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Funding roads

Reducing inefficiency and securing investment in roads for future generations

October 2013

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Contents

Background

Roads continue to be the backbone of the UK economy, with most journeys either taking place entirely on the network or using it to access another form of transport.

According to the 2013-14 World Economic Forum Global Competitiveness Index the UK is ranked 28th out of 148 countries for the quality of its road infrastructure which places it just below Chile and Belgium and significantly behind Germany (11th) Portugal (4th) and France (2nd).

This suggests that the UK is falling behind, and that it needs to step up its investment programme into the road network to ensure that it entices investment into the UK.

Government has taken some steps towards improving road investment and maintenance, recognising the importance it plays to the UK economy. The Chief Secretary to the Treasury Danny Alexander MP, as part of his announcement of the 'Investing in Britain's future' report, outlined the greatest investment in our roads since the 1970s.

He announced that the government will invest over £28bn over the 6 years from 2014 in enhancements and maintenance of national and local roads. The government committed £10bn of investment in road repairs between 2015-16 and 2020-21, with £4bn to be spent on national roads and £6bn on local roads. This will be enough to resurface 21,000 miles of road and fill 19m pot holes a year.

However, despite this, government estimates that by 2040 the number of hours each household will spend in traffic[1] each year could reach 70 hours. This compares to data for 2013 that shows that the number of hours spent in traffic is approximately 29 hours annually.

Such an increase in traffic and congestion would act as a significant deterrent to investment for businesses going forward. The UK should be aiming to improve its road network, reducing inefficiency not simply mitigating a rise over time.

It is therefore important that government explores new models of road investment which reforms funding, financing, ownership, taxation, risk and accounts for technological and behavioural change.

Abstract

This report takes a macroeconomic approach to explore the potential inefficiency and loss of economic productivity as a result of the current condition of the road network.

This report considers a number of inefficiencies as part of this loss, with a total annual inefficiency of £12.2bn across England's entire road network.

One of the concerns emphasised in this report is that this annual inefficiency adds up quickly over time, and given recent Government estimates that the number of hours each household will spend in traffic by 2040 will rise to 70 hours, with inefficiency on a path to reaching £27bn annually.

The government should be aiming to reduce inefficiency in the network, not mitigate a rise. As such this paper suggests two models which move the government and policy making towards stable investment mechanisms to ensure that the road network receives the maintenance and investment it requires.

These models are underpinned by the principle of a long term asset management approach to both the local and strategic network and they consider the risks that the private and public sector are able to bear under each scenario.

Executive summary

According to the 2013-14 World Economic Forum Global Competitiveness Index the UK is ranked 28th out of 148 countries for the quality of its road infrastructure.

The government's recent 'Action for Roads, a network for the 21st century' report[2] outlined a number of challenges, such as population growth and the rationale as to why action is needed on investment in road infrastructure.

By 2040 the time spent sitting in traffic on the strategic road network is forecast to increase, not decrease, suggesting a deterioration in road conditions and an increase in economic inefficiency if nothing is done to address road financing and funding.

Government has taken steps towards improving road investment; the Chief Secretary to the Treasury Danny Alexander MP, as part of his announcement of the 'Investing in Britain's future' report, outlined the greatest investment in our roads since the 1970s. The government will invest over £28bn over the 6 years from 2014 in enhancements and maintenance of national and local roads.

To understand how an improved model for road investment is likely to evolve going forward, it is of vital importance to analyse the current income and expenditure generated by road related activities.

Motoring taxation is made up of two elements: vehicle excise duty (VED) which is a tax on the ownership of a vehicle and is paid annually; and fuel duty, which is paid as an individual uses a car through petrol consumption.

Transport statistics for 2011-12[3] reveal that the government collected £5.9bn in VED and £26.8bn in fuel duty, equating to over £32bn in collected road taxes. However, expenditure on roads is only about a third of this at approximately £9bn per annum.

Road inefficiency

This report considers a number of inefficiencies as part of this loss, with a total inefficiency of £12.2bn across England's entire road network. This inefficiency consists of the following:

- Cost of road inefficiency due to vehicle repairs, approximately £397m.
- Inefficiency of reactive maintenance, approximately £114m.
- Inefficiency of time spent in congestion, approximately £9.43bn.
- Inefficiency within petrol consumption due to congestion, approximately £1.32bn.
- Inefficiency caused due to inadequate parking provision, approximately £902m.

The cumulative effect of inefficiency

If no further action were taken, maintaining the status quo of investment and maintenance[4], by the end of the decade the England would potentially have suffered from a cumulative inefficiency of over £97bn as a result of the poor quality of its network.

The table below demonstrates how a continued annual inefficiency can quickly build into a long term sustained loss of productive economic output.

Inefficiency by 2020 in Billions (£)	
Yorkshire and Humber	7.9
East Midlands	7.6
Eastern	11.9
London	15.9
North East	3.4
North West	11.1
South East	20.2
South West	10.2
West Midlands	9.2
England	**97**

The most significant loss would be in the South East and London (£36.1bn combined), with the Midlands (East and West combined) equating to £16.8bn of inefficiency by the end of the decade.

What does this analysis suggest about investing and reducing inefficiency

If government were to spend £1bn to achieve a one minute reduction in the time spent in traffic there would be a benefit in the order of an additional £1bn. This is because the resources that would have been lost in under productive time and the cost of fuel, which could be utilised for other more productive economic output. 1 minutes for £1bn reduces in economic inefficiency by £2.2bn.

Similarly. if the government were to invest and reduce the amount of inadequate parking provision from 16% down to 15% this would reduce the inefficiency figure by £55m. Using indicative building costs[5] this saving would be the equivalent of providing between 27,000 and 50,000 parking spaces.

Looking to 2040

The 'Action for Roads, a network for the 21st century' report[6] suggests that by 2040 the number of hours each household will spend in traffic each year could reach 70 hours. This compares to current data of 29 hours annually, if we update our analysis to account for the figure projected by DfT, road inefficiency in England would increase to over £27bn per year.

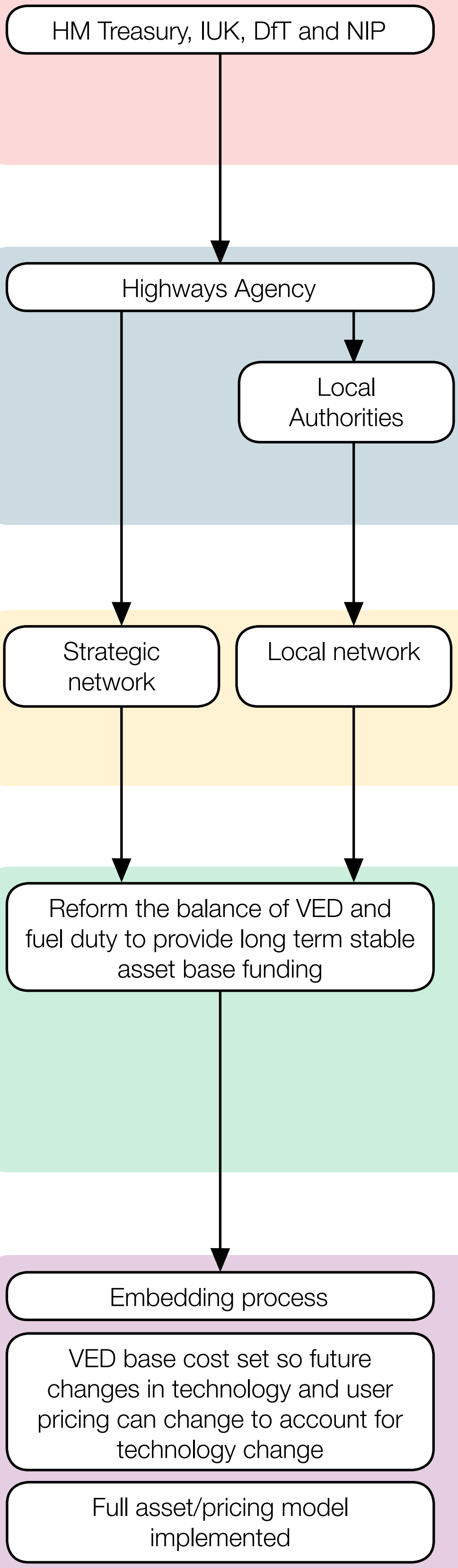
This would also suggest that the cumulative effects of traffic over multiple years would be greater than those originally anticipated in this report as inefficiencies would be rising each year rather than staying constant.

Striking the balance, financing the UK roads infrastructure

This report expands on the inefficiency calculation to propose two new models of how government could operate the financing and funding of the road network to create a long term stable investment mechanism.

The models proposed are, a Co-ordinated Single System Operator (CSSO) or Multiple System Operators (MSO).

Model 1 – Co-ordinated Single System Operator (CSSO)



Central government - national infrastructure planning

HM Treasury (HMT) DfT, and IUK would continue to provide a national overview through the National Infrastructure Plan (NIP) for road investment. This provides a strategic direction.

HMT would continue to sign off funding and financing requirements

Road delivery, financing and funding body

The Highways Agency under this new model would be given the role as the strategic delivery and financing and funding body for the road sector. Whilst high level determinations would be made by HMT as to the split of local and strategic funding the Highways Agency would manage the process of distribution of funds to the relevant authorities. By knowing the plans of local authorities (LA's) and project pipelines HA should be able to ensure road investment occurs in a holistic sustainable way promoting best practice and efficiency.

Network segmentation

As is currently the case the Strategic Road Network would fall directly under the control of the Highways Agency and the local roads under local authorities.

Importantly this structure allows for a greater flow of definition between the two systems to maximise investment efficiency

Funding and financing

Under this model the Highways Agency would remain a publicly funded body with all of its income for asset management derived from VED.

This would not be as difficult a transition as it initially sounds as the differential between road expenditure and VED collection is only about £3bn.

This transfer could be done by reducing fuel duty to compensate with the result being a budget which motorists know will be invested in the roads year on year to increase certainty, leverage finance and drive improvements

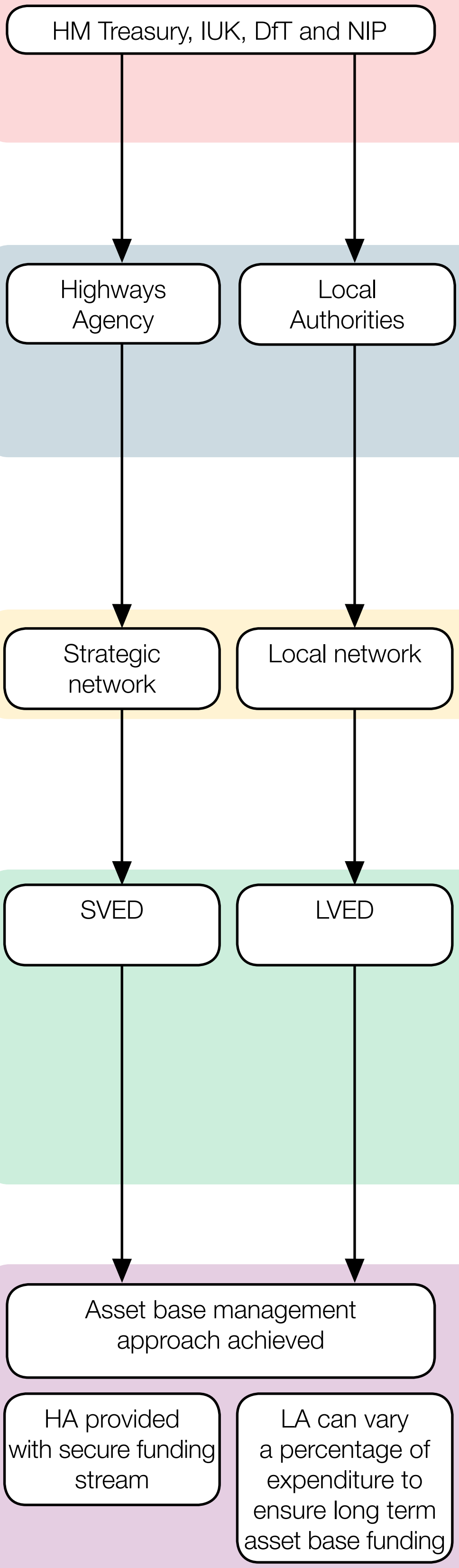
Long term vision

Under this model the government would outline its plan for ensuring a secure asset management base with an eventual transfer to road user pricing as petrol duty declines in usage.

As a public body, government can take the risk of this transfer, whereas a private delivery company would be unlikely to.

Road pricing would be introduced on new vehicles, so the transition would occur slowly. This would provide time (e.g. over a ten year period) for consumers and government to refine and adjust to the new pricing model.

Model 2 – Multiple System Operators (MSO)



Central government - national infrastructure planning

HMT, DfT and IUK would continue to provide a national overview through the National Infrastructure Plan (NIP) for road investment. This provides a strategic direction.

HMT would continue to sign off funding and financing requirements

Road delivery, financing and funding body

Under this model the system would remain relatively unchanged with the Highways Agency and local authorities (LA's) receiving funding separately.

Both would have their funding determinations assessed by HM Treasury, based on tax collection rates for the regulated asset based approach through a reformed VED mechanism for at least a five year period.

Network segmentation

As is currently the case the Strategic Road Network would fall directly under the control of the Highways Agency and the local roads under local authorities.

Funding and financing

Under this reformed version of VED, the money would continue to be raised centrally but would be classified into two regimes.

The first is Strategic VED, which is the money spent by the HA on the strategic road network, the second would be Local VED where budgets would be set by HMT with a LA able to amend this up or down within 3% of the original to enable additional investment or to reflect efficiency savings (with a proportion provided as a one off incentive).

