

Funding Transport¹

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Summary

We address the problems of funding local transport infrastructure and transport services without making additional financial demands on central or local government. We propose the creation of regional, public interest transport funding bodies. Their income would be an allocation of the extra revenue from increasing the rate of road fuel duty to recover some of the one third fall in the rate since the start of the century. The constitution of these public interest bodies, defined in existing law, would ensure all their income and any borrowing is ring-fenced for spending on transport purposes determined by the existing, elected authorities. It would make increases in road taxation more palatable because the revenues would be transparently dedicated to improving local roads and other transport. Duty on fossil fuels will have to be replaced sooner or later and this proposal would accommodate a transition to road user charging.

The problem

The 2020 edition of *The Annual Local Authority Road Maintenance by the Asphalt Industry Alliance* (24th March) “highlights that highway maintenance budgets have dropped by an average of 16% across England and Wales – back to a level they were at 15 years ago – and the amount needed to bring the network up to scratch has increased to £11.14 billion. While the Government’s Budget announcement [March 2020] of an extra £2.5 billion to English roads over five years is a big step in the right direction, looking ahead, our local road network will need additional and sustained

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investment and a rethink in the stop/start approach to funding we have seen over the last 25 years in order to improve its overall condition and resilience for the future.”

Local authorities would like more resources to maintain and enhance their transport infrastructure and to operate transport services. Neglected local road maintenance and declining bus services are particular problems. Although central government has stated an intention to increase spending on infrastructure, particularly in the north of England, it may be difficult in practice to find sufficient additional central Exchequer funding given the many competing calls on local authorities for increases in other elements of their spending. This especially in the light of the unexpected demands imposed by the flooding in early 2020 and the public expenditure implications of the Covid-19, the extent of which only became fully apparent after the Budget had been delivered.

Further, devolution of powers and duties to city regions and other subnational transport bodies is developing and locally-elected politicians are frustrated by having to rely on central government for funding rather than having control of funds for which they can be responsible.

Meanwhile road traffic has been growing faster than capacity and on current policies that will continue once the Covid-19 crisis has passed: congestion will continue to worsen. Air pollution and carbon emissions from road traffic are increasing concerns. Deaths and injuries on the roads are unacceptable and appear to have stopped falling. More spending on road safety would be highly productive.

Revenues from national road taxation will continue to soften as petrol and diesel vehicles become more efficient and there is a switch to electric traction. Road taxation is going to have to be reformed in response to this come what may, and that creates an opportunity to align local authority funding with the spending demands faced by local and regional government.

It is possible that people’s experiences of dealing with the restrictions on physical movement caused by Covid-19 will result in a lasting shift in the balance between

physical and tele-communications. But even if this does happen there is a great deal of catching up to be done and many of the problems in transport policy will remain.

In short: better-maintained roads are needed and more capacity needs to be provided in selected places; road traffic growth needs to be managed; incentives need to be sharpened to move to better technologies; alternatives modes of transport to the private car need to be improved; total road tax revenues need to be protected; and local government needs to be given control over a higher proportion of taxation and spending.

A response

We are looking for a way forward that is politically and technically feasible and could be implemented within a few years. Our suggestions do not involve new distance-based road charging because the public would resist, and implementation would be politically difficult and slow. But short term solutions must be compatible with the longer-term aspiration. We recognise HM Treasury's funding dilemmas so our proposals do not require reduction in net funds available to the Exchequer to fund non-transport general government expenditure.

The reality is that to achieve this road users will have to pay more in total. We seek improvements which the public would judge an acceptable price to pay in exchange for an assured improvement. The public would be less resistant if they were confident in a promise that paying more would be in return for an improved level of service. Only thirty per cent of road tax revenues are spent on roads. The balance is an important contribution towards funding general government expenditure. Currently road taxes are correctly perceived as general national taxation and not ring-fenced for transport so a reform of governance is necessary to mitigate public opposition to higher road taxation.

A focus of our proposal is the rate of fuel duty. This is a significant source of Exchequer tax revenues at £28bn + VAT in 2018/19. Fuel duty has desirable characteristics as a way of raising revenue: administration is long-established and

routine; it is cheap to collect; hard to evade; and it provides some desirable incentives—though the incidence on some low income households can be argued to be unfair.

There has been a significant and systematic reduction in fuel duty rates in real terms from about 80 pence per litre in the late 1990's to 58 pence per litre. This creates headroom to increase funding hypothecated to transport whilst giving a reasonable protection to Exchequer receipts. For instance if capital plus current public expenditure on roads in Great Britain were to increase from £9.4bn p.a. to an average of £12½ bn p.a. over a five year period, there are several ways to adjust road taxation rates to fund this whilst remaining within the annual yield from 1999 rates (increased in line with the RPI), and have a terminal receipts level sufficient to maintain this additional expenditure into the future.

A way to make such an increase less unpopular would be to ensure that a significant portion of the increased revenue would be ring-fenced and available in full to local authorities and Highways England for revenue and capital expenditures only on roads and other local transport.

To gain credibility this would require changes to the governance regime for transport. Otherwise an increase in roads taxation would continue to be dismissed as “stealth taxation”. Rates of fuel duty would be increased somewhat and some of the extra fuel duty revenues would be allocated as secure incomes for independent, public interest transport funding bodies, analogous to the public benefit corporations common in North America or the public trust funds that have frequently been used in the past in the UK. Suitable governance structures for such bodies have been established in English law for a very long time. If they wished, they would be able to borrow on the markets against these secure incomes and service the debt. They would release funding to their “client” local authorities for purposes approved within their statutorily defined objects.

We suggest that the yield on Vehicle Excise Duty, being a tax on ownership rather than use, should remain stable or be reduced and be regarded as a tax to incentivise the initial purchase of more fuel-efficient and less polluting vehicles.

Increasing in fuel duty rates would have incidental beneficial effects of limiting traffic growth and emissions. They would give greater incentives for vehicle fuel efficiency and lower carbon emissions. Differential rates of fuel duty can easily be applied to different fuels (petrol, diesel, natural gas) to reflect their differential damages to air quality. Similar measures have proven effective in the past.

The recently reformed administrative arrangements for the stewardship of the Strategic Road Network by Highways England are generally satisfactory. A National Roads Fund could be constituted as its own, independent, public interest body, funded out of a share of VED (as now) and fuel duty revenues. The Strategic Road Network could be divided into a distinct regional structure taking opportunities presented by the current trend towards devolution of transport powers. In the medium term, simple pay-as-you-go charging based on automatic number plate recognition on some limited access sections of the Strategic Road Network would be technically easy and a fairer way to manage capacity and generate funds.

There is a case for reviewing the portfolio of roads classified to the Strategic Road Network possibly by adopting (“trunking”) the busier local authority ‘A’ roads. Alternatively, proposals for the creation of an English Major Road Network (MRN) – including perhaps five thousand additional miles of ‘A’ roads – have been the subject of a consultation by the Department for Transport (DfT). These could be designated as roads of regional importance to be managed and developed by groups of local highways authorities in accordance with national guidelines consistent with those for Highways England and with access to the new funding bodies.

London already has clear governance in relation to transport and we suggest no change, other than allocating a share of the extra fuel duty revenues to the Greater London Authority, commensurate with the allocations to other local bodies. Other

large metropolitan regions could follow suit when similarly robust governance is in place.

For the many other local highway authorities independent, public interest transport funding bodies would be created - probably with geographies larger than individual local highways authorities. The additional, ring fenced central funding for this, allocated from a share of the increased fuel duty revenues.

Performance criteria could be required by the funding bodies for both regional and local roads which might be a combination of output and outcome measures starting with mainly output but developing into mainly outcome measures as the system matures.

The longer term

Our immediate-term proposals could be implemented within a few years since they rely on reforming existing taxation and governance rather than wholesale switching to new technological systems. For the medium term, an option with advantages would be to progress these reforms with incremental adoption of proven technologies to shift the funding burden towards simple pay-as-you-go systems.

In the long run fully 'efficient pricing' is the best approach in principle. Vehicles could be progressively equipped with on board units that would enable their use of the road system to be monitored. Transition would be an issue but with the prospective widespread use of 'smart fuel pumps' fuel duty charges could be reduced or eliminated as pay-as-you-go takes over. Pay-as-you-go tariffs would be set without need for any 'on board' adjustment, and tariffs or tariff ranges would be published and updated periodically. This would allow a gradual transition towards national efficient pricing as and when deemed to be politically acceptable.

If it were felt that a full pay-as-you-go scheme would impose too great a financial burden on some groups of low income motorists the payment of an annual fee could entitle road users to a basic annual mileage - possibly limited to the use of local roads or non-peak travel. Road use in excess of this would then be subject to pay-as-you-go

charges. This way low use motorists would benefit from reduced payments and road use on the Strategic Road Network would be managed during peak periods.

Road safety

There has been a loss of skill and resource devoted to road safety in local authorities and to policing and enforcement. Road safety policy needs to be overseen by one or more national independent bodies with duties to understand road system risk, set standards and enforce against those standards; all with due regard to value for money and what is “reasonably practicable”. This is the approach that is commonplace and successful for other transport modes and in places of work, where hazard is materially lower. The new funds would offer the monies necessary to repair this and to provide an appropriate level of enforcement of traffic laws and highway standards.

Environment

Whilst policy for reducing the environmental impact of transport would be managed centrally all operators would have clear responsibilities for the local environmental performance of their networks. Proper regard to environmental issues would be a requirement of the transport funding bodies.

CONTENTS

Summary	1
THE PROBLEMS	10
Congestion, potholes, safety, pollution and taxation	10
Who is in charge?	11
Paying for quality.....	13
Inadequate roads provision by local authorities	14
Somebody has to pay more.....	15
The need for clearer governance.....	15
"Sustainable" transport policies are not enough	16
The limited contribution of new technologies	16
Traffic has not peaked	17
FUEL DUTY, VEHICLE EXCISE DUTY AND ROAD FUNDING	18
Current road funding arrangements	18
Revenues	18
Funding the Strategic Road Network	23
Funding Local roads	24
PROPOSALS FOR THE STRATEGIC ROAD NETWORK.....	27
Governance is clear.....	28
No need for immediate reform	28
Further reform in the medium term?	29
Which roads are in the Strategic Road Network?.....	30
PROPOSALS FOR LONDON	31
PROPOSALS FOR LOCAL AUTHORITY ROADS	32
National road pricing not feasible in the short term	32
Reform for local roads	32
Local roads funding authorities	33
Other funding possibilities.....	35
THE OVERALL FISCAL PROPOSITION	35
Road taxes, charges and spending.	35
Fuel duty and Vehicle Excise Duty	36
Pay-as-you-go charges to raise revenue	40
A simple pay-as-you-go scheme.....	40
Fully efficient pay-as-you-go charges	42
ROAD SAFETY	43
ENVIRONMENT	44
SOURCES.....	47

APPENDICES AVAILABLE ON REQUEST²

APPENDIX A – LEVEL OF SERVICE

- Maintenance
- Public attitudes
- Congestion

APPENDIX B – SAFETY

APPENDIX C - EFFICIENT PRICING **Error! Bookmark not defined.**

APPENDIX D – SOURCES OF FUNDS FOR ROADS

- Pay-as-you-go Systems currently in operation
- Charges for car parking
- Property taxes
- Development levies
- General taxes and motoring taxes
- Tax increment financing
- National and local government bonds

APPENDIX E - DELIVERY OF ROAD MAINTENANCE, MANAGEMENT AND IMPROVEMENTS

Measurement of performance and fee determination

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THE PROBLEMS

Congestion, potholes, safety, pollution and taxation

The English road system faces several distinct problems: traffic is growing; maintenance is inadequate; there is insufficient funding for construction of new capacity; risk of death and injury to road users is significantly higher than in other walks of life and is not as low as reasonably practicable; there are air quality, carbon emissions and other environmental issues. Evidence on present and future road congestion and on Public attitudes to road conditions is set out in Appendix A.

Taxes on road users are an important source of revenue to the Exchequer, but improvements to vehicle fuel economy and emissions have caused these revenues to stabilise and they are forecast to fall³. Government has committed to phasing out sales of new fossil-fuelled cars and vans. This, in itself creates pressure to reform the fiscal regime for roads.

Proposals need to achieve results within a few years. At the same time reform must not compromise the exploitation in the future of opportunities that may become politically and technically practicable. We offer staged proposals: the initial proposals could be implemented within the term of a Parliament. They could evolve into fuller, second-stage reforms over a longer term.

We make separate immediate and then medium term proposals for the Strategic Road Network, London and the other local authority roads and we offer an overall, national fiscal reconciliation.

Our proposals are devised in the context of Great Britain but on some matters our analysis is confined to England to avoid the complications of elaboration in three separate contexts. Some of the ideas could be of value in dealing with these problems overseas.

³ Johnson *et al* 2012.

Who is in charge?

The UK road system is extensive, complex and varies in character from country lanes and quiet residential *culs de sac* to busy motorways and expressways. It would be neither desirable nor practicable to have a uniform system of governance for its entirety. Any reasonable system should reflect the fact that at one extreme (motorways) the road function is exclusively for the safe and speedy passage of motor traffic. At the other extreme a village high street will have people living on it along with shops and other community facilities. It will provide both access for foot, wheeled and motor traffic—perhaps also used by four legged animals—and be a local amenity in its own right. Inevitably it will provide easements for a variety of utilities beneath its surface and may also accommodate street furniture reflecting its variety of purposes.

The governance arrangements reflect these road characteristics and should continue to do so, with local roads the responsibility of local authorities with their knowledge of and accountability to businesses and residents in their area. This has implications for how local roads should be funded. If a local road has little vehicular traffic and most of the costs of maintenance and management are not related to traffic use then it is questionable as to whether the few vehicles that use the road can be expected to bear the entire costs of its upkeep.

In England there are three distinct systems of road governance, though this is not obvious to road users. They are: the Strategic Road Network (SRN) which is about 2 per cent by length and one third by traffic volume; the Greater London Area which contains about 16 percent of England's population; and the local highway authorities. We expect the three distinct systems to remain (though some major roads may be reclassified to the Strategic Road Network) and we recognise that policy reform may differ for the three.

In England the Strategic Road Network is the responsibility of Highways England and the other roads are the responsibility of the 153 local highway authorities⁴. In Scotland

⁴ LGIU 2018.

