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6 July 2016

Mr Andrew Hall
Deputy Chief Inspector of Rail Accidents
Cullen House
Berkshire Copse Rd
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Hampshire
GU11 2HP

Dear Andrew,

RAIB Report: Freight train derailment at Angerstein Junction

I write to report[1] on the consideration given and action taken in respect of the recommendations addressed to ORR in the above report, published on 12 August 2015.

The annex to this letter provides details of the consideration given/action taken in respect of these recommendations. The status of recommendation 1 is '**Implemented**'. We do not propose to take any further action in respect of this recommendation unless we become aware that any of the information provided becomes inaccurate, in which case we will write to you again.

The status of recommendations 2, 4 and 6 is '**Progressing**' and for recommendations 3 and 5 is '**Implementation ongoing**'. ORR will advise RAIB when further information is available regarding actions being taken to fully address these recommendations.

We will publish this response on the ORR website on 8 July 2016.

Yours sincerely,

Tracy Phillips

[1] In accordance with Regulation 12(2)(b) of the Railways (Accident Investigation and Reporting) Regulations 2005

Initial consideration by ORR

1. All 6 recommendations were addressed to ORR when the report was published on 12 August 2015.

2. After considering the recommendations ORR passed recommendation 1 to Aggregate Industries, recommendations 2 and 6 to RSSB and recommendations 3, 4 and 5 to Network Rail asking them to consider and where appropriate act upon them and advise ORR of its conclusions. The consideration given to each recommendation is included below.

3. This annex identifies the correspondence with end implementers on which ORR's decision has been based.

Recommendation 1

The intention of this recommendation is to prevent wagons operating on the network with unacceptable uneven retained loads after unloading.

Aggregate Industries, in consultation with relevant train operators, should review its processes for discharging aggregate hopper wagons, and for inspection of train loading and condition prior to despatch, to ensure that the risks arising from uneven residual loads are identified and effectively managed. Aggregate Industries should then implement appropriate control measures to mitigate this risk so far as is reasonably practicable.

ORR decision

4. Although ORR is not the enforcing authority for Aggregate Industries, in accordance with the Railways (Accident Investigation and Reporting) Regulations ORR has forwarded this recommendation on to the end implementer and considers that its response clearly demonstrates that:

a. Aggregate Industries has taken action to review and improve its processes for discharging hopper wagons; and

b. this action has resulted in a significant reduction in the level of risk from its operations.

5. ORR also notes Aggregate Industries' commitment to address any residual issues through its active participation in the work of the Cross Industry Freight Derailment Working Group (XIFDWG).

6. After reviewing the information provided ORR has concluded that, in accordance with the Railways (Accident Investigation and Reporting) Regulations 2005, Aggregate Industries has:

- taken the recommendation into consideration; and
- taken action to implement it.

Status: Implemented.

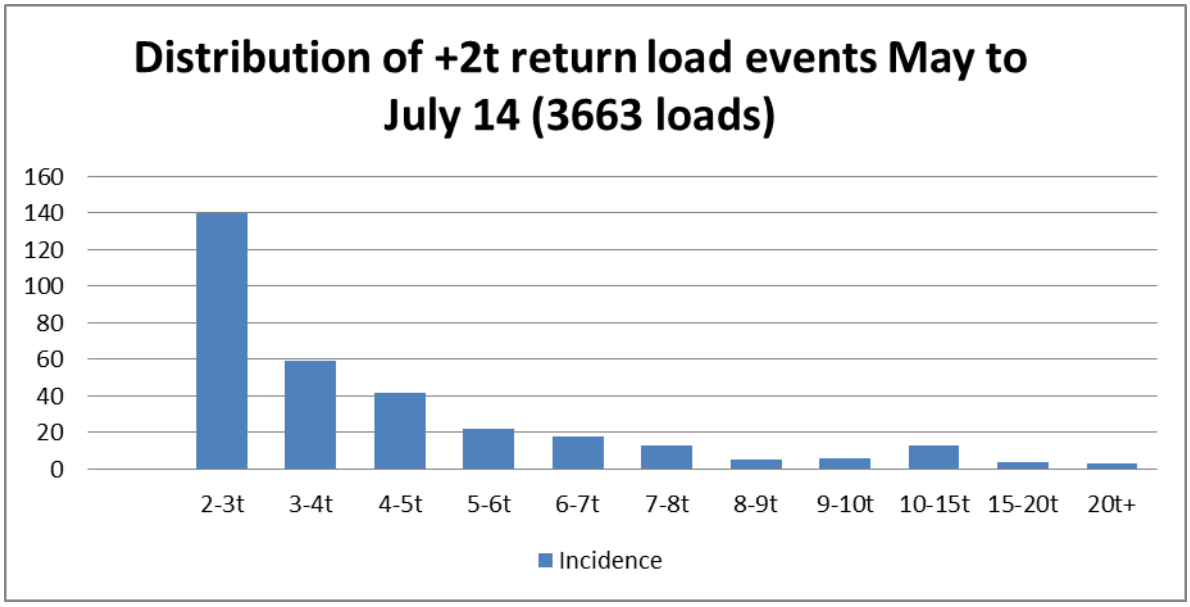
Information in support of ORR decision

7. On 9 November 2015 Aggregate Industries (AI) provided the following initial response:

Following the Derailment and the subsequent publication of the RAIB report, AI has taken a number of remedial actions, has revised certain procedures for implementation and is engaging with the wider industry to inform and participate in cross industry learnings.