This system aims to encourage LA's to act on their asset evaluations they have undertaken in the past 3 years

Long term vision

Under this model there would be greater scope for LA's and the HA to align with private companies to deliver area wide road asset maintenance programmes, given funding certainty.

Alternatively, if local authorities choose to provide their own service the system encourages them to take an asset management approach.

This model does not see a transfer to user pricing in the long term as private involvement in the asset at a time of such pricing change would carry significant risk, which could result in significant price increases or contracts failing.

Providing a solid foundation, to raise finance for new road building

Given the scale of the investment requirements to meet the UK's expanding population, efficiency savings alone would be unlikely to be sufficient to finance new road investment going forward.

This is where the importance of the security of the regulated funding stream for the asset base becomes a significant benefit. This is because this funding base would allow the institution that operates the network to leverage and borrow money for investment in the road network.

This report proposes a number of finance and funding combinations under the proposal models which going forward would provide a stable tool through which investment can be planned and improved both in the short and long term.

How future development such as road user pricing fits into these models

Road user pricing has been raised as a prospect previously and receives a mixed reaction from the public. The main concerns of this new system surround: the cost to individuals; will it raise the same revenue for government and the prospect of pricing individuals off of the road. As such, if government wishes to implement road pricing, it will need to explore in detail the potential costs and structure of such a policy in detail.

However, this is difficult as the data on road usage is not detailed enough to calculate the potential income gain or loss that would occur, and how this would affect not only government's budget in total but also its potential ability to finance the maintenance and improvement of the road network. In addition, any road pricing system that incorporated all the aspects of time, distance, emissions and behaviour would be very complex.

This report therefore suggests two models where VED forms the basis of a secure revenue stream so that the road network can adopt a long term asset management based approach to investment. Importantly this secures the funding stream for road investment and maintenance.

From an individual's point of view this charge would be levied in recognition of the fact that they can access and use any part of the road network, which is maintained and of a reasonable standard for any period of time.

Interestingly, maintaining such a system would create a solid foundation on to which something like road pricing can be used to affect behaviour and ensure the efficient use of the road network. Road user pricing would therefore, rather than attempting to cover all aspects of current taxation, effectively become a replacement for fuel duty.

Road user pricing would therefore become a much simpler mechanism not to fund the road network, but as a tax to incentivise the efficient use of the network.

This report has taken a number of scenarios for road usage, and calculated a potential price per km at which the behavioural road user aspect could be set in an attempt to meet the condition of revenue neutrality for government.

To do this, the report uses a number of assumptions about road user's distance travelled and the time at which they are most likely to travel.

For individual users, the scenarios run as part of this research suggests an inferred price per km of 4.70p for peak travel, 3.75p for off peak travel and 2p for travel at night.

For the freight companies an additional element of the analysis was added that accounted for those companies that can primarily run operations at night.

The results reveal that those companies that run at night would benefit from the road user rates, as opposed to those that operated during the day and incurred a slight increase.

These results suggest that if a company operating primarily in the day could shift even a limited amount of its activity to a night time they could offset any loss from activities which are run during the day.

In terms of the pricing, using the average cost of fuel and travel distances (£52,500 per annum[7], 110,000km, 135,000km and 160,000km) prices of 21.2p for peak travel, 19.2p for off peak travel and 15.5p for night time driving provided the closest scenarios to cost neutrality.

Given these results, this report then explores how the price compares to existing toll charges on the M6 toll road and on the French road network. This not only provides a UK example but also an international comparison.

The results find that whilst there are some discrepancies in the figures calculated, overall the road user pricing calculations analysed in this report are in line with toll road estimates which suggest that the numbers are robust.

However, as with all schemes of this nature a much more detailed analysis would be needed of road user usage and patterns to ensure that such a policy would not create any unintended consequences or adversely effect any single road user.

Inefficiency in the road network

According to the 2013-14 World Economic Forum Global Competitiveness Index, the UK is ranked 28th out of 148 countries for the quality of its road infrastructure which places it just below Chile and Belgium and significantly behind Germany (11th) Portugal (4th) and France (2nd)[8].

The importance of the road network and its inefficiency is generally cited in surveys as one of the most important concerns of businesses. For example:

- The CBI[9] recently reported the importance of transport infrastructure within investment decisions, with 84 per cent of businesses reporting that the quality and reliability of transport infrastructure had a significant bearing on their investment decisions.

- The FSB recently reported that seven in ten of its members identify investment in road infrastructure as an important future transport priority, with half of small businesses indicating that the poor state of the UK's roads has cost their business up to £5,000 in the past 12 months.

However, whilst previous studies have aimed to discuss the individual cost to businesses, and the importance they place on the road network, many do not consider the macro economic implications of inefficiency. These wider macroeconomic implications should be an important part of helping to align investment to reduce inefficiencies and create future opportunities for economic growth.

The need for action

The government's recent 'Action for Roads, a network for the 21st century' report[10] outlined a number of challenges, such as population growth and the rationale as to why action is needed on investment in road infrastructure.

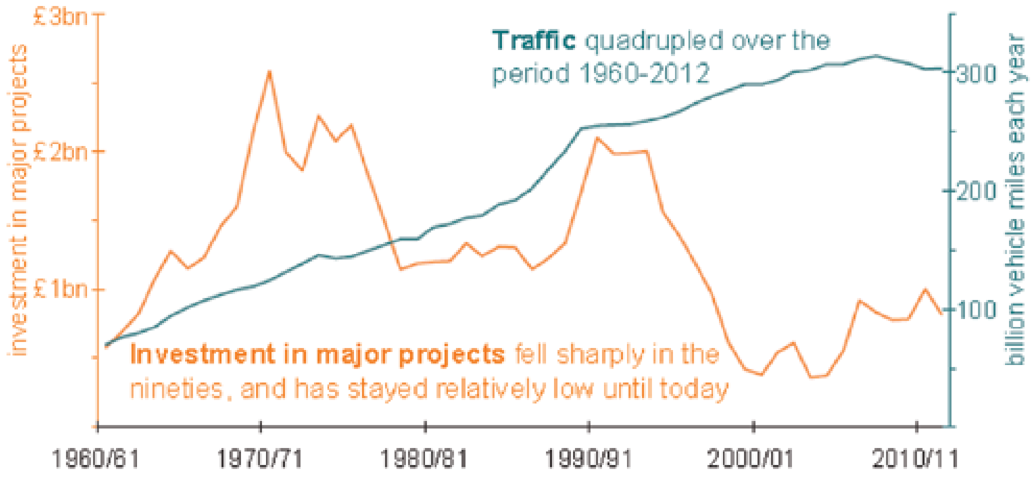
For example, the report looks at the level of traffic on the trunk road network against investment in major schemes.

As can be seen from the chart on the next page, traffic has quadrupled since 1960 and investment in major schemes has been relatively low compared to historic levels since the year 2000.

Whilst there was a slight decline in traffic in the past few years this is likely to have been due to incomes being squeezed during the recession period, which then encourages people to reduce the use of their car to reduce costs.

However, the most recent data on this chart shows that this fall has already stabilised. Given more positive recent economic data, pointing to improving conditions in the market, growth in car usage and traffic volumes are likely to once again start to increase.

Spending on the trunk road schemes

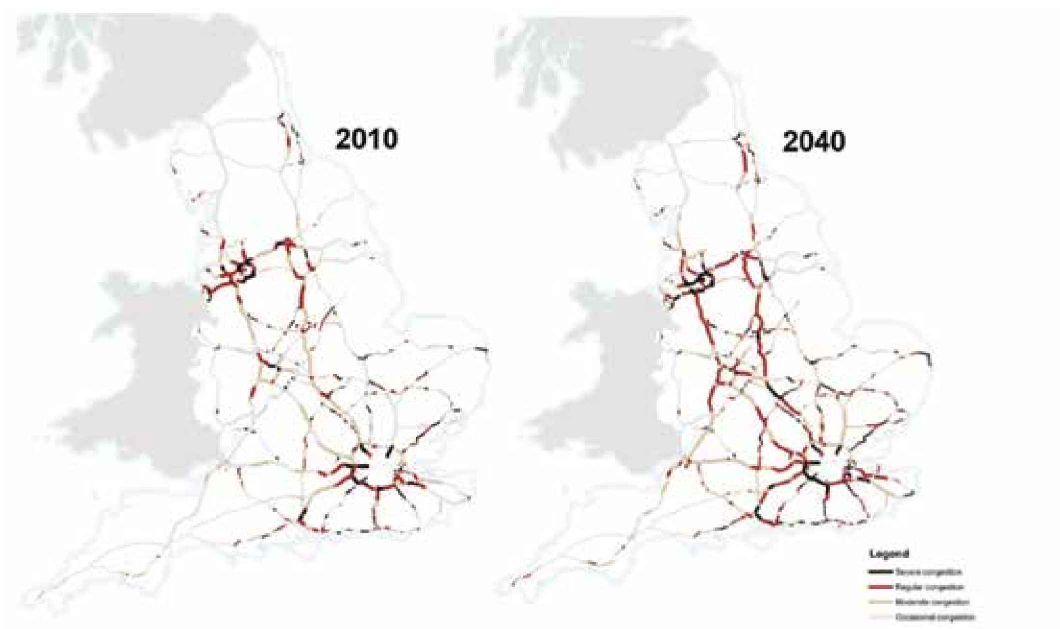


Source: Transport Statistics Great Britain table TRA0101; spending data before 1997 collected from a range of published government documents, and subsequently from internal data. The data on major improvements is an accurate reflection of the trend in central spending on improving the network, but note there have been minor changes in some years to the classification of some road projects

Interestingly the report also provides a strategic road network route map with forecast congestion points highlighted. As can be seen below, the UK by 2040 will see a greater amount of its strategic road network suffer from regular congestion. This increase will be due to a number of factors, such as population increases and behavioural patterns.

As will be discussed in this report the inefficiency caused by congestion can be significant in terms of its scale, and affect the economy. If by 2040 a greater proportion of the UK's strategic road network is to be subject to congestion, then the costs of this inefficiency will rise.

Congestion on the strategic road network



Source DfT National transport model, TASM Division, DfT, Action for Roads a network for the 21st century, 2013 (click here)

However, it is important to remember that the UK road network extends beyond that of the strategic road network, with the other 97% of the road network classified as A roads or other local roads.

So the efficiency of the network outside of the strategic network is also important for economic growth. This is because a significant number of journeys are able to take place without ever utilising the strategic road network, and even where they do almost all journeys will start and end on the local road network.

As the focus of road management shifts towards one of an asset based approach, where economic inefficiencies are increasingly identified, road investment should start to encourage the efficient allocation of funding and maintenance over the entire road network, reducing the long term macroeconomic inefficiencies.

Central government is starting to recognise the importance of roads

Government has taken steps towards improving road investment and maintenance, recognising the importance it plays to the UK economy.

Chief Secretary to the Treasury Danny Alexander MP, as part of his announcement of the 'Investing in Britain's future' report, outlined the greatest investment in our roads since the 1970s.

He announced the government will invest over £28bn over the 6 years from 2014 in enhancements and maintenance of national and local roads. The government committed £10bn of investment in road repairs between 2015-16 and 2020-21, with £4bn to be spent on national roads and £6bn on local roads. This will be enough to resurface 21,000 miles of road and fill 19m pot holes a year.

In addition to the investment decisions taken, government also took the step of announcing that the Highways Agency will be transformed into a publicly owned corporation. This transformation aims to provide the Highways Agency with the long term funding certainty it requires to deliver improvements to the road network.

Aligning the investment need of the road network to potential sources of financing and funding will be of significant importance if government is to generate investment and economic return.

To understand how an improved model for road investment is likely to evolve going forward, it is of vital importance to analyse the current income and expenditure generated by road related activities.

Road taxation

Motoring taxation is made up of two elements: vehicle excise duty (VED) which is a tax on the ownership of a vehicle and is paid annually and fuel duty, which is paid as an individual uses a car through petrol consumption.

Transport statistics for 2011-12[11] reveal that the government collected £5.9bn in VED and £26.8bn in fuel duty, equating to over £32bn in collected road taxes.

Road expenditure

In 2010-11 the UK government spent £8.7bn on road expenditure, varying between £1.2bn in the South East to £455m in the North East. However, road expenditure only equates to approximately 27% of the funds raised through road taxation.

In England almost half of total expenditure (48%) was for new construction/improvement for highways, lighting, road safety and structural maintenance of local roads.

Routine maintenance accounted for only £55.6m of spending on local roads and £413m on motorways and trunk roads which is approximately 6% of total expenditure. Interestingly, this means the routine maintenance budget (for local, motorway and trunk roads) accounts for the same percentage of total expenditure as the amount spent on public lighting of local roads.

Another way to analyse the road expenditure figures is to compare them to the scale of the road network in each of the regions.

Whilst this does not reflect a true cost of new construction or maintenance because it is compares expenditure to the entire network rather than the length of works undertaken, it does provide an indication as to relative scale of spending per km and so has some inferences for efficiency of spending against the scale of the asset.

As can be seen in the table below, London undertakes significantly more expenditure per km in all areas than any other area of the country. This will partly reflect the extent of usage of the road network and the increased emphasis this places on maintenance, the cost of mobilising materials and labour linked to operating times. But usage will also be linked to the quality and current state of the road asset. This is because the poorer the current condition of the asset the more it costs to repair.

	Total expenditure (£ per km of road network)	**New construction** (£ per km of road network)	**Routine maintenance** (£ per km of road network)
London	£90,594	£58,500	£14,905
East of England	£35,951	£28,559	£4,352
North West	£30,599	£23,128	£4,648
England	£28,949	£19,612	£5,238
North East	£28,163	£17,459	£4,368
South East	£26,495	£15,196	£6,645
Yorkshire and Humber	£25,605	£15,679	£5,297
West Midlands	£23,427	£15,756	£4,572
East Midlands	£22,377	£16,258	£3,800
South West	£16,375	£10,445	£3,754

However, whilst the spending per km varies, anecdotal evidence suggests that there is not a significant variance in the perceived poor quality and condition of the road assets across England.