Transport Scotland is directly responsible for 283 miles of motorways and 1,737 miles of trunk roads with the remaining 28,188 miles the responsibility of the 32 local authorities⁵. In Wales the Welsh Government is directly responsible for 88 miles of motorways and 962 miles of trunk roads with the remaining 16,312 miles the responsibility of the 22 Unitary Authorities⁶.

London’s 9,194 miles of public roads are the responsibility of Transport for London (TfL) and the London Boroughs⁷. Highways England is responsible for the 37.4 miles of motorway in Greater London. TfL looks after the Transport for London Road Network—closely, but not entirely, following the Red Route Network established by the 1991 Road Traffic Act⁸—comprising 360 miles of main roads carrying about 30 per cent of London’s traffic. The remaining roads are the responsibility of the London boroughs. TfL is also responsible for the 6,000 or so sets of traffic signals in London⁹.

Table 1: Numbers of Highway authorities in Great Britain

Type of Authority	Number	Example
Greater London	1	TfL
Shire Counties	27	Hampshire
London Boroughs	33	Croydon
Unitary Authorities	56	Blackpool
Metropolitan Districts	36	Stockport
Total England	153	
Welsh Unitary Authorities	22	Cardiff Council
Scottish Local authorities	32	Glasgow City Council
Total Great Britain	207	

Sources: LGIU 2018.

⁵ DfT 2016d & Scottish Government 2017.

⁶ DfT 2016d & Welsh Government 2015.

⁷ Including the City Corporation.

⁸ C 40 1991. Part II.

⁹ TfL 2013a.

Transport in London is the overall responsibility of the Greater London Authority, consisting of a directly elected, Executive Mayor and Assembly. TfL is the executive agency, usually chaired by the Mayor. Much of the road network remains the responsibility of the thirty-two London Boroughs and the City Corporation. The Mayor retains high-level powers, including the power set public transport fares and to operate road user charging schemes. The overall Greater London Authority transport budget, including roads, is funded from fares revenues, local property taxes and, importantly, central government grant.

The remaining roads in England (and that is most of them) are administered by local highway authorities. There are 207 of these in Britain as a whole.

These range from almost entirely rural authorities to the major metropolitan areas such as Manchester and Birmingham. Roads form one of their many statutory duties and functions. Local authorities are mainly funded by central government grant and local taxation, though local tax yields are severely restricted by central government. Since 2000 local authorities have had powers to introduce road user charging schemes and workplace parking charges, though Nottingham is the only authority to have used them in addition to London¹⁰.

Paying for quality

In most walks of life consumers have shown themselves to be willing to pay more to secure better quality, especially as living standards increase. For many products the market has evolved spontaneously over the decades to meet the rising expectations of the public. But in the case of some publicly supplied goods and services this has not always been the case — and roads (where there is no explicit price to users) are an example.

Below we offer evidence that the public are particularly dissatisfied with the level of service offered by roads, relative to other public services. Road condition is poor in many local authorities and congestion is set to worsen.

¹⁰ Apart from the small pricing scheme at Sadler Street, Durham. The GLA Act 1999 makes provision for the London Congestion Charge scheme.

The public may well be willing to pay more for better roads if faced with the real choices as they often do overseas.

Inadequate roads provision by local authorities

There is confused governance and accountability; poor transparency; dysfunctional local government. This is a consequence of centralisation, national government interference with local government including national government-imposed limits on use of the local tax base and over-riding statutory duties to provide other services. Most central government grants nominated for roads are not protected and are vulnerable to being diverted to more pressing purposes.

This situation has resulted in a long-standing failure, whereby the standard of provision of local roads has too often fallen below what local people want and would be willing to pay for. This result comes in spite of the evidence that the local electorate care about delivery of good road services more than almost any other local service. (See Appendix A).

Financial stringency imposed by central government together with increasingly demanding statutory duties has forced many local authorities to under-maintain their roads. Over the last twenty years spending on road maintenance has been falling by around 3 per cent a year and, with growing pressures on local care budgets this is expected to continue for the foreseeable future¹¹. Studies by the National Audit Office^{12,13} show the differential impact of expenditure reductions on particular services. Local revenue spending on transport has been particularly badly hit.

There has also been a reduction in funding activity to improve road safety.

As discussed in December 2016 by the Public Accounts Committee¹⁴, this confusion is at risk of being made significantly worse by the move towards various devolved bodies. Over recent years government has started to devolve transport responsibilities to several types of new institution such as Local Enterprise Partnerships and Local

¹¹ Figure 2, below.

¹² National Audit Office 2014, Figure 10, p26.

¹³ National Audit Office 2018, Figure 10, p30.

¹⁴ HoC 2016.

Transport Bodies¹⁵. But this seems to have done little to resolve the fundamental problems with roads, not least because the main source of funds has remained central government.

Somebody has to pay more

It is essential to acknowledge that if more resources are to be spent on road maintenance and capital investment in roads then either (a) road users will have to pay more or (b) new tax and charge revenue from third party beneficiaries will have to be created or (c) less of the present tax revenues from road users will be available for other general government expenditure purposes.

As private motorists and commercial users of the roads the public will often lobby for the latter. Yet the difficult fiscal situation facing both UK national and local governments make the surrendering of any existing road tax revenues to fund general government expenditures difficult.

The need for clearer governance

There are several potentially helpful changes that have been technically possible for some time. But they have proved to be impossible to implement because the public have been reluctant to accept them — even though there is widespread understanding that something has to change, especially in respect of local road maintenance, traffic congestion, safety and air quality. These measures include increases in road fuel duty and forms of pay-as-you-go charges for use of roads.

The impediment to improvement is not technological. Nor is it a flat refusal to pay more for better service. It is poor institutional design and lack of public trust in those institutions. Our systems of national and local government finance have evolved in such a way as to render them unable to deal with the roads problems despite healthy tax receipts from road users.

The key issue here is that the motoring public could be prepared to pay more if people were confident that the extra receipts would be used to improve the road system and

¹⁵ Sandford 2016a.

not just substituted for existing funding. But before accepting any proposition the public will have to be convinced that this is in fact what is happening, and that they are not facing new “stealth taxes” in addition to the existing, heavy taxation on roads.

Public acceptance will dictate that reform will have to be simple enough to facilitate general understanding and, above all, the governance will have to be sufficiently transparent and robust to gain the trust of an untrusting public. Even when reforms improve the lot of the generality of road users they will typically disadvantage some people: where disadvantaged groups stand to suffer disproportionately, measures to mitigate this are necessary.

"Sustainable" transport policies are not enough

Transport policies such as promoting cycling and walking, or greatly improving public transport provision can be worthwhile in their own terms, depending on cost and subject to value for money appraisals. In central London improvements in bus, Underground, rail and Light Rail have had a significant impact on traffic. Elsewhere densities are generally much lower and these policies are often not sufficiently effective in isolation, at a feasible cost, to solve the problems addressed in this paper.

The limited contribution of new technologies

New technologies are revolutionising the way we pay for things: for instance pay-as-you-go motor insurance, electronic transfers for parking and Congestion Charge payment, smart petrol pumps¹⁶, apps for paying for rail and air trips. Over the medium to long term technological innovations in methods of paying for the use of roads will play an important part in the reforms we are proposing. These innovations are essentially available today, though under-used.

Other technological changes such as electric vehicles and autonomous vehicles are interesting and potentially important in themselves. But our problem relates to the mass market for private and commercial road transport and it will be some time before these innovations penetrate the mass market. The evidence leads us to think that these other innovations will only make a significant difference after a matter of decades and

¹⁶ Times 2017.

in the meantime the need for a fit for purpose road system remains. Some of them have the potential to make private vehicles cheaper and readily accessible to a larger portion of the population and to that extent they could make the problem of shortage of road capacity worse.

Traffic has not peaked

We recognise that there are important social and demographic forces at work but we do not think these will resolve the problems; indeed, they are taken into account in the official forecasts of demand by passengers and commercial users for movement by road. We are not convinced by the argument to the effect that we have reached a point of "peak car"; in particular, the assertion that young adults do not have the same wish to use private cars as previous generations¹⁷. Evidence is mounting that young adults — especially young men — now face significantly less favourable economic circumstances than did the previous generations and this may largely explain their apparent reduced propensity to drive¹⁸. Meanwhile, after a pause following the 2008/09 economic crisis, traffic on all types of road has returned to growth by 6.4 percent over the six years from September 2015. Motorway traffic grew by 7.8 percent, rural "A" roads by 8.6 percent and that on "A" roads by 8.4 percent. Car and taxi traffic grew by 5.7% percent and light goods vehicles by 13.6 percent¹⁹. The traffic mix may be changing somewhat but the overall demand for adequate roads will continue to grow.

The London population may prove to be an exception: it has always behaved differently. Even so, there are signs of an end of the long-term decline in London's traffic²⁰.

Whilst London's road traffic (cycling apart) has not been growing until recently congestion has been worsening²¹ because of removal of road capacity—by the order

¹⁷ Le Vine *et al* 2012

¹⁸ Berrington *et al* 2014.

¹⁹ DfT 2019.

²⁰ TfL 2019.

²¹ *Ibid.*

of 30 percent since 2000 in Central London²². Thus the need to deal with congestion in London is not only a consequence of traffic growth. Existing road congestion is the worst in the country and appears to be worsening faster than elsewhere.

FUEL DUTY, VEHICLE EXCISE DUTY AND ROAD FUNDING

Current road funding arrangements

Present funding arrangements provide no effective linkage between the service offered to the road user and the amount paid in motoring taxes. However it is proposed that the proceeds of Vehicle Excise Duty will be used to fund the English trunk road network from 2020²³.

Revenues

After increasing strongly over many years, revenues from motoring taxes have been falling in real terms for some time. Figure 1 shows UK Fuel Duty and VED receipts from 1970/71 to 2018/19. From a peak in 1999, when road fuel taxes amounted to 85% of the pump price²⁴, at constant prices²⁵ Vehicle Excise Duty and fuel duty receipts fell by 26% over the seventeen years to 2018. This is because there has been a systematic reduction in fuel duty rates in real terms from about 80 pence per litre in the late 1990's to 58 pence per litre (fuel duty rates have not been increased in nominal terms for nearly a decade). Also, vehicle fuel efficiency has been improving. Traffic growth has been slow and temporarily reversed by the recession, and Vehicle Excise Duty discounts for low emission vehicles have been introduced.

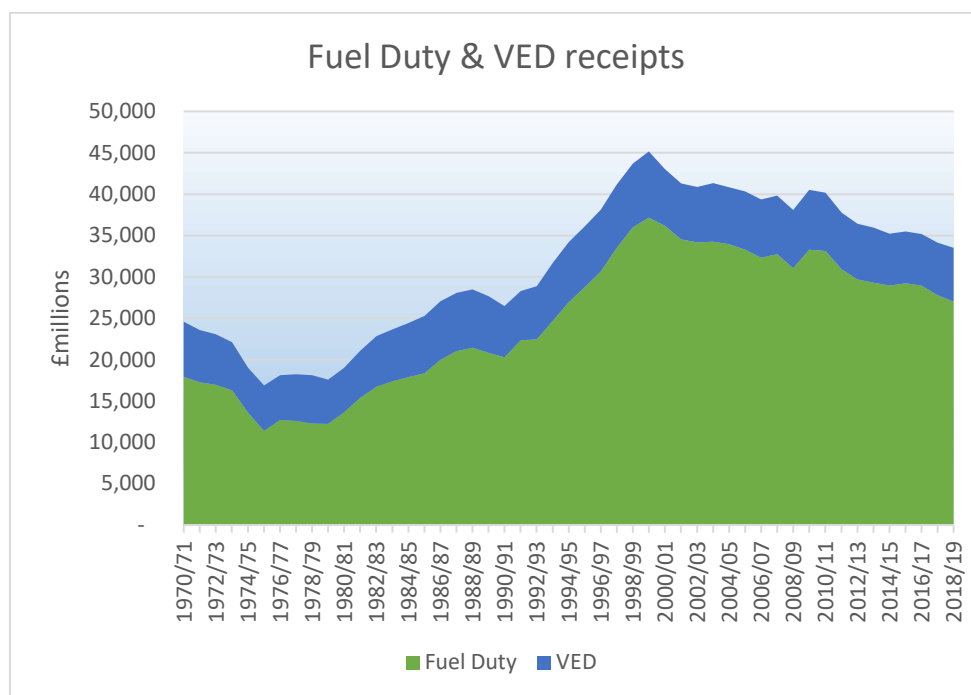
²² TfL 2014.

²³ HMT 2015.

²⁴ Seeley 2014.

²⁵ Outturn values adjusted by the RPI

Figure 1: Vehicle Excise Duty & fuel duty Receipts since 1990²⁶ (2018/19 prices).



Source: DfT 1983, 1987, 1992, 1996, 2000, 2002, 2006, 2009, 2016a & HMRC 2017.

This fall is forecast to continue, unless tax rates are increased, by perhaps a further £10bn by 2029/30²⁷.

Over this period motoring taxes paid per vehicle mile have fallen by more than 30%²⁸. As VAT is levied on road transport fuel prices including duty, VAT receipts from this element of motor fuel purchases have also fallen as VAT rates are now only 2½% higher than the 17½% in the 1990s. These revenues are forecast to continue falling²⁹. This is an inescapable consideration for HM Treasury and is inevitable that Vehicle Excise Duty and fuel duty will be candidates for reform. Any proposed reform for roads must be explicit on the issue.

Over the last forty five years roads expenditure has been substantially lower than the yield from motoring taxes. From the end of the peak decade of motorway

²⁶ UK totals adjusted to remove the Northern Ireland component.

