Metropolitan Transport Research Unit

Review of Government proposals for Longer Semi-Trailers (LSTs)

Report prepared for Freight on Rail

June 2011

Review of Government proposals for Longer Semi-Trailers (LSTs)

Contents

MTRU
www.mtru.com
June 2011

Summary

This report analyses the evidence base for the consultation on longer semi-trailers **(LST)**, in particular the Final Summary Report and Impact Assessment **(IA)** which DfT has published. It critiques the "best estimate" produced and sets out what are considered to be a more realistic set of outcomes.

Overall this report concludes that some road freight operators would benefit from longer trailers, but others may be forced to buy vehicles they rarely need, particularly small and medium sized public hauliers. This would lead to less efficient operations (lower load factors). It is also likely that total environment costs will increase, not decrease as the IA suggests. This is because the operators who do save unit costs will tend to generate more traffic (for example by changing where stock is held and using fewer depots). There are other serious overestimates of potential benefits and underestimates of costs.

It is worth remembering that previous increases in size and weight limits have been justified on the grounds that they would reduce the traffic from HGVs (vehicle kilometres) required to move goods around the UK. In fact there is no clear evidence for this, either in terms of HGVs carrying more per journey (average load by weight has consistently fallen), or national reductions in HGV traffic[1].

There are three overall issues considered in this report. The first is the lack of co-ordination of these proposals with other freight policies at national and EU level. The second is the failure to define problems and then a properly developed range of solutions (in line with the Treasury Green Book). The third is the way in which the Impact Assessment (IA) omits several important effects and underestimates others. Sections 2 to 4 of this report analyse the IA in detail.

Before summarising the findings, there is one additional difficulty in setting the weight and size limits for HGVs which needs to be remembered.

The Leapfrog Effect

This difficulty can be summarised as follows: volume and weight limits cannot be optimised at the same time. Every time the industry lobbies for higher weight limits, but not larger vehicles, as soon as weights are increased fewer loads are weight constrained and a far higher proportion immediately become volume constrained. This then becomes the focus for industry lobbying for size increases.

Thus, because weights were raised to 44 tonnes in 2001, but with no change in dimensions, it appears that currently only 10.9% are weight constrained at the current size limits, but 42.5% are volume constrained. More importantly, 46.6% are not constrained by either and indicate part loading and generally low load factors.

There is actually no end in prospect to this see-saw, leapfrogging effect which is the natural result of two factors:

1 the huge variation in density and shape of goods, and the way in which they packed (such as pallets, containers, cages), and

2 the way in which operators move quickly to standardise their fleets at the maximum limits.

---

[1] For a review of recent relevant statistics see *Freight Update,* MTRU, November 2010,

Omissions from the IA

While the IA explores several aspects of freight operations, some of these have not been followed through and incorporated in the most likely outcome (central estimate) on which the IA is based. The key omissions are:

1) There is no "like for like" safety comparison – there is no introduction of best available technology for the base line, and instead new and improved trailer designs are compared to existing trailers.
2) It is assumed that very few accidents involving articulated HGVs (15%) are in any way influenced by length, this is based on a series of individual judgements and takes no account in the increasing probability of accidents occurring.
3) This leads to the assumption that there is a zero increase in danger from longer vehicles and that there is no difference between 1 or 2 metres extra length.
4) No allowance for the cost of early retirement of existing semi-trailers by all operators, especially public hauliers, to ensure fleet interoperability and ability to maintain competitiveness this could be as much as £1.8billion over 5 years.
5) The over-purchase of longer trailers, as with previous increases in size and weight, would lead to lower load factors and this is not addressed.
6) Existing low load factors which would mean extra volume could not be used, are not taken into account.
7) Non-monetised environmental factors related to length such as severance and visual intrusion which impact on pedestrians, cyclists and non-road users are omitted entirely.
8) Generation of longer distances caused by cost reductions (the "rebound effect") which is well documented, and widely accepted (for example by the EU) is not used for the central estimate, and the sensitivity test uses an unusually low value.
9) Congestion impacts of longer vehicles in conditions other than free flowing traffic on motorways are seriously underestimated, only 1/3 of the length increase is used in the assessment.
10) Nuisance and intimidation caused to drivers and passengers in other road vehicles are not included, which, together with 5 above, are likely to be very significant and are not included in the IA, despite these being standard items in transport appraisal.

Including only some of these impacts changes the outcome of the impact assessment and shows that the introduction of LSTs is not justified on economic or environmental grounds.

The impact of lower rail use caused by introducing LSTs

It is important to say that the DfT central case is built on the prediction that road operators will increase their share of goods traffic as a result of introducing LSTs. This creates serious issues with the way in which costs and benefits of rail are treated. For example, between 27% and 32% of the net environmental benefits of introducing LSTs are assumed to be gained by running fewer freight trains. Thus if trains were electrified or became quieter, the benefits of not running them would fall and so would the benefits of LSTs. It is not at all clear that the IA and other consultative documents have understood this somewhat odd situation.

This is mirrored by the way in which rail freight costs are saved. It is assumed that road freight will capture some freight that would have gone by rail, and thus fewer train kilometres are run. This reduces overall industry costs and this represents a high share of the total predicted savings from introducing LSTs. Taking the average of the most popular LST options, 4 to 6, 27% of the industry operational savings in 2015 are lower rail costs. In 2020 this has risen to 53% of savings and by the end of the assessment period, 2025, this has risen to 84%. This makes the whole assessment very sensitive to the way that less rail traffic translates into fewer train kilometres. It is surprising that this is not identified clearly in the main text as a key issue.

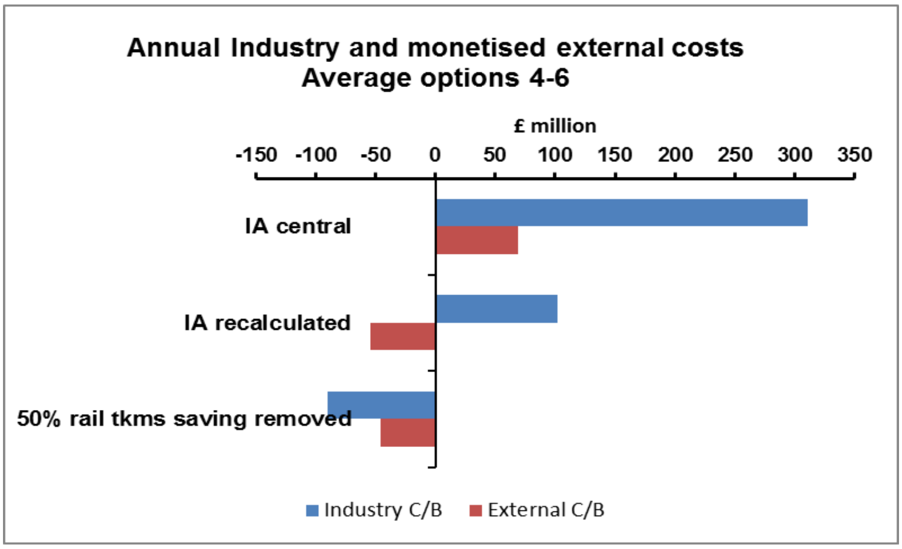
Overall it appears that, even assuming that the lower share of freight transport reduces rail costs in the way assumed, a more realistic picture of the likely impact is that external costs would rise significantly, and that total industry benefits would fall significantly. Omitting even 50% of the rail cost savings would mean an overall social disbenefit.

Sensitivity testing

In the IA, there are a range of sensitivity tests and this is welcome. Unfortunately the central estimate on which they are based suffers from the omissions and uncertainties set out above. However, two of these DfT tests, on congestion costs and traffic generation, provide data which has been used in this report to produce a more reliable central estimate. The accepted EU traffic generation factor of 0.6, and a traffic increase value of 2/3 (rather than 1/3) of the length increase have been used. In addition, an estimate of the cost of premature replacement is included, using conservative assumptions and standard depreciation techniques. This is shown as the "IA recalculated" result in the chart below. The "IA central" estimate in the chart is taken directly from the DfT's IA.

The issue of whether the rail savings could be achieved should be investigated further and almost certainly needs more detailed modelling. Marginal reductions in rail freight may not be reflected in reduced train kilometres, but result in empty wagons (lower load factors). To test sensitivity, the rail operating and environmental cost savings have been reduced by 50% to reflect this. It is clear that the results are sensitive and this means further detailed analysis is required.

Chart 1



Is the existing situation satisfactory?

There is one final point to be made about the general approach to regulating and charging heavy lorries. At present, the largest HGVs do not meet their environmental, congestion and other external costs[2]. In the IA there is an assumption that the present situation is a reasonable “Do Minimum” from which to proceed. It is related to the “like with like” safety point above, but goes much further in terms of relating the true costs of operating the largest vehicles to what and how they are charged.

Until external costs are incorporated in a proper charge for use, there will always be high levels of economic and environmental inefficiency. It is possible to minimise the charge by matching better vehicle standards, sizes and weights to which parts of the road network they are allowed to use. In the absence of such controls (which seem less frequent than in some other parts of Europe) costs should charged.

Conclusions

Overall, the conclusions are that:
1 the most likely outcome of allowing LSTs would be significant environmental costs
2 the impact on operating costs will be positive for some operators but likely to be negative for others, particularly public hauliers, any savings will be quickly eroded
3 the safety impact is seriously underestimated: it is assumed that an extra 1 metre or 2.05 metre length has zero impact on safety per vehicle kilometre
4 there are more effective and more certain ways of achieving the social and efficiency objectives in the IA, for example through proper user charging and addressing the issue of empty running.

