



# Response to Network Rail Consultation

## Variable Usage Charge Estimates and Freight Caps



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## 1. EXECUTIVE SUMMARY

This report has been produced by Morgan Tucker to provide an independent appraisal of the methodology and calculations undertaken by Network Rail in relation to the anticipated cost estimates for Variable Usage Charges (VUC's) Freight Only Line Charges and Freight Caps.

In addition, the report examines the technical processes and parameters that have been used by Network Rail in the Consultation process.

Morgan Tucker have been appointed by representatives of the Rail Freight Industry and the Rail Freight Group. In order to ensure impartiality in the review process, Morgan Tucker have appointed Dr David Tann of London South Bank University to also undertake an initial appraisal of the consultation process and the technical parameters contained therein.

### Scope of this report

Whilst this report has examined the contents of all of the consultation documents and associated supporting material it concentrates heavily on the technical issues that have resulted in the biggest increase in the anticipated VUC costs.

The review of the consultation documents have shown that the overriding reason for the



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increase of estimated costs for the CP5 VUC's is as a result of including the costs for brick and masonry arch structures in the estimation methodology. This report, therefore, concentrates on engineering issues relating to this factor.

### Growth

Network Rail are suggesting that there is a directly proportional relationship between costs and an increase in traffic on the Network. We believe this relationship is a fundamentally important issue to understand and we have discussed the topic in detail in Chapter 4.

The relationship between growth and the increased costs of maintenance of brick and masonry arch structures is particularly complex and we do not feel it is appropriate to make a direct linear relationship between the two. There are many factors that we believe Network Rail should have taken into consideration such as :

- Traffic Constitution
- Geographic Spread
- Quality of Existing Assets
- Age of the Structure, etc.

We have suggested that Network Rail undertake further investigative research work in order to understand the complex effects of growth on brick and masonry arch structures.



## 1. EXECUTIVE SUMMARY

### Top Down Engineering Judgement

Network Rail have used an 'engineering judgement' technique to estimate the costs associated with non track assets such as brick and masonry arch structures, culverts and minor signalling works. The inclusion of these categories in the CP5 estimates have had a very large impact on the increase of the CP5 VUC cost estimates.

We believe it is not appropriate to use the 'top down' approach for the estimation of the VUC costs for the following reasons: -

- The Office of Rail Regulation (ORR) stated in 2006 that it did not want Network Rail to use 'top down' assessments for calculating costs associated with VUC's.
- There is no technical information in any of the consultation documents backing up the engineering judgements that have been made in the top down assessments. The effects of loading on brick and masonry arch structures, for example, is very complex and we would expect to see further technical information to examine this issue.

### Modelling Techniques – Track Costs

We have noted that Network Rail have used the Vehicle Track Interaction Strategic Model



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(VTISM) and the Strategic Route Section Maintenance Model (SRSMM) to estimate initial track costs for the CP5 period. The use of these models is a significant change from the use of the Infrastructure Cost Model (ICM) which was used to obtain costs in the PR08 processes.

We are concerned that the two 'new models' have not yet had enough time to be validated and tested. There is also evidence to suggest the models are not as widely used in the industry as Network Rail have suggested.

We have suggested that further work be undertaken in order to validate the accuracy and relevance of the models.

### Modelling Techniques – Non Track Costs

It would appear that Network Rail do not have any 'modelling' information available to be able to estimate the likely impact of non track costs in CP5 – instead 'top down engineering judgement' has been used.

There is a fundamental change in the methodology for estimating the CP5 non track costs estimates in that Network Rail wish to include masonry and brick underbridges in the formulae for estimating the VUC's.



## 1. EXECUTIVE SUMMARY

These changes, which are based solely on engineering judgement, appear to be the main reason why there is a proposed increase to the VUC's and subsequently the level of the Freight Cap.

We have suggested that Network Rail provide further information to validate the relevance of their top down assessments.

In the Consultation Conclusion letter that was published by Network Rail on 21st March 2012 they appear to suggest that passenger traffic does not have any impact on brick and masonry arch structures. There is evidence available that would suggest the resonance associated with high speed passenger trains can affect brick and masonry arch structures – this is dealt with in more detail in Chapter 6.

### **Variability Assumptions – General**

Network Rail have applied a range of 'top down' variability assumption factors to the cost estimates in order to estimate individual asset category cost estimates for the CP5 period.

These variability assumptions appear to be an 'arbitrary' assessment and it is understood that they are derived from the Booz Allen Hamilton Study for the structure of costs and charges (SOCC) review in 2005.

We have suggested that Network Rail should provide further information regarding the appropriateness of the variability assumptions that they have used in the determination of the VUC cost estimates.

### **Variability Assumptions – Brick and Masonry Arch Structures**

We have noted the methodologies adopted by Network Rail in order to calculate the Variability Assumptions for Brick and Masonry Arch structures.

We have also examined the suggested amendment to the proposed variability assumption contained in the Network Rail Consultation Conclusion letter. We do not agree with the methodology they have used and have suggested further investigative work needs to be undertaken.

### **Variability Assumptions – Minor Points Renewals**

Network Rail have used engineering judgement to estimate that a 44% variability assumption should be applied to minor works points renewals.

In our opinion, the 44% variability assumption seems overly excessive and it is also unclear why this track asset is being treated in the 'top down' methodology.



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## 1. EXECUTIVE SUMMARY

We have reviewed the Network Rail explanatory notes contained in the Consultation Conclusion letter and believe a number of mathematical errors have been made in the calculation process. We would suggest that Network Rail review the calculations that they have made.

### Brick and Masonry Arch Structures

We have examined a number of technical factors that we feel should have been taken into consideration by Network Rail that show the 'top down' engineering judgement process to estimate costs for brick and masonry arch structures is not appropriate. For example:-

- Vibration and Resonance
- Train Velocities
- High Speed Passenger Trains
- Construction Materials
- Maintenance History
- Traffic Constitution
- Design Parameters
- Ultimate Limit State
- Serviceability Limit State

We do not feel that an appropriate level of investigation into the effects of traffic growth on masonry arch structures has been suitably examined. We have, therefore suggested that a substantial research project needs to be commissioned.



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### Conclusion

We do not feel there is enough information in the consultation documents to justify the cost increases being proposed for the VUC's.

Our ultimate conclusion suggests that the existing VUC charges passed on to the Rail Freight companies be frozen for the next control period in order to give enough time for a thorough research programme to be completed specifically on brick and masonry arch structures. The research programme should examine the effects of an increase of passenger traffic, high speed passenger traffic, freight traffic and heavy axle freight traffic, **specifically** on brick and masonry arch structures.

As this research project will need to be done on a 'bridge by bridge' basis we would need full access to the Network Rail asset inventory so that we could have a clear picture of the true state of the brick and masonry arch bridges on the Network.

We would also recommend that a full and detailed inventory survey of all brick and masonry underbridges be undertaken so that a full understanding of the challenges that need to be addressed can be quantified.



## 2. INTRODUCTION

**Morgan Tucker has been commissioned** by Operators of the Rail Freight Industry (DB Schenker, Freightliner, Direct Rail Services, GB Rail Freight & Colas) and the Rail Freight Group to review and provide a technical commentary on the various consultation documents that have been published by Network Rail in relation to a proposed increase to variable usage charges, freight only line charges and Freight Caps. In particular, we have reviewed the following consultation documents:-

- NR letter dated 13<sup>th</sup> September 2011 initially discussing the proposals.
- NR letter dated 29<sup>th</sup> November 2011 discussing the proposals in more detail.
- Freight Cap Consultation Industry Workshop Presentation dated 5<sup>th</sup> January 2012.
- NR letter dated 21<sup>st</sup> March 2012 highlighting the outputs of the consultation process.

