MDS Transmodal

Local and Global Transport and Logistics Research

Impact of changes in track access charges on rail freight traffic

Stage 1 Report

by

MDS Transmodal Limited

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1 EXECUTIVE SUMMARY

1.1.1 MDS Transmodal were commissioned by the Office of Rail Regulation (ORR) to estimate the impact of changes in track access charges on demand for rail freight, This report presents the results of this work

1.1.2 The impact of percentage changes in the Variable Usage Charge (VUC) (-10%, +10%, +20%, +50%, +100%) was investigated for forecast traffic in 2018/19 for each commodity group separately.

1.1.3 We estimate that the overall impact of a 100% increase in VUC would be a reduction of 8.9% in rail freight tonne kms and an increase in VUC revenue of £52.5m (+83%) from the 2018/19 base forecast. However the impact varies considerably by commodity as shown in table E1.

1.1.4 For Nuclear, ESI (power station) coal, other coal and iron ore traffics, we estimate that a 100% increase in VUC would result in less than 1% fall in tonne km, and hence revenue would increase by close to 100%: an increase of £18.1m. If VUC were increased for these commodities, there would be a small amount of traffic lost from rail. The majority of this lost traffic would *not* switch directly to road.

1.1.5 We estimate that a 100% increase in VUC would result in a fall of around 4% of tonne km for metal traffic and an increase in VUC revenue of £4.6m (+92%). For other commodities (intermodal, domestic waste, construction materials, general merchandise, petro / chemicals / industrial minerals and automotive) a doubling of VUC (100% increase) would result in a between 8.8% and 15% fall in tonne km, and an overall increase in VUC revenue of £29.9m (+74%).

1.1.6 For each commodity, table E2 shows a comparison of the increased VUC revenue with the increase in external costs ***IF*** all the traffic lost to rail were to switch directly to road. In reality, much of this traffic would NOT switch directly to road. For intermodal, the environmental damage caused by rail traffic switching directly to road (HGV externalities as measured by Mode Shift Benefits (MSBs)) would exceed the additional VUC revenue. For ESI coal, traffic lost to rail is a result of a switch to another energy source and would not result in extra road traffic.

1.1.7 We consider the switching between energy sources to be the most substantive effect for ESI coal, but the full impact is currently being subject to further more detailed work, considering increases in VUC beyond 100%.

Table E1: Percent change in Tonne kms and increased VUC revenue in 2018/19 by commodity if VUC were doubled

Commodity	% change in Tonne kms	Increased VUC revenue (£m)
Other (mostly Nuclear)	**0.0%**	**0.3**
ESI Coal	**-0.4%**	**13.4**
Other Coal (inc Biomass)	**-1.0%**	**3.9**
Iron Ore	**0.0%**	**0.5**
Automotive	-10.1%	1.0
Metals	-4.2%	4.6
General Merchandise	-8.8%	0.3
Petro / Chemicals / Industrial Minerals	-11.4%	2.8
Intermodal	-12.9%	20.3
Domestic Waste	-12.3%	0.2
Construction materials	-14.8%	5.2
Total	-8.9%	**52.5**

Table E2: Double VUC: Change in VUC revenue vs change in External costs *IF* all the traffic lost to rail were to switch directly to road

Commodity	ΔVUC revenue £m	ΔHGV ext cost * £m	ΔHGV ext cost / ΔVUC revenue	Propensity to directly switch from rail to the same journey by road, if lost from rail
Other (mostly Nuclear)	**0.3**	**0.0**	**0.00**	**Low**
ESI Coal	**13.4**	**0.5**	**0.03**	**Low**
Other Coal (inc Biomass)	**3.9**	**0.3**	**0.07**	**Medium**
Iron Ore	**0.5**	**0.0**	**0.00**	**Medium**
Automotive	1.0	0.3	0.28	High
Metals	4.6	1.7	0.38	Medium
General Merchandise	0.3	0.2	0.78	Medium
Petro / Chem / IndMin	2.8	4.1	1.45	Medium
Intermodal	20.3	33.4	1.64	High
Domestic Waste	0.2	0.4	1.76	High
Construction materials	5.2	10.6	2.03	Medium
Total	**52.5**	**51.4**	**0.98**	

Note: External costs are as measured using Mode Shift Benefit values.

* Change in HGV external cost ***IF*** all the traffic lost to rail were to switch directly to road. In reality, much of this traffic would NOT switch directly to road.

2 INTRODUCTION

2.1 Background to the project

2.1.1 ORR launched its Periodic Review 2013 (PR13) in May 2011, to assess what Network Rail must achieve from 2014, the money it needs to do so, and the incentives needed to encourage delivery and outperformance. But the review goes beyond Network Rail and looks at how it should work more closely with train operators, suppliers and others to reduce costs and deliver more for customers.

2.1.2 As part of PR13:

- ORR, in collaboration with the industry, is undertaking a review of the existing freight charges.
- To increase certainty to the freight industry with respect to the charges they are likely to pay in Control Period 5 (CP5), ORR is considering placing a cap on the overall level of certain freight charges.
- ORR in its May 2011 consultation[1] stated it will review the ability of different market segments to pay a mark up.

2.1.3 To be able to conclude on the capping or phasing of changes to certain freight charges two work streams are being undertaken:

- Work stream 1: Network Rail is calculating initial estimates of Variable Usage Charges (VUC) and freight only line charge costs.. Network Rail consulted on these initial cost estimates in November 2011 and is aiming to conclude on its consultation in February 2012.
- Work stream 2: ORR with input from Department for Transport and Transport Scotland is examining the ability of different freight markets to pay more than the marginal cost of operation on the network As part of the second work stream, MDS Transmodal have been commissioned by the ORR to estimate the change in demand for rail freight, by different commodities, under different options of changes in track access charges This report presents the results of this work.

2.1.4 In their last periodic review, Periodic Review 2008 (PR08), ORR commissioned a similar project: "Impact of track access charge increases on rail freight traffic" - MDS Transmodal Limited: http://www.rail-reg.gov.uk/upload/pdf/mds-freight-nov06.pdf

1 Download the Periodic review 2013: First consultation Annexes (349 Kb)

2.2 Scope of the project

2.2.1 The aim of this study is to forecast the long-term impact of changes in VUC on future rail freight traffic volumes across Great Britain. It is not the purpose of this report to pass any comment upon the costs of maintaining track as a function of use; this is a separate matter. This report is stage 1 of a two stage study. The second stage of the study concerns further analysis of a subset of the most inelastic rail freight market segments.

2.2.2 VUC does not currently vary by route. ORR has asked us to consider the impact of VUC changes by commodity rather than by route.

2.2.3 Where there is a clear overlap between the cost effectiveness of the road and rail modes and active competition exists between the modes then the demand for rail services will be relatively price elastic. In the case of intermodal containers, for example, where cargo is secure within a box and handling at the receiving or loading point (typically a warehouse) is identical then the main determinants of demand will be price and service availability (frequency). In other cases, methods of cargo handling and the potentially higher up front (or fixed) costs of rail handling will be a major determinant, as will related issues of critical mass.

2.2.4 Nevertheless, for any cargo flow where active competition between the modes exists, in a competitive market place and over the medium to long term beyond the timescale of existing contracts, a change in track access charge (VUC) can be expected to have an impact on the price any rail traction supplier can offer, and therefore on demand.

2.2.5 Our modelling technique takes into account the volume of cargo available to the road and rail modes in total, estimates total current costs and calibrates results to explain current modal shares. In an extreme case such as coal from a port to rail connected power station, rail offers such a saving over road costs that it may require a large increase in VUC before rail loses market share. However, an increase in VUC is likely to be passed on to the cargo owners who would, as a result, find the cost of generating electricity from coal instead of gas would rise, and therefore reduce (to some extent) the demand for coal by rail to inland power stations.

2.2.6 Where active competition does exist, calibration is achieved by making implicit assumptions about the service frequency required by shippers. In this way, the cost of rail freight rises as a consequence of either road collection costs rising because a wider ‘hinterland’ is required to fill a train or less cargo is carried on a given train, thereby raising unit costs. Every effort has been made to ensure that the costs used for the road and rail modes reflect market realities, and the consultancy team has had the opportunity through other studies to check their validity. However, the process of calibration does mean that where there is active price cross elasticity between modes that even if prices did not correspond exactly to rates currently in the market, the results would not be significantly affected.

2.2.7 In practice, the freight transport market is complex and 'imperfect', largely because the unit cost of providing services is often significantly affected by the volume available (issues of critical mass) and because economies can be achieved through contractual commitments to key investments. Thus, for example, the cost of providing bulk rail services will be reduced, the larger the trains that can be justified and the more intensive use can be made of terminals. Furthermore, the longer the term of the contract between cargo owner and haulage supplier, the better the case for new and modern wagons and the more capital intensive but more efficient terminals can be justified. As a consequence, the impact of a change in VUC may not be immediate and its effect on the parties to a contract will depend upon whether the terms of that contract require the cargo owner or the traction supplier to cover the impact of that change. Our approach does not consider such immediate 'realities' but assumes that over the timescale we are considering (to 2018/19), impacts of a change in VUC will play out. Effectively, we take the view that in the medium term, because there is a competitive environment in both the road and rail sectors that each individual supplier is a 'price-taker' and that prices are therefore a function of cost because there are sufficient suppliers to ensure active choice is available to cargo owners. Part of our task is therefore to distinguish between those freight transport markets that (mainly) reflect competition between suppliers from both road and rail (e.g. maritime containers), and those where transport cost is a determinant of the demand for transport in the first place. One such example is power station coal. Another could be the demand of iron ore movement where an increase in transport costs could affect the viability of a steel plant. Similar arguments apply where road haulage is dominant; a quarry serving a regional market could succumb to remote competition (from sea or rail) if excise duty on diesel was to increase.

2.2.8 This work has been carried out using

- The GB Freight Model (GBFM) (MDS Transmodal) - described in chapter 2
- Other bespoke models and calculations for specific commodities and markets

2.2.9 The study assesses the impact of different VUC options, each of which consists of a global percentage change in VUC as follows: -10%, +10%, +20%, +50%, +100%.

2.2.10 The changes in VUC are applied to base-case forecasts for 2018/19.

2.2.11 Several route level examples of the impact of a change in VUC are given. These examples identify generalised cost and change in generalised cost and flow by mode. Sensitivity tests have been carried out. These show whether alternative assumptions for the forecasts significantly alter the results.

2.2.12 Changes in VUC impact on the competition between road and rail. Any resultant changes in road traffic can be quantified in terms of *"Mode Shift Benefits"* (MSBs). MSBs are a measure of the benefits to society of switching traffic from road to rail, based on the environmental costs of road haulage that are not paid by the haulier – the externalities. The MSBs (both positive and negative) of changes in VUC are calculated.

2.2.13 The VUC revenue to Network Rail as a result of the changes in VUC rates is also calculated for each scenario.

3 MODELS EMPLOYED

3.1.1 Rail freight operates in a competitive environment in competition with other modes of transport and between rail traction suppliers. It is therefore important that the modelling approach adopted reflects the 'real world' experience of shippers (the owners of goods and therefore the clients of the transport industry) in selecting mode and route, because it is their decisions, based on the relative prices and levels of service on offer for typical services, that will determine modal choice.