[2] For example see: *Heavy Lorries - do they pay for the damage they cause?* MTRU, April 2008

1 Introduction and overview

The Government has published its consultation documents on options for permitting longer semi-trailers for articulated HGVs in the UK. The current overall limit is 16.5 metres, effectively limiting trailers to 13.6 metres. A more specialist vehicle type, a rigid HGV which tows a shorter trailer, is already permitted to be up to 18.75 metres. However, this is rare, less than 2% of UK HGV traffic. Options for 1 or 2 metre extensions to trailers are proposed and these are referred to as "Longer Semi-Trailers (LSTs).

There are three overall issues considered in this report. The first is the lack of co-ordination of these proposals with other freight policies at national and EU level. The second is the failure to define problems and then a properly developed range of solutions (in line with the Treasury Green Book). The third is the way in which the Impact Assessment (IA) omits several important effects and underestimates others.

The Leapfrogging Effect

Before summarising the key issues identified in this report, there is one major issue in relation to policymaking on weights and dimensions that needs to be understood. It is simply that volume and weight limits cannot be optimised at the same time. Every time the industry lobbies for higher weight limits, but not larger vehicles, if they are successful (which they have been over the last 40 years), as soon as weights are increased fewer loads are weight constrained and a far higher proportion immediately become volume constrained.

Thus, because weights were raised to 44 tonnes in 2001, but with no change in dimensions, it appears that currently only 10.9% are weight constrained at the current size limits, but 42.5% are volume constrained. Interestingly, 46.6% are not constrained by either and represent part loads and generally low load factors.

If the volume constrained loads are significantly reduced by making lorries bigger, the picture will change and a higher proportion will be weight constrained. The operators who now find they could carry a greater weight in the longer trailers will, quite understandably, start to lobby for a weight increase, in exactly the same way that those operators who currently experienced volume constraints are currently lobbying for a size increase.

There is actually no end in prospect to this see-saw, leapfrogging effect which is the natural result of two factors:

1 the huge variation in density and shape of goods, and the way in which they packed (such as pallets, containers, cages)

2 the way in which operators standardise their fleets at the maximum limits

One unhappy side effect of this is the recurring breaking of assurances given that each increase is the last. Thus in 1980 the Armitage Report, the result of a major public inquiry into lorries, recommended raising weight limits, but only in the context of fixing size limits, saying

"…. an important part of our recommendations is that there should be no further increases in maximum dimensions. We are sure that the public would be well served by such a commitment."[3]
The same paragraph also says
"Some people ask: "Where will it all end?" The answer is simple: it will end right here.".

Matching vehicles to consignments

Before setting out the analysis, it is important to understand that freight transport in general, and road freight in particular, is a very difficult area in which to predict results. This is for several reasons. First, the commodities carried are very varied in terms of density, value, fragility, and type of packing (e.g. pallet, cage, container). Goods are moved from point of production or port of entry to depots, between depots, and then to customers. These can be located anywhere and often not on the motorway network, on roads to which even current HGVs are not suited. Although it is the case that HGVs use the motorway network for much of their longer distance travel.

Despite this huge variety, there is a surprising mono-culture of vehicle size and weight, strongly focussed at the maximum size and weight. The advantages of inter-operability and knowing that almost any consignment can be competed for, are traded off against having the right vehicle for the right job, and this leads to extensive part loading and overall inefficiency and cost to industry and the public.

This report begins by an overview of the three areas set out above.

***i)	Lack of co-ordination at national and EU level***

The first observation is that this proposal is coming forward at the same time as a new method of charging heavy vehicles is being proposed. However, there is no apparent relationship between the two. It is clear that the method of charging for heavy vehicles has a powerful impact on the fleet composition and patterns of use. It would also influence the way in which firms respond to any change in vehicle dimensions.

The second is that the proposal does not appear well related to EU wide discussions on even longer and heavier vehicles. There is a major problem here for companies, particularly smaller ones, which is not dealt with in the impact assessment. If new trailers of the longest type have to be bought to compete in the market (this has been precisely the pattern of previous changes), small hauliers will have to find the capital, and will not be able to get a reasonable trade in value for their existing trailers. They will essentially take a capital value reduction which will be more significant for small fleet owners.

If the EU then proceeds with a different maximum length, operators will be faced with another investment and another trailer with lower than expected resale value.

This will clearly affect small general haulage firms, of which there are over 70,000 in the UK. There are some who may wish for the sector to be consolidated into a far smaller number of larger firms, a move which would be encouraged by the UK making a unilateral change to its trailer length. If this is

[3] Armitage Report, December 1980, para 414

the case, it should be stated clearly as an outcome and the consequent change to the competitive environment should be estimated and included as a specific cost in the formal Impact Assessment. At present the impact of the UK change alone is described (paras 7.4.1-5 in the IA) but then dismissed in para 7.4.6:

"There does not seem to be a viable means of allowing exemptions for small firms from this regulation, since the adoption of LSTs would be entirely voluntary and existing vehicle types would remain in use."

At the very least, the capital requirements and potential loss of value should be included. Later in this report an indication is set out of what the cost of premature replacement would be for the LST proposal. It was not included in the IA.

ii) Inadequate problem definition

As in all Government interventions, the whole process should follow the clear guidance set out in the Treasury Green Book[4]. This starts with asking the question *Why is this intervention necessary?* and includes areas such as identifying problems; defining objectives; developing options; and undertaking appraisal, monitoring and evaluation. It should be noted that increasing trailer size is not an objective, it is one of a possible list of solutions.

The IA basically follows the Green Book format but is clearly inadequate in terms of defining objectives, options and appraisal. This is surprisingly common, alternative options should not be limited to minor variations on a single option, particularly where there are well documented criticisms of similar options which have been implemented previously.

The IA does have a summary of the reason for this policy intervention. The problem to be addressed is said to be:
"Determining the most socially beneficial length of Heavy Goods Vehicle semi-trailers."
This section goes on to describe current limits as designed to address
"a variety of external costs associated with their use".

Reducing external costs or ensuring that those responsible pay for them is a classic reason for Government intervention. In the case of the heaviest lorries they include safety, road damage, congestion, air pollution, carbon emissions, visual intrusion and severance impacts. There are also impacts on the built and natural environment which are unaccounted for, from trees and hedgerows to buildings and other roadside structures. Seeking to limit these costs by limiting the length of semi-trailers alone would clearly be somewhat indirect and inefficient. Here again there is a major omission in not linking this to the methods of charging, currently under review. For any such regulation on trailer length to achieve the objective of reducing external costs, it must be part of a coherent tax and regulatory framework for freight in general and road freight in particular. This need not be over-complicated and burdensome, indeed a sensible overall framework would be more immediately comprehensible both to operators and society as a whole. This is linked to the issue of where the largest HGVs should be permitted - there is a balance between charges and the size of the permitted network.

---

[4] *THE GREEN BOOK, Appraisal and Evaluation in Central Government,* HM Treasury

The IA refers to external costs in its cost benefit analysis, but notes that this only includes the environmental costs which have been monetised for mode switch grant purposes, it clearly states that they:

“do not include “Other costs” as these should be treated as non-monetised elements in all appraisals and impact assessments carried out using these values.”

However, non-monetisation does not mean that the issues should be ignored. As the Green Book says in para 5.76,

“Costs and benefits that have not been valued should also be appraised; they should not be ignored simply because they cannot easily be valued. All costs and benefits must therefore be clearly described in an appraisal, and should be quantified where this is possible and meaningful.”

The estimation of external costs in the IA is therefore only for that part of the real external costs which have been monetised. It is correct to say that a reduction in the monetised costs implies a partial reduction in the non-monetised costs, because both are based on vehicle kilometres to a significant degree. However, effects which are related to size may be increased. On the other hand, where there is an increase in monetised costs, there is very likely to be an increase in non-monetised costs.

The significance is not made clear in the IA, and is particularly relevant to the sensitivity testing.

iii) Inadequate testing

A critical factor in any impact assessment is how robust the assumptions are which underly it, and how sensitive the results are to plausible changes in those assumptions. It is relatively easy to choose an assumption which can be changed to an extreme extent without much effect on the outcome, and then change it extremely to prove that even after making such major changes, the original assessment is robust.

This would not be sensitivity testing in any meaningful sense. Sensitivity testing should be about finding which assumptions will make a difference with relatively small changes. This is an effective way of identifying risk, or the likelihood of a policy intervention achieving its objectives.

In this case, the impact assessment has undertaken sensitivity testing which in several cases is very useful, but would be more appropriate as the central estimate (base case). Some sensitivities are underestimated or omitted.

One obvious factor in measuring the impact is the extent to which HGV traffic is generated by a fall in costs. This is usually represented by an elasticity value. This is only done as a sensitivity test, not part of the main appraisal.

The reason that this is important is that decisions over stockholding and depot location are strongly influenced by cost, as are choice of supplier, and thus distances travelled can change. This can happen even if there is no change in the overall amount of goods delivered to consumers, or businesses. Thus total tonnes can be insensitive to changes in cost (inelastic) while tonne and vehicle kilometres can be sensitive to cost (elastic). This is illustrated in the MTRU Note which forms an Annex to this report.

The IA contrasts with other studies, particularly at the EU level, where this factor is normally covered, for example in the TML Europe wide study which the IA quotes[5]. Indeed, there has been considerable discussion at EU level, using a peer review group, to identify, and agree, sensible averages for such elasticities.

These figures have been completely ignored by the IA, and a far smaller value (0.1) is used. For example, after allowing for mode shift, the demand elasticity suggested in the Europe wide study is 0.6[6]. We consider that this should have been used, and have made an estimate of how this would impact on the IA.