- For example, a recent report by the FSB revealed a consistent two-thirds of companies in all regions rate the state and repair of the roads as having a negative impact on their business.

Another important consideration within the spending profile is the possible increase in productivity that can be achieved.

For example, if you compare the total spending per km on roads to the level of Gross Value Added (GVA) in each region[12] it is found that whilst London has the largest spending per km, it also has the greatest GVA per head.

Whilst this is a broad comparison, it does start to attempt to link, spending, inefficiency and productivity together, with a view to targeting investment to maximise economic output.

	Total expenditure (£ per km of road network)	GVA (per head)	Ratio (GVA / £per km)
London	90,594	35 638	0.39
South East	26,495	22 369	0.84
England	28,949	21 349	0.74
East of England	35,951	19 355	0.54
South West	16,375	19 093	1.17
East Midlands	22,377	18 083	0.81
North West	30,599	17 754	0.58
West Midlands	23,427	17 486	0.75
Yorkshire and Humber	25,605	17 037	0.67
North East	28,163	15 842	0.56

However, whilst the GVA per head in London is higher, the scale of its change in comparison to that of spending per km compared to other regions shows that there may be more economic benefit in investing in other regions if the government wished to improve growth.

Interestingly, using this approach, it highlights some regions where the current rate of spending on roads per km is low, but where GVA per head suggests that significant productivity growth could generate economic returns.

For example, in the South West spending on road per km is the lowest of all England's regions, and whilst it's GVA ratio per head is not the highest when considered alongside its expenditure the figures would suggest it would be a good place to invest.

Likewise the South East is another region where the ratio between the expenditure per km of road and the GVA per head is such that spending some extra to drive improvements could result in significant productivity improvements driving future growth.

Whilst this analysis is quite broad it does start to raise some interesting questions as to what the efficiency of the road network is and how this effects productivity and economic growth going forward.

To explore efficiency, this report takes publically available data, and research by a number of organisations to calculate the potential inefficiency loss within each of the region's roads networks.

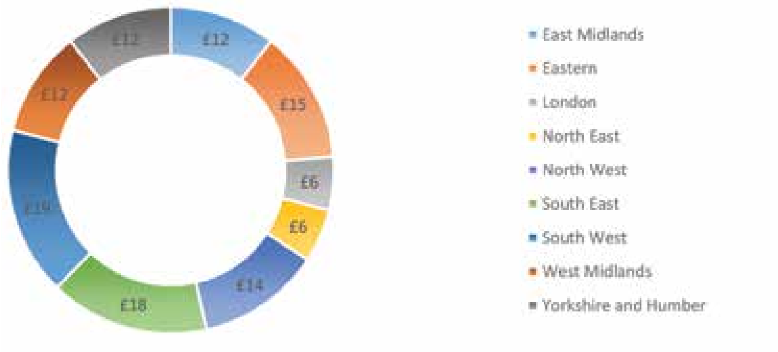
This report considers a number of inefficiencies as part of this loss, with a total inefficiency of £12.2bn across England's entire road network.

Repair inefficiency

One of the side effects of a road asset that has been allowed to deteriorate is that there is a cost attached to short term fixes which would otherwise not have been undertaken if a holistic asset management approach had been carried out.

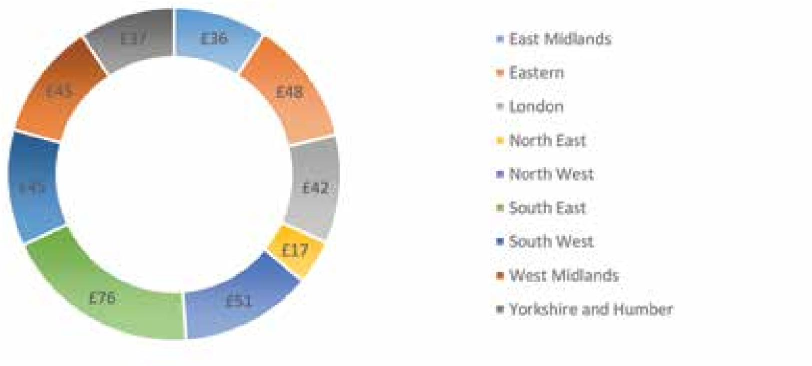
By taking the number of pot holes repaired in each region during a year and multiplying this by the average cost of repairing each pot hole an inefficiency can be calculated. These range from £6m in London and the North East to £19m in the South East.

Inefficiency - cost of short term road repairs in millions



In addition to repairing the pot holes themselves, such defects also cause damage to vehicles. Research[13] reveals that as many as one in eight cars are damaged by potholes. So by taking the number of cars registered in each region and assuming one in eight are damaged in a year at an average cost of repair of £132[14] an inefficiency for the cost of car repairs can be calculated. This cost varies from approximately £17m in the North East to £76m in the South East.

Inefficiency - cost of car repairs by region in millions

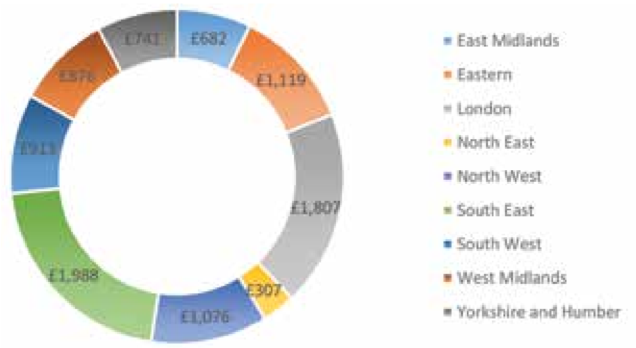


Time and congestion inefficiency

One of the most significant inefficiencies that can occur on the road network is that of congestion, as this results in time not being used productively for other economic outputs.

To calculate the cost of this inefficiency, median regional wages[15] were multiplied by the amount of time spent in traffic per year[16] and then multiplied by the number of cars registered in that region. This therefore provides a cost as to the inefficiency for vehicles in that region spending time in traffic. The inefficiency estimates varied from £1.99bn in the South East to £307m in the North East.

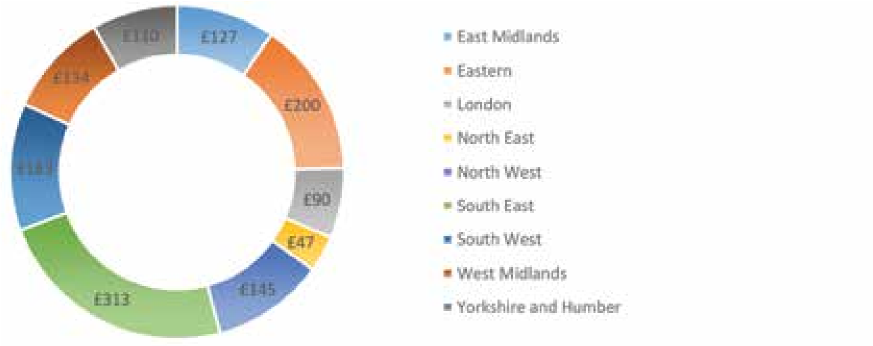
Inefficiency – cost of time in congestion by region in millions



In addition to the loss of potential output due to congestion, there is also a cost of petrol as a resource being utilised that would not otherwise have been consumed. This is an inefficient use of petrol and of income that could be used in other ways to benefit the local economy.

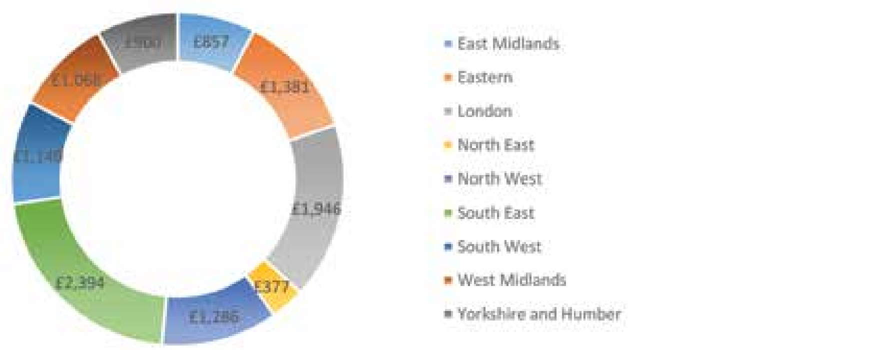
Using the distance travelled per year, a typical vehicle's[17] fuel consumption and performance adjusted for a congestion environment it was calculated that petrol inefficiency varies between £313m in the South East to £46m in the North East.

Inefficiency – cost of petrol in congestion by region in millions



If all these factors are added together a total inefficiency can be calculated for the road network in each region. These vary between £2.39bn in the South East and £377m in the North East and total £11.2bn per year for England as a whole.

Inefficiency – total cost of road inefficiency by region in millions



The inefficiency in the road network does not only come from congestion, lost time and inefficient use of resources. Many business and individuals will comment on the time it takes to find parking spaces due to the lack of parking in their area.

Some companies have even taken to hiring unemployed individuals as car sitters[18], whose role involves staying with a vehicle and if required driving it round to avoid the cost of parking fines. For such activity to take place, the cost and burden of parking and the fines associated with being illegally parked must significantly impact on that businesses costs.

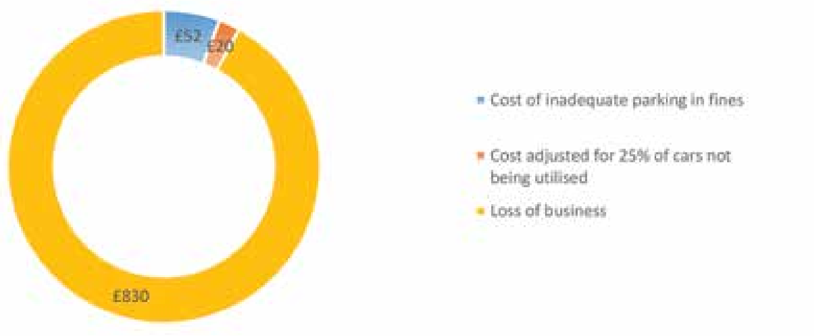
Data on parking is sparse and so it is difficult to calculate. Subsequently this report has calculated the inefficiency of parking using its own methodology which is outlined below.

The first is calculated by taking the percentage of the total cost of parking fines[19] issued to drivers which could be considered to be as a result of inadequate parking.

The second estimate is that of the cost of time spent looking for parking. This is calculated assuming 25% of the cars are utilised per region have to spend time looking for parking, and using the median wage per region to value this time.

Finally, the report takes the total value of retail sales nationally, adjusts the figure as a percentage of GDP for activity that may require parking, and then using an inadequate parking provision figure to calculate a value for sales which have been lost as a result of individuals not returning following continued efforts to park and shop and failing to do so. In total inadequate parking is calculated to account for £903m of inefficiency across England.

Inefficiency – inadequate parking in millions



If the total of all the inefficiency calculations is taken it is revealed that there is a £12.2bn annual cost of inefficiency within the road network for congestion and inefficient provision of parking.

The cumulative effect of inefficiency

If no further action were taken to improve congestion and the condition of the roads asset, by the end of the decade the England would have potentially suffered from over £97bn of inefficiency as a result of the condition of its roads network.

To calculate final estimates for the regions, the national parking estimate needs to be added to each region. As there is no specific data for each region this has been done using the percentages of the road network in each region as this should align to usage and parking availability.

Regional inefficiency estimates by 2020

Inefficiency by 2020 in Billions	
Yorkshire and Humber	7.9
East Midlands	7.6
Eastern	11.9
London	15.9
North East	3.4
North West	11.1
South East	20.2
South West	10.2
West Midlands	9.2
England	**97**

The above demonstrates how a continued annual inefficiency can quickly build into a long term sustained loss of productive economic output. The most significant loss would be in the South East and London (£36.1bn combined), with the Midlands (East and West combined) equating to £16.8bn of inefficiency by the end of the decade.

Looking to 2040

The 'Action for Roads, a network for the 21st century' report[20] suggests that by 2040 the number of hours each household will spend in traffic each year could reach 70 hours. This compares to the data used in this report of 29 hours annually. If the analysis is updated this figure projected by DfT, road inefficiency in England would increase to over £27bn per year.

This increased annual inefficiency also suggests that the cumulative effects of traffic over multiple years would be greater than those originally anticipated in this report, as inefficiencies would be rising each year rather than staying constant.

In addition, as traffic increases so does the difficulties of items such as repair and maintenance as road users are likely to spread usage over a longer period of the day. This could have a detrimental effect on the cost of roadwork's and improvement programme as the amount of time the road network was congested or considered as operating at its peak would be longer.

This is because this extended period not only increases the economic cost of individuals sitting in traffic, but also means that the cost of traffic management systems and the emphasis and importance of safety measures increases for those working on increasingly busy sections of the road network.

Investing to reduce inefficiency

The inefficiencies explored in this report may help to suggest at a macroeconomic level, how government should approach the task of improving Britain's roads.

For example, the time and petrol inefficiencies calculated in this report are based on the time a registered vehicle spends in traffic. If government were to target projects which reduced the time spent in congestion by one minute a day or 365 minutes a year, the inefficiency caused in England in terms of time lost would fall from £9.4bn to £7.5bn, saving £1.9bn and petrol inefficiency would also fall by £277m.

If government were to spend £1bn to achieve this one minute reduction in the time spent in traffic there would be a benefit in the order of an additional £1bn. This is because the resources that would have been lost in under productive time and the cost of fuel, could be utilised for other more productive economic output. 1 minutes for £1bn reduces in economic inefficiency by £2.2bn.