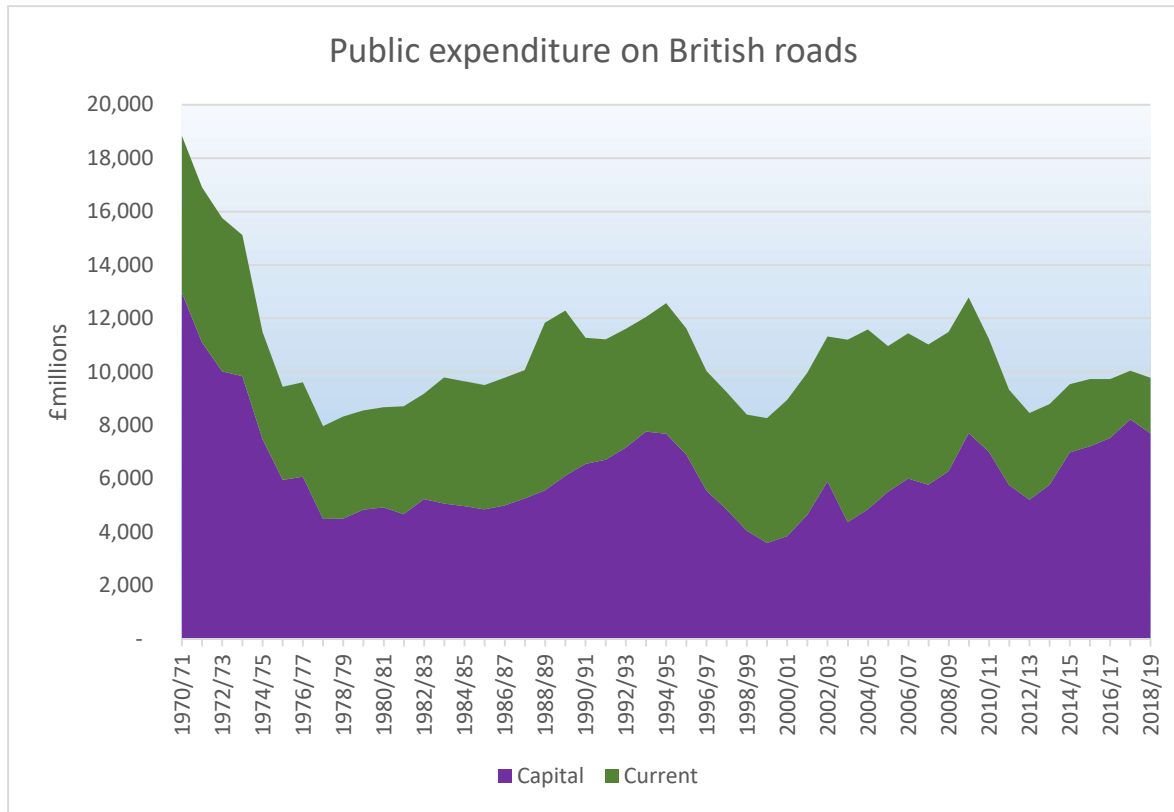
²⁷ Based on Johnson *et al* 2012.

²⁸ DfT 2017d & DfT 2017e.

²⁹ Johnson *et al* 2012.

construction at end 1971³⁰ roads spending fell from over £15bn/year to less than £10bn in the mid-1970s and has not exceeded £12bn/year since (see Figure 2).

Figure 2: Public Expenditure on Roads 1990/91 – 2018/19 (2018/19 prices)³¹

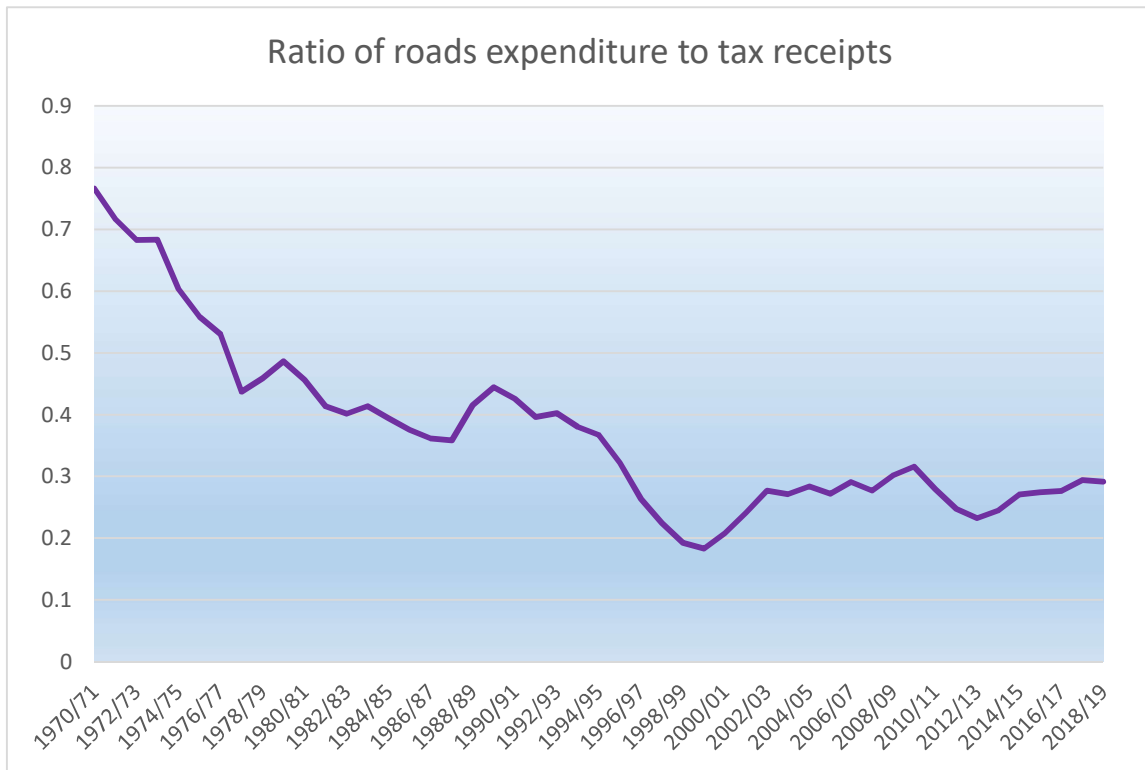


Sources: DfT 1983, 1987, 1992, 1996, 2000, 2002, 2006, 2009 & 2016c.

³⁰ Motorway Archive 2018.

³¹ N.B accounting conventions were changed between 2000/01 and 2001/02 and there are some unexplained inconsistencies between numbers in the sources used.

Figure 3: Ratio of roads expenditure to motoring tax receipts



Sources: As figures 1 & 2.

The difference between motoring tax receipts and roads spending has grown from an average of £8bn/year in the 1970s to £29bn/year in the 2000s since when it has fallen back to less than £24bn/year. Since 1999 public expenditure on roads has risen from 19% of motoring tax receipts to almost 29% (figures 2 & 3).

Excise Duty is a tax on ownership whereas fuel duty is a tax on use. Most road costs and other damages are caused by use rather than ownership: congestion; road wear and tear; traffic accidents; air pollution; carbon emissions; noise pollution. Moreover, as is forecast by some, car use will become more of a shared service rather than through exclusive vehicle ownership taxes on use rather than ownership will be more relevant.

Further, fuel is burned—and therefore fuel duty is paid—in specific locations whereas Vehicle Excise Duty does not relate to location to the same extent. Since levels and

sources of road funding vary by type of road it is more natural to consider dividing fuel duty in relation to location than to arbitrarily allocate Vehicle Excise Duty. In particular, the current proposal to allocate all Vehicle Excise Duty revenues to a National Roads Fund for the benefit of the Strategic Road Network is an administrative convenience. The fact that Vehicle Excise Duty revenue is close to Strategic Road Network expenditure is coincidental. Most roads and most traffic are not on the Strategic Road Network.

These considerations would suggest shifting the burden of Vehicle Excise Duty to fuel duty. This would reduce traffic and improve the alignment of incentives with costs for road users.

Unfortunately there are problems with this. In recent years Vehicle Excise Duty has been 'tiered' so as to favour vehicles with low carbon emissions³²: this is aimed at affecting new vehicle purchase decisions resulting in a significant number of vehicles that are liable for little or no Vehicle Excise Duty. This changed in April 2017 with, after a strongly differentiated initial tax (based on CO₂ emissions) all but ultra-low emission vehicles and those costing over £40k paying a flat rate after the first year³³.

For this reason we suggest that the system of Vehicle Excise Duty be left alone for the immediate term, but that its yield is recognised as a sumptuary tax (with a beneficial environmental element) and it not be regarded as a charge for the use of the roads. Nor should it be an explicit source of funding for roads. Those roles are to be filled by fuel duty and eventually any alternative charges for road use.

Fuel duty has many characteristics of a "good" tax: hard to evade; cheap to collect; it bears on usage (rather than ownership). It is buoyant to the extent that traffic volumes continue growing. It is probably progressive as the fifth richest households spend five times as much on petrol/diesel as the poorest³⁴.

The pump price of fuel is a sensitive issue for the general public, even though they are reaping the benefits, which they will continue to enjoy, of reduced fuel consumption

³² Butcher 2017.

³³ GOV.UK 2018.

³⁴ ONS 2018.

and less fuel duty from owning more fuel efficient cars. Under the "fuel duty escalator" in the late 1990s Chancellors more than doubled fuel duty³⁵. In 2000 protests caused major disruption to the road network which threatened the economy. The policy was quickly abandoned and now Chancellors are wary of increasing fuel prices³⁶. Successive Chancellors have felt the need to respond to opposition to increasing fuel duty and have chosen to let rates decline in real terms even when the fall in crude oil prices offered an opportunity to do otherwise.

As an illustration, if capital plus current public expenditure on roads in Great Britain were increased from its present £9.4bn p.a. by a third to an average of £12½bn p.a. over a nine year period an additional £23bn would be required. In the section below on our overall fiscal proposition we illustrate that there are several ways to adjust road taxation rates to achieve this whilst remaining within the annual yield within the total levied in 1999/2000, and have a terminal receipts level sufficient to maintain this additional expenditure into the future.

Funding the Strategic Road Network

The English 4,432 mile trunk road network³⁷ (Strategic Road Network) is controlled by a government owned company - Highways England – which receives a grant from central government as its main source of income and is given a measure of future financial certainty with a government statement of funds available allowing it to plan its roads investment strategy costing about £15bn over five years³⁸. Highways England has to account to the Secretary of State for its performance and is monitored by the Office of Rail and Road.

Highways England employs contracts to manage its roads, known as the strategic road network, in given geographical areas. It has also appointed a number of Design, Build, Finance and Operate (DBFO) or Private Finance Initiative (PFI) contracts for specific roads.

³⁵ See Appendix A and Seeley 2014.

³⁶ See OBR 2016.

³⁷ DfT 2017f.

³⁸ Highways England 2016.

These contractors have authority to exercise Highways England's legal powers and obligation under the Highways Act 1980 and New Roads & Street Works Act 1991³⁹.

At the end of 2015/16 Highways England had a dozen PFI contracts with a whole life (usually 30 years) value of £2.27bn and an annual payment of just under £0.4bn⁴⁰.

Funding Local roads

The funding of local roads (Local Highway Authority, LHA) is both complex and uncertain⁴¹. Capital expenditure is financed from a range of sources including borrowing and capital receipts as well as central government grants – which come mainly in the form of the highways maintenance block grant. Since 2011/12, mainly to help local authorities cope with effects of harsh winters, the DfT has also provided over £300m of 'one off' grants. The mix of locally raised funds for roads is set to change further with proposals to retain 100% of the non-domestic rate yield locally and the imposition of infrastructure supplements on non-domestic rates⁴².

The DfT has recently changed the maintenance block grant regime to provide a total of £976m/year (cash) for each of the six years 2015/16-2020/21 with an element depending on how quickly LHAs adopt efficient maintenance practices and an element to help with particular problems that cannot readily be dealt with through the basic maintenance funding.

Other capital grants that can be used for the maintenance of local roads include the Integrated Transport Block Grant allocated via the Local Enterprise Partnerships, the Local Growth Fund and more recently through the newly established Local Transport Bodies. As yet there is little evidence of local highway maintenance being given a high priority in the allocation of these.

Over the last few years some LHAs have entered into Private Finance Initiatives with private sector partners. These are funded by a separate PFI grant worth about £250m in 2014/15.

³⁹ Highways England 2014.

⁴⁰ Highways England 2017.

⁴¹ See Bayliss 2015 on which the following paragraphs have been based.

⁴² UK Parliament 2017.

The most recent allocation of central government funding for local authority roads in 2017/18⁴³ is split into six categories:-

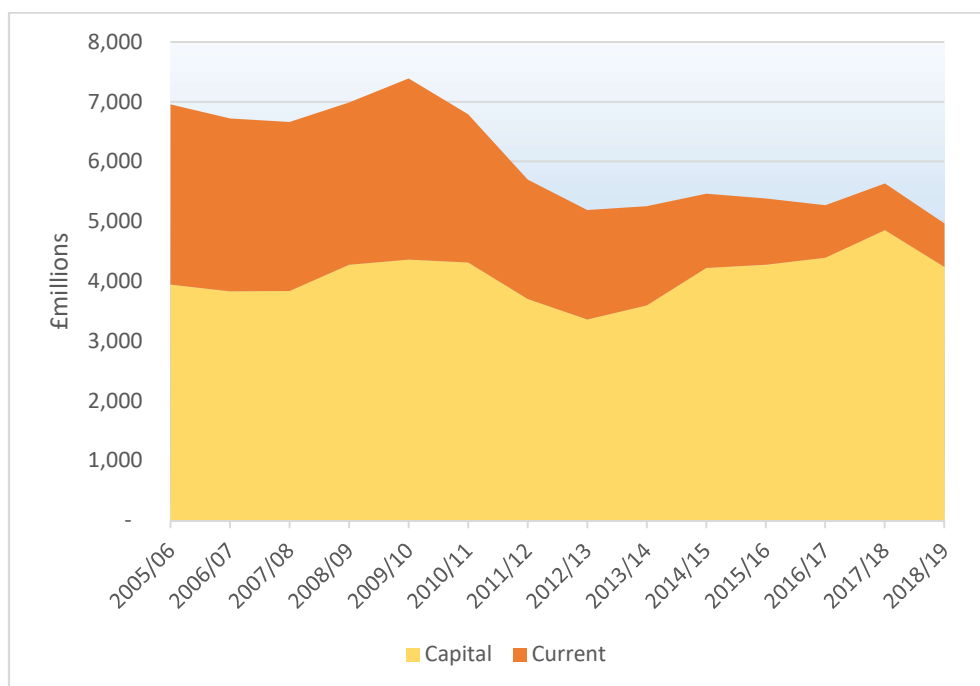
- Local Highways Maintenance Funding – Needs Element - £801 million
- Local Highways Maintenance Challenge Fund - £75 million*
- Local Highways Maintenance Incentive/Efficiency Element Funding - £75 million*
- Pothole Action Fund - £70 million
- National Productivity Investment Fund - £185 million
- Safer Roads Fund - £25 million*

* Funds that have to be bid for – the others are based on a ‘needs’ formula

Revenue spending on LHA roads maintenance is funded from a combination of central government grants, council tax receipts and business rates with nearly three quarters of all income coming from the centre. Overall local authority revenue expenditure has been reducing of late. Although highway maintenance is a component of the local needs calculation of the DCLG grant it is not ring fenced and so does not have to be used for roads purposes.