The second key omission is the failure to reflect the impact of the extra length on various external costs, for example on congestion. Only a third of the increase in length is assumed to increase congestion. The IA is very sensitive to this assumption.

Other effects, such as visual intrusion (landscape), intimidation and severance are also likely to be directly related to size. These impacts have not been included.

A zero increase in accidents per vehicle kilometre is assumed. Again this is unlikely, and appears to have two causes:

1 the assumption that very few accidents involving articulated HGVs (15%) are in any way influenced by length

2 the comparison is between LSTs with the best safety features and existing trailers without such safety features (although new trailers at the same length could incorporate them and would benefit).

5 Although the MTRU reports, which corrected two arithmetical errors in the TML report, and their implications for traffic generation, are not referenced, a summary was published as *Overview of the research undertaken for the EU Commission to assess the impact of introducing Larger, Heavier Vehicles (LHVs)* MTRU, July 2009

6 *Price sensitivity of European road freight transport – towards a better understanding of existing results,* De Jong et al, T&E, June 2010

2 Safety and vehicle design

One of the most important issues for LSTs is their impact on safety. Before setting out exactly how DfT have conducted the assessment, it must be said that predicting changes in accidents from changes in vehicle standards is very difficult. This is because each accident may have many factors involved, and the removal of even one could prevent the accident occurring. In addition, there are underlying trends in driver behaviour and vehicle technology which obscure the effects of previous changes. For these reasons it is wrong to be too definitive about any prediction, and it would be wise to undertake sensitivity tests which vary such extreme assumptions.

In this case the IA has assumed a zero increase in accidents per vehicle kilometre for LSTs. At first sight this appears completely illogical. There are two underlying reasons for this value being used:

1 the assumption that very few accidents involving articulated HGVs (15%) are in any way influenced by length

2 the comparison is between LSTs with improved technology and existing trailers without such technology (although new trailers at the same length could incorporate it and would benefit from it).

The first requires a very detailed analysis of the DfT's assumptions in order to explain why they chose to eliminate so many accidents from their calculations.

Length treated as irrelevant in most accidents

The starting point for the DfT's analysis involves making judgements about which HGV accidents might be influenced by increases in length. Their conclusion is that very few should be included in the IA figures. In fact 85% of all accidents involving articulated HGVs are assumed to be unaffected by length[7]. This is partly justified by a close examination of 276 fatal accidents[8] which considered the types of accidents considered relevant in more detail.

For example, in relation to fatal accidents within 20 metres of a junction, one of the largest categories, 99% were assumed to be outside the scope of the report.[9] Such adjustments have a major impact in reducing the predicted safety effects of LSTs. The percent reductions for the fatal accidents were then applied to serious and other casualties without amendment.

This approach may be suitable in very extreme cases of specific accidents where there is a single cause or a small number of causes, such as a lorry being blown over by strong winds where there probably three (weight, centre of gravity and side area). It is not well suited to accidents with multiple causes, where a probability based approach would be more useful. There is also the issue of whether accident patterns are the same between fatal, serious and slight.

It is also the case that the technical Report by TRL has somewhat confused the picture by using Venn diagrams (circles)[10] to assist the reader in understanding which accidents are included and which excluded. Unfortunately the size of the circles is not related to the actual numbers. In the report it looks as though most HGV accidents are included in the analysis when the opposite is in fact true.

7 Table 20, page 60, TRL Report PPR 526

8 Heavy Vehicle Crash Injury Study (HVCIS) database 1997-2006

9 Table 19, TRL Report PPR 526

10 TRL Report PPR 526, page 54 onwards

While the causes of accidents are complex, in this case only one vehicle characteristic is being changed. How could its impact be assessed? Alongside the DfT approach in this report, of setting major assumptions, then a detailed set of calculations, an alternative and widely used technique in transport appraisal and risk analysis is to look at probability. This is particularly useful where there are a number of factors that need to come together to cause an event (in this case an accident) and this coming together has a strong element of chance.

Such an approach starts by assuming that there are, literally, thousands of accidents waiting to happen. The likelihood of them happening is influenced by many factors. One of these must be the presence of the vehicle on the road, and the longer or further it travels, the higher the probability of an accident occurring. In the case of larger vehicles, their presence on the road can be measured in terms of how much road space they occupy.

Thus an approach parallel to that for congestion costs could be used. In the middle of the night on a motorway with no other vehicles the number of potential accidents is low and any change in that probability is unlikely to have a major influence. In mixed traffic, or on an A or B road, the number of potential accidents will be higher probability will be strongly influenced by the road space occupied. It should be remembered that important causes, such as driver behaviour, weather conditions or vehicle performance are assumed to be unaffected by any change in length[11].

Applying the same road space figure as the IA (1/3 of the length increase) would suggest a 4.1% increase in accidents and the sensitivity test (2/3) would suggest 8.2%. Of course this would be moderated if fewer kilometres are run by articulated HGVs, but would have a major impact on the conclusions of the Impact Assessment, even using the other assumptions in the IA. The IA uses a 3 year average of fatalities involving articulated HGVs 0f 166.7 and a 4% increase is equivalent to 6 additional fatalities per year. This is not in any sense a robust prediction, but is meant to illustrate the potential importance of underestimating the increase in accident risk and is, for the reasons set out earlier, subject to high levels of uncertainty.

Like for like comparison not undertaken

The other key reason for assuming a zero change in accident rates for LSTs is that the new trailers are assumed to be designed to be no more dangerous than current trailers in use[12] [13].

This is a critical assumption and if changed would also impact on the accident numbers in the IA. It is caused by not making an adjustment to existing trailers to allow for the extra safety features which are assumed for LSTs. If correct, this would be to assume that known safety improvements would not be implemented. This is a fairly extreme assumption and is not the usual approach, in which safety features would be implemented over time. It creates a misleading baseline against which to

[11] One aspect which will change is the delay time between the driver applying the brakes and the rear brakes actually being applied. Test track data from Daimler AG found that for a 25 metre long vehicle the braking distance on a dry surface would increase by up to 5 % and on slippery surface up to 17 %. Proportionately this would mean between 1% and 4% for 18.55m HGVs.

Reported in: TML, 2008, Section 2.3, page 78

[12] IA, Table 6, page 43, in turn based on TRL Report PPR526

[13] The non like for like approach is set out in the *Final Summary Report*, December 2010, para 3.3.7

judge the impact and again the EU LHV Peer Review Group and the Commission agreed that the "like for like" principle would be used in any appraisal.

From the tables produced for the IA it appears that changes in steering axles can have a positive safety effect of 7-10%. Unfortunately this was in relation only to the limited number of accidents studied. Assuming the best technology in this particular case would, however, improve the performance of existing vehicles significantly by reducing their cutting in and tail swing. These issues are briefly set out below. The positive effects of improving current trailers should be estimated and included as the base line in the impact assessment.

To put this in perspective, DfT predict that around half of all articulated vehicle traffic will be undertaken by LSTs in most options which they have considered[14]. Even a small change in the assumption on safety relative to existing trailers would have a major impact on the overall impact.

Some key safety impacts of LSTs

There are a range of safety issues in relation to what are already very long vehicles, and of sufficient mass for any vehicle, even a large car, to have pretty much the same effect as driving into a solid wall. This occurs when the relative mass is about ten times – the largest articulated HGVs approach this even when unladen. The TRL Report is clear that its findings do not in any way suggest that existing vehicles could not be significantly improved.

There are different issues on different types of road. On motorways, side winds and the so-called "snaking" effect is a concern, and on roads which are designed for much smaller vehicles, whether urban or rural size, low speed stability and manoeuvrability may be more important.

Manoeuvrability for trailers with rear axles that do not steer in line with the tractor unit is always a compromise, For example, positioning the trailer axles close to the rear means that the trailer cuts across the inside path of a turn, when the trailer pivots on its rear wheels. Moving them forward lessens the inside cut across, but creates a rear tail swing. This is illustrated in Figure 1 below.

In both these cases, as soon as the tractor unit moves out of line with the trailer, the driver loses visibility along both sides and any person, vehicle, or other object next to the trailer is vulnerable. This can be tackled by new types of mirrors or video cameras to replace or supplement them. Obviously, this issue of manoeuvrability is closely related to congestion impacts, particularly off motorways.

Thus on motorways the safety issues are different, and related to a range of different effects. Much of this is discussed in previous TRL, EU and MTRU reports. The overall conclusion is that LSTs should be compared to trailers of the existing length, both with the best possible safety and manoeuvrability features. This is of course challenging because of predicting exactly how much more dangerous the longer vehicles would be. At the least a simple test should have been undertaken increasing accidents in proportion to the increased length of the vehicle (plus an allowance for headway).

