***Ekta Sareen***
*Senior Regulatory Economist*
*Kings Place, 90 York Way*
*London, N1 9AG*
*Ekta.Sareen@networkrail.co.uk*

**To:** all freight train operators; vehicle and bogie suppliers

2 March 2012

Dear colleague,

**Allocating Freight Vehicles to Suspension Bands – Consultation on a Revised Approach**

*1. Purpose of this letter*

The purpose of this letter is to consult on our proposal:

- to introduce a revised approach to allocating freight vehicles to Suspension Bands (see report attached);
- to introduce the new approach to allocating freight vehicles to Suspension Bands for new freight vehicles in CP5[1] only;
- not to retrospectively[2] apply this approach for old bogie types in CP4[3] and CP5;
- to reset all Suspension Factors to 1.00 from the beginning of CP6[4] (1 April 2019), unless they have been assessed using the CP5 approach; and
- to retain the current level of discount/premia associated with different Suspension Bands[5].

*2. Background*

You will be aware that, currently, freight vehicles are allocated to Suspension Bands depending on a qualitative description of their bogie. As part of the 2008 Periodic Review, Network Rail committed to produce a more quantitative approach to allocating freight vehicles, which are introduced in CP4, to Suspension Bands.

[1] Control Period 5; we expect this to be the period from 1 April 2014 – 31 March 2019.

[2] This means that we do not propose to 'backdate' any Suspension Factors applied prior to the new approach being introduced.

[3] Control Period 4; this is the period from 1 April 2010 – 31 March 2014.

[4] Control Period 6; we expect this to be the period from 1 April 2019 – 31 March 2024.

[5] Currently there is a +9.8 and -14.2% spread across the Suspension Factors.

In June 2011, we sent you a consultation letter and held a workshop on our original approach on allocating freight vehicles to Suspension Bands. In December 2011, we wrote to you setting out our responses to the key issues raised in the June 2011 consultation, and to inform you that we planned to carry out some further work to try and address some of the primary concerns raised by the industry by modifying our proposed approach. In that letter, we said that we would consult on the revised approach in early 2012, which is what this consultation seeks to do.

*3. Revised approach*

In our June 2011 consultation, we proposed the use of the Ride Force Count (RFC) as a metric for allocating freight vehicles to Suspension Bands. The RFC ranks vehicles in terms of the magnitude of dynamic ride forces which are directly related to the performance of the vertical suspension system.

Our original proposal was that a RFC could be determined for each freight vehicle. The RFC would have been calculated based on modelling of a complete vehicle (bogie and wagon body) rather than the bogie alone. This would have meant that the details of the wagon body design would need to be known early in the vehicle procurement process so that an RFC value could be calculated and a Suspension Band determined. Some stakeholders considered that this was impractical, and would compromise their ability to enter into contracts to manufacture bogie types. They said the reason for this was the lack of certainty as to what the Suspension Band would be for their new bogie until it was combined with a wagon body.

We have carried out some further work to assess the feasibility of pre-determining RFC values based on specific bogie types but with generic representative wagon bodies as opposed to the actual wagon body and bogie combination. From a contractual standpoint, this would make the application of an RFC based banding capable of being more easily planned and calculated. It should also allow RFC values, and hence Suspension Bands, to be determined earlier than would have been the case with our original proposal.

The revised methodology will permit a bogie design derivative (with a given suspension configuration) to be banded irrespective of the body type to be placed on it. The only other vehicle data required will be the maximum axleload (at GVW[6]) to be carried by that bogie. Once determined, the Suspension Band would be fixed, irrespective of the specific use made of it.

The process would require vehicle dynamic modelling of the bogie with a small range of generic body types, whose parameters will be defined in the RFC application guidelines. The results from the dynamic modelling will be processed using a simple piece of software to generate the Suspension Factor applicable to that bogie design derivative.

[6] Gross Vehicle Weight

We consider that this revised approach addresses the key concerns raised in the June 2011 consultation, by limiting any commercial impact of the new RFC approach to allocating freight vehicles to Suspension Bands. In doing this, our analysis suggests that the accuracy of the RFC value may be reduced (relative to the original proposal). However, on balance we consider the benefits of simplification outweigh the small loss in accuracy.

