Demand side carbon reductions in the road freight industry

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Summary and conclusions

Introduction

Reducing carbon emissions through improved vehicle technology is even more challenging for Heavy Goods Vehicles (HGVs) than for cars, and there has thus been increasing interest in improving the efficiency of road freight operations overall, including demand side changes. The latter cover a wide range of possibilities, all of which would have the effect of reducing vehicle kilometres:

1) Using existing vehicles more efficiently – mainly by reducing empty running and part loading but also driving technique
2) Matching vehicle capacity with demand – reducing inefficiency from “standardisation at the biggest” and ensuring diversity in the goods vehicle fleet
3) Behavioural change – including size and location of depots, choice of suppliers, patterns of stockholding, balance between efficiency and service (i.e. emphasis on “Just In Time”)
4) Transfer to a more efficient mode (water, rail, pipeline).

If HGVs were to pay in full for their external costs, for example through the weight distance charging now seen in several European countries[1], and there was better regulation of which parts of the road network they are permitted to use, all of these issues would be addressed, and a more efficient outcome would be achieved.

The Committee on Climate Change (CCC) has commissioned a piece of work from the Centre for Sustainable Road Freight (CSRF) which begins to explore some, but not all of these issues[2]. In particular it considers using HGVs more efficiently (item 1 above), some use of larger vehicles but not for all freight (part of item 2), and most interestingly begins to address part of the behavioural change potential (item 3). Although routeing is mentioned it is only in relation to longer HGVs. The key issue of how to persuade operators and clients to behave in the most efficient way, for example through a weight distance charge, is not explored. There is also underestimation of the potential from land use planning, mode transfer and improved rail connections.

This memorandum identifies further options where improvements are possible but also suggests that some of the options would fail to reduce carbon unless action is taken to avoid the pitfalls of previous policies for vehicle regulation. Examples are the alternating increases in size and weight over many years (the “see saw” effect), and the failure to regulate where the largest vehicles are allowed to travel (for example Lorry Routeing and the Dykes Act). Both of these date back to the 1970s but longer or heavier vehicles and routes and bans are still hot topics for public discussion[3].

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[1] Electronic HGV user charging (Switzerland, Germany, Austria, Czech Republic, Slovakia), as well as nationwide tolls (France, Spain, Italy)

[2] An Assessment of the potential for demand-side fuel savings in the Heavy Goods Vehicle (HGV) sector, CSRF, December 2015

[3] For example on size and weight: current trials of longer trailers, controversial EU proposals over LHVs; on routeing see latest proposals for an HGV access only restriction in the Peak District National Park.

Conclusions

The savings explored in the CSRF report are interesting in as far as they go and could help to move discussion forward. The report predicts a reduction of:

- 3.1 to 3.9 million tonnes of carbon a year in 2035 from reduced fuel consumption. Of this, the majority (2.3 Mt CO_2e) is from driver training and monitoring.
- 2.0 to 2.6 Mt CO_2e due to logistics measures, including larger vehicles (about 20% of the total).
- 0.3 to 1.14 Mt CO_2e from transfer to rail.

Most of the reduction occurs by 2020 due to driver training and monitoring. The subsequent reductions for 2020-2035 from operator efficiency and logistics appear very modest (11-18% over 15 years).

For the reasons set out in this report, the results appear to be too low for mode transfer and for behavioural change by a significant amount. Co-ordinating consolidation with mode transfer, for example, should provide major benefits.

On the other hand, without effective pricing, initial savings from the use of larger vehicles will begin to erode after a year or so of introduction, due to growing under utilisation as the fleet is standardised at the new higher limits. The costs are then likely to exceed any initial benefits.

The one off costs of replacing so many trailers is also an important factor in changes such as longer vehicle limits.

Land use planning could also provide more benefits but these are harder to quantify – more research is needed.

Overall, if larger vehicles were not included in the CSRF model, its predictions for carbon savings would fall by 0.5 Mt CO_2e (8 to 10%) in 2035.

The potential for mode transfer alone (>1Mt CO_2e) more than compensates for the predicted loss of predicted savings from larger vehicles. Improvements to rail freight traction could take carbon savings to an even greater level.

The introduction of Lorry Road User Charging such as a weight distance charge to incentivise behavioural change would clearly make a further significant difference and enable the modest improvement predicted from 2020 to 2035 to be very significantly increased.