⁴³ DfT 2017g.

Figure 4. Spending on local roads 2005/06 – 18/19 (2018/19 prices)



With growing demands for other local services some, such as child and adult social care, which are very difficult to control, highways maintenance budgets are being squeezed between funding for these and reductions in overall revenue spending. As a result LHA maintenance spending has been reduced from 32.7 billion in 2008/09 to £0.7 billion in 2018/19 (2018/19 prices) and this reduction has largely affected spending on minor roads. Between 2010/11 and 2014/15 spending on highways and transport by upper tier authorities fell by 21% and by district councils by 16%⁴⁴ suggesting a continuing trend of downward pressure.

The prospects for the next few years are not good, with an analysis by the LGA⁴⁵ estimating a 35% further reduction in local highway maintenance budgets by the end of the decade. If this is realized, the significant improvements in prospect from the new DfT capital grant regime will be in jeopardy as the lack of routine maintenance will accelerate the deterioration of local authority highway assets with a consequent expansion of the structural maintenance backlog – which the new DfT grant regime is designed to prevent.

⁴⁴ NAO 2014.

⁴⁵ LGA 2015.

Local authority budgets have been under pressure for many years and legal obligations have compelled many of them to divert funds away from roads. This report from Transport Networks⁴⁶ is typical of a frequent complaint:

“Analysis published by the LGA ahead of the Autumn Budget forecasts that for every pound of council tax collected by councils 56p could be spent on caring for the elderly, vulnerable adults and children. This is up from 41p in 2010/11...

“Howard Robinson, chief executive of the Road Surface Treatments Association (RSTA) said: ‘The result will be more poorly maintained roads and more potholes.

“Local government in England faces a £5.8bn funding gap by 2020. The Government must recognise that councils cannot continue without sufficient resources that enable adequate funding for all areas of council services.

“The local road network is a council’s most important asset yet they are forced to ransack their highways budget to fund other services.”

PROPOSALS FOR THE STRATEGIC ROAD NETWORK

The Strategic Road Network is operated by Highways England. It is a company with its one share owned by the Secretary of State (SoS). It operates under a licence issued by the Secretary of State and its performance is monitored by the independent Office of Rail and Road. Transport Focus comments on user issues and Highways England is subject to direct scrutiny by Parliament through the Transport Select Committee, National Audit Office and Public Accounts Committee.

The investment programme, maintenance levels and levels of service to be achieved are determined by the Department of Transport and the whole is funded almost entirely from Exchequer grant. Every five years government is required to commit to a programme of work—the Road Investment Strategy (RIS)—and a corresponding

⁴⁶ TransportNetwork 2017.

Statement of Funds Available. Once these are set any changes must go through a public change control process.

This structure was created in April 2015⁴⁷ giving clear accountability, a degree of stability and independent monitoring. It forms an adequate basis for further, incremental reform. The second, five-year road investment strategy (RIS2) is under consideration⁴⁸.

Governance is clear

There are discussions to be had about maintenance spend, investment in capacity, safety and environmental policies: but the SoS is clearly accountable with stakeholders able to comment directly on the government's proposals⁴⁹ and there is a clear route for the public to engage: through Parliament. For the second Road Investment Strategy the government could decide to maintain, increase or reduce the annual rates of capital and operating expenditures already committed for the first Road Investment Strategy.

No need for immediate reform

The present structure is relatively new and an improvement on the previous arrangement.

In the current national public spending environment it is unclear whether future governments will be able to commit to matching—or increasing—the levels of funding enshrined in the first RIS. Whilst the government's National Roads Fund⁵⁰ is welcome there is no connection between the yield from Vehicle Excise Duty and the funding justified for the Strategic Road Network. It will not be secure in that its income will depend on Vehicle Excise Duty rates, subject to determination by the Exchequer. For the short to immediate term a commitment to a level of Exchequer grant would come to much the same thing and it would be equally “unbankable”.

⁴⁷ DfT 2015d.

⁴⁸ DfT 2017h.

⁴⁹ DfT 2016a.

⁵⁰ HM Treasury 2015.

It would transform the situation if a connection were to be established between the levels of expenditure on operating and investing in the Strategic Road Network and the levels of use. A way to achieve this is to commit a share of fuel duty (rather than Vehicle Excise Duty) to a National Roads Fund.

Further reform in the medium term?

This could be followed, in the medium term by the introduction of direct charging for some limited access parts of the Strategic Road Network initially using automatic number plate recognition. This would apply to most of the Motorways and possibly some of the limited access dual carriageways. The choice of which sections to include and the rates of charge would have to be carefully designed to mitigate undesirable diversion onto the local road network, as it is in Continental Europe. This is a form of pay-as-you-go charging which would be relatively cheap and easy to implement on limited access roads and is commonly applied in many countries in Continental Europe⁵¹.

Fuel duty and Vehicle Excise Duty are taxes levied both on and off the Strategic Road Network so we defer consideration of how they would change as part of this reform, together with and the levels and yields of the pay-as-you-go charges, to a following section looking at the whole picture.

Public acceptability would require that these pay-as-you-go charges be presented in the context of the whole: these are not simply additional "stealth taxes" but part of an overall package that will deliver better roads in return for pay-as-you-go charges.

In the case of Highways England's roads the current governance arrangements would facilitate the creation of new administrative bodies to guarantee the ring fencing of these extra revenues for the benefit of the charged system. Public trusts with legally binding objects are attractive: they are not "privatisation" and they can be properly and distinctly defined in law. Public trusts (or public benefit corporations in North America) have a long history of delivering transport facilities. With the security of income streams from pay-as-you-go charges and a share of fuel duty they could be

⁵¹ ASECAP 2017.

competent to borrow in order to service private investment. There could be one national body, or there could be significant advantages to defining a number of regional bodies, together with a national system operator.

These bodies could take over responsibility for the existing “shadow-tolled” (or Design, Build, Finance and Operate: DBFO) schemes on the Strategic Road Network. Under the Private Finance Initiative there are 12 such sections of road in the UK⁵². These are operated by private companies under a long term contract with Highways England. They receive periodic payments which depend on performance and these may depend on the number of vehicles that pass. These arrangements appear to work reasonably well and offer an exemplar of a basis for what could be done should explicit cash tolls be judged unacceptable⁵³.

Which roads are in the Strategic Road Network?

The definition of which roads are part of the Strategic Road Network is, to an extent, the result of historical accident (and is currently 20 per cent shorter than in 2000⁵⁴): the density varies a great deal in different parts of the country. It should be reviewed against objective criteria. As Quarmby and Carey⁵⁵ argue there is a case for establishing a more comprehensive main road network of the order of eight thousand miles in length in England. If this scale of increase were applied to the Welsh and Scottish networks they would be as shown in Table 2 and the expanded Strategic Road Network would carry $\frac{3}{7}$ ^{ths} of all vehicular traffic.

Table 2: Existing and Expanded Strategic Road Network

Country	Existing SRN	Expanded SRN
England	4,400 miles	8,000 miles
Scotland	2,020 miles	3,650 miles
Wales	1,050 miles	1,900 miles
Great Britain	7,470 miles	13,550 miles

⁵² See Appendix A for more detail.

⁵³ NAO 2003.

⁵⁴ DfT 2017f.

⁵⁵ Quarmby & Carey 2016.

Quarmby and Carey suggest that the additional lengths of Strategic Road Network—in England—could be the responsibility of the emerging devolved administrations and funded by the National Roads Fund. Whilst this has the merit of minimising change the new devolved administrations have yet to show their mettle and it seems unlikely that the National Roads Fund, if funded only by the proceeds of Vehicle Excise Duty, would have the capacity to accommodate the adequate funding of a network 80 per cent longer than the existing Strategic Road Network. The government has recently consulted on the definition of a Major Road Network for England which could have a length of 9,400 miles⁵⁶.

PROPOSALS FOR LONDON

Governance in London is transparent, with the Mayor and the Assembly accountable to the local electorate. This has facilitated a, small-scale pay-as-you-go system—the Congestion Charge—which was implemented in 2003⁵⁷. It was successful.

London's funding has become more difficult following reductions in central government grant and shortfalls in public transport fares revenues. London witnesses a significant proportion of the nation's road congestion.

London should receive a proportion of any increased revenue from fuel duty rate increases. In addition the Mayor should consider a much-extended system of pay-as-you-go over a larger area of London as recommended by the GLA Transport Committee in 2017⁵⁸. This would both facilitate management of demand for the roads—thereby mitigating congestion—and provide a buoyant source of funding for maintenance, management, enforcement and capacity enhancement where appropriate. The powers exist and under current legislation the revenues would automatically be ring fenced for transport purposes in London. Detail and the appropriate technology would have to be researched, but several technologies are available today.

⁵⁶ DfT 2017a.

⁵⁷ Glaister (2014b) gives a more detailed history of how the London Congestion Charging scheme came about.

⁵⁸ London Assembly (2017).

If the mechanisms for charges for road use could be integrated with the present system for charging for the public transport system⁵⁹ then public acceptability by the London electorate of a pay-as-you-go system⁶⁰ would be increased. This would need to be coordinated with other reforms of London's funding.

This arrangement could be replicated in other major UK cities when strong enough local governance is in place.

PROPOSALS FOR LOCAL AUTHORITY ROADS

We have noted the particularly unsatisfactory situation facing local roads and their funding. A solution to this must involve the identification of adequate additional income streams together with a ring-fencing mechanism to ensure that they spent on maintaining, managing and improving local roads.

National road pricing not feasible in the short term

In principle national road pricing is the right solution (see Appendix C) but it is unlikely to be implemented in the near future. The London Congestion Charging scheme, introduced in 2003, was facilitated by special circumstances: the creation of a new local governance structure. It was reasonably successful in reducing congestion at the outset but the subsequent reallocation of road space for non-motor traffic purposes has resulted in congestion in the charging area increasing to pre-2003 levels⁶¹. Whilst other local schemes are possible their prospects do not look good in political terms following abortive attempts to introduce them in Edinburgh and Manchester. The Nottingham proxy of a Workplace Parking Levy is operating satisfactorily but it is more a tax-source for funding public transport than a solution for the roads congestion and maintenance problems.

Reform for local roads

The existing local roads funding regime is not easily improved in the immediate term but it is quite possible to provide greater funding through capital grants if the political will exists. In 2016/17 British local authorities' capital expenditure on roads

⁵⁹ See Glaister (2014b) for more detail.

⁶⁰ Populus 2017.

⁶¹ Transport for London 2014.

amounted to £4.1bn⁶². What is needed is a regime which gives a five year rolling grant allocation with clear rules on what purposes the money can be used for plus a major projects fund for investment schemes costing say, over £10m, based on a programme in which specific local authority schemes are entered after going through a process of appraisal and prioritisation. This programme would not necessarily provide the full costs of schemes but contributions could be based on their transport value for money. It would also require local authorities to understand bidding and delivery rules.

Local roads funding authorities

Roads perform all sorts of functions for local populations and it is not sensible to expect local authorities to give up all control of policy or how they are managed. But that does not necessarily imply that they should have complete control of the available budgets: they do not have that now and there needs to be assurance that monies they share from increases in fuel duty payments should be applied to improving the condition of their roads and the service they give to road users.

What is required is some mechanism for ring fencing funds for the express purpose of maintaining and enhancing local roads.

The mechanism would have to:

- be transparent and accountable;
- create access to the funds required;
- provide a revenue stream of sufficient scale and reliability to borrow against;
- be clearly enough defined in law to allow it to issue debt and
- be accepted by the electorate

The level and structure of the budget will have to be determined by an agency—guided as strongly as possible by road user value for money. It is difficult to see how this could be anything other than a ‘public interest’ body of some kind. This could be

⁶² DfT 2017g.

a general authority for the area (County Council or Unitary Council or, where these are combining in some way, a combined authority). Where there is already a multi-area transport authority this could be the relevant authority and indeed a reform could require authorities of this kind to be established across the whole of England. In the other countries of the UK Transport Scotland, The Welsh Government and Transport NI could be the relevant agencies.

Alternatively there could be special purpose public trusts covering relevant areas (e.g. the 9 English regions plus Scotland, Wales and Northern Ireland) with direct responsibilities for budgets and investment funding – although there could be delegation to lower level authorities. In which case consideration could be given to whether they would be coterminous with similar regional bodies for the Strategic Road Network.

These bodies could be set up with legally enforceable powers and duties to ensure that the monies given for roads purposes were spent appropriately and that allocations to lower authorities were in line with the transparent principles (such as the Objects of public trusts). They would have a right to receive defined incomes. These could, in the longer term include revenues from pay-as-you-go user charges. But they need not. They could range from a defined share of national fuel duty revenues to local taxes, such as the special levy on the business rate that helped to fund Crossrail.

Whilst a fully efficient pricing scheme would be the most productive way of reforming road charging and funding to date this approach has failed to attract sufficient political support to make it a likely candidate for introduction in the near future. Other possibilities should therefore be considered which aim to realise some of the benefits of efficient pricing whilst providing a robust and buoyant source of funds for maintaining and developing the road system and, ideally, are capable of being developed towards a full efficient charging scheme in due course.

Funding could be by hypothecation of a share of existing motoring taxes, an employment tax (the number of jobs influence peak travel), property taxes (reflecting the collective wealth of the area), sales taxes (sales generating both travel to and

income for the area) or a combination of these. Each has, to varying extent, some relation to the level of transport activity in the area and therefore some legitimacy as a source of roads financing.

Other funding possibilities

Other funding possibilities (see Appendix D) include:

- extensions of the Business Improvement District (BID) concept⁶³;
- Municipal Bonds to fund specific projects, serviced out of local taxes and charges and subject to a vote with a corresponding franchise (as in the US);
- bundling charges for local road use in with charges for local public transport and other services administered through electronic ticketing (unified "Travelcard") and
- local fuel duties.

THE OVERALL FISCAL PROPOSITION

We have acknowledged that more money needs to be spent on roads and this will have to come from somewhere. In this section we sketch some of the options for a fiscal balance. This can only be a rough indication: a more comprehensive set of propositions would require more research and modelling.

