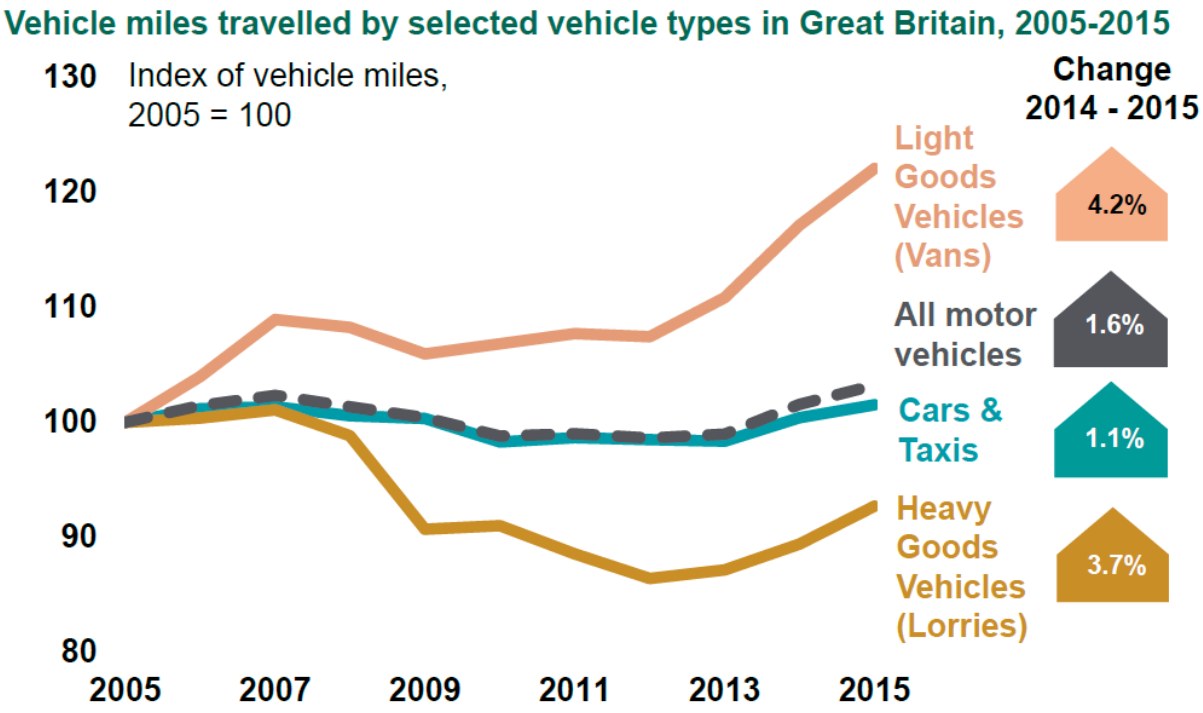
DEMAND IN THE LONGER TERM

Introduction

This Supporting Document provides further information to support the discussion on long term demand forecasting in the main Study Report (Section 7.4, Chapter 7) in two areas: first, it gives more background to the greater uncertainty around trends in personal travel demand by car and the implications for forecasting; and second it sets out some issues and challenges in the forecasting of road freight traffic which are only briefly mentioned in the Study Report.

Understanding and forecasting personal travel demand by car

Flatlining of trends in overall car mileage in Great Britain over the last fifteen years is a well known but less well understood phenomenon; this chart shows how over the last ten years this matches the trend in all vehicle traffic, with lower HGV volumes offset by higher light van mileage. Growth in aggregate vehicle mileage has however started to pick up since 2012/13.



Source: Road Traffic Estimates 2015, Department for Transport, 2016

To help understand these trends in car travel, the last decade has seen considerable research by academics and research bodies (such as the RAC Foundation), and more recently by DfT itself. Some have picked up concerns and issues raised over many previous years by commentators such as Phil Goodwin and David Metz about the 'peak

car' phenomenon[1]. Extensive research into social, demographic, income, motoring cost, driving licence holding and many other trends (including differential effects between population segments, and localities) which affect car ownership and travel behaviours have led to findings of substantial changes and new trends in many of these elements. They typically fall between the cracks of macro travel demand forecasting models, and demand a more disaggregated approach.

Their effects on the quantity and length of trips and the choices of travel mode are now better understood, although there remains considerable uncertainty about the nature and quantum of these effects into the future. .