3.1.2 The study is based on projected freight tonnages for 2018/19. To arrive at these figures, we have adopted a similar approach to that we adopted for rail freight forecasts in summer 2011 for the Rail Freight Group, to be used in the "Initial Industry Plan" (Sept 2011).

3.2 GBFM

3.2.1 The forecasts are predominantly based on the GB Freight Model. The GB Freight Model seeks to explain and to then forecast road and rail freight flows by origin, destination, commodity group and, for international cargo, port and/or ferry route chosen. It is based upon a comprehensive description of road, rail and port flows using a wide range of data, including the DfT's Continuing Survey of Road Goods Transport (CSRGT), Network Rail billing data and UK Maritime Statistics. Mode and route choice are based upon transport cost models and a mode choice function which is calibrated to reproduce base year flows. Forecasts are then based upon a range of assumptions (GDP growth, energy prices and so forth). The model has been independently validated by the DfT and now forms part of the National Transport Model. Further methodology details can be found on the DfT's website:
http://www2.dft.gov.uk/pgr/economics/rdg/gbfreightmodel/gbfm5report1.pdf

3.2.2 In GBFM the broad assumption is made that there is competition between modes for freight traffic that is based upon price. For many markets, the cost advantage of one mode will be so overwhelming that other modes can never be expected to win any share, but that does not imply that cargo owners do not seek the most cost effective solutions. This has been evident post privatisation in the way that for traffics that could be regarded as relatively captive to rail, cargo owners regularly tender to competing rail traction suppliers (e.g. for power station coal).

3.2.3 GBFM is a continuous (therefore not 'lumpy') model and therefore able to model very small changes in VUC. E.g. a 2% increase in VUC would roughly produce double the impact of a 1% increase in VUC, even if in the 'real world' such small changes would only be felt in the long term.

3.2.4 Output from the model is at a detailed level, including assignments to the strategic rail and road networks and growth rates by mode at a detailed origin and destination level. This permits rail freight volumes to be forecast by reference to existing train movements, which can then be adjusted up or down to reflect forecast changes for the rail mode by origin, destination and commodity. In this way, a comprehensive forecast can be built up of rail freight and train movements based upon existing route choice and tonnages carried per train.

3.2.5 GBFM has been used on a regular basis to assess both road and rail schemes, including the case for rail linked distribution parks (SRFI) and to generate forecasts of rail freight that underpin the Strategic Rail Freight Network.

3.3 Validating VUC in rail cost model

3.3.1 It is important to ensure that GBFM's road and rail cost models represent real-world costs. They are regularly used and tested by both public and private sector clients which helps provide validation.

3.3.2 However for this project it is particularly important to ensure that the rail cost models are accurately reflecting VUC, such that the impact of changing VUC has the correct impact on overall rail cost.

To validate VUC we:

- Applied published VUC rates by loco / wagon / commodity / loaded-or-empty to total rail freight movements in 2010/11
- Compared the resultant total VUC to actual VUC receipts (source Network Rail) by commodity
- Ensured rail cost models reflect the average VUC by commodity

3.3.3 As part of this validation process, the average VUC paid by commodity can be calculated by dividing total VUC receipts by cargo tonne kms for each commodity to give the average VUC / ***Cargo*** Tkm (£/kTkm). These VUC rates were then uplifted by inflation (RPI) to represent the base year: beginning of October 2010 to end of September 2011.

Table 1: Average VUC paid per cargo tonne km and per Gross tonne mile

Commodity	VUC / ***Cargo*** Tkm (£/kTkm)	VUC / ***Gross*** tonne ***MILE*** (£/kGTM)
Automotive	9.37	2.05
Chemicals	2.78	1.75
Coal other (inc Biomass)	2.97	2.12
of which Biomass	2.30	1.85
Construction materials	2.18	1.83
Domestic Waste	1.94	1.74
ESI Coal	2.25	1.80
General Merchandise	2.91	1.81
Industrial Minerals	2.34	1.86
Intermodal	2.22	1.45
Ore	2.39	2.05
Metals	2.55	1.92
Other	6.19	2.17
of which Nuclear	9.13	2.36
Petroleum	2.08	1.71
Average	**2.33**	1.72

3.3.4 These average figures will vary depending on which and how many wagons and locomotives are used for each journey, and the extent of empty running, but they represent an average over all traffic in each commodity.

3.3.5 The less dense cargoes need more wagon and loco weight per cargo tonne moved and therefore generally have higher VUC / Cargo Tkm. For example there are not many tonnes of cars carried per train, so the VUC per tonnekm in the automotive industry is high (£9.37 per kTkm).

3.3.6 For the carriage of spent nuclear fuel, relatively small consignments are involved with typically just a couple of wagons per train. The VUC for the locomotive is therefore shared amongst only a few tonnes of cargo.

3.3.7 Table 1 also shows the average VUC per ***gross*** tonne ***mile***: the rates used by Network Rail to charge their customers.

4 MODELLING METHODS AND RESULTS

4.1.1 To estimate the impact of changing VUC, we need to forecast what the base case traffic would be in 2018/19 without changing VUC, to act as a benchmark. In order to forecast traffics, it is important to understand current traffic levels in the base year.

4.1.2 It should be noted that Network Rail Engineering traffic is not included in any of the modelling or results.

4.2 Establish base year

4.2.1 Base year traffics have been calculated by processing Network Rail's traffic movement database (PALADIN) for the 12 months up to the end of September 2011. As a means of validation, these traffics match the published net tonne kms figures in National Rail Trends by commodity.

4.3 Base case forecasts (no change in VUC) to 2018/19

4.3.1 In the 7.5 years from the base year to 2018/19, fuel prices are assumed to have a real-terms increase of 8% (source: DECC's Oct 2011 fuel price projections) and drivers wages are assumed to increase by 15% (source: WebTAG). In terms of road versus rail competition, these cost increases tend to favour rail, because both fuel and drivers' wages are a smaller proportion of overall costs for rail than they are for road.

4.3.2 Most of the base case commodity forecasts are conducted using GBFM (which is described above). However there are some commodities that require a different approach. These are described in the following commodity-specific sections.

4.3.3 The base case forecasts follow the same principles as the 2020 and 2030 forecasts produced in summer 2011 for the Rail Freight Group and Rail Freight Operators' Association.

4.3.4 It should be noted that these are forecasts of traffic *demand*. I.e. it is implicitly assumed that capacity will be available on the rail network to accommodate the forecast traffic.

4.4 Test various changes in VUC levels

4.4.1 Once the base case forecasts have been established, alternative forecasts can be run with different levels of VUC input into GBFM's cost model. Results for VUC changes of -10%, +10%, +20%, +50% and +100% are shown.

4.4.2 For some commodities, alternative approaches are adopted as detailed in the following commodity-specific sections.

4.5 Maritime Containers

4.5.1 Deep sea containerised growth is assumed to be +20% for Britain in the 7.5 years to 2018/19, based on outputs from the World Cargo Database (MDS Transmodal).

4.5.2 There are several port development schemes that are likely to accommodate this growth:

- Felixstowe South – phase 1 just opened (Sep 2011)
- London Gateway part-open at the end of 2013
- Liverpool post-panamax berth

4.5.3 The increase in fuel and drivers' wage costs along with the development of inland terminals with on-site warehousing helps to boost rail mode share.

4.5.4 Increased VUC is unlikely to affect the overall cargo demand because the typical value of cargo in a container (~£30,000) dwarfs the typical VUC paid (e.g. for a South East port to the North West, VUC averages around £13 per container). However the choice of route and mode will be affected.

4.5.5 Increased VUC leads to increased rail costs and some of this improved rail mode share by 2018/19 is lost back to road again. For example, the cost per container from Felixstowe port to the Manchester area in 2018/19 is as follows:

RAIL: 425 km via cross-country route. Cost = £342 including

- £13 VUC
- £120 local road haul

ROAD: 390 km. Cost = £474.

The cost models used to arrive at these figures are detailed in appendix 1.

4.5.6 Road is generally considered more flexible than rail (easier to spontaneously organise transport on demand etc), but given the cost differential, rail is forecast to dominate this market with 83% of the market.

4.5.7 If VUC were doubled (up by £13 per container), rail would still be cheaper than road, but there would be some switch from rail to road, with the rail mode share falling to 75%.

4.5.8 There is also a mode share impact for getting from South East ports (e.g. Felixstowe, Southampton or London Gateway) to the North East and Scotland in terms of switching from rail to coastal shipping. For example to get to the Tees area, a container could go by rail from Felixstowe to Wilton, by road, or by coastal shipping to Teesport. Costs given are per container for 2018/19:

RAIL: 425 km. Cost = £342 including

- £13 VUC
- £120 local road haul

ROAD: 440 km. Cost = £522. As the road cost is much higher than the rail cost, there is very little traffic by road.

Costs of COASTAL SHIPPING to the Tees area are likely to be around £310 per container, including a £120 local road haul.

4.5.9 Coastal shipping is cheaper than rail but slower and less frequent. Following similar mode share principles as with road vs rail competition, if VUC is doubled (up by £13 per container), rail routes from the South East ports to the North East lose 5% of their traffic.

4.5.10 A similar argument follows for containers between South East ports and Scotland. Currently for Felixstowe to the Scottish Central Belt, VUC is £23 per container. Doubling this would result in a 9% loss of rail traffic to coastal shipping.

4.5.11 However volumes of rail traffic between South East ports and Scotland & North East by rail are relatively small. Doubling VUC for maritime containers by rail causes an overall 11.8% switch from rail to *road* and only an additional 0.4% switch from rail to coastal shipping.

4.5.12 There is also the possibility that increased VUC could encourage a switch between deep-sea container ports to reduce the inland length of haul. For example London Gateway could be favoured instead of Felixstowe and Southampton. However the ***relative*** cost saving of switching to London Gateway only applies to the ***difference*** in journey length (approximately 60km shorter length of haul compared to Felixstowe or Southampton). If VUC were doubled, this would equate to under £2 per container journey.

4.5.13 When London Gateway opens there will already be a rail cost differential – an incentive for shipping lines to use London Gateway instead of Felixstowe or Southampton to cut inland haulage cost. Doubling VUC would add another ~10% to this cost differential.

4.5.14 The choice of deep sea container port is largely dependent on relationships between shipping lines and ports, and is influenced by port capacity and the shipping rotation (other ports the ship calls at) as well as cost. If VUC doubled, London Gateway could charge an extra ~£0.50 per container lifted (i.e. typical 25% rail share X £2 per container). There could possibly be some effect when a tipping point is reached for a particular shipping line whereby the shipping line changed the ports called at. We have not modelled this effect - effectively assuming that the ports or shipping lines would absorb these costs.

Table 2: Modelling Results for Maritime Containers

Change in (Δ) VUC	Absolute change (£/kGTM)	Cargo Tonnes (Million)	% Change from base	Cargo Tonnekm (Billion)	% Change from base
Oct2010 - Sep2011		14.3		4.99	
Base forecast 2018/19		19.6		6.64	
-10%	-£0.15	19.8	1.2%	6.70	1.0%
+10%	£0.15	19.4	-1.1%	6.57	-1.0%
+20%	£0.29	19.1	-2.2%	6.51	-2.0%
+50%	£0.73	18.4	-6.0%	6.28	-5.3%
+100%	£1.45	17.2	-12.2%	5.91	-10.9%

4.5.15 Longer haul traffic has a bigger VUC cost penalty per container but shorter hauls are more vulnerable to road competition. As a result there is a similar impact on tonnes and tonne kms.