The recommendation in the Report pertaining to AI relates to uneven residual loads. For clarity it is not part of AI's normal operation to release into traffic wagons that are partially loaded. It is AI's aim for wagons to be fully discharged as residual loads are not only inefficient but also introduce a significant level of contamination between the various product types AI transports. However leftover residue in wagons is not a new phenomenon and it is believed that the issue has existed for 20 plus years. Over these years a variety of mitigation factors having been tried with variable success, these have included wagon linings, wagon vibrators, air lances, various wagon strikers and other operational practices.

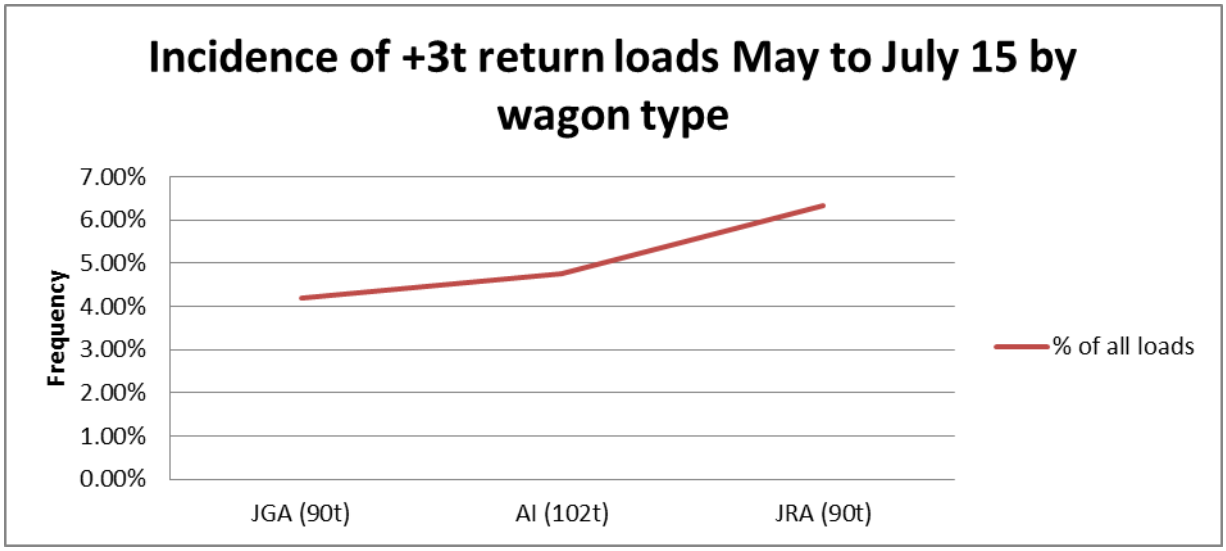
To provide a baseline from which to identify the effect of further risk reduction techniques, AI has analysed the records within its business, focussing on the ex Bardon Hill Quarry operation (the loading location prior to the Derailment). Other locations have been reviewed and have an incidence of residual load events a small fraction of those ex Bardon Hill. Graph 1 shows the incidence and distribution of residual loads immediately post the Derailment.



Graph 1

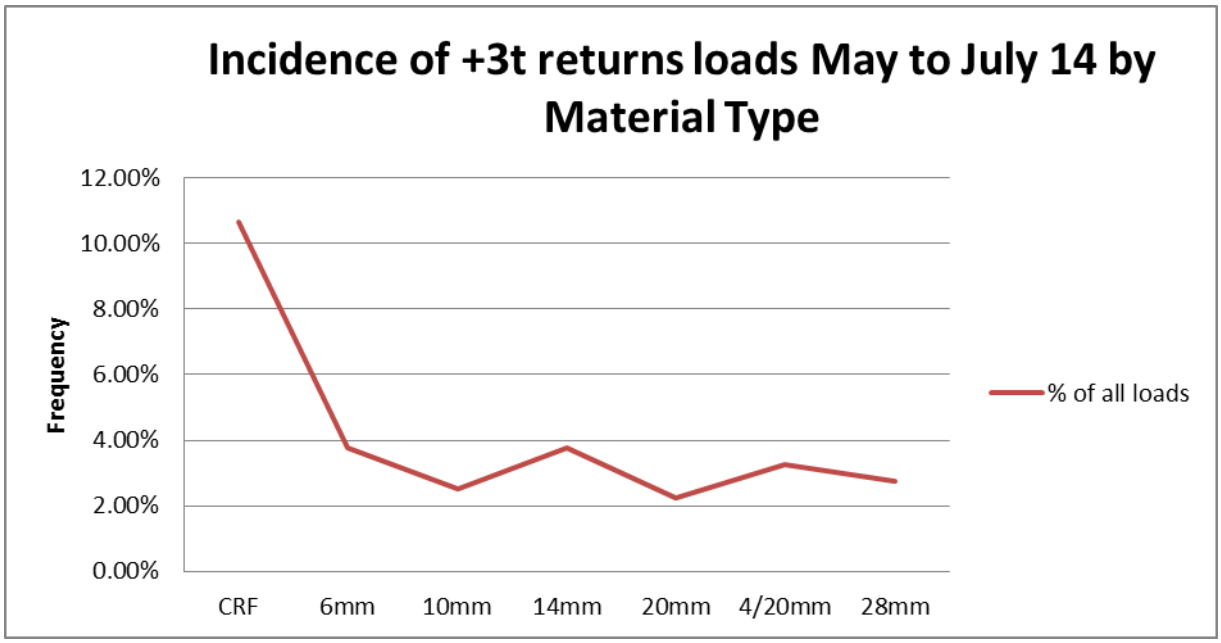
The data exhibits a normal distribution with a cumulative incidence of +2t return events of 8.87%.

Further analysis of this data was undertaken to identify whether particular wagon types (Graph 2) or material types (Graph 3) were of greater susceptibility.



Graph 2

This graph indicates the wagon type described as JRA (90t) has a greater propensity than others for retaining a load. This wagon type has a hopper body with more discrete compartments than the more open compartments of the other types used by AI and shown on Graph 2.



