Network Rail and Office of Rail Regulation

AO/036: Review of Network Rail VTISM modelling and allocation to market segments for Freight Avoidable Costs

Report

223767-09-04-05

Issue 2 | 8 November 2012

Job number 223767-09

Ove Arup & Partners Ltd
13 Fitzroy Street
London
W1T 4BQ
United Kingdom
www.arup.com

ARUP

Contents

Tables

Figures

Appendices

Appendix A

Mandate

1 Introduction

In May 2012, the Office of Rail Regulation (ORR) issued a consultation to the rail industry on the variable usage charge and a potential freight-specific charge to be levied on operators in CP5. For freight operators, the ORR is considering replacing the existing freight-only line charge with a charge that would recover freight avoidable costs (that is, infrastructure costs that would be avoided if commercial freight services were removed from the network on a permanent basis), where the market can bear the cost.

Network Rail commissioned LEK to estimate freight avoidable costs. LEK recently produced a report setting out its findings[1]. Network Rail and the Office of Rail Regulation (ORR) have issued a mandate to carry out a high-level review of some of the analysis that was undertaken. Specifically, the purposes of this work are:

- To review Network Rail's (NR's) use of the Vehicle Track Interaction Strategic Model (VTISM) to support the work it commissioned from LEK, following a request by ORR, to estimate freight avoidable costs;
- To advise on the robustness of the VTISM model outputs, and the underlying data and assumptions used to produce these outputs; and
- To review LEK's initial analysis (carried out on behalf of Network Rail) of how freight avoidable costs should be disaggregated by market segment (commodity type).

This report presents our findings of this review. The mandate is provided in Appendix A.

[1] LEK Report: "Estimating Freight Avoidable Costs" version of 14th September 2012

2 VTISM Modelling

2.1 Introduction

Under LEK's analysis, the largest element of the estimate of freight avoidable costs is variable usage costs which are mostly made up of variable track maintenance and renewal costs. These costs have been estimated by Network Rail using the VTISM model and provided to LEK. LEK included two estimates of avoidable variable usage costs in its final report:

- The first approach estimated the costs of a marginal change in traffic (+20%) to estimate a cost per gross tonne km, and then applied this rate to all freight gross tonnage. It produced an annual estimate of avoidable variable usage costs of £70m and was included in the Low case scenario in LEK's "Estimating Freight Avoidable Costs" report.
- The second approach was to remove all freight traffic from the model and run it to estimate avoidable costs. This method produced a higher avoidable cost estimate of £178m per year and was included in the High case scenario.

A number of reasons have been given by Network Rail for the large difference in costs from the two approaches. These include:

- Removing all freight traffic in the High case scenario tends to impact slow and relief lines, where freight vehicles currently run. These lines are lower track category (because of the lower line speed) and tend to be more sensitive to tonnage changes leading to re-classification of track category and hence the volume of specified maintenance regime.
- Material methodological differences between the two approaches. The Low case scenario increased both passenger and freight vehicles in the same proportion as currently operates on the railway in order to estimate an average cost per gross tonne km. This average cost was then adjusted using the allocation methodology in the CP4 variable usage charging model in order to estimate a freight-specific average cost. In contrast, the average cost in the High scenario is based on removing all freight traffic.
- Freight tends to run on lower criticality routes, where although the cost per track km is lower, the cost per tonne-km is higher. The higher the average network tonnage the lower the expected cost of adding the same absolute tonnage (i.e. it costs more to add 1 million equivalent gross tonnes to a route currently carrying 1 million equivalent gross tonnes than it does to one carrying 30 million equivalent gross tonnes). This results in a flattening cost curve and thus a higher incremental cost at lower tonnages.

However, the wide variation in the two cost estimates has created some uncertainty in respect of the true quantum of avoidable variable usage costs. This section considers the modelling undertaken to gauge the level of uncertainty and to suggest what further work might be undertaken to improve the accuracy.

As agreed at the inception meeting, held on the 24th September 2012, our focus has been on the High case scenario, namely the modelled cost reduction associated with the VTISM run removing all freight traffic from the network. This was because, if robust, ORR and Network Rail advised that it appeared more relevant.

2.2 VTISM

VTISM is the Tier 1 strategic model developed as part of a significant research programme led by the Vehicle/Track Systems Interface Committee (V/T SIC) and supported by RSSB. Network Rail use VTISM to forecast maintenance and renewal (M&R) work volumes, condition, performance and expenditure for the whole track network.