Demand side carbon reductions in the road freight industry

Introduction and overview

Reducing carbon emissions through improved vehicle technology is even more challenging for Heavy Goods Vehicles (HGVs) than for cars, and there has thus been increasing interest in improving the efficiency of road freight operations overall, including demand side changes. The latter cover a wide range of possibilities, all of which would have the effect of reducing vehicle kilometres:

5) Using existing vehicles more efficiently – mainly by reducing empty running and part loading but also driving technique
6) Matching vehicle capacity with demand – reducing inefficiency from "standardisation at the biggest" and ensuring diversity in the goods vehicle fleet
7) Behavioural change – including size and location of depots, choice of suppliers, patterns of stockholding, balance between efficiency and service (i.e. emphasis on "Just In Time")
8) Transfer to a more efficient mode (water, rail, pipeline).

Of these, improving loading and mode transfer are fairly well known, but most studies of these factors assume fixed flows of goods and a fixed road vehicle fleet (and to an extent fixed rail and water capacity). On the other hand trying to ensure that an appropriate range of goods vehicles is available implies changes in the fleet, but also in the systems of distribution, land use, and in patterns of consumption. Changing the fleet (2) includes creating a wider range of vehicles but also covers the issue of whether HGVs should be longer or heavier (LHVs). It should be noted that the context is all important, larger HGVs might lead to economic and environmental savings if only used for the goods for which they are best suited and at high levels of vehicle utilisation. Previous experience over decades of increases in size & weight shows that this has not happened and environmental damage in particular has increased.

If HGVs were to pay in full for their external costs, for example through the weight distance charging now seen in several European countries[4], and there was better regulation of which parts of the road network they are permitted to use, all of these issues would be addressed, and a more efficient outcome would be achieved. In this context it is possible that relaxing some weight or size limits would be beneficial. Without such a framework, including Lorry Road user Charging (LRUC) it is likely that increases would be counter productive, for the reasons set out later in this report.

The Committee on Climate Change (CCC) has commissioned a piece of work from the Centre for Sustainable Road Freight (CSRF) which begins to explore some, but not all of these issues[5]. In particular it considers using HGVs more efficiently (item 1 above), some use of larger vehicles but not for all freight (part of item 2), and most interestingly begins to address part of the behavioural change potential (item 3). Although routeing is mentioned it is only in relation to new longer HGVs. The key issue of how to persuade operators and clients to behave in the most efficient way, for example through weight distance charging to cover their external costs, is not explored. There is also underestimation of the potential from land use planning, mode transfer and improved rail connections.

This MTRU memorandum identifies further options where improvements are possible but also suggests that some of the CSRF options would fail to reduce carbon unless action is taken to avoid the pitfalls of

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5 An Assessment of the potential for demand-side fuel savings in the Heavy Goods Vehicle (HGV) sector, CSRF, December 2015

previous freight policies. Examples are the alternating increases in size and weight over many years (the "see saw" effect), and the failure to regulate where the largest vehicles are allowed to travel (for example Lorry Routeing and the Dykes Act). Both of these date back to the 1970s but longer or heavier vehicles and routes and bans are still hot topics for public discussion[6].

Before considering to what extent the new CSRF report addresses these issues and where progress can be made, it is worth briefly mentioning the issue of external cost pricing which is not taken into account and would justify the use of LRUC. It is clear that the existing larger HGVs only meet their marginal external costs by about a third, and this is reflected in Government analysis[7] see Table 1 below. This is probably a cautious valuation, and does not take account of realistic increases in the cost of carbon reduction over time (Marginal Abatement Cost). Some impacts are not monetised at all, for example the lack of specific severance and visual intrusion impacts to accompany landscape is an important omission[8]. The DfT table for monetised external costs compared to tax revenue is shown below.

Table 1: MSB values by road type and component (pence per lorry mile)

	Motorways		**A**	**Other**	**Weighted Average**
	High	**Low**			
Congestion	99	24	72	78	57
Accidents	0.5	0.5	5.6	5.5	2.7
Noise	9	7	8	14	8
Pollution	0.0	0.0	0.1	0.2	0.1
Greenhouse Gas	6	6	7	9	7
Infrastructure	7	7	24	171	18
Other (roads)	6	6	6	6	6
Taxation	-31	-31	-32	-40	-32
Rail	-8	-8	-8	-8	-8
Total	89	12	82	235	58

Mode Shift Benefit Values: Refresh, DfT December 2014.

In the absence of regulation or pricing which fully addresses all external costs (including congestion, road damage, safety, air pollution, noise and carbon emissions), second best options such as subsidising less damaging behaviours have to be employed. The current Government mode transfer grants, although modest, illustrate this approach. This is the reason that the above table, showing the extent of the marginal external costs, was produced.

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6 For example on size and weight: current trials of longer trailers, controversial EU proposals over LHVs; on routeing see latest proposals for an HGV access only restriction in the Peak District National Park.