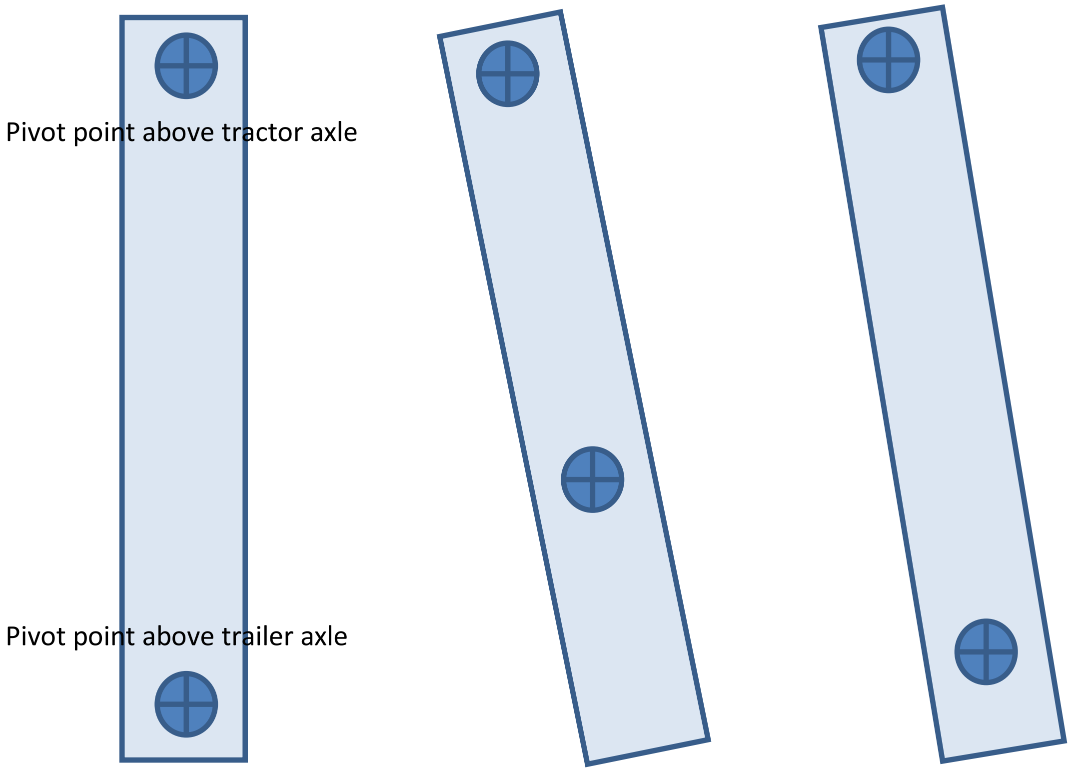
---

[14] All except Option 1, which is a 1m length increase but a new weight limit of 40 tonnes

The figure below is a greatly simplified example[15] of the conflicting impacts of different positions for rear trailer axles. It does not include vertical pivot type issues, which in the central illustration could cause too much weight to the rear. This in turn requires information about the positioning of the load itself, whether it is more to the rear or closer to the tractor unit. This serves to confirm the complexity of the interactions between load distribution, axle type and positioning, and the safety, road damage and congestion effects.

Figure 1

Impacts of trailer rear wheel positions (no steered axles)



Better for side wind	Better for inner swept path	Better for tail swing
Worse for inner swept path	Worse for tail swing	Worse for inner swept path

One approach to this is to steer one of the rear axles[16], so that the pivoting effect is modified. This reduces one of the factors to be taking into account in finding the best position for the trailer axles. Unfortunately, this lessens rather than removes the problems, and there are still other factors to be considered in placing the axles, for example side winds and weight distribution. The latter affects both safety and road damage. Even slight axle overloading has a disproportionate effect on damage.

[15] An additional technical drawing exemplifying the issue of swept path and tail swing has been supplied to us and is reproduced as Annex A

[16] There are several different forms of rear axle steering which are considered in the IA

In safety terms it is critical that sufficient weight is on each axle when braking, and on the rear tractor axles to maintain stability.

One other aspect which is omitted, and is indeed difficult to include, is the common practice of raising axles, so that they have no contact with the road surface. There are probably tyre wear savings but there is reduced traction. This makes road damage estimates more complex, and means that most calculations, which are based on all axles being used, underestimate the amount of road damage actually caused.

The Final Summary Report is clear about the comparison with existing vehicles and sets out the overall complexity and the issue of trade-offs.

"The analyses suggest that it would be very difficult for a longer vehicle to provide an improved performance over an existing vehicle in every metric considered. There are no combinations where the performance is reduced in all metrics at the same time – there is a trade-off based on wheelbase such that the metrics which are adversely affected are often accompanied by metrics where there is an improvement. This means that overall there can be net performance improvements relative to existing vehicles. Where individual reductions in performance are predicted these can be mitigated or improved by the imposition of design restrictions or new performance standards that force the use of new technology." (Para 3.2.9)

Overall it seems extremely unlikely that increasing the length of trailers would not cause an increase in accidents per vehicle kilometre if similar safety features are installed, and accidents are properly assessed.

This would cause increased accident costs, even on the DfT assumptions that LSTs will lead to reductions in vehicle kilometres from HGVs overall. These traffic assumptions are examined in the next section of this report.

3 Is the IA's vehicle kilometre and congestion assessment robust?

How much goods vehicle traffic will be generated?

In response to the question w*ould lowering the cost of road haulage cause more of it?* The IA test assumes an incredibly small effect and even this produces a noticeable change. Assuming that, for every 10% reduction in cost, the distance travelled by goods increases by 1%, the predicted benefits of LSTs would fall by 1.4%. This provides an answer to the next question *what level of sensitivity would remove all the benefits and is this plausible?*

The work undertaken by the Department indicates that this sensitivity is about a 7% increase in distance travelled for every 10% decrease in cost. This is within the range of most research on elasticities[17] and the widely accepted starting point is 6%. This is additional to any transfer to rail. This is more usually referred to as an elasticity value, in this case 0.6. Assuming an elasticity of 0.6 would remove 82% of the congestion and environmental benefits of LSTs in the IA.

One argument put forward in the Technical Report is that the UK is somehow different from other European countries, saying
"This frustrates any attempt to extrapolate the results of LST or LHV studies from one country to another." (para 2.3.3)
However, the report then goes on to describe the results of various relevant EU studies into longer or heavier vehicles, in particular it is also said that the UK is more similar to the Netherlands than other countries and thus their trial is relevant.

Overall it seems sensible to assume that the fundamental laws of supply and demand are not suspended in this case, although it is important to distinguish between tonnes (inelastic outside mode transfer) and distances (more elastic). This is set out in an MTRU Note for the EU LHV Peer Group from 2009 which is annexed to this report and discusses the modelling difficulties for LHVs, which also apply to LSTs.

Given that the elasticity of 0.6 is the level agreed by a wide range of experts advising the EU on changes in size and weight limits, applying an elasticity is not really a sensitivity test. It should be part of the central estimate.

Load factors and traffic reductions

As important as generated traffic is the issue of whether the predicted savings in vehicle kilometres will not occur because of lower load factors. This is not dealt with by DfT, which is surprising since it is recognised in several of the references they quote (including TML and JRC reports).

The problem is that the nature and size of consignments do not necessarily change with the size of vehicle. Even supermarkets cannot determine precisely how many lorry loads of which product they consume (although they may try!). In this case only those consignments for which an LST is available, and which needs an extra vehicle to carry it at present, will benefit. If there is a constant

---

[17] *Review of income and price elasticities of demand for traffic, Final Report,* Graham and Glaister, Imperial College, July 2002

and unlimited flow of a product from one place to another, the bigger the load, the fewer of them. This is, however, not the typical load in the UK, and if it were, it would probably be better transported by rail or water.

The approach on load factors is not immediately apparent from the IA, but the DfT approach appears to be as follows.

1 all volume constrained loads at present can benefit from 90% of the increase
2 all loads neither volume not weight constrained will benefit from 50% of the increase
3 for weight constrained loads a loss of payload equivalent to the increase.

In fact, the last category is very small and does not influence the results. The first assumes the "unlimited flow" argument for 90% of traffic and this seems too high. The second looks plainly incorrect, why would loads which are not constrained at present achieve any gains? Given that load factors are currently low, why would they increase? The DfT have been asked for further details on this and a reply is awaited. The IA analysis is clearly sensitive to these assumptions. For example, 37% of the predicted benefits in terms of lower vehicle kilometres are derived from item 2 above, where there is a possibility that only marginal gains could be made, if any.

What is the real congestion effect of LSTs?

There is a similar issue over the congestion impact of LSTs. It is quite correct to say that, in some circumstances, longer vehicles do not consume any more road space. These are where there are no other vehicles with which they interact, for example during certain hours in the middle of the night. There are also circumstances in which the length underestimates the impact. For example, when a long vehicle has to wait for a gap in the traffic to turn right, the probability of a large enough gap occurring will not be linear, even in free flowing traffic.

Both of these circumstances are likely to be in a minority, so how should the impact be estimated? The DfT are open about the uncertainty and have simply assumed a third of the additional length impacts on congestion without any specific evidence. The impact assessment is very sensitive to this assumption. Assuming two thirds of the length reduces congestion benefits by 90%. Assuming a directly proportional relationship (surely the logical starting point) would generate disbenefits almost as great as the benefits claimed in the DfT base case.

From this it is easy to understand that using the standard distance sensitivity (0.6) and two thirds of the length (a more plausible middle point than one third) the overall picture is very clear and probably more in tune with what most people would expect. There are still cost savings to be made by operators, but these are achieved by imposing environmental and congestion costs on third parties.

Using the IA data to create new assessments

The sensitivity tests in the IA provide sufficient information to estimate the effect of assuming:

1 a situation in which lowering cost generates traffic: the basis of most economic theory and especially so in transport where there are many opportunities which trade off transport cost against other costs such as land use and stockholding.

2 the impact of the increase in length on the increased road space required, and thus the increase in congestion.

Impact of generated traffic

First the IA sets out the DfT "central estimate" in which there are benefits to operators, but also benefits in terms of congestion and environment.