Related to the point above, we note that by using this simplified approach, it may restrict a manufacturer's option to tune its bogie (within its normal available spring set) to a specific wagon body to reduce its RFC. We see this as being an issue only for tare wagon bodies where body mass varies. All the generic laden bodies have the same mass. Therefore, we would accept bespoke applications to provide more specific information to calculate a more accurate RFC value, for example, by using the original approach proposed in June 2011 which calculates RFC based on the specific bogie/wagon body combination.

*4. Software proposal*

In order to calculate the RFC for a new freight vehicle, the relevant information will need to be entered in to a specific piece of software (discussed above), which will produce the RFC value and Suspension Band for that bogie type. A draft proposal for what the software will do, and how it will be created is set out in Appendix B.

*5. Timing of introduction*

In this consultation, we are also seeking your views on our proposal that:

- the revised approach should be introduced no earlier than the start of CP5 (1 April 2014);
- the proposed approach should not be applied retrospectively for old bogie types in CP4 and CP5; and
- to reset all Suspension Factors to 1.00 from the beginning of CP6 (1 April 2019), unless they have been assessed using the CP5 approach.

We consider that these points address the key concerns from our consultation in June 2011. Many respondents considered that there should be sufficient time before a new approach was introduced to allow the industry to fully understand the process and enter into contracts on that basis. Given we are approaching the end of year 3 of the current control period, it seems sensible to propose the introduction at the beginning of CP5 (1 April 2014).

Almost all respondents expressed concerns about retrospective banding. As noted above, we propose that the revised methodology should not be applied retrospectively for old bogie types in CP4 and CP5. Moreover, we do not consider it appropriate to adjust variable usage charges retrospectively following the introduction of the proposed new methodology. Not only do we consider that this may be unfair, but the costs of doing so are likely to outweigh the benefits.

We believe that the industry should move towards a level 'playing field' for all bogie types, i.e. they should be assessed and charged on the same basis. Therefore, as noted above, we propose that, from the beginning of CP6 (1 April 2019), all subjective Suspension Factors should be reset to 1.00 (i.e. discounts/premia should be removed[7]) unless the bogies have been assessed using the proposed CP5 approach to gain the relevant Suspension Band. This will ensure that all industry players are treated fairly. Introducing this in CP6 should allow the industry sufficient time (i.e. 7 years) to prepare and assess their bogie types as necessary.

*6. Suspension Factors*

Because we are proposing that the new approach for allocating freight vehicles to Suspension Bands is introduced at the start of CP5, we also considered it appropriate to revisit the evidence for the level of discount and premia associated with different bands so that when the new Suspension Banding approach is introduced we can be confident that they are evidence based.

Currently there is a +9.8 and -14.2% spread between the highest and lowest Suspension Factors respectively. We have carried out some analysis, and our assessment suggests that the current Suspension Factors associated with the seven bands are reasonable and are still fit for purpose. For this reason, we propose to retain the current Suspension Factors associated with each of the Suspensions Bands. These are set out in Table 1.1 below along with the proposed RFC ranges associated with each band.

*Table 1.1: Proposed Suspension Band table*

| Suspension Band | Tare RFC Range | Laden RFC Range | Suspension Factor |
|---|---|---|---|
| 1 | RFC > 715 | RFC > 1650 | 1.098 |
| 2 | 680 – 715 | 1545 – 1650 | 1.058 |
| 3 | 640 – 679 | 1450 – 1544 | 1.018 |
| 4 | 605 – 639 | 1350 – 1449 | 0.978 |
| 5 | 565 – 604 | 1255 – 1349 | 0.938 |
| 6 | 465 – 564 | 925 – 1254 | 0.898 |
| 7 | RFC < 465 | RFC < 925 | 0.858 |

*7. Variable Usage Charges and PR13*

We are conscious that there are inter-related issues currently being consulted on and debated by the industry in the context of PR13[8]. We are keen to provide as much early clarity

[7] i.e. all suspension factors would be reset to 1.00.

[8] 2013 Periodic Review.

as we can on how these inter-related issues could work together in CP5. Appendix C sets out our thinking on this. Because some of this appendix may be of interest to stakeholders other than those copied to this letter, we will circulate it more widely.