The Consultation documents identified above indicate that Network Rail (NR) will be recommending to the Office of Rail Regulation that a substantial increase should be made to the variable usage charges for the Freight Industry. Network Rail have inferred in their consultation documents that the main reason for recommending this increase is that Freight Trains cause a significant amount of damage to brick and masonry arch structures and culverts.



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This response document has reviewed the technical contents of the Network Rail consultation process on behalf of the Rail Freight Industry and, in our opinion, has shown that further investigative work is required before a final decision on VUC costs is made.

## London South Bank University

In order to ensure complete impartiality during the processes that have been adopted to produce this response document, Dr David B Tann BSc(Eng.) MSc PhD CEng FICE MIMMM, who is Head of Urban Engineering at London South Bank University has been appointed to review the work that Morgan Tucker have undertaken and to provide his own initial technical assessment of the Network Rail Consultation Documents.

A summary letter from Dr. Tann containing his initial summary observations relating to the NR Consultation documents is attached at **Appendix A.**

The technical assessment and review work that has been undertaken shows that the broad-brush approach that Network Rail has used to arrive at the proposed level of increase to the Variable Usage Charges (VUC's) has not been appropriate. In addition, the Network Rail Consultation Documents regularly refers to



## 2. INTRODUCTION

‘engineering judgement and experience on the ground’ as the main reason for including new categories of engineering structures which were not included in CP4 – this report shows that such an arbitrary methodology without presenting any valid supporting evidence is, in our opinion, not a suitable approach.

### Scope

We have been asked to concentrate the scope of our work on the technical issues that have the largest impact on the cost estimations of the VUC’s.

It has not been possible to fully examine the many complex technical issues associated with the VUC cost estimation process and we have, therefore, in the first instance concentrated on the technical elements relating to brick and masonry arch structures.

This report has been structured as follows to discuss the contents of the Network Rail Consultation Documents:-

### 1. Executive Summary

### 2. Introduction

**3. Background** – this chapter gives a brief summary of the main technical factors considered by Network Rail that have the largest impact on the VUC cost estimates.

**4. Growth** – We feel that the way Network Rail have treated the relationship between growth and costs is a fundamentally important relationship. We have, therefore, discussed the main parameters of growth in this Chapter.

**5. Technical Review** – This Chapter of the report provides a commentary on the main technical parameters affecting the cost estimation process used by Network Rail.

**6. Brick and Masonry Arch Structures** – The effects of traffic growth on masonry arch structures is extremely complex. This Chapter examines some of the factors that we believe need to be addressed by Network Rail.

### 7. Conclusions



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### 3. BACKGROUND

The variable usage charge (VUC) is levied against train and freight operating companies with the intention to recover Networks Rail's operating, maintenance and renewal costs that can be attributed to the wear and tear caused by use of the rail network. Consideration is currently being given by Network Rail and the Office of Rail Regulation (ORR) to review the variable usage charges levied against the Freight Operators.

Network Rail have produced a 'suite' of consultation documents that give the background for the reasons and methodology for the potential increase of variable usage charges (VUC's). This Chapter contains a summary of the main elements contained within those consultation documents that have the largest impact on the anticipated VUC's for CP5. **A more detailed review of the above and other technical elements affecting the VUC's is contained in Chapters 5 and 6.**

As part of the review work that has been undertaken to complete this report we have also examined all of the responses that the Rail Freight Industry made in reaction to the Consultation Process. A full commentary is attached in **Annex A**.

The methodology used by Network Rail for calculating the VUC's is very complex and it is

difficult to accurately determine exactly how much of an increase in percentage terms the Freight Industry may need to contribute to increased VUC's. Information contained in the various consultation documents indicate that a potential increase of between approximately 11% and 33% may be incurred.

#### Freight Caps

In addition to the proposed increase in the VUC's, Network Rail and the Office of Rail Regulation are intending to place an early 'Cap' on the level of increased VUC's that may be experienced by the Freight Operating Companies (FOCs). These caps are being considered in order to give the FOC's some cost certainties in future financial planning.

The consultation documents originally indicated a potential cap of £1.81 which is 33% higher than the average existing vehicle VUC's.

The implementation of the Freight Cap will give certainty of cost to the Freight Industry and for that reason a Cap should be implemented as early as possible.

We do not believe, however, that the approach used by Network Rail is sufficient to justify such a large potential increase to the current Rail Freight Cap Figure.



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### 3. BACKGROUND

#### Cost Modelling

There is a significant change being proposed to the methodology that has been used to calculate variable usage costs.

To estimate initial track costs for the CP5 period, Network Rail have used the Vehicle Track Interaction Strategic Model (VTISM) and the Strategic Route Section Maintenance Model (SRSMM.) The use of these models is a significant change from the use of the Infrastructure Cost Model which was used to obtain costs in the PR08 processes.

#### Brick and Masonry Arch Structures

The Consultation documents issued by Network Rail indicate that the main reason for the anticipated increase of the VUC's is a result of the inclusion of a number of non track related elements in the calculation for the anticipated CP5 figures that were not included in CP4.

The largest impact on the estimated increase to the charging regime for the CP5 figures is the inclusion of the 20% variability assumption that was applied to metallic under bridges being extended to brick and masonry arch structures.

#### Traffic Scenarios and Growth

Network Rail have adopted a methodology of



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estimating how the costs associated with the VUC's may change with traffic forecasts of +/- 5%, 10% and 20%.

Traffic growth is mentioned on numerous occasions throughout the consultation documents and is one of the fundamental reasons for changing the VUC. It is also the main parameter used for calculating the suggested cap on the charge.

Network Rail are suggesting in their consultation documents that there is a direct correlation between track expenditure per year and anticipated traffic growth. Whilst it is appreciated that there may be some linear correlation between increased cost and traffic growth in relation to the track assets the relationship between growth and the effect on brick and masonry arch structures is a very complex issue which needs further investigation. The complex issue of growth is dealt with in more detail in Chapter 4.

#### Engineering Judgement

Whilst the consultation documents indicate that there is a modelling process for estimating costs associated with track wear and tear, there does not appear to be any 'modelling' information available to be able to estimate the likely impact of non track costs in CP5 - instead 'top down' engineering judgement has been used.





## 4. TRAFFIC GROWTH.

The issue of traffic growth in relation to the calculation of the anticipated VUC costs is a fundamentally important issue to understand as Network Rail have made a direct line correlation between growth and increased costs.

As the issue of traffic growth is such an important factor in the methodology that Network Rail has adopted we felt that it was appropriate to discuss the issue in detail in this Chapter.

The consultation documents highlight the fact that the VUC is designed to recover Network Rail's operating, maintenance and renewal costs that vary with traffic. Paragraph seven of the 29<sup>th</sup> November 2011 Consultation Letter states that *"the charge ensures that we are compensated for the wear and tear that results from additional traffic on the GB rail network"*

One of the major elements that has resulted in a significant increase to the VUC cost estimates for CP5 is the cost inclusion of brick and masonry arch under bridge renewals. There would appear to be no statistical information available to Network Rail in order to estimate the costs associated with brick and masonry arch structures as a result of growth on the network. Subsequently, Network Rail is using 'top down engineering judgement' as a methodology to estimate these future costs.

In the Consultation Documents published by Network Rail they are suggesting that there is a directly proportional relationship between costs and an increase in traffic on the Network. We have not seen any validated technical information in the documents, however, that justifies this relationship.

Most industry forecasts acknowledge that there is likely to be a growth in freight being moved on the Rail Network in the UK. This will result in a number of significant advantages for the economy, environment and population.