Table 1: (reproduced from the IA)

Table 19: Summary of Change in Average Annual 2011-2025 Values (£m) Compared to Base Case

Option	Internal Industry		Externalities		Total	
	Costs	Benefits	Costs	Benefits	Costs	Benefits
1	£0	£45	-£15	£0	-£15	£45
2	£0	£142	£0	£39	£0	£181
3	£0	£105	£0	£37	£0	£142
4	£0	£317	£0	£72	£0	£389
5	£0	£321	£0	£67	£0	£388
6	£0	£296	£0	£67	£0	£363
7	£0	£268	£0	£67	£0	£335

It is clear that the industry benefits are higher than the externalities (congestion plus environment). Both are, however, modest in relation to the totals.

Applying the standard EU elasticity value for increasing distance travelled when cost is reduced gives the following:

Table 2: Revised costs and benefits using 0.6 elasticity

Option	Internal Industry		Externalities		Total	
	Costs	Benefits	Costs	Benefits	Costs	Benefits
1	£0	£45	-£21	£0	-£21	£45
2	£0	£112	£0	£15	£0	£127
3	£0	£87	£0	£19	£0	£106
4	£0	£233	£0	£0	£0	£239
5	£0	£237	£0	£1	£0	£238
6	£0	£224	£0	£1	£0	£225
7	£0	£202	£0	£7	£0	£209

Source: IA Tables and MTRU spreadsheet

Industry benefits have fallen, but external benefits have become marginal, and probably not statistically significant in options 4 to 7.

Impact of additional length on congestion

In terms of congestion, the impact of the assumption that the increase in length will only have one third of the impact of the actual increase produces a small benefit. Increasing this to two thirds produces a clear disbenefit.

Table 3: Congestion costs under different assumptions

Option	Annual Average HGV Congestion Cost £m		
	Zero	Best Estimate (one-third)	Double (two-thirds)
1	-£6	-£22	-£39
2	£38	£5	-£28
3	£36	£3	-£30
4	£77	£11	-£54
5	£76	£11	-£55
6	£76	£10	-£55
7	£75	£10	-£56

Source: First two columns from the IA, third from MTRU spreadsheet

Combining these two produces the following results, which are significant and this analysis would suggest are the real "best estimate".

Table 4: Revised central estimate

Option	Internal Industry		Externalities		Total	
	Costs	Benefits	Costs	Benefits	Costs	Benefits
1	£0	£0	£6	-£39	£6	-£39
2	£0	£30	£0	-£13	£0	£17
3	£0	£18	£0	-£11	£0	£7
4	£0	£84	£0	-£54	£0	£30
5	£0	£84	£0	-£54	£0	£30
6	£0	£72	£0	-£54	£0	£18
7	£0	£66	£0	-£49	£0	£17

Source: IA data and MTRU spreadsheet

This shows that the benefits to operators are only slightly greater than the external costs to the public as a whole. Of course, as the IA says, the external costs are only those which can be monetised. The rest are missing from the financial analysis.

Other non-monetised costs to road users

As well as factors which affect non-motorised users such as intimidation or visual intrusion, there are disbenefits to motorised users, in particular drivers. Research conducted which forms the basis of the current value of time[18] showed how drivers would prefer to have no HGVs on main roads rather than an extra traffic lane. This indicates a very strong willingness to pay, and thus high cost to drivers, which should be included in the impact assessment.

18 *The Value of Travel Time on UK Roads,* Accent Research, DfT 1997

4 The real operator costs and benefits of LSTs

In this section the operator cost savings are examined and the question is asked *who benefits?*

In this case it is not the operators of articulated HGVs as a whole. To understand this issue it is necessary to understand something about how the haulage market operates. First it is split between those who run goods vehicles entirely to support their core business and those who are open to carry any traffic – the "own account " and "public haulage" sectors.

The former run businesses that do not make money from transport. A very powerful example is supermarket operations. Their HGVs are dedicated to delivering the goods they need to their stores in time for the shelves to be kept full and the customers to be able to buy unhindered. Efficiency is defined in terms of the goods arriving "just in time" not in terms of minimising vehicle traffic.

Public hauliers are just that, anyone can ask them to carry a load or loads form anywhere to anywhere. Of course some haulage companies offer comprehensive packages to firms who have regular high demand for goods transport, and these may include organising stockholding too.

The public haulage sector is thus very diverse and this is reflected in the many small companies who operate within it. They compete very fiercely and users are able to press for and obtain low rates. In the past, they have quickly moved to upgrade to the largest and heaviest articulated vehicles permitted. In the case of LSTs this has two critical effects:

1 premature replacement of existing trailers

2 buying trailers which are larger than needed for most work, so as to maintain competitiveness with other hauliers.

Both of these are costs which are not included in the IA.

Premature replacement of the existing trailer fleet

In the IA no allowance is included for the cost of early retirement of existing semi-trailers by all operators, especially public hauliers, to ensure fleet interoperability and ability to maintain competitiveness. This could be as much as £1.8billion over 5 years.

The issue of premature replacement is referred to in the IA but no estimate is offered as to the scale. In fact it is possible to use standard methods to provide a useful estimate, especially when compared to the uncertainty in some of the calculations of external costs.

About 240,000 trailers are MOT tested in the UK each year, and it can be assumed these are the active fleet. There may be more trailers, but these have been omitted from our calculations. It is also assumed that not all trailers will be replaced, but 75% will. The major cautionary note here is how far more specialised types of trailers will be replaced. This is an area where further work could refine the estimate.

These trailers vary in complexity, for example tankers, tippers, double deckers etc. In this example a standard curtain sided trailer is used as the base line, again a conservative cost estimate. A widely accepted average figure for these new is £25,000. There are trailers still being sold which are 20 years old, and in this case a residual value of £1,000 is assumed.

Even if all trailers were of this basic type, the current “as new “ value of the UK trailer fleet is at least £6billion. It is then possible to use standard accounting formulae to ascertain the depreciated value of the fleet. Using a standard annual depreciation formula, the book value would be at least £2.6billion. It is assumed that the age profile of the trailers is evenly distributed. This will tend to undervalue the fleet slightly, since there is likely to be more of vehicles in use between 1 and 5 years old than between 15 and 20.

Assuming that LSTs were announced a year in advance, and that no-one bought a new trailer of the shorter type in that year, it is then possible to retire the fleet early but with a year’s depreciation (the highest) avoided. Again this is a cautious but not unreasonable approach.

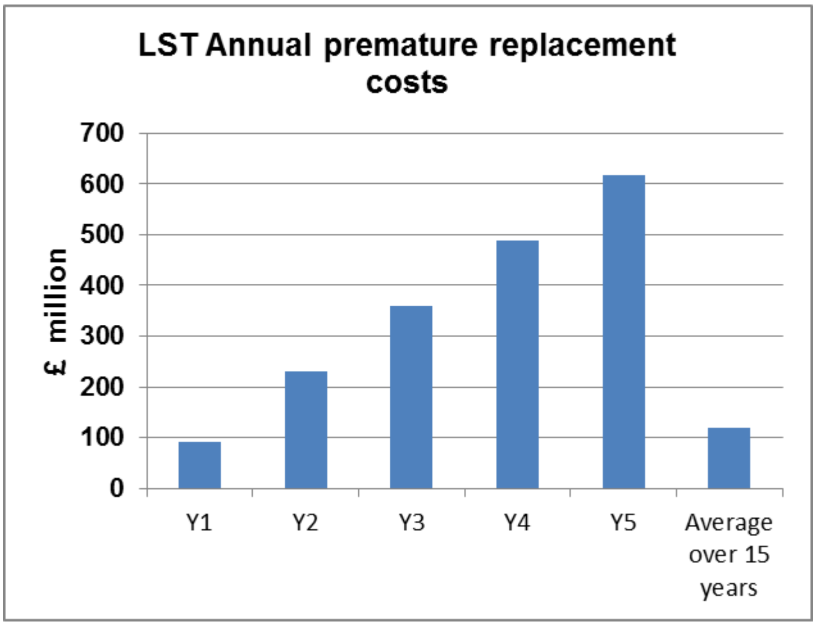
To continue to provide a cautious estimate, the oldest, and therefore lowest value, trailers are retired first. This gives the newest, highest value trailers 6 years depreciation before they have to be replaced and means that no trailer less than 5 years old is retired early. The cost of retiring the oldest tranche is excluded altogether.

This gives an estimate of £1.8billion, without allowance for inflation or discounting, over 5 years. Spread over 15 years to give an annual average comparable to that in the IA, provides a figure of £119million.

It is interesting to note that in the early years, the premature replacement costs are low, as people replace the oldest trailers first. It increases as newer vehicles are retired early, but moderated by the high depreciation of the newest vehicles. Overall this is a cautious approach and the true cost is likely to be higher.

The results are shown in the chart below.