*8. Next steps*

Appendix A sets out some consultation questions relating to the revised proposal. Please could you send your response to this consultation to Gabriela Weigertova (Gabriela.Weigertova@networkrail.co.uk) by **Friday 30 March 2012**, making it clear if any part of your response is confidential.

If you would like to discuss this letter or its appendices please contact Gabriela Weigertova or myself. We would be happy to meet stakeholders individually if they have issues that they wish to discuss on a one-to-one basis.

Yours sincerely,

Ekta Sareen

**Senior Regulatory Economist**

## Appendix A – Consultation Questions

*Revised approach (technical report attached)*

1. Do you agree that the revised approach (to allocating freight vehicles to Suspension Bands) addresses the issues raised in responses to the June 2011 consultation?

2. Do you consider the revised approach to be generally fit for purpose?

3. Do you have any comments to make on Manchester Metropolitan University's (MMU) report (attached)?

*Timing of introduction*

4. Do you agree with our proposal to introduce the revised approach (to allocating freight vehicles to Suspension Bands) from the beginning of CP5?

5. Do you agree that the revised approach (to allocating freight vehicles to Suspension Bands) should not be applied retrospectively for old bogie types in CP4 and CP5?

6. Do you agree that it is reasonable to reset all Suspension Factors to 1.00 from the beginning of CP6?

*Suspension Factors*

7. Do you agree that it is reasonable to retain the current spread between the highest and lowest Suspension Factors of +9.8% and -14.2% respectively?

## Appendix B – Proposal for RFC post-processor software (RFCpro)

*1. Introduction*

As part of the CP4 Final Determinations, Network Rail (NR) was requested by the ORR to investigate methods to quantitatively allocate freight vehicles to 'Suspension Bands'. A process has been developed by MMU to achieve this. However, before the method can be brought into use it is necessary to develop a piece of software that can be used by vehicle manufacturers. This will ensure that the new method is straightforward to implement and gives consistent results. We use the terms pre and post-processor to describe the part of an analysis task in relation to the main simulation task.

The software package will allow users to obtain a vehicle Suspension Band for use in NR's track access charging process. This includes the pre-processing tasks required by the bogie based method. In addition to the software itself, the required Vampire run environment will be developed, together with a software installation and user guide.

*2. Software Requirements*

The requirement of the software is firstly to act as a pre-processor to generate the generic wagon body mass properties required for the revised bogie based RFC method. These are then used in Vampire dynamic simulations to establish the wheel-rail forces. Following completion of the vehicle dynamic simulations, the second function of the software is to act as a data post-processor. This will evaluate the resultant vertical wheel-rail forces and calculate for the user the value of Ride Force Count (RFC) and resulting Suspension Band for the bogie. As the intention is for the software to be distributed openly, to users of varying technical expertise, it is proposed that the software operates using a simple Graphical User Interface (GUI). This will decrease the opportunities for user error and provide consistency and security to the banding process. Details of the software specification are listed below:

- Pre-processing (Generate body mass data)
  - Prompt the user for the bogie design maximum GVW axleload (e.g. 20.5t)
  - The software will then return sets of body dynamic properties for 7 tare vehicle and 6 laden vehicles
- Post-processing (Process 13 sets of Vampire simulation results)
  - Apply a 20Hz Low Pass Filter to the wheel-rail forces output from Vampire simulations
  - Calculate the Standard Deviation (SD) of the vertical forces over 200m track sections
  - Average the 200m vertical force SDs for all axles of the vehicle
  - Calculate the Ride Force Constant and Coefficient
  - Apply the TfB track file SD distribution to evaluate the Ride Force Count (RFC)

- Compute the average RFC value for the 7 tare and 6 laden simulations to return a single bogie based RFC value for the tare and laden conditions
- Apply the relevant RFC discount curve to evaluate the bogie based Suspension Factors
- Return to the user the values of bogie based: RFC, Suspension Factor and Suspension Band (1-7)

- An output log file will be produced which will contain information for the submission review process, including:
  - Number of axles processed for vertical ride forces
  - Gross Vehicle Weight and confirmation of either a 'Tare' or 'Laden' RFC analysis
  - Vehicle simulation speed (mph)
  - Vampire *.lis file details and date of Vampire simulation
  - Vampire software version
  - RFC value, Suspension Band and Suspension Factor
- Error reporting will be included to highlight problems in applying the RFC process including:
  - Incorrect track file used in run file
  - Incorrect simulation length
  - Missing Vampire input file (the Vampire *.lis, *.out and *.log files are required)
  - Number of input axles does not match Vampire simulation output
  - Input GVW axleload does not match Vampire simulation output
  - Output channels used in Vampire simulations incorrect
  - Output timestep incorrect

The RFCpro software will be written in Matlab and compiled as a Windows executable (*.exe). This will allow the software to be used on any Windows-based computer without any pre-existing software or licence requirement. However, the user will require a licence in order to run the Vampire analysis.