Similarly, if the government were to invest and reduce the amount of inadequate parking provision from 16% down to 15% this would reduce the inefficiency figure by £55m. Using indicative building costs[21] this saving would be the equivalent of providing between 27,000 and 50,000 parking spaces.

Moving towards efficient asset management

A major challenge around effectively managing the roads network in the UK, however, is that there is limited knowledge of exactly what kind of state the asset is currently in. This not only needs to be understood in terms of its value today, but also in terms of the investment required to improve the asset, the level of service provision required, and the economic benefits it generates.

Efforts are being made to better understand the state of the asset, however. In 2006, HM Treasury (HMT) and the Department for Transport (DFT) commissioned a review[22] from the Chartered Institute of Public Finance and Accountancy (CIPFA) of accounting management and finance mechanisms for local authority transport infrastructure.

Their report on the transport infrastructure assets recommended that local authorities should shift towards an asset management plan based approach. This approach and code would help local authorities to plan more effectively through the development of efficient asset management strategies.

This approach to introducing asset management was fully implemented from the financial 2012/13 year and while it is clearly too early to judge the success, it should significantly help to improve asset knowledge. This will provide important information if the government were to invite private parties into manage road assets, such as the PFI scheme now operating in Birmingham.

So how do we want our roads to operate in the coming years? Previous ACE papers on procurement of public private finance models[23] found that the rigidity of traditional PFI contracts' structures resulted in difficulties for projects that performed below demand expectations. In the case of roads, given the uncertainty in demand, such risks would be large and are likely to be unacceptable to private parties and institutional investors such as pension funds who prefer revenue certainty.

As such, more flexible contracts which limit risks over shorter pre-defined periods with flexibilities built in to allow expansion need to be considered. Such flexibility has been used in other road projects such as the 407 ETR Toronto Canada. This project has provisions for widening once traffic volumes meet a predefined level. This flexibility not only secures future growth for the public sector but also limited maintenance and demand risk for the operation of the road whilst traffic volumes are lower.

Ultimately government is going to have to clearly and transparently outline what risks it is willing to take and what it considers to be a reasonable rate of return where private sector involvement and investment is undertaken.

It is this balance of the risks and returns that is therefore going to determine the potential investment, maintenance and financing model of the road network going forward.

Striking the balance, financing UK roads infrastructure

The government has recently been exploring a number of options for financing and funding the future road network. This has not been a simple task, and there are a number of challenges present in this area:

- The road network is not a homogenous structure in terms of responsibility, with there being a split between local authorities and the Highways Agency.
- The current system of taxation whilst reflecting use to some extent through fuel duty also has a fixed element in the form of VED, this makes linking asset deterioration and maintenance to usage difficult.
- The process of auditing the UK's road asset is underway, but is required if the government wishes to consider models that involve the private sector undertaking responsibility for investment, repair and maintenance of proportions of the road network.
- For the private sector there are still a number of concerns as to how funding stream will be formulated. For example, traffic volumes are difficult to forecast and so returns can vary significantly from actual outcomes.

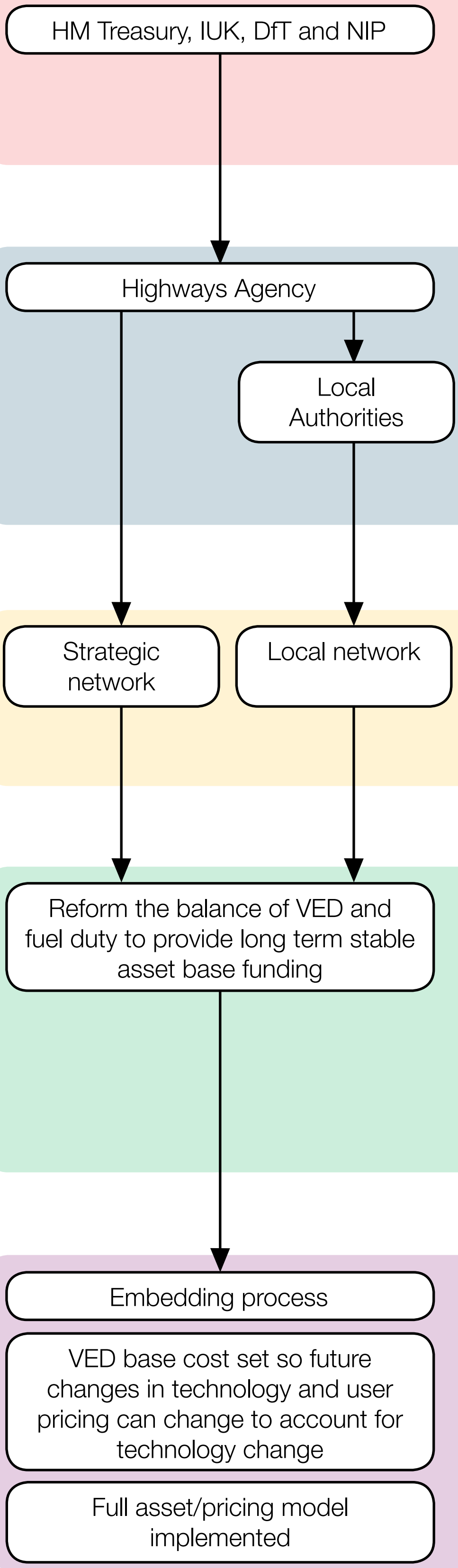
Given the recent government announcement that the Highways Agency is to be made into a public body, and given the analysis in this report on potential inefficiencies within the road network, this report proposes two models through which financing, investment and maintenance of the road network could progress going forward.

The first of these models assumes that the government wishes to maintain the Highways Agency as a public body going forward, but considers the importance of transforming their role towards one of financing, funding and an asset management approach in co-ordination with local authorities.

The second model considers the possibility of aligning with private companies with parts of the highways chain to deliver services. In doing this it considers the risk profile and funding mechanism that is needed to ensure that these alliances perform in an optimum manner.

Importantly, both of the models set out the base scenario of having the roads run as part of an asset management approach. Beyond this they then consider the possible development option given the models' ability to handle risk within the sector to ensure that road investment in the long term is secured in as efficient a manner as possible.

Model 1 diagram – Co-ordinated Single System Operator (CSSO)



Central government - national infrastructure planning

HM Treasury (HMT) DfT, and IUK would continue to provide a national overview through the National Infrastructure Plan (NIP) for road investment. This provides a strategic direction.

HMT would continue to sign off funding and financing requirements

Road delivery, financing and funding body

The Highways Agency under this new model would be given the role as the strategic delivery and financing and funding body for the road sector. Whilst high level determinations would be made by HMT as to the split of local and strategic funding the Highways Agency would manage the process of distribution of funds to the relevant authorities. By knowing the plans of local authorities (LA's) and project pipelines HA should be able to ensure road investment occurs in a holistic sustainable way promoting best practice and efficiency.

Network segmentation

As is currently the case the Strategic Road Network would fall directly under the control of the Highways Agency and the local roads under local authorities.

Importantly this structure allows for a greater flow of definition between the two systems to maximise investment efficiency

Funding and financing

Under this model the Highways Agency would remain a publicly funded body with all of its income for asset management derived from VED.

This would not be as difficult a transition as it initially sounds as the differential between road expenditure and VED collection is only about £3bn.

This transfer could be done by reducing fuel duty to compensate with the result being a budget which motorists know will be invested in the roads year on year to increase certainty, leverage finance and drive improvements

Long term vision

Under this model the government would outline its plan for ensuring a secure asset management base with an eventual transfer to road user pricing as petrol duty declines in usage.

As a public body, government can take the risk of this transfer, whereas a private delivery company would be unlikely to.

Road pricing would be introduced on new vehicles, so the transition would occur slowly. This would provide time (e.g. over a ten year period) for consumers and government to refine and adjust to the new pricing model.

Model 1 – Co-ordinated Single System Operator (CSSO)

The first model is designed with a view to keeping the road assets and their investment within the public sector.

Under the model, IUK and HM Treasury would maintain their role in setting out projects within the National Infrastructure Plan that are deemed to be of national significance. Beyond this, HM Treasury would continue its role as the department that signs off on the funding and financing requirements of departments.

However, below this, the model changes significantly with the promotion of the Highways Agency to a body that in the public interest draws together the funding, financing and expertise for operations on the road network into a single resource.

That is not to say that local authorities would not continue to be granted their current level of funding but that this would go through the Highways Agency which would be able to help drive alliances, knowledge sharing, efficiency and long term thinking as the funding and financing streams for both local and strategic roads would be guaranteed for five years via this public delivery body.

Such a change would be a significant step for government, with the road network for the first time given the certainty and funds required to perform long term efficient asset maintenance and renewal.

Importantly, the benefit of local authorities remaining responsible for the local road network, and the Highways Agency for the strategic network is that the asset does not become unmanageable.

For example, part of the problem with Rail Track when privatised was the scale of the asset. Understanding the maintenance and usage patterns of a new railway of that scale would have been difficult enough but trying to manage an asset of that scale where the system has been constantly amended, updated and also suffered underinvestment is extremely difficult.

This is why maintaining the local knowledge of the road network is vital to a model's success. If England can connect such knowledge with funding certainty the efficiency gains, the benefits to local communities would be significant.

This raises the issue of funding and financing. To ensure efficient investment, road funding and financing for both the strategic and local road network needs to be stable. The asset itself has a maintenance and renewal cost to maintain the current 'status quo' which historically has not always been met due to economic and political cycles. If the government wishes to seriously embed long term investment and reduce inefficiency within the system it needs to address the long term funding mechanism.

This model suggests doing this by rebalancing VED and petrol duty over a pre-defined period (such as five years) where the money raised by VED covers the investment and maintenance cost of the road network. This would equate to increasing the income raised from VED from approximately £6bn to £9bn, and could be done alongside an equivalent reduction in the rate of petrol duty, which would equate to approximately 6 to 7 pence per litre[24].

However, once complete, this transition would see VED become a guaranteed, clear funding stream for the road network. Fuel duty, would then be considered a usage and behavioural tax.

Importantly if such a system were put in place, it would prepare the road network for the future challenge of alternative fuel types, changing behaviours and possibly full road user charging based on economic externalities such as traffic, as the base cost of maintaining the asset would be in place.

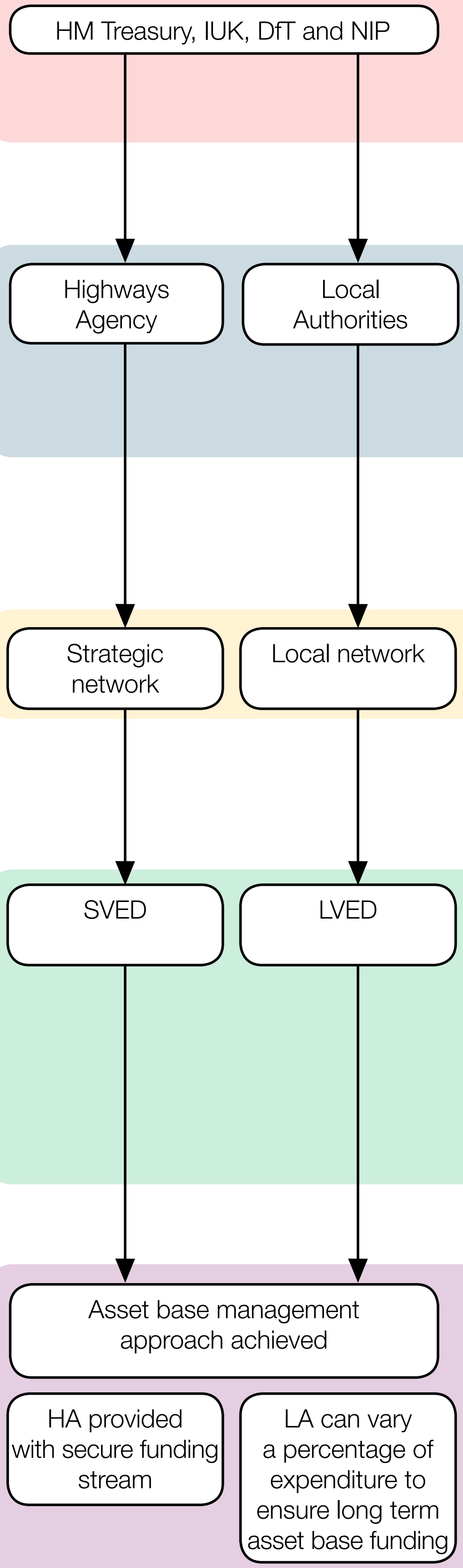
Addressing the increasing diversity of vehicles will be important because in the medium to long term as the number of vehicles using petrol and diesel declines, so too will fuel duty revenues. Eventually government will need to put in place an alternative mechanism for incentivising behaviour and usage of the road network, but whilst maintaining the investment required to keep the asset.

Given the way technology is developing, the likely outcome is some form of road pricing system. However, given the volatility of traffic volumes, the need for usage data and the scale of uncertainty surrounding revenue a significant period of introduction will be required.

As such, only the public sector is best placed to take the forecast and traffic volume risk associated with such a policy. Creating the stable funding mechanism via VED allows government the flexibility in the future to explore such policies.

An additional benefit would be that as Network Rail can leverage borrowing to invest (given the funding certainty provided by its access charges), the Highways Agency would also be able to borrow in a similar way, given the certainty that a VED asset base revenue system would create.

Model 2 diagram – Multiple System Operators (MSO)



Central government - national infrastructure planning

HMT, DfT and IUK would continue to provide a national overview through the National Infrastructure Plan (NIP) for road investment. This provides a strategic direction.

