-compliant UIC spigots.

Each of these is now considered in turn.

#### Wind speed threshold

- 66 Freightliner's company operating procedure for reducing the likelihood of a container being blown from a train in high winds had a trigger wind speed threshold of 50 mph (80 km/h) (paragraph 31). GB Railfreight's company procedure, however, was triggered at a wind speed threshold of 55 mph (89 km/h) (paragraph 34). Although the lower wind speed threshold would provide more of a margin of safety, neither Freightliner nor GB Railfreight was able to demonstrate that the wind speed thresholds took sufficient account of topographical factors, such as embankments, affecting the actual wind speeds experienced at the railway, as had been recommended by the RAIB in its Hardendale and Cheddington report.

- 67 Five of the seven containers that detached at Hardendale and Cheddington were blown off in cross wind gusts calculated to be less than 50 mph (80 km/h). Therefore, neither the threshold wind speed of 55 mph (89 km/h) in NIR 2350, nor the lower threshold of 50 mph (80 km/h) subsequently used by Freightliner, could have been expected to reliably prevent a recurrence.

#### Application of operating restrictions to all wagons with non-compliant spigots

- 68 Until 25 March 2015 the strong wind warning forwarded by the NOC to freight operating companies required the operating restrictions in NIR 2350 to be applied only when empty containers were being conveyed on FEA-B wagons. This is because Network Rail was unaware that other wagon types also had non-compliant spigots. Freightliner told the RAIB that it had addressed this omission by issuing an internal instruction to its staff to apply the same operating restrictions to its FEA-E wagons.
- 69 However, although GB Railfreight's company operating procedure required its control staff to apply operating restrictions to trains conveying empty containers on FEA-B and FEA-S wagons when winds speeds of more than 55 mph (89 km/h) were forecast (as was the case on 31 March 2015), the control staff did not apply operating restrictions to train 4Z33. This was because the strong wind warning issued by Network Rail referred only to FEA-B and FEA-E type wagons and did not specifically mention FEA-S wagons. Senior managers at GB Railfreight confirmed to the RAIB that they had been aware FEA-S wagons were subject to the same risk of container detachment in strong winds.

#### **Arrangements for communicating wind warnings to freight operators**

- 70 The process put in place by Network Rail to provide freight operating companies with strong wind warnings (paragraph 23) was separate from its core processes for weather management in NR/L3/OCS/043 'National Control Instructions'. These instructions set out detailed steps to be taken for increasing levels of weather severity, including high winds, but do not cover the management of risk relating to containers detaching from wagons, necessary to support NIR 2350 (paragraphs 20 to 23). The process for issuing strong wind warnings relating to container overturning was, however, contained in Network Rail's training manual for new staff working in the NOC.
- 71 Network Rail found during its investigation of the container detachment at Scout Green that the conditions requiring the issue of a strong wind warning were not mutually understood between itself and the weather forecast provider. In particular, Network Rail found that it had not specified a requirement to be notified immediately of localised wind gusts measured at a single weather station which exceeded the threshold of 55 mph (89 km/h).
- 72 The use of email to issue warnings of strong winds depended on recipients regularly checking their emails. At busy times it is possible that emails could be overlooked, leading to delayed implementation of the operating procedure. Network Rail found, for example, that there had been a delay of 69 minutes between the receipt and forwarding of an email containing a strong wind warning, issued a few hours after the container had detached at Scout Green. The email system also did not provide feedback to the NOC to confirm that a forwarded email had been opened and acted upon.

## Implementation of company operating procedures

- 73 After a strong wind warning had been issued, Network Rail was not party to the implementation of company operating procedures for mitigating the risk of container detachment. Network Rail has stated that its signallers and route controllers were not briefed on the procedure in NIR 2350 and were not expected to contact relevant trains so that instructions to reduce the train speed to a maximum of 60 mph (97 km/h) (in accordance with Freightliner's and GB Railfreight's operating procedures), could be passed to the drivers.

## Lack of an engineered design solution

- 74 In the seven years since the incidents at Hardendale and Cheddington, little progress had been made in achieving an engineered solution to non-compliant spigots. However, the engineering consultancy employed by Freightliner in July 2014 (paragraph 36) has designed a potential modification to secure spigots when in the deployed position and the RAIB has seen the results of prototype tests. Freightliner reports that an engineered solution now appears feasible.
- 75 GB Railfreight has reported to the RAIB that since the container detachment near Deeping St Nicholas, it has been working with its wagon owner and its maintainer on an engineered solution to allow unrestricted carriage of empty containers on its FEA-B and FEA-S wagons. It has reported that a modification to the inward-hinging spigot, to prevent container overturning in high winds, has been developed and is to be trialled.
- 76 Notwithstanding the recent progress made by Freightliner and GB Railfreight to develop a permanent engineered solution, the RAIB considers that had the parties involved acted earlier to develop such a solution, the FEA-B and FEA-S wagons involved in these two incidents would already have been modified and these incidents could have been avoided.

