Impact on congestion of transfer of freight from road to rail on key strategic corridors

Report by MTRU

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1 Introduction and Key Objectives

Key objective

To establish the feasibility of a realistic modal shift from HGVs to rail which could reduce road congestion in key strategic corridors. This would be used as input to cross modal investment planning for the RIS2 strategic network and beyond.

Overall approach

The study has three stages, which also act as sequential reality checks, as follows:

1) On the roads included in the study, are there sufficient HGVs of a type which is best suited for large scale goods transport whose removal would make a significant impact?
2) Without a full roadside survey what reasonable estimates can be produced for the proportion which could be captured by an alternative (assumed in this case to be rail)?
3) How far does the industry and other experts consider the level of increase in rail freight realistic, both in terms of increasing market share and in terms of available rail network capacity?

It is important to note that in this preliminary study these three stages have different levels of certainty in the analysis.

The first can be addressed through capturing available data from counts, supplemented by matrix data from a validated model (GB Freight Model), and CSRGT data, and is thus very robust. The second uses known parameters such as journey length and concentrations of trip ends (including national roadside data) but must be slightly less certain. Even a new roadside survey would have its problems due to the day to day variability of freight transport. “Big data” such as mobile phone tracking is not yet reliable for the HGV flows in question.

The ability to capture freight traffic depends on a number of variables which themselves are not fully predictable, in particular:

1) Charging and regulatory framework for all freight transport modes (road is subject to the greatest potential change).
2) Ability of rail companies to organise their operations to be attractive in terms of service and price and to market those services.
3) Ability of network and rail facility providers to fund and deliver capacity increases where they are required.

While this contains some uncertainties, these are greater in the long term but more importantly amenable to central and local Government policy, on planning, funding, and charging.

Methodology

1) Identify a sample of key congested sections of the strategic network where reduction of HGV flows could have a significant step change impact. Initially this would be defined as 2,000 vehicles per day.
2) Using count data and sample interrogation of the GB Freight Model (and other available data such as CSRGT) estimate what proportion could potentially use rail transport on the sampled roads.
3) Consult informally with the rail freight operators and forecasters as to
a. the likelihood and timescale for transferring the targeted traffic
b. the additional network capacity required
c. how much capacity would be required additional to existing plans.

4) Assess the likelihood of such reductions being achieved using a range of assumptions in particular on intermodal transfer, use of Strategic Rail Freight Interchanges (SRFIs) and consolidation (for example considering length of haul).

5) In the light of the above draw conclusions on the possible outcomes and key barriers to progress.

**Key Conclusions**

1. The latest count data shows there is a strong concentration of flow at either end of the size and weight spectrum within the overall HGV category on the Strategic Road Network (SRN) i.e. between the largest articulated vehicles and smaller rigid. There are very significant numbers of 5 and 6 axle artics in the traffic stream, usually significantly more than 50% of all HGVs and averaging 11% of all traffic on the sections of the network studied.

2. Within the HGV traffic flow there is also strong differentiation between the largest articulated vehicles and other HGVs in terms of trip length distribution – as would be expected the largest make far more longer distance trips – 25% of all their trips are over 300 kms and a half over 200 kms.

3. Samples were analysed from two ports (where transfer is clearly possible) using count data and two sections of the SRN using the GB Freight Model. Three showed a significant proportion of the heaviest HGVs had closely linked origins or destinations or both.

4. A range of views from operators were expressed on the likelihood of capturing traffic, but all were significantly positive and depended on:
   a. The timescale of existing and future plans for increasing rail freight capacity (including the establishment of a network of SRFIs).
   b. Developments to ensure both path availability and infrastructure improvements to allow larger wagon profiles and longer trains.
   c. The policy framework in particular the charging regime for all freight modes.

5. There were capacity issues, even allowing for existing plans, and in fact some of these are not yet funded. There is thus no ready reserve of unused rail capacity, onto which HGVs can immediately be transferred. Moving 2,000 lorries a day to rail freight represents a doubling of current rail traffic from the examined ports, and this cannot be achieved without substantial additional investment in track and terminals.

6. There was a level of current freight demand which could be transferred very quickly if capacity were to become available. However, growing demand to the target levels would take a longer period, probably beyond RIS2.

7. There are modest opportunities for smart path making – using short stops to make better use of spare capacity – although this may need more investment in places to hold freight trains.