Documents published by DfT in late 2014/early 2015 supporting the first Road Investment Strategy for the Strategic Road Network[2] included a comprehensive review of traffic trends and forecasts, working from the National Transport Model and the Road Traffic Forecasts 2015[3]. The Strategic Vision[4] *inter alia* discussed these trends and how they have affected road demand, drawing on recent research and the DfT's own more detailed analysis with some assessment of the effects on future traffic levels on the SRN, using a number of different scenarios

A report analysing trends and their influences in more depth, drawing extensively on recent research, was commissioned by DfT from RAND Europe and published in early 2015[5]. Generally, the DfT reports bring together much of the understanding developed initially by Scott Levine and Peter Jones (and subsequently by others on related topics) in a sequence of research originally commissioned by the RAC Foundation, the Independent Transport Commission and others[6], together with other work (some overseas) in this area.

Considerable new light has been cast on a number of trends which drive travel behaviours, though some are understood rather more thoroughly than others.

- Significant and growing differences as between London, other Metropolitan Areas and the rest of the country in car ownership and car use, reflecting densification of development in London, much improved public transport and other factors such as the effects of traffic congestion and residential on-street parking problems
- Changes in the patterns of driving licence holding and in car ownership among young adults, especially men; and the significant fall in employment and in incomes among this group

[1] See for example *Peak Car – where did the idea come from?* P Goodwin, CTS Winter Conference, Centre for Transport and Society, University of the West of England, 2012.
[2] *Road Investment Strategy* series of documents, Department for Transport, December 2014
[3] *Road Traffic Forecasts 2015,* Department for Transport, March 2015
[4] *Road Investment Strategy Strategic Vision*, Department for Transport, December 2014
[5] *Understanding the drivers of road travel: current trends in and factors behind roads use*, Department for Transport, January 2015
[6] *Keeping the Nation Moving,* RAC Foundation, November 2011

- The effects and subsequent consequences of the recession since 2008 (including changes in income distribution) on travel and on car ownership
- Changes in the costs of car ownership and use, including fuel costs
- Increases in car ownership and use among women and older people
- Collapse in the ownership/use of company cars (due to taxation changes), and the consequences for car travel volumes
- The sustained and significant growth of rail travel over the last 15 years, and the growth of walking and cycling in urban areas
- The nature and consequences of population growth, and the implications of the increased proportions of migrants on travel behaviours, especially in London and other large cities, coupled with uncertainty about where the additional people and jobs will locate,

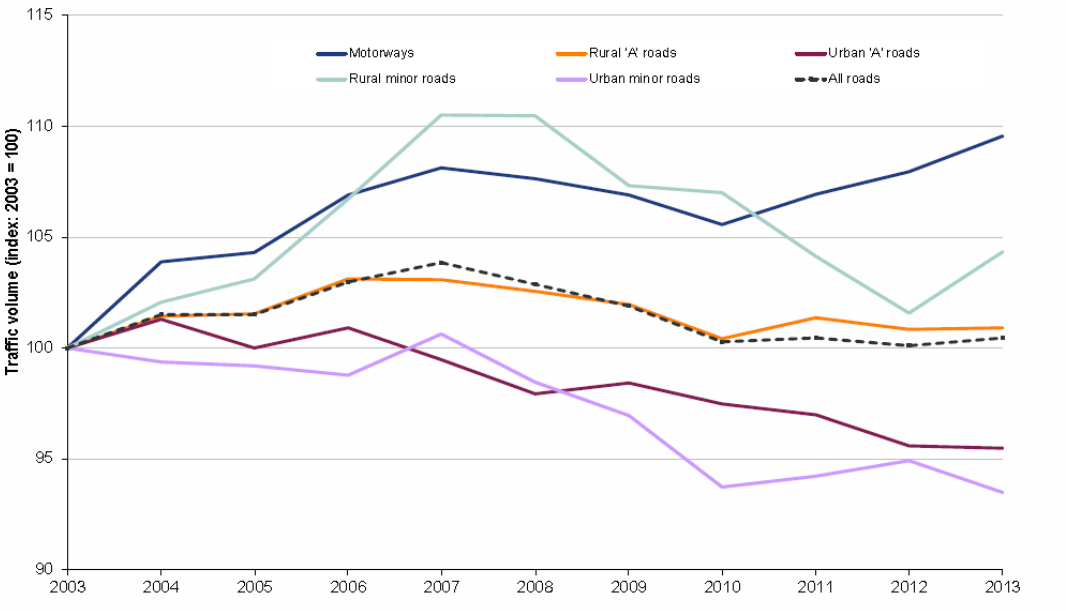
More speculative, not fully understood and without clear evidence as to the effect on tripmaking, are the potential changes in travel propensity brought about by technology. Briefly referenced in Supporting Document 10: Opportunities and Challenges of Technology, these include