*3. Production of RFCpro User Guide*

To support the software tool, an installation and user guide will be produced. This installation guide will detail the computer system and software requirements, together with the necessary steps to install and run RFCpro. The user guide will detail the functionality of the software, including a brief background of the revised bogie-based RFC approach to Suspension Banding.

*4. Generation of Vampire Run Environment*

To control the simulation aspect of the RFC approach, a Vampire simulation environment will be defined. This task involves the generation and verification of these files, which will be supplied to the RFC user along with the RFCpro software.

*5. RFCpro Software Support*

Although the RFCpro software will be a relatively simple tool, it is envisaged that software users may require support during the early stages of its release. It is, therefore, proposed that provision is made for a 6 month period whereby MMU support all RFCpro software related queries.

In addition to the above software support period, it is proposed that a workshop be held to demonstrate the RFC process and provide users with a question and answer session.

## Appendix C – Variable Usage Charges and PR13

As mentioned above, we are keen to provide as much early clarity as we can on how these inter-related issues could work together in CP5.

*Suspension Bands and Variable Usage Charges in CP5*

As we propose earlier in this letter we consider that Suspension Factors continue to be appropriate to be incorporated as part of the Variable Usage Charge calculation for freight vehicles. The current costing tools (including VTISM[9]) are not currently capable of robustly assessing the effects of different bogie types. We have, therefore, developed the RFC approach for assessing different bogies and allocating individual freight vehicles to Suspension Bands. We also consider that the current range of Suspension Factors used in the Suspension Band table continue to be appropriate (i.e. 1.098 to 0.858).

As colleagues may be aware, we are currently in the process of concluding our 'freight caps' consultation that sets out Variable Usage and Freight Only Line Charge Initial Cost Estimates for CP5[10]. By the time that we consult again in Summer 2012, our estimate is likely to have been refined further. We hope to have concluded on the approach to allocating freight vehicles to Suspension Bands for CP5 by the time that we consult the industry on Variable Usage Costs and Charges for CP5 in the Summer of 2012.

*Consultation on Variable Usage Costs and Charges*

In the Summer of 2012, we aim to consult on:

- Our estimate of the total size of variable usage costs;
- the proposed apportionment of track costs between vertical and horizontal damage;
- the way in which we plan to attribute variable usage costs to specific vehicles; and
- how the various factors, including the Suspension Factors, are applied to the individual freight variable usage charges.

In CP4, vertical track wear accounted for around 70% of all track damage. It is very likely that we will conclude that vertical track wear will continue to account for the vast majority of all track damage in CP5. We are considering retaining the modelling approach used in CP4 for vertical track damage which allocated vertical degradation costs based on equivalent tonnage. This approach takes account of:

- axle-load;

[9] VTISM – Vehicle Track Interaction Strategic Model.

[10] The Consultation document is accessible here: http://www.networkrail.co.uk/WorkArea/DownloadAsset.aspx?id=30064779042.

- speed;
- un-sprung mass; and
- bogie suspension.

For rail surface damage (horizontal track wear), we are considering using a tool called Track-Ex (VTISM applies the same underlying modelling approach as Track-Ex, but is easier to use than VTISM) to allocate rail surface damage costs to individual vehicles.

Track degradation and damage accounts for c.85% of total variable usage costs. We will also need to allocate non-track related costs, such as civils and signalling, to specific vehicles.

*Next steps*

We hope this clarifies the link between the work we are doing on the allocation of freight vehicles to Suspension Bands in this consultation, and the way this will fit in to the wider work we are doing on the development of Variable Usage Charges in CP5. As mentioned above, we aim to issue our consultation on Variable Usage Charges in CP5, in the summer of 2012.