Road taxes, charges and spending.

We assume that the current national fiscal situation precludes a simple net increase in central government grant for roads, which would be at the expense of other general government expenditures, or some new tax such as on property or employment.

We have mentioned various options open to local authorities for raising new income streams from new local taxes, charges or levies (see Appendix D). Local authorities will want to continue to explore these and we do not dismiss them. But attempts to use them are not new and there are many other needs that local bodies are seeking to fulfil in this way. Whilst local authorities must do what they can to secure an equitable

⁶³ DCLG 2014b.

contribution from these sources we are unsure that, in practice, they would generate sufficient new money for our purposes; with the possible exception of contributions from major new developments – but these would be patchy.

So for the purposes of this section we are assuming that extra roads spending will have to come from extra roads taxes and charges. We confine ourselves to what could be achieved by adjustments to Vehicle Excise Duty and fuel duty starting within a year or so, supplemented in the medium term—as an option—some modest pay-as-you-go charges.

There is one factor that is helpful: the burden of fuel duty on road users has been allowed to fall substantially over the last few years. Fuel duty is a buoyant tax and it enjoys most of the characteristics desirable for a "good" tax. By returning fuel duty towards the kind of rates experienced in the past a significant proportion of the necessary resources could be generated.

We recognise that Chancellors have allowed fuel duty rates to decline for good political reason and that to just increase them has proven to be very unpopular. So has the imposition of new pay-as-you-go charges to use roads. But we have argued that the reason for this is that people have regarded these as increases in taxation on already heavily taxed activities for the benefit of funding general government expenditures.

The crucial new feature of our proposals is the simultaneous introduction of new governance arrangements to promote public trust that any increases in fuel duty or pay-as-you-go charges are for the sole purpose of solving the inadequacies of the roads and that they will be so applied.

Fuel duty and Vehicle Excise Duty

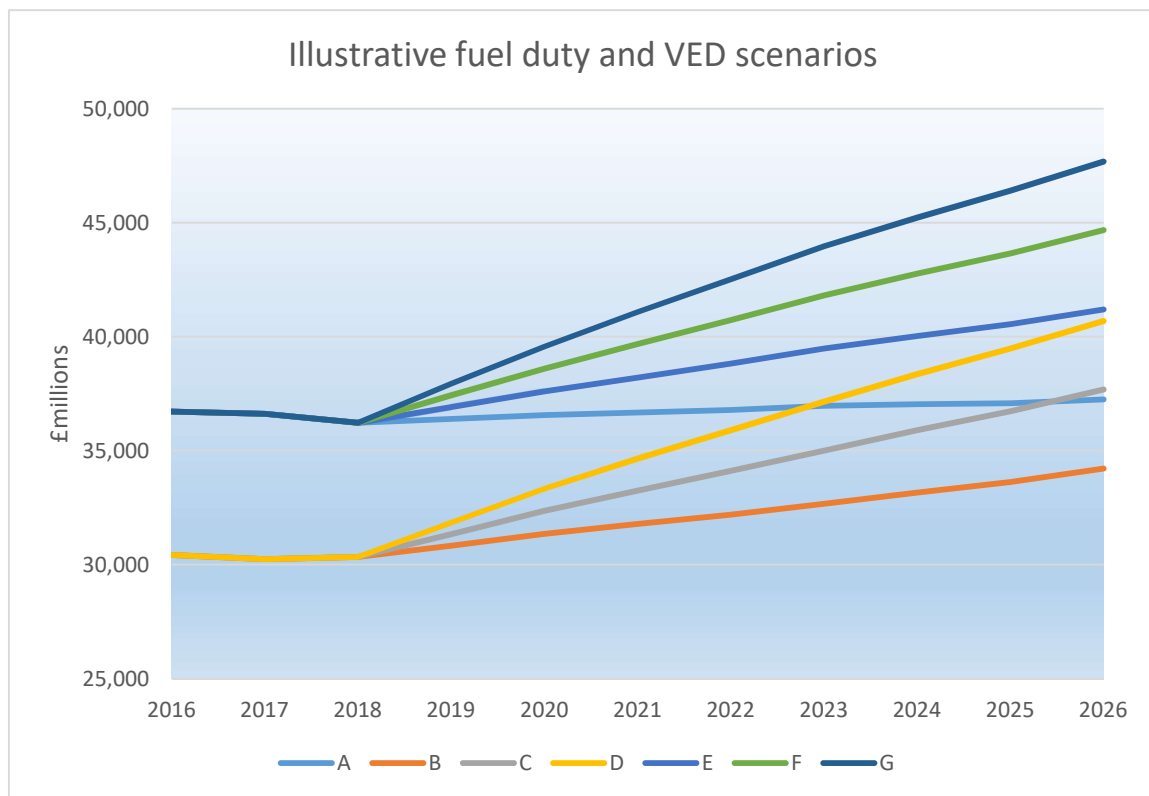
In 2016 fuel duty plus Vehicle Excise Duty produced revenues of £34bn⁶⁴. If they had remained at their peak 1999 rates in real terms this would have amounted to £44.8bn

⁶⁴ DfT 2017d.

p.a. Figure 5 illustrates the financial effects of a series of fuel duty/Vehicle Excise Duty scenarios up to 2025 – all but one of which lie within this £44.8bn p.a. ceiling.

The analysis illustrated in Figure 5/Table 3 is based on national traffic forecast of traffic growth vehicle number and fuel consumption trends⁶⁵ but a number of assumptions have been made to derive receipts from these – especially in the case of VED as the impacts of the new 2018 tariff structure is as yet unknown. Where fuel duty has been increased an allowance has been made for a corresponding suppression of traffic growth. As the revised VED rates are not expected to affect the average amount paid per vehicle no adjustment has been made to the vehicle ownership forecasts.

Figure 5: Proceeds from a range of Fuel duty and Vehicle Excise Duty Scenarios, GB 2016 – 2026 (2018/19 prices).



⁶⁵ DfT 2015b.

Table 3 Summary of yield of a range of Fuel duty and Vehicle Excise Duty Scenarios.

Scenario	VED	Fuel Duty (pence/litre)	Average Yield (2019 to 2026) £bn	Additional average annual Yield £bn	Yield in 2026 £bn
A	New rates from 2018	57.95	36.8		36.8
B	0	57.95 – 65.95	32.5	- 4.4	28.1
C	0	57.95 – 73.95	34.5	- 2.3	32.2
D	0	57.95 – 81.95	36.4	- 0.4	36.0
E	New rates from 2018	57.95 – 65.95	39.1	2.3	41.1
F	New rates from 2018	57.95 – 73.95	41.2	4.3	45.5
G	New rates from 2018	57.95 – 81.95	43.0	6.2	49.2

Sources DfT 2017b, DfT 2017d & DfT 2017f.

Case A is a reference case which holds Vehicle Excise Duty and fuel duty yields at 2016 values but allows for the change in VED tariffs after April 2018.

Scenarios B, C, D and H assume that Vehicle Excise Duty is reduced to a nominal vehicle registration charge with no net receipts. If Vehicle Excise Duty were to be replaced by an increase in fuel duty in 2017 this would have to rise by 11½p/litre. Scenarios E, F and G assume Vehicle Excise Duty yield is levied at the newly introduced 2018 rates.

In each case, save A, the fuel duty rate is increased steadily towards a 2025 end-point.

Compared with the base scenario, A, all but one scenarios (B) provide additional income by 2026. If fuel duty had increased by the RPI between 1999 and 2017⁶⁶ then receipts would have been £37bn rather than the actual of £29bn. To achieve this increase of £8bn by 2016 fuel duty would have to increase by 39/litre as in scenarios D & G.

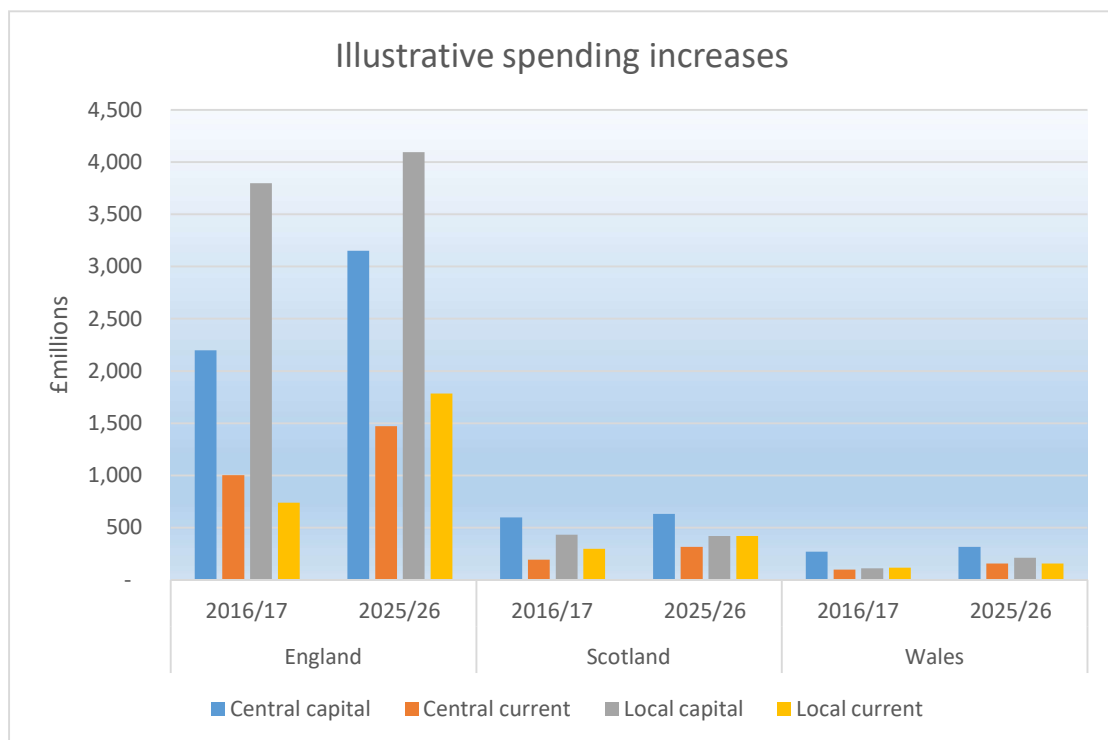
⁶⁶ ONS 2018b.

If the new regime increased capital plus current public expenditure on roads in Great Britain from its present £9.4bn p.a. by a third to an average of £12½bn p.a. over this period an additional £23bn would be required (less with a slower build-up). Scenarios F & G would all provide this and have a terminal receipts level sufficient to maintain this additional expenditure into the future. However, depending on which of these scenarios were chosen, there would be a need for some borrowing in the early years of the programme.

Over the period to 2025 scenarios F & G would all be in surplus before the end of the period and if the spending build up at £1bn p.a. over the first three years, the maximum required borrowing would be £2½bn in 2021.

As an illustration the increase from £9.4bn to £12½ bn p.a. by 2026 might be divided as shown in figure 6. This gives a strong emphasis to spending on maintenance and management of local roads to address the poor state that many of these are in.

Figure 6: Illustrative road spending increases by country and expenditure type (2018/19 prices).



Pay-as-you-go charges to raise revenue

Whilst returning fuel duty yield towards its historical levels could provide much of the revenues required it has the disadvantage of being a blunt instrument from the point of view of matching charges to the situations where traffic congestion and other damages are at their worst. If charges are adjusted to be lower in rural, uncongested areas and higher at the times and places of serious congestion then similar net revenues can be generated whilst having far more beneficial effect on the worst congestion; and, as Eddington pointed out, significantly reducing the need to construct new road capacity with all the problems that would bring.

There is evidence that motorists generally see the “fairness” of paying for their use of roads in proportion to their volume of use—as with other utilities. This was a finding of a large survey by the ANWB⁶⁷ (Royal Dutch Touring Club) and by an Ipsos MORI survey for the RAC Foundation⁶⁸ and a more recent Populus survey for the GLA⁶⁹. But they are generally much less content with rates of charge that vary with circumstances.

A simple pay-as-you-go scheme

Whilst a fully efficient pricing scheme along the lines described in Appendix C would be the most productive way of reforming road charging and funding, to date this approach has failed to attract sufficient political support to make it a likely candidate for introduction in the near future. Other possibilities should therefore be considered which aim to realise some of the benefits of efficient pricing whilst providing a robust and buoyant source of funds for maintaining and developing the road system and, ideally, are capable of being developed towards a full efficient charging scheme in due course.

⁶⁷ ITS 2011

⁶⁸ Ipsos MORI 2012.

⁶⁹ Populus 2016.

Table 4: Illustrative Yields of pay-as-you-go Charges on British Roads.

Charge scale	Motorways £bn	Dual 'As' £bn	Single 'As' £bn	Minors £bn	All £bn
1/1/1/1	0.84	0.40	1.21	1.17	3.62
3/2/2/1	2.51	0.80	2.43	1.17	6.90
3/3/2/1	2.51	1.20	2.43	1.17	7.31
6/4/4/2	5.02	1.60	4.85	2.34	13.81
6/6/4/2	5.02	2.41	4.85	2.34	14.61
15/15/10/5	12.54	6.02	11.52	5.84	35.92

In all cases heavy vehicles (above 3.5tonne gvwt) are charged at three times the light vehicle rate.

Sources: DfT 2017i, DfT 2017j

A simple pay-as-you-go scheme would levy a charge based on say road type (or could be road speed limit) and the sorts of yield are illustrated in Table 4. These illustrate a range of PAYG scenarios which could be used to supplement the existing taxation system through to the highest charge which (after allowing for some traffic suppression as a result of the higher marginal costs of road use) would generate a sum broadly equivalent to the proceeds of current fuel duties and vehicle excise taxes. The highest charge scenario is about twice the rate charged on tolled motorways in continental Europe⁷⁰ [8p/mile (light vehicle), 20p/mile (heavy vehicle); based on French, Spanish and Italian rates]. If the national motorway network were subject to these continental toll charges the yield could be up to 6bn/year depending on how much traffic was displaced to other roads.

To give an example, on the above the charge for a (220 mile) car journey from Croydon to Wilmslow would be roughly 2.25 with the lowest tariff rising through 6.50 with the second to 13 with the fourth and to 31.50 with the sixth (but with no VED or fuel tax).