VTISM forecasts the future track M&R volumes based on an input of set route tonnages (track life is primarily a function of wear and tear due to the weight of traffic carried), the existing degradation models and asset information.

In order to demonstrate compliance with the track policy objectives, as set out in the Network Rail Track Asset Policy document[2], the Tier 1 models are designed to produce track condition output indicators under the following headings:

- Actionable geometry defects per 100 km
- Ballast fouling
- Good Track Geometry
- Poor Track Geometry
- Rail used Service Life
- Serious rail defects per 100 km
- Sleeper used Service Life
- Switch used Service Life

The principal volume outputs by Strategic Route Section from VTISM are complete plain line track renewal, plain line medium and heavy refurbishment, S&C complete renewal, S&C medium and heavy refurbishment, track geometry maintenance, rail repairs and mechanical rail grinding.

Track interventions are defined by the user, based on the track location (e.g. route criticality), characteristics (e.g. sleeper type) and predicted condition (e.g. track quality or expected defects), either each month, for maintenance, or each year, for renewals.

One of the principal tools in VTISM is T-Spa, which is used to calculate the renewal and heavy maintenance work necessary to produce a required condition output. For the Initial Industry Plan, Network Rail ran the model iteratively over-riding automatic processes by using manual inputs of volumes of work until a balance is reached between the input and the pre-set condition output. It has made these manual interventions because by doing so it is able to take account of:

- Likely deliverability of renewals, including the volume that could be delivered with Network Rail's High Output track machines;
- Likely deliverability of heavy and medium refurbishments, which could be limited by the level of asset information available, the capacity of bespoke machinery that can be deployed, likely track access, reliability targets (at a generic level of route criticality) and the level of risk associated with moving from the CP4 policy to CP5 policy;

[2] Network Rail Track Asset Policy dated 11th September 2011

- Feedback from detailed modelling of interventions in 'Tier 2' models, including levels of uncertainty; and
- Route-specific issues that impact volumes of work.

It is adopting a similar approach in its analysis for the SBP.

For CP5 and subsequent control periods, Network Rail set the track condition outputs (see above) to be those planned for the end of CP4. In summary Network Rail's strategic track plan will be based on calculations in the model that will generate renewal and maintenance volumes compliant with policy to meet the pre set performance outputs, as measured by the condition indicators listed above. To these work volumes are applied unit costs to produce annual budgets.

The application of VTISM to produce Network Rail's Initial Industry Plan for CP5 for the track asset was a part of the overall review by Arup in their report "Part A Reporter Mandate AO/017: Initial Industry Plan (IIP) 2011 Review 16/12/2011". In this report Arup considered the work under the following headings:

- Robustness – "The track policy is deemed robust as it has demonstrated a good knowledge of the asset, its current condition and degradation rates, the impact of traffics forecast for CP5 together with a programme of maintenance and renewals that should deliver the same track performance and safety levels that will be in place at the end of CP4."
- Sustainability – "Sustainability is not clear. Analysis … suggests that track geometry quality remains fairly constant, whereas the used service life of rail, sleepers and ballast increases over successive control periods."
- Efficiency (optimum whole life cost) – "There are no detailed plans to show how track renewal volumes and track maintenance will be delivered in CP5 in a way that will deliver stated efficiencies. However, the early development is commendable."

VTISM was also used to estimate the variable track cost of freight for inclusion in ORR's Periodic Review 2013 consultation on freight charges in May 2012[3]. This was reviewed by Arup in March 2012, and concluded it was a sound bottom up approach.

2.3 Freight Avoidable Cost

Track life and its rate of degradation are primarily a function of gross vehicle tonnage. Therefore, by removing all freight traffic, and fixing track performance criteria, a reduction in the required M&R volumes can be calculated.

As a consequence of removing freight, new lower annual traffic tonnages will be set (and inter alia a reduction in annual track forces). Intervals between M&R interventions can be extended and the type of intervention can be changed in order to achieve the same track performance output to that produced by VTISM for IIP.

This reduction in M&R volumes has been calculated by Network Rail by removing all freight from the NETRAFF and ACTRAFF databases within VTISM

[3] "Periodic Review 2013 Consultation on the variable usage charge and on a freight-specific charge", May 2012

including Network Rail's engineering trains. In other words, only passenger trains are loading the track.