- possible longer term effects of ICT on the workstyles of individuals in work, including homeworking, "one day a week working from home", and the relocation of certain types of business, with consequences for the nature and amount of commuting and business travel;
- possible effects on travel propensity of the high penetration and use of social media;
- The effects of the rapid growth of on-line shopping: it is not yet clear how far this is leading to fewer shopping trips by car, or how significant an influence it is in fast-rising van traffic, especially in urban areas

Some of these trends particularly impact short distance travel; some have more impact in the larger urban areas; some affect commuting more than other travel purposes. All these elements introduce uncertainties into forecasting, which are reflected in the DfT's approach in their 2015 Road Traffic Forecasts. This presents a range of forecasts based on different assumptions about key underlying parameters (see the Main Report Section 7.4).

Of particular interest in making generic forecasts for the Major Road Network (as a combination of the SRN and similar mileage of more economically important local authority 'A' roads) is understandingthe factors which have been driving different rates of growth between types of road and types of area. Are the increasingly known trends in travel behaviours discussed above (together with the commercial transport decisions of firms) causing these differentials, and can the traffic forecasting models reasonably represent these effects? This chart shows the differential growth rates in traffic by type and area of road over a recent ten year period, for Great Britain.

Index of traffic volumes in Great Britain by type and area of road (2003-2013)



Source: Annual Road Traffic Estimates: Great Britain, Department for Transport, June 2014

In the main Study Report is a discussion of the range of differential forecasts from *Road Traffic Forecasts 2015*[7] by area type and road type; some concern is expressed about the range of forecasts of urban - and particularly - London traffic, given the pattern of recent years. No such concern is expressed about the range of rural area forecasts or specifically those for motorways and non-urban 'A' roads.

Longer term effects of congestion on demand

We believe little is known or understood about the longer-term response term of road users to sustained, frequently occurring and more widespread traffic congestion on the main road network, and to its consequences for journey time reliability and predictability. This is the implication of assuming that over the next 15 years and beyond traffic volumes will rise at a faster rate than (in most parts of the network) capacity can be affordable and acceptably increased, unless measures are introduced to manage demand,. With congestion sustained for several hours every day on many parts of the Major Road Network, what are the likely impacts on journey frequency, destination and mode choice, and the times and routes of travel?

Such conditions exist already on many roads – mostly in conurbations – today[8]. Those drivers who can adjust their travel times, routes or modes of travel at modest or no cost to themselves do so; the fact that so many choose to stay in the queues indicates the high value they place on making those particular journeys at those times. In the long

[7] *Road Traffic Forecasts 2015, op.cit.*

[8] There are some sections of roads and motorways through conurbations where for more than 50 hours a wee
k observed speeds are less than half the design speed; this statistic used to be reported in the annual

run if demand grows, more and more of it will be 'priced' off by the time cost to those people of making those journeys under those conditions. Those who continue to travel at those times will experience increasingly adverse travel conditions.

It is important that travel demand models – such as DfT's National Transport Model at national overview level and area-level models used by planners for specific network planning and evaluation – should be able to capture and represent these effects. On the face of it this phenomenon can be represented by iterations of the models which progressively re-estimate demand in the face of the consequential effects of network traffic volumes on travel time, reliability and cost, and we understand that the National Transport Model works this way. We have not investigated whether these mechanisms can capture the possible longer term effects of such conditions, as they might affect residential location and lifestyle decisions as well as logistical, locational and even strategic decisions by businesses.