It is evident that a pay-as-you-go system with average charges significantly lower than existing tax rates (which are of the order of 10p per vehicle mile) could yield

⁷⁰ Tolls EU

substantial revenue and, with a premium for high quality roads a larger high quality road network could increase revenues – depending on the differentials between charging rates for different classes of roads.

A pay-as-you-go system is likely to be buoyant with the prospective increases in road traffic and progressive. However the cost of setting up and operating such a system cannot be ignored and it would be necessary to collect a substantial revenue stream to justify this investment – especially as the cost of collection of existing motoring taxes is relatively low.

Whilst a fully efficient pricing scheme along the lines described in Appendix C would be the most productive way of reforming road charging and funding, to date this approach has failed to attract sufficient political support to make it a likely candidate for introduction in the near future. Other possibilities should therefore be considered which aim to realise some of the benefits of efficient pricing whilst providing a robust and buoyant source of funds for maintaining and developing the road system and, ideally, are capable of being developed towards a full efficient charging scheme in due course.

Fully efficient pay-as-you-go charges

A more comprehensive national pay-as-you-go charging system could produce a revenue stream greater than that needed. *Roads and Reality*⁷¹ estimated that a fully efficient pricing scheme could generate a net revenue of 15bn - 20bn a year in addition to existing motoring taxes. Whilst to be publicly acceptable it is most unlikely that charging at these levels could be introduced without reducing existing motoring taxes there is room within a pay-as-you-go system to provide funds for non-traffic capacity costs of maintaining the road system.

⁷¹ Banks *et al* 2007, p47.

ROAD SAFETY

In spite of considerable improvements over the years, and Britain having one of the lowest road accident rates in the world, it is still the case that the risk of death whilst using roads is of the order of three times higher than in everyday life^{72 73}.

Whether one is in the course of work or going about daily business being out and about on the roads is to be in one of the most hazardous situations we normally experience. The risks have not been made "as low as reasonably practicable" to use the crucial concept in the independent safety regulation of factories and public transport⁷⁴. In places of work or whilst travelling by air or on the railways these levels of hazard would not be accepted by the authorities.

There is a great deal of interest and activity in improving road safety. But it is fragmented between: the "duty holders", Highways England and other highway authorities; central government; the police; and a number of non-statutory bodies. Crucially, none of those with executive responsibility for overseeing the safety of the road system is independent of the funding bodies.

Central government changes policy on and interest in road safety from time to time. Local authorities also vary in their attitudes, but all of them have been driven to reduce their activity and expertise because of the wider financial difficulties⁷⁵.

Improving road safety must be a core element in all road maintenance, management and development policies. One aspect of recent road development in Britain is the limited expansion of the motorway network which has a much lower accident rate than all-purpose main roads. Despite the cost of and disruption from constructing new purpose built traffic routes their superior safety performance means that they should be considered as part of future Strategic Road Network development policy.

As with maintenance and enhancement, highways authorities need to have ring fenced budgets available for road safety. Their responsibilities in this matter need to be

⁷² See Appendix B

⁷³ Allsop 2016.

⁷⁴ HSE 2017.

⁷⁵ Amos *et al* 2015.

clearly stated and understood. And there needs to be an independent body or bodies that achieve better understanding of system risk; learning from no-fault analysis of incidents; oversight of the risk management by the duty holders—all the time with due regard to value for money of safety measures⁷⁶. Specific road safety spending in England peaked at 250m in 2008 so to restore this would not add greatly to existing local authority highway budgets and any new funding regime should ensure appropriate provision for road safety programmes at both central and local levels.

The independence of such road safety oversight bodies can be fostered by funding them, not by government grant, but by levies on the roads delivery bodies. It is not known what the cost of such bodies is likely to be but the expenditure on rail safety by the Office of Rail and Road has averaged just about 16m a year over the five years to 2016/17⁷⁷. A similar annual levy on a typical highway authority might be of the order of one or two hundred thousand pounds.

ENVIRONMENT

Road transport infrastructure and operations have long created environmental problems. From the mud and dust thrown up by ‘speeding’ motor vehicles at the beginning of the last century⁷⁸ through disruption from major road construction in the 1970s and 1980s, to concerns about lead pollution and traffic noise followed by an awareness to reduce Greenhouse Gas (GHG) emissions from transport towards the end of the 20th century and, more recently growing concerns about the health impacts of road transport emissions – especially NO_x and particulates.

Many of these have been dealt with reasonably effectively. The sealing of road surfaces, elimination of tetraethyl lead as a petrol additive, progressive reduction of vehicle, tyre and road surfacing noise levels, improvements to internal combustion engine technology to reduce GHG emission rates and tighter standards for noxious emissions have all helped and there is potential for more to be achieved by most of these. Although some progress is being made (NO_x emissions down 57 per cent,

⁷⁶ See the report of the Transport Safety Commission, 2015.

⁷⁷ ORR 2017.

⁷⁸ Plowden 1971.

particulates⁷⁹ down 40 per cent and GHGs down 4 per cent between 2000 and 2015⁸⁰) present concerns focus mainly (but not exclusively) on these three issues.

The main efforts in mitigating these problems must be taken at national and international levels. These should include both regulatory and financial measures. Vehicle Excise Duty rate differentials are used to encourage the purchase of cars with lower CO₂ emissions but the rates changed in April 2017 with a sharp first year penalty for high emitting vehicles and a flat annual rate thereafter (except for electric vehicles). This is expected to impact mainly on firms buying cars to use for a limited period – such are car rental companies – but the wider impacts are as yet unknown. Whilst the Vehicle Excise Duty tariff addresses CO₂ emissions it has encouraged a switch to diesel engine vehicles. It can be argued that NO_x and particulates should figure in structuring the tariff, but by discouraging CO₂ the existing structure discourages fuel burn and therefore both NO_x and particulate emissions (as does fuel duty) and tightening emission regulations and stricter testing compliance are a better way of reducing these emissions than complicating the Vehicle Excise Duty band structuring.

Increases in the price of fuel give incentives to burn less of it: if the pump price of fuel increases by 10 percent consumption, and therefore carbon dioxide emissions, will fall by of the order of 7 percent in the long term (and traffic will fall by 3 or 4 percent: the difference being accounted for by more prudent usage).

This is one of the advantages of shifting taxation from Vehicle Excise Duty and onto fuel duty and pay-as-you-go charges. However, it should be noted that the appropriate carbon tax on a litre of fuel is already less than current duty rates. The 2019 central, short term traded carbon value used for UK public policy appraisal is 13.15 per tonne of CO₂ equivalent⁸¹. Burning a litre of fuel produces about 5½lbs of CO₂⁸² so the carbon tax should be 1315p x 5.5/2240 = 3.2p/litre. However this value rises rapidly after 2020 and by 2030 has reached 20p/litre.

⁷⁹ PM_{10s}, PM_{2.5s}, reduced by 50%.

⁸⁰ DfT 2017j & 2017k.

⁸¹ DBEIS 2019.

⁸² Based on USEIA 2016.

Diesel cars (Euro 5 standard) emit 26 times as much NO_x as petrol cars so⁸³, not withstanding the higher fuel efficiency of diesel vehicles, there is a case for reducing the diesel engine proportion of the internal combustion engine car parc. This could easily be done by increasing fuel duty (and any pay-as-you-go) rates for diesel vehicles.

Road operators also have a role. Reducing congestion generally and reducing the use of high emitting vehicles in densely populated areas particularly limits damages from emissions and some highway authorities are already introducing low emission zones⁸⁴ of which the London scheme is the largest and best known.

Highways England has specific conditions in its licence relating to sustainable development and design⁸⁵ and similar conditions should be attached to the warrants of other main road agencies. Where the highways authority is part of a local authority with powers and duties for planning, transport and public health it is reasonable to expect these will ensure adequate respect of environmental needs in the light of their local circumstances.

⁸³ DfT 2016w.

⁸⁴ DEFRA 2017.

⁸⁵ DfT 2015e.

SOURCES

- Allsop R., (2015), *Saving Lives by Lowering the Legal Drink-Drive Limit*, RAC Foundation, December 2015,
http://www.racfoundation.org/assets/rac_foundation/content/downloadables/saving_lives_by_lowering_legal_drink-drive_limit_Allsop_December_2015.pdf.
- Allsop R., (2016) “*Vision Zero is flawed, but we should harness its spirit to keep driving down deaths*”, Local Transport Today, 19 August 2016, <https://www.transportxtra.com/publications/local-transport-today/news/49812/vision-zero-is-flawed-but-we-should-harness-its-spirit-to-keep-driving-down-deaths>
- Amos L., Davies D. & Fosdick T., (2015), *Road Safety Since 2010*, RAC Foundation, September 2015,
http://www.racfoundation.org/assets/rac_foundation/content/downloadables/Road_Safety_Since_2010_Amos_Davies_Fosdick_PACTS_RAC_Foundation_final_report_September_2015.pdf
- Asphalt Industry Alliance (2020), *Annual Local Authority Road Maintenance Survey 2020*, March 2020.
- Association Européennes des Concessionnaires d’Autoroutes et d’Ouvrages à Péages. (2017), *Statistical Bulletin 2017*, May 2017, <http://www.asecap.com/?Itemid=191>.
- Audit Commission, (2011), *Going the distance: achieving better value for money in road maintenance*, June 2011, <http://apse.org.uk/apse/index.cfm/members-area/briefings/2011/11-30-going-the-distance-achieving-better-value-for-money-in-road-maintenancepdf/>
- Banks N., Bayliss D. & Glaister S.G., (2007), *Motoring Towards 2050, Roads and Reality*, December 2007,
http://www.racfoundation.org/assets/rac_foundation/content/downloadables/roads_and_reality-glaister_et_al-041207.pdf
- Bayliss D, (2011), *A Speculative Estimation of Direct Road User Charging Impacts*, in ‘Funding Strategic Road’, RAC Foundation, November 2011,
http://www.racfoundation.org/assets/rac_foundation/content/downloadables/funding_strategic_roads-glaister_lytton_bayliss-291111.pdf.
- Bayliss D. (2015), *The Condition of England’s Local Roads and how they are Funded*, RAC Foundation, November 2015,
http://www.racfoundation.org/assets/rac_foundation/content/downloadables/condition_of_englands_local_roads_and_how_they_are_funded_David_Bayliss_November_2015_web_version.pdf

BDRC et al, (2014), *Business attitudes to Roads in England: Multi-wave findings*, March 2014, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/395089/business-attitudes-roads-england-multi-wave.pdf.

Berrington A & Mikolai J., *Young Adults' Licence-Holding and Driving Behaviour in the UK*, RAC Foundation, RAC Foundation, December 2014, http://www.racfoundation.org/assets/rac_foundation/content/downloadables/Young-Adults-Licence-Holding-Berrington-Mikolai-DEC-2014.pdf

Box E. & Wengraf I., (2013), *Young Driver Safety: Solutions to an age-old problem*, RAC Foundation, July 2013, http://www.racfoundation.org/assets/rac_foundation/content/downloadables/young_driver_safety-box_wengraf-july2013.pdf.

Buchanan J. M., (1952), *The Pricing of Highway Services*, National Tax Journal, Washington D.C. 1952.

Butcher L., (2017), *Vehicle Excise Duty (VED)*, HoC Briefing Paper, SN01482, November 2017, <https://researchbriefings.parliament.uk/ResearchBriefing/Summary/SN01482>

Champion T., (2014), *People in cities: the numbers*, Government Office for Science, June 2014, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/321814/14-802-people-in-cities-numbers.pdf.

Confederation of British Industry (2016), *Thinking Globally: Delivering Locally - CBI/AECOM Infrastructure Survey 2016*, November 2016, http://www.cbi.org.uk/index.cfm/_api/render/file/?method=inline&fileID=860BAA45-F34B-4303-B05609B8235A8E14

Costley T. & Gorasia M., (2014), *Public Attitudes to Roads in England: Wave 3*, September 2014, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/395135/public-attitudes-roads-england-wave-3.pdf.

Dartagnan Consulting, (2010), *Road Pricing*, November 2010, <http://roadpricing.blogspot.co.uk/2010/11/what-are-different-types-of-road.html>.

Department for Business Energy & Industrial Strategy (2019), *Updated short-term traded carbon values used for public policy appraisal*, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/794186/2018-short-term-traded-carbon-values-for-appraisal-purposes.pdf

Department of Transport (1992), *Transport Statistics Great Britain 1992*, HMSO, London, September 1992.

Department for Transport (1996), *Transport Statistics Great Britain 1996 Edition*, HMSO, London September 1996.

Department for Transport (2000), *Transport Statistics Great Britain 2000 Edition*, TSO, London October 2000.

Department for Transport (2002), *Transport Statistics Great Britain 2002 Edition*, TSO, London October 2002.

Department for Transport (2004a), *Feasibility study of road pricing in the UK – Full Report*, July 2004,

https://www.london.gov.uk/sites/default/files/gla_migrate_files_destination/DfT%20road%20pricing%20feasibility%20study.pdf.

Department for Transport (2004b), *Survey of Privately Owned Vans Results of survey October 2002 – September 2003, SB 04(21)*, DfT, London January 2004.

Department for Transport (2005), *Survey of Van Activity 2004, SB 08(27)*, DfT, London, June 2005.

Department for Transport (2006), *Transport Statistics Great Britain 2006 Edition*, TSO, London November 2006.

Department for Transport (2009), *Transport Statistics Great Britain 2009 Edition*, TSO, London November 2009.

Department for Transport (2012), *Transport Statistics Great Britain 2012 Edition*, December 2012, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/71279/tsgb-2012.pdf.

Department for Transport (2015a), *Road Traffic Forecasts 2015*, March 2015, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/411471/road-traffic-forecasts-2015.pdf.

Department for Transport (2015b), *English regional plus Welsh traffic growth and speeds forecasts: scenario 2*, March 2015, <https://www.gov.uk/government/publications/road-traffic-forecasts-2015>.

Department for Transport (2015b), *British Social Attitudes Survey 2014: Public attitudes towards transport*, December 2015, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/481877/british-social-attitudes-survey-2014.pdf.

Department for Transport (2015c), *Road Investment Strategy: for the 2015/16 – 2019/20 Road Period*, March 2015, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/408514/ris-for-2015-16-road-period-web-version.pdf

Department for Transport (2015d), *Highways England to take over motorways and major A roads*, March 2015, <https://www.gov.uk/government/news/highways-england-to-take-over-motorways-and-major-a-roads>.