HMT would continue to sign off funding and financing requirements

Road delivery, financing and funding body

Under this model the system would remain relatively unchanged with the Highways Agency and local authorities (LA's) receiving funding separately.

Both would have their funding determinations assessed by HM Treasury, based on tax collection rates for the regulated asset based approach through a reformed VED mechanism for at least a five year period.

Network segmentation

As is currently the case the Strategic Road Network would fall directly under the control of the Highways Agency and the local roads under local authorities.

Funding and financing

Under this reformed version of VED, the money would continue to be raised centrally but would be classified into two regimes.

The first is Strategic VED, which is the money spent by the HA on the strategic road network, the second would be Local VED where budgets would be set by HMT with a LA able to amend this up or down within 3% of the original to enable additional investment or to reflect efficiency savings (with a proportion provided as a one off incentive).

This system aims to encourage LA's to act on their asset evaluations they have undertaken in the past 3 years

Long term vision

Under this model there would be greater scope for LA's and the HA to align with private companies to deliver area wide road asset maintenance programmes, given funding certainty.

Alternatively, if local authorities choose to provide their own service the system encourages them to take an asset management approach.

This model does not see a transfer to user pricing in the long term as private involvement in the asset at a time of such pricing change would carry significant risk, which could result in significant price increases or contracts failing.

Model 2 – Multiple System Operators (MSO)

The second model in this paper considers a similar approach by creating a stable form of revenue stream for future road investment but keeps the strategic and local road network separated throughout the whole chain.

Under this model the Highways Agency and local authorities would continue to manage the networks as they currently do but the funding for these networks would be secured and guaranteed via a reformed VED, which once again would require rebalancing the total amount raised to cover the investment in the entire network.

This would equate to increasing the income raised from VED from approximately £6bn to £9bn, and could be done alongside an equivalent reduction in the rate of petrol duty, which would equate to approximately 6 to 7 pence per litre[25].

VED would be separated into two constituent parts, Local VED and Strategic VED. Whilst these would be administered centrally in the same way VED is currently collected, and the rates set by HM Treasury, the Local VED aspect would allow local authorities to adjust their spending profile by +/- 3% in a similar way to council tax rates in London.

This gives local authorities the ability to invest extra when required or to make savings if efficiencies can be made. Any saving would also see a proportion of savings gifted to the local authority as an incentive to continue to manage the efficiency of its road investment programme.

Unlike the first model, due to the separation of the strategic roads network, it would be possible to consider privatisation. However, this is only possible as the revenue stream for the network is ensured through VED.

Another aspect which would have to be considered for privatisation is if the current split and definition of the strategic and local road networks provides a sufficient scale to make the strategic network attractive to a private investor. It may be the case that more of the network needs to be included in the strategic network to make it a more attractive investment proposition. Such a significant change in the defining and distribution of the network would need significant consultation with Local Authorities if it was to be successful.

The reason user pricing is only considered as an option in the first model, is that if going forward there was a shift towards user pricing the cost and risk of implimentation is a risk the private sector would be unlikely to be able to manage without significant cost given the traffic volume and flow risk.

Providing a solid foundation, to raise finance for new road building

The models discussed previously explore how government can secure funding for the road asset base to be moved towards a more efficient and optimal outcome. As part of this, efficiency savings could be either used to increase the scale of maintenance and reactive works, or alternatively it could be directed towards new road investment.

However, given the scale of some of the investment requirements to meet the UK's expanding population, efficiency savings alone would be unlikely to be sufficient to finance new road investment going forward.

This is where the importance of the security of the regulated funding stream for the asset base becomes a significant benefit. This is because this funding base would allow the institution that operates the network to leverage and borrow money for investment in the road network.

However, within this it is also important to recognise that as the road network expands so too do the maintenance requirement of the asset base. As such, the new institution would need to consider how its funding stream could be utilised, or additional revenues raised to support this expanded maintenance requirement.

One method that has traditionally been used for raising the funding for new roads from users is through the tolling of roads. However, as has been seen with projects such as the M6 toll road in the UK, the degree to which users can take alternative routes to avoid the toll network does have a significant effect on predicted income.

As will be discussed in the next part of this report in the future, another option may be to add a surcharge to part of a road user pricing element. This in theory could be an efficient means of collecting the revenue required and could be applied regionally or at peak times.

Another alternative is to raise the level of VED, (to account for the utility of the increased availability of additional capacity), and spread the cost over the wider public cost base. Whilst this method would need some degree of consultation with the public and businesses as it raises the fixed element of car ownership it is important to recognise that until full road pricing is available some investments are not be suitable for tolling and so could only take place with a funding model such as VED.

Alternatively, a combination of both VED and user pays could be used, providing a significant degree of flexibility to the long term funding of the road network.

The combination of these investment and funding options and the securing of VED going forward therefore provides a stable tool through which investment can be planned and improved both in the short and long term.

How could government implement road user pricing?

Road user pricing has been raised as a prospect previously and receives a mixed reaction from the public. The main concerns of this new system surround the cost to individuals, will it raise the same revenue for government, and the prospect of pricing individuals off of the road. As such, if government wishes to implement road pricing it will need to explore in detail the potential costs and structure of such a policy in detail.

However, this is difficult as the data on road usage is not detailed enough to calculate the potential income gain or loss that would occur, and how this would affect not only government's budget in total, but also its potential ability to finance the maintenance and improvement of the road network.

This highlights one of the issues with current thinking around road pricing. The expectation is that any system brought in would replace all current systems, making the pricing model extremely complex. Such a complex implementation would require significant traffic data and demand certainty, something which is difficult to predict even on smaller investments on the road network.

To demonstrate how complex you could make the system, you could have different prices for local and strategic roads, different times of day, different types of vehicle and emissions. This complexity is not only difficult to implement but would make it extremely difficult for individuals and companies using the road network to calculate what it was actually costing them. Therefore, the temptation to over complicate the system must be avoided.

This report has suggested two models where VED forms the basis of a secure revenue stream so that the road network can adopt a long term asset management based approach to investment. Importantly this secures the funding stream for road investment and maintenance.

From an individual's point of view this charge would be levied in recognition of the fact that they can access and use any part of the road network, which is maintained and of a reasonable standard for any period of time.

Interestingly, maintaining such a system would create a solid foundation on to which something like road pricing can be used to affect behaviour and ensure the efficient use of the road network. Road user pricing would therefore rather than attempting to cover all aspects current taxation, effectively become a replacement for fuel duty.

Fuel duty as a behavioural tax is a blunt instrument, as it does not encourage enough variation in behaviour to encourage efficient use of the road network. Also, moving forward, as the number of cars running on petrol decline, revenues to government from this form of taxation will fall, and so either a replacement is required or a gap in government revenues will occur.

This report proposes that as has traditionally been the case VED bands would continue to incentivise the purchase of efficient vehicles based on emissions, as this policy has been successful in driving not only users to buy more efficient vehicles but has also encouraged companies to invest in cleaner technologies.

This also has a significant benefit because it therefore removes two of the significant variances and complexities that would have to be built into a road user pricing model if it was to replace all forms of transport taxation (the asset management base cost and environmental incentivisation).

Road user pricing would therefore become a much simpler mechanism not to fund the road network, but as a tax to incentivise the efficient use of the network.

Using this premise, if government were to replace petrol duty with road user pricing what process would have to take place and what would the potential costs be?

First, for road user pricing to be introduced and publically accepted the policy would need to be revenue neutral. This would not be easy to achieve, and there would inevitably be some variations so a detailed analysis would have to be undertaken to ensure the policy is robust.

Second, as mentioned earlier in the report to establish a solid VED foundation to cover road expenditure there would need to be a shift of taxation from petrol duty to VED in the order of a reduction of approximately 6p per litre. Therefore the calculations in this report have taken this into account when calculating the potential cost to an individual per mile for road user pricing.

Finally, given the new more stable asset based approach, efficiency of investment in the road network should improve and reduce the extent to which the government needs to influence behaviour to ensure efficient asset use. As such, it may be possible to reassess the scale of the differential in road user pricing to reflect this improvement, reducing the tax burden on individuals and businesses, or alternatively this would enable government to avoid future taxation increases that may have had to occur under the previous system.

Exploring road pricing further

This report has taken a number of scenarios for road usage, and calculated a potential price per km at which the behavioural road user aspect could be set in an attempt to meet the condition of revenue neutrality for government.

This report uses a number of assumptions about road users' distance travelled and the time at which they are most likely to travel.

The first set of users considered are individual car users with a scenario for a low, medium and high usage of the road network.

These scenarios vary in that as usage increases the probability of the requirement to drive at peak time when the highest cost would be incurred increases, and so the percentage of time they are assumed to be paying the higher cost increases.

User profiles – car usage

User statistics	England Average	Low usage	Medium usage	High usage
KM per year	5,434	5,000	10,000	25,000
Peak driving percentage		30%	60%	70%
Off peak driving percentage		60%	20%	20%
Night driving percentage		10%	20%	10%

The second set of users the report considers is that of freight drivers. Given the impact road user pricing could have for their cost base it is important to ensure their costs do not increase.

The Freight Transport Association have a number of statistics on the cost of fuel to the freight industry. A recent report notes that in the case of road freight, fuel represents nearly 40% of a 44 tonne hgv operating costs. This equates to £52,500 per annum[26].

Another important aspect is to correctly gage the potential millage of a typical low, medium and high freight user. In the same report for various vehicle classes the FTA suggest a mileage for a low, medium and high user.

To ensure that the estimates in this report are as robust as possible in attempting to hit neutrality, the highest distance travelled for each vehicle type is taken for the low, medium and high user.

Finally, an additional to consider is the degree of daytime and night time operating, which is one of the behaviours that road user pricing would influence over time.

User profiles – freight usage

User statistics	Night shift low	Night shift medium	Night shift high	Day shift low	Day shift medium	Day shift high
KM per year	110,000	135,000	160,000	110,000	135,000	160,000
Peak driving percentage	15%	15%	15%	45%	45%	45%
Off peak driving percentage	25%	25%	25%	20%	20%	20%
Night driving percentage	60%	60%	60%	35%	35%	35%

Using the current price of petrol, fuel duty and annual distance travelled it is therefore possible to calculate what each user would pay in fuel duty under the current system and an inferred road user price, whilst minimising the impact on each user category in an attempt to meet cost neutrality.

Road pricing scenario results – car

Price calculation	Low usage	Medium usage	High usage
Price per km - peak	£0.0470	£0.0470	£0.0470
Price per km - off peak	£0.0375	£0.0375	£0.0375
Price per km - night	£0.0200	£0.0200	£0.0200
Cost to user - peak	£70.50	£282.00	£822.50
Cost to user - off peak	£112.50	£75.00	£187.50
Cost to user - night	£10.00	£40.00	£50.00
Total cost to user	**£193.00**	**£397.00**	**£1,060.00**
Saving/loss compared to fuel duty	**£15.48**	**£19.96**	**-£17.59**

For individual users the scenarios run as part of this research suggests an inferred price per km of 4.70p for peak travel, 3.75p for off peak travel and 2p for travel at night.

From the analysis it is revealed that under our assumptions low and medium usage drivers would benefit slightly (£15.48 to £19.96 per year) and high use drivers would incur a slight increase in cost (£17.59).

Given these prices an individual would need to shift a significant amount of their driving to the evening to significantly change the extent of the road pricing tax they pay.

Road pricing scenario results – freight

Price calculation	Night low	Night medium	Night high	Day low	Day medium	Day high
Price per km - peak	£0.212	£0.212	£0.212	£0.212	£0.212	£0.212
Price per km - off peak	£0.192	£0.192	£0.192	£0.192	£0.192	£0.192
Price per km - night	£0.155	£0.155	£0.155	£0.155	£0.155	£0.155
Cost to user - peak	£3,498	£4,293	£5,088	£10,494	£12,879	£15,264
Cost to user - off peak	£5,280	£6,480	£7,680	£4,224	£5,184	£6,144
Cost to user - night	£10,230	£12,555	£14,880	£5,967	£7,323	£8,680
Total cost to user	**£19,008**	**£23,328**	**£27,648**	**£20,685**	**£25,386**	**£30,088**
Saving/loss compared to fuel duty	**£1,293**	**£1,587**	**£1,881**	**-£384**	**-£471**	**-£558**

For the freight companies an additional element of the analysis was added that accounted for those companies that can primarily run operations at night.

The results reveal that those companies that run at night would benefit from the road user rates, as opposed to those that operated during the day and incurred a slight increase.

These results suggest that if a company operating primarily in the day could shift even a limited amount of its activity to a night time they could offset the any loss from activities which are run during the day.

In terms of the pricing, using the average cost of fuel and travel distances (£52,500 per annum[27], 110,000, 135,000 and 160,000) prices of 21.2p for peak travel, 19.2p for off peak travel and 15.5p for night time driving provide the closest scenarios to cost neutrality.

How robust are these estimates?

The road user prices calculated above attempt to align pricing with the current cost to the user of the variable (usage) taxation element of car ownership. One way to assess how robust these estimated charges would be is to look at the cost of using existing toll routes to see if the cost per km is in line with the estimates calculated as part of this report.

The UK has very few tolled routes (including bridges etc) and even fewer tolled roads. The most popular of these is the M6 toll road.

When used by a company and/or an individual they pay a fee which under the current system is on top of VED and petrol duty costs which they will also incur.

However, under the model discussed in this report if the UK were to shift towards road pricing in the future this fee would be incurred instead of the fuel duty cost. This would therefore instantly pass a saving onto the user as a layer of cost has been removed.

The M6 toll road is 27 Miles long (43km) and was opened in December 2003. The current pricing structure[28] is designed by class of vehicle, with a peak and night time rate.