7 For Government figures see *Mode Shift Benefit Technical Report,* DfT 2009, updated in *Mode Shift Benefit Values: Refresh,* DfT December 2014.

8 For wider discussion see *Heavy Goods Vehicles - do they pay for the damage they cause?* MTRU for Freight on Rail, June 2014.

Land use planning can also play a part – the Government guidance on Strategic Rail Freight Interchanges (SRFI) is an example where better planning can improve mode split but also reduce the need to travel. Location of large scale users of freight close to mass freight modes should be part of land use planning – however freight use has been undervalued in the past and even less likely to be considered in the current system. The lack of a proper national ports policy framework is another problem, both for coastal shipping but also for minimising inland freight travel by landing goods closer to their final destination[9]. Planning for depot and consolidation centres is partly considered in the CSRF, but linking these to sustainable modes, other locational choices, prioritising rail and water access where longer distance or bulk flows are to be produced, and better use of ports are not.

CSRF modelling

CSRF have constructed a spreadsheet model which allows reasonable assumptions or benchmark impacts to be applied to different sectors and vehicle types. This is similar to the approach used to assess the impact of behavioural change through "Smarter Choices" and steps have been taken to avoid double counting of impacts. This does mean, however, that the absolute impact of individual elements will change according to the number and type of elements in the package, and the order in which they are applied in the spreadsheet model. We have not undertaken a full model audit but hope it will be made widely available by the CCC if it is to be relied upon in future. We would also like other material used to be made public, for example the Starfish data (collected by DfT) and all the studies which use it. The CSRF authors also recognise that there remain high levels of uncertainty, not only due to the assumptions behind the impacts. All practitioners in this field, including those who collect the data, are aware of the highly diverse nature of freight demand. For example there are a huge range of densities of goods, of value (and hence security), of public safety (including hazardous and semi-hazardous loads), and of the need for special vehicles, from tankers to refrigerated units to mobile lifting gear.

Even for the DfT's comprehensive Continuous Survey of Road Goods Transport (CSRGT), sample sizes for specific vehicle types, regional flows, commodities and purposes can be quite small. There have also been changes to the survey and there are ongoing differences between national traffic surveys and CSRGT for overall vehicle kilometres[10]. Both their estimates of current HGV traffic are extrapolations from a diverse and variable data set. This makes analysis difficult for all practitioners.

In addition, it is always difficult to classify freight sectors other than commodity type, and even here there are often generalised categories[11]. It is suggested however, that a simpler classification related to the type of transport needed rather than for historical reasons would help guide both policy development and impact assessment.

A set of four basic types of goods is proposed below to assist in the design of policies to achieve the desired environmental and economic outcomes.

Table 2: Key freight types

Continuous stream: e.g. Bulk construction material, Coal, Oil (other than retail), Waste, Raw materials (such as ores, aggregates), Inter-factory (including semi-manufactured goods).

9 Changing port of entry has been investigated by MDS Transmodal using the national freight model, but in the context of reducing congestion rather than carbon. However, the same principles could be applied to produce a carbon minimising pattern.

10 Some of this explicable, for example the CSRGT does not include foreign vehicles. CSRGT remains the only source for load data such as tonnes, tonne kilometres apart from ad hoc surveys.

11 For example general manufactured goods

Consignment by consignment: the most variable category but by definition a large number of less predictable individual demands.

Consolidated: Consignments are frequent enough from one source to be grouped together, e.g. Depot or factory to depot (from small parcels to large scale stockholding), Depot to large retail outlet (including supermarkets).

Containerised and intermodal: International shipping is dominated by the use of containers and port facilities are a key issue for mode share, but intermodal transport is also a key growth area.

It is then possible to indicate where various measures included in the current studies may have a major impact. The rest of this memorandum explores the possibility for using some of these policy levers, in the context of the CSRF.

Table 3: Impacts of different policy levers

	Key vehicle parameter	Mode competition	Logistics effect	Land use Planning effect
Continuous stream	Weight but some vehicle specialisation	High	Low	High
Consignment by consignment	Very variable	Low but variable	Low	Medium
Consolidated	Footprint /Height (cage/pallet/open)	Low (apart from	High	Medium
Containerised	Unit length	High	Medium	High

Synergy

In terms of the potential for carbon reduction, the CSRF may be too cautious. While Lorry Road User Charging (LRUC) such as a weight distance charge is the most efficient option, even without it there could be major benefits from a combined approach, using:

- regulations restricting the largest existing or future vehicles to the motorway and similar standard road network
- creation of urban distribution systems*****
- refocussing logistics on carbon reduction, both in terms of number and location of depots and improved consolidation*****
- better land use planning for freight*****
- the development of more SRFIs and rail connected consolidation centres
- improved provision for rail freight paths[12]*****
- planning to land goods from outside the UK closer to primary destination
- development of coastal shipping for intermodal services

******land use planning and the need for rail freight paths are mentioned in the CSRF but not explored fully, while urban distribution and consolidation centres are discussed and included in the model as individual items*

12 There is demand to use new rail freight paths out of Felixstowe and Southampton immediately

Assessing the impact of measures in combination is always difficult but a useful approach is to assess a range of impacts (e.g. high-medium-low) for individual measures and rerate them higher when a supporting measure is introduced. This could be done for the individual measures suggested below.