Graph 3

*This graph clearly identifies the product known as Crushed Rock Fines ("**CRF**") as being the major cause for residual loads. This product is a through graded 3mm down product, which demonstrates poor flow characteristics.*

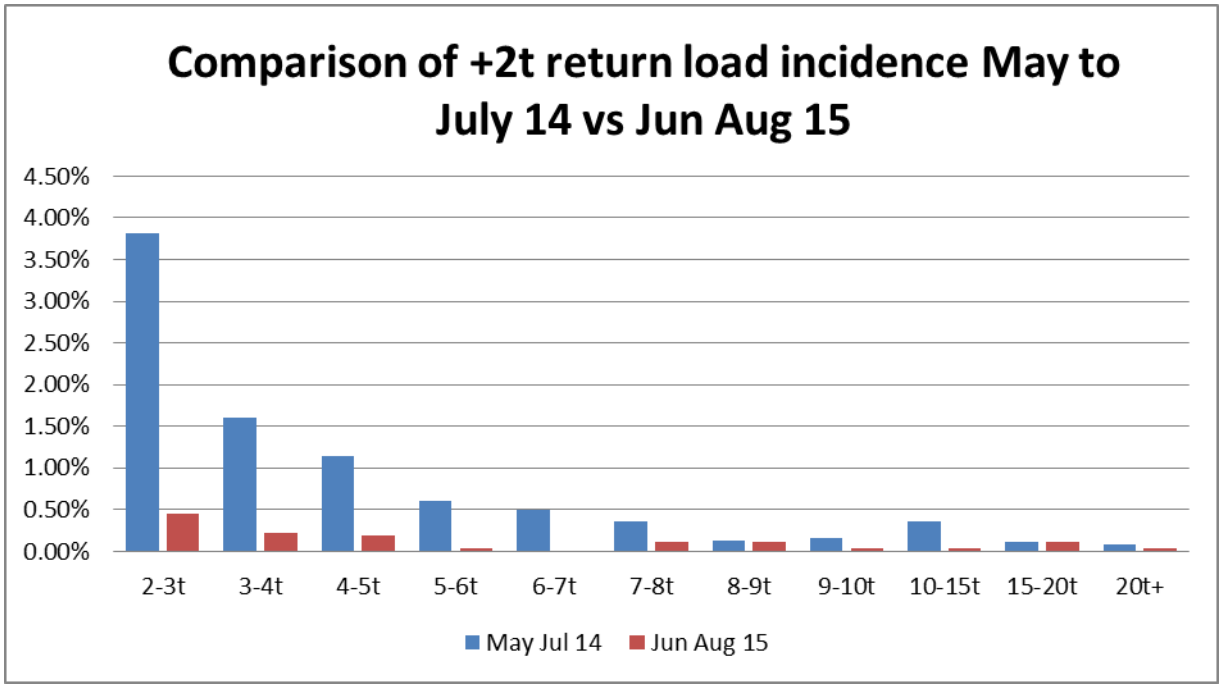
*Following the communication across its business of the Derailment circumstances and the RAIB generated Urgent Safety Advice ("**USA**"), AI has formed an internal working group with contributions from key operations to formulate actions to a) reduce the incidence of residual loads and b) manage the risk resulting from residual loads.*

1. Reducing the Incidence of Residual Loads

Measures which AI has established to reduce the incidence of residual loads include:

- ***Hopper wagon type selection:** at the weekly planning stage of AI's rail operation we select the wagons to operate particular flows. In recognition of the JRA (90t) wagon propensity to create a residual load we choose not to allocate this wagon to traffic which has a large proportion of CRF products.*
- ***Product delivery planning:** it was suspected that the duration of time materials spent in a wagon prior to discharge increased the likelihood of a residual load occurring. During the weekly planning event and at the daily order taking stage cognisance of this is taken and CRF's orders are loaded to minimise the period they are within the wagon.*
- ***Material conditioning**: to manage the fugitive dust generated from material handling and blow off en route, water sprays have traditionally been used as a dust suppression agent. This technique has now been replaced at Bardon Hill Quarry with a Foam System which results in a much drier product being transported which has better flow characteristics. A more detailed description of the Foam System is attached in Appendix 1.*

The combined effect of these actions can be seen in Graph 4.



Graph 4

The cumulative incidence over a similar three-month period shows a reduction from 8.87% to 1.33% fairly uniformly across the range. Despite this significant reduction to residual loads, AI has also identified further actions to implement as part of its endeavours to minimise incidence which include revisions to operating procedures for loading (consisting of material flow checks) and offloading (which include enhanced discharge operation if residual loads are present after normal operation). These actions will be implemented as part of

AI's commitment to minimising residual loads, with a completion target of 31 December 2015.

2. Risk Management of Residual Loads

Eradication of residual loads and completely discharging each and every wagon on each event is AI's goal in relation to its rail operations. Similarly to other rail transporters of aggregate materials and other bulk commodities (coal, bio fuel etc.), in normal operations, and additionally during periods of inclement weather (such as sub-zero temperatures), there will be occasions when loads will be incompletely discharged.

As part of its review of the Report, AI requested and received a copy of the Rail Freight Operators Association's Approved Code of Practice, prepared by the Freightliner Group and entitled "Inspection of Hopper Wagons with Uneven Residual Loads". It is AI's opinion that this document is not fit for purpose, is impractical and is not applied by freight operators due to its shortcomings, the proposal to red card all wagons identified with a residual load being an impractical solution.