The issue of traffic growth is a fundamentally important issue that cannot be explained as a simple linear relationship. There are many factors that need to be taken into consideration when examining the likely impact of growth on the network, particularly in relation to brick and masonry arch structures.

### **The Effect of Growth on Brick and Masonry Arch Structures**

In the absence of any suitable technical data, Network Rail have used 'top down engineering judgement' as their means for estimating likely cost increases as a result of including Brick and Masonry Arch Structures in the VUC calculation process.



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## 4. TRAFFIC GROWTH.

The engineering judgement is still based, however, on the over arching principle that there is a direct linear relationship between traffic increase and cost.

In our opinion, it is not appropriate to make a direct relationship between traffic growth and the cost of maintaining brick and masonry arch structures.

The effects of moving loads (trains) on brick and masonry arch structures is an extremely complex technical issue and it is further complicated by the effects of traffic growth on that structure. Chapter 6 of this report examines the technical background to the complexity of brick and masonry arch structures but the following parameters are just some factors why we do not believe it is appropriate for Network Rail to base their calculation process on a direct liner relationship between growth and cost in relation to brick and masonry arch structures.

- **Traffic Constitution** - An increase in traffic volumes will not necessarily result in increased axle loads. The industry accepted forecasts indicate that it is likely that a large proportion of rail freight growth in future years will be as a result of the development of the multi modal and retail sectors. This freight sector will be carrying lighter loads and would therefore not have the detrimental

impact of 'heavy axle' loads that Network Rail are implying.

In addition, it is possible that there will be an 'overall' reduction in average axle load as growth at the lighter end of the market place increases.

- **Geographic Spread** – the assumption of a directly proportional relationship between traffic growth and cost suggests that traffic growth will be uniform throughout the rail network. There will, however, be certain regions and routes that will experience growth of varying rates and there will be some areas and routes that may experience a reduction in traffic. These relationships do not appear to have been considered in the Network Rail methodology.

- **Zone of Influence** – It is likely that some of the growth expected in the UK will be dealt with by the freight operators simply extending the length of their trains. In these examples it is likely that the individual axle loads passing over a structure at any one time will remain the same. i.e. axle loads will not be increased.

The effects on a brick and masonry arch structure of a longer train travelling over it with the same axle loadings is a complex issue which we do not feel has been



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## 4. TRAFFIC GROWTH.

examined thoroughly in the consultation documents.

- **Quality of existing assets** – The amount and varying type of infrastructure on the UK rail network is vast and will all be of varying quality and standard. In our opinion, the methodologies adopted by Network Rail do not make relevant consideration of the varying nature of the assets on the existing network.

In the Consultation Conclusion letter published by Network Rail on the 21<sup>st</sup> March 2012 they describe a ‘model’ length of rail line that has been used as a basis for estimating costs associated to brick and masonry arch structures (and other assets).

The model rail line used was the Settle to Carlisle route and we believe this is an extreme example of the network and it is likely that it is only a minor representation of the true status nationally. Conversely, it is possible that there will be a huge number of structures throughout the UK that will not be impacted at all by the anticipated increase in traffic growth.

We do not feel it is appropriate to make a direct line correlation between the increase in costs apportioned to brick and masonry arch structures and an increase in traffic.

This relationship between growth and increased costs, particularly in relation to brick and masonry arch structures, is very complex and we suggest that Network Rail need to do more work to examine this relationship.

In addition, we do not feel it is appropriate to simply say, as Network Rail are implying in their consultation documentation, that just because Rail Freight traffic may grow in future years there will be a resultant **linear** degradation of brick and masonry arch structures.

It is also not appropriate to say that as a result of this growth the resultant axle weights enforcing applied loads to the structures will simply increase.



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## 5. TECHNICAL REVIEW

This Chapter of the report presents our findings of the various technical aspects contained within the consultation documents published by Network Rail.

It should be noted that we have not had access to any supporting or supplementary documentation used internally by Network Rail as part of their methodologies. We have, therefore, based our assumptions on documentation that is in the public domain.

### Modelling Techniques - Track Costs

Paragraph 10 of the 29<sup>th</sup> November 2011 letter describes the modelling methodologies that were used to estimate anticipated future track costs. To estimate initial track costs for the CP5 period, Network Rail have used the Vehicle Track Interaction Strategic Model (VTISM) and the Strategic Route Section Maintenance Model (SRSMM.) The use of these models is a significant change from the use of the Infrastructure Cost Model which was used to obtain costs in the PR08 processes.

The development and advancement of new models to estimate track costs in today's challenging environment is a positive move. We are concerned, however, that the two 'new models' have not yet had enough time to be validated and tested.

In their consultation documents Network Rail indicate that the new models are widely used by the freight industry and have been suitably tested to be able to estimate costs. Consultations with the Rail Freight Operators, which were undertaken as part of developing this report, would indicate that there does not appear to be the 'wide use' of the model across the industry as is claimed by Network Rail. In their consultation response letter sent to Network Rail, DB Schenker have commented as follows:

*"Much reliance is placed on VTISM and its supposedly cross industry genesis and 'wide use' across the rail industry. DB Schenker believes that undue emphasis is being placed on the cross industry nature of VTISM and as (we have) not been greatly involved in the model's development, particularly how it might be used to predict track damage and hence short run incremental costs. Indeed during September 2011 it was only due to DB Schenker's strong intervention that the industry group working on VTISM was expanded to include substantive freight involvement".*

In addition, we also have concern that the models do not yet have the required confidence levels to be able to be used for such an important issue. Dr Tann of Southbank University has made the following comments:-



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## 5. TECHNICAL REVIEW

*“The main tools used in estimating the activities volumes of the track degradation and maintenance, and hence indirectly the costs, were the VTISM and SRSMM models. It was noted that these newly developed models, whilst they had cross industry representations during the development stage, the accuracy of the modelling results still need further validation.*

*The models are only capable of dealing with increased traffic scenarios. One notable deficiency is the models’ inability in predicting meaningful activity volumes when reduced traffic scenarios were used, say at -5% or -10%. This puts in doubt the models’ reliability and rigor and hence confidence levels of the results.*

*The CP4 baseline costs were based on activity volumes forecast for 2013/2014 rather than any verifiable operational data, hence adds further uncertainties to the modelling results”.*

The above statement adds further concern to the reliability of the models used to estimate track costs and we believe further work needs to be undertaken in order to validate the relevance of the models. In addition, we would also suggest that the ORR will need to satisfy themselves that the rigour and accuracy of the new models are suitable to be used to estimate track costs for CP5.



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### Modelling Techniques – Non Track Costs

It would appear that Network Rail do not have any ‘modelling’ information available to be able to estimate the likely impact of non track costs in CP5 – instead ‘top down engineering judgement’ has been used.

There is a fundamental change in the methodology for estimating the CP5 non track costs estimates in that Network Rail wish to include masonry and brick underbridges in the formulae for estimating the VUC’s .

In addition, based on engineering judgement, Network Rail also consider it necessary to include the costs of culverts and minor works to signalling points in the formulae for estimating the VUC’s.

These changes, which are based solely on engineering judgement appear to be the main reason why there is a proposed increase to the VUC’s and subsequently the level of the Freight Cap.

The engineering assumptions made by Network Rail resulted in the initial recommendations to be made as follows:-

- the 20% variability assumption applied to metallic underbridges should be applied to brick and masonry underbridges.*



## 5. TECHNICAL REVIEW

- A 5% variability assumption to culverts.
- A 44% variability assumption to be applied to minor works points renewals.

We are surprised that Network Rail have adopted a 'top down' engineering judgement methodology on a range of issues that have a fundamental impact on the calculation of costs for the VUC's.