It should be noted that there will be situations where factors will undermine each other instead of being mutually supportive, for example introducing LHVs will result in some efficiencies if they are fully utilised but will have other impacts working in the opposite direction, for example attracting freight from rail, or encouraging more energy intensive patterns of distribution and stockholding.

Mode transfer

It should be noted in the context of strong growth in some rail freight sectors there has been a significant decline in coal traffic. This needs to be studied further to see if there are any innovative ways of using redundant rail or water connected facilities to meet areas of growth (for example recycling or consolidation centres). This decline, which has affected both water and rail freight, is an interesting combination of commodity substitution (gas for coal) and mode transfer (to pipeline). Again, planning and economic regeneration policies for goods need to be designed with carbon reduction in mind.

An MTRU study in 2015[13] which was focussed on congestion relief also studied the impact of transferring some of the longer distance road freight traffic to rail using DfT data. The overall level of carbon reduction was not calculated but it was estimated that a 12% reductions in tonne kilometres was possible from rail alone using example Government figures for transfer. This would yield about 50% more than the "high" figure for mode transfer savings suggested in CSRF, even using their figures for the relative fuel efficiency of road and rail. These are that road uses 3 times more diesel than the equivalent delivery by rail. The CSRF then add 20% to rail to allow for extra kilometres due to a less dense rail network than road. Rail industry operators consider this high, even in current conditions.

There are two problems with this assumption about relative energy consumption. First is that there is likely to be further widening of the difference between road and rail by 2035 which is a key future year for the CSRF study forecasts. This may be as a result of rail electrification or improved train power systems. Industry estimates vary from 20 to 50% electrification by 2035. The second issue is that the 20% extra assumes that the whole road network is open to all HGVs – a problem in relation to existing HGVs even without considering further increases in length or weight. The motorway network, for example, is considerably less extensive than the rail network used for freight. In this sense, the assumed advantage of HGV (or LHV) use would be reversed in the event of a more restrictive routeing for the largest vehicles.

In addition to energy use, a further reason for the low mode transfer benefit is the choice of trip length used as the target for transfers – over 150kms in the MTRU study but over 200kms (CSRF high) and 300kms (CSRF central). It should be noted that a key factor in the attractiveness of rail or water is a high volume of freight, in many circumstances more important than distance travelled. Bulk construction traffic and coal are examples of where high volume, shorter distance rail freight can be found.

However, any transfer to coastal shipping as well as rail would be more likely to be focussed on longer distances (although these by definition generate significant vehicle kilometres). Allowing for this the MTRU study showed a further potential transfer about 70% that of rail. This would raise the potential from mode transfer even higher.

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[13] *Potential reductions in congestion on the strategic road network from alternatives to HGV use,* MTRU, April 2015

Use of longer heavier vehicles

This is listed as a benefit in the CSRF report, but long haul only. It is not totally clear what options have been considered, the study quoted[14] looked at a wide range of options. It is the case that for some loads of the "continuous stream" variety, larger vehicles should reduce vehicle kilometres. Where they exceed the weight limit, an increase in weight would help. However, where they exceed the volume limit, the weight increase is not useful, and it may be counter productive. The problem is restricting the use of larger HGVs to those flows alone. Use of larger vehicles for existing flows which do not need them will lead to no change in vehicle kilometres, but an increase in external costs, including safety and congestion, due to greater length, and carbon emissions, due to greater deadweight per tonne carried. This may occur due to an extra axle being required to limit road damage, or a steered axle trailer to avoid "swept path" accidents. Indeed, TRL found that an 18.75m LHV could not meet swept path regulations without trailer steering.

This problem occurs because of the clearly observable phenomenon of "standardisation at the biggest". This, and further changes to weight and length limits in relation to carbon, is explored in the section below.