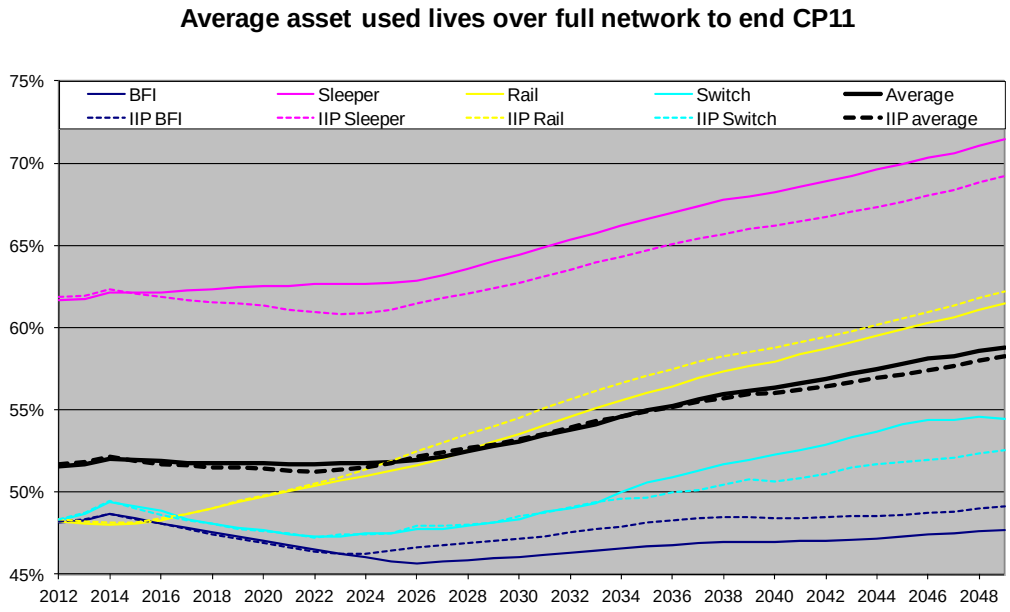
2.4 Network Rail's Modelling Methodology

To ensure deliverability and consistent with the method used to run VTISM for IIP, Network Rail manually interacted with the model, inputting type and frequency of interventions and aiming at all times to work within the range of track quality parameters set out in Network Rail track standards and the track policy.

For this piece of work, Network Rail used the IIP model as a baseline. It then made changes to the M&R interventions until, with new lower work volumes over successive control periods, the performance criteria without freight closely matched that achieved for IIP.

Figure 2.1 shows graphs of used track asset lives for both IIP and the removal of freight scenarios. Network Rail, in running the VTISM model, considered that as the asset lives were broadly equivalent under the two scenarios (as measured by the average asset lines shown by the black lines in the figure), the reduced M&R volumes forecast by VTISM could be attributed to the removal of freight services.

Figure 2.1: Graph of track asset used lives for IIP (dotted lines) versus Removal of all Freight (full line); source: Network Rail



2.5 Results

The revised M&R volumes were multiplied by the same unit costs used in the IIP calculations to give an annual cost reduction of £178m.

For CP5 to CP11, VTISM shows that when up to 37% of the total annual tonnage is removed the cost reduction is 23% overall (see Table 2.1 and Table 2.2). The smaller cost reduction is not unexpected because track M&R costs are not totally proportionate to tonnage. A small proportion of costs is necessary to manage the

line of route irrespective of traffic, such as fencing, track drainage, leaf fall and other factors associated with the environment and the neighbours to the railway. Also, higher speed lines are more expensive to maintain than lower speed lines, as they need to be stronger and have more accurate geometry.

Table 2.1: VTISM output showing reduced costs with freight traffic removed; source: Network Rail

	% saving in M&R costs with no freight, by control period									
	PL renew	***PL refurb***	***Rail***	***PL OTM***	***S&C renew***	***S&C refurb***	***S&C OTM***	***All CAPEX***	***All OTM***	**Total**
CP5	17%	26%	19%	40%	12%	14%	44%	17%	42%	20%
CP6	13%	26%	19%	41%	15%	20%	45%	17%	42%	20%
CP7	4%	27%	18%	41%	24%	21%	45%	17%	43%	20%
CP8	18%	29%	18%	41%	34%	21%	44%	25%	42%	27%
CP9	25%	25%	17%	41%	30%	24%	43%	25%	42%	27%
CP10	19%	27%	19%	41%	28%	21%	45%	23%	43%	25%
CP11	14%	29%	17%	41%	13%	25%	45%	18%	42%	21%
CP5-11	**16%**	**27%**	**18%**	**41%**	**22%**	**21%**	**45%**	**20%**	**42%**	**23%**