Chart 2

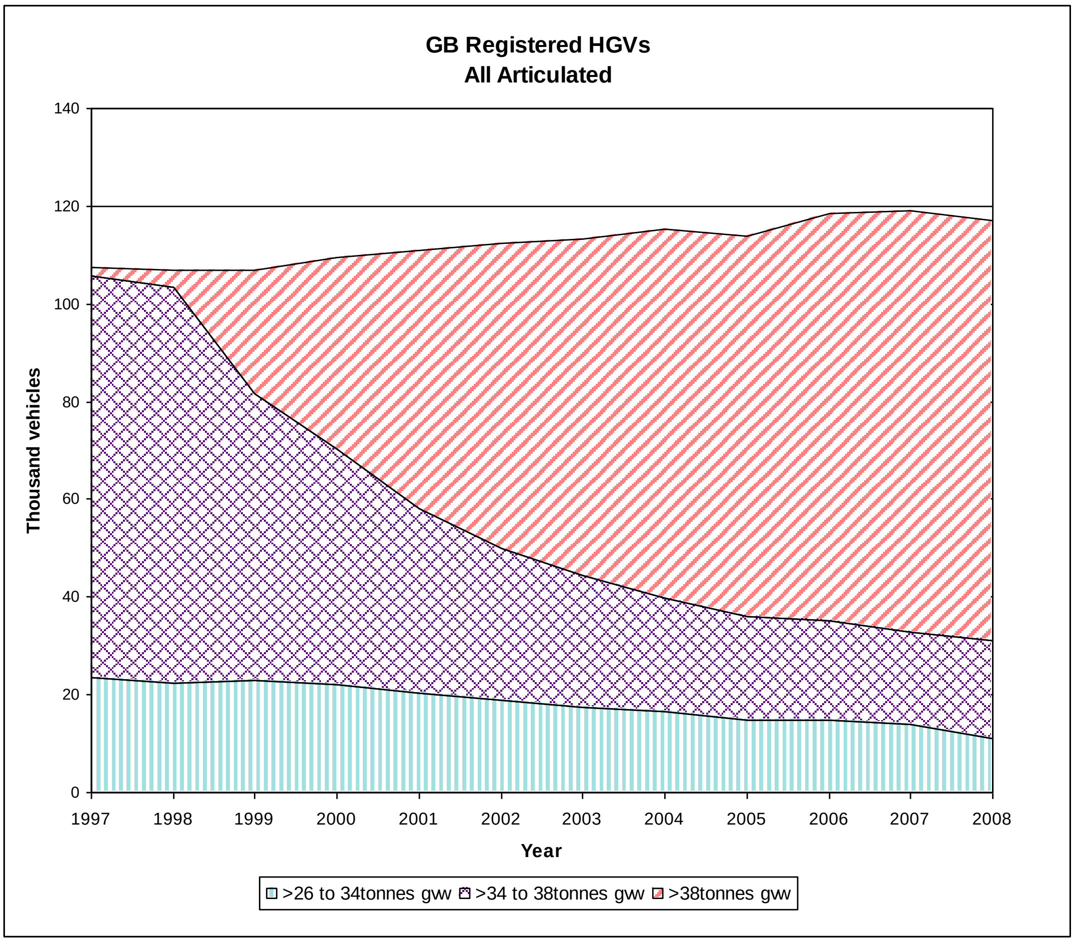


As to who will have to pay, it is most likely that own account operators will be able to manage their trailer replacement to maximise financial benefits, while public hauliers will be, as they have been in every increase in size and weight over the last 30 years, forced to buy the biggest as soon as possible. Indeed, 5 years may be too long a period. Any shorter and the costs would escalate rapidly, because new trailers (as with other road vehicles) depreciate more rapidly in the early years.

Buying trailers which are larger than needed for most work

There is ample evidence for this effect from the published data and this is widely reported[19]. The following chart illustrates the point.

Chart 3



Source: TSGB 2009

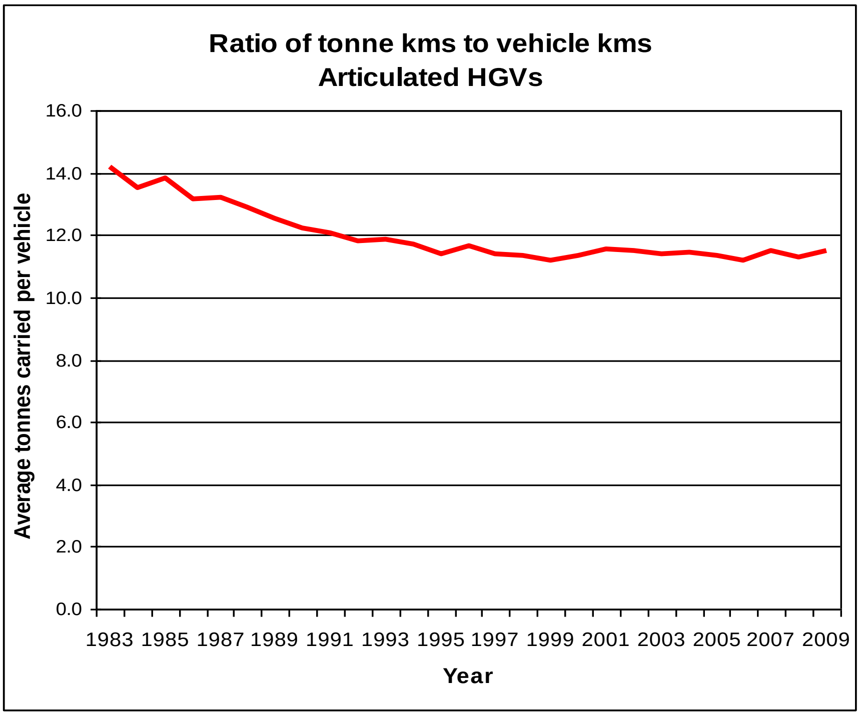
The rapid uptake of the maximum sized vehicles is very clear. In 1999, weights were increased to 40 tonnes, although it should be noted that in many cases 40 tonners were capable of carrying 44 tonnes. Thus the move was simply a matter of replating the vehicle[20]. This does not affect the trend in the chart. Most of the switch occurs in the first five years.

19 For example see *Longer heavier vehicle impacts,* MTRU, November 2010

20 Registering at a higher gross permitted weight

Moving to the maxima has two effects. Initially the earliest adopters are the most likely to make best use of the increases. This is followed by a rapid uptake by those who wish to compete or maintain interoperability, and for whom there may be losses exceeding gains. The end result is no increase in average weight carried, as shown below.

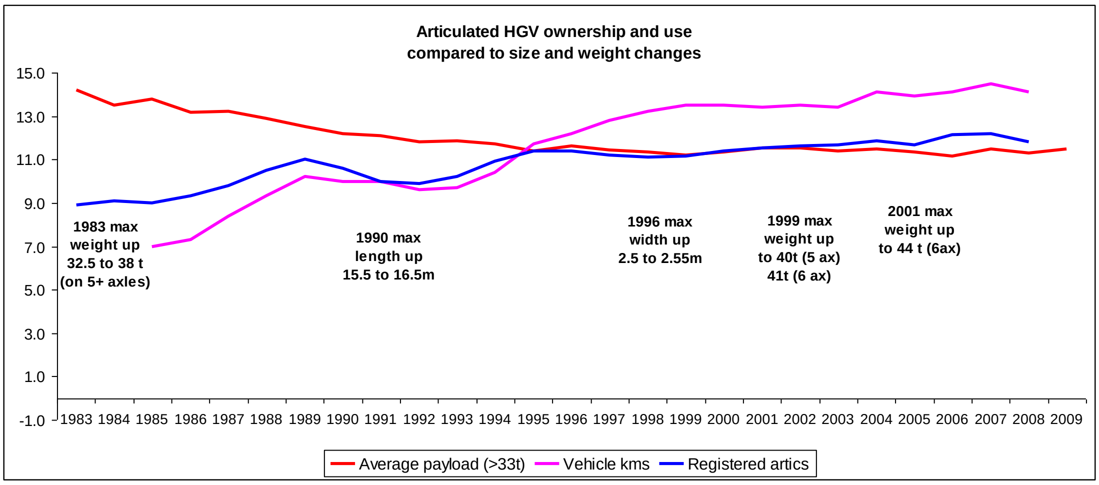
Chart 4



Source: CSRGT 1990, 1995, 2006 and Road Freight Statistics 2009

However, the overall picture is that, despite strong claims made for the increases in weight limits in 1983, 1999 and 2001 there is no overall progress in improving the average weight carried per vehicle. This is summarised in the chart below.

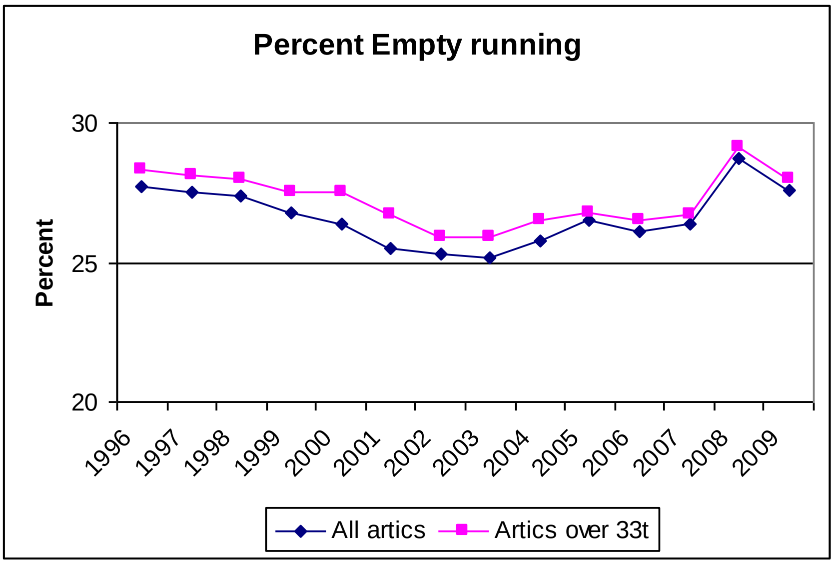
Chart 5



Source: CSRGT 1995, 2005 and 2006, Road Freight Statistics 2009

In addition, many vehicles run completely empty, and no progress has been in this regard either (see chart below). It is hard to see why permitting longer trailers will address any of these fundamental problems in terms of road freight efficiency and consequent environmental impact.