4.6 Domestic (non-port) intermodal

4.6.1 Carrying fast-moving consumer goods (FMCGs) to, from and between national and regional distribution centres is a very large transport market currently dominated by road. For rail it is a relatively small but fast growing market: we forecast this to grow from 2.5 to 11.0 million tonnes by 2018/19.

4.6.2 This substantial growth is largely driven by rail-connected warehousing development (national and regional distribution centres). There is a total of approximately 1 million square metres of large warehousing built per year. We assume one third are built at rail-connected sites based on actual proposals. For example:

- DIRFT (Tesco are just starting new services to Thurrock & Magor (S Wales)
- Castle Donington (Marks & Spencer)
- 3MG (Ditton)
- Port Salford
- SIFE
- London Gateway
- Liverpool port
- and others

4.6.3 Locating a warehouse next to a rail terminal removes the need for a local road haul, thus significantly reducing overall transport costs of using rail and making rail more attractive.

4.6.4 We are assuming that planned development of rail connected warehousing continues irrespective of moderate increases in VUC because the planning system encourages rail-connection and there is already momentum behind many of these schemes. However in the long term, significant VUC increases may discourage developers from investing in rail-connected sites because increased rail cost lessens the attractiveness to occupiers of being at a rail-connected site. Developers may choose to focus on cheaper road-only sites instead.

4.6.5 To approximately quantify this issue we use a hypothetical strategic rail freight interchange with on-site warehousing in the Midlands, with 10 trains in and 10 trains out per day. Assuming 300 working days per year, an average of 300 kms per journey and 430 tonnes per train gives ~ 0.8 billion tonne kms per annum. Using the current average intermodal VUC of 2.22 £/kTkm, this equates to approximately £1.7 million per year. Doubling VUC would therefore add £1.7m p.a. to transport costs to and from the site, which effectively reduces the attractiveness to occupiers by this same amount. £1.7 million per year approximately equates to 7% of warehouse rents or ~£17 million in upfront infrastructure costs.

4.6.6 If transport becomes more expensive, optimal supply chains have reduced cargo miles – for example further encouraging port-based logistics. However adapting to different logistics scenarios due to increased VUC has not been modelled.

Table 3: Modelling Results for Domestic (non-port) intermodal

∆VUC	Absolute change (£/kGTM)	Cargo Tonnes (Million)	% Change from base	Cargo Tonnekm (Billion)	% Change from base
Oct2010 - Sep2011		2.5		1.16	
Base forecast 2018/19		11.0		4.90	
-10%	-£0.15	11.2	2.0%	4.97	1.5%
+10%	£0.15	10.7	-2.6%	4.80	-2.0%
+20%	£0.29	10.4	-5.2%	4.70	-4.0%
+50%	£0.73	9.9	-10.2%	4.51	-8.0%
+100%	£1.45	8.9	-18.6%	4.18	-14.8%

4.6.7 Doubling VUC loses ~15% of rail traffic. This is more elastic than maritime containers. Again there is stiff competition with road and often at least one end is not rail connected. Road is normally more able to offer an on-demand service than rail so it is difficult to compete with road unless there is critical mass for frequent services.

4.7 Channel Tunnel

4.7.1 In so far as Channel Tunnel services are concerned, our analysis has been based upon GBFM which includes regional distributions of international traffic and the commercial characteristics of competing ferry routes. The market is modelled as being highly price elastic.

4.7.2 The Channel Tunnel carries a mix traffics:

- Intermodal containers import and export (0.49m tonnes) (modelled separately)
- Metals – mainly exports from Scunthorpe (0.56m tonnes)
- Mineral water to Daventry (0.18m tonnes)
- Total = 1.31m tonnes

4.7.3 Future rail-connected warehousing boosts growth in intermodal containers as per maritime and domestic intermodal. A container from Folkestone to the Midlands pays ~ £9 VUC but most track charges are paid on the Continent or to Eurotunnel.

4.7.4 Channel Tunnel is competing with sea services between ports (e.g. Thames or Humber), for which there is flexibility – i.e. it is easy to switch route and therefore it is a relatively elastic market.

4.7.5 In terms of the modelling for intermodal, overall continental and GB origins and destinations remain unchanged but the port and route can change.

Table 4: Modelling Results for Channel Tunnel (Intermodal containers)

∆VUC	Absolute change (£/kGTM)	Cargo Tonnes (Million)	% Change from base	Cargo Tonnekm (Billion)	% Change from base
Oct2010 - Sep2011		0.49		0.14	
Base forecast 2018/19		2.57		0.79	
-10%	-£0.15	2.60	1.2%	0.81	1.8%
+10%	£0.15	2.54	-1.2%	0.78	-1.8%
+20%	£0.29	2.51	-2.4%	0.77	-3.5%
+50%	£0.73	2.42	-5.9%	0.72	-8.8%
+100%	£1.45	2.27	-11.8%	0.65	-17.6%

4.7.6 Longer hauls have a bigger absolute VUC cost penalty if VUC is increased, and both long and short hauls in competition with short sea to East coast ports, so there is a larger impact on tonne kms than on tonnes.

4.7.7 We have ignored the interaction with HS1 (“High Speed 1”: the high-speed line between the Channel Tunnel and London) because this is mostly a separate market:

European-gauge traffic to Barking etc. There is unlikely to be much traffic on HS1 going beyond East London. The main competition is between tunnel and shipping because changes in VUC impacts on the whole GB route rather than just the Folkestone – London section when considering HS1 versus Network Rail.

4.8 Power Station (ESI) Coal

4.8.1 The largest single market for rail freight is for ESI (power station) coal. The demand for coal is clearly related to its delivered price because competing power stations are available using other forms of energy such as gas. Even if at the peak, every station was operating to full capacity, in off-peak periods the generators have a very active choice as to whether to consume coal or gas. We have estimated an approximate elasticity: coal demand w.r.t. coal delivered price = -1.0 (deduced from DECC reports). As VUC is a component of the delivered price of coal, the level of VUC does have an impact on the demand for rail freight.

4.8.2 The typical coal price is approximately £95 per tonne delivered to power station, of which VUC averages £0.36 per tonne (or 0.4%) (Average Length of Haul (ALOH) = 160km at £2.25/Cargo KTkm). Doubling of VUC would therefore reduce coal consumption by approximately 0.4%.

4.8.3 There is a lot of uncertainty about base forecasts for ESI coal by rail. Recent years have shown significant fluctuations, with annual changes for the 7 most recent years of +6%, +11%, -16%, +9%, -9%, -22% and +30% (with the +30% for calendar year 2010 to 2011).

4.8.4 There are various factors that suggest there may be a decline in coal burnt for electricity generation in the coming years such as the need to purchase carbon allowances under the EU Emissions Trading Scheme, and to pay for the UK Government's Carbon Price Floor. However recent data for the 3 months from October to December 2011 (i.e. the 3 months after the end of the base year for this study) show an increase of 24% compared to the same period in 2010.

4.8.5 Some power stations (Cockenzie, Didcot and Ironbridge) will close because Flue Gas Desulphurisation (FGD) equipment (as required beyond 2015) is not fitted. The ESI coal by rail to Cockenzie, Didcot and Ironbridge has declined to only 4.7% of total ESI coal by rail. If this generating capacity is removed, some of the shortfall is likely to be taken up by other coal power stations, and some could also switch to other means of generation. Our base case forecast for ESI coal is for unchanged total tonnes & tonne kms from current traffics to 2018/19. If we were to forecast a slightly different base case for 2018/19, this would not change our conclusions on the elasticity of the market.

Table 5: Modelling Results for ESI Coal

∆VUC	Absolute change (£/kGTM)	Cargo Tonnes (Million)	% Change from base	Cargo Tonnekm (Billion)	% Change from base
Oct2010 - Sep2011		38.38		5.982	
Base forecast 2018/19		38.38		5.982	
-10%	-£0.18	38.40	0.0%	5.985	0.0%
+10%	£0.18	38.37	0.0%	5.980	0.0%
+20%	£0.36	38.36	-0.1%	5.978	-0.1%
+50%	£0.90	38.31	-0.2%	5.971	-0.2%
+100%	£1.80	38.24	-0.4%	5.960	-0.4%

4.8.6 Origins and destinations are already reasonably well rationalised – i.e. most journeys are short-haul where possible. Some longer hauls do exist to ensure diversity of supply and the correct mix of coal types (sulphur content), and to take Scottish coal to markets. As the market is already well rationalised, origins and destinations are unlikely to be significantly changed by modest VUC changes, although this assumption would be less robust for any VUC increases beyond +100%. This has not been modelled.

4.8.7 It is also important to recognise that Network Rail is not the only infrastructure owner in the supply chain. The very fact that imported coal is handled through ports with different distances from the destination power stations, and such differences cannot be explained as a trade off against ship capacity (larger ships through deeper-water ports offer maritime savings per tonne) suggests some ports enjoy a higher level of economic rent than others. That is, some ports can (and do) charge different levels of ship dues to others).

4.8.8 On the basis that (in the long run) transport suppliers in a competitive environment are all price takers, then an increase in VUC is likely to reduce the level of cargo dues that some ports can charge (or increase the dues a nearby port can charge).

4.8.9 For example, using the port of Tyne or Immingham to serve Drax: The distance difference is ~70km so the VUC difference is ~ £0.16 per tonne. Doubling VUC would result in Tyne being an extra £0.16 per tonne relatively worse off compared to Immingham.

4.8.10 A similar impact would be experienced by relatively remote domestic coal sources (e.g. open cast supplies in Scotland serving English power stations by rail). An increase in VUC would reduce the net price such a facility would receive from a generator and, in the extreme, could render a facility non-viable. For any supplier (cargo owner or transport facility owner), an increase in VUC would have a negative impact on the effective value of a long term asset and may (or may not) affect the amount of tonne kms moved by rail. See section 4.21 for impacts on Scotland. This may mean that some of the extra VUC costs may be absorbed by some ports and pits, as well as being paid by power stations.

4.8.11 So in summary for port, pit and power station competition upon increased VUC:

- Transporting coal becomes more expensive for everyone, but for ports, pits and power stations for which long rail journeys are required, the cost increases are greater.
- Such remote ports and pits may suffer. Conversely local port and pits may find themselves in a privileged competitive position, whereby their more distant competitors are suffering greater increases in transport costs than they are.
- Considering a hypothetical example of supplying a power station from 2 ports - where doubling VUC would make it 20 pence per tonne relatively more expensive from port A to the power station than from port B, there may be various responses:
    - Port A may be able to absorb some of these costs and offer reduced port charges in order to retain the traffic, or may be happy to lose the traffic
    - Port B may be able to increase their port charges to exploit their competitive advantage
    - There may be some switching of traffic from port A to port B
    - The power station may absorb the cost increases
    - The power station may reduce coal burn
    - A combination of the above
- The prices are largely set by prices of delivered import coal because
    - the domestic producers are a relative minority (37% of ESI coal tonnes by rail. The rest (63%) is from ports), and
    - pits are difficult to turn on or off quickly

4.8.12 This port, pit and power station competition is NOT included in the modelling.

4.8.13 Another potential impact of increasing the price of coal-by-rail is **mode switch to road or waterway**. The effects of modest increases in VUC of no more than 100% are unlikely to produce significant mode switches and have therefore not been modelled. However the issues and opportunities are discussed:

4.8.14 **Road**: There are currently 38 million tonnes of coal per year to power stations by rail. According to data from CSRGT (the DfT's Continuing Survey of Road Goods Transport), there are just 8.2 million tonnes of coal per year by road (excluding small shipments e.g. in containers), of which much is travelling to railheads for onward travel by rail or going to industrial users. The only exception to rail's dominance is Ferrybridge with around 30% incoming by road. It is possible that increases in VUC could encourage more road-sourcing for Ferrybridge, but given rail's general dominance in the market, this effect would be relatively small overall. If VUC were to increase by more than 100%, there would be a greater incentive for Ferrybridge to source more by road. Some other power stations with currently small quantities of road-sourced coal (e.g. Ratcliffe) may also look to increase their traffic by road.