8. Greater increases in capacity would be gained from train lengthening, the ability to take such trains should be built in to investment plans in order to future proof them.

9. While this study considers each corridor separately, the creation of capacity in several corridors at once, plus a network of SRFIs, would create additional opportunities to transfer traffic, particularly from the ports, not captured in this analysis.
**Key tasks**

The project started with a desk top review of available road data, mainly from DfT sources. Classified traffic counts and CSRGT have allowed the production of a disaggregated analysis of corridor HGV flows (to distinguish vehicle types) and an overall picture of trip length distribution and overall traffic for the heaviest HGVs (5 or more axle artics). Congested parts of the network were identified using published Highways Agency (HE) and DfT data from their traffic forecasting work. A particular focus was the traffic from ports, here it is possible to definitively identify the origin of a number of HGVs and track changes across the road network.

In addition, the GB Freight Model (GBFM), run by MDS Transmodal for the DfT, contains very useful information on a combination of origins and destinations (O&D), likely routeing and trip lengths. They are able to select a link in the Strategic Road Network and analyse the traffic on that link, showing O&D and thus the concentration of trip ends. Greater concentration is assumed to increase the likelihood of transfer. However, the data covers all HGVs, not just the largest. It thus represents a cautious view of the level of concentration of trip ends of the heaviest artics.

Neither of the two sources give an absolute picture of the likely scale of transfer but are sufficient to estimate the possible scale and whether this is significant. It should be noted that recent freight market studies have explored this but this study is highly focussed on the impact on the SRN.

It should be noted that some forecasts were unconstrained in terms of capacity and that the volatility of the oil price may have an impact, as well as new longer term ways of paying for road use necessitated by the move to low carbon transport.

Two examples from each source have been used once the road corridors were identified. These are summarised below.

<table>
<thead>
<tr>
<th>Count data:</th>
<th>Felixstowe A14</th>
<th>Southampton M3/A34</th>
</tr>
</thead>
<tbody>
<tr>
<td>GBFM link analysis</td>
<td>M6 Junctions 12 to 13</td>
<td>M62 junctions 21 to 22</td>
</tr>
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</table>

Once the corridors were identified, a review of capacity requirements and fit with existing Network Rail plans was undertaken. The corridor analysis was greatly assisted by the recent Draft Network Rail Freight Network Study (August 2016) which has a number of options for increasing capacity, with different timescales, and outline costs.

In addition we have identified two further issues which need to be considered. The first is longer freight trains: MDS identify this as a major advantage in their work for Transport for the North. The second is smarter freight path making - piecing together bits of capacity by being able to hold freight trains at suitable locations. This is done already but not as a systematic route wide process.
2 The national context:

Trip length distribution of the largest HGVs

New tables from CSRGT have been supplied by the Road Freight Statistics team at DfT to extract information on the travel patterns of the heaviest articulated HGVs and to distinguish them from data which includes HGVs as a whole. Many of the latter will be undertaking shorter, multiple drop deliveries to end users. It is important to note that the figures only include GB registered heavy vehicles. They thus exclude foreign registered vehicles and it might be expected that these cover longer distances than the GB registered HGVs. They remain a small minority however.

As might be expected, the disaggregation of the GB data in the charts below reveals a picture of the largest HGVs (5 axles or more) undertaking the longest distance trips, but significantly that the proportion of traffic from these long distance journeys is very high. For example, two thirds of the traffic from these large HGVs is on trips which are over 150kms, half of it is on trips over 200kms, and a quarter on trips over 300kms. In this sense the use of an average trip length is rather misleading. The results are shown in the chart below.

Figure 1: Trip length characteristics of HGV artics with 5 or more axles

![Traffic by kilometre distance band from artics with 5 or more axles compared to other HGVs](image)

Note:
Average distance travelled for this type of vehicle is 127 kms.
Average for all HGVs is 85 kms.
Source: CSRGT data for 2015

Trip length characteristics of different cargo types

A second analysis which has been supplied by the DfT team examined the trip length characteristics of different cargo types. This reveals the long distance nature of unitised goods, in particular containers and palletised goods. The latter was perhaps less expected and two thirds of the distance for this consignment type is on trips of over 150kms. To put this in perspective, palletised goods form a third of all the distance travelled by consignments on GB vehicles. This of course does not take into account size and weight or the number of pallets dropped at one or more locations. Thus it...
is important to note that this is **not** comparable to vehicle kilometres. One container, for example, may make up the whole payload of a large HGV.