Understanding and forecasting road freight demand

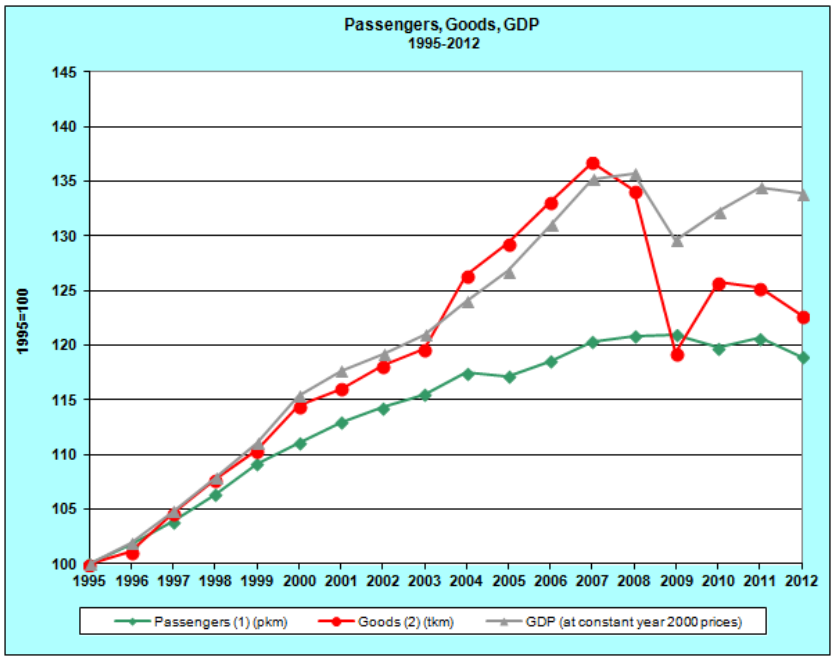
Much less effort has been put into understanding, modelling and forecasting road freight traffic than for car traffic, whether in individual urban areas or nationwide on the SRN. Yet handling commercial transport is a key aspect of the Major Road Network – understandably as that has been the basis for its definition and designation (see Chapter 3 of the main Study Report and Supporting Document 2 *Defining the MRN*). Over the MRN as a whole, commercial transport (HGVs and light vans[9]) comprise 20% of traffic on average, with 24% across the SRN; on some individual motorways and dual carriageways it is much higher than that.

Background

For many years total tonne-kms carried by HGVs has closely tracked GDP (at constant prices). While GDP fell in 2009 due to the global financial crisis, but recovered in subsequent years up to 2012, freight carried fell much more sharply, and its subsequent recovery has not been sustained. Has the link now been broken for good, or will it again track GDP, perhaps at a lower level? We do not know yet.

Chart: passenger-kms and tonne-kms by road, and GDP, 1995-2012, indexed to 1995=100

[9] In this study, Heavy Goods Vehicles (HGVs) are those over 3.5 tonnes gvw (gross vehicle weight); vehicles up to 3.5t gvw are called Light Vans. This aligns with current DfT usage, but not EU classification.



Source: authors' own compilation for GB from DfT and economic statistics

HGVs account for some 7% of all vehicle miles on the Major Road Network as defined in this study – averaging 10% on motorways, 9% on all purpose trunk roads and 4% on the local authority 'A' roads on the MRN. Proportions are higher on rural trunk and 'A' roads in comparison with urban; and the HGV intensity varies between different parts of the network and different times of the day, reaching all-day averages, for example, of over 20% on stretches of the A14 and up to 15% on parts of the M62.

The disproportionate effect that heavy goods vehicles have on traffic flows, capacity and congestion is captured by applying a factor (called a passenger car unit – PCU) to the numbers of HGVs; this represents the effect that an HGV has on traffic as that number of cars: typically a PCU of 2.5[10] is applied to HGVs for traffic modelling and planning. A 10% HGV percentage would then be deemed to have an effect equivalent to 22%, that is 10x2.5/115, of the equivalent traffic flow.

Light Vans account for some 14% of all vehicle miles on Britain's motorways and 'A' roads, with a remarkably similar proportion applying across all road types; Light Van intensity varies across routes, but much less widely that HGV intensity. For Light Vans a PCU factor of 1 is typically applied; as a result the traffic capacity implications of both heavy and light commercial vehicles is equivalent to 36% of he equivalent traffic flow, on average.

The business tasks undertaken by Light Vans cover a wide range: only a minority of vans are used for the straightforward carriage of goods from A to B. Most are engaged in providing services to commercial premises or households, or in the construction industry, as this Table shows.

[10] The DfT's Webtag advises the use of 1.9 for rigid goods vehicles and 2.9 for articulated vehicles, and the choice of 2.5 reflects an average mix slightly favouring articulated vehicles on the strategic road network.