4.8.15 **Sea**: Fiddlers Ferry power station receives most of its coal through nearby Liverpool port (54%). However 33% comes from Hunterston – split between a direct rail service, and going by feeder ship to Ellesmere Port (plus short rail journey to Fiddlers Ferry). It is possible that increases in VUC could encourage more coal to go by sea via Ellesmere Port instead of direct rail on this route. If VUC were to increase by more than 100%, it may not be viable to serve Fiddlers Ferry by rail from Hunterston.

4.8.16 **Barge**: There are very few realistic opportunities to serve power stations by barge. The most substantial barge opportunity is probably between Immingham port and the Aire and Calder canal to serve Ferrybridge power station. This station was served by barge for many years through a short journey from local pits using a barge lift to tip coal into hoppers and then by conveyor. This fell into disuse when the source of coal switched to imports. It would be perfectly feasible to operate a similar tug and barge system along the estuary from Immingham, although the original equipment would have to be replaced by more powerful tugs. It might also be more practical to use self discharging barges of (say) 600 tonnes capacity which could be moved in groups to Goole. Individual barges could then be towed along the canal to the power station.

4.8.17 Given a dedicated loading berth at Immingham, such a system could probably handle several million tonnes per annum. A 'push tow' of 6 x 600 tonne barges could handle 3,600 tonnes. A pair of push tows could operate on each tide, which would equate to an annual capacity of some 4m tonnes. Within the enclosed water of the canal, a barge load could then be delivered at hourly intervals. From the point of view of the client (the generating company), this approach would suffer from a lack of flexibility. The entire investment would depend upon traffic via Immingham remaining on a long term basis.

4.8.18 A perhaps more serious problem would be that of the power stations local to Immingham, only Ferrybridge could be so readily served by barge. The current volume of coal moving from Immingham to Ferrybridge is 1.2 million tonnes per annum. This would mean that the potential volume that a barge system could offer, loading and discharging a 600 tonne barge every hour, could not be fully exploited.

4.8.19 There would clearly be a point at which an increase in TAC would tip the balance and make such a system viable. However, even a 100% increase in TAC would add only around 20 pence to a tonne of coal moved to Ferrybridge by rail, which is unlikely to address the very significant barriers to entry that a barge system would face.

4.8.20 ORR has commissioned a further study by NERA Economic Consultancy of the impact of changes in the level of variable usage charge on the demand for ESI coal. The findings of this study will also be published.

4.9 Nuclear

4.9.1 Nuclear traffic is predominantly spent nuclear fuel between power stations & Sellafield. Volumes are 74 thousand tonnes per year (29 million tonne km). We forecast this to be stable in the base case forecast. We have not used transport models to model nuclear traffic, but we believe traffic is unlikely to be impacted by increased VUC because:

- Compared to coal, it involves small quantities of cargo transported compared to the value of the electricity generated
- Origins and destinations are fixed - at least for the short and medium term
- There is little mode choice
- Going by sea would require infrastructure investment and the small consignment sizes are unsuitable for sea

4.9.2 Road would in theory be a possible alternative to rail but public opposition and security issues etc would make road unattractive. Currently no spent nuclear fuel is carried by road.

4.9.3 In the extreme case of very large increases in VUC, for example much greater than 100%, one could conceive of the following possible responses to such an increase:

- Try to overcome the difficulties with switching to road
- Store the spent fuel in a slightly different form so there was more spent nuclear fuel per tonne of cargo transported. For example more wagons per train
- Build appropriate quays etc and store a lot of spent nuclear fuel until enough is gathered to make it worth chartering a dedicated ship.
- Reduce electricity production.

4.9.4 Due to the reasons set out in paragraph 4.9.1, above, we estimate a 100% increase in VUCs will not result in a reduction in nuclear traffic volumes.

4.10 Metals

4.10.1 The metals market can be sub-divided into one group of movements between parts of the steel industry (e.g. blast furnace to rolling mill) and another group which involves delivery to end users and scrap metal. We have concluded that around half of all traffic falls into the first category with sufficient traffic to fill daily trains.

4.10.2 While we understand that for some of the 'inter-works' market there is competition from road haulage, we believe that rail does enjoy a technical advantage over road through the way in which steel works are organised, and traffic volumes sufficient to fill a daily train are therefore reasonably captive to rail (i.e. immune to modest VUC increases).

4.10.3 The remainder of the metals traffic (delivery to end users, scrap metal and smaller volumes between rail-connected parts of the steel industry) is assumed to be in competition with road.

4.10.4 This is a relatively simplistic approach. For some flows that we have categorised as captive to rail (at least a daily train and from rail-connected to rail-connected site), there may be other reasons why they could be vulnerable to road competition (e.g. multiple splitting / shunting of trains required, or using rail wagons as a storage buffer etc). Conversely, many flows with slightly less than a daily train load, yet still from rail-connected to rail-connected site, may actually be reasonably captive to rail, with road struggling to compete.

Table 6: Modelling Results for Metals

∆VUC	Absolute change (£/kGTM)	Cargo Tonnes (Million)	% Change from base	Cargo Tonnekm (Billion)	% Change from base
Oct2010 - Sep2011		8.58		1.93	
Base forecast 2018/19		8.92		1.96	
-10%	-£0.19	8.94	0.3%	1.97	0.3%
+10%	£0.19	8.88	-0.5%	1.95	-0.4%
+20%	£0.38	8.84	-0.9%	1.95	-0.9%
+50%	£0.96	8.74	-2.0%	1.92	-2.1%
+100%	£1.92	8.57	-3.9%	1.88	-4.2%

4.10.5 There is an argument that increased VUC could affect overall demand because steel production is an internationally competitive market. However when VUC is compared to the value of steel, it is only a very small proportion:

- Value of Steel ~ £600 per tonne depending on the type of steel
- VUC for inland steel flow of 250 km ~ £0.65

4.10.6 As it is such a small proportion of the total value of product, modest increases in VUC are unlikely to have a significant effect on steel production. This demand suppression has not been modelled.

4.11 Ore

4.11.1 Ore traffic is very much related to the steel industry. The vast majority of this traffic is iron ore from the port of Immingham to Scunthorpe. For this journey VUC is just £0.10 per tonne. As the volumes are high (several daily trains) and it is from rail-connected site to rail-connected site, there is no realistic competition from road. There is therefore negligible impact for modest increases in VUC. The only impact would be if increased VUC affected overall steel production in Britain – which we have not modelled.

4.11.2 If rail was much cheaper, there would be more scope for port competition (e.g. Redcar - Scunthorpe).

Table 7: Modelling Results for Ore

∆VUC	Absolute change (£/kGTM)	Cargo Tonnes (Million)	% Change from base	Cargo Tonnekm (Billion)	% Change from base
Oct2010 - Sep2011		5.30		0.21	
Base forecast 2018/19		5.35		0.21	
-10%	-£0.20	5.35	0.0%	0.21	0.0%
+10%	£0.20	5.35	0.0%	0.21	0.0%
+20%	£0.41	5.35	0.0%	0.21	0.0%
+50%	£1.02	5.35	0.0%	0.21	0.0%
+100%	£2.05	5.35	0.0%	0.21	0.0%

4.12 Construction materials

4.12.1 Overall demand for construction materials is unlikely to be noticeably affected by increased VUC – i.e. construction work will continue. However aggregates are a low value commodity (around £20 per tonne) and transport costs are a high proportion of delivered cost, so any increase in VUC will significantly affect how they are delivered. Most “rail” journeys also include road for final delivery. There is competition between road and rail.

Table 8: Modelling Results for Construction materials

∆VUC	Absolute change (£/kGTM)	Cargo Tonnes (Million)	% Change from base	Cargo Tonnekm (Billion)	% Change from base
Oct2010 - Sep2011		17.78		3.21	
Base forecast 2018/19		19.74		3.39	
-10%	-£0.18	19.98	1.2%	3.43	1.2%
+10%	£0.19	19.32	-2.1%	3.33	-1.7%
+20%	£0.37	18.89	-4.3%	3.27	-3.4%
+50%	£0.92	18.02	-8.7%	3.13	-7.7%
+100%	£1.83	16.57	-16.1%	2.88	-14.8%

4.12.2 The GBFM mode share modelling shows that it is a relatively elastic market. However there are various other (unmodelled) factors that will also affect the impact of increased VUC:

- *Less* impact than modelled: Planning restrictions at some sites, for example limits on the number of lorry movements, encourages rail to be used from some quarries. This effectively makes these traffics more captive to rail than modelled in GBFM
- *More* impact than modelled: Existing long distance rail traffic (e.g. West Country to London) would be unlikely to switch directly to road. Instead, if rail costs increased significantly, there would be a switch to more local sourcing – e.g. recycled aggregates.

4.13 Petroleum, Chemicals and Industrial minerals

4.13.1 Modelling for these categories has been based on GBFM mode share modelling. Most of this traffic is petroleum, where there is some additional competition with pipeline in the long term, although being rail connected at both ends makes the larger volume flows reasonably captive to rail, at least in the short term.

Table 9: Modelling Results for Petroleum, Chemicals and Industrial minerals

∆VUC	Absolute change (£/kGTM)	Cargo Tonnes (Million)	% Change from base	Cargo Tonnekm (Billion)	% Change from base
Oct2010 - Sep2011		8.21		1.63	
Base forecast 2018/19		8.66		1.70	
-10%	-£0.17	8.69	0.3%	1.72	0.8%
+10%	£0.17	8.58	-1.0%	1.67	-1.8%
+20%	£0.35	8.50	-2.0%	1.64	-3.5%
+50%	£0.87	8.33	-3.8%	1.59	-6.5%
+100%	£1.74	8.07	-6.9%	1.51	-11.4%

4.14 Automotive

4.14.1 Rail plays a part in the import of cars from ports to inland depots, the export of cars from factory to port and the transport of components. For exports, the trips are often rail-connected plant to rail-connected port which would imply a competitive advantage for rail over road. However rail's competitive advantage over road is limited because a single train is equivalent to only around 15 HGVs or less. Therefore no traffic is captive to rail.