Table 2.2: Percentage of all traffic tonnage that is freight CP5 – CP8; source: Network Rail

End FY	All traffic	No freight from CP5	Freight fraction
2012	8.9	8.9	
2013	8.9	8.9	
2014	9.3	9.3	
2015	9.4	6.2	34%
2016	9.5	6.2	34%
2017	9.7	6.3	34%
2018	9.9	6.5	34%
2019	10.0	6.6	35%
2020	10.1	6.6	35%
2021	10.2	6.6	35%
2022	10.3	6.7	35%
2023	10.4	6.7	35%
2024	10.4	6.7	36%
2025	10.7	6.8	36%
2026	10.7	6.8	36%
2027	10.7	6.8	36%
2028	10.7	6.8	36%
2029	10.7	6.8	36%
2030	11.1	7.0	37%
2031	11.1	7.0	37%
2032	11.1	7.0	37%
2033	11.1	7.0	37%
2034	11.1	7.0	37%

2.6 Summary

Network Rail has used the same strategic track planning tool that will be used to generate its Strategic Business Plan for CP5, to calculate the Freight Avoidable Cost for track.

Whilst the tools and methodology are considered robust, there are a number of factors, in our opinion, that limit the confidence in the High case scenario result.

These include:

1. The CP5 track policy, as implemented in the VTISM runs for the SBP, has been developed in the context of forecast incremental increases in traffic, not for a single large reduction that applies when all freight is removed.
2. Network Rail has necessarily had to use judgement to apply revised intervention intervals and renewal types to produce the required performance level for a passenger only railway. These have been based on current track policies because amending the policies for such a railway would require significant effort. As an example, with the removal of all heavy axle load traffic, the track renewal policy for routes in Criticality Bands 3 and 4[4] could be changed to refurbishment only and the continuation of maintenance of

[4] Network Rail have classified all routes sections into one of five Criticality Bands, according to the amount of delay that an incident will cause, with 1 causing the most delay (generally the busiest sections) and 5 the least delay. The track policy is then tailored to each Criticality Band.

jointed track. **This simplification is likely to result in an under-estimate of freight avoidable cost**.

3. Using the track policy *material* specification for renewals might be more than is necessary with freight removed. Instead, the policy is likely to be refined to focus on the particular wear and tear characteristics of passenger traffic. Again, this **simplification is likely to result in an under-estimate of freight avoidable cost**.
4. All freight has been removed from the model, whereas Network Rail's engineering trains should remain as they will continue to operate. Network Rail estimate that engineering trains currently represent approximately 10% of all freight (reducing to 5% over the next 35 years). All other things being equal, this oversight is likely to have resulted in freight avoidable costs being over-stated by about 10%.
5. The unit costs used may not be those used in the final business plan for CP5. It is unclear what impact this will have on the freight avoidable cost.

Accounting for Network Rail's engineering trains reduces the cost estimate from £178m to about £160m (i.e. -10%). The other factors tend to push the cost upwards, perhaps by up to 30%. We therefore judge that the freight avoidable cost is likely to be in the range of £144m (-10%) to £210m (+30%) at IIP CP4 exit unit costs.

We would suggest two approaches to improve the accuracy of the freight avoidable track M&R costs:

- Re- run the end of CP8 scenario with no freight in the High case scenario but keep in Network Rail's Engineering trains. Also look in more depth at those individual SRSs with the largest reductions in annual tonnages: for these, reconsider the track policy by Criticality Band and adjust for a largely passenger only railway. Then re-run the model to match the long term condition outputs of the IIP scenario.
- Run additional tests to gather more evidence on the shape of the avoidable cost curve. For example, reduce freight gradually from its proposed level for the end of CP8 by intervals of 10%, 20% and 30% of total gross tonnage, and for each case run the VTISM model in the same way as the Low case to calculate a unit cost per gross tonnage kilometre.

Network Rail has also suggested a review of the historical and planned M&R costs, looking at the relationship with tonnage and freight usage. We agree that this is a sensible idea that would provide a sense check to the shape of the cost curve produced by the VTISM model.

3 Allocation to Market Segments

3.1 Introduction

The purpose of the Freight Avoidable Cost allocation spreadsheet created by LEK is to distribute the total overall avoidable cost estimate among the main commodity groups. LEK stated that the process adopts a high-level method in order to provide an indicative allocation and is not intended to be used by ORR to apply final freight charges. This section describes the checks that were carried out on the allocation spreadsheet and the findings of the review. It should be noted that the review was limited to computational checks and not input data, as agreed in the inception meeting.