Business Activity	Share of mileage	Share of LGV numbers
Infrastructure maintenance	10%	7%
Goods collection and delivery	20%	13%
Service provider	40%	40%
Other	17%	18%
Not specified / Not applicable	13%	23%

Source: *Van Activity Baseline Survey 2008,* Department for Transport, 2009

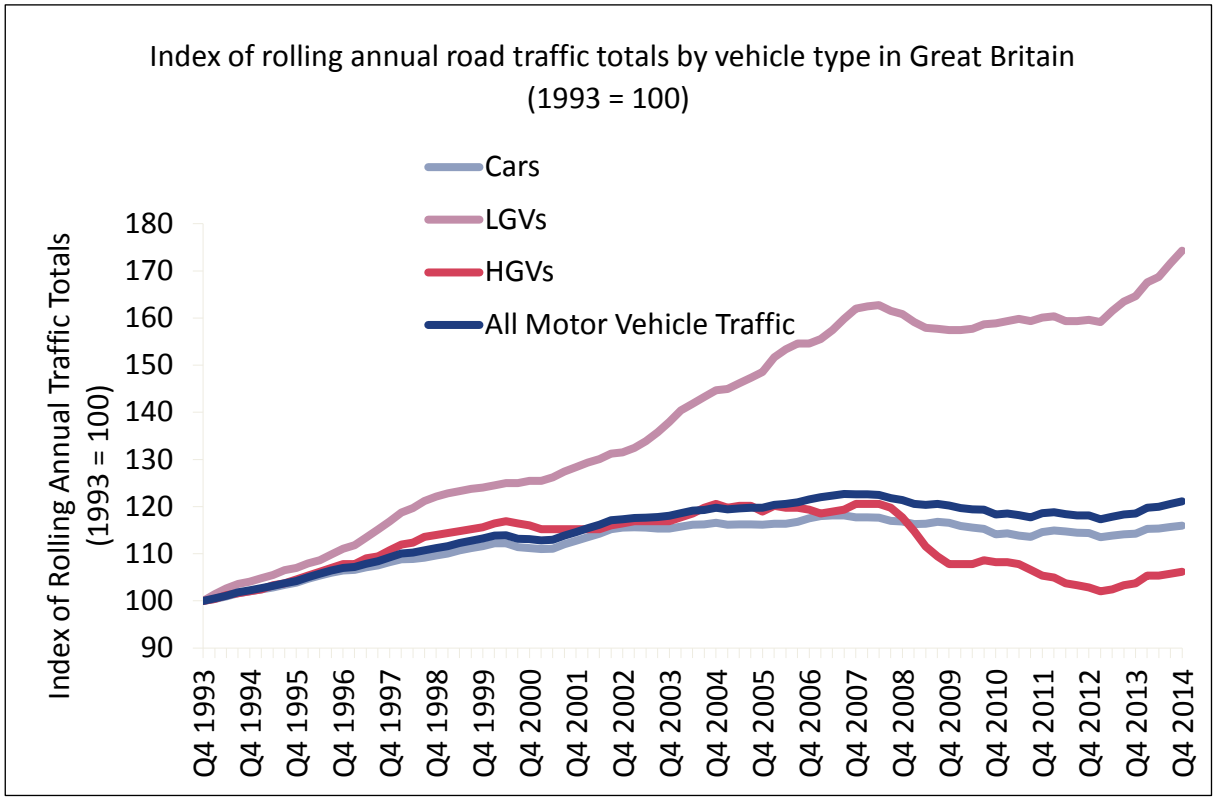
Highly significant are the very different trends in HGV and Light Van traffic over the last 15-20 years. The next chart (similar to that on page 1 above) shows first the changes in HGV traffic on all roads – particularly the slower increase from 2000 followed by rapid decline since 2007, back to the levels of the early 90's; and the steady increases in LGV (Light Van) traffic on all roads, which flattened out after 2007, and from 2012 has been rising again to a level nearly 75% above 1993. The HGV decline does not match the rising trend in tonne-kms of freight over this period, a phenomenon we believe is accounted for by

a) the change in mix of HGV capacities, with a higher proportion of maximum weight 44-tonne vehicles today, leading to an increase in average tonnes carried per vehicle

b) average tonnes carried per vehicle is likely also to have increased as a result of the increased sophistication of logistics management, increasing vehicle utilisation and the proportion of backloads

c) a degree of substitution of light van use for HGV use due to the more demanding regulatory and licensing requirements for HGV operation and use[11]. Light Van mileage has also increased (particularly within urban areas), probably affected in part by the dramatic rise in online shopping and in the consequent multi-drop delivery activity.