Part loading, larger vehicles and improving efficiency

There are two key measures of efficiency in road freight. The first is the proportion of time a vehicle spends running completely empty. The second is where a load or series of loads simply cannot fit in the available vehicle. The simple measure of how much of its working life a lorry spends running empty (29% for the UK's heaviest articulated vehicles) is easy to understand and has not changed much for over a decade. It can be addressed by organising loads when the vehicle is sent out (frontloads) or if it is returning (backloads). However, in regard to situations where the vehicle is loaded, but not to the fullest extent possible, there are there two key ways of measuring whether and why this occurs: it is can be constrained by weight or by size (volume or footprint).

An example would be when a consignment, say a machine moving from one factory to another, is significantly below the maximum weight, and/or the maximum size, that could be carried by the vehicle used to deliver it. The key question is why wouldn't the right sized vehicle (at least approximately) be used? The answer is that most goods vehicles for general use, particularly the largest and heaviest, have become standardised at the upper limits and that a range of vehicles is simply not available. This is complicated by the use of specialised vehicles (for example tankers) which are not used for general goods and which tend to be full for their deliveries and completely empty for the return journey to their base. Leaving such issues to one side for the time being, the second reason for part loading is the complex interplay between maximum weights which goods vehicles can carry, and the available space, both in terms of volume and floor space (footprint).

Perhaps the most obvious part loading is by weight – if a customer wants a particular delivery to one address and it is lighter than the carrying capacity of the vehicle it will be part loaded by weight. However, part loading by weight can occur if the delivery fills the available space on the vehicle before the weight limit is reached[15]. In addition a simple volume measure of available space is misleading – a consignment may take up a unique and unalterable footprint on the vehicle's loading area. Factors such as density and shape will vary significantly by the different types of commodity being carried, many of which have specialist vehicles, for example tippers or tankers, or use standard unitised packing, from pallets and cages

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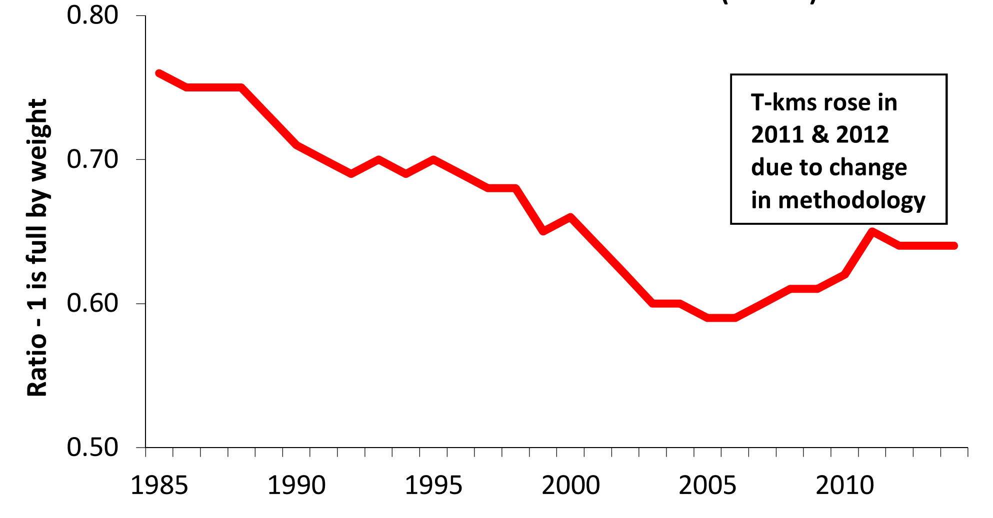
14 *TRL Report PPR 285,* Knight et al TRL 2008

15 Often referred to as "cubing out"

to containers. The most reliable data for part loading is by weight, the time series is shown below. This is same data set used in fig 17 in the CSRF report.

Figure 1: Ratio of actual tonne kms to capacity tonne kms: articulated HGVs over 33 tonnes (CSRGT)



Apart from the fall in utilisation by weight (which could be partly the result of goods generally becoming less dense or packed onto pallets and cages) it is important to note that there were several increases in size and weight affecting this period, set out below.

Table 4: Key changes in maximum size and weight for articulated HGVs with 4 axles or more