Chart 6



Source: CSRGT 2006 and Road Freight Statistics 2009

Less rail use augments LST benefits

Another unusual feature of the IA is that the total benefits to industry are calculated in a way which assumes that lower rail use is an important part of the benefits of introducing LSTs. This counter intuitive finding is not insignificant, and deserves further analysis.

The DfT central case is built on the prediction that road operators will increase their share of goods traffic as a result of introducing LSTs. This will increase LST vehicle kilometres and thus total national road freight costs, and there will be significant increased external costs, including carbon and congestion.

However, it is also assumed that by losing mode share, total national rail freight costs will be reduced, as will rail external costs. The way in which this works depends on the balance between costs and there are some assumptions which may not reflect the realities of freight transport.

For example, between 27% and 32% of the net environmental benefits of introducing LSTs are assumed to be gained by running fewer freight trains. Thus if trains were electrified or became quieter, the benefits of not running them would fall and so would the benefits of LSTs. It is not at all clear that the IA and other consultative documents have understood this somewhat odd situation.

This is mirrored by the way in which rail freight costs are saved. It is assumed that road freight will capture some freight that would have gone by rail, and thus fewer train kilometres are run. This reduces overall industry costs and this represents a high share of the total predicted savings from introducing LSTs. Taking the average of the most popular LST options, 4 to 6, 27% of the industry operational savings in 2015 are lower rail costs. In 2020 this has risen to 53% of savings and by the end of the assessment period, 2025, this has risen to 84%. This makes the whole assessment very sensitive to the way that less rail traffic translates into fewer train kilometres. It is surprising that this is not identified clearly in the main text as a key issue.

Different tables in the IA have to be combined to see this effect, and this has been done to produce the following table.

Table 5

			Change in Annual Costs (£m)		
			2015	2020	2025
Option			**ROAD**		
1	14.6m Fixed Axles		-£9	£56	£126
2	14.6m Single Self-steer Axle		-£116	-£57	£7
3	14.6m Active Steering		-£73	-£14	£51
4	15.65m 2 x Self-steer Axles		-£277	-£173	-£60
5	15.65m 1 x Command-steer Axle		-£282	-£178	-£65
6	15.65m 2 x Command-steer Axles		-£254	-£150	-£36
7	15.65m Active Steering		-£222	-£117	-£3
Option			**RAIL**		
1	14.6m Fixed Axles		-£57	-£106	-£158
2	14.6m Single Self-steer Axle		-£57	-£106	-£158
3	14.6m Active Steering		-£57	-£106	-£158
4	15.65m 2 x Self-steer Axles		-£102	-£191	-£284
5	15.65m 1 x Command-steer Axle		-£102	-£191	-£284
6	15.65m 2 x Command-steer Axles		-£102	-£191	-£284
7	15.65m Active Steering		-£102	-£191	-£284
Option			**COMBINED**		
1	14.6m Fixed Axles		-£66	-£51	-£32
2	14.6m Single Self-steer Axle		-£173	-£163	-£151
3	14.6m Active Steering		-£130	-£120	-£107
4	15.65m 2 x Self-steer Axles		-£379	-£364	-£344
5	15.65m 1 x Command-steer Axle		-£384	-£369	-£349
6	15.65m 2 x Command-steer Axles		-£356	-£341	-£320
7	15.65m Active Steering		-£324	-£308	-£287

Source: Impact Assessment Tables 8, 9 and 10

This is paralleled by environmental benefits, and in this case there is the added paradox that, if freight locos were to be electrified and trains overall become quieter, the environmental benefits of LSTs would become lower.

Overall it appears that, even assuming that the lower share of freight transport reduces rail costs in the way assumed, a more realistic picture of the likely impact is that external costs would rise significantly, and that total industry benefits would fall significantly. Omitting even 50% of the rail cost savings would mean an overall social disbenefit.

5 Conclusions

In terms of safety, there are considerable uncertainties, but the IA appears to seriously underestimate the increased accident risks, by

1 assuming that very few accidents involving articulated HGVs (15%) are in any way influenced by length

2 comparing LSTs with the best safety features, and existing trailers without such safety features, (although new trailers at the same length could incorporate them and would benefit).

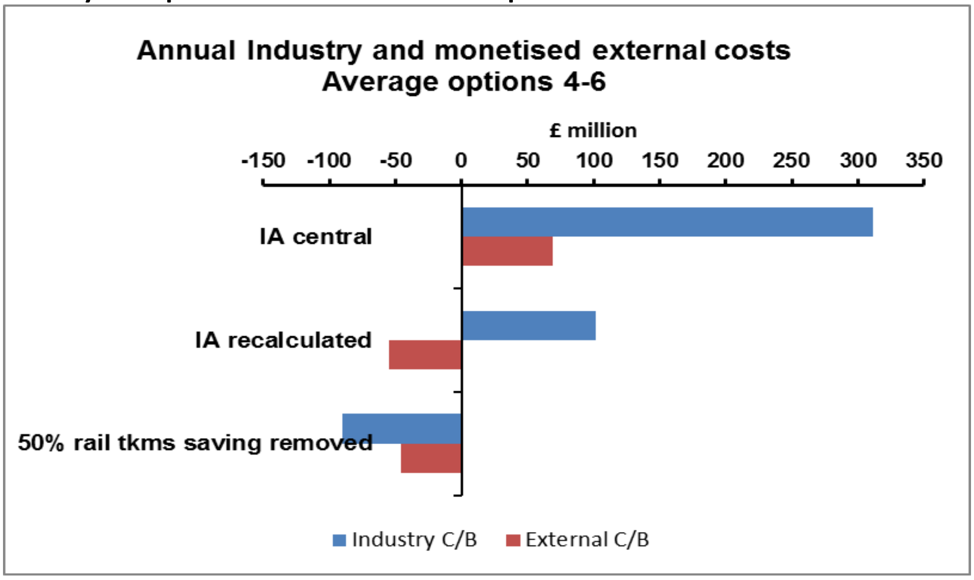
A sensitivity test, however, is suggested in this report increasing accidents in proportion to one third of the extra length.

However, several elements have been identified which can be used to create a new impact assessment. These are:

- Allowance for generated HGV kilometres using generally accepted elasticity
- Adjustment of congestion effect from 1/3 to 2/3 of increase in length
- Estimate of the cost of premature retirement of existing trailers
- Test of sensitivity to lower fall in rail train kilometres than predicted

The results are summarised and compared to the original IA in the chart below.

Chart 6 Summary of impacts under different assumptions



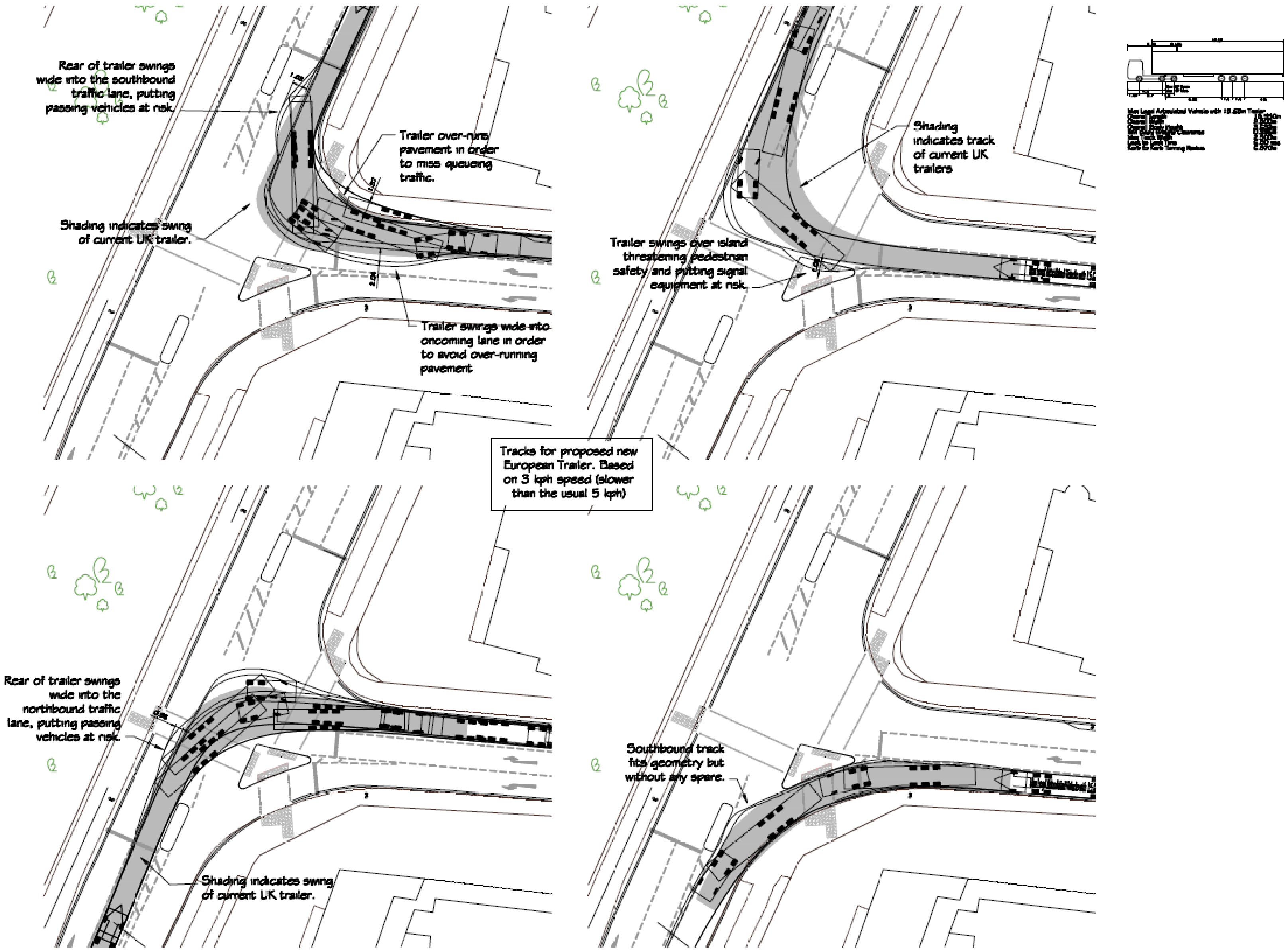
In addition the following have been not been included in any analysis due to lack of data:

- Environmental costs associated with length, such as intimidation, severence and visual intrusion (including landscape)
- Costs to drivers for example from intimidation and anxiety, similar to those in other transport appraisals such as journey ambience
- Lowering the benefits of LSTs where load factors by volume are already low
- Underutilisation of LSTs due to them becoming the standard vehicle.