We also note that in December 2006, as part of PR08, the Office of Rail Regulation stated:-

*"our preferred method for calculating the variable usage charge is through forward looking bottom up engineering analysis, although we acknowledged that there may not be enough time in PR08 for Network Rail to undertake all the detailed work necessary and would accept a continuation of the hybrid approach."<sup>1</sup>*

In addition, the independent reporters, Halcrow who were appointed to review Network Rail's variable and freight only line cost estimates

<sup>1</sup> An extract from Paragraph 3.22 of the Office of Rail Regulation Document "Periodic review 2008- Consultation on Caps for Freight Track Access Charges" dated December 2006



concluded that NR needed to do more work to justify their cost estimates.<sup>2</sup>

We do not understand why 6 years after the publication of the above report Network Rail are still using 'top down – engineering judgement' to estimate parameters of the VUC calculation that have a significant impact on the suggested increase to VUC's, specifically as we note that the ORR have stated that their preferred method for calculating these costs should use bottom up methodologies.

In our opinion, there is not sufficient technical information in any of the consultation documents backing up the engineering judgements that have been made in the top down assessments. The effects of loading on brick and masonry arch structures, for example, is very complex and it would appear that Network Rail have made some very 'straight forward' assumptions.

We believe it is essential that Network Rail provide further detailed information to the Rail Freight Industry that give credibility to the engineering judgements that have been adopted.

<sup>2</sup> An extract from Paragraph 3.37 of the Office of Rail Regulation Document "Periodic review 2008- Consultation on Caps for Freight Track Access Charges" dated December 2008





## 5. TECHNICAL REVIEW

We also suggest that assurances should be sought from the ORR that they are still content for Network Rail to be using top down engineering judgements on factors that have a significant impact on the VUC cost estimates for CP5 when they had previously asked Network Rail not to use the 'top down' process.

In their consultation response letter published on the 21<sup>st</sup> March 2012 Network Rail made the following statements:-

*“Masonry arches have historically been reliable because the weight of vehicles using them has been small in comparison to the weight of the structure itself. Hence, the fluctuating load was well within the capacity of the materials the bridge was constructed from. For passenger and light freight traffic we consider that this still remains the case today. However, we have observed that heavy freight traffic, composed of four axle bogie wagons with axle loadings in excess of 22.5 tonnes, causes greatly increased deterioration in arches.*

*Recently, as a result of a safety issue with arch viaducts in Scotland, we conducted research to monitor a range of structures and model the effects of this heavy traffic. We are now able to better understand the interaction between heavy wagons and arches, the cause of the rapid deterioration, and identify the groups of*

*structures at risk. The research has confirmed the observational evidence that heavy freight traffic is damaging many arches and that in addition to on-going work, any new heavy freight flows will lead us to identify, monitor and undertake precautionary works to arches that fall in the highest risk groups.”*

We do not feel it is appropriate for Network Rail to suggest that passenger traffic does not have any impact on brick and masonry arch structures. There is evidence available that would suggest that the resonance associated with high speed passenger trains can affect brick and masonry arch structures – this is dealt with in more detail in Chapter 6.

We also do not feel that it is appropriate to take a 'blanket' approach to the affects of brick and masonry arch structures as a result of problems that have been experienced with a particular arch structure in one part of the Country. There are many factors that would have had an impact on the performance of that structure not just the fact that heavy freight traffic may have travelled over the bridge. The effects of loads on structures can only be dealt with on a 'structure by structure' basis. This complex issue is also examined in more detail in Chapter 6.

We would welcome sight of the research work that Network Rail have referred to in their consultation response letter.



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## 5. TECHNICAL REVIEW

### Variability Assumptions - General

Network Rail have applied a range of 'top down' variability assumption factors to the cost estimates in order to estimate individual asset category cost estimates for the CP5 period.

These variability assumptions appear to be an 'arbitrary' assessment and it is understood that they are derived from the Booz Allen Hamilton Study for the structure of costs and charges (SOCC) review in 2005.

There is not enough information in the consultation documents to determine the appropriateness of the variability assumptions, although it is noted that if the assumptions are derived from the Booz Allen Hamilton study, the figures are now nearly eight years old.

We suggest that Network Rail should provide further information regarding the appropriateness of the variability assumptions that they have used in the determination of the VUC cost estimates.

### Variability Assumptions – Brick and Masonry Arch Structures

In the original consultation documents Network Rail introduced their proposal to apply the same variability assumption of 20% that was used for metallic structures to brick and masonry arch

underbridges.

Whilst we have not had access to the background data that Network Rail has used to calculate their variability assumptions we do not believe it is appropriate to treat brick and masonry arch structures in the same way as metallic underbridges. They are significantly different types of structures and the materials will act in significantly different manners.

In their consultation response letter published on the 21<sup>st</sup> March 2012 Network Rail suggested that a better approach to estimating the variability assumption for brick and masonry underbridges would be to estimate costs on existing and new heavy freight routes.

In the consultation response letter they make the following statements:-

*“Therefore, in respect of ‘existing’ routes, based on engineering judgement we estimate that for a ‘national average’ 70 mile section of track subject to heavy freight traffic that £200K per annum would be required to remedy the effects of heavy freight traffic. We can extrapolate this cost estimate across the proportion of the network that we estimate, based on expert judgement, is made up of ‘existing’ heavy freight routes in order to derive a national estimate of £10.98m.*



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## 5. TECHNICAL REVIEW

*In respect of ‘new’ routes, based on engineering judgement we estimate that for a ‘national average’ 70 mile section of track subject to heavy freight traffic that £2.1m would be required to remedy the effects of heavy freight traffic. This estimate is based on our annual renewals expenditure on the Settle and Carlisle Line which is approximately £3.5m per annum, reduced by 40% to reflect the fact that this line has more extreme topography with a greater number of larger structures; necessitating higher renewal costs than one would expect on the rest of the network more generally. We can extrapolate this cost estimate across the proportion of the network that we estimate, based on expert judgement, that is made up of ‘new’ heavy freight routes in order to derive a national estimate of £2.35m.*

*Based on the above cost estimates for ‘existing’ and ‘new’ heavy freight routes we estimate total masonry and brick variable usage costs to be £13.3m per annum, this equates to a variability assumption of 14%. We consider this revised estimate to be more robust than our original estimate of 20%. It should not, however, prejudice the outcome of any further analysis in respect of this issue, including that being carried out by freight operators, which we welcome.”*

In our opinion, this alternative methodology adopted by Network Rail still relies too heavily



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on engineering judgement, rather than verified technical research and output data.

We note that the Settle to Carlisle route has been used as the basis for calculating the cost estimate for ‘new routes’. We note that the £3.5million renewals cost per annum is reduced by 40% to reflect the fact that the line has more extreme topography than most routes. We would suggest, however, that this figure should be reduced by more than 85% as it is one of the most extreme routes in the UK with well over 20 large viaducts in its approximately 70 mile route – or alternatively a more standard route could be used as a base model.

We have also concluded that if the weak brick and masonry arch under bridges in 98% of the existing heavy freight lines (98% of 3920, or 3842 route miles) have already been strengthened as confirmed by the footnote on page 19 of the Network Rail Consultation Conclusion letter, with just 78 “new” heavy route miles that would cost £2.35million to strengthen, then the total new annual spend during CP5 would be at most the annual spend in the current CP4 plus the £2.35million extra.

### Variability Assumptions - Minor Points Renewals

Network Rail have used engineering judgement to estimate that a 44% variability assumption



## 5. TECHNICAL REVIEW

should be applied to minor works points renewals.