If the toll rate is taken and divided by the length of the motorway it allows you to calculate a price per km. This can then be compared to the rates calculated for road user pricing to see how they differ, and provide some indication as to the robustness of the road user pricing estimations.

M6 toll road comparison

	Mon - Fri (06:00 - 23:00)	**Sat - Sun (06:00 - 23:00)**	**Night (23:00 - 06:00)**
Length (km)	43	43	43
Class 1 (e.g. motorbike)	£3.00	£2.80	£1.80
Class 2 (e.g. car)	£5.50	£4.80	£3.80
Class 3 (e.g. car and trailer)	£10.00	£8.60	£6.60
Class 4 (e.g. van or coach)	£11.00	£9.60	£8.60
Class 5 (e.g. HGV or coach)	£11.00	£9.60	£8.60
Class 1 price per km	£0.07	£0.07	£0.04
Class 2 price per km	£0.13	£0.11	£0.09
Class 3 price per km	£0.23	£0.20	£0.15
Class 4 price per km	£0.26	£0.22	£0.20
Class 5 price per km	£0.26	£0.22	£0.20

As can be seen from the table above the lowest Class 1 rate per km at 7p (peak) and 4p (night) is similar to the rates of 4.70p (peak), 3.75p (off peak), with a bigger difference occurring between the 2p (night) rate and the M6 night time rate.

Interestingly, if you then look at the freight (HGV, class 5) rates for the M6 toll road the peak and off peak rates continue to be close to the road pricing estimates calculated, with the exception of the night rate which is significantly lower.

The M6 peak rate at 26p, weekend 22p and the night rate at 20p and this report estimates of 21.2p (peak), 19.2p (off peak) and 15.5p (night) are similar.

This night time differential is likely to mean that the road user pricing rates calculated as part of this report would have a greater effect at encouraging night time use, and shift traffic away from peak hours, where congestion occurs.

However, as mentioned previously the UK has not tolled many roads and further comparisons are needed to ensure that the 43km M6 toll could be used as an accurate proxy for road user pricing.

France, however, has a significant tolled road network and so the price of the toll here should be more robust. So how does this compare to the prices calculated in this report and the M6 toll?

Autoroutes.fr is the professional association for the French motorway companies, and their website directs users to tools that allow individuals to calculate the price they would pay to travel a specific journey on the network.

APRR is an example of one of the companies that run a tolled part of the network, and a list of routes, their lengths and the toll that is paid.

Again the rates are split into five classes of vehicle[29] with one being for the smallest cars up to category four for HGVs, and category five reserved for motorbikes.

Their full tariff document[30] contains almost 300 pages outlining every possible journey and associated cost that applies. For the purpose of this research the first page of data was analysed to provide an average Euro per km cost for each category type. This was then converted into pounds[31].

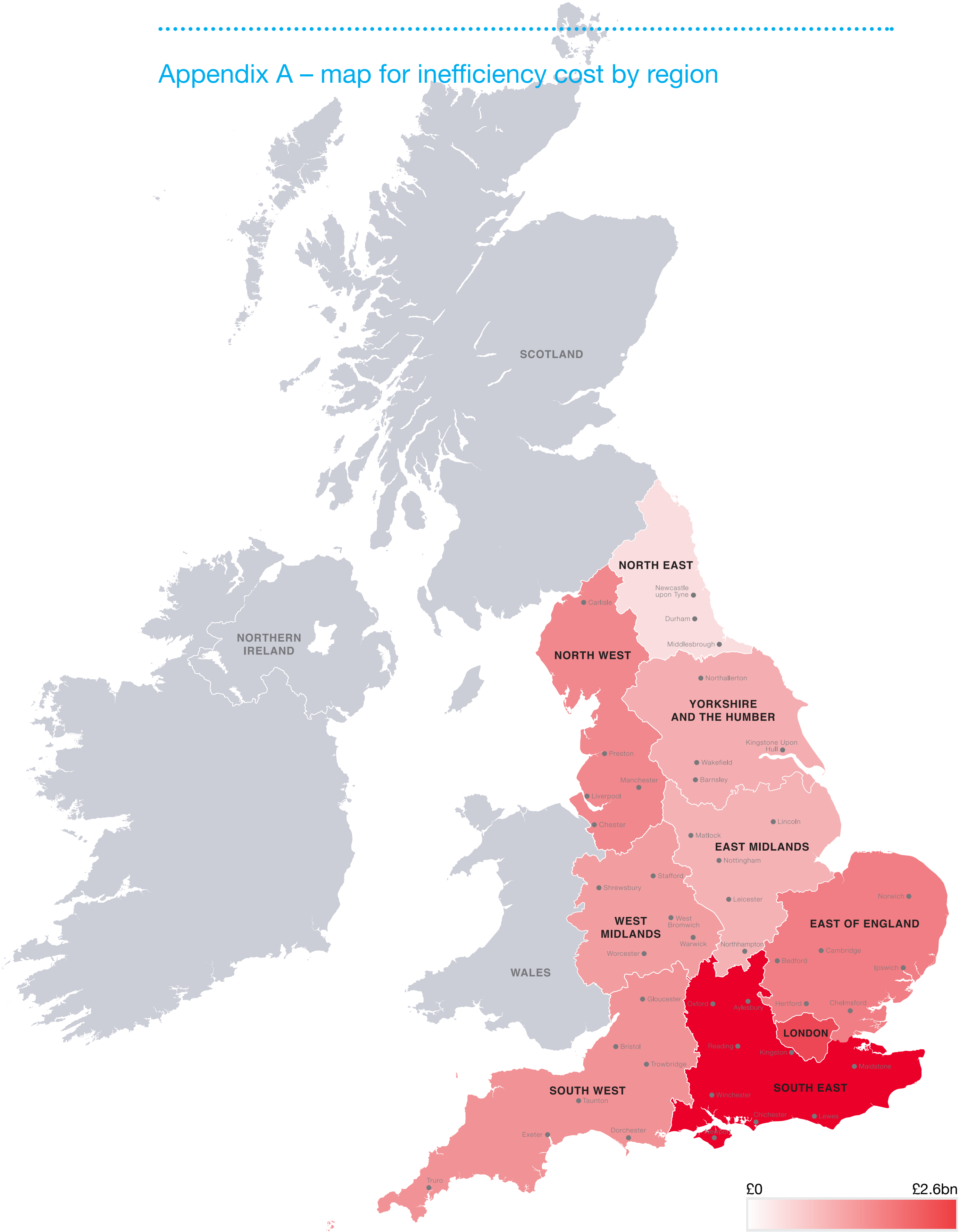
As can be seen from the results below the cost per mile for the car (class 1) and HGV (class 4) categories average 9p per km and 27p per km respectively. These figures again are in line with both the M6 toll and road pricing calculations done as part of this report.

	Average per KM	**Average £ per km**	
Class 1 per km	0.10	£	0.09
Class 2 per km	0.15	£	0.13
Class 3 per km	0.25	£	0.21
Class 4 per km	0.32	£	0.27
Class 5 per km	0.06	£	0.05

Given these findings, it is therefore reasonable to suggest that whilst the rates suggested in this report could be refined by analysing detailed data on journey usage, initial indications suggest that they are in line with the costs levied as part of usage of other charged road networks.

Appendices

Appendix A – map for inefficiency cost by region



Appendix B – map for expenditure per km by region

Appendix C – map for regional road lengths by region (000’s kms)

Appendix D - Regional road expenditure – Motorways, local and truck road

£ Million

	North East	North West	Yorkshire and Humber	East Midlands	West Midlands	East of England	South East	London	South West	England
Motorways and trunk roads										
New construction/ improvement and structural maintenance	71.0	114.7	192.2	235.9	123.0	670.6	236.4	6.6	87.3	1,737.6
Percentage of total	16%	10%	23%	34%	16%	47%	19%	0%	11%	20%
Current maintenance, including routine & winter maintenance	33.1	39.4	58.0	34.1	27.5	49.1	107.5	5.7	59.0	413.5
Percentage of total	7%	3%	7%	5%	4%	3%	9%	0%	7%	5%
DBFO service payments	45.1	0.0	75.3	19.2	0.0	50.2	127.9	0.0	50.6	368.2
Percentage of total	10%	0%	9%	3%	0%	4%	10%	0%	6%	4%
Local Roads										
New construction/ improvement for highways, lighting, road safety and structural maintenance	211.2	739.7	308.9	273.2	394.6	461.3	487.2	859.2	433.9	4,169.2
Percentage of total	46%	65%	38%	39%	51%	32%	39%	64%	53%	48%
Revenue expenditure on bridge structural maintenance & strengthening	4.0	4.7	3.1	1.7	7.0	7.3	9.3	14.5	3.9	55.6
Percentage of total	1%	0%	0%	0%	1%	1%	1%	1%	0%	1%
Routine and winter maintenance	37.5	132.3	111.3	84.9	122.7	123.4	208.9	214.9	128.3	1,164.2
Percentage of total	8%	12%	14%	12%	16%	9%	17%	16%	16%	13%
Revenue expenditure on road safety	7.8	15.5	16.4	14.1	38.5	16.6	24.5	174.2	12.3	320.0
Percentage of total	2%	1%	2%	2%	5%	1%	2%	13%	2%	4%
Revenue expenditure on public lighting	45.6	84.1	53.1	37.5	56.4	46.4	59.8	65.7	41.7	490.3
Percentage of total	10%	7%	6%	5%	7%	3%	5%	5%	5%	6%
All road expenditure	**455.2**	**1,130.4**	**818.3**	**700.7**	**769.6**	**1,424.9**	**1,261.6**	**1,340.8**	**817.1**	**8,718.7**

Appendix E – Inefficiency in the road network

	England	East Midlands	Eastern	London	North East	North West	South East	South West	West Midlands	Yorkshire and Humber
Road statistics										
Road length (000's km)	301,178	31,313	39,634	14,800	16,163	36,942	47,617	49,899	32,851	31,959
Percentage of network	100%	10%	13%	5%	5%	12%	16%	17%	11%	11%
Cars registered (000's)	24,095	2,157	2,921	2,557	1,037	3,084	4,606	2,748	2,744	2,242
Number of cars damaged	3,012	270	365	320	130	385	576	343	343	280
One in eight cars damaged by pot holes (click here)										
Repair inefficiency										
Average cost of repair	**£397,567,500**	**£35,588,306**	**£48,195,791**	**£42,196,787**	**£17,113,503**	**£50,881,529**	**£75,992,334**	**£45,341,175**	**£45,280,290**	**£36,986,631**
Average cost of repair £132 (click here)										
Number of potholes	2,200,000	228,730	289,515	108,110	118,067	269,849	347,823	364,492	239,964	233,451
Regional split calculated based on percentage of road length										
Cost of repairing potholes	**£114,400,000**	**£11,893,983**	**£15,054,798**	**£5,621,695**	**£6,139,495**	**£14,032,150**	**£18,086,770**	**£18,953,569**	**£12,478,104**	**£12,139,437**
2013 Alarm survey - £52 (click here) - no overall improvement in road asset										
Fuel and consumption statistics										
Regional average cost of petrol	£1.33	£1.35	£1.35	£1.34	£1.34	£1.35	£1.35	£1.35	£1.35	£1.34
AA report June 2013 (click here)										
Average fuel consumption	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061
In 2011 - 6.1 litres per 100km or 0.061 per km (click here)										
Miles per person per region	3,376	4,084	4,157	1,544	3,287	2,993	3,972	3,916	3,371	3,267
Data from Gov.uk (click here)										
KM per person per region	5,434	6,572	6,690	2,485	5,289	4,817	6,393	6,303	5,425	5,257
Calculated using conversion factor 1.609344										
Average fuel consumption	331	401	408	152	323	294	390	384	331	321
Data from Gov.uk (click here)										
Yearly cost of fuel	£442	£540	£550	£203	£434	£396	£526	£518	£445	£430
Calculated using consumption and price										
Efficiency/real life adjustment	£560	£684	£696	£258	£549	£501	£665	£656	£563	£544
21% reduction in line with discrepancy findings of ICCT report										
Fuel consumption typical car	53.3	53.3	53.3	53.3	53.3	53.3	53.3	53.3	53.3	53.3
Ford mondeo 1.6l extra urban										
Fuel consumption typical car	31	31	31	31	31	31	31	31	31	31