Freight avoidable costs are considered in seven categories in the spreadsheet and each includes a separate range of cost impacts. The seven categories are:

1. Freight Only Line costs
2. Redundant freight assets costs
3. Variable usage costs
4. Redundant enhancement costs
5. Consequential cost reductions
6. Consequential cost increases
7. Network Rail staff costs

In order to reach an appropriate allocation, different metrics have been applied to the relevant cost item. In most cases more than one metric has been applied to each category. For more details on the metric allocation see pg. 41 of 'Estimating Freight Avoidable Costs-Final Report' by LEK.

3.2 Review Process

LEK's spreadsheet[5] is split over three worksheets: inputs, indicative commodity allocation and an appendix page. The inputs sheet calculates the commodity split for each allocation metric. The forecast commodity split for each metric is determined by taking input data from the IIP to calculate a percentage split between each of the key commodities up to the start of Control Period 9 (2034/35). As the input page includes predominantly raw data that has been imported, very few computational checks were required. Checks that were performed included a review of how commodities had been grouped as well as commodity split calculations.

The indicative commodity allocation page provides a summary of the forecast commodity split for each metric which is fed directly from the Inputs worksheet. Two additional metrics are included, the Strategic Freight Network (SFN) allocation and Other Enhancements allocation. In order to allocate individual schemes to specific commodities (Cost Category 4 in the above list of seven), this split is determined separately in the appendix worksheet.

[5] Freight Avoidable Cost allocation_SENT.xls

The appendix includes all currently planned network enhancement costs that would be made redundant by removing commercial freight. It includes High and Low case costs for the SFN as well as other network enhancements. By implementing the gross tonne kilometres (gtkm) based commodity split from the inputs page, an effective commodity split for each enhancement was determined. This split is then multiplied by the enhancement cost in order to determine a total High and Low Case cost for SFN and all the other enhancements in each financial year (FY) and in turn a percentage commodity split for each case in each FY. An extensive computational check was performed at each stage of this process.

Following the determination of all commodity splits, costs are then calculated for each of the seven categories in the indicative commodity allocation worksheet. Gross and Net costs are calculated for each FY up to CP12 (2049/50) by multiplying the appropriate percentage commodity split by the total cost for a particular item. The CP5 and 35 year averages are calculated for both the net and gross costs. Once each cost had been calculated these values are fed into a summary table which presents the total net and gross costs for both High and Low cases.

It was noted that certain costs have intentionally been excluded in the worksheet, including items 2.2, 2.3, 5.1, 5.2, 7.4 and 7.5[6]. The reasons for their omission are explained in LEK's main report as:

1. No estimate of the cost was available at the time of the report, and further work was identified to produce a cost; or
2. The cost was considered to be zero of near-zero.

Computation checks were again carried out at each stage of this process and the final values were compared to LEK's report. An error summary was also included in the spreadsheet which did not identify any computational errors.

3.3 Findings

No computational errors were found in the cost allocation spreadsheet.

However, we found that it in some cases the commodity split for a particular enhancement was not consistent throughout the worksheet. LEK have confirmed that this was an input error and arose after an update to the commodity splits did not filter through to the numerical inputs of the model. We have corrected these to be in line with the comments in the appendix worksheet and confirmed that the changes do not affect the total freight avoidable costs (as expected). They do, however, affect the cost allocation as shown in Table 3.1 and Table 3.2, below, for gross and net costs respectively. These tables compare the original allocations in LEK's report against the adjusted corrections.

[6] These categories are: Redundant freight assets costs – Measurement trains fleet (2.2) and Freight property assets (2.3); Consequential cost reductions – Policy driven maintenance and renewal cost savings (5.1) and Engineering access (5.2); Network Rail staff costs – Freight property team (7.4) and Other staff partially involved with freight (7.5).

