

A stylized graphic of a road intersection. A vertical road with a dashed white center line runs through the middle. It intersects with a horizontal road. The background is divided into four quadrants by the roads: top-left is orange, top-right is blue, bottom-left is green, and bottom-right is yellow. The roads are dark grey with white dashed lines for lane markings.

An Independent Review of **Road User Charging** in Wales

Derek Turner CBE FREng

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About the Author

Derek Turner CBE FREng

Derek Turner CBE is a fellow of the Royal Academy of Engineering, a Chartered Civil Engineer and Visiting Professor at UCL who has spent his entire 47 year career dealing with transport related problems across the world. While mostly working within the Public Sector for both national and local government, he also provides advice as an independent consultant to international private clients and national governments.

From 1991 to 2000, Derek Turner was The Traffic Director for London; a position created by parliament to design, introduce and maintain London's Priority (Red) Routes. He was also asked to oversee the design and introduction of London's Bus Priority Network. When the position of Mayor of London, and Transport for London (TfL) were created in 2000, the powers of the Traffic Director were transferred and Derek Turner became the Managing Director of TfL Streets and his responsibilities included the design, implementation and from February 2003, operation of the Road User Charging Scheme for central London (also known as Central London Congestion Charging Scheme). Subsequently, he was also part of the team advising Stockholm on the development their scheme.

Derek Turner was appointed Deputy Chief Executive of the Highways Agency (now Highways England) in 2005 and retired from that position in 2013. Since then he has filled his time with his consultancy work and his garden in Shropshire – just a few hundred metres from Wales!

1. Executive Summary

The issues encompassing Road User Charging (RUC) in Wales are wide ranging and very important for the Welsh nation and its government. They require urgent consideration and action. This “Independent Review of Road User Charging in Wales” has attempted to cover:

- a) What’s the issue?**
- b) Why is it a matter for wales?**
- c) Why is necessary to consider it now?**
- d) Why it can’t all wait?**

Wales’ transport issues are not geographically homogeneous. Nevertheless, among the wide range of schemes which come under the general description of RUC, there may well be designs which would assist the Welsh economy, transport, sustainability and environment of all the different constituent parts of the country. An important issue for the Welsh Government highlighted by this review is whether, and if so how, to deal with and co-ordinate these RUC schemes, and their design, if/when they be proposed.

The Welsh Government has, in the main, appropriate powers concerning most of these matters. At a strategic level it can decide to adopt policy making and/or executive roles; although some of the matters do also come directly within the remit of Welsh local authorities. Some of these authorities are already actively considering, and promoting, RUC schemes for their areas.

In these circumstances the review concludes that:

“... there is a pressing need for a “National Policy Framework for RUC in Wales” to be developed and introduced as soon as possible.”

2. Background to, and nature of, the Review



2.1 Ministerial objectives and aim of the review

- 2.1.1** Welsh Ministers' objectives are understood to include to do all they can to decarbonise the Welsh transport network, improve air quality and reduce congestion. They believe that achieving these objectives will benefit Wales' environment, economy and society. Furthermore, that investing in and incentivising public transport and active travel are vital in encouraging people to make fewer journeys by car.
- 2.1.2** The Ministers recognise, however, that demand management measures may also be needed to achieve a significant modal shift from private car to more sustainable transport in Wales. The aim therefore is to review the benefits and challenges of different demand management approaches such as road user charging.

2.2 Terms of Reference

- 2.2.1** The published Terms of Reference (ToR)¹ for this independent review states that its purpose is to report to Ministers on:
- “The potential rationale for different types of road user charging in Wales, including clear advice on what the objectives of any such scheme should be. This could include range of possible objectives such as alleviating congestion, improving air quality or reducing carbon emissions, increasing rates of active travel, encouraging modal shift and travel behaviours – such as travel to school.
 - The options for implementation for different road user charging types including a broad SWOT assessment of the options and the different technologies available: What are the relative costs of the different technologies; the ability of each technology to meet the required objectives; who these costs might be borne by – user or authority or other?
 - The case for an over-arching national framework to be applied to any local or sub-regional road user charging policies in order to avoid undue adverse wider effects (such as impacts on drivers affected by more than one charge, and to preserve and incentivise the option of subsequent incorporation into a national policy).
 - What other policies or transport interventions might be required to successfully implement road user charging in Wales, and at what stage in the implantation timeline (for example, to offset any adverse distributional implications). This should have particular regard to the interaction with motoring taxation in order to consider the fiscal impact of driving in the round. Such policies need not be currently devolved.
 - Matters likely to inform the acceptability of any road user charging policy, including but not limited to the level of the charge, the fairness and equality of its application (both within and beyond the area affected by the scheme) and potential uses of revenue, including arguments for and against hypothecation, to achieve different policy objectives.
 - The wider economic, social, environmental and behavioural implications of road user charging in the Welsh context, including issues arising from the border with England.
 - The evidence of effectiveness and any lessons learned from implementation of road user charging schemes in either the rest of the UK or internationally.”
- 2.2.2** The Written Statement also states that for the purposes of the review: ***“The term “road user charging” covers all feasible charging methods, including distance charging, congestion charging, workplace and retail parking levies.”***