In our opinion, the 44% variability assumption seems overly excessive when compared to the other variability percentages that have been considered in the CP5 calculations.

In addition, it is also unclear why this track asset is being treated in the 'top down' methodology rather than the bottom up approach which has been used for other track assets.

In their consultation conclusion letter Network Rail have included a number of explanatory notes on how they have achieved their estimate for the minor works signalling variability assumption.

We have reviewed the Network Rail explanatory notes and believe a number of mathematical errors have been made in the calculation process. We would suggest that Network Rail review the calculation that they have made.

Network Rail uses a 100% growth scenario for estimating the cost increases associated with growth. The 100% increase in traffic is used in their calculations and we feel this will significantly over estimate the variability assumption for minor points works.

Our own review of the data contained in the consultation conclusion letter would suggest that the actual variability assumption should be, at least, reduced by 50%.

In our opinion, Network Rail should provide further information on their calculations for the variability assumptions so that a further review can be undertaken.

### CP4 and CP5 Cost Comparisons

The 29<sup>th</sup> of November 2011 consultation letter contains a number of tables that summarise the various track and non track categories and their associated cost estimates between CP4 and CP5.

Paragraph 21 of the consultation letter states that the annual average costs for the non track assets have been modelled using the Infrastructure Cost Model (ICM). NR have previously taken the decision to stop using the ICM for estimating track related costs, instead favouring the VTISM and the SRSMM models.

Presumably, the change in modelling methodology has been implemented as an improvement to the ICM modelling method. If the ICM is not the favoured model it brings into question the accuracy of the information used to determine anticipated non track related costs.



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## 5. TECHNICAL REVIEW

We would suggested that Network Rail provide further clarity on the suitability of the ICM model to estimate non track variable usage costs.

cost information in the consultation documents has been undertaken in order to summarise the main changes being proposed by Network Rail as follows:-

A review of the various tables and elements of

Asset type	CP4 Variable Usage Cost (£m)	Percentage Variability	CP5 Variable Usage Cost (£m)	Variance with CP4 variable usage cost (£m)
Track maintenance and renewals	221	N/A	242.4	+21.4
Embankment renewals	2	6%	1.9	-0.1
Metallic underbridge renewals	19	20%	9.7	-9.3
Brick and masonry underbridge renewals	0	20%	18.5	+18.5
Culverts Renewals	0	5%	0.5	+0.5
Signalling Maintenance	6	6%	8.2	+2.2
Minor works signalling points renewals	0	44%	5.4	+5.4
<b>Total</b>	<b>248</b>		<b>286.6</b>	<b>+38.6</b>

**Cost comparison between annual CP4 costs and anticipated CP5 costs – the above figures have been obtained from a review of the various consultation documents issued by Network Rail**



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## 6. BRICK AND MASONRY ARCH STRUCTURES

The consultation documents issued by Network Rail indicate that the main reason for the anticipated increase in the VUC's is as a result of the inclusion of a number of non track related elements in the calculation for the anticipated CP5 figures that were not included in CP4.

The largest impact on the estimated increase to the charging regime for the CP5 figures is the inclusion of the 20% variability assumption that was applied to metallic under bridges being extended to brick and masonry arch structures.

The effects of moving loads on structures is an extremely complex one and we feel that, Network Rail have taken an inappropriate approach that is based on 'engineering judgement' rather than validated technical appraisals and engineering processes.

In addition, another important factor which has already been discussed by this report is that Network Rail are suggesting that there is a directly proportional relationship between costs and an increase in traffic. Again, we do not believe that there is enough suitable validated technical information in the consultation documents that justify this relationship.

We note, however, that the two factors mentioned above (engineering judgement and growth v cost relationship) has the largest impact on the estimation of the CP5 VUC costs.



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The relationship between the effects on a structure as a result of moving loads is extremely complicated and it is simply not possible to go into the full details of the issue in this report. The purpose of this Chapter is to identify some of the technical factors that we feel should have been taken into consideration and to show the use of engineering judgement on its own is not acceptable.

In our opinion, we believe the following technical issues need to be taken into consideration when examining the effects of growth and freight train movements:-

### Vibration and Resonance

The effects of vibration of a dynamic (moving) load on structures and parts of the structure have been well known for some time.<sup>3</sup> Moving loads have an effect on dynamic stresses in structures and cause them to vibrate intensively, especially at high velocities.

Research has indicated that the long term effects of the vibration of the load travelling over the structure will have a bearing on the future maintenance requirements of the structure.

<sup>3</sup> For example, *Vibration of Solids and Structures Under Moving Loads – Ladislav Fryba*, Published by Thomas Telford Ltd in 1972.



## 6. BRICK AND MASONRY ARCH STRUCTURES

We do not believe the methodologies adopted by Network Rail give enough consideration to this issue. Alternatively, Network Rail have concentrated on the effects of the axle loads of heavy freight trains on brick and masonry arch structures.

The long term effects of vibration caused by moving loads will be influenced by all trains that travel over the structure and we believe the effects of this phenomena should be investigated in more detail.

Although the basic dynamic impacts due to moving loads has been known for some time a more recent emergence is the phenomenon of resonance. Resonance is the state of a system in which an abnormally large vibration is produced in response to an external stimulus, occurring when the frequency of the stimulus is the same, or nearly the same, as the natural vibration frequency of the system.

Furthermore, resonance is the condition when the natural frequency of a structure or material and the frequency at which it is operated are equal or very nearly equal. This makes the structure or material become very excited and can often lead to unexpected behaviour of the structure or material.

Again, this complex issue does not seem to have been taken into consideration during the

calculation of the CP5 VUC cost estimates. Research work undertaken by the Rail Safety and Standards Board has further examined these complex issues and has suggested that train velocities can be just as an important factor affecting bridges as axle weight.

### Train Velocities

Research work has been undertaken that shows that the vertical deflection of structures increases with train velocity, however, the relationship between train velocity and maximum net horizontal stress is not linear. The largest incremental increase in the maximum net horizontal stresses occurs when the train velocity increases from 250 to 350KpH.

The research also indicates that the maximum vertical deflection of a high speed passenger train with an axle load of 250kN travelling at 250 to 350KpH is greater than a freight train of axle load 330kN travelling at 100KpH.

Again, this is another issue that needs further consideration in the estimation of the VUC's to make sure the allocation of costs between passenger and freight operators is appropriate.

This is a significantly important issue that we believe warrants a specific research exercise being undertaken by Network Rail.



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## 6. BRICK AND MASONRY ARCH STRUCTURES

### Construction Materials

There are a number of construction material parameters that need to be taken into consideration when examining the effect of increased freight traffic on brick and masonry arch structures.

It is not simply the case of saying that there is a directly proportional relationship between freight growth and maintenance costs of brick and masonry arch structures.

Historically, a number of different types of materials have been used to construct brick and masonry arch structures in the UK and each product has differing properties and engineering qualities. Depending on the age and quality of construction, each material type will now be acting in differing ways. The only way to determine the current properties of the materials in a structure is to undertake a site specific appraisal of each structure.

We would expect Network Rail to have an asset register of their structures and the associated condition, construction methodology, loading limits etc. We would suggest that this asset register should be used to determine what proportion of brick and masonry arch structures may be affected by a growth in rail traffic – rather than using a blanket approach.

In addition, depending on location, age and build quality, there is a selection of differing mortar types and mixes that were used during the construction of brick and masonry arch structures, and again, each will have differing properties in the overall behaviour of the structure. This will need to be examined on a structure by structure basis rather than making a simple linear relationship between growth and costs.

Other factors that will need to be taken into consideration when examining the effects of loads on the structure is the quality and type of ballast and / or sub ballast material, foundation types, soil and embankment parameters etc.