Table 3.1: Impact of correcting commodity use of enhancement schemes on overall commodity allocations for Gross Freight Avoidable Costs

Commodity	Gross Freight Avoidable Costs - High Case (Millions of FY11/12 pounds p.a.)							
	Original		Adjusted		Difference		% Difference	
	35 year avg.	CP5 avg.	35 year avg.	CP5 avg.	35 year avg.	CP5 avg.	35 year avg.	CP5 avg.
Aggregates / Construction Materials	38.003	32.899	37.797	32.742	-0.205	-0.157	-0.543%	-0.480%
Coal ESI	61.014	64.974	60.212	64.452	-0.802	-0.522	-1.331%	-0.810%
Coal Other	3.261	3.451	3.224	3.426	-0.038	-0.025	-1.174%	-0.720%
Intermodal	190.291	123.974	190.751	124.313	0.460	0.339	0.241%	0.273%
Iron Ore	1.411	1.355	1.386	1.339	-0.025	-0.016	-1.808%	-1.176%
Nuclear	2.187	1.996	2.185	1.994	-0.002	-0.001	-0.088%	-0.063%
Petroleum	18.088	16.244	19.166	16.923	1.078	0.678	5.625%	4.008%
Steel	15.532	14.796	15.230	14.607	-0.302	-0.190	-1.983%	-1.300%
Other	47.484	40.920	47.320	40.813	-0.165	-0.107	-0.348%	-0.261%
Total	377.270	300.609	377.270	300.609	0.000	0.000	0.000%	0.000%

Commodity	Gross Freight Avoidable Costs - Low Case (Millions of FY11/12 pounds p.a.)							
	Original		Adjusted		Difference		% Difference	
	35 year avg.	CP5 avg.	35 year avg.	CP5 avg.	35 year avg.	CP5 avg.	35 year avg.	CP5 avg.
Aggregates / Construction Materials	18.305	12.395	18.170	12.300	-0.136	-0.095	-0.747%	-0.774%
Coal ESI	20.926	16.731	20.200	16.251	-0.726	-0.480	-3.596%	-2.952%
Coal Other	1.254	1.057	1.220	1.035	-0.034	-0.023	-2.812%	-2.190%
Intermodal	79.744	39.149	80.491	39.703	0.748	0.553	0.929%	1.393%
Iron Ore	0.439	0.296	0.420	0.284	-0.020	-0.011	-4.666%	-4.039%
Nuclear	1.332	1.190	1.330	1.189	-0.002	-0.001	-0.144%	-0.106%
Petroleum	5.164	3.183	5.735	3.486	0.571	0.302	9.955%	8.678%
Steel	4.402	2.620	4.166	2.482	-0.236	-0.138	-5.663%	-5.579%
Other	20.910	15.516	20.745	15.410	-0.165	-0.107	-0.794%	-0.692%
Total	152.477	92.139	152.477	92.139	0.000	0.000	0.000%	0.000%

Table 3.2: Impact of correcting commodity use of enhancement schemes on overall commodity allocations for Net Freight Avoidable Costs

Commodity	Net Freight Avoidable Costs - High Case (Millions of FY11/12 pounds p.a.)							
	Original		Adjusted		Difference		% Difference	
	35 year avg.	CP5 avg.	35 year avg.	CP5 avg.	35 year avg.	CP5 avg.	35 year avg.	CP5 avg.
Aggregates / Construction Materials	27.720	23.349	27.515	23.192	-0.205	-0.157	-0.747%	-0.678%
Coal ESI	37.002	38.963	36.201	38.440	-0.802	-0.522	-2.214%	-1.359%
Coal Other	1.990	2.083	1.952	2.058	-0.038	-0.025	-1.939%	-1.198%
Intermodal	129.936	82.172	130.396	82.511	0.460	0.339	0.353%	0.411%
Iron Ore	0.872	0.828	0.847	0.812	-0.025	-0.016	-2.957%	-1.939%
Nuclear	1.434	1.295	1.432	1.293	-0.002	-0.001	-0.134%	-0.098%
Petroleum	10.981	9.865	12.060	10.544	1.078	0.678	8.940%	6.433%
Steel	9.879	9.285	9.577	9.095	-0.302	-0.190	-3.153%	-2.087%
Other	29.673	25.678	29.508	25.571	-0.165	-0.107	-0.558%	-0.417%
Total	249.487	193.517	249.487	193.517	0.000	0.000	0.000%	0.000%