Table 10: Modelling Results for Automotive

∆VUC	Absolute change (£/kGTM)	Cargo Tonnes (Million)	% Change from base	Cargo Tonnekm (Billion)	% Change from base
Oct2010 - Sep2011		0.29		0.11	
Base forecast 2018/19		0.35		0.14	
-10%	-£0.21	0.36	0.8%	0.14	0.8%
+10%	£0.21	0.35	-1.4%	0.14	-1.0%
+20%	£0.41	0.34	-2.9%	0.13	-2.1%
+50%	£1.03	0.33	-6.3%	0.13	-5.1%
+100%	£2.05	0.31	-12.1%	0.12	-10.1%

4.15 Waste

4.15.1 The waste market is changing rapidly, as landfill sites are closed down and municipal waste becomes an energy product to be traded (albeit based on gate fees to take it away). We agree with the observation that it may develop as an intermodal market alongside biomass in serving power stations. Only if planning conditions dictate will it be obliged to move by rail, but such planning conditions (at least for part of the market) do exist. Whether it is appropriate for VUC to be charged on the basis of ‘captivity’ being based upon environmental objectives is beyond the scope of this study.

4.15.2 In terms of modelling waste flows, there are various uncertainties. We have assumed that current tonnes and tonne kms are unchanged in the future base case, although the destinations may change. The response to increased VUC is assumed to be same as intermodal (domestic & maritime).

Table 11: Modelling Results for Waste

∆VUC	Absolute change (£/kGTM)	Cargo Tonnes (Million)	% Change from base	Cargo Tonnekm (Billion)	% Change from base
Oct2010 - Sep2011		1.49		0.16	
Base forecast 2018/19		1.49		0.16	
-10%	-£0.17	1.52	1.4%	0.16	1.2%
+10%	£0.17	1.47	-1.6%	0.15	-1.4%
+20%	£0.35	1.45	-3.2%	0.15	-2.8%
+50%	£0.87	1.38	-7.4%	0.15	-6.3%
+100%	£1.74	1.28	-14.3%	0.14	-12.3%

4.16 Biomass

4.16.1 The market for the transport of biomass is in its early stages. Most commentators appear to expect the majority to be in wood chip form and originate in the Americas. In many respects it can be expected to behave similarly to coal; most will be imported and it is in competition with other sources of energy. However, it is not yet clear what the full range of biomass products that will appear is likely to be. Domestic sourced waste wood or wood chips are likely to move in containers if on rail and be in head to head competition with road. Such traffic maybe more sensibly considered as an intermodal traffic. Indeed, in this respect biomass may more closely correspond to municipal waste, also bound for new generation power stations. It is even possible that trains could be shared and the same wagons employed to carry waste or biomass containers and maritime containers.

4.16.2 Biomass is charged at “other coal” (i.e. not the more expensive ESI coal) rates, but because biomass is generally less dense than coal, the cost per *cargo* tonne km is higher than that for other “other coal”. Biomass also provides less energy per tonne of fuel than coal, so the VUC paid *per MWh of electricity generated* is higher than ESI coal.

4.16.3 The future biomass market is effectively segregated into two types:

1. Co-firing with coal in existing coal fired power stations (currently Tyne to Drax is the only regular rail traffic)
2. Dedicated new biomass power stations (currently no regular rail traffic)

4.16.4 Most coal fired power stations are switching to co-firing with biomass. We have assumed that in addition to the coal tonnes incoming by rail to coal power stations, a fixed percentage of this tonnage is additional biomass also incoming by rail from ports. There are various influences on this fixed percentage:

- Technical limit: Biomass can only make up around 25% of total fuel burnt
- The Renewables Obligation requires that 15.4% of generation is renewable by 2015/16
- Electricity suppliers can only meet 12.5% of their obligation from co-fired ROCs
- Some of this biomass may be sourced more locally by road for some power stations

We have assumed that by 2018/19, the biomass tonnage by rail is an additional 8% of the coal tonnage arriving by rail to each power station, with the same ALOH as coal and that this 8% proportion remains constant. Drax already achieves this proportion. The response to changes in VUC is therefore assumed to be in line with that of ESI coal.

Table 12: Modelling Results for Biomass (co-firing with coal)

ΔVUC	Absolute change (£/kGTM)	Cargo Tonnes (Million)	% Change from base	Cargo Tonnekm (Billion)	% Change from base
Oct2010 - Sep2011		0.636		0.126	
Base forecast 2018/19		3.071		0.606	
-10%	-£0.19	3.072	0.0%	0.606	0.0%
+10%	£0.19	3.070	0.0%	0.606	0.0%
+20%	£0.37	3.069	-0.1%	0.605	-0.1%
+50%	£0.93	3.065	-0.2%	0.605	-0.2%
+100%	£1.85	3.059	-0.4%	0.604	-0.4%

4.16.5 This shows a big growth to get to the 8% of coal tonnage in the base case forecast, but is a rather conservative view of the impact of increased VUC on biomass traffic because

- It assumes that the only biomass by rail will be for co-firing at existing coal power stations
- It assumes that the traffic will be from (rail-connected) ports and therefore captive to rail.
- It assumes the 8% of coal tonnage remains fixed for technical and regulatory reasons, and thus ignores the fact that the VUC paid per MWh of electricity generated is higher than for coal.

4.16.6 Consequently, and given the uncertainties, we have also modelled a sensitivity test to include dedicated new biomass / waste rail-fed power stations.

4.17 Sensitivity test: NEW rail-fed, off-port dedicated biomass / waste power stations

4.17.1 As discussed in the previous section, the future market for rail-fed, dedicated biomass / waste power stations is uncertain. There are currently no regular rail traffics but there is the potential for a significant rail market to develop.

4.17.2 New biomass-only plants are likely to be built near to ports for flexibility, although some could be fed by rail. New waste power stations are also being built as there is a switch from landfill to incineration. There are big potential traffics for rail but there are significant uncertainties – for example local authorities' policy to use local incinerators means that rail's advantage is lessened.

4.17.3 The sensitivity test assumes the equivalent of co-fired biomass and/or waste rail-fed capacity is built again at new sites. This approximately represents 20% of proposed new biomass and 10% of new waste incineration capacity. The response to increased VUC is assumed to be same as intermodal (domestic & maritime) because the sources may be from around the country and / or imports, and intermodal containers are likely to be an option – particularly if domestically sourced from non-rail-connected sources over long distances.

Table 13: Modelling Results for NEW rail-fed, off-port dedicated biomass / waste power stations

∆VUC	Absolute change (£/kGTM)	Cargo Tonnes (Million)	% Change from base	Cargo Tonnekm (Billion)	% Change from base
Oct2010 - Sep2011		0.00		0.00	
Base forecast 2018/19		3.07		0.61	
-10%	-£0.19	3.11	1.4%	0.61	1.2%
+10%	£0.19	3.02	-1.6%	0.60	-1.4%
+20%	£0.37	2.97	-3.2%	0.59	-2.8%
+50%	£0.93	2.84	-7.4%	0.57	-6.3%
+100%	£1.85	2.63	-14.3%	0.53	-12.3%

4.17.4 These sensitivity test results are not included in base case forecasts. The ORR has commissioned Consultants NERA to consider the impact of changes in VUC on the biomass market as part of the same study of the impacts on the demand for ESI Coal.

4.18 Other Coal

4.18.1 'Other coal' traffics fill two main categories; coking coal to steelworks (or coke from coke owner to steel works'), and coal to industrial plants such as cement works.

4.18.2 The first group can be regarded similarly to iron ore; relatively captive to rail and sensitive to the longer term prospects of the UK steel industry; VUC forms a very small input into overall steelwork costs. Coking coal is mostly Immingham and Redcar to Scunthorpe, and the main coke flow is Redcar to Port Talbot. Current traffics for this first group (3.0 million tonnes, 670 million tonne kms) are assumed to remain constant in the future base case, and then to be unaffected by modest increases in VUC. However it is possible that there could be some port competition for coking coal – and increased VUC would penalise the more distant ports (e.g. Redcar vs Immingham). As per port competition in ESI coal, such modest impacts on the competitive positions of ports has been assumed to be absorbed by the ports themselves.

4.18.3 The second group for cement works is in competition with other heat sources in the long term. It is also in competition with road; even if discharging facilities are close at hand they will not be for 'merry-go-round' trains (block trains of hopper wagons which both load and unload their cargo while moving) and handling costs are significant (lacking scale economies). Traffic volumes rarely warrant full daily trains which reduces rail's attractiveness. We have adopted the same response to increased VUC as for intermodal traffic (domestic & maritime).

Table 14: Modelling Results for 'second group' of other coal: to industrial plants such as cement works

∆VUC	Absolute change (£/kGTM)	Cargo Tonnes (Million)	% Change from base	Cargo Tonnekm (Billion)	% Change from base
Oct2010 - Sep2011		0.21		0.088	
Base forecast 2018/19		0.21		0.088	
-10%	-£0.21	0.22	1.4%	0.089	1.2%
+10%	£0.21	0.21	-1.6%	0.086	-1.4%
+20%	£0.42	0.21	-3.2%	0.085	-2.8%
+50%	£1.06	0.20	-7.4%	0.082	-6.3%
+100%	£2.12	0.18	-14.3%	0.077	-12.3%

4.19 General Merchandise

4.19.1 The other rail commodity is General Merchandise. This represents 0.4m tonnes (120 m tonne km) per year and is mainly mineral water, wood and paper. The response to changes in VUC is taken as the average of the rest of the market.

4.20 Other responses to changes in VUC

4.20.1 There are various other responses that the industry might adopt to mitigate the impact of increased VUC. For example:

- The optimum train length may increase
- There may be more effort to gain backloads

4.20.2 We do not believe that any of these responses are likely to have a significant effect on the overall results and we have assumed no change to operating practices for this work.

4.21 Scotland

4.21.1 The impact of any potential VUC changes will vary from region to region, depending on various factors including the types of traffic, the rail-connectedness of the origin and destination (i.e. whether a local road haul is required), the length of haul and the volumes involved.

4.21.2 Of the total annual tonnes lifted by rail in Britain (101.6 million tonnes), 13.4 m tonnes is to, from or within Scotland:

Table 15: Rail freight tonnes by commodity to, from or within Scotland

Commodity	Million Tonnes	Proportion
Automotive	0.0	0%
Chemicals	0.0	0%
Coal Other	0.2	1%
Construction materials	0.5	4%
Domestic Waste	0.2	1%
ESI Coal	8.7	65%
General Merchandise	0.0	0%
Industrial Minerals	0.2	1%
Intermodal	2.6	20%
Iron Ore	0.1	1%
Metals	0.5	4%
other	0.0	0%
Petroleum	0.4	3%
Grand Total	**13.4**	**100%**

4.21.3 The commodity mix of Scottish rail freight differs from that for the whole of Britain. Power station coal represents 65% (8.7 million tonnes) of all Scottish traffic. As discussed in the ESI coal section, there is competition between energy sources for electricity generation (predominantly with gas), and that increased costs of delivered coal as a result of increased VUC would result in a switch away from coal fired electricity generation.

4.21.4 The majority of power station coal traffic in Britain is well rationalised – with mostly short distance journeys. The few longer journeys that do occur are mainly to ensure a diversity of supply, or the correct mix of coal types (e.g. sulphur content). Any small change to the competitive position of ports or pits as a result of changes in VUC has been assumed to be absorbed by the port, pit or power station (either positive or negative).

4.21.5 We have therefore assumed that increased VUC will not have a significant effect in further rationalising the origin and destination choices for power station coal.