[11] See *Van Travel Trends in Great Britain,* Clarke, Johnson, Nankivell and Turpin (AECOM*)* for the RAC Foundation, April 2014



Source: Department for Transport, Road Traffic Statistics, chart TR2503A, 2015

The evolution of freight demand modelling and forecasting

The development of freight modelling capability has been focussed largely on the Great Britain Freight Model (GBFM), developed as an intermodal tool by the consultancy MDS Transmodal, originally in the 1990's. It has been used by them for specific consultancy assignments for a wide range of transport clients, and licensed to the Department for Transport and others for their own use. The model covers road freight carried by HGVs. The small amount of freight carried in Light Vans is not included in the model.

For many years the Britain-wide Continuing Survey of Road Goods Transport[12] has provided a rich source of data of domestic and international movements of goods by commodity, tonnage, vehicle type (UK Registered HGVs) and area/region. This has been one of the key sources of data used to provide the origin/destination data for the GBFM, and to calibrate it, over the period of evolution since its original development in the 1990's as a means of modelling cross channel flows of freight.

GBFM4 modelled flows on a multimodal basis between counties, and for road freight at postcode level. It was subject to an audit on behalf of the DfT in 2003, as a result of which a more integrated, logically structured and more stable version *GBFM5* was developed and made available from 2008. This version modelled flows by 15

[12] The CSRGT itself is not published but its data is used to compile the DfT's statistical tables about road freight.

commodity groups, by road and rail, integrating with the DfT's National Transport Model for road network representation, and successfully capturing different logistics stages in the typical supply chain. *GBFM5* also has the capability to analyse and present the mix of freight movements taking place on particular links of the road (and rail) networks.

This capability has been well illustrated in a report prepared in December 2008 by MDS Transmodal showing how the model can replicate road and rail freight flows, including the implied road vehicle movements, on the M6/West Coast Main Line corridor between the M1/M6/A14 junction and the M6/M62 junction, and the Rugby/Warrington rail corridor; it can analyse and present the composition – commodities, origins/destinations – of those traffics[13].

Later, a report prepared in September 2009[14] presented a network analysis of domestic and international road and rail freight movements on the 14 Strategic National Corridors in England (as defined at that time).

The principal capability of the GBFM is to model, first, the effects on freight traffic flows of a wide range of changes in the nature, cost and performance the road and rail networks, including the creation of rail links into major freight destinations and logistics centres; second, the impacts of (externally given) changes in origin and destination land use/floor areas, employment, and commodity mixes; and thirdly, the effects of policy changes, for example on vehicle taxation, road charges, subsidies for rail freight, etc.

However, there is no fully tested, internal capability within *GBFM5* to forecast a future O-D matrix of freight tonnages. While *GBFM5* itself has a basic capability to carry out the analysis of future domestic freight tonnage as a function of external economic, commodity/sector, productivity and land use factors, it has not been thoroughly tested or validated, and it cannot be relied on at this stage to generate a future O-D matrix. Instead, there has to be an externally generated forecast of growth in domestic tonnages by commodity/sector, which is used to scale the baseline O-D matrix. If relevant economic, land use and spatial changes can be forecast separately, these too can be incorporated. The model will then show how the resulting demand spreads across the road and rail networks. Forecasts of international freight traffic to and from Britain are available from authoritative global sources, and provided as external input to the model alongside the domestic forecasts.

Meanwhile, *GBFM5* has been utilised by the model owners MDS Transmodal since 2010, to assist with a range of project and policy evaluations for Network Rail and for the then Highways Agency, as well as other organisations, but in these cases the lack of an internal future forecasting capability has not been seen to be critical.

[13] *Network Analysis of Freight Traffic - Final*, MDS Transmodal and Mott Macdonald for the Department for Transport, December 2008

[14] *Network Analysis of Freight Traffic – Final (second report),* MDS Transmodal for the Department for Transport, September 2009

Commercial Vehicle Demand Forecasting in the National Transport Model and the Road Traffic Forecasts 2015

This model approach has been used for handling the freight forecasting content of the National Transport Model and the Road Traffic Forecasts 2015[15]. A number of assumptions have been made – about the scaling of the matrix of freight tonnage origins and destinations, and about land use and the spatial distribution of freight generators - to arrive at reasonable high-level forecasts of domestic tonnages. A different method has been used for estimating internatonal freight movements (ie imports into and exports from the UK).