Determining an appropriate procedure to effectively manage the risks from residual loads has proven to be particularly challenging. AI has been unable to establish what, if any, parameters can be applied to the magnitude and/or location of a residual load at this time. In addition, it would appear that there are no industry standards for wagon ride characteristics between laden and tare condition. However, AI has identified an RSSB led Freight Train Derailment Cross Industry Working Group which has been established to address similar unbalanced wagon operation, and secured an invite to participate in their next meeting. In relation to the RAIB Report concluding the residual load in wagon 546 being a significant causal factor in the Derailment, it is important to note a derailment which occurred under identical circumstances at the same precise location in June 2015, but with entirely empty wagons is perhaps an indication of the relative importance and magnitude of the other factors.

Despite the unknowns relating to the relative level of risk, AI is in the process of formulating a new procedure to manage this risk area. The elements of this procedure will be:

- *All relevant depots will have a means of internally inspecting wagons post offloading.*
- *Residual loads if present will be assessed against specific criteria to identify higher risk examples, photos and weight estimations will be used to assist in the process. (The criteria is planned to be set at 50% of the load contained on wagon 546 when it derailed i.e. 7 tonnes or greater.)*

  A White Card will be placed in the wagons card carrier identifying destination depot, estimated residual load and date.
- *The wagon will return to traffic due to the impracticality of removal at depot locations and the lack of suitable equipment to affect a full wagon discharge event. Experience recognises that the tare journey of such wagons and subsequent loading and off loading events can result in the residual load being freed and the wagon being fully discharged.*

- *The wagon will remain in traffic for up to seven days with the White Card being endorsed by further depots to monitor whether the residual load is reducing. If after this date the load remains greater than 7 tonnes it will be carded for removal at its base maintenance location.*
- *The wagon will be removed from traffic when it returns to its base maintenance location (AI's Bardon Hill Quarry) and an intervention event will be undertaken to remove the residual load. The wagon will then be returned to service.*

It is intended for this new procedure to be fully implemented by 31 December 2015. The procedure will be operated as a trial for a three-month period and then a review undertaken of its effectiveness. This procedure will provide the flexibility for AI to be able to accommodate new industry standards when available and provide a practical solution to managing risk reduction.

In summary we have already undertaken measures which have demonstrated a significant effect and have reduced the incidence of residual loads. We have further actions planned and ready for implementation which AI believes will further reduce the incidence of residual loads, which we will continue to monitor. In addition, AI has formulated a practical and flexible procedure for the management of risk presented by residual loads. We look forward to the improved performance and reduced risks from the combination of these measures and welcome any comments that you may have.

8. In view of the rail related aspect of this incident, ORR requested further information Aggregate Industries in respect of the further work that it was due to complete by 31 December 2015 and subsequently conduct a 3 month review.

9. On 20 April 2016 Aggregate Industries provided the following update:

AI had engaged with a Cross Industry Freight Derailment Working Group which had been established by RSSB to address a number of recommendations and concerns expressed by the ORR. A further meeting of a Bowtie Risk Assessment group will take place on 22 April 2016 at which it was expected that the area of operational procedures / practices relative to residual offset loads in hopper wagons will be discussed. This group will reach a consensus as to the appropriate actions relative to the risk and how parameters might be determined. Prior to this agreement AI has held back on trialling its formal, feedback and intervention for high risk loads.

AI has however continued to monitor and receive feedback from off loading points as and when any residual loads of significance have been witnessed. Following this feedback AI has taken appropriate action to return the wagon to its full tare condition at the earliest opportunity. The other actions it has implemented remain and monitoring continues. In the period January to March 2016 the overall incidence of +2t events was 1.7% which is in line with the performance experienced in the drier summer months of 2015.

Recommendation 2

The intention of this recommendation is to manage the contribution that diagonal wheel unloadings, due to twisted bogie frames or other defects, make to derailment risk. The RAIB notes that action taken in response to this recommendation could be informed by work undertaken as part of the railway industry's response to the ORR's letter of 5 December 2014 (paragraph 163).

RSSB, in conjunction with freight wagon operators, freight operating companies and entities in charge of maintenance for freight wagons, should review the extent to which diagonal wheel unloadings are present within freight wagon bogies that are operating on Network Rail infrastructure, and the contribution that this makes to derailment risk. This review should consider:

- identifying the magnitude and prevalence of diagonal wheel unloadings caused by bogie frame twist (and other possible causes);
- proposing criteria for acceptable levels of diagonal wheel unloading, or for bogie frame twist; and
- proposing proportionate measures for identifying, and then managing, unacceptable diagonal wheel unloadings

ORR decision

10. Whilst noting RSSB's plans to address this recommendation through the XIFDWG, it is not clear to ORR whether any other types of wagon other than hopper and container wagons may be subject to asymmetrical loading and therefore fall within the scope of this recommendation. RSSB has been asked to comment on this.

11. After reviewing the information provided ORR has concluded that, in accordance with the Railways (Accident Investigation and Reporting) Regulations 2005, RSSB has:

- taken the recommendation into consideration; and
- is taking action to implement it, but ORR has yet to be provided with a timebound plan.

Status: Progressing. **ORR will advise RAIB when further information is available regarding actions being taken to address this recommendation.**

Information in support of ORR decision

12. On 10 November 2015 RSSB provided the following initial response:

> *With reference to Recommendations 2 and 6 of RAIB's investigation report on the Angerstein Junction derailment of 2 April 2014, having already agreed to consider the derailment risk caused by asymmetrically loaded hopper wagons (due to residual loads), as well as asymmetrically loaded container wagons, the Cross Industry Freight Derailment Working Group also agreed (at its meeting of 23 September 2015) that Recommendations 2 and 6 fell within its scope. The*

recommendation will therefore be considered as part of the working group's programme.