Commodity	Net Freight Avoidable Costs - Low Case (Millions of FY11/12 pounds p.a.)							
	Original		Adjusted		Difference		% Difference	
	35 year avg.	CP5 avg.	35 year avg.	CP5 avg.	35 year avg.	CP5 avg.	35 year avg.	CP5 avg.
Aggregates / Construction Materials	9.104	3.870	8.968	3.774	-0.136	-0.095	-1.513%	-2.522%
Coal ESI	1.450	-4.394	0.723	-4.874	-0.726	-0.480	-100.406%	9.845%
Coal Other	0.228	-0.047	0.194	-0.070	-0.034	-0.023	-17.671%	32.402%
Intermodal	26.546	2.331	27.293	2.884	0.748	0.553	2.739%	19.178%
Iron Ore	-0.037	-0.170	-0.057	-0.182	-0.020	-0.011	34.346%	6.327%
Nuclear	0.759	0.660	0.757	0.658	-0.002	-0.001	-0.253%	-0.192%
Petroleum	-1.230	-2.539	-0.659	-2.236	0.571	0.302	-86.646%	-13.527%
Steel	-0.729	-2.381	-0.965	-2.519	-0.236	-0.138	24.443%	5.495%
Other	6.124	2.904	5.960	2.797	-0.165	-0.107	-2.763%	-3.815%
Total	42.215	0.233	42.215	0.233	0.000	0.000	0.000%	0.000%

3.4 Conclusions

In conclusion, no computational errors were found in the cost allocation spreadsheet. The only concern raised was the commodity split inconsistency throughout the enhancement scheme allocation (in appendix worksheet). The largest monetary impact is on petroleum which has been allocated an additional £1.08m in the High Case as a result of the correction (although ORR consulted on exempting this market segment from any freight-specific charge).

4 Conclusions

Network Rail's use of VTISM to estimate freight avoidable track maintenance and renewal costs in the High scenario is considered to be appropriate, with one key caveat: that they correct treatment of engineering trains in the model run.

Taking account of Network Rail's engineering trains reduces the costs from £178m to about £160m. However, a number of other assumptions have had to be made which produces some uncertainty on the calculated costs. We would judge that the avoidable freight variable usage cost is in the range of approximately £144m (-10%) to £210m (+30%) at IIP CP4 exit unit costs. We have suggested a number of additional model runs to improve the accuracy of the estimate.

We have also carried out computational checks on LEK's spreadsheet which allocates the freight avoidable costs to market segments. No errors have been identified. However, we found some inconsistencies in the allocations of some enhancement schemes. Correcting these inconsistencies results in a small change to the overall allocations.

5 Recommendations

The following recommendations are made:

No.	*Recommendations*	*Location in Text*	*Data Champion Responsible*	*Due Date*
2012.FAC.1	Add back in the engineering trains and re-run VTISM to produce more accurate results.	2.6	ORR	Nov 2012
2012.FAC.2	Carry out sensitivity tests to gain a better understanding of M&R cost savings: consider adjusting the track policy on those Strategic Route sections with largest reductions in tonnage; and reduce freight by 10%, 20% and 30% of total gross tonnage to gather more evidence on the avoidable cost curve.	2.6	ORR	Nov 2012
2012.FAC.3	As a further sense check on the cost curve, review historic changes to freight and passenger gross tonnage km and compare against the change in observed renewal costs (by Strategic Route Section).	2.6	NR	Nov 2012
2012.FAC.4	Update the commodity split inputs for the enhancement schemes in the Freight Allocation Cost allocation spreadsheet.	3.3	LEK	Oct 2012

Appendix A

Mandate

Reporter Remit: Review of Network Rail VTISM modelling for Freight Avoidable Costs Study, and of the allocation of these costs to market segments

Audit title	Review of VTISM modelling and allocation to market segments for Network Rail's freight avoidable costs analysis
Mandate Ref:	AO/036
Document version	Draft
Date:	5 September 2012
Draft prepared by:	Jon Clyne/Joe Quill
Remit prepared by:	Jon Clyne/Joe Quill
Network Rail reviewer:	Ben Worley

Authorisation to proceed

ORR	Chris Fieldsend
NR	Bill Davidson

Purpose

- To review Network Rail's (NR's) use of the Vehicle Track Interaction Strategic Model (VTISM) to support the work it has commissioned from LEK, following a request by ORR, to estimate freight avoidable costs
- To advise on the robustness of the VTISM model outputs, and the underlying data and assumptions used to produce these outputs
- To review LEK's initial analysis (carried out on behalf of Network Rail) of how freight avoidable costs should be disaggregated by market segment (commodity type)

This work should **not** review LEK's overall analysis of total freight avoidable costs: rather, the focus for the Reporter is on Network Rail's VTISM analysis and LEK's initial calculations to allocate freight avoidable costs to market segments.