Ford mondeo 1.6l extra urban										
% performance drop from extra urban to urban	42%	42%	42%	42%	42%	42%	42%	42%	42%	42%
Fuel drop for traffic scenario	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0
The efficiency drop for traffic is assumed to be the same as that from extra urban to urban										
Fuel consumption factor	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Ratio of consumption in traffic compared to typical car on extra urban road										
Time inefficiency										
Time taken to travel to work	25	22	25	35	21	24	26	23	22	23
Figures from the Department for Transport (click here)										
Time spent in traffic per year in minutes	1,740	1,531	1,740	2,436	1,462	1,670	1,810	1,601	1,531	1,601
Data from Inrix (click here)										
Minutes in a year	525,600	525,600	525,600	525,600	525,600	525,600	525,600	525,600	525,600	525,600
Assume individual spends 10 percent time in car	52,560	52,560	52,560	52,560	52,560	52,560	52,560	52,560	52,560	52,560
Time spent in traffic	3.31%	2.91%	3.31%	4.63%	2.78%	3.18%	3.44%	3.05%	2.91%	3.05%
% time spent in traffic is calculated as a percentage of the estimated time spent in car not total time										
Median full-time gross weekly earnings	£506	£464	£495	£653	£455	£470	£537	£467	£469	£465
Data from ONS - regionally available April 2012 (click here)										
Median wage per hour	£13.49	£12.38	£13.21	£17.41	£12.14	£12.53	£14.31	£12.45	£12.51	£12.39
Working week is assumed to be 37.5 hours										
Median wage per min	£0.22	£0.21	£0.22	£0.29	£0.20	£0.21	£0.24	£0.21	£0.21	£0.21
Wage cost of time spent in traffic - per person	£391	£316	£383	£707	£296	£349	£432	£332	£319	£331
Wage cost of time in traffic for region	**£9,426,670,787**	**£681,655,556**	**£1,118,594,114**	**£1,807,466,871**	**£306,625,185**	**£1,075,770,456**	**£1,987,634,732**	**£913,019,944**	**£876,259,342**	**£741,119,193**
Petrol inefficiency										
KM a year in traffic	179.88	191.47	221.49	115.19	147.09	153.10	220.10	191.96	158.03	160.12
Calculated using km per person per region and percentage of time spent in traffic										
km per year not in traffic	5253.67	6380.88	6468.99	2370.13	5142.34	4664.17	6172.63	6110.67	5266.54	5097.12
Calculated by subtracting time in traffic from total km per person per region										
KM traffic adjusted for fuel consumption	533.2	567.6	656.6	341.5	436.0	453.8	652.5	569.0	468.5	474.7
Given that the consumption of fuel significantly increases in traffic the length of km spent in traffic has been adjusted by the fuel consumption ratio calculated previously to reflect a real life scenario										
KM non traffic	1772.3	2152.5	2182.2	799.5	1734.7	1573.4	2082.3	2061.3	1776.6	1719.4
Equal to the total km per person per region										
KM traffic adjusted as a percentage of total	10%	9%	10%	14%	8%	9%	10%	9%	9%	9%
Cost of petrol in traffic per year per car	£55	£59	£68	£35	£45	£47	£68	£59	£49	£49
Petrol inefficiency - Cost for all cars in region	**£1,323,427,605**	**£127,423,924**	**£199,621,162**	**£90,488,312**	**£46,932,827**	**£145,454,458**	**£312,773,203**	**£162,637,358**	**£133,515,011**	**£110,171,403**

Parking inefficiency

Parking fines (2008)	£328,000,000									
Areas with inadequate or no parking provision	16%									
Data from report by RAC (click here)										
Cost of inadequate parking in fines	**£52,480,000**									
Cost of looking for parking	£1.12	£1.03	£1.10	£1.45	£1.01	£1.04	£1.19	£1.04	£1.04	£1.03
Assumes a person spend 5 minutes a day looking for parking										
Cost for whole region	£27,088,134	£2,225,887	£3,214,351	£3,709,907	£1,048,937	£3,220,098	£5,491,917	£2,851,761	£2,861,348	£2,314,840
Assuming all registered cars in the region are used										
Cost adjusted for 25% of cars not being utilised	**£20,316,101**	**£1,669,415**	**£2,410,763**	**£2,782,431**	**£786,703**	**£2,415,074**	**£4,118,938**	**£2,138,821**	**£2,146,011**	**£1,736,130**
Retail sales	£310,817,269									
All retail sales excluding automotive and fuel in 2012 in thousands										
Adjusted out of thousands	£310,817,269,000									
GDP of UK	£1,562,263,000,000									
Retail sales as a percentage	20%									
Potential sales lost from no parking	£9,894,095,906.63									
Calculated using retail sales activity adjusted for the percentage of economic activity, using the percentage of inadequate parking provision would lead to a loss of those sales										
Return adjustment	£989,409,591									
Assumption that 90% return at some point to purchase product, and loss of spontaneous purchases #										
England only adjustment	**£830,114,647**	**£86,305,677**	**£109,241,329**	**£40,792,407**	**£44,549,694**	**£101,820,744**	**£131,242,069**	**£137,531,775**	**£90,544,200**	**£88,086,750**
Based on percentage of output generated by England as a percentage of the UK using GVA figures by ONS - regional breakdowns are based on the percentage of the road network in each region										

Road inefficiency cost - no asset improvement

Total road only inefficiency cost	**£11,262,065,891**	**£856,561,769**	**£1,381,465,865**	**£1,945,773,664**	**£376,811,010**	**£1,286,138,593**	**£2,394,487,039**	**£1,139,952,046**	**£1,067,532,746**	**£900,416,663**
Total road and parking inefficiency cost	**£12,164,976,639**	**£944,536,861**	**£1,493,117,957**	**£1,989,348,502**	**£422,147,407**	**£1,390,374,411**	**£2,529,848,046**	**£1,279,622,642**	**£1,160,222,958**	**£990,239,544**

Appendix F – Road user calculations

	Low use car	Medium use car	High use car	Freight - night shift low	Freight - night shift medium	Freight - night shift high	Freight - day shift low	Freight - day shift medium	Freight - day shift high
User statistics									
KM per year	5,000	10,000	25,000	110,000	135,000	160,000	110,000	135,000	160,000
Peak driving percentage	30%	60%	70%	15%	15%	15%	45%	45%	45%
Off peak driving percentage	60%	20%	20%	25%	25%	25%	20%	20%	20%
Night driving percentage	10%	20%	10%	60%	60%	60%	35%	35%	35%
KM covered per method									
Peak driving km	1,500	6,000	17,500	16,500	20,250	24,000	49,500	60,750	72,000
Off peak driving km	3,000	2,000	5,000	27,500	33,750	40,000	22,000	27,000	32,000
Night driving km	500	2,000	2,500	66,000	81,000	96,000	38,500	47,250	56,000
Fuel and consumption statistics									
Average cost of petrol (cars) diesel (HGV's)	£1.33	£1.33	£1.33	£1.39	£1.39	£1.39	£1.39	£1.39	£1.39
AA report June 2013 (click here)									
Average fuel consumption	0.061	0.061	0.061	0.270	0.270	0.270	0.270	0.270	0.270
In 2011 - 6.1 litres per 100km or 0.061 per km (click here)									
Efficiency/real life adjustment	0.077	0.077	0.077	0.342	0.342	0.342	0.342	0.342	0.342
21% reduction in line with discrepancy findings of ICCT report									
Fuel usage									
Usage - full year (litres)	386	772	1930	37595	46139	54684	37595	46139	54684
Usage - peak (litres)	116	463	1351	5639	6921	8203	16918	20763	24608
Usage - off peak (litres)	232	154	386	9399	11535	13671	7519	9228	10937
Usage - night (litres)	39	154	193	22557	27684	32810	13158	16149	19139
Tax/fuel payment under current system									
Tax rate on heavy oil and petrol for normal use	£0.5400	£0.5400	£0.5400	£0.5400	£0.5400	£0.5400	£0.5400	£0.5400	£0.5400
From 1 Jan 2013									
Fuel duty paid	£208	£417	£1,042	£20,301	£24,915	£29,529	£20,301	£24,915	£29,529
Fuel cost	£307	£613	£1,533	£32,031	£39,311	£46,590	£32,031	£39,311	£46,590
Total cost	£515	£1,030	£2,575	£52,332	£64,226	£76,119	£52,332	£64,226	£76,119
Road pricing scenario 1 - equal charge									
Price per km - peak	£0.04	£0.04	£0.04	£0.04	£0.04	£0.04	£0.04	£0.04	£0.04
Price per km - off peak	£0.02	£0.02	£0.02	£0.02	£0.02	£0.02	£0.02	£0.02	£0.02
Price per km - night	£0.02	£0.02	£0.02	£0.02	£0.02	£0.02	£0.02	£0.02	£0.02

Cost to user - peak	£60.00	£240.00	£700.00	£660.00	£810.00	£960.00	£1,980.00	£2,430.00	£2,880.00
Cost to user - off peak	£60.00	£40.00	£100.00	£550.00	£675.00	£800.00	£440.00	£540.00	£640.00
Cost to user - night	£10.00	£40.00	£50.00	£1,320.00	£1,620.00	£1,920.00	£770.00	£945.00	£1,120.00
Total cost to user	**£130.00**	**£320.00**	**£850.00**	**£2,530.00**	**£3,105.00**	**£3,680.00**	**£3,190.00**	**£3,915.00**	**£4,640.00**
Saving/loss compared to fuel duty	**£78.48**	**£96.96**	**£192.41**	**£17,771.27**	**£21,810.19**	**£25,849.11**	**£17,111.27**	**£21,000.19**	**£24,889.11**
Positive equals a saving, negative a loss									
Road pricing scenario 2 - varied for cars and freight - v1									
Price per km - peak	£0.08	£0.08	£0.08	£0.30	£0.30	£0.30	£0.30	£0.30	£0.30
Price per km - off peak	£0.04	£0.04	£0.04	£0.25	£0.25	£0.25	£0.25	£0.25	£0.25
Price per km - night	£0.02	£0.02	£0.02	£0.20	£0.20	£0.20	£0.20	£0.20	£0.20
Cost to user - peak	£120.00	£480.00	£1,400.00	£4,950.00	£6,075.00	£7,200.00	£14,850.00	£18,225.00	£21,600.00
Cost to user - off peak	£120.00	£80.00	£200.00	£6,875.00	£8,437.50	£10,000.00	£5,500.00	£6,750.00	£8,000.00
Cost to user - night	£10.00	£40.00	£50.00	£13,200.00	£16,200.00	£19,200.00	£7,700.00	£9,450.00	£11,200.00
Total cost to user	**£250.00**	**£600.00**	**£1,650.00**	**£25,025.00**	**£30,712.50**	**£36,400.00**	**£28,050.00**	**£34,425.00**	**£40,800.00**
Saving/loss compared to fuel duty	**-£41.52**	**-£183.04**	**-£607.59**	**-£4,723.73**	**-£5,797.31**	**-£6,870.89**	**-£7,748.73**	**-£9,509.81**	**-£11,270.89**
Positive equals a saving, negative a loss									
Road pricing scenario 3 - varied for cars and freight - v2									
Price per km - peak	£0.06	£0.06	£0.06	£0.25	£0.25	£0.25	£0.25	£0.25	£0.25
Price per km - off peak	£0.04	£0.04	£0.04	£0.20	£0.20	£0.20	£0.20	£0.20	£0.20
Price per km - night	£0.03	£0.03	£0.03	£0.15	£0.15	£0.15	£0.15	£0.15	£0.15
Cost to user - peak	£90.00	£360.00	£1,050.00	£4,125.00	£5,062.50	£6,000.00	£12,375.00	£15,187.50	£18,000.00
Cost to user - off peak	£120.00	£80.00	£200.00	£5,500.00	£6,750.00	£8,000.00	£4,400.00	£5,400.00	£6,400.00
Cost to user - night	£15.00	£60.00	£75.00	£9,900.00	£12,150.00	£14,400.00	£5,775.00	£7,087.50	£8,400.00
Total cost to user	**£225.00**	**£500.00**	**£1,325.00**	**£19,525.00**	**£23,962.50**	**£28,400.00**	**£22,550.00**	**£27,675.00**	**£32,800.00**
Saving/loss compared to fuel duty	**-£16.52**	**-£83.04**	**-£282.59**	**£776.27**	**£952.69**	**£1,129.11**	**-£2,248.73**	**-£2,759.81**	**-£3,270.89**
Positive equals a saving, negative a loss									
Road pricing scenario 4 - varied for cars and freight - v3									
Price per km - peak	£0.0470	£0.0470	£0.0470	£0.212	£0.212	£0.212	£0.212	£0.212	£0.212
Price per km - off peak	£0.0375	£0.0375	£0.0375	£0.192	£0.192	£0.192	£0.192	£0.192	£0.192
Price per km - night	£0.0200	£0.0200	£0.0200	£0.155	£0.155	£0.155	£0.155	£0.155	£0.155
Cost to user - peak	£70.50	£282.00	£822.50	£3,498.00	£4,293.00	£5,088.00	£10,494.00	£12,879.00	£15,264.00
Cost to user - off peak	£112.50	£75.00	£187.50	£5,280.00	£6,480.00	£7,680.00	£4,224.00	£5,184.00	£6,144.00
Cost to user - night	£10.00	£40.00	£50.00	£10,230.00	£12,555.00	£14,880.00	£5,967.50	£7,323.75	£8,680.00
Total cost to user	**£193.00**	**£397.00**	**£1,060.00**	**£19,008.00**	**£23,328.00**	**£27,648.00**	**£20,685.50**	**£25,386.75**	**£30,088.00**
Saving/loss compared to fuel duty	**£15.48**	**£19.96**	**-£17.59**	**£1,293.27**	**£1,587.19**	**£1,881.11**	**-£384.23**	**-£471.56**	**-£558.89**
Positive equals a saving, negative a loss									