13. ORR met with the chair of the XIFDWG (RSSB Safety Director), on 19 April 2016, to review progress in the Group's production of, amongst other things, its programme and workstream scopes as referenced in its letter dated 14 March 2016. ORR noted that the Group has a number of workstreams under way, some of which will potentially provide information which supports responses to RAIB recommendations. ORR agreed with XIFDWG's approach to RAIB recommendations, in that whilst the Group will endeavour to provide relevant information to support group members address their particular recommendations, it is for those individual members to ensure that their own recommendations are addressed and reported to ORR. This is line with the Railways (Accident Investigation and Reporting) Regulations 2005*.* ORR also noted that for this approach to be fully effective, the Group should define within its programme and supporting workstreams the boundaries of the workstreams so that Group members can consider what gaps to recommendation requirements might remain that they need to consider. ORR noted that the RSSB, on behalf of the Group, is developing a recommendation mapping tool for this purpose.

14. The XIFDWG met again on 16 May 2016 where the group's programme plan, remit and RAIB recommendations mapping outcome were discussed.

Recommendation 3

The intention of this recommendation is to ensure that the control of derailment risk in sidings takes account of the possibility of exporting that risk onto running lines.

Network Rail should review the processes by which track geometry is managed in sidings and connections on the approach to running lines, in order to identify and implement any changes necessary to ensure that the export of risk to running lines is effectively managed. This should include consideration of how dynamic track geometry is assessed on infrequently used lines.

ORR decision

15. ORR is satisfied that Network Rail's initial response demonstrates that work is progressing to deliver the recommendation. Subsequent discussions with Network Rail have provided clarification of how Network Rail will move to implementation of the recommendation by December 2016.

16. After reviewing the information provided ORR has concluded that, in accordance with the Railways (Accident Investigation and Reporting) Regulations 2005, Network Rail has:

- taken the recommendation into consideration; and
- is taking action to implement it by the end of December 2016.

Status: Implementation on-going. **ORR will advise RAIB when actions to address this recommendation have been completed.**

Information in support of ORR decision

17. On 17 December 2015 Network Rail provided the following initial response:

Network Rail will review the processes by which track geometry is managed in sidings and connections on the approach to running lines, in order to identify and implement any changes necessary to ensure that the export of risk to running lines is effectively managed.

3.1. The process to be applied to the review/consideration

3.1.1. Review the guidance currently provided within Network Rail standards with particular reference to BCRP Bowties / MoCs for the creation of a Track Geometry Inspection Plan (by March 2016);

3.1.2. Providing an overview of available dynamic testing methodologies including the appropriateness of these for differing infrastructure (running lines, sidings etc.) and any limitations i.e. ability to record at slow speed (by March 2016);

3.1.3. Consider the need to provide a form of risk based approach to inform the development of a Track Geometry Inspection Plan for the circumstances described in the recommendation; developing such if necessary (by March 2016);

- *Consider how dynamic track geometry is assessed on infrequently used lines by mapping the overview of available dynamic testing methodologies with the current asset register (by March 2016);*
- *Confirming what the criteria is which should be used to determine whether a piece of Track should be inspected dynamically (by March 2016)*

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3.2. The rigor to be applied to understanding potential issues

3.2.1. Do the current standards & existing bow ties to date provide clarity on the risks associated with infrequent measured lines? If found inadequate revise Standards & Bow ties

3.2.2. What are the current methodologies available & any alternatives? Are they effective in notifying the TME of the risk of derailment from geometry irregularities in sidings? Is there sufficient coverage of the network..? What alternatives measures are available & the practicality of employing such?

3.2.3. What are the additional factors that contribute towards the risk of derailment in sidings, e.g.

- *Tight Curvature*
- *Check rail availability*
- *S&C*
- *Line speed*
- *Axle load*
- *Component type*
- *Component condition & age*

3.2.4. Where on the network are the 'Gaps' of measurement coverage & what the physical limitations to achieving full coverage are? How does this compare with the risk model

3.3. The person proposed to be involved in the review/considerations

3.3.1. STE, Principal Track Engineer

3.3.2. STE, Principal Track Engineer

3.3.3. STE, Principal Track Engineer leading a workshop of other STE members with members of the RAM track & TME fraternity

3.3.4. STE, Principal Track Engineer leading a workshop of other STE members with members of the RAM track & TME fraternity

3.4. How the outcomes of the review/consideration will be documented

3.4.1. If adequate, summarise the salient points in the closure statement. If inadequate, set a programme to undertake an update to the standards / bow ties as appropriate

3.4.2. Summarise in a report the current state of the art & found deficiencies. Set a programme to conduct any improvements as appropriate

3.4.3. Develop a risk model that differentiates between low & high risk sidings & set a programme for the model to be applied to the infrastructure to score accordingly

3.4.4. Produce a summary of the areas where current measurement is inadequate & the risk profile high. Set a programme to undertake an in depth review on how to reduce the risk to acceptable levels. The output of this programmed in depth review shall be the mitigating actions to be in place to reduce the risk of derailment to as low as reasonably practicable.

Network Rail expects to complete this work by 23 December 2016.

18. At a subsequent meeting Network Rail informed ORR that emerging findings from its review are that whilst the track geometry recording requirements set out in various company standards are generally good, a number of these documents will be updated to take account of the required management arrangements for manual measurement of track geometry and reflect current industry structure.. Remits for this work are completed and Network Rail expects the revised standards to be available for issue by December 2016, with briefing and publication complete by March 2017. Network Rail continues to review the appropriateness of guidance including MOC 5236 and aims to review the local changes made to date under Business Critical Rules (BCR) arrangements.