Background

In its May 2012 consultation on the variable usage charge and a freight specific charge, which forms an important part of the Periodic Review 2013 (PR13)[1], ORR explained that it had asked Network Rail to update estimates of freight avoidable costs (see Chapter 5 of that document). ORR noted that it expected to use Network Rail's estimates in making final decisions on a cap on the charge to recover freight avoidable costs. One aspect of the analysis will be to allocate the total freight avoidable costs to market segments (commodities). The ORR consultation document also explained the work that Network Rail had carried out to estimate variable usage costs, and the review of this work by the Reporter (Arup).

[1] http://www.rail-reg.gov.uk/pr13/PDF/freight-charge-consultation-may2012.pdf

Since ORR issued its consultation, Network Rail has commissioned LEK to engage with the freight industry and support it with the quantification of freight avoidable costs. LEK's work to quantify freight avoidable costs is continuing, drawing on data and inputs provided primarily by Network Rail, in consultation with industry stakeholders. In order to carry out its assessment, LEK has considered seven categories of cost:

- Freight-only line costs;
- Redundant fixed costs;
- **Variable usage costs (particularly relevant to this remit);**
- Redundant enhancement costs;
- Consequential cost reductions;
- Consequential cost increases; and
- Network Rail staff costs.

In addition to estimating the range of freight avoidable costs, LEK has initially allocated these costs between market segments. LEK notes in its report that ORR is consulting on the allocation of freight avoidable costs and, therefore, that the potential metrics and resulting outputs included in the report are not final and will require further analysis and discussion. This is an important exercise as it informs the process of capping any increase in freight charges for each market segment.

Scope / Methodology

Network Rail's VTISM data and outputs

One of the most significant categories of freight avoidable costs is variable usage costs. The majority of these variable usage costs are estimated using the RSSB and Network Rail jointly-owned model VTISM, by comparing the outputs from a "mixed use" scenario (Scenario A) based on the current rail network configuration allowing for traffic growth, with the scenario where all freight traffic is removed from the network (Scenario B).

The independent Reporter is required to critically review the use of, and outputs from, the VTISM model runs for scenarios A and B for robustness and consistency, considering also the assumptions and data used to produce these VTISM outputs. One particular area of stakeholder concern is how well VTISM represents scenarios with significant changes in traffic volumes, such as Scenario B.

The Reporter's review should build on related remits, as appropriate:

- the previous Reporter review of the use of VTISM in Network Rail's analysis to estimate variable usage costs in March 2012; and
- the current Reporter review of the use of VTISM in Network Rail's analysis to estimate CP5 track maintenance and renewal costs. This review is expected to conclude in early September 2012.

Apportioning freight costs between freight market segments

The independent reporter is required to critically review the calculations carried out by LEK (on behalf of Network Rail) to initially estimate the allocation of freight avoidable costs to individual market segments (commodities). For the avoidance of doubt, reviewing the choice of metrics used to initially allocate costs is beyond the scope of this remit.

Deliverables

The Reporter should provide a publishable report, including findings, conclusions and recommendations, expressed in quantitative terms where meaningful to do so. The report should be prepared in draft form and sent electronically to Network Rail and ORR, at the same time. The Reporter should facilitate and provide a revised report with track changes. This should be followed by a final report for publication on ORR and Network Rail's website.

Timescales / Resources

A fully costed proposal for this work is required by 12 September 2012. The response should also confirm whether there are any conflicts of interest and if so how they will be handled. Work is expected to commence shortly after, following approval by Network Rail and ORR.

LEK is due to issue its final report including an estimated range of total freight avoidable costs and an initial allocation of these costs to market segments by 14 September 2012 (subject to views from industry stakeholders).

The deliverables are to be phased as follows:

- Draft report by no later than close of business **2 October 2012** setting out:
    - Whether the Reporter is satisfied with Network Rail's VTISM outputs and underlying assumptions, any concerns it has, and the scale of uncertainty associated with different estimates; and
    - Whether the Reporter is satisfied with LEK's calculations (on behalf of Network Rail) for initially allocating total freight avoidable costs to market segments.
- Final report, covering the Reporter's opinion on both Network Rail's VTISM outputs and LEK's calculations (on behalf of Network Rail) for initially allocating total freight avoidable costs to market segments by no later than close of business **16 October 2012.**

ORR and Network Rail will aim to provide comments on the draft report by no later than close on business on **9 October 2012** (assuming the draft report is received on 2 **October 2012**).

The breadth and depth of this review is subject to a resource cap of 10 man days.