**Distance characteristics of different cargo types**

**Figure 2: Unitised and non-unitised cargo**

![Proportion of distance travelled by kilometre distance band and unitised/non-unitised cargo type](source: CSRGT data for 2015)

**Figure 3: Distance travelled by all cargo types**

![Proportion of distance travelled by kilometre distance band for all cargo types](source: CSRGT data for 2015)
The categories available from CSRGT and the abbreviations are set out below. These are used in Figure 3 to show the pattern for all categories.

Liquid Bulk (LB)
Large Freight Containers (LFC)
No packaging (NP)
Other Freight Containers (OFC)
Other Cargo Types (OT)
Palletised Goods (PL)
Pre-slung Goods (PS)
Roll Cages (RC)
Solid Bulk (SB)
3 Count data and sample port corridors

DfT count data for specific sites on the road network is available on the web in the form of downloadable files for Annual Average Daily Flows (AADF). These show results by year and type of vehicle. In particular, the HGV category is split so that articulated vehicles with more than 5 but less than 6 axles, and HGVs with 6 axles or more can be separately identified.

The flow at the point of origin (in this case the port) could be located, and then a series of counts for the SRN route being considered, plus any major roads leaving or joining the route, were identified. Each count site has to be located from the relevant sub-regional map, downloaded and the number of vehicles in the above categories calculated. An average for the most recent 3 years was calculated as well as the most recent year (2015). In addition, the percent of total flow which these vehicles represented was calculated, but with no allowance made for the size of vehicle at this stage. Thus cars and HGVs are all of equal value. A car is usually used as the base unit for the road capacity required (passenger car unit: pcu). This issue is discussed briefly later in the report. Two port corridors were selected: Southampton (M3/A34) and Felixstowe (A14).

Southampton corridor

Current rail mode share is about 35% and there is an AADF flow of 4,800 articulated HGVs with 5 axles or more immediately North of the freight terminal. Counts on the M3/A34 corridor stay high to at least as far as the M4. This is shown in Figure 5 which follows.

In the longer term (say 2030), increasing the mode share to 50% and after allowing for growth of 2% a year, this would reduce articulated HGV flows by 2,200 and thus more than meet the initial criterion of removing 2,000 HGVs AADF. Interestingly, once allowance is made for the additional pcu value of the largest vehicles (between 3 and 4) this would be far higher and represent a total traffic reduction of 12% to 16% (to Newbury). While the data is not available to absolutely determine the exact route taken, the nature of this corridor suggests most of this HGV traffic will continue at least as far as the M4. Air quality, noise and safety benefits are not included in this study, but at this level would see significant improvements.

The potential to accommodate this on the rail network is the next issue and the recent Network Rail Freight Network Study (August 2016) which shows short and longer term improvements which could meet this requirement. This is shown on their map reproduced below. Further analysis of rail capacity and freight market issues is given in Section 5 of this report.

Figure 4: Rail capacity potential North of Southampton
Figure 5
Strategic Road Network Out of Southampton
Counts of articulated HGVs 5 or more axles (% of total vehicles)
(Not to scale)
**Felixstowe corridor**

Current rail mode share is about 28% and there is an AADF flow of 5,031 articulated HGVs >5 axles immediately North West of the freight terminal. Counts on the A14 corridor stay high to the junction with the M11 where flows become very high (over 10,000 AADF). This is shown in Figure 6 on the following page.

Increasing rail mode share from 28% to 50% (considered possible longer term providing there is capacity) and allowing for growth to 2030 would reduce articulated HGV flows by 2,000 and just meet the initial criterion of removing 2,000 vehicles AADF. Again, once allowance is made for the additional pcu value of the largest vehicles (between 3 and 4 pcus) this would represent an average traffic reduction of 17% to 19% on the A14 as far as the junction with the M11. This excludes the 40% reduction on the A14 from Felixstowe to Ipswich. Clearly there would be very significant benefits from improvements in air quality, noise and safety in the Ipswich area and along the whole corridor.

However, in this case there is less certainty about the leakage of HGV flows from the A14 onto other routes, in particular the A12. While the reductions are not lost, they become more diffuse. This is a limitation of the count data approach but could be straightforwardly remedied in a more detailed appraisal. The key aim for this study is to determine whether it would be worth pursuing the road to rail transfer and moving to option appraisal. In that sense this study provides an early strategic assessment of the proposed initiative.