Appendix G – French tariff data for averages

Start	Exit	Class 1 per km	Class 2 per km	Class 3 per km	Class 4 per km	Class 5 per km	Class 1 per km	Class 2 per km	Class 3 per km	Class 4 per km	Class 5 per km
ALLAINES	AMBERIEU	0.09	0.14	0.23	0.30	0.05	£0.08	£0.12	£0.19	£0.26	£0.05
ALLAINES	ARLAY	0.10	0.15	0.24	0.31	0.05	£0.08	£0.13	£0.20	£0.26	£0.05
ALLAINES	AUXERRE NORD	0.13	0.20	0.32	0.40	0.07	£0.11	£0.17	£0.27	£0.34	£0.06
ALLAINES	AUXERRE SUD	0.12	0.18	0.30	0.38	0.06	£0.10	£0.16	£0.25	£0.32	£0.05
ALLAINES	AVALLON	0.11	0.17	0.28	0.36	0.06	£0.10	£0.14	£0.23	£0.30	£0.05
ALLAINES	BALAN	0.09	0.14	0.22	0.29	0.05	£0.08	£0.12	£0.19	£0.25	£0.04
ALLAINES	BAUME-LES-DAMES	0.09	0.14	0.23	0.31	0.05	£0.08	£0.12	£0.19	£0.26	£0.05
ALLAINES	BEAUNE NORD	0.10	0.16	0.25	0.32	0.06	£0.09	£0.13	£0.21	£0.27	£0.05
ALLAINES	BEAUNE SUD	0.10	0.16	0.25	0.33	0.06	£0.09	£0.13	£0.21	£0.28	£0.05
ALLAINES	BEAUPONT	0.09	0.14	0.23	0.30	0.05	£0.08	£0.12	£0.19	£0.26	£0.04
ALLAINES	BEAUREPAIRE	0.10	0.15	0.24	0.31	0.05	£0.08	£0.12	£0.20	£0.26	£0.05
ALLAINES	BELLEVILLE S/ SAONE	0.10	0.15	0.23	0.31	0.05	£0.08	£0.12	£0.20	£0.26	£0.05
ALLAINES	BERSAILLIN	0.10	0.15	0.24	0.32	0.05	£0.08	£0.12	£0.20	£0.27	£0.05
ALLAINES	BESANCON EST	0.09	0.14	0.23	0.30	0.05	£0.08	£0.12	£0.19	£0.26	£0.04
ALLAINES	BESANCON NORD	0.10	0.15	0.24	0.31	0.05	£0.08	£0.12	£0.20	£0.26	£0.05
ALLAINES	BESANCON OUEST	0.10	0.15	0.24	0.31	0.05	£0.08	£0.13	£0.20	£0.27	£0.05
ALLAINES	BEYNOST	0.09	0.14	0.23	0.30	0.05	£0.08	£0.12	£0.19	£0.25	£0.04
ALLAINES	BIERRE-LES-SEMUR	0.11	0.16	0.26	0.34	0.06	£0.09	£0.14	£0.22	£0.29	£0.05
ALLAINES	BOURG NORD	0.10	0.15	0.23	0.31	0.05	£0.08	£0.12	£0.20	£0.26	£0.05
ALLAINES	BOURG SUD	0.09	0.14	0.23	0.30	0.05	£0.08	£0.12	£0.19	£0.25	£0.05
ALLAINES	BULGNEVILLE	0.09	0.14	0.23	0.30	0.05	£0.08	£0.12	£0.19	£0.25	£0.04
ALLAINES	CHALON NORD	0.10	0.16	0.25	0.32	0.06	£0.09	£0.13	£0.21	£0.27	£0.05
ALLAINES	CHALON SUD	0.10	0.15	0.25	0.32	0.06	£0.08	£0.13	£0.21	£0.27	£0.05
ALLAINES	CHATENOIS	0.09	0.14	0.22	0.30	0.05	£0.08	£0.12	£0.19	£0.25	£0.04
ALLAINES	CHATILLON-LABORDE	0.12	0.18	0.29	0.37	0.06	£0.10	£0.15	£0.25	£0.32	£0.05
ALLAINES	CHAUMONT-SEMOUTIERS	0.10	0.15	0.24	0.32	0.05	£0.08	£0.13	£0.21	£0.27	£0.05

Start	Exit	Class 1 per km	Class 2 per km	Class 3 per km	Class 4 per km	Class 5 per km	Class 1 per km	Class 2 per km	Class 3 per km	Class 4 per km	Class 5 per km
ALLAINES	CHOISEY	0.10	0.15	0.24	0.32	0.06	£0.08	£0.13	£0.20	£0.27	£0.05
ALLAINES	CLERMONT-BARRIERE	0.09	0.14	0.22	0.30	0.05	£0.08	£0.12	£0.19	£0.25	£0.05
ALLAINES	COLOMBEY-LES-BELLES	0.09	0.14	0.22	0.29	0.05	£0.08	£0.12	£0.19	£0.25	£0.04
ALLAINES	COMBRONDE	0.09	0.14	0.22	0.29	0.05	£0.07	£0.11	£0.18	£0.24	£0.04
ALLAINES	COURTENAY	0.15	0.22	0.36	0.44	0.08	£0.12	£0.19	£0.30	£0.37	£0.06
ALLAINES	DIJON SUD	0.10	0.15	0.25	0.32	0.06	£0.08	£0.13	£0.21	£0.27	£0.05
ALLAINES	DIJON-ARC S/TILLE	0.10	0.15	0.24	0.32	0.06	£0.08	£0.13	£0.20	£0.27	£0.05
ALLAINES	DIJON-CRIMOLOIS	0.09	0.14	0.22	0.29	0.05	£0.08	£0.12	£0.19	£0.24	£0.04
ALLAINES	DOLE	0.10	0.15	0.24	0.32	0.06	£0.08	£0.13	£0.20	£0.27	£0.05
ALLAINES	FEILLENS	0.10	0.15	0.24	0.31	0.06	£0.08	£0.13	£0.20	£0.26	£0.05
ALLAINES	FLEURY-EN-BIERE	0.12	0.18	0.30	0.37	0.06	£0.10	£0.16	£0.25	£0.31	£0.05
ALLAINES	FONTAINEBLEAU	0.13	0.19	0.31	0.39	0.07	£0.11	£0.16	£0.26	£0.33	£0.05
ALLAINES	FORET DE TRONCAIS	0.09	0.15	0.23	0.30	0.06	£0.08	£0.12	£0.19	£0.25	£0.05
ALLAINES	FORGES	0.12	0.18	0.29	0.37	0.06	£0.10	£0.15	£0.25	£0.31	£0.05
ALLAINES	GANNAT	0.09	0.14	0.22	0.29	0.05	£0.07	£0.11	£0.18	£0.24	£0.04
ALLAINES	GENDREY	0.10	0.15	0.24	0.31	0.05	£0.08	£0.13	£0.20	£0.26	£0.05
ALLAINES	GERZAT-VILLE	0.09	0.14	0.21	0.28	0.05	£0.07	£0.11	£0.18	£0.24	£0.04
ALLAINES	GROISSIAT	0.10	0.15	0.23	0.31	0.05	£0.08	£0.12	£0.20	£0.26	£0.05
ALLAINES	GYE	0.09	0.14	0.22	0.29	0.05	£0.08	£0.12	£0.19	£0.25	£0.04
ALLAINES	JOIGNY	0.14	0.21	0.34	0.42	0.07	£0.12	£0.17	£0.28	£0.35	£0.06
ALLAINES	L ISLE-S/LE-DOUBS	0.09	0.14	0.23	0.30	0.05	£0.08	£0.12	£0.19	£0.25	£0.04
ALLAINES	LA BOISSE	0.09	0.14	0.23	0.30	0.05	£0.08	£0.12	£0.19	£0.25	£0.05
ALLAINES	LA BOISSE - MONTLUEL	0.09	0.14	0.22	0.29	0.05	£0.08	£0.12	£0.19	£0.25	£0.04
ALLAINES	LA COTIERE	0.09	0.14	0.23	0.30	0.05	£0.08	£0.12	£0.19	£0.25	£0.05
ALLAINES	LA CROIX-CHALON	0.10	0.15	0.23	0.31	0.05	£0.08	£0.12	£0.20	£0.26	£0.05
ALLAINES	LANGRES NORD	0.10	0.15	0.23	0.30	0.05	£0.08	£0.12	£0.20	£0.26	£0.04
ALLAINES	LANGRES SUD	0.10	0.15	0.23	0.31	0.05	£0.08	£0.12	£0.20	£0.26	£0.05

Start	Exit	Class 1 per km	Class 2 per km	Class 3 per km	Class 4 per km	Class 5 per km	Class 1 per km	Class 2 per km	Class 3 per km	Class 4 per km	Class 5 per km
ALLAINES	LE MIROIR	0.09	0.14	0.23	0.31	0.05	£0.08	£0.12	£0.20	£0.26	£0.05
ALLAINES	LES EPRUNES	0.11	0.17	0.28	0.36	0.06	£0.09	£0.14	£0.23	£0.30	£0.05
ALLAINES	MACON NORD	0.10	0.15	0.24	0.31	0.05	£0.08	£0.13	£0.20	£0.26	£0.05
ALLAINES	MACON SUD	0.10	0.15	0.24	0.31	0.05	£0.08	£0.13	£0.20	£0.26	£0.05
ALLAINES	MAGNANT	0.11	0.17	0.27	0.34	0.06	£0.09	£0.14	£0.22	£0.29	£0.05
ALLAINES	MAROLLES-SUR-SEINE	0.13	0.19	0.31	0.39	0.07	£0.11	£0.16	£0.26	£0.33	£0.06
ALLAINES	MONTIGNY-LE-ROI	0.10	0.14	0.23	0.30	0.05	£0.08	£0.12	£0.19	£0.26	£0.04
ALLAINES	MONTLUCON	0.09	0.14	0.22	0.30	0.05	£0.08	£0.12	£0.19	£0.25	£0.05
ALLAINES	MONTMARAULT	0.09	0.14	0.23	0.30	0.05	£0.08	£0.12	£0.19	£0.25	£0.05
ALLAINES	NEMOURS	0.13	0.20	0.32	0.40	0.07	£0.11	£0.16	£0.27	£0.33	£0.06
ALLAINES	NITRY	0.12	0.18	0.28	0.36	0.06	£0.10	£0.15	£0.24	£0.31	£0.05
ALLAINES	NUITS-ST-GEORGES	0.10	0.16	0.25	0.32	0.06	£0.09	£0.13	£0.21	£0.27	£0.05
ALLAINES	PEROUGES	0.09	0.14	0.23	0.30	0.05	£0.08	£0.12	£0.19	£0.25	£0.04
ALLAINES	PONT D AIN	0.09	0.14	0.23	0.30	0.05	£0.08	£0.12	£0.19	£0.26	£0.05
ALLAINES	POUILLY-EN-AUXOIS	0.11	0.16	0.26	0.34	0.06	£0.09	£0.14	£0.22	£0.29	£0.05
ALLAINES	REPLONGES	0.10	0.15	0.24	0.31	0.05	£0.08	£0.12	£0.20	£0.26	£0.05
ALLAINES	RIOM	0.09	0.14	0.22	0.29	0.05	£0.07	£0.12	£0.18	£0.24	£0.04
	Average	**0.10**	**0.15**	**0.25**	**0.32**	**0.06**	**£0.09**	**£0.13**	**£0.21**	**£0.27**	**£0.05**

Endnotes

1 The ‘stuck in traffic figure’, forms part the analysis into the cost of congestion by DfT in the Action for Roads a network for the 21st century report (click here)

2 DfT, Action for Roads a network for the 21st century (click here)

3 Department for Transport, Transport Statistics Great Britain, 2011-12 (click here)

4 Status quo is based on the profile of spending remaining similar to that of the latest data, 2010-11, as such any additional future commitments that do take place should reduce the scale of the inefficiency assuming that the rate of deterioration does not increase.

5 EC Harris, Indicative building costs, 2006 (click here) – estimates used for calculation of the numbers of spaces that could be provided are based on the information in the document and allowing for no change in price in the low cost £1100 scenario, some variation in the medium scenario £1500, and increased costs in the high scenario £2000

6 DfT, Action for Roads a network for the 21st century (click here)

7 FTA, Fuel price and duty update Budget 2013, 2013 (click here)

8 World Economic Forum, Global Competitiveness report 2013-14 (click here)

9 CBI, Infrastructure survey, Better connected, better business 2012 (click here)

10 DfT, Action for Roads a network for the 21st century (click here)

11 Department for Transport, Transport Statistics Great Britain, 2011-12 (click here)

12 GVA measures the contribution to the economy of each individual producer, industry or sector in the United Kingdom. GVA + taxes on products - subsidies on products = GDP

13 This is Money, Pothole fightback: One in eight motorists suffer damage from council negligence – but you can grab compensation if you’re one of them, 2012 (click here)

14 The Independent, Councils in a pothole panic over £5m bill for car damage, 2012 (click here)

15 Median wages are used to provide a value for an individual’s time, with an assumption that their annual salary encompasses the individual’s wage/utility requirements for work, travel and leisure time. Whilst it could be argued that there will be a percentage of an individual’s time that they would not substitute for work, this is unlikely to be represent a significant degree of total road usage.

16 Data from Inrix (click here)

17 Car used for study, Ford Mondeo

18 Admiral, Car sitters used to avoid parking tickets, 03/04/2013 (click here)

19 The figure used is for the total cost of parking fines, as it could be argued that if parking provision was completely efficient no one would ever need to park illegally. However, the report does realise that whilst such an assumption may be theoretically true, human behaviour may mean that a small degree of these parking fines would still occur even with total parking provision.

20 DfT, Action for Roads a network for the 21st century (click here)

21 EC Harris, Indicative building costs, 2006 (click here) – estimates used for calculation of the numbers of spaces that could be provided are based on the information in the document and allowing for no change in price in the low cost £1100 scenario, some variation in the medium scenario £1500, and increased costs in the high scenario £2000

22 CIPFA, code of practice on transport infrastructure assets (click here)

23 ACE, Procurement in PPFM, 2012 (click here)

24 Approximate fuel duty collected: petrol £11bn, diesel £15bn, rate of tax on petrol and heavy oil £0.5795 per litre (rate prior to 1st January 2013), approximate number of litres used 19bn petrol, 25bn diesel. If fuel duty falls by £3bn then the rate of duty would fall between 6-7 pence.

25 Approximate fuel duty collected: petrol £11bn, diesel £15bn, rate of tax on petrol and heavy oil

£0.5795 per litre, approximate number of litres used 19bn petrol, 25bn diesel. If fuel duty falls by £3bn then the rate of duty would fall between 6-7 pence.

26 FTA, Fuel price and duty update Budget 2013, 2013 (click here)

27 FTA, Fuel price and duty update Budget 2013, 2013 (click here)

28 M6 toll, Pricing overview, 2013 (click here)

29 APRR, Classes for vehicles, 2013 (click here)

30 APRR, Tarifs de péage, 2013 (click here)

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Further information

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