4.21.6 The exception to this is Scottish ports and pits. Scotland generates more coal than it needs for its power stations (both through mining and through its ports). A large amount of this (4.6m tonnes) is railed to English & Welsh power stations with an average length of haul of around 470 km – paying an average of £1.05 VUC per tonne. In contrast the average length of haul from English & Welsh sources to English & Welsh power stations is around 120 km – paying an average of £0.27 VUC per tonne. I.e. Scottish sourced coal pays an extra £0.79 VUC per tonne to get to English & Welsh power stations. If VUC were doubled, this would double this differential. It is possible that this effective £0.79 VUC per tonne increase on the 4.6 m tonnes of coal sent to English and Welsh power stations could be absorbed by the Scottish ports and pits, or it may push some Scottish coal sources towards not being viable.

4.21.7 Attempting to estimate the viability of Scottish coal sources is beyond the scope of this project. ORR's separate study ESI coal market study will include an assessment of the potential impacts on the Scottish open coal mining industry of changes in the level of VUC.

4.21.8 The other significant Scottish rail freight commodity is intermodal (20% (2.6 m tonnes) of all Scottish traffic). Intermodal traffic is forecast to increase nationally as warehouses are increasingly built at rail-connected sites, thus eliminating the need for a local road haul between rail terminal and origin/destination.

4.21.9 As far as Scotland is concerned, much of this intermodal traffic is relatively long distance traffic between Scotland and England, although there are also significant shorter-distance traffics within Scotland too. The impact on Scottish intermodal can be assumed to be broadly in line with the impact across the whole of Britain.

4.21.10 There is a mitigating factor in terms of the cost to business of increased VUC for delivering maritime containers to Scotland: A large proportion of maritime containers from around the world to Scotland are already delivered by coastal shipping from Felixstowe or another major European deep sea port (e.g. a large container ship coming from China drops the containers at Felixstowe and then they are transhipped to a smaller ship and taken to Grangemouth). The estimated impact of a doubling of VUC would be to shift 9% of the containers between South East Ports and Scotland onto coastal shipping, thus reducing the cost impact on Scottish business.

5 RESULTS SUMMARY

Table 16: Modelling Results for impact of % changes in VUC on all rail freight

∆VUC	Cargo Tonnes (Million)	Cargo Tonnekm (Billion)	VUC revenue £m
Oct10-Sep11	101.6	20.56	47.9
Base forecast 2018/19	122.8	27.38	63.6
-10%	123.6	27.60	57.7
+10%	121.7	27.10	69.2
+20%	120.6	26.82	74.8
+50%	117.9	26.11	90.2
+100%	113.5	24.93	116.1
% change from Base forecast			
-10%	0.7%	0.8%	-9.3%
+10%	-0.9%	-1.0%	8.8%
+20%	-1.8%	-2.1%	17.6%
+50%	-4.0%	-4.6%	42.0%
+100%	-7.6%	-8.9%	82.6%

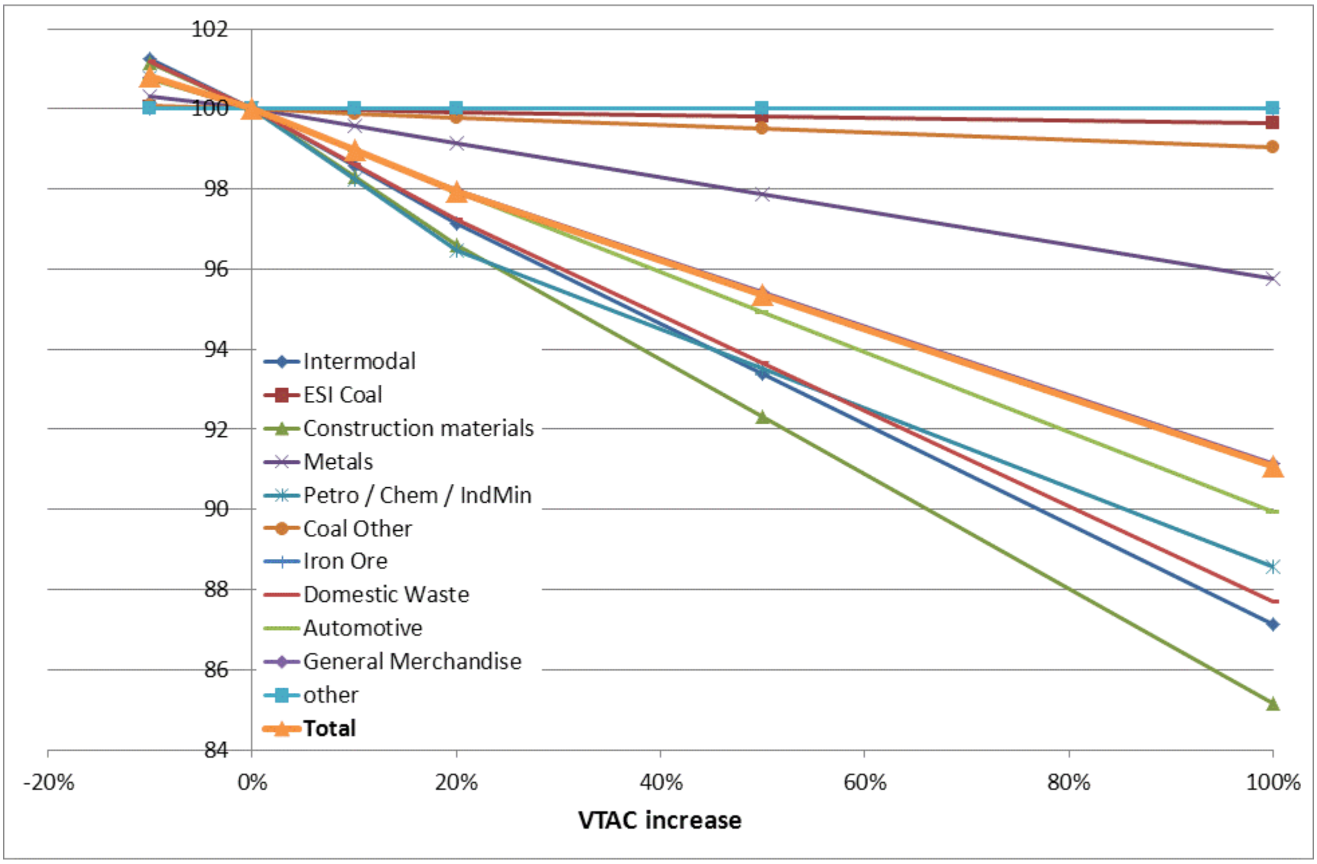
Network Rail Engineering traffic is not included in any of the modelling or results.

5.1.1 The VUC revenue for the base year and the base forecast year is calculated by multiplying the cargo tonne kms by the VUC from table 1 for each commodity. For the changed VUC scenarios, these VUC rates are scaled up or down as per the % change in VUC.

Table 17: Impact of % changes in VUC on Tonnes & Tonne kms by commodity.

	Tonnes					Tonne kms				
% Change in VUC	**-10%**	**+10%**	**+20%**	**+50%**	**+100%**	**-10%**	**+10%**	**+20%**	**+50%**	**+100%**
Other (mostly Nuclear)	0.0%	0.0%	0.0%	0.0%	**0.0%**	0.0%	0.0%	0.0%	0.0%	**0.0%**
ESI Coal	0.0%	0.0%	-0.1%	-0.2%	**-0.4%**	0.0%	0.0%	-0.1%	-0.2%	**-0.4%**
Other Coal (inc Biomass)	0.1%	-0.1%	-0.1%	-0.3%	**-0.7%**	0.1%	-0.1%	-0.2%	-0.5%	**-1.0%**
Iron Ore	0.0%	0.0%	0.0%	0.0%	**0.0%**	0.0%	0.0%	0.0%	0.0%	**0.0%**
Automotive	0.8%	-1.4%	-2.9%	-6.3%	**-12.1%**	0.8%	-1.0%	-2.1%	-5.1%	**-10.1%**
Metals	0.3%	-0.5%	-0.9%	-2.0%	**-3.9%**	0.3%	-0.4%	-0.9%	-2.1%	**-4.2%**
General Merchandise	0.6%	-0.9%	-1.8%	-3.9%	**-7.5%**	0.8%	-1.0%	-2.0%	-4.6%	**-8.8%**
Petro / Chem / IndMin	0.3%	-1.0%	-2.0%	-3.8%	**-6.9%**	0.8%	-1.8%	-3.5%	-6.5%	**-11.4%**
Intermodal	1.4%	-1.6%	-3.2%	-7.4%	**-14.3%**	1.3%	-1.4%	-2.9%	-6.6%	**-12.9%**
Domestic Waste	1.4%	-1.6%	-3.2%	-7.4%	**-14.3%**	1.2%	-1.4%	-2.8%	-6.3%	**-12.3%**
Construction materials	1.2%	-2.1%	-4.3%	-8.7%	**-16.1%**	1.2%	-1.7%	-3.4%	-7.7%	**-14.8%**
Total	**0.7%**	**-0.9%**	**-1.8%**	**-4.0%**	**-7.6%**	**0.8%**	**-1.0%**	**-2.1%**	**-4.6%**	**-8.9%**

Figure 1: Impact of % changes in VUC on Tonne kms by commodity.
All commodities tonne kms indexed to 100



5.1.2 Overall the rail freight market has relatively low elasticity:

- Rail freight tonnes w.r.t. VUC ~ -0.08

- Rail freight tonne kms w.r.t. VUC ~ -0.09

although as can be seen by the above graph, this tonne kms elasticity varies by commodity from 0 to approximately -0.15.

5.1.3 For most commodities, increased VUC results in increased revenue: Doubling VUC for all commodities results in an extra 83% VUC revenue. Doubling VUC results in a loss of some rail traffic (7.4% of tonnes and 8.8% of tonne kms). This is environmentally negative for that which switches to road.

5.2 Environmental Impact in terms of Mode Shift Benefits (MSBs)

5.2.1 We have already mentioned that increased VUC will encourage a switch of some traffic from rail to road. This extra road traffic can have an environmental cost that can be quantified using Mode Shift Benefits (the same concept as Sensitive Lorry Miles (SLMs)).

5.2.2 MSBs are a measure of HGV external costs. They represent a measure of the benefit to society of switching road traffic to rail because road doesn't pay all its environmental external costs in taxes. MSBs justify some rail subsidies. Conversely we can measure the *disbenefit* of traffic switching from rail to road in terms of negative MSBs.

5.2.3 In order to do this, we need to make some general assumptions about the nature of any rail traffic switching to road:

- An average of 13 tonnes per HGV for transferred traffic - i.e. empty returns for bulks etc
- 27.3 pence external cost per HGV km for transferred traffic. This is the weighted average of MSBs across all roads (from DfT). It includes costs for congestion, accidents, noise, climate change, air pollution, infrastructure and other costs (previously called "Unquantified").

5.2.4 ***IF*** all the traffic lost to rail switched directly to road when VUC doubled, there would be a mode shift cost of £51 million per year in HGV environmental external cost. Overall this approximately equates to the increased VUC revenue of £53m per year. However in reality, traffic lost to rail would NOT all switch directly to road. As discussed in the sections above for each commodity, some would be suppressed, some would have an altered OD pattern and some would switch ports.