¹ Welsh Government (2020) Cabinet Statement by Ken Skates, Minister for Economy, Transport and North Wales: An Independent review of road user charging in Wales.

2.3 General approach

2.3.1 This is the report resulting from the independent review commissioned by the Welsh Ministers. While the document is mainly qualitative rather than quantitative it draws upon the author's experience, referenceable sources and views which are believed by the author to be generally accepted within the appropriate professional communities.

2.3.2 To aid readers who may not have substantial prior knowledge of the technical topics covered a list of abbreviations that have been used and a Glossary of terms is provided commencing page 79.

2.3.3 In seeking to fulfil the ToR the following questions, which some readers may have in their minds, have also been considered and, it is hoped that they have been implicitly, if not explicitly, answered:

- a) What's the issue?**
- b) Why is it a matter for Wales?**
- c) Why is necessary to consider it now?**
- d) Why it can't all wait?**

2.3.4 The time horizons below have been chosen (along with the principal reasons for their selection) to help frame the matters considered in this review:

i. The Short Term – 2023

- For practical purposes 2023 can be thought of as the earliest that any decisions regarding RUC (anywhere) in Wales could be implemented in Wales.

ii. The Medium Term – 2028

- A period within which transport policies, and other related policies, may change with a bearing on RUC.

iii. The Longer Term – 2035

- The UK Government's aim is for all new cars and LGVs (e.g. vans) being fuelled by means other than diesel or petrol within this period. (The Welsh Government made clear its position in this respect when it declared that the Welsh public sector fleet should be ultra-low emission by 2025)². At present it is envisaged that this will largely mean a transition to electric powered vehicles with no new Hydrocarbon Oil or Hybrid fuelled vehicles being registered.

iv. The Long Term – 2040+

- This time horizon is used to consider various scenarios of how transport and society may change with a bearing on RUC.
- Consideration will mainly be in the context of the UK Government's 2019 publication "The Future of Mobility".³

² Welsh Government (2020) *Prosperity for All: A Low Carbon Wales*.

³ Government Office for Science (2019) *The Future of Mobility*.

3. An introduction to Road User Charging



3.1 Terminology – Is RUC a tax?

- 3.1.1** The review requires that a very wide definition of RUC be adopted. Nevertheless, the RUC examples within the written statement (including distance charging, congestion charging, workplace and retail parking levies) are not generally regarded as ‘taxes’ by the public. While the distinction may not be crystal clear to everyone neither is it just semantics. Indeed, for the original Central London Congestion Charging scheme, introduced in 2003, the point has been tested in the Courts where it was confirmed that the scheme did not, in law, constitute as tax. Although, even now, that ruling is not accepted by all countries, notably the United States of America. One can speculate as to the reasons but by convention, foreign diplomats do not pay what they consider to be ‘local taxes’.
- 3.1.2** The scheme that was introduced in 2006 in Stockholm, Sweden is, however, called the Stockholm Congestion Tax. The enabling central government legislation in Sweden effectively defined the scheme as a tax. The scheme will be considered in more detail at para 6.5.2.
- 3.1.3** One aspect arising from these distinctions is particularly important. Non-compliance with a ‘charge’ can be pursued as a debt or a ‘civil’ offence similar to parking infringements. This has significant implications for resolving the Enforcement/Compliance/Deterrence/Revenue equation. See 7.3.1.