The potential to accommodate the transferred flows on the rail network is the next issue and the recent Network Rail Freight Network Study (August 2016), shows short and long term improvements which could meet this requirement. Related to the comment above on relieving the A12, it is interesting that Network Rail include this in the Felixstowe corridor. Their draft proposals are shown on their map reproduced below. Further analysis of rail capacity is given in Section 5 of this report.

**Figure 6: Rail capacity out of Felixstowe**

![Felixstowe to the North Map](image-url)
Figure 7
Strategic Road Network Felixstowe corridor
Counts of articulated HGVs 5 or more axles (% of total vehicles)
(Not to scale)
4 Site specific origin and destination analyses using the GB Freight Model

While routes from ports provide an absolute concentration of origins and destinations (trip ends) and thus make the count based analysis possible, moving onto corridors and specific points on the Strategic Road Network (SRN) creates a greater challenge. While national averages for trip length (assuming that length of trip is correlated with transferability) and single site counts can be used, the combination of national and local data produces much greater uncertainty. Fortunately data is available from the GB Freight Model which can help to address these issues, and two contrasting points on the SRN were chosen to undertake a supplementary analysis at key points on the network. These were: M6 (between junctions 12 and 13) to capture North/South movements, and the M62 (between junctions 21 and 22) to include shorter East West movements.

However, a disaggregation by HGV type, identifying the largest artics, is not available at this level of the model output. In this sense the analysis provides a conservative estimate of the concentration of trip ends, since many HGVs used for local deliveries will be captured as well as the largest used for longer distance transport.

This effect is shown in the chart below (Figure 8). It can be seen that there are many more short distance trips in the GBFM all HGV figure than the national figure for artics with more than 5 axles.

Figure 8

Despite this effect, there is a very significant concentration of trip ends of all the HGVs at the sites on the SRN (Os & Ds), as shown in the two maps which follow. In terms of potential impact, this concentration is used to assess the likelihood of transfer, as well as the distribution of trip length. This is not the whole picture and the issue is further discussed in Section 5 of this report. The potential for reduction is applied to the DfT count data from the same sites, which does separate out the largest artics with 5 axles or more from other traffic.
Figure 9: Concentration of trip ends M6 site
Figure 10: Concentration of trip ends M62 site
Count data for the two sites is set out in the following tables.

**Table 3: M6 site flows, artics 5 axles or more**

<table>
<thead>
<tr>
<th></th>
<th>M6 J 11-12</th>
<th>M6 J 12-13</th>
<th>M6 J 13-14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absolute number</td>
<td>12318.67</td>
<td>13232.33</td>
<td>13542.33</td>
</tr>
<tr>
<td>% of all traffic</td>
<td>11%</td>
<td>12%</td>
<td>11%</td>
</tr>
</tbody>
</table>

**Table 4: M62 site flows, artics 5 axles or more**

<table>
<thead>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Absolute number</td>
<td>11530.67</td>
<td>11664.67</td>
<td>11186.67</td>
</tr>
<tr>
<td>% of all traffic</td>
<td>10%</td>
<td>12%</td>
<td>12%</td>
</tr>
</tbody>
</table>

Without more data on cargo type and trip ends for artics alone it is hard to produce a definitive transfer rate. However, using the conservative distance data and the clear trip end concentrations, an estimate of the potential transfer was made and cross checked with the rail freight operators. It was decided to use a transfer rate of 20% to see if this would achieve the threshold level of reduction.

This resulted in the following reductions in the largest artics.

**Table: Reduction in artics >5 axles using distance and trip end based data**

<table>
<thead>
<tr>
<th></th>
<th>Transfer rate of 20%</th>
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</thead>
<tbody>
<tr>
<td>M6</td>
<td>2,646</td>
</tr>
<tr>
<td>M62</td>
<td>2,333</td>
</tr>
</tbody>
</table>

While the trip end concentration supports viability on the M62, the trip distances are significantly shorter than the M6. Sufficient bulk flow means that rail can be viable over shorter distances but insufficient data is available on cargo type to allow further investigation in this study. In this case it is likely that the M62 would not meet the 20% transfer rate and at a modest reduction to 17% would be at about the threshold reduction (1,983). While the other three case studies are convincing, the M62 needs further work before being confident that it would meet the threshold.