This confirms the view that there are better ways of achieving the Government objectives in relation to the impact of heavy articulated vehicles, and that the LST proposal could actually be counter productive.

Annex A
Technical drawing
Swept path from 18.55m articulated HGV

Supplied by: Alasdair Massie CEng MIStructE


Rear of trailer swings wide into the southbound traffic lane, putting passing vehicles at risk.
Trailer over-runs pavement in order to miss queueing traffic.
Shading indicates swing of current UK trailer.
Trailer swings wide into oncoming lane in order to avoid over-running pavement
Shading indicates track of current UK trailers
Trailer swings over island threatening pedestrian safety and putting signal equipment at risk.
Tracks for proposed new European Trailer. Based on 3 kph speed (slower than the usual 5 kph)
Rear of trailer swings wide into the northbound traffic lane, putting passing vehicles at risk.
Shading indicates swing of current UK trailer.
Southbound track fits geometry but without any spare.

Annex B

MTRU Freight Information Note, November 2009

Why are freight elasticities so problematic?

This short note sets out the problems in relation to understanding freight elasticities but also the demanding nature of the modelling involved. In the latter case, there is a serious lack of data. A good example is the range and nature of the land use/logisitics/supplier choice reactions for different freight commodities.

1 Different measures of freight activity

The first issue relates to the differences in elasticities between tonnes, tonne kilometres and vehicle kilometres. While data is limited, several studies report a progressive increase in overall elasticity for these three. This can be explained by considering the number of responses possible.

Tonnes

For a consumer or producer of goods, the choice of not consuming or producing them is extreme and unlikely. Thus the total demand is inelastic, although demand by mode may vary. For example, goods being carried today by one mode may have another mode available which is currently more expensive or less convenient. This relative attractiveness can be altered by changes in price or convenience, including availability of a new loading point such as a wharf, rail siding or a road link.

Tonne kilometres

In addition to this effect, consumers of goods often have a choice of supplier. This extends to a broad range of finished goods and raw materials and applies at local, national and European wide levels. Producers have an equivalent market area for supplying their products. For many commodity types this choice is likely to be very sensitive to transport cost. Since tonne kilometres is simply the tonnes supplied X distance travelled, the latter is an additional sensitivity to be added to mode transfer.

Vehicle kilometres

The final measure of activity is the traffic from the goods vehicles themselves. The relative importance of achieving high load factors, and avoiding empty running (in particular returning to depot or next task after the main delivery), will change according to price. This can happen without changing tonne kilometres, although is most likely in association with such changes.

Table 1 Summary of underlying freight elasticity factors

Tonnes	Tonne kilometres	Vehicle kilometres
Mode transfer	Mode transfer	Mode transfer
	Length of haul	Length of haul
		Change in load factors

Notes:
Length of haul includes choice of closer supplier, changes in depot location etc.
Change in load factors includes more return loads, less empty running, double decking etc.

2 Alternative modes

There are two basic elements at work in choice of mode. The first is the availability and convenience, the second is comparative cost (including handling). There is probably some evidence for estimating cross elasticities for rail and water, although not for all commodity types.

In relation to the first, availability is affected by existing networks and access points, but also by the opportunity to locate freight generating activities close to an access point, whether motorway, rail or water. Here there will be a strong difference between short term elasticities, where locations are fixed, and long term elasticities, where they can be changed. It is important to distinguish between the location of businesses and the location of holding depots and warehouses which are part of the distribution chain. The latter are relatively low cost in terms of building and land and subject to change faster than the location of manufacturers and producers.

As regards cost, the main haul cost is only part of the picture for non-road modes. If rail or water links are not direct to depot, port or factory, the cost of mode transfer needs to be included. Of course there is also the option of swap body or "piggy back" operation (particularly in the case of rail) and the use of containers has tended to reduce this cost over time. As goods vehicles have got larger and heavier, the issue of whether the assumption that they can access every site has become more important. This tends to result in local environmental objections but is rarely addressed at the level of "which road vehicles should be allowed on which part of the road network?".

For example, should we be considering heavy goods vehicles on motorways as one trunk network, rail as another and water as another, all requiring transhipment onto the local road network?

3 Commodities

Another area of complexity for freight transport is the differences between the commodities carried. Again, differences between studies are often explained by which commodity has been studied. Even in this case it is difficult to make general rules, for example there may be alternative sources for very bulky, low cost raw materials as well as high value finished products.

In future, some current sources for raw material may scale down or close, because low cost transport makes them uncompetitive, and some may reopen or expand if transport costs rise. This is equally the case for production. An example is that US steel production is strongly related to the cost of shipping steel from China and India.

For this reason, an overall elasticity conceals a variety of sensitivities to price.

This is compounded by the fact that understanding the freight market is just as complex for transport planners as passenger travel, if not more so, but there is less data available. There is often a lot of basic information for commuting, business travel, shopping, etc. In goods transport, data at the company level is often commercially sensitive, and difficult to obtain.

4 Distance and handling costs

Distance travelled by goods has several dimensions. For some internal EU traffic, and all traffic with an origin or destination outside the EU, the choice of port (and airport) is a variable which needs to be considered. The UK is particularly sensitive in this regard, and some work on the UK freight transport model for DfT has been undertaken which shows this effect to be strong. This will, of course, vary by country but will be relevant because the choice of port is now EU wide. The comparative cost of long distance maritime and inland freight transport is the key factor.

Apart from point of entry, elasticities are often held to be low for short distance and higher for long distances. This is in itself misleading because short distances can become longer in response to falling cost, and long distances can become shorter if costs rise.

In addition, the number of times goods are handled is important because this is separate from trunk haul costs. This is very flexible in the case of some commodities with a complex distribution chain, less so with simple point to point flows. It should be noted that direct access for any one mode, such as a rail siding, is very important in this regard. For example short haul bulk materials may be very suitable for rail if one or both ends have direct links. Examples can be found in the aggregates, quarry and coal sectors.

The final issue is what length should be counted as short, medium and long. Most regional flows, for example, are shorter than a few hundred kilometres, yet they have been affected strongly by changes in HGV transport costs.

5 Modelling

This leads into a brief discussion on the use of modelling, in this instance at the EU wide level. Rather than use a general demand elasticity, a model can reflect changes in costs on a network and feed these back into changes in patterns of goods transport. Behavioural responses can still be reflected in a price elasticity, but the model can enable the consequences of first order effects to be counted and arrive at a more accurate representation of the future once these effects have been through the system for several iterations. Predictions for choice of destination are often undertaken using a logit or gravity model.

However, the requirements of such a full network model are very high. One which is at too coarse a level will be no better (and may be worse) than using a non-network elasticity based model. The latter may be easier to use and thus offer more capacity to answer "what if" questions and to undertake a larger number of sensitivity tests. Given the uncertainties described above, range estimates under different assumptions will be essential to reduce risk.

Overall, a model should have the following structural elements.

i) Network and origin/destination elements

The model should have sufficient detail in the following terms:

- **Model Network** – to allow for the full effects over all distances and to distinguish between where HGVs and LHVs can and cannot go.
- **Model Zones** sufficiently small to capture the differences of choice of origins and destination and locations on the detailed network.
- **Land Use data** sufficient to capture of all alternative sources of supply.

ii) *Behavioural choice model*

The model structure must contain a variable demand model which allows for:

- Induced traffic,
- Traffic redistribution (change in choice of destination),
- Vehicle loadings (by different size of goods vehicle), and
- Mode split.

Clearly the creation of a new category of larger, heavier goods vehicles will impact on the performance of the other categories which they replace. An example is the way in which the full loads on the next category down will transfer up, thus reducing the potential for full loads in that category.

6 Conclusions

Much of the above summary is touched on in existing work, for example the TML, JCR and previous MTRU reports.

Vehicle kilometres is the output which is key for the environmental, safety and greenhouse gas impacts, however, it is the most complex category in terms of possible and likely responses.

In these circumstances, data quantity and quality issues will be key to understanding the level of certainty for any future predictions.

This suggests that a wide range of elasticities should be used, given that data will not be sufficient to supply answers for all factors in all commodity groups.

In relation to cost impacts, we do have some data from the German Maut and other tolls which suggests a strong effect. According to Toll Collect, between 2005 and 2007, empty running fell by 11%, loaded runs increased by 2%, and rail freight increased by 7%.

The use of modelling has to be approached with extreme care, in particular a model which is useful for broad brush assessments in relation to passenger travel will have to undergo substantial change if it is to produce meaningful results even at the national level.

It must be remembered that all the safety and environmental impacts depend on the traffic changes by vehicle type. The risk of actions causing overall disbenefits must be properly assessed for policymaking purposes.