Department for Transport (2015e), *Highways England Licence*. April 2015, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/431389/strategic-highways-licence.pdf.

Department for Transport (2016a), *Road Investment Strategy post 2020: planning ahead*, March 2016, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/508505/road-investment-strategy-post-2020-planning-ahead.pdf

Department for Transport (2016b), *Road investment strategy: post-2020*, November 2016, <https://www.gov.uk/government/collections/road-investment-strategy-post-2020>.

Department for Transport (2017a), *Proposals for the Creation of a Major Road Network: Consultation*, December 2017, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/670527/major-road-network-consultation.pdf

Department for Transport (2017b), *Road traffic (vehicle miles) by road class in Great Britain, rolling annual totals from 1993, Table TRA2502a*, November 2017, <https://www.gov.uk/government/statistics/provisional-road-traffic-estimates-great-britain-october-2016-to-september-2017>.

Department for Transport (2017c), *Road traffic (vehicle miles) by vehicle type in Great Britain, rolling annual totals from 1993, Table TRA2501a*, November 2017, <https://www.gov.uk/government/statistics/provisional-road-traffic-estimates-great-britain-october-2016-to-september-2017>.

Department for Transport (2017d), *Fuel duty and Vehicle excise duty from 1987, Table TSGB1310*, November 2017, <https://www.gov.uk/government/statistics/transport-statistics-great-britain-2017>.

Department for Transport (2017e), *Road traffic (vehicle miles) by vehicle type in Great Britain, annual from 1949, Table TRA0101*, April 2017, <https://www.gov.uk/government/statistics/road-traffic-estimates-in-great-britain-2016>.

Department for Transport (2017f), *Road lengths (miles) by road type in Great Britain: 1914 to 2016, Table TSGB0709*, November 2017, <https://www.gov.uk/government/statistics/transport-statistics-great-britain-2017>

Department for Transport (2017g), *UK Public Expenditure on Transport by Country and Spending Authority: from 2005/06, Table TSGB1302*, November 2017, <https://www.gov.uk/government/statistics/transport-statistics-great-britain-2017>.

Department for Transport (2017h), *Shaping the future of England's strategic roads (RIS2)*, December 2017, <https://www.gov.uk/government/consultations/shaping-the-future-of-englands-strategic-roads-ris2>.

Department for Transport (2017i). *Roads Funding: Information Pack*, January 2017, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/583263/roads-funding-information-pack.pdf.

Department for Transport (2017j), *Air pollutant emissions by transport mode: United Kingdom, from 1970, Table ENV0301*, November 2017, <https://www.gov.uk/government/statistics/transport-statistics-great-britain-2017>

Department for Transport (2017k), *Greenhouse gas emissions by transport mode: United Kingdom, 1990-2015, Table ENV0201*, November 2017, <https://www.gov.uk/government/statistics/transport-statistics-great-britain-2017>.

Department for Transport (2017l), *Licensed vehicles by body type at the end of quarter, Great Britain from 1994 Q1; also United Kingdom from 2014 Q3, Table VEH0101*, January 2017, <https://www.gov.uk/government/statistical-data-sets/all-vehicles-veh01#table-veh0150>.

Department for Transport (2017m), *Proportions perceiving traffic congestion in towns and cities as a problem: (GB), Table ATT0335*, August 2017, <https://www.gov.uk/government/statistical-data-sets/att03-attitudes-and-behaviour-towards-roads-and-road-travel#table-att0302>.

Department for Transport (2017n), *Proportions perceiving motorway congestion as a problem: (GB), Table ATT0334*, August 2017, <https://www.gov.uk/government/statistical-data-sets/att03-attitudes-and-behaviour-towards-roads-and-road-travel#table-att0302>.

Department for Transport (2017o), *New road construction and improvement: motorways and all-purpose trunk roads: England: 2006/07 to 2016/17, Table TSGB0720*, November 2017, <https://www.gov.uk/government/statistics/transport-statistics-great-britain-2017>.

Department for Transport (2017p), *Reported accidents and casualties, population, vehicle population, index of vehicle mileage, by road user type and severity, Great Britain, 1926-2016, RAS40001*, September 2017, <https://www.gov.uk/government/statistical-data-sets/ras40-reported-accidents-vehicles-and-casualties#table-ras40001>.

Department for Transport (2017q), *Total value of prevention of accidents by severity and road type: GB 2016, RAS60004*, September 2017, <https://www.gov.uk/government/statistical-data-sets/ras60-average-value-of-preventing-road-accidents>.

Department for Transport (2017r), *International comparisons of road deaths: number and rates for different road users: by selected countries: 2015 and 2016 (provisional)*, September 2017, <https://www.gov.uk/government/statistical-data-sets/ras52-international-comparisons>.

Department for Transport (2017s), *Reported accidents and accident rates by road class and severity, Great Britain, 2010-14 average, 2009 – 2016, RAS10002*, September 2017, <https://www.gov.uk/government/statistical-data-sets/ras10-reported-road-accidents#table-ras10002>.

Department for Transport (2017t), *Average trip length by main mode: England, 1995/97 to 2016, Table NTS0306*, July 2017, <https://www.gov.uk/government/statistics/national-travel-survey-2016>.

Department for Transport (2017u), *Average length of haul by commodity: annual 2004 – 2015, Table RFS0112*, January 2017, <https://www.gov.uk/government/statistical-data-sets/rfs01-goods-lifted-and-distance-hauled#table-rfs0112>.

Department for Transport (2017d), *British Social Attitudes Survey 2015*, January 2017, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/586193/british-social-attitudes-survey-2015.pdf.

Department for Transport (2017), *Household car availability: England, 1951 to 2016, Table NTS0205*, July 2017, <https://www.gov.uk/government/statistics/national-travel-survey-2016>.

Department for Transport (2017h), *Road lengths (miles) by road type and region and country in Great Britain, 2016, Table RDL0101*, April 2017, <https://www.gov.uk/government/statistics/road-lengths-in-great-britain-2016>.

Department for Transport (2017i), *Government invests 350 million improving local roads*, October 2017, <https://www.gov.uk/government/news/government-invests-350-million-improving-local-roads>.

Department for Transport (2017), *Emissions for road vehicles (per vehicle kilometre) in urban conditions: Great Britain, Table TSG0309*, December 2017, <https://www.gov.uk/government/statistics/transport-statistics-great-britain-2016>.

Department for Transport (2017n), *Licensed vehicles by body type at the end of quarter, Great Britain from 1994 Q1; also United Kingdom from 2014 Q3, Table VEH0101*, December 2017, <https://www.gov.uk/government/statistics/vehicle-licensing-statistics-july-to-september-2017>.

Department for Transport (2018a), *Principal and non-principal classified roads where maintenance should be considered, by Region in England, 2007/08 to 2016/17, Table RDC0121*, January 2018, <https://www.gov.uk/government/statistics/road-conditions-in-england-2017>.

Department for Transport (2019), *Provisional Road Traffic Estimates GB: October 2018 - September 2019*, December 2019, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/832049/prov-road-traffic-estimates-Jul-2018-to-Jun-2019.pdf

Department for Transport (2018b), *Percentage of unclassified roads where maintenance should be considered, by region in England, 2007/08 to 2016/17, Table RDC0131*, January 2018, <https://www.gov.uk/government/statistics/road-conditions-in-england-2017>.

Department for Transport (2018c), *Surface condition of trunk roads in England, from 2007/08 to 2016/17, Table RDC0201*, January 2018, <https://www.gov.uk/government/statistics/road-conditions-in-england-2017>.

Department for Transport (2018a), *Transport Secretary welcomes next step in 1.7 billion fund to transform local journeys*, March 2018, <https://www.gov.uk/government/news/transport-secretary-welcomes-next-step-in-1-7-billion-fund-to-transform-local-journeys>

Driver & Vehicle Licensing Agency (2016), *Vehicle tax (VED) is changing*, June 2016, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/534511/ved-reform-briefing-for-motor-industry.pdf.

Eddington R., (2006), *The Eddington Transport Study*, HMSO, December 2006, <http://webarchive.nationalarchives.gov.uk/20090104005813/http://www.dft.gov.uk/about/strategy/transportstrategy/eddingtontstudy/>.

European Commission (2015), *eCall in all new cars from April 2018*, April 2014, <https://ec.europa.eu/digital-single-market/en/news/ecall-all-new-cars-april-2018>.

European Commission (2018), *Statistical Pocketbook 2016: Transport in Figures*, retrieved on 11th March 2018 from https://ec.europa.eu/transport/facts-fundings/statistics/pocketbook-2017_en

Florida Department of Transportation (2017), *SunPass*, retrieved 18th January from <http://www.fdot.gov/SearchResults.shtm?cx=017316194735045521938%3Avyo1fdrdg3g&cof=FORID%3A11&ie=UTF-8&q=sunpass&sa=>.

Glaister S. G., Lytton L. & Bayliss D., (2011), *Funding Strategic Roads*, November 2011, http://www.racfoundation.org/assets/rac_foundation/content/downloadables/funding_strategic_roads-glaister_lytton_bayliss-291111.pdf.

Glaister S. G., (2014a), *The Right Road to Reform? Delivering a highway network for the 21st century*, RAC Foundation, February 2014, http://www.racfoundation.org/assets/rac_foundation/content/downloadables/road_to_reform-glaister-feb2014.pdf.

Glaister S. G., (2014b), *The Smeed Report at Fifty: will road pricing always be ten years away?* University College, London, October 2014, <http://www.ucl.ac.uk/transport-institute/pdfs/UCL-smeed-memorial>.

Government Office for London, (2000), *Road Charging for London: A Technical Assessment*, TSO, London, March 2000.

GOV.UK (2018), *Vehicle tax rates*, retrieved from <https://www.gov.uk/vehicle-tax-rate-tables>, 18th March 2018.

Greater London Council (1974), *A Study of Supplementary Licensing*, GLC, London, December 1974,

Hau T. D., (1990), *Electronic Road Pricing: Developments in Hong Kong 1983-89*, Journal of Transport Economics and Policy, Vol. 24, No. 2, May 1990, pp. 203-214, http://www.econ.hku.hk/~timhau/electronic_road_pricing.pdf

Health and safety Executive (2017), *ALARP "at a glance"*, Retrieved 24th February from <http://www.hse.gov.uk/risk/theory/alarpglance.htm>

Highways England (2014), *New Roads & Street Works Act 1991: Highways England responsibility*, October 2014, <https://www.gov.uk/government/collections/new-roads-street-works-act-1991-highways-agency-responsibility>.

Highways England (2017), *Annual Report and Accounts 2016-2017*, HC 252, July 2017, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/638619/S160578_Highways_England_Annual_Report_V25_-_Web_.pdf.

- Hill J. & Starrs C., (2011), *Saving Lives saving Money*, RAC Foundation, April 2011, [http://www.racfoundation.org/assets/rac_foundation/content/downloadables/saving%20lives,%20saving%20money%20-%20rsf%20and%20racf%20-%20main%20report%20\(embargoed%20copy\).pdf](http://www.racfoundation.org/assets/rac_foundation/content/downloadables/saving%20lives,%20saving%20money%20-%20rsf%20and%20racf%20-%20main%20report%20(embargoed%20copy).pdf)
- HM Revenue and Customs (2016a), *Hydrocarbon Oils Bulletin*, November 2016, <https://www.gov.uk/government/statistics/hydrocarbon-oils-bulletin>.
- HM Revenue and Customs (2016b), *HMRC Tax and NIC Receipts: Monthly and annual historical record*, December 2016, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/578818/Nov16_Receipts_NS_Bulletin_Final.pdf.
- HM Revenue and Customs (2017), *HMRC Tax Receipts Between England, Wales, Scotland & Northern Ireland*, October 2017, <https://www.gov.uk/government/statistics/disaggregation-of-hmrc-tax-receipts>
- HM Revenue and Customs (2018), *Hydrocarbons Oil Bulletin*, February 2018, <https://www.uktradeinfo.com/Statistics/Pages/TaxAndDutybulletins.aspx>.
- HM Treasury (2012), *Budget 2012*, March 2012, <http://webarchive.nationalarchives.gov.uk/20120403141350/http://www.hm-treasury.gov.uk/budget2012.htm>
- HM Treasury (2015), *Chancellor George Osborne's Summer Budget 2015 speech*, July 2015, <https://www.gov.uk/government/speeches/chancellor-george-osbornes-summer-budget-2015-speech>
- HM Treasury (2018a), *Local government account: current receipts, PSA6I*, February 2018, <https://www.gov.uk/government/statistics/public-sector-finances-bulletin>.
- HM Treasury (2018b), *Central government account: current receipts, PSA6D*, February 2018, <https://www.gov.uk/government/statistics/public-sector-finances-bulletin>.
- House of Commons (2016) Public Accounts Committee - *Devolution in England: governance, financial accountability and following the taxpayer pound*: Thirty-second Report of Session 2016–17, December 2016, <https://www.publications.parliament.uk/pa/cm201617/cmselect/cmpubacc/866/866.pdf>.
- IAM (2009), *Motoring Facts*, IAM Motoring Trust, London, June 2009.
- Institute of Taxation and Economic Policy (2017), *State Gasoline Taxes: Built to Fail, But Fixable*, February 2017,

- INRIX (2018), *Global Traffic Scorecard*, February 2018, <http://inrix.com/scorecard/>.
- IPSOS/MORI, (2012), *Road Use Survey: Topline Summary*, RAC Foundation, July 2012, http://www.racfoundation.org/assets/rac_foundation/content/downloadables/ipsos_mori_racf_payg_attitude_survey_july2012.pdf.
- ITS International, (2011), *Dutch survey shows drivers are in favour of road user charging*, March 2011, <http://www.itsinternational.com/categories/charging-tolling/features/dutch-survey-shows-drivers-are-in-favour-of-road-user-charging/>.
- Johnson P., Leicester A, and Stoye G., (2012), *Fuel for Thought: The what, why and how of motoring taxation*, RAC Foundation, May 2012, http://www.racfoundation.org/assets/rac_foundation/content/downloadables/fuel_for_thought-johnson_et_al-150512.pdf.
- Land Transport Authority (2016), *Electronic Road Pricing*, September 2016, <https://www.lta.gov.sg/content/ltaweb/en/roads-and-motoring/managing-traffic-and-congestion/electronic-road-pricing-erp.html>
- Leibling D.; (2017). *Local Authority Parking Finances in England 2016 – 17*, RAC Foundation, November 2017, <https://www.racfoundation.org/research/mobility/council-parking-revenue-in-england-2016-17>.
- Le Vine S. & Jones P. (2012), *On the Move: Making sense of car and train travel trends in Britain*, RAC Foundation, December 2012, http://www.racfoundation.org/assets/rac_foundation/content/downloadables/on_the_move-le_vine_&_jones-dec2012.pdf
- LGIU (2018), *Local Government Facts and Figures*, Retrieved 23rd March 2018 from, <https://www.lgiu.org.uk/local-government-facts-and-figures/#how-many-councils-are-there>.
- Local Government Association (2015), *Future funding outlook for councils 2019/20 Interim 2015 update, LGA London*, June 2015, <http://www.local.gov.uk/documents/10180/11531/Future+Funding+Outlook+interim/39ad19fb-e5d8-4a2b-81a8-bf139497782d>.
- Local Government Association (2017), *Potholes: 2017 could be 'tipping point year' warn councils*, January 2017, http://www.local.gov.uk/web/guest/media-releases/-/journal_content/56/10180/8140445/NEWS.