With this approach, overall freight tonnage within Great Britain is forecast to grow by 22% from 2010 to 2040. The GBFM then allocates these tonnages between road and rail, and converts the road forecasts to HGV traffic volumes, using assumptions about average capacities and utilisation efficiencies of HGVs which are unchanged from the initial calibration of the model. While *GBFM5* can give reasonably good network-level analysis of flows and the composition of freight traffic, the NTM does not, as with forecasts of personal travel, give traffic forecasts at link, route or even corridor level.

Light Vans are handled entirely outside the GBFM model, and any freight they carry is not included in the tonnage forecasts above (although likely to be modest, there is no accounting for possible transfer of tonnage from HGV to light vans). Forecasts of Light Van traffic for the NTM are based on a simple model which extrapolates current network flows (traffic counts) on an area basis, based on elasticities with respect to fuel cost, population and GDP per capita for those areas, derived from analysis of a 2003 van survey. This method does not reflect any behavioural understanding of the historic high rates of growth; given that vans continue to be the fastest growing element in forecast traffic flows, this does deserve further attention.

The result of all this is that in the Road Traffic Forecast 2015 the 'central' forecast for HGV growth is 22% between 2010 and 2040 on all roads (with a range of 1% to 58% representing *low GDP/high oil price* and *high GDP/low oil price* scenarios respectively). In contrast, the 'central' forecast for Light Van growth is 79% (with a range of 42% to 115% representing the same GDP/oil price scenarios).

Trends and drivers of freight demand

We have not seen much general analysis or consideration of the current and future drivers of freight and other commercial vehicle demand, although individual issues (such as the arrival of multi-channel retailing) have received some attention in the literature. Without this background assessment, we can at this stage only speculate on

[15] *Road Traffic Forecasts 2015*, Department for Transport, March 2015

some of the factors that may be at work, in addition to general economic activity (as measured by GDP), to influence future forecasts of HGVs and light vans.

a) A consequence of the way technology is transforming retail, through the rapid growth of on-line shopping and the adoption by major retail chains of a multi-channel approach, would be to reinforce the current growth in van traffic. One might expect this to manifest most in urban areas, but the traffic statistics show modest growth in urban areas of 10% compared with 20% on motorways and rural A roads between 2006 and 2014[16]. How much further scope is there for transformational changes in the pattern of retailing, and what effects will they have on local transport in urban areas – or interurban traffic?

b) How significant is the substitution of light vans for HGVs for some traffics, due to the more onerous regulatory and licensing regime for HGVs, and how might this develop?

d) It is probable that the effect of ICT-based techniques, and the continuous competitive pressures to improving the costs, efficiency and responsiveness of supply chains (as well as responding to driver shortages and environmental concerns), continues to improve HGV and driver utilisation, as well as increasing the proportion of maximum size/weight HGVs, and fuller use of the 24 hour 7 day week. A continuation of slow but steady increases in average tonnage lifted per vehicle will partly decouple HGV increases from tonnage growth.

e) Given the relative forecasts of GDP growth in the manufacturing and services sectors used by DfT, the shift from manufacturing to service industries in the GB economy seems set to continue. This would suggest that the tonnage balance between imported and domestically produced goods has not yet reached an equilibrium, and it is likely that rising GDP, leading to relatively more consumption, will continue to suck in a disproportionate increase in imports. 'First stage' movements of international tonnage tend to dominate on certain corridors (particularly A14, A12, A13, M25/M20/M26, A34) because of where many national distribution centres are located in relation to the main port clusters (Haven Ports, Thames Estuary, Southampton). Understanding this will help identify where disproportionate tonnage growth may be experienced in the future if international movements increase proportionately.

f) There is some scope for growth of rail at the expense of road: tests with the GBFM demonstrate the commodities for which an increasingly reliable rail freight offer (and the presence of rail links to major logistics centres) may

[16] Table TRA0104 *Traffic by road class and vehicle type annually from 2006,* Roads and Traffic Statistical Tables, Department for Transport, 2015

lead to some higher growth in rail freight, in sectors such as FMCG and food and drink, and in certain high volume corridors.