19. ORR and Network Rail have agreed that, to move this recommendation towards implementation, the work activity under 3.1.2 and 3.1.3 of paragraph 17 above needs to include:

- a review of the criteria to determine if dynamic or manual inspection is required so as to control risk SFAIRP on running lines; and

- guidance to assist an engineer in determining how to deliver track geometry inspection by manual means when dynamic means are not deemed reasonably practicable, including when dynamic movement has to be taken into account, and how that could be delivered.

20. Network Rail envisages that the output of this work will be a Track Worker Information Sheet due by September 2016, with briefing out complete by December 2016.

Recommendation 4

The intention of this recommendation is to review whether the historic track twist measurement base (3 metres) is still a sufficient control for track twist risk applicable to current rolling stock. The RAIB notes that this recommendation could be informed by the joint industry action taken in response to ORR's letter of 5 December 2014 (paragraph 163).

Network Rail should liaise with RSSB to review whether the existing 3 metre measurement base used for identification of track twist is sufficient for managing the derailment risk applicable to rolling stock currently operating on Network Rail infrastructure. If found to be inadequate or insufficient, Network Rail should:

- update its process for assessing track twist by the inclusion of additional and/or alternative measurement bases; and
- implement a time-bound plan to apply the new process to all of its infrastructure.

ORR decision

21. Whilst ORR is satisfied that Network Rail's initial response demonstrates that work is progressing, it notes that the wider input of the industry is required to implement the recommendation. It is also unclear how Network Rail will move to implementation of the recommendation by 23 December 2016, and ORR has sought further information from the end implementer about this.

22. After reviewing the information provided ORR has concluded that, in accordance with the Railways (Accident Investigation and Reporting) Regulations 2005, Network Rail has:

- taken the recommendation into consideration; and
- is taking action to implement it, but ORR has yet to be provided with a timebound plan.

Status: Progressing. **ORR will advise RAIB when further information is available regarding actions being taken to address this recommendation.**

Information in support of ORR decision

23. On 17 December 2015 Network Rail provided the following initial response:

a. The process to be applied to the review/consideration

i. *Review the guidance currently provided within Network Rail standards, Group Standards & the TSI.*

ii. *Review the current wheel base distribution of UK fleet*

iii. *Examine areas of different known twist density & apply additional twist calculations of appropriate base lengths to ascertain if there are additional risks exposed by this undertaking.*

b. The rigor to be applied to understanding potential issues

i. *Do the current standards & existing bow ties to date provide clarity on the risks associated with the measurement of Twist & do they provide guidance on limits for different base lengths*

ii. *What is the density of wheel base with UK fleet? How does this compare with existing measurements? Are there any identified gaps.*

iii. *What are the outcomes of measuring different wheel base twists to the test cases? Has more twist been detected that exceed the researched associated exceedance limits..?*

c. The person proposed to be involved in the review/considerations

i. *STE, Principal Track Engineer with liaison with RSSB*

ii. *STE, Principal Track Engineer with liaison with RSSB*

iii. *STE, Principal Track Engineer with liaison with RSSB*

d. How the outcomes of the review/consideration will be documented

i. *If adequate, summarise the salient points in the closure statement. If inadequate, set a programme to undertake an update to the standards as appropriate*

ii. *Summarise in a report the current state of the art & found deficiencies. Set a programme to conduct any changes to the recording fleet functionality if appropriate & estimate the cost & supplier availability to implement,*

iii. *Produce a summary report outlining any gaps of coverage the current systems provide. This will feed into 4.4.2*

Liaison will be through the cross-industry working group which has already been requested to consider this aspect of asset management. Only when the output from this group is reported will consideration be given to the impact on Network Rail processes and procedures.

Network Rail expects to complete this work by 23 December 2016.

24. ORR subsequently met with Network Rail to discuss its work to explore the appropriateness of measuring track twist at a baseline length longer or shorter than the current 3 metres. Network Rail reported some progress in reviewing the impact of shorter and longer measurement baselines on fault identification, but that its work

does not currently take account of vehicle characteristics. It was agreed that Network Rail should ensure that its emerging findings are shared with the XIFDWG and that the XIFDWG's relevant workstream is looking at both shorter and longer measurement bases. Once this work is complete, and the outcome known, Network Rail will be able to address the detail of this recommendation. More information about the XIFDWG programme of work can be found in paragraphs 13 and 14 above.

Recommendation 5

The intention of this recommendation is to encourage use of available monitoring data from wheel impact load detection systems, such as Gotcha, to inform rolling stock maintenance.

Network Rail should review the potential to use wheel impact load detection system data to provide information about possible defects, such as uneven wheel loading or uneven load distribution, relating to specific wagons. The review should include consideration of how this information could be used to improve control of overall derailment risk (such as identifying the need for entities in charge of maintenance to check the condition of suspect wagons and take appropriate remedial action). Network Rail should seek inputs from relevant entities in charge of maintenance as part of the review. If justified by the review, Network Rail should implement track side and reporting processes needed for collecting and disseminating this information.

ORR decision

25. Whilst ORR is satisfied that Network Rail's initial response demonstrates that work is progressing to deliver the recommendation, it considers that two issues need to be noted to enable the recommendation to be reported as implemented:

- Network Rail state that a business case is required to justify the cost to upgrade and repair the Gotcha Mobile System at High Marnham for uneven load data validation. Without that work, the validation of the GOTCHA concept for monitoring wheel loading to establish asymmetrically loaded vehicles will be severely hindered; and
- On completion of validation, intervention limits and production of downstream processes to manage non-compliant vehicles a Network Change will need to be finalised and agreed.

26. We are also considering this response in conjunction with the work of the XIFDWG, more information about which can be found in paragraphs 13 and 14 above.

27. After reviewing the information provided ORR has concluded that, in accordance with the Railways (Accident Investigation and Reporting) Regulations 2005, Network Rail has:

- taken the recommendation into consideration; and

- is taking action to implement it, but ORR has yet to be provided with a robust timebound plan that takes account of other associated activities..