These are just some of the materials parameters that need to be taken into consideration when trying to examine the effect of increased traffic growth on brick and masonry arch structures – rather than assuming a simple linear relationship between traffic growth and cost.

### Maintenance History

We do not have any access to Network Rail's maintenance history record for their brick and masonry arch structures.

The maintenance history is an important factor that needs to be taken into consideration when



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## 6. BRICK AND MASONRY ARCH STRUCTURES

examining the effects of rail growth on brick and masonry arch structures.

A structure that has a high quality maintenance history with the appropriate repairs and on going upkeep will have a better long term performance than a structure that has not been maintained appropriately. In addition, previous repair works that have been undertaken to the structures may affect the capability of the structure to accommodate future freight and passenger growth.

The effects of the maintenance history on growth can only be examined on a structure by structure basis. We would envisage that Network Rail would be able to interrogate their asset register in order to be able to identify the proportion of their brick and masonry arch structures which are at most risk to the effects of rail growth rather than using a blanket approach.

### Traffic Constitution

As mentioned previously it is likely that a large proportion of rail freight growth will be as a result of an increase in movement in the multi modal and retail sectors.

These sectors will result in lighter trains using the network and will not have the same impact of heavy loads that Network Rail are implying.



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In addition, we have previously discussed in this chapter the effects that the higher speed passenger trains could have on brick and masonry arch structures as a result of vibration and resonance. In the absence of any technical research information the detrimental effect of high speed passenger trains on the network has not been taken into consideration.

### Design Parameters

Each brick or masonry arch structure would have originally been designed to accommodate varying local factors. Whilst we accept that a large number of the bridges are of such an age that the original design factors will not be as relevant as when they were new, each individual bridge structure will act according to its own individual parameters such as:-

- Height
- Length and Width
- Foundation Details
- Ground Conditions
- Adjacent embankment details, etc.

All of these factors, and the original design parameters, will have a bearing on the load carrying capacity of the structure.

Again, the effects of these need to be considered on a bridge by bridge basis rather than adopting a blanket approach.



## 6. BRICK AND MASONRY ARCH STRUCTURES

### Zone of Influence

As mentioned previously, it is likely that some of the growth expected in the UK will be dealt with by the freight operators simply extending the length of their trains. In these examples it is likely that the individual axle loads passing over a structure at any one time will remain the same i.e. axle loads will not be increased.

The effects on a brick and masonry arch structure of a longer train travelling over it with the same axle loadings is a complex issue which we do not feel has been examined appropriately in the determination of the estimation of VUC costs.

It could be argued, however, that two different length trains with the same individual axle loads will have the same effects on the brick and masonry arch structure. The longer train will not be imparting a different point load on the structure – it will just be longer.

We acknowledge that a longer train travelling over the structure may have a bigger impact in terms of vibration and resonance but as freight train speeds are relatively slow we do not feel this will be a big impact.

In our opinion, we do not feel Network Rail have taken this parameter into consideration in their methodologies.



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### Ultimate Limit State and Serviceability Limit State

The Ultimate Limit State (ULS) is defined as the condition at which a collapse mechanism forms in the structure or its supports. In other words, if the ULS capacity is exceeded the structure will fail. The Serviceability Limit State (SLS) is defined as the limit at which there is a deformation in the structural performance which may measurably affect the ability of the bridge to carry its working loads for the expected life of the bridge.

All of the parameters discussed previously in this chapter will have an impact on the ULS and SLS of the brick and masonry arch structure. In theory, each individual structure will have a load capacity that can be accommodated before the ULS or SLS is achieved.

It could be argued that if an increase in axle load or train length does not result in a loading on the structure that is close to its ULS or SLS there will be no detriment to the structure.

We anticipate there will be many bridges throughout the UK in this category and we do not, therefore, feel it is appropriate to have a blanket approach to the treatment of brick and masonry arch structures.



## 6. BRICK AND MASONRY ARCH STRUCTURES

### Technical Conclusion

The purpose of this Chapter has been to provide a brief review of some of the many complex technical issues that need to be taken into consideration when examining the impact of possible freight traffic increases on the brick and masonry arch structures.

We accept that there is a requirement for maintenance costs to be attributed to managing the performance and safety of brick and masonry arch structures. We feel it is too simplistic an approach, however, to attribute variability costs to a given percentage increase in traffic volumes below serviceability limit state of the bridges. There is a vast amount of research projects and data regarding the performance of brick and masonry arch structures in the public domain and we would expect these to be considered when developing the cost estimation process for the CP5 VUC's.

The analysis of dynamic loadings on brick and masonry arch structures is an extremely complex issue which requires a large amount of analysis and effort. We have discussed in this Chapter that we feel the effect of passenger and freight traffic growth on the network can only be examined on a bridge by bridge basis.

We would, therefore, recommend that a detailed research project be undertaken,



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in conjunction with an independent research institute, to examine the effects of an increase of passenger traffic, high speed passenger traffic, freight traffic and heavy axle freight traffic, **specifically** on brick and masonry arch structures.

This will be a complex research project and will need to examine the following parameters:-

- An increase in axle weights
- An increase in train lengths
- Train velocities
- Vibration
- Resonance
- Individual conditions

As this research project will need to be done on a 'bridge by bridge' basis, we would also suggest that Network Rail review their asset inventory so that we could have a clear picture of the true state of the brick and masonry arch bridges on the Network.

In addition, we would also recommend that a wide selection of the Network Rail bridge inspection reports be examined for brick and masonry underbridges so that we can get a full understanding of the challenges that need to be addressed.



## 7. CONCLUSIONS

Morgan Tucker has been commissioned by Operators of the Rail Freight Industry (DB Schenker, Freightliner, Direct Rail Services, GB Rail Freight, Colas) and the Rail Freight Group to review and provide a technical commentary on the various consultation documents that have been published by Network Rail in relation to a proposed increase to variable usage charges, freight only line charges and Freight Caps.

The Network Rail consultation documents indicate that the main reason for the suggested increase to the CP5 VUC cost estimates is as a result of including the variability assumption for costs relating to brick and masonry arch structures, culverts and minor works to signalling assets. The largest impact on an increase in CP5 cost estimates is the inclusion of brick and masonry arch structures and as such the contents and comments in this report have concentrated on this issue where appropriate.

In order to ensure impartiality during the review process, Dr David B Tann who is the Head of Urban Engineering at London South Bank University, has been asked to appraise the consultation documents and make an initial assessment of the technical parameters followed by Network Rail.

This report has reviewed in detail the



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information contained in the consultation suite of documents and undertaken an initial technical summary of the very complex issue of dynamic loading on brick and masonry arch structures. We would make the following conclusions:-

- We do not feel that there is a directly linear relationship between growth and costs. The blanket approach that Network Rail have adopted will result in an over estimation of the effects of rail freight traffic.
- The VTISM and SRSMM models are newly adopted models and the accuracy of the modelled results need further validation. Even with the further information contained in the consultation conclusion letter they do not appear to be able to suitably model reduced traffic volumes.
- We have shown that the relationship between traffic growth and costs associated with brick and masonry arch structures is extremely complicated. As there is no direct linear relationship between traffic growth and brick / masonry arch structures we do not feel the process followed by Network Rail is appropriate.
- We have noted that in 2006 the ORR stated that their preferred method of estimating costs should be the 'bottom up' process using detailed engineering analysis.



## 7. CONCLUSION

- There is not enough information in the consultation documents to determine the appropriateness of the variability assumptions, although it is noted that if the assumptions are derived from the Booz Allen Hamilton study, the figures are now nearly eight years old.
- The 44% variability assumption applied to minor works points renewals seems overly excessive.