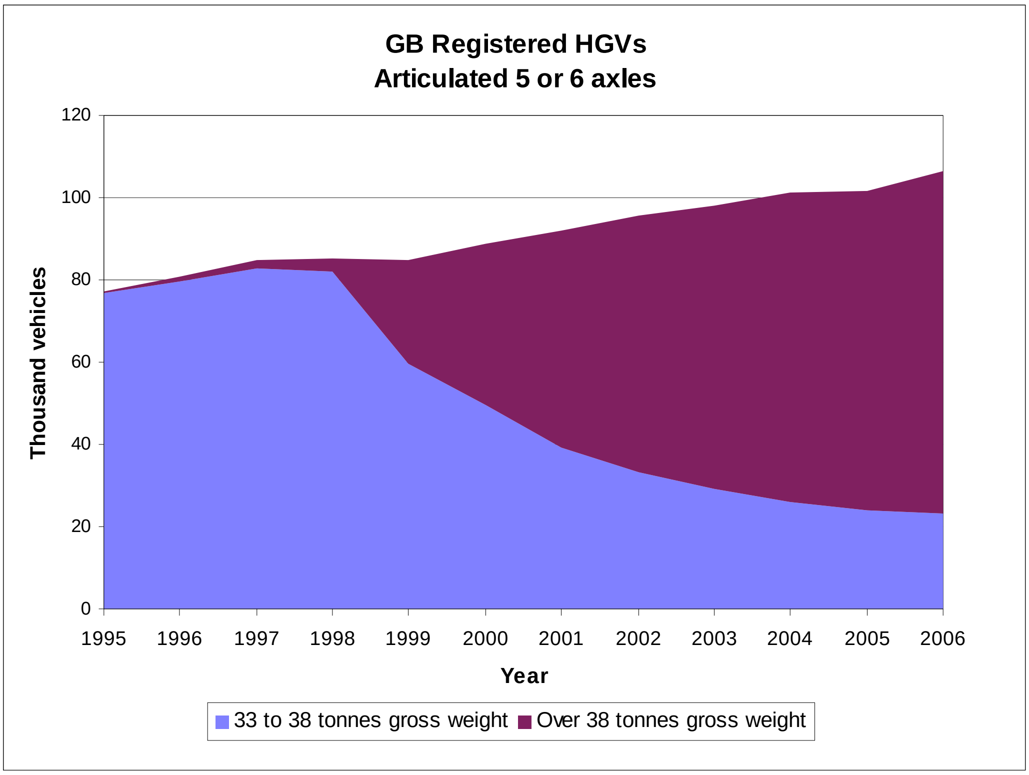
1983	Gross weight up to 38 tonnes (on 5 axles or more). Previously 32.5 tonnes
1990	Length up from 15.5 metres to 16.5 metres
1996	Width up from 2.5 to 2.55 metres
1999	Gross weight up from 38 tonnes on 5 axles to 40 tonnes and from 38 tonnes to 41 tonnes on 6 axles
2001	Gross weight up from 41 tonnes on 6 axles to 44 tonnes, including drawbar trailers

If utilisation had even stayed constant, there might have been real efficiency improvements.

On the issue of whether there is a major volume or footprint issue, it is concerning that high figures for volume constraint have been produced for the largest HGVs[16], but there is little evidence of users choosing cheaper articulated vehicles with a lower weight limit. Instead all the articulated HGVs are concentrated at the heaviest and largest end of the spectrum: “standardisation at the biggest”. This phenomenon has been known for a very long time. Figure 2 below is a chart which shows the rapid move towards the new maximum weight limit introduced in 2001 (from 41 to 44 tonnes).

Figure 2
Source: TSGB

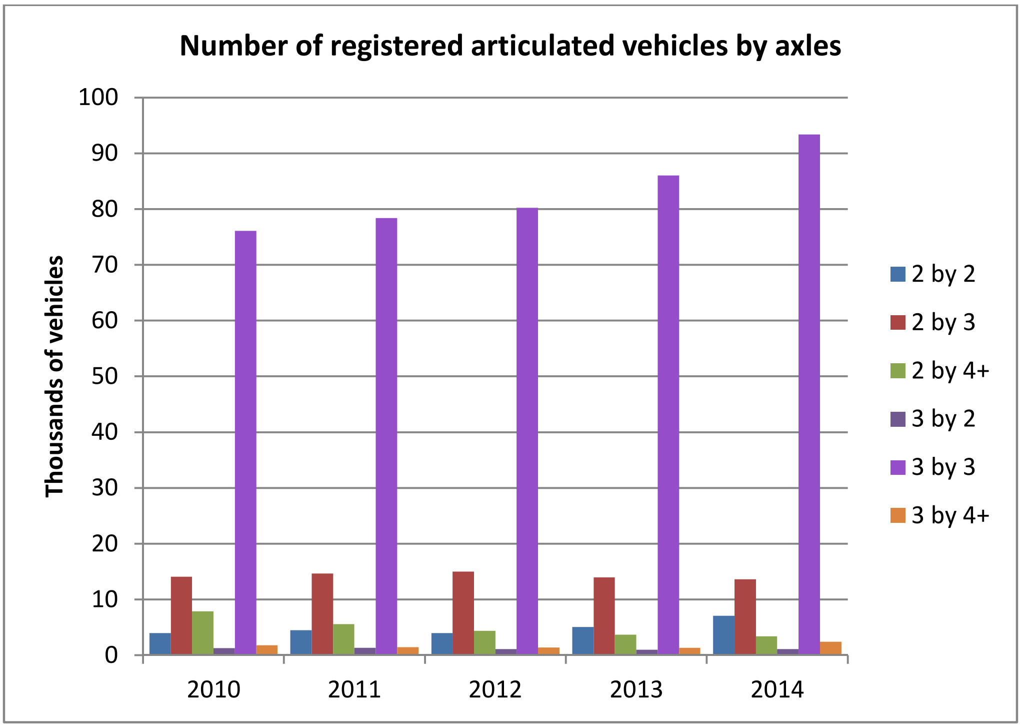
[16] For example see Figure 8 of CSRF report. While the increase in vehicle weight limits is reflected in lower weight constraints, the figure for loads constrained by weight and volume seem to have risen without explanation. This illustrates the care with which the data has to be treated.