## Learning points<sup>10</sup>

77 The RAIB will not make any further recommendations as a result of this investigation. This is because measures to prevent a recurrence are already contained in recommendations in a previous RAIB report. Network Rail is taking action to address the additional issues relating to the communication of wind warnings to freight operators and the operational procedures to facilitate the adoption of mitigation measures when such warnings are issued. However, the RAIB has identified the following key learning points:

- 1 When operating procedures are employed as a means of mitigating safety risk they must be based on a good understanding of that risk. In this instance the wind speed thresholds for applying company operating procedures were not derived from suitable modelling of all the relevant risk factors, such as local topography (eg embankments) and peak gusts. Recommendation 1 from the RAIB's Hardendale and Cheddington report remains valid.
- 2 Container detachments are infrequent but not exceptional events and have the potential to cause significant harm and damage to infrastructure. The RAIB considers that the incidents at Scout Green and Deeping St Nicholas reinforce the urgent need for an engineering solution to be found for non-compliant UIC spigots. Recommendation 3 from the RAIB's Hardendale and Cheddington report therefore remains valid.
- 3 The freight operators' company operating procedures to mitigate risk of container detachment in strong winds were not fully integrated with procedures at Network Rail and as a result could not be reliably implemented. It is important that where risk reduction is achieved using procedural measures, that such procedures are agreed by all parties, are tested and are part of a comprehensive system, including briefing, training, instructions, and monitoring, to ensure their consistent implementation.

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<sup>10</sup> 'Learning points' are intended to disseminate safety learning that is not covered by a recommendation. They are included in a report when the RAIB wishes to reinforce the importance of compliance with existing safety arrangements (where the RAIB has not identified management issues that justify a recommendation) and the consequences of failing to do so. They also record good practice and actions already taken by industry bodies that may have a wider application.

## Appendices

### Appendix A - Glossary of abbreviations and acronyms

CCTV	Closed circuit television
NIR	National incident report
NOC	Network Rail National Operations Centre
ORR	Office of Rail and Road
UIC	Union International Chemins de Fer

## Appendix B - Investigation details

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

- information provided by the freight operating companies involved and Network Rail;
- information taken from the trains' on-train data recorders;
- CCTV recordings taken from Felixstowe Container Port, Doncaster Railport, Peterborough station, various trains that passed train 4Z33 and from train 4Z33.
- site photographs and measurements;
- weather reports from near the incident sites and relevant weather warnings;
- track geometry data;
- records on the NIR system;
- company operating procedures;
- Network Rail company standards, procedures and instructions;
- train consists from the Total Operations Processing System; and
- a review of previous RAIB investigations relevant to these incidents.

## Appendix C - Urgent Safety Advice

RAIB SF-3.1.9.1  
ISSUE : 1  
27 OCTOBER 2005

### URGENT SAFETY ADVICE



1. INCIDENT DESCRIPTION			
<b>LEAD / INSPECTOR</b>		<b>CONTACT TEL. NO.</b>	
<b>INCIDENT REPORT NO</b>	0744	<b>DATE OF INCIDENT</b>	7 March 2015
<b>INCIDENT NAME</b>	Scout Green		
<b>TYPE OF INCIDENT</b>	Container blown off freight train		
<b>INCIDENT DESCRIPTION</b>	<p>At around 02:20 hrs on 7 March 2015, an empty 30 ft container was blown off an FEA(B) wagon, that formed part of train 4S83 operated by Freightliner. The train was travelling at around 75 mph (120 km/h) on the Down Main line in the vicinity of Scout Green, Cumbria, around 2.5 miles south of Shap Summit. The container passed over the adjacent Up Main line and came to rest at the bottom of the Up side embankment. There was no damage to train 4S83, any other train, the overhead line equipment or the track. Trees on the embankment and a boundary wall at its foot were knocked over.</p> <p>The incident took place at a time of high cross-winds. Although it did not result in injuries, the potential for more serious consequences is evident.</p>		
<b>SUPPORTING REFERENCES</b>	 <p>[Image courtesy of Network Rail (looking south)]</p>		