The wish in some large urban areas to manage more tightly freight and van movements, due to concerns about emissions, noise and congestion, makes it important to understand better the range and diversity of factors driving the demand for these movements, and how the emergence of policies to address these concerns may affect the use of the Major Road Network.

Light Vans

Transport planners and modellers have for many years despaired of trying to comprehend and model the quantity and movement of vans and other light commercial vehicles – the fastest growing vehicle type on the road in the last 15-20 years. As already noted above, among the very wide range of functions carried out by vans are supporting construction, servicing existing premises and servicing utility networks (including carrying tools, equipment and materials, and in some cases acting as a mobile workshop). Perhaps the fastest growing function is in the delivery and fulfilment of retail goods bought on line – facilitated by ICT and advances in sophisticated multi-channel logistics. Some van use is for personal travel, but a study commissioned by the Independent Transport Commission found that the wide range of types of journeys being made by van drivers are mostly not being captured by the National Travel Survey (which focuses on home-based personal travel)[17]. The most comprehensive overview and analysis of light vans – and the most recent – is the report by AECOM for the RAC Foundation Report on Van Travel Trends[18].

This all matters because as we have seen vans account for by far the fastest growing share of road traffic in the last 25 years; and the RTF forecasts (albeit using simplistic methods) forecast a nearly 80% growth over the next 25 years.

There is a relationship between van vehicle-mileage and GDP but the diverse mix of purposes together with structural changes in, for example, retailing mean that there are other important drivers of volume of van movements which are not generally understood. And there may be other influences at work: anecdotally there are suggestions that the overheated housing market in London and some other cities has driven tradesmen to relocate outside these cities, forcing additional van mileage to reach their places of work (and there is no opportunity for such journeys to change modes to public transport). Overall, however, the traffic statistics show that the largest

[17] *Van Travel in Great Britain: what do we know from the National Travel Survey?* Independent Transport Commission, October 2013.
[18] *Van Travel Trends in Great Britain,* Clarke, Johnson, Nankivell and Turpin (AECOM*)* for the RAC Foundation, April 2014

growth has been in the number of vans registered (46% increase since 2000) rather than in van traffic (39% increase)[19].

Summary

Freight vehicles and vans are significant components of road traffic on the SRN and on the more 'strategic' local A roads, with their intensity higher in particular corridors and particular times of day. HGVs have shown very different trends in vehicle miles in the last 15 or so years compared with Light Vans – the former declining by some 10% while the latter has grown by well over 30%.

Development of the Great Britain Freight Model (GBFM) version 5 has enabled the effective modelling of freight flows by road and rail across both networks, and by commodity and location. At the right level of operation the GBFM is a powerful tool for exploring the short term effect of changes in land use and economic activity, changes in networks and charges, and the effects of policy changes affecting both demand for and costs of road and rail freight services. As already stated, the model covers road freight carried by HGVs; the small amount of freight carried by Light Vans is not included in the model.

Significantly, the GBFM has no tested and validated internal capability to forecast the effect on tonnage (and the geography of its movement by commodity group) of *future* changes in external factors – economic growth, employment, land use, productivity, population. These have to be determined outside the model and provided as inputs to the GBFM in the form of O-D matrices of tonnage by commodity group. Forecasting future freight demand therefore requires a view to be taken outside the model on how these factors will impact the tonnage volumes of freight demand, as well as interpreting the effects of other exogenous trends which may disrupt current supply chains and bring about transformational impacts on demand.

Light Van forecasting is scaled on an area basis using elasticities with respect to population, GDP/capita, and oil prices, estimated from a 2003 comprehensive Van Survey. Given the high forecast for 2040, and the significance of light van traffic already, we believe that this deserves further research and investigation, with a view to comprehending the drivers of Light Van traffic rather more than we do today.

Given the importance of HGV and Light Van traffic on the Major Road Network, and the SRN in particular, and the rapid growth of van traffic, there is a strong and urgent case first for more development of freight modelling capability, and second for more research to understand the evolution of the Light Van market and to model its behaviour.

[19] VEH0101 *Licensed vehicles by body type, Great Britain, annually from 1994,* Licensed Vehicles Statistics Tables, Department for Transport, 2015; TRA0101 *Road Traffic by vehicle type, Great Britain*, Roads and Traffic Statistical Tables, Department for Transport, 2015