**Summary of GBFM results**

These high level assessments show that in one instance, the M6 site, the criterion is likely to be met, while on the other, the M62 site, it might or might not be. Given the as expected shorter length trips on the M62 it would nevertheless be worthwhile to investigate this corridor in more detail, in particular to isolate the transpennine traffic and to allow for the high concentration of trip ends evident on the M62 map. Data on cargo type would also be useful, for example minerals are likely to be important in this corridor and would bring the heaviest rigid vehicles into play in terms of reducing HGV flows. For rail freight to compete, high volume will compensate for shorter trip lengths. Capacity issues on the parallel rail corridor (West Coast Main Line) are considered in the next section.
Further data on rail capacity and potential transfer

As well as the Network Rail summary of proposed capacity increases, rail freight operating companies were contacted for an additional insight into capacity and market shares. The results of this have been combined together and anonymised to protect commercial sensitivities, and are set out below. The number of HGV equivalents removed by existing length trains has been calculated using mode share and count data for the two ports – it is about 70 for Felixstowe and 80 for Southampton. For the purposes of the report an average of 75 has been used. Clearly there will be variation, but this is in line with other industry estimates.

Southampton

There is broadly an hourly freight path each way throughout the Southampton - West Midlands route now, at about 640m. For all destinations there are some 20 intermodal trains per day from Southampton Maritime and Western Docks, lengths in the range of 550-600m. There are also some 6-7 specialised non-containerised trains per day via Eastern Docks, up to 680m long.

The intermodal paths are due to rise to 2 per hour when the Oxford area capacity work is complete in 2019/2020. The Southampton Train Lengthening works will provide for 700-775m intermodal train running. Thus, on the cautious assumption of an extra 100m productive length per current intermodal train the works effectively create 3-4 additional trains per day’s worth of intermodal capacity on current paths, twice that once the new paths are available.

It is not possible to predict exactly how many HGV equivalents this could take, but it is clearly in the right scale – the equivalent of around 30 (new paths plus extra length) extra train paths (2,250 HGV equivalents) per day. Lengthening will also reduce costs, encouraging mode transfer. However, the operators point out that there are other capacity issues relating to terminals and distribution centres if these paths are used. The planning framework for SRFIs has been put in place and several are proceeding, but sufficient are needed to ensure terminal capacity will be available for the level of expansion identified in this report, and in other regional and national freight strategies.

Felixstowe

Currently there are around 28-30 trains per day out of Felixstowe. The Port of Felixstowe’s new north terminal lines can already handle longer trains of 700m in length which is the limit for Felixstowe to Nuneaton. There is a limit of 640m for trains which travel via the Great Eastern Main Line (GEML), related to the track lengths at Ipswich Nodal Yard which govern the maximum lengths of trains pathed with a recess/loco change there. Modest lengthening plus the doubling of paths (some of which are already in CP5) would provide capacity sufficient to reduce the articulated HGVs by over 2,000 AADF.

Again, the operators point out that there are other capacity issues relating to terminals and distribution centres if these paths are used. The target reductions therefore are unlikely to be achievable in the short term (up to 2020) but will require high standard terminal capacity to be provided as well as train capacity, for example in CP6/CP7.

M6 Corridor

Capacity and market share is more complex for the M6 because there is no one dominant origin or destination. However, the maps earlier showed significant concentration of road trip ends which are or could be served by the strategic rail network. For example, for M6 J12/13 traffic two new
terminals coming on stream should be able to handle about 10 trains per day each. The problem here is capacity limits on the WCML. If an extra path per hour could be made available, 10 to 15 train paths per day could be implemented after allowing for maintenance and non-peak running. Trains lengths of 750m are already available to the Midlands area. Fifteen paths per day at this length would achieve an HGV equivalent of 1,300 AADF and, as one operator put it, “make a dent”.

More information is available from the MDS Transmodal study for Transport for the North1. This looked in great detail at a more comprehensive strategy for freight in their region, including new distribution centres as well as new freight paths. It has a longer time horizon than this project, with an appraisal date of 2033, but shows that the GB Freight Model predicts major reductions along the M6 corridor, between 2,700 and 5,500 HGVs AADF are achievable. This applied to all HGVs, but in practice will be mainly the largest. An extract from the MDS Transmodal report showing the reduction is reproduced below. It should be noted this assumes the investment required to achieve 2-5 additional paths on the WCML, plus a small increase in train length.