Table 18: Double VUC: Change in VUC revenue vs change in MSBs *IF* all the traffic lost to rail were to switch directly to road

Commodity	**∆VUC revenue £m**	**∆HGV ext cost * £m**	**∆HGV ext cost / ∆VUC revenue**	**Propensity to directly switch from rail to the same journey by road, if lost from rail**
Other (mostly Nuclear)	**0.3**	**0.0**	**0.00**	**Low**
ESI Coal	**13.4**	**0.5**	**0.03**	**Low**
Other Coal (inc Biomass)	**3.9**	**0.3**	**0.07**	**Medium**
Iron Ore	**0.5**	**0.0**	**0.00**	**Medium**
Automotive	1.0	0.3	0.28	High
Metals	4.6	1.7	0.38	Medium
General Merchandise	0.3	0.2	0.78	Medium
Petro / Chem / IndMin	2.8	4.1	1.45	Medium
Intermodal	20.3	33.4	1.64	High
Domestic Waste	0.2	0.4	1.76	High
Construction materials	5.2	10.6	2.03	Medium
Total	**52.5**	**51.4**	**0.98**	

* Change in HGV external cost ***IF*** all the traffic lost to rail were to switch directly to road. In reality, much of this traffic would NOT switch directly to road.

5.2.5 Tables 17 & 18 suggest the following commodities are the least elastic and have the lowest HGV environmental impact:

- Other (mostly Nuclear)
- ESI Coal
- Coal Other (inc Biomass)
- Iron Ore

5.2.6 Recall that there is considerable uncertainty as to the nature of future biomass traffics, and therefore their sensitivity to VUC. Instead of being predominantly co-firing in coal power stations sourced from rail-connected ports (as per our central modelled scenarios), it is quite possible (as per the sensitivity test) that many biomass traffics may be in intermodal containers, sourced domestically over long distances for dedicated power stations and may therefore be much more sensitive to increases in VUC than suggested here.

5.2.7 Tables 17 & 18 also suggest that the following commodities are the most elastic and have the greatest HGV environmental impact as a result of increasing VUC:

- Intermodal. The majority of lost traffic to rail is switching to road although some maritime container traffic is switching to coastal shipping for northern regions, and some Channel Tunnel traffic is switching to nearer ports

- Construction materials. However many of these lost rail journeys would switch to more local sourcing rather than long distance road journeys, so the estimated HGV environmental cost would be much lower than suggested if all traffic switched directly to road.
- Waste. There is considerable uncertainty as to the nature of future waste flows, but as per construction materials, it is unlikely that traffic lost to rail would necessarily all switch directly to road.

5.2.8 As mentioned above, we need to be wary of directly comparing VUC revenue and MSBs because:

- not all traffic directly switches to road
- They are measures of different things which cannot necessarily be 'netted off'. Even if MSBs were greater than the extra VUC revenue, it wouldn't necessarily mean that increasing VUC was unjustified because society does not necessarily have to pay to remove external costs. For example cost – benefit ratios of much greater than 1 are normally required to justify building new transport infrastructure.
- Rail journeys are typically further than average road journeys. Longer road journeys are more likely to have a higher proportion of their distance on motorways and dual carriageways, than average road journeys. These major trunk roads tend to have lower MSB values than average roads. Therefore any rail traffic that did switch directly to road, would typically have an MSB lower than 27.3 pence external cost per HGV km.

6 CONCLUSION

6.1.1 We have modelled the impact of changes in Variable Usage Charges (VUC) on base case rail freight forecasts for 2018/19 for each commodity group separately.

6.1.2 For Nuclear, ESI (power station) coal, other coal and iron ore traffics, we estimate that a 100% increase in VUC would result in less than 1% fall in tonne km, and hence revenue would increase by close to 100%. If VUC were increased for these commodities, there would be a small amount of traffic lost from rail. The majority of this lost traffic would *not* switch directly to road.

6.1.3 We estimate that a 100% increase in VUC would result in a fall of around 4% of tonne km for metal traffic. For other commodities (intermodal, domestic waste, construction materials, general merchandise, petro / chemicals / industrial minerals) a doubling of VUC (100% increase) would result in a between 8.5% and 15% fall in tonne km.

6.1.4 There is considerable uncertainty over the nature of future biomass traffics. The response to increased VUC could range from relatively inelastic – similar to ESI coal (as per our standard results), to much more elastic – similar to intermodal (as per our sensitivity test).

6.1.5 For intermodal, the environmental damage caused by rail traffic switching directly to road (HGV externalities as measured by Mode Shift Benefits (MSBs)) would exceed the additional VUC revenue.

Table 19: Percent change in Tonne kms and increased VUC revenue in 2018/19 by commodity if VUC were doubled

Commodity	**% change in Tonne kms**	**Increased VUC revenue (£m)**
Other (mostly Nuclear)	**0.0%**	**0.3**
ESI Coal	**-0.4%**	**13.4**
Other Coal (inc Biomass)	**-1.0%**	**3.9**
Iron Ore	**0.0%**	**0.5**
Automotive	-10.1%	1.0
Metals	-4.2%	4.6
General Merchandise	-8.8%	0.3
Petro / Chemicals / Industrial Minerals	-11.4%	2.8
Intermodal	-12.9%	20.3
Domestic Waste	-12.3%	0.2
Construction materials	-14.8%	5.2
Total	-8.9%	**52.5**

7 APPENDIX 1: ROAD AND RAIL COST MODELS

7.1.1 The components of the GBFM road and rail cost models used for this work are shown below, for the base year (12 months up to the end of Sept 2011) and for 2018/19. Example calculations are shown for each cost model for a container from Felixstowe to the Manchester area.

7.1.2 For both road and rail, our 2018/19 cost models assume a real-terms increase of 8% for fuel costs (source: DECC's Oct 2011 fuel price projections) and 15% for drivers wages (source: WebTAG).

7.1.3 The 3000 hours per year for a loco reflects average active loco usage, given downtime for heavy maintenance and weekend non-working.

7.1.4 The 4 crew per loco represents dividing the total number of crew by the total number of active locos. When compared to road haulage, this ratio may seem high. However as well as spending time driving a train, train crew are also occupied by essential non-driving duties (e.g. attending training related to gaining/updating route knowledge, health and safety etc). Shift patterns may also be less flexible than in the road haulage industry, and compared with the passenger rail sector where frequent services operating over much shorter distances allows more efficient train crew allocation.

7.1.5 These figures have been sourced and validated through contacts with FOCs.

FELIXSTOWE – MANCHESTER AREA ROAD AND RAIL COSTS.
Current and 2018/19 road and rail cost calculations

RAIL FREIGHT CURRENT COST MODEL

Traction - Class 66 Diesel			**Comment**
Basic Assumptions			
Capital cost - locomotive	£1,550,000		Class 66
Depreciation	25	years	Straight line
Residual Value	£0		Scrap
Interest rate pa	6%		
Train crew wage pa	£40,000		
Employer NIC	13.8%		Source: HMR&C - 12.8% of wage above Threshold
NIC Threshold	£7,072		Source: HMR&C
Other train crew costs	£5,000		
Number train crew per locomotive	4		
Insurance of asset	3%		of capital cost
Overheads	15%		of fixed costs
Rate of Return on assets	10%		of mid-life 'book value'
Operating hours pa	3,000		12 hours per day x 250 days pa
Weight per locomotive	126		tonnes
Fuel consumption	0.24		km/litre
Cost fuel per litre	£0.6299		per litre

Operating Costs

Fixed Costs

Interest charges	£93,000	
Depreciation	£62,000	
Train crew wages	£160,000	
Employer NICs	£18,176	
Other train crew costs	£20,000	
Maintenance	£50,000	
Insurance - of locomotive asset	£46,500	
Sub-total	*£449,676*	
Overheads	£67,451	
Return on assets	£77,500	
Total Fixed Costs + Return on assets pa	**£594,628**	
Fixed Costs per operating hour	**£198**	

Running Costs

Fuel	£2.58	per km
Variable Maintenance	£0.00	per km
Total Running Costs	**£2.58**	**per km**

Intermodal Wagons - FSA/FTA Intermodal Flat

Standard 'Freightliner' wagon. Deck height 980mm, deck length 18.25mm

Basic Assumptions

Capital cost per wagon	£47,000		Fixed formation pair
Depreciation	25	years	Straight line
Residual Value	£0		Scrap

Interest rate pa	6%		
Rate of Return on assets	10%		
Annual Distance	160,000	km	
Maintenance	£0.005		per bogie per km
Number bogies per wagon	2		
Operating days per annum	275		
Operating hours per annum	6,600		
TEU per loaded wagon	3	TEU	
Tare weight	21.0	tonnes	
Max gross loaded weight per wagon	82.0	tonnes	
Max cargo capacity per wagon	61.0	tonnes	
Axle weight at maximum load	20.5	tonnes	
Length wagon	20.5	m	

Operating Costs

Fixed Cost	
Interest charges	£2,820
Depreciation	£1,880
Maintenance	£1,600
Sub-total	*£6,300*
Return on assets	£2,350
Total Fixed Costs + Return on assets pa	**£8,650**
Fixed Costs per operating day	**£31.45**
Fixed Costs per operating hour	**£1.31**

Track Access Charges (TAC)

Basic Assumptions

Class 66/0 Domestic Intermodal TAC	£1.4063	per	1,000

			gross tkm
			per 1,000
FSA/FTA Laden TAC		£0.7489	gross tkm

Wagons/train	24
Trailing length (m)	492
Max TEU per train	72
Mean TEU per train	50
Load factor (TEU)	69%
20ft units per train*	10
40ft units per train*	20
Mean weight/TEU	10
Trailing weight (tonnes)	1,004

Distance/time related costs - on one hour/50km

Traction fixed	£198
Traction running	£129
Wagons	£31
Track Access Charges	£46
Total train cost	£405
Cost per train km	*£8.10*
Cost per unit per km	*£0.2700*

Other Fixed costs per unit to non rail-linked inland destination

Traction shunting****	£13.21

Wagons in terminal*****	£6.29
Unit shunting - stack to terminal	£35
Terminal lifts	£45
Local road haul at inland terminal	£120
Total fixed cost per unit	*£219.50*

* For FSA/FTA, assume c85% loading factor for 40ft boxes and 2:1 ratio for 40ft & 20ft boxes

**** Assume 2 hours shunting at traction fixed cost per hour

***** Assume 6 hours wagons in terminals at wagon fixed cost per hour

Felixstowe to Manchester area = 425 km:

One-way RAIL CURRENT cost = £219.50 + 425 x £0.2700 = £334

ROAD FREIGHT CURRENT COST MODEL

Standard 6x2 tractor unit and tri-axle semi-trailer

Semi-trailer, plated 44 tonnes gvw

Basic Assumptions			**Comment**
Capital Cost - Tractor Unit	£69,200		Source: RHA.net - Online Cost Tables
Capital Cost - Semi-trailer	£19,000		Source: RHA.net - Online Cost Tables
Depreciation - Tractor Unit	6	yrs	
Depreciation - Semi-trailer	10	yrs	
Residual cost - Tractor Unit	£17,300		25% of new price
Residual cost - Semi-trailer	£0		Scrap Value
Mean speed	65	km/h	
Annual distance	260,000	km	
Fuel cost	£1.10	£ per litre	ex VAT
Fuel consumption rate	2.55	km/l	Source: RHA.net - Online Cost Tables
Maintenance interval	15,000	km	
Maintenance: number of inspections pa	17		Fixed Cost
Maintenance cost per inspection - Tractor Unit	£760		Source: RHA.net - Online Cost Tables
Maintenance cost per inspection - Semi-trailer	£300		Source: RHA.net - Online Cost Tables
Number tyres - Tractor Unit	8		
Cost per tyre - Tractor Unit	£280		Source: mytyres.co.uk
Tyre life - Tractor Unit	105,000	km	Source: RHA.net - Online Cost Tables