The analysis of dynamic loadings on brick and masonry arch structures is an extremely complex issue which requires a large amount of analysis and effort. We have discussed in this report that we feel the affect of passenger and freight traffic growth on the network can only be examined on a bridge by bridge basis.

We do not, therefore, believe it is appropriate to adopt the blanket coverage approach and engineering judgement techniques that Network Rail have adopted. We do not feel there is enough information in the consultation documents to justify the cost increases being proposed for the VUC's.

As the issue is such a complex one, we would recommend that the existing VUC charges passed on to the Rail Freight companies be

frozen for the next control period in order to give enough time for a thorough research programme, specifically in relation to brick and masonry arch structures, to be undertaken. The research project will need to examine the effects of an increase of passenger traffic, high speed passenger traffic, freight traffic and heavy axle freight traffic, **specifically** on brick and masonry arch structures.

This will be a complex research project and will need to examine the following parameters:-

- An increase in axle weights
- An increase in train lengths
- Train velocities
- Vibration
- Resonance
- Individual conditions

As this research project will need to be done on a 'bridge by bridge' basis we need full access to the Network Rail asset inventory so that we could have a clear picture of the true state of the brick and masonry arch bridges on the Network.

We would also recommend that a full and detailed inventory survey of all brick and masonry underbridges be undertaken so that we can get a full understanding of the challenges that need to be addressed.





## Annex A

# A review of the consultation responses made by the Rail Freight Industry



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## ANNEX A: REVIEW OF CONSULTATION RESPONSES MADE TO NR

Following the publication of the Network Rail Consultation documents various organisations from the rail freight industry returned consultation responses highlighting their concerns and comments.

This Chapter provided a brief summary of the consultation responses that have been returned. It is understood that the following organisations provided a consultation response:-

- Rail Freight Group
- DB Schenker
- GB Rail Freight
- Freightliner
- Direct Rail Services Ltd
- Freight Transport Association

Whilst the responses from the above companies were detailed and varied the following main elements were discussed.

### Rail Freight Group

The Rail Freight Group supports the principles of applying a cap on freight charges at an early stage in the PR13 process although they have expressed concern in relation to the timescales involved in undertaking work in areas other than VUCs.

If a freight cap is to be agreed in 2012 the Rail Freight Group (RFG) feels that there needs to be urgent progress involving all parties on the 'freight deal'.

The RFG are concerned that a large amount of work still needs to be done to assess the affordability implications on freight only line charges.

There is also concern as to the quality of data available to NR to enable them to assess the level of any fixed costs for freight traffic.

Whilst the RFG do not object to the principle of the modelling approach used to calculate VUC costs, they would expect the ORR to satisfy themselves as to the rigour and detail of the VTISM and SRSMM models.

The RFG have an expectation that the ORR will ensure that the engineering judgements that have been relied upon throughout the consultation documents are appropriate and robust.

In general, the RFG support the range of traffic growth scenarios discussed in the consultation documents. They are, however, concerned that the models are unable to cope with modelled scenarios implying a reduction in traffic levels – this raises concern over the validity of the models being used.



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## ANNEX A: REVIEW OF CONSULTATION RESPONSES MADE TO NR

The RFG are also concerned that the modelling methodologies do not produce results on a route by route basis, particularly if ORR/NR are to move to route based charging regimes.

The RFG feel that the 44% variability assumption for minor signal works is excessive and should be explained in more detail.

The inclusion of the analysis on masonry and brick underbridges has caused significant concern and needs further detailed analysis.

The proposed confidence interval of +/- 20% is too high.

The suggested cap of £1.81 per kgtkm is too high.

RFG are concerned at NR's understanding of the network in relation to freight only lines. They are also concerned that there appears to be no robust traffic data for some route sections.

### DB Schenker

DB Schenker strongly support the intention to place a cap on anticipated VUC's although they are concerned that they have been set too high and will, consequently, give a negative message to the industry i.e. rather than giving the rail industry and its customers the degree of certainty and assurance they are looking for, it

could instead cause concern that track access charges could be significantly increased.

DB Schenker have stressed that the setting of the Freight Cap charge needs to happen as soon as possible, albeit at a suitable figure less than £1.81 kgtkm.

Whilst DB Schenker note the progress that has been made regarding VUC's they are concerned that work on other elements relating to charging has not been progressed.

The ORR is assessing the ability of rail freight markets to bear a 'mark-up' on direct track access costs with particular emphasis on the ESI coal, nuclear and biomass sectors. DB Schenker hope that the consultation work for this element can happen as a matter of urgency.

Network Rail indicate in their consultation documents that the VTISM and SRSMM models used to estimate track costs are widely accepted industry models – DB Schenker challenge this statement.

It also indicates that their involvement in the industry working group was only as a result of their direct interaction – rather than being invited.



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## ANNEX A: REVIEW OF CONSULTATION RESPONSES MADE TO NR

DB Schenker are concerned on the heavy reliance on the use of 'engineering judgement' throughout the consultation process.

DB Schenker are concerned that the VTISM and SRSMM models are not capable of modelling a reduction in traffic volumes on the network and as such challenge the suitability of the modelling techniques.

Like most of the other freight organisations, DB Schenker have significant concern in relation to the 'top down' engineering assumptions that have been used throughout the consultation documents.

In addition, they are concerned that no technical information has been provided in relation to brick and masonry arch structures.

The suggested increase to the variability assessment for minor signalling works seems to be excessive.

DB Schenker consider the proposed confidence level of +/- 20% to be excessive.

DB Schenker believe the suggested cap estimate of £1.81 kgtkm is too high and that a 33% increase on the current CP4 average vehicle cost is excessive.

### GB Rail Freight

Whilst GB Rail Freight support the consultation that is being undertaken on VUC's they are concerned that costs may escalate from April 2014 onwards.

GB Rail Freight are supportive of the philosophy to set a freight cap at an early stage but are concerned at the assumptions that have been made in the consultation documents.

The issue relating to under bridge and culvert renewals is causing particular concern and further detailed work is required.

The suitability of the VTISM and SRSMM models need further validation and to show the ability to reflect a decrease in traffic volumes.

The use of a 20% traffic growth scenario is too high.

The biggest concern for GB Rail Freight is the inclusion and use of 'engineering judgement' to determine estimated costs associated with non track assets.

GB Rail Freight believes the +/- 20% confidence rate is too high and would prefer more emphasis being placed on inputting of accurate data in the first place rather than relying on large confidence factors.



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## ANNEX A: REVIEW OF CONSULTATION RESPONSES MADE TO NR

### Freightliner

Freightliner recognise the work that has been done to consider the emerging view on the variable costs of track, civils and signalling for CP5.

They are, in principle, supportive of the implementation of a freight cap as early as possible in the process but would note that without including capacity charges and the possible scarcity and reservation charges, the attempted relaying of certainty to customers and investors is undermined.

Freightliner welcome the work that has been done to use the VTISM and the SRSMM models but they do have some specific comments and concerns relating to these models.

The assumptions and numbers referred to in the consultation documents were very difficult to follow particularly when trying to compare PR08 and PR03 values.

The models are unable to produce meaningful results for a fall in traffic and that the baseline is a forecast for 2013/2014 rather than an actual activity level – there should have been some sort of validation process to prove the new models.

Freightliner disagree with the 'perfect relationship' between cost and traffic growth and would suggest this is as a result of the method rather than reality.

Freightliner question why the +/- 20% confidence level is necessary as Network Rail are promoting VTISM and SRSMM as an improvement to modelling techniques and should therefore be more accurate.

The methodology to calculate the suggested Rail Cap results in a number that is too high as is the use of the generic use of the +20% traffic growth factor.