**Figure: Changes in HGV traffic 2033, Central Case proposals compared to Do Minimum**

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1. *Northern Freight and Logistics Report, MDS Transmodal for TfN, October 2016*
What is interesting here is that the impact of roll on roll off traffic can be seen clearly, first at Dover, then at Folkestone. The impact on the North East section of the M25 is very powerful and continues through to the M6 site considered in this study.

Detailed corridor freight studies are rare, but this reflects earlier work by DfT in 2008\(^2\), which considered this corridor in some detail. It concluded that container traffic at that time was relatively modest (a few hundred HGVs AADF) due to the dominance of flows in the Eastern corridor. However, it did find strong evidence of bulk flows and a surprising 20% of HGV traffic was on an international journey. Both of these suggest strong potential for mode shift and support the MDS Transmodal report. The relevant two tables are reproduced below.

\(^2\) Delivering a Sustainable Transport System: The Logistics Perspective, DfT December 2008
The different sources all suggest the strong potential for attracting and coping with significant amounts of articulated HGV flows, meeting the target level of over 2,000 vehicles AADF on key sections of the SRN. Counting this as pcus would easily exceed the criterion. However, there are challenges in meeting this within a short timescale, for example by 2025. Beyond this, with sufficient paths and terminal capacity freight mode switch would produce significant and noticeable benefits. This is important because the congestion, safety and environmental impacts of these largest HGVs are many times greater than a car and simple vehicle kilometres seriously underestimates their impact. This is explored further in the following section.
6 Issues raised

During the course of the study there have been several issues which have arisen which need to be taken into consideration. These are:

- The impact of longer freight trains (discussed in the previous section)
- Smart path making – using passing loops to make better use of spare capacity
- The variability of congestion impact (pcu value)
- External costs other than congestion, for example safety and air quality.

Train lengthening

As indicated earlier, longer freight trains could offer major advantages. They have two impacts, first it obviously increases capacity to a significant degree. However, it also reduces cost and, if this is reflected in prices, would encourage more transfer to rail.

In the longer term beyond CP6/7, train lengthening in excess of 1000m, (in the TfN report 1500m was tested but not assumed) would further reduce costs and increase capacity, although longer passing loops and upgraded terminal facilities would also be needed. Doubling length does not produce exactly double capacity due to the need for a greater time path at any given speed. However, it approaches this level of increase and can provide very significant cost savings which would attract freight from road.

Thus it would be worthwhile conducting a separate exercise exploring the options for longer trains beyond 775m and setting out the cost of terminal facilities and any pathmaking issues compared to the capacity and cost saving benefits for the different options. This would be geared towards the identification of key freight corridors, although much of this is already apparent from, for example, the GBFM analyses. It would also be important to ensure that any programme for achieving 775 trains more widely is designed to be future proofed against this long term aim.

The TfN freight report considered this issue and found that a rail option based on this approach would achieve the benefits of a much broader package. Accommodating the longer trains at terminals and passing loops would require investment, but the extra traffic would be carried on 31% fewer train kilometres⁴.

Assembling part paths to create capacity

The second issue is smart freight path making - piecing together bits of capacity by being able to hold freight trains at suitable locations. As well as “clean paths” freight trains can be held when only part of their journey can be completed without interfering with other paths. Passenger paths almost always have to run straight through. In this way, unused capacity can be assembled to create a one or two stop longer distance freight path. This requires planning, for example through the use of intermediate holding places such as the nodal yards now being created, for example at Ipswich. However given the availability of computing resources it may be possible to undertake this on a systematic route wide basis. This would lead to the creation of more holding or nodal yards and more freight paths. It is also the case that better co-ordination with passenger pathmaking could help this process. This is an area where the rail profession can do more work. In some instances it may be very obvious where a rail "parking" place could enable such pathmaking without any elaborate system optimisation tools.

⁴ Table B.1, Northern freight and logistics report, Technical Appendices
**Vehicles or pcus**

Thirdly it is important to note that the congestion impact of the heaviest vehicles is very variable. The acceleration/deceleration/braking characteristics will mean much higher road space occupancy than the 2.9 pcus often used. On the other hand, on an empty road adding an extra car or articulated lorry will make no difference to the capacity of that road. In this study a range of 3 to 4 pcus has been used. Further work might be able to distinguish more disaggregated values by time of day.