Number tyres - Semi-trailer	6		
Cost per tyre - Semi-trailer	£280		Source: mytyres.co.uk
Tyre life - Semi-trailer	90,000	km	Source: RHA.net - Online Cost Tables
Number drivers per vehicle per 24 hour period	2		
Shift length per driver	12	hours	
Driving time per shift	8	hours	
Days per week working	5	days	
Vehicle operating time per day	22		
Vehicle operating per annum	50	weeks	
Weeks per year	52	weeks	
Basic wage per hour - 8 hours per shift	£10.00		Source: RHA.net - Online Cost Tables
Overtime - after 8 hours	£15.00		Basic + half
Drivers annual wage - 8hrs basic+4hrs OT	£36,400		
Employer NIC Rate	13.8%		Source: HMR&C - 12.8% of wage above Threshold
NIC Threshold	£7,072		Source: HMR&C
Interest Rate pa	6.00%		
Rate of Return on Assets	10.00%		% of mid-life book value of asset

Operating Costs

Fixed Costs	*Tractor*	*Semi-trailer*	Comments
Interest Charges	£4,152	£1,140	
Depreciation	£8,650	£1,900	Straight line
Maintenance	£12,920	£5,100	
Insurance (Motor and Goods-in-transit)	£4,280	£0	Source: RHA.net - Online Cost Tables
Vehicle Excise Duty	£1,200	£0	Source: DVLA, Band E
Drivers Wage	£72,800	£0	
Employer NIC	£8,095	£0	
Driver equipment costs	£500	£0	Uniform, gloves, hard hats etc…

Cabphone	£600	£0	£50 per month
Wash	£520	£0	£10 per wash one wash per week
Overheads and office costs	£21,750	£0	Source: RHA.net - Online Cost Tables
Return on Assets	£4,325	£950	
Total per unit	***£139,792***	***£9,090***	
Total Fixed Costs per annum	**£148,882**		
<u>Running Costs</u>			
Fuel per km	£0.4314	£0.0000	
Oil per km	£0.0053	£0.0000	Source: Motor Transport cost tables
Tyres per km	£0.0213	£0.0187	
Distance Based Road Charging	£0.0000	£0.0000	
Total Running Costs per km	**£0.46**	**£0.02**	
Fixed Cost per operating hour	**£27.07**		Vehicle operating hours per annum =
…assuming 65 km/h, this fixed cost becomes	**£0.42**	per km	
Total Running Costs per km	**£0.48**		
Fixed + running costs per km	**£0.8931**		This is the marginal cost of an extra km where the fixed (time) cost is included in the distance
Repositioning = 3 hours and 25 km = £93.12			

Felixstowe to Manchester area = 390 km:

One-way ROAD CURRENT cost = £93.12 (repositioning) + 390 x £0.8931 = £441

RAIL FREIGHT COST MODEL 2018/19
(Fuel prices up 8%. Drivers' wages up 15%)

Traction - Class 66 Diesel			**Comment**
Basic Assumptions			
Capital cost - locomotive	£1,550,000		Class 66
Depreciation	25	years	Straight line
Residual Value	£0		Scrap
Interest rate pa	6%		
Train crew wage pa	£46,000		
Employer NIC	13.8%		Source: HMR&C - 12.8% of wage above Threshold
NIC Threshold	£7,072		Source: HMR&C
Other train crew costs	£5,000		
Number train crew per locomotive	4		
Insurance of asset	3%		of capital cost
Overheads	15%		of fixed costs
Rate of Return on assets	10%		of mid-life 'book value'
Operating hours pa	3,000		12 hours per day x 250 days pa
Weight per locomotive	126		tonnes
Fuel consumption	0.24		km/litre
Cost fuel per litre	£0.7074		per litre

Operating Costs

<u>Fixed Costs</u>

Interest charges	£93,000	
Depreciation	£62,000	
Train crew wages	£184,000	
Employer NICs	£21,488	
Other train crew costs	£20,000	
Maintenance	£50,000	
Insurance - of locomotive asset	£46,500	
Sub-total	*£476,988*	
Overheads	£71,548	
Return on assets	£77,500	
Total Fixed Costs + Return on assets pa	**£626,036**	
Fixed Costs per operating hour	**£209**	

<u>Running Costs</u>

Fuel	£2.89	per km
Variable Maintenance	£0.00	per km
Total Running Costs	**£2.89**	**per km**

<u>Intermodal Wagons - FSA/FTA Intermodal Flat</u>

Standard 'Freightliner' wagon. Deck height 980mm, deck length 18.25mm

Basic Assumptions

Capital cost per wagon	£47,000		Fixed formation pair
Depreciation	25	years	Straight line
Residual Value	£0		Scrap
Interest rate pa	6%		

Rate of Return on assets	10%		
Annual Distance	160,000	km	
Maintenance	£0.005		per bogie per km
Number bogies per wagon	2		
Operating days per annum	275		
Operating hours per annum	6,600		
TEU per loaded wagon	3	TEU	
Tare weight	21.0	tonnes	
Max gross loaded weight per wagon	82.0	tonnes	
Max cargo capacity per wagon	61.0	tonnes	
Axle weight at maximum load	20.5	tonnes	
Length wagon	20.5	m	

Operating Costs

<u>Fixed Cost</u>	
Interest charges	£2,820
Depreciation	£1,880
Maintenance	£1,600
Sub-total	*£6,300*
Return on assets	£2,350
Total Fixed Costs + Return on assets pa	**£8,650**
Fixed Costs per operating day	**£31.45**
Fixed Costs per operating hour	**£1.31**

<u>Track Access Charges (TAC)</u>

Basic Assumptions

Class 66/0 Domestic Intermodal TAC	£1.4063	per 1,000 gross tkm

FSA/FTA Laden TAC	£0.7489	per 1,000 gross tkm

Wagons/train	24
Trailing length (m)	492
Max TEU per train	72
Mean TEU per train	50
Load factor (TEU)	69%
20ft units per train*	10
40ft units per train*	20
Mean weight/TEU	10
Trailing weight (tonnes)	1,004

Distance/time related costs - on one hour/50km

Traction fixed	£209
Traction running	£145
Wagons	£31
Track Access Charges	£46
Total train cost	£431
Cost per train km	*£8.63*
Cost per unit per km	*£0.2876*

Other Fixed costs per unit to non rail-linked inland destination

Traction shunting****	£13.91
Wagons in terminal*****	£6.29
Unit shunting - stack to terminal	£35
Terminal lifts	£45
Local road haul at inland terminal	£120
Total fixed cost per unit	*£220.20*

* For FSA/FTA, assume c85% loading factor for 40ft boxes and 2:1 ratio for 40ft & 20ft boxes

**** Assume 2 hours shunting at traction fixed cost per hour

***** Assume 6 hours wagons in terminals at wagon fixed cost per hour

Felixstowe to Manchester area = 425 km:
One-way RAIL cost 2018/19 = £220.20 + 425 x £0.2876 = £342

ROAD FREIGHT COST MODEL 2018/19
(Fuel prices up 8%. Drivers' wages up 15%)

Standard 6x2 tractor unit and tri-axle semi-trailer
Semi-trailer, plated 44 tonnes gvw

Basic Assumptions			**Comment**
Capital Cost - Tractor Unit	£69,200		Source: RHA.net - Online Cost Tables
Capital Cost - Semi-trailer	£19,000		Source: RHA.net - Online Cost Tables
Depreciation - Tractor Unit	6	yrs	
Depreciation - Semi-trailer	10	yrs	
Residual cost - Tractor Unit	£17,300		25% of new price
Residual cost - Semi-trailer	£0		Scrap Value
Mean speed	65	km/h	
Annual distance	260,000	km	
Fuel cost	£1.18	£ per litre	ex VAT
Fuel consumption rate	2.55	km/l	Source: RHA.net - Online Cost Tables
Maintenance interval	15,000	km	
Maintenance: number of inspections pa	17		Fixed Cost
Maintenance cost per inspection - Tractor Unit	£760		Source: RHA.net - Online Cost Tables
Maintenance cost per inspection - Semi-trailer	£300		Source: RHA.net - Online Cost Tables
Number tyres - Tractor Unit	8		

Cost per tyre - Tractor Unit	£280		Source: mytyres.co.uk
Tyre life - Tractor Unit	105,000	km	Source: RHA.net - Online Cost Tables
Number tyres - Semi-trailer	6		
Cost per tyre - Semi-trailer	£280		Source: mytyres.co.uk
Tyre life - Semi-trailer	90,000	km	Source: RHA.net - Online Cost Tables
Number drivers per vehicle per 24 hour period	2		
Shift length per driver	12	hours	
Driving time per shift	8	hours	
Days per week working	5	days	
Vehicle operating time per day	22		
Vehicle operating per annum	50	weeks	
Weeks per year	52	weeks	
Basic wage per hour - 8 hours per shift	£11.50		Source: RHA.net - Online Cost Tables
Overtime - after 8 hours	£17.25		Basic + half
Drivers annual wage - 8hrs basic+4hrs OT	£41,860		
Employer NIC Rate	13.8%		Source: HMR&C - 12.8% of wage above Threshold
NIC Threshold	£7,072		Source: HMR&C
Interest Rate pa	6.00%		
Rate of Return on Assets	10.00%		% of mid-life book value of asset

Operating Costs

Fixed Costs	*Tractor*	*Semi-trailer*	Comments
Interest Charges	£4,152	£1,140	
Depreciation	£8,650	£1,900	Straight line
Maintenance	£12,920	£5,100	
Insurance (Motor and Goods-in-transit)	£4,280	£0	Source: RHA.net - Online Cost Tables
Vehicle Excise Duty	£1,200	£0	Source: DVLA, Band E
Drivers Wage	£83,720	£0	
Employer NIC	£9,601	£0	

Driver equipment costs	£500	£0	Uniform, gloves, hard hats etc…
Cabphone	£600	£0	£50 per month
Wash	£520	£0	£10 per wash one wash per week
Overheads and office costs	£21,750	£0	Source: RHA.net - Online Cost Tables
Return on Assets	£4,325	£950	
Total per unit	***£152,218***	***£9,090***	
Total Fixed Costs per annum	**£161,308**		
<u>Running Costs</u>			
Fuel per km	£0.4618	£0.0000	
Oil per km	£0.0053	£0.0000	Source: Motor Transport cost tables
Tyres per km	£0.0213	£0.0187	
Distance Based Road Charging	£0.0000	£0.0000	
Total Running Costs per km	**£0.49**	**£0.02**	

Fixed Cost per operating hour	**£29.33**		Vehicle operating hours per annum =
…assuming 65 km/h, this fixed cost becomes	**£0.45**	per km	
Total Running Costs per km	**£0.51**		
Fixed + running costs per km	**£0.9583**		This is the marginal cost of an extra km where the fixed (time) cost is included in the distance

Repositioning = 3 hours and 25 km = £100.66

Felixstowe to Manchester area = 390 km:

One-way ROAD cost 2018/19 = £100.66 (repositioning) + 390 x £0.9583 = £474