There is concern regarding the movement of costs relating to the non track assets and the dramatic impact this has on the VUC's.

Freightliner are concerned at the reliance on professional opinion based on a small sample data, for example, high profile viaduct failures in Scotland.

They also question the relevance of including road user misuse at levels crossings as a parameter that is passed to the FOC's and TOC's in the VUC's – surely this factor should be a fixed cost?



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## ANNEX A: REVIEW OF CONSULTATION RESPONSES MADE TO NR

### Direct Rail Services Ltd

Direct Rail Services Ltd (DRS) are concerned that any significant increase in charges could be damaging to the rail freight sector with customers' confidence in rails ability to compete with road freight being reduced.

DRS support the principle of a freight cap and find it encouraging that it is being discussed at an early stage in the PR13 process.

They express concern that the consultation documents indicate that Network Rail do not have robust traffic data available to them to estimate the VUC's. They are of the opinion that this issue must be addressed as a matter of urgency.

DRS are disappointed that the newly adopted VTISM and the SRSMM models are only capable of dealing with traffic growth and question what would happen if there was a reduction in traffic flows on the network.

DRS question the relevance of including road user misuse at level crossings as a parameter that is passed to the FOC's and TOC's in the VUC's – surely this factor should be a fixed cost?

The variability assumptions for points (18%) and minor works to points (44%) needs further



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clarification.

Concern is also expressed at the 'engineering judgement' that has been used in relation to bridges and structures and have asked for further scientific clarification.

DRS do not agree with the 20% confidence level proposed by Network Rail and suggest it indicates that there is no confidence in the new VTISM and SRSMM models that have been adopted.

They also do not agree with the use of the +20% confidence factor to calculate the suggested cap estimate.

DRS question why the nuclear only freight lines show three 'new' lines coupled with an 83% increase in costs and are concerned that an error was made previously. This does not instil confidence in the Network Rail knowledge of their network.

### Freight Transport Association

The Freight Transport Association indicate in their letter that they represent the end users of rail freight i.e. the shippers and they do not have detailed comments to make on the rail freight elements of the consultation.

They do make the general comments as follows:-





## ANNEX A: REVIEW OF CONSULTATION RESPONSES MADE TO NR

- The FTA are concerned that costs to the rail freight companies are reduced and to give certainty of cost to the end user so that rail can be as competitive as road freight.
- Whilst the FTA agree with the underlying estimates of growth in rail freight traffic, there needs to be certainty in a continuing reduction of the VUC's to reflect Network Rail's continued efficiencies in the delivery of infrastructure.
- The FTA oppose mark ups on freight only line traffic segments where market analysis shows certain markets can bear these costs.

The consultation documents issued by Network Rail and the responses made by the Freight operators contain a large number of complex issues that need further substantial input from Network Rail.

It would not be possible to discuss at length every single element in this report but in order to aid discussion that will need to be had between the freight operators and Network Rail, a matrix of the main items identified by the Freight operators is shown on the next page.

The Freight Transport Association column has been 'greyed out' as the comments they returned were general industry wide comments, rather than freight specific comments.



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## ANNEX A: REVIEW OF CONSULTATION RESPONSES MADE TO NR

Objection	Rail Freight Group	DB Schenker	GB Rail Freight	Freightliner	Direct Rail Services Ltd	Freight Transport Association
Supports the principle of the implementation of a Freight Cap as soon as possible						
Concern about the affordability of freight only line charges						
The validity, suitability and robustness of the VTISM and SRSMM is not good enough						
VTISM and SRSMM is not an industry wide tool as suggested by Network Rail						
The philosophy of engineering judgement on such important issues is a flawed approach						
44% variability assumption for minor signalling works is excessive – and there is no data available to back up this number						
The ‘top down’ approach to the inclusion of brick and masonry arch structures (and other non track costs) is not acceptable						
The confidence interval of +/- 20% is too high, particularly with the use of new modelling techniques						
The suggested freight cap estimate contained in the consultation documents is too high						
Work on other factors affecting costs is not being addressed						
The inclusion of costs associated with driver damage at level crossings is not appropriate						



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# Appendix A

## South Bank University Review Letter



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Ref: dbt/20120416  
Date: 19 April 2012

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Dear Matthew,

**Network Rail Freight Cap Consultation  
Brick and Masonry Arch Bridges Technical Appraisal**

Having read the Network Rail (NR) Freight Cap Consultation document dated 29 November 2011, I would like to offer the following observations.

1. The main tools used in estimating the activities volumes of track degradation and maintenance, and hence indirectly the costs, were the Vehicle Track Interaction Strategic Model (VTISM), and the Strategic Route Section Maintenance Model (SRSMM).
2. It was noted that these newly developed models, whilst they had cross-industry representations during the development stage, the accuracy of the modelling results still need further validation.
3. The models are only capable of dealing with increased traffic scenarios. One notable deficiency is the models' inability in predicting meaningful activity volumes when reduced traffic scenarios were used, say, at -5% or -10%. This puts in doubt of the models' reliability and rigor, and hence confidence level of the results.
4. The CP4 baseline costs were based on activity volumes forecast for 2013/14 rather than any verifiable operational data, hence adds further uncertainties to the modelling results.
5. Based on "engineering judgement and experience 'on the ground' in CP4," NR assumed a 20% variability to masonry and brick arch underbridges in a top down approach when estimating non-track costs, together with a 5% variability assumption to culverts. The approach to include these two categories of civil engineering structures that were not considered in CP4 for variable costs and the way the variability percentages were determined appeared to be rather arbitrary without presenting any valid supporting evidence.
6. Whilst it is recognised that increased traffic volumes could have some impact on the structural performance of masonry and brick underbridges, it was too simplistic an approach to attribute variability costs to a given percentage increase in traffic volumes either at or below serviceability limit state of the underbridges or culverts,

especially when such an attribution was made without convincing supporting evidence.

7. It is noted that in its latest concluding document dated 21 March 2012, NR has adjusted the assumed variability for masonry and brick underbridges from 20% to 14%. This adjustment was based on “engineering judgement” that for a ‘national average’ 70 mile section of track subject to heavy freight traffic, £0.2m and £2.1m per annum would be required to remedy the effects of heavy freight on the existing and new routes respectively. This is a welcome move towards transparency but still lacks convincing supporting evidence.
8. If the weak brick and masonry arch underbridges in 98% of the existing heavy freight lines (98% of 3920, or 3842 route miles) have already been strengthened as confirmed by the NR report (p18-19), with just 78 “new” heavy route miles that would cost £2.35m to strengthen, then the total new annual spend during CP5 would be at most the annual spend in the current CP4 plus the £2.35m extra, ie, £62m + £2.35m = £64.35M. However, an annual spend of £93m is estimated for CP5, which is 150% of that for the CP4 value of £62m.
9. The £93m annual total spending on brick and masonry arch bridges is therefore considered a great overestimation. It should be a maximum of £73.3m even if a 14% variability is included.
10. The relationship between structural behaviour of brick and masonry arch underbridges to traffic volume and magnitude of loading below the serviceability limit state is a complex, non linear one. The material properties; arch and spandrel geometry; vehicle characteristics, original design parameters, configuration as well as loading magnitude and frequencies are just but a few influencing factors.
11. It is fully appreciated that maintenance costs are inevitably incurred by brick and masonry underbridges owners to ensure their intended functionality is fulfilled. However, a comprehensive, independent study is required before a definitive, quantifiable link between the changes in traffic loading and volume and the structural performance of masonry and brick underbridges, and hence the maintenance costs, can be determined.

With kind regards

Yours sincerely



Dr David Tann, CEng FICE

Head of Department