This study concentrates on the Strategic Road Network (SRN), a majority of which will have junctions designed to take larger HGVs. However, parts of the SRN, and the roads leading to the destinations of most of the HGV traffic, will not. In these circumstances the pcu value, for example of turning articulated vehicles, can create pcu values extending to double figures.

**Third party costs**

Finally this study has focussed on congestion and traffic reduction. It is well understood, and reflected in Government policy, for example on freight facility grants, that other third party impacts of these largest articulated vehicles will be reduced by many times more than the simple percentage of total vehicle kilometres. These include:

- Air pollution, including particulates which are not exhaust related (the majority for HGVs)
- Noise, including low frequency vibration
- Road safety, HGVs are many times more likely to be involved in fatalities than cars on each road type (including motorways)
- Carbon emissions (artics are currently 5-6 times greater emitters than cars but this ratio is increasing very rapidly as car emissions fall
- Road maintenance, road surface damage is related to the 4th power of axle weight and one of the heaviest HGVs is more than 100,000 times more damaging than a car.
7 Overall conclusions and recommendations

Conclusions

1. The latest count data shows there is a strong concentration of flow at either end of the size and weight spectrum within the overall HGV category on the Strategic Road Network (SRN) i.e. between the largest articulated vehicles and smaller rigids. There are very significant numbers of 5 and 6 axle artics in the traffic stream, usually significantly more than 50% of all HGVs and averaging 11% of all traffic on the sections of the network studied.

2. Within the HGV traffic flow there is also strong differentiation between the largest articulated vehicles and other HGVs in terms of trip length distribution – as would be expected the largest make far more longer distance trips – 25% of all their trips are over 300 kms and a half over 200 kms.

3. Samples were analysed from two ports (where transfer is clearly possible) using count data and two sections of the SRN using the GB Freight Model. Three showed a significant proportion of the heaviest HGVs had closely linked origins or destinations or both.

4. A range of views from operators were expressed on the likelihood of capturing traffic, but all were significantly positive and depended on:
   a. The timescale of existing and future plans for increasing rail freight capacity (including the establishment of a network of SRFIs).
   b. Developments to ensure both path availability and infrastructure improvements to allow larger wagon profiles and longer trains.
   c. The policy framework in particular the charging regime for all freight modes.

5. There were capacity issues, even allowing for existing plans, and in fact some of these are not yet funded. There is thus no ready reserve of unused rail capacity, onto which HGVs can immediately be transferred. Moving 2,000 lorries a day to rail freight represents a doubling of current rail traffic from the examined ports, and this cannot be achieved without substantial additional investment in track and terminals.

6. On the other hand there was a level of demand which could be transferred very quickly if capacity were to become available. However, growing demand to the target levels would take a longer period, probably beyond RIS2.

7. There are modest opportunities for smart path making – using short stops to make better use of spare capacity – although this may need more investment in places to hold freight trains.

8. Greater increases in capacity would be gained from train lengthening, the ability to take such trains should be built in to investment plans in order to future proof them.

9. While this study considers each corridor separately, the creation of capacity in several corridors at once, plus a network of SRFIs, would create additional opportunities to transfer traffic, particularly from the ports, not captured in this analysis.

Recommendations

Development work
1. Further more detailed work using count data and the GBFM should be undertaken to take rail freight proposals forward. The GBFM work for Transport for the North shows the high potential benefits across the country just from initiatives in their region.

2. The impacts are sufficient that such work should feed into the planning of both the SRN (Highways England) and the rail freight network (Network Rail) and there would be mutual benefits from further co-ordination.

3. At the scheme level in terms of longer term strategic freight network planning, further data would be useful on the concentration of trip ends in combination with cargo type.

**Implications for investment**

4. There is current demand for rail services which is not being met because of a lack of capacity and further investment in rail freight capacity in the corridors identified (and others not covered in this study) could be justified.

5. It is clear that short to medium term investment in rail freight capacity could have a significant impact on the SRN in terms of reduced congestion and other expenditure and should be considered in tandem with the assessment of road capacity.

6. Investment in the improvements for train lengthening should be part of the package for increased capacity.

7. Investigation of the potential of smart (aggregated) path making should also lead to the creation or improvement of stopping places such as nodal yards.

8. The programme for capacity increases will also require the development of a network of SRFIs, built to take advantage of longer trains and other capacity increases.