The precise weight data used has been changed, so the more recent DfT time series data has been used to give the latest picture, set out in Figure 3.

Figure 3

Source: DfT Table VEH0524



It is very clear that combinations which use 2 axle tractor units are very much a minority and that the 3 + 3 maximum size and weight vehicle dominates. It is important to note that, if volume constraint really were a serious problem, why there are fewer vehicles with 2 axle tractors. These are vehicles with fewer axles, they are cheaper, and have lower operating costs but carry the same volume as HGVs with more axles. The only difference is that they can carry less weight: 2+2 is limited to 36 tonnes[17], 2+3 to 40 tonnes.

All this makes an objective assessment of how efficient road freight transport is or could be a complex issue. This works two ways – while it is hard to generalise about potential to improve operational efficiency, it is equally hard to justify "one size fits all" actions such as increasing size or weight limits. Making vehicles larger means any volume or footprint constraints might be avoided. However, as soon as this happens, the additional amount of goods is more likely to come up against a weight limit constraint. This see-saw effect is not well appreciated. Increasing the weight limit increases the likelihood of hitting a volume constraint, and vice versa, and this means that there is no optimum size and weight for vehicles, even for the largest, heaviest loads.

This can be illustrated by the following. A typical 44 tonne articulated lorry has a trailer with about 13.4m of available loading length, about 2.5m wide and 2.5 to 3m loading height. A typical maximum payload would be 28tonnes. Three different commodities with 3 different loading requirements can be considered as carried at present, and under two options, one increasing length, the other increasing weight, different impacts on part loading can be illustrated:

Current situation

1. 28 tonnes of commodity 1 requires a loading space of **15.5m** X 2.5m X 2.6m, so this is **volume constrained**
2. **32** tonnes of commodity 2 could be fitted within the existing size limits of 13.5m X 2.5m X 2.6m so this is **weight constrained**
3. 28 tonnes of commodity 3 fits inside the existing size limits of 13.5m X 2.5m X 2.6m so this is **just right**

Option A: In order to address the volume constraint for commodity 1, trailers are allowed to be longer, say 15.5m. The list then becomes:

1. 28 tonnes of commodity 1 needs 15.5m X 2.5m X 2.6m, so this **becomes just right**
2. **36.7** tonnes of commodity 2 could be fitted within the new size limits of 15.5m X 2.5m X 2.6m so this is **still weight constrained**
3. **32** tonnes of commodity 3 could be fitted within the new size limits of 15.5m X 2.5m X 2.6m so this **becomes weight constrained**

Option B: Instead of relaxing length, it is decided to allow a higher maximum weight of 32 tonnes to address the weight constraint issue for commodity 2. The list then becomes:

1. 28 tonnes of commodity 1 still needs **15.5m** X 2.5m X 2.6m, so this is **still volume constrained**
2. **32** tonnes of commodity 2 could be fitted within the existing size limits of 13.5m X 2.5m X 2.6m and the new weight limit means that this **becomes just right**
3. **32** tonnes of commodity 3 would need a new size limit of **15.5m** X 2.5m X 2.6m so this **becomes volume constrained**

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[17] Can be 38 tonnes with less damaging drive axles

The result of this in the real world is that as soon as one of the two constraints is addressed, the other will become more of a serious issue. The obvious question is: why don't the carriers for each commodity choose the most suitably balanced size and weight combination?

The problem is that there is a tendency for all HGVs to be purchased at the maximum size and weight permitted. This is probably based on the assumption that this will maximise the ability to compete for any load. This optimises the position for the largest and heaviest loads, but creates part loading for other consignments. This problem is one of the key reasons that increasing size and weight limits is not likely to lead to improved efficiency for road freight as a whole unless the standardisation to the biggest can be avoided. Of course, within this picture there will always be individual examples of where efficiency has improved or got worse.