London Assembly (2017), *London stalling Reducing traffic congestion in London*, January 2017, https://www.london.gov.uk/sites/default/files/london_stalling_-_reducing_traffic_congestion_in_london.pdf.

Mayor of London (2017), *The Mayor's new 10 'Toxicity Charge' for London's most polluting cars*, October 2017, <https://www.london.gov.uk/what-we-do/transport/mayors-new-ps10-toxicity-charge-londons-most-polluting-cars>.

Ministry of Housing, Communities and Local Government (2017a), *Table RO2: Net current expenditure highways & transport services, England, 2008/09 to 2016/17*, November 2017, <https://www.gov.uk/government/collections/local-authority-revenue-expenditure-and-financing>.

Ministry of Housing, Communities and Local Government (2017b), *Local Authority Capital Expenditure and Receipts, England: 2016 – 17 Final Outturn*, September 2017, <https://www.gov.uk/government/statistics/local-authority-capital-expenditure-and-receipts-in-england-2016-to-2017-final-outturn>.

Ministry of Transport, (1964), *Road Pricing: The Economic and Technical Possibilities*, HMSO, London, 1964.

Motorway Archive (2018), *The length of motorway opened in each year since 1958*, Retrieved March 2018 from, <http://ukmotorwayarchive.org/>.

National Audit Office (2003), *Maintaining England's Motorways and Trunk Roads, HC 431*, March 2003, <https://www.nao.org.uk/wp-content/uploads/2003/03/0203431.pdf>.

National Audit Office (2014), *The impact of funding reductions on local authorities*, November 2014, <https://www.nao.org.uk/wp-content/uploads/2014/11/Impact-of-funding-reductions-on-local-authorities.pdf>

National Audit Office (2018), *Financial Sustainability of Local Authorities 2018*, March 2018, <https://www.nao.org.uk/wp-content/uploads/2018/03/Financial-sustainability-of-local-authorities-2018.pdf>.

National Highways & Transport Network (2017), *NHT Public Satisfaction Survey 2016 - Key Results*, September 2017, http://www.nhtnetwork.org/files/7215/0891/9327/2017_Executive_Summary_-_Importance_vs_Satisfaction_1.PDF

National Police Chiefs' Council (2016), *Automatic Number Plate Recognition (ANPR) Factsheet*, April 2016, <http://www.npcc.police.uk/documents/ANPR%20Factsheet.pdf>.

Nottingham City Council (2016), *Workplace Parking Levy*, July 2016,
<http://www.cbthoughtleadership.org/WPL-Briefing-Nottingham.pdf>.

Nottingham Post (2016), *Controversial workplace parking levy clocks up 9.3 million for Nottingham City Council*, September 2016, <http://www.nottinghampost.com/workplace-parking-levy-clocks-up-9-3-million-for-nottingham-city-council/story-29708392-detail/story.html>

Read more at <http://www.nottinghampost.com/workplace-parking-levy-clocks-up-9-3-million-for-nottingham-city-council/story-29708392-detail/story.html#ibUcPUKt8SBIFH65.99>

O'Connell S., (2017), *Addendum to London Assembly Transport Committee Report, London stalling: Reducing traffic congestion in London*, January 2017,
https://www.london.gov.uk/sites/default/files/addendum_to_london_assembly_transport_committee_report.pdf.

Office for Budget Responsibility (2016), *Fuel Duties*, May 2016,
<http://budgetresponsibility.org.uk/forecasts-in-depth/tax-by-tax-spend-by-spend/fuel-duties/>.

Office for National Statistics (2011), *Public attitudes towards road congestion, November 2009 to February 2010*, August 2010,
<https://www.lgcplus.com/Journals/3/Files/2010/8/26/roadcongestion.pdf>

Office for National Statistics (2016), *Police workforce, England and Wales, 31 March 2016 Table F4*, July 2016, <https://www.gov.uk/government/statistics/police-workforce-england-and-wales-31-march-2016>.

Office for National Statistics (2017a), *Weekly road fuel prices*, January 2017,
<https://www.gov.uk/government/statistical-data-sets/oil-and-petroleum-products-weekly-statistics>.

Office for National Statistics (2018a), *Family spending in the UK: financial year ending 2017*, January 2018,
<https://www.ons.gov.uk/peoplepopulationandcommunity/personalandhouseholdfinances/expenditure/bulletins/familyspendingintheuk/financialyearending2017>.

Office for National Statistics (2018b), *RPI All Items Index: Jan 1987=100*, March 2018,
<https://www.ons.gov.uk/economy/inflationandpriceindices/timeseries/chaw/mm23>.

Office of Rail and Road (2017), *Annual report and accounts 2016 -17*, June 2017,
http://orr.gov.uk/_data/assets/pdf_file/0011/25022/annual-report-2016-17-print.pdf.

Owen R., Ursachi G. and Allsop R.(2016), *The Effectiveness of Average Speed Cameras in Great Britain*, RAC Foundation, September 2016,

http://www.racfoundation.org/assets/rac_foundation/content/downloadables/Average_speed_camera_effectiveness_Owen_Ursachi_Allsop_September_2016.pdf.

Oxford Economics (2017), *The Economic Impact of Changes to Vehicle Excise Duty: A Report for the BVRLA*, February 2017,

http://www.bvrla.co.uk/sites/default/files/documents/20170203_oxecon_bvrla_ved_final_report.pdf.

FACTS (2015), *UK Transport Safety: Who is responsible?* March 2015,

<http://www.pacts.org.uk/wp-content/uploads/sites/2/TSC%20Responsibility%20report%20-%20PrepubFINAL%202015-03-23.pdf>.

Pigou A., (1920), *The Economics of Welfare*, Macmillan, London, 1920.

Plowden S. (1971), *The Motor Car and Politics 1986-1970*, The Bodley Head, London, 1971.

Policy Exchange (2016), *2017 Wolfson Economics Prize: Guide for entrants*, October 2016,

<https://policyexchange.org.uk/wolfsonprize/>

Pope T. & Waters T., (2016), *A survey of the UK tax system, IFS Briefing Note BN09*, November 2016, <https://www.ifs.org.uk/bns/bn09.pdf>.

Populus (2016), *Traffic Congestion and Road Charging Survey: September 2016*, January 2017,

https://www.london.gov.uk/sites/default/files/survey_results_-_congestion_and_road_charging.pdf.

Public Finance (2016), *First ever Scottish council bond issue planned by Aberdeen*, October 2016,

<http://www.publicfinance.co.uk/news/2016/10/first-ever-scottish-council-bond-issue-planned-aberdeen>.

Quarmby D, & Carey P., (2016), *A Major Road Network for England*, October 2016,

<http://www.reesjeffreys.co.uk/wp-content/uploads/2016/10/A-Major-Road-Network-for-England-David-Quarmby-and-Phil-Carey-Rees-Jeffreys-Road-Fund-October-2016.pdf>.

Reuters (2016), *U.S. voters say yes to big bond issues, mixed message on taxes*, November 2016,

<http://www.reuters.com/article/usa-election-bonds-idUSL1N1D91IT>.

Richards M. G., (2006), *Congestion Charging in London: The Policy and Politics*, Palgrave macmillan, Basingstoke, 2006.

Rinocarhire (2017), *How Much Do Toll Roads in Italy Cost?* retrieved 16th January 2017 from

<http://www.rhinocarhire.com/Car-Hire-Blog/August-2015/Italian-Toll-Roads-A-Guide-to-Toll-Roads-in-Italy.aspx>.

Sandford M., (2016a), *Devolution to Local Government in England*, HoC Briefing Paper 07029, November 2017,

<http://researchbriefings.parliament.uk/ResearchBriefing/Summary/SN07029#fullreport>.

Sandford M., (2016b), *Local government in England: capital finance, HoC Briefing Paper 05797*,

June 2016, <http://researchbriefings.parliament.uk/ResearchBriefing/Summary/SN05797#fullreport>.

Savills (2014), *CIL: Is it delivering?* November 2014, <http://pdf.euro.savills.co.uk/uk/residential---other/spotlight-cil.pdf>.

Scottish Government (2016), *Scottish Local Authorities*, retrieved 16th February from

<http://www.gov.scot/Topics/Government/local-government/localg/usefullinks>.

Seeley A (2014), Taxation of road fuels, HoC Standard Note: SN824, January 2014,

<http://ukparliamentre.searchbriefings.files.parliament.uk/documents/SN00824/SN00824.pdf>

Tantalum, (2017), *Connected Car Platform*, retrieved 15th February from

<https://www.tantalumcorporation.com/>.

The National Highways and Transport Network (2015), *National Highways and Transport Public Satisfaction Survey (2015a) 2014 NHT Survey Summary Report*,

[<http://nhtsurvey.econtrack.co.uk/Content.aspx?6360>]. Accessed 15th October 2015.

The Times (2017), ‘Smart’ pumps help drivers to fill and go, February 5th,

<http://www.thetimes.co.uk/article/smart-pumps-help-drivers-to-fill-and-go-70hszn5n7>.

Tolls.EU, (2017), *Highway toll (Country)*, retrieved 16th January 2017 from,

[http://www.tolls.eu/\(country\)](http://www.tolls.eu/(country)).

Transport Extra (2017), *Heathrow sees parking revenues reach 114m a year*, 24th February 2017,

<https://www.transportextra.com/publications/parking-review/news/52739/heathrow-sees-parking-revenues-reach-114m-a-year>.

Transport for London (2003), *London Congestion Charge Impacts Monitoring First Annual Report*,

June 2003, <http://content.tfl.gov.uk/impacts-monitoring-report1.pdf>.

Transport for London (2014), Roads Task Force - Technical Note10 *What is the capacity of the road network for private motorised traffic and how has this changed over time?* September 2014,

<http://content.tfl.gov.uk/technical-note-10-what-is-the-capacity-of-the-road-network-for-private-motorised-traffic.pdf>

Transport for London (2017a), *Annual Report and Statement of Accounts 2016/17*, July 2016, <http://content.tfl.gov.uk/tfl-annual-report-2015-16.pdf>.

Transport for London (2017b), *Travel in London: Report 10*, December 2017. <http://content.tfl.gov.uk/travel-in-london-report-10.pdf>.

Transport for London (2017c), *Congestion Charge*, retrieved 18th January 2017 from <https://tfl.gov.uk/modes/driving/congestion-charge>.

Transport for London (2019), *Annual Report and Statement of Accounts 2018/19*, <http://content.tfl.gov.uk/tfl-annual-report-and-statement-of-accounts-2018-19.pdf>

Transport Network (2017), *Councils to 'ransack roads budget' as social care devours cash*, November 2017, <https://www.transport-network.co.uk/Councils-to-ransack-roads-budget-as-social-care-devours-cash/14606>.

Transport Safety Commission (2015), *UK Transport safety: who is responsible?* <http://www.pacts.org.uk/wp-content/uploads/sites/2/TSC%20Responsibility%20report%20-%20PrepubFINAL%202015-03-23.pdf>

UK Municipal Bonds Agency, (2016), *About UKMBA*, retrieved 15th February 2017 from <https://www.ukmba.org/about-the-agency/>.

UK Parliament (1969), *Transport (London) Act 1969*, Chapter 35, HMSO, June 1968, <http://www.legislation.gov.uk/ukpga/1969/35/contents>.

UK Parliament (1980), *Highways Act 1980*, Chapter 66, TSO, November 1980, http://www.legislation.gov.uk/ukpga/1980/66/pdfs/ukpga_19800066_en.pdf

UK Parliament (1990), *Town and Country Planning Act 1990*, Chapter 8, TSO, February 1990, http://www.legislation.gov.uk/ukpga/1990/8/pdfs/ukpga_19900008_en.pdf.

UK Parliament (2000), *Transport Act 2000*, Chapter 38, TSO, <http://www.legislation.gov.uk/ukpga/2000/38/contents>.

UK Parliament (2017), *Local Government Finance Bill 2016/17*, January 2017, <http://www.publications.parliament.uk/pa/bills/cbill/2016-2017/0122/17122.pdf>.

US Energy Administration (2016), *How much carbon dioxide is produced by burning gasoline and diesel fuel?* May 2016, <http://www.eia.gov/tools/faqs/faq.cfm?id=307&t=11>.

Wadsworth B., (2015), *Funding our Roads: A Better Way*, RAC Foundation, May 2015, <http://www.racfoundation.org/research/economy/funding-our-roads-a-better-way-research>.

Walker J., (2011), *The Acceptability of Road Pricing*, RAC Foundation, May 2011, http://www.racfoundation.org/assets/rac_foundation/content/downloadables/acceptability_of_road_pricing-walker-2011.pdf.

WhatDoTheyKnow, (2014), *FoI Request on ANPR Camera Numbers to TfL*, November 2014, https://www.whatdotheyknow.com/request/tfl_anpr_cameras_and_data.

Welsh Government (2015), *Unitary Authorities*, June 2015, <http://gov.wales/topics/localgovernment/unitary-authorities/?lang=en>

World Bank Group, (2016), *Relieving Traffic Congestion -The Singapore Area Licensing Scheme*, 1975, January 2016, <http://documents.worldbank.org/curated/en/514871467993172515/pdf/104686-WP-PUBLIC-2006-08-The-Singapore-Area-Licensing-Scheme-1975.pdf>.