2. URGENT SAFETY ADVICE	
<b>USA DATE:</b>	25 March 2015
<b>TITLE:</b>	The control of risks associated with spigots that are non-compliant with UIC standard 571-4, particularly inward hinging designs.
<b>SYSTEM / EQUIPMENT:</b>	Container carrying wagons fitted with UIC spigots
<b>SAFETY ISSUE DESCRIPTION:</b>	<p>The ability of wagons fitted with UIC spigots to retain containers subject to overturning forces, such as those developed in high cross-winds, is dependent on compliance with the dimensional tolerances specified in UIC 571-4. Investigation of previous similar incidents at Hardendale and Cheddington in 2008, concluded that spigots which do not comply with UIC 571-4 are ineffective in such circumstances. The inward hinging spigots fitted to FEA(B) wagon involved in this incident did not comply with the standard.</p> <p>The intent of this safety advice is that urgent consideration be given to the efficacy of current measures that are intended to manage the risk of containers being blown off wagons fitted with spigots that are non-compliant with UIC571-4, particularly inward hinging designs, and the steps that are required to fully implement recommendation 3 of the RAIB's investigation into similar incidents at Hardendale and Cheddington.</p>

## URGENT SAFETY ADVICE



<b>CIRCUMSTANCES:</b>	<p>On 1 March 2008, seven containers were blown off wagons in two separate incidents; one at Hardendale and one at Cheddington. The circumstances were almost identical to the incident at Scout Green: FEA(B) wagons; empty containers; high cross-winds; a train speed of around 75 mph (120 km/h); and the alignment running along an embankment. These incidents were investigated by the RAIB and recommendations made (RAIB report 12/2009).</p> <p>As a result of the previous incidents Freightliner report that prior to this incident, they were applying the following process for FEA(B) wagons in cross-winds:</p> <ul style="list-style-type: none"> <li>• if winds of over 55 mph (88 km/h) are forecast, any empty containers should be pinned or the maximum train speed reduced to 60 mph (96 km/h); and</li> <li>• if winds over 65 mph (104 km/h) are forecast, any empty containers should be removed or pinned.</li> </ul> <p>The forecast wind-speed for Cumbria on the night of 7 March 2015 was below 55mph (88 km/h) so none of these procedural mitigations were triggered. The wind-speeds measured at the local Shap weather-station were around 62 mph (100 km/h) at the time of the incident. As a result, Freightliner have since reduced the 55 mph (88km/h) wind-speed trigger level to 41 mph (66 km/h) and issued a National Incident Report (NIR) to inform the GB rail industry.</p> <p>Freightliner reports that it is fitting a prototype modification to the FEA(B) container retention system over the next six weeks. Subject to this being successful, they are aiming to complete the fitting of the fleet modification by the time the wagons are due for General Repair, scheduled to start in 2016.</p>
<b>CONSEQUENCES</b>	Risk of empty containers becoming detached from wagons fitted with non-compliant UIC spigots with the possibility of striking another train.
<b>SAFETY ADVICE:</b>	<p>It is seven years since the incidents at Hardendale and Cheddington. FEA(B) and some other wagon types continue to operate with non-compliant spigots. In the case of FEA(B), the refitting of whole fleet to remedy this is still some years away. In the interim, the risk of losing an empty container in high cross-winds continues to be managed by procedure. In this incident that procedure was ineffective for one or both of the following reasons:</p> <ul style="list-style-type: none"> <li>• wind conditions at the point the container was blown off were higher than forecast; and/or</li> <li>• the wind-speed thresholds used did not fully mitigate the risk.</li> </ul> <p>Since at least one of the above must have applied in this instance, the RAIB advises that Network Rail and Freight Operating Companies carry out an urgent review of the adequacy of current procedures that are in place to manage the risk of container loss from wagons with non-compliant UIC spigots, and their application. This review should consider whether existing action thresholds are appropriate, whether the forecast data is sufficiently reflective of actual conditions along the railway.</p> <p>In the circumstances the RAIB also wishes to reiterate recommendation 3 from the Hardendale and Cheddington investigation (RAIB report 12/2009). This incident at Scout Green demonstrates the need to move more rapidly from a situation where this risk is being controlled by procedure to one where it is more reliably controlled by hardware design.</p> <div style="background-color: #ffff00; padding: 5px;"> <p><b>Recommendation 3 of RAIB report 12/2009</b>        3 Freight Operating Companies running wagons fitted with non-compliant UIC spigots, should develop and implement solutions to reliably retain empty or lightweight containers in windy conditions, in order to eliminate the need for special measures in the long term.</p> </div>

USA SIGN-OFF*			
INSPECTOR NAME:		DCI NAME:	
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DATE:	25/03/15	DATE	25/03/15

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