The conclusion from this analysis is that there could be fuel and thus carbon benefits for certain loads if size or weight limits were increased, but that an increase in one will always generate pressure for the other to be raised.

This is serious because the impacts of such changes are not limited to internal costs. Larger or heavier HGVs have a wide range of significant external costs including congestion, road damage, safety, air pollution, and noise as well as carbon emissions. There was no limitation in terms of access to the road network to accompany these increases and no charges to reflect such costs. This failure to integrate changes in size and access to the network is one of the key reasons for the current situation which is unsatisfactory in both economic and environmental terms. This leads to serious adverse costs on the non-motorway network, especially in urban and sensitive rural areas. The rapid escalation in external costs on such roads can be seen earlier in Table 1.

Land use planning and urban distribution

In a sense this follows on from routeing, since the location of freight generators and depots is sometimes poorly related to either road or rail networks, and rarely to both. There is some indication that SRFIs may help and, in the longer term, land use planning also has a wider role to play in planning for distribution centres, depots and industry. It must be remembered that rail based consolidation can occur at locations other than SRFIs, for example for regional or urban distribution. Action so far in this regard has been extremely limited apart from SRFI guidance, for example using transport land for non-transport uses could be discouraged.

Encouragement of urban consolidation centres may be brought forward by operators seeking efficiency improvements, and this is identified in the CSRF report. Their estimates show this as the largest single factor in their prediction of the potential for reducing carbon even without use of rail linked centres.

Behavioural change

There are a number of behaviours and choices which can improve efficiency and several are identified by CSRF. They include a general reduction in emphasis on "Just in Time" which has secondary effects such as making consolidation and return loads (or finding loads for the journey to pick up goods)[18] easier. These estimates are not examined in detail in this memorandum but together with urban consolidation make up a majority of the CSRF predicted carbon savings. The most obvious ways to encourage such change is through routeing and charging.

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[18] Backhaul and fronthaul

Restructuring the supply chain

This is considered in the CSRF, but as small effect, and may consist of changing, for example, from a national depot to regional multi-depot system. Choice of supplier or stockholder is also a major driver of change in vehicle kilometres, and is one of the reasons that freight price elasticities can be more than one. This has not been included and an elasticity based approach might have been used to see how much this could reduce carbon[19]. The implication is that some of form of Lorry Road User Charging, based on weight and distance travelled, would have to be introduced. This is briefly mentioned in para 6.4.6 of the CSRF report, but only in the context of mode transfer. In reality it would be a real driver of change in terms of location and patterns of demand and distribution and should have been discussed in more depth in the CSRF analysis.

Conclusions

The savings explored in the CSRF report are interesting in as far as they go and could help to move discussion forward. The report predicts a reduction of:

- 3.1 to 3.9 million tonnes of carbon a year in 2035 from reduced fuel consumption. Of this, the majority (2.3 Mt CO2e) is from driver training and monitoring.
- 2.0 to 2.6 Mt CO2e due to logistics measures, including larger vehicles (about 20% of the total).
- 0.3 to 1.14 Mt CO2e from transfer to rail.

Most of the reduction occurs by 2020 due to driver training and monitoring. The subsequent reductions for 2020-2035 from operator efficiency and logistics appear very modest (11-18% over 15 years).

For the reasons set out in this report, the results appear to be too low for mode transfer and for behavioural change by a significant amount. Co-ordinating consolidation with mode transfer, for example, should provide major benefits.

On the other hand, without effective pricing, initial savings from the use of larger vehicles will begin to erode after a year or so of introduction, due to growing under utilisation as the fleet is standardised at the new higher limits. The costs are then likely to exceed any initial benefits. The one off costs of replacing so many trailers is also an important factor in changes such as longer vehicle limits.

Land use planning could also provide more benefits but these are harder to quantify – more research is needed.

Overall, if larger vehicles were not included in the CSRF model, its predictions for carbon savings would fall by 0.5 Mt CO2e (8 to 10%) in 2035.

The potential for rail mode transfer alone (>1Mt CO2e) more than compensates for the predicted loss of predicted savings from larger vehicles. Improvements to rail freight traction could take carbon savings to an even greater level.

The introduction of Lorry Road User Charging such as a weight distance charge to incentivise behavioural change would clearly make a further significant difference and enable the modest improvement predicted from 2020 to 2035 to be very significantly increased.

[19] For example see *Price sensitivity of European road freight transport – towards a better understanding of existing results,* De Jong et al, June 2010.