Status: Progressing. **ORR will advise RAIB when further information is available regarding actions being taken to address this recommendation.**

Information in support of ORR decision

28. On 25 February 2016 Network Rail provided the following initial response:

Network Rail (NR) has reviewed the potential to use Wheel Impact Load Detection (WILD) for uneven load detection and have designed the next release of the Gotcha Data software (version 4) to do this.

This software is currently undergoing performance and risk assessment by the Network Rail Global Business Services (GBS) team (Software experts).Once GBS release the latest Gotcha Data (v4) software into the NR network, we will have the capability to measure and alert for uneven loading at each Gotcha location in a similar way to how NR alarm for wheel impact damage.

NR GBS preliminary performance and User Acceptance Testing (UAT) results show nine critical issues that are to be resolved or mitigated for before the software can be released for use. Eight of these critical issues are for NR to resolve and the remainder is to be resolved in a software modification by the Original Equipment Manufacturer (OEM).

Once this software becomes available on the NR network, we will have the ability to interrogate the uneven load/diagonal imbalance functionality to measure and monitor trains over each location. To enable implementation of this functionality, NR will need to go through a trial and validation period before a full Network Change application is made.

Network Rail will initially seek input from Safety Technical & Engineering (STE) specialist skills and experience to review the data and the recommended load limits from the Freight Technical Committee (FTC), Huddersfield University and other technical consultants. Once sufficient data has been reviewed, this data will be verified through physical testing of loaded vehicles, most likely at High Marnham, using the Mobile Gotcha system.

Table 1. Project proposed for testing and implementation of Uneven Load Measurement and Alerts:

#	**Action**	**Due Date**
1	Gotcha Data v4 software release	May 2016
2	Preliminary Gotcha v4 Data review	June 2016
3	Business Case Approved	August 2016
3.1	Repair & Upgrade Mobile Gotcha	August 2016

3.2	Uneven Load Project Initiation and Scoping	September 2016
3.3	Uneven Load Project - Define test plan to validate limits	To follow
3.4	Uneven Load Project - Operational processes (generic)	To follow
3.5	Uneven Load Project - Formal Communication & Authorisation	To follow
3.6	Uneven Load Project - Process and Local Instructions	To follow
3.7	Uneven Load Project - Network Implementation	To follow

Gotcha Uneven Load Monitoring

1) Gotcha Data v4 software release

- *First round of Performance and UAT tests is complete and a Defect Log has been issued to the OEM.*
- *Waiting on date from OEM for new software release.*
- *Performance and UAT tests second round to complete to pass stagegate for software release to NR network*

2) Review of uneven load data in conjunction with the necessary NR departments.

3) A business case is required to justify the cost to upgrade and repair the Gotcha Mobile System at High Marnham for uneven load data validation.

3.1) The Gotcha Mobile system is to be used to simulate a permanent Gotcha system on the network and measure uneven load distributions on a passing freight vehicle.

3.2) Use of the uneven load functionality of Gotcha requires validation of the data by NR with independent assessment. This project requires scoping and support from operator(s) for vehicle tests at High Marnham.

3.3) Carry out data validation work at High Marnham.

3.4) Complete uneven load data review in conjunction with the necessary departments within network Rail and in consultation with freight operators and independent assessor to determine the cross industry potential and operational requirements.

3.5 & 3.6) Informal and formal review of process needed to implement uneven load 'alarm' at NOC and National Control Centres. Informal Network Change application sent to operators and Entity in Charge of Maintenance (ECMs) with draft update to Standards and Operational

Procedures. Inform Office of Rail Regulation (ORR) and Rail Accident Investigation Branch (RAIB) of project progress.

3.7) *Implementation of uneven load monitoring and alarm notifications. At this stage, this is envisioned to be a similar process that currently operates for WILD Alarms where mitigating action must be taken as soon as reasonably practicable in the form of a Temporary Speed Restriction (TSR) or instruction for Rolling Stock Technician (RST) to stop and inspect and operators/ECMs are notified of the alarm details.*

Gotcha Data Software Functionality

Aspirationally, implementation of the Gotcha Data v4 software will enable:

1) *All-Wheel condition data provision, automatically, to train operators for their Remote Condition Monitoring (RCM) use and wheel maintenance planning,*
2) *The capability to use Automatic Vehicle Identification (AVI) data to identify each axle/wheel for each activation (wheel damage, overweight and uneven loading).*
3) *Functionality to measure and alert for uneven/unbalanced loading. This covers side-to-side, end-to-end, diagonal and combination offset/uneven loads. The various limits that have been recommended as part of the FTC sub group and analysis by Huddersfield University (and other parties) are listed below.*
    a. *Lateral load imbalance, proposed limit 1.25*
    b. *Side-to-side axle load imbalance, proposed limit 1.7*
    c. *Longitudinal load imbalance, proposed limit 3,*
    d. *Combination load imbalance, proposed limit 1.*

Recommendation 6

The intention of this recommendation is to ensure that the distribution of loads in wagons, including partly loaded wagons, is controlled in a manner compatible with wagon and track characteristics. The RAIB notes that action taken in response to this recommendation could be informed by work undertaken as part of the railway industry's response to the ORR's letter of 5 December 2014.

RSSB, in consultation with industry, should review the risks associated with the uneven loading of wagons, with particular reference to partial loads, and propose any necessary mitigation, so that the extent of permitted load imbalance is effectively controlled.

ORR decision

29. Whilst noting RSSB's plans to address this recommendation through the Cross Industry Freight Derailment Working Group, it is not clear to ORR whether the working group will also be considering this recommendation in the light of open and flatbed wagons. RSSB has been asked to comment on this.

30. After reviewing the information provided ORR has concluded that, in accordance with the Railways (Accident Investigation and Reporting) Regulations 2005, RSSB has:

- taken the recommendation into consideration; and
- is taking action to implement it, but ORR has yet to be provided with a timebound plan.

Status: Progressing. **ORR will advise RAIB when further information is available regarding actions being taken to address this recommendation.**

Information in support of ORR decision

31. On 10 November 2016 RSSB provided the following initial response:

With reference to Recommendations 2 and 6 of RAIB's investigation report on the Angerstein Junction derailment of 2 April 2014, having already agreed to consider the derailment risk caused by asymmetrically loaded hopper wagons (due to residual loads), as well as asymmetrically loaded container wagons, the Cross Industry Freight Derailment Working Group also agreed (at its meeting of 23 September 2015) that Recommendations 2 and 6 fell within its scope. The recommendation will therefore be considered as part of the working group's programme.

Appendix I

Supplier Best- Chem Ltd

Bardon Hill - Foam System As per our recommendation in Section 3.2 we have specified a 6 port Foam Dust Suppression Unit for the Bardon Hill rail loading facility. This is based on our proven design and will efficiently dampen the material so that the dust emissions when loading the wagon at Bardon Hill and discharging at Wembley BDU will be greatly reduced.

To apply foam the following elements are required

• Foam Generating Unit ('FGU')

• Nozzle and hoses

• Water

• Foaming Agent

• Compressed air

• Power

• Controls

• Modified shipping container

1. Foam Generating Unit – FGU Our FGU will comprise

• 1 x Lowara vertical multistage pump capable of delivering 60 litres per minute. This unit is driven by a 1.1kw tefc motor running at 29000rpm suitable for a circuit of 400/3/50. The motor is fitted with an a/con heater.

• Fitted to this is suction manifold containing

♦ Isolating valve

♦ Y Type strainer

♦ Inlet pressure regulating valve

♦ Pressure gauge

♦ Pressure switch

• 1 x Dosatron dosing pump capable of dosing 0.2 – 2.0%. This is manually adjusted and has a maximum pressure rating of 8 bar. This unit is fitted with suction manifold containing an isolating valve and a Y type strainer.

• Both the pumps are fitted with a common discharge manifold containing

♦ Pressure transducer

♦ Non return valve

♦ Bleed/drain connection

♦ Flow meter

♦ Pressure gauge

♦ Distribution manifold block with 6 connections. Each outlet is fitted with an isolating valve and non-return valve.

• The unit is fitted with an air line filter/regulator/pressure gauge which is connected to the discharge block via a non-return valve and individual air lines. The air line is fitted with a pressure switch to indicate lack of air pressure.

• The FGU is pre-wired to a control panel comprising Door interlocked isolator

♦ MCB

♦ Contactor overload

♦ Control module and timers

♦ Power pack 24 vdc

♦ Power on lamp

♦ Hand/off/auto switch

♦ Hi/Lo selector switch

♦ Water purge test

♦ Purge on/off switch

♦ Run/trip lamp water pump

♦ Emergency stop

♦ Internal D socket for commissioning set/up

♦ Cooling fan and anti-con heater

♦ External switch for local operation of each zone The system has provision for automatic shutdown for

• No water in suction

• No chemical

• No air in system The FGU will be housed in the maintenance workshop.

2. Nozzles and hoses

We plan to deploy 6 nozzles at the two penultimate transfer points before the material is loaded in the wagons. Each nozzle will be capable of delivering 5 litres per minute of solution converted to foam. We will use reinforced rubber hose which will be securely mounted on cable trays.

3. Water

The system will require 1,800 litres per hour and this will be drawn from the water supply near the rinse plant at the rail head. We are informed that water supplies here are particularly susceptible to disruption in sub-zero temperatures. To ensure 100% availability for the Wembley deliveries a dedicated heated water tank capable of holding sufficient water to load at least one train might be worth considering. This is feasible – but comes down to cost.

4. Foaming Agent

Our foaming agent Dustrol 70 will be used and this will be supplied in 1000L IBC. This will be used at 200 to 1 and will be stored on a bund stand in the container. On a high setting of 30 litres per minute of foam the hourly consumption of chemical will be 9 litres. Thus 1,000L will give approximately 110 hours of application.

5. Compressed air

The system will require approximately 40 cfm at 4 bar pressure. This will be drawn from a rotary screw compressor that will be supplied and fitted in the modified shipping container.

6. Power supply

The foam system will require a 400v 3 phase power supply. We have not included this in our scope of supply. We envisage that the quarry's on site electricians will provide this as this is the practice at Bardon Hill.

7. Controls

The system is designed to operate without operator intervention. Once the power supply is switched on and the FGU set in the AUTO mode the system will be triggered by a material on belt sensor. The FGU will have two setting – High and Low – when set on the High setting all 6 nozzles will come on and on the Low setting 3 nozzles will operate. This selection is made on unit to be mounted in the control cabin at the rail head which will also have an emergency stop button.

8. Modified Shipping Container

At Bardon Hill there are no suitable buildings which can house the FGU, chemical supply and the compressor. In addition all structures in the vicinity of the rail head are open to the elements and would not be suitable in sub-zero temperatures. We will supply a single use 20ft shipping container with the following features

- Ply lining and insulation including doors

- Personnel door
- Lights
- Heaters with thermostat
- Distribution board
- Vents
- Ducting for compressor

There is sufficient ground at the rail head to position this safely. The quarry staff can level the ground and compact it with suitably sizes aggregate.

Photo 1 Internal view of Modified Shipping Container

Photo 2 Internal view 2 of Modified Shipping Container

Photo 3 External view of installed (Bardon Hill) Modified Shipping Container