3.2 Terminology – Is RUC the same as Road Pricing?

- 3.2.1** In many minds the answer is ‘Yes’. It is also sometimes argued that the term RUC implies a closer link with the economic externalities (see later); also, it is explicitly clear that it is intended that the ‘user’ would be doing the paying. For both of these reasons, some people believe that the term Road User Charging (RUC) may make the basic concept a more acceptable one to the public.

3.3 Terminology – So, what is RUC?

- 3.3.1** Unfortunately, it is one of those terms which has come to mean different things to different people. This review is fortunate, however, as it is explicitly stated that for the purposes of the review: ***“The term “road user charging” covers all feasible charging methods, including distance charging, congestion charging, workplace and retail parking levies.”*** The inclusion of non-residential parking levies in the review is being considered in the context that the ‘charge’ is for ‘using’ the road (The vehicles parked in these places have used the road to get there!) **But** it not directly related to the ownership of the vehicle.

3.4 Terminology – What is Motoring Taxation?

3.4.1 While RUC is not necessarily a ‘tax’ it would clearly add to the cost of driving. It will therefore be wise in this review to consider other costs of driving, particularly motoring taxation. Motoring taxes are generally regarded as:

- i. Vehicle Excise Duty (VED)
- ii. Hydrocarbon Oil Duty (Fuel Duty)
- iii. VAT on VED and Fuel Duty

3.4.2 The RAC Foundation published in 2012 a report entitled “Fuel for Thought-The what, why and how of motoring taxation⁴” that examines motoring taxes including whether “*the current system of UK motoring taxes falls in line with good economic principles.*” and it concludes that:

“The main reason why governments should intervene in motoring decisions is that motoring generates external costs which lead to an inefficiently high private demand for road use. These external costs are overwhelmingly dominated by the costs of congestion. Existing motoring taxes, particularly taxes on vehicle fuel, are completely incapable of being deployed in a manner that effectively accounts for the costs of congestion, since they do not vary according to where and when people drive; however, where and when people drive is the key determinant of congestion costs.”

3.4.3 To conclude this rather esoteric topic for the purposes of this review:

***Most road user charges are not taxes, but...
All motoring taxation is a cost/charge for road use.***

⁴ Johnson, P et al. (2012) *Fuel for thought: the what, why and how of motoring taxation.*

3.5 Paying for Roads – the historical context of RUC

- 3.5.1** The history of the development of the road network in the UK and the laws governing it are often regarded as arcane subjects. They can, however, be traced back via the ‘Turnpike Roads’ of the sixteenth and seventeenth centuries to Roman times and a good deal earlier. Nevertheless, for many people today, being able to access the public highway from their property, and to freely pass and re-pass along it are their inalienable public rights.
- 3.5.2** The vast majority of today’s road network is either ‘owned’ by National Highway Authorities (Motorways and Trunk Roads) or by Local Highway Authorities. In Wales all local authorities are Local Highway Authorities.
- 3.5.3** Funding for the road network has long been a contentious issue. In 1909 Lloyd George set up the Road Fund which consolidated all motoring related revenues. This including an annual licence fee payable on motor vehicles which, in effect was the origin of today’s VED. The monies from the Road Fund were used by central government to construct, improve, maintain and operate roads either directly or via grants to local highway authorities. The responsibilities of local authorities also require them to allocate funds to fulfil their legal duties for roads where they are also the Local Highway Authority.
- 3.5.4** Furthermore, 1933 saw the publication by the government of the “Salter Conference Report”⁵ following consideration of the perceived disparities between the funding and regulation arrangements for the country’s roads and railways. It recommended creating a system of vehicle road duties which were introduced in 1933-4 and remain a key part of VED today and thereby established the principle that the operators of motor vehicles, rather than the local community should pay for the roads.
- 3.5.5** The twentieth century saw a rapid increase in car ownership in the UK with a corresponding increase in the UK government’s Road Fund in particular due to the hypothecated revenues from VED and fuel duty. The case for the continued hypothecation of these funds to roads therefore became much less attractive to Her Majesty’s Treasury and in 1937 this ceased.
- 3.5.6** The result of this decoupling was that the conventional principle of a Services Market Model – that ‘The User Pays’ – ceased. There was no longer a clearly traceable financial link between ‘use’ and the provision of the ‘service’. Thus, even when taking into account the ‘duty’ component of the cost of fuel; roads, arguably, became ‘free at the point of use’.

5 Ministry of Transport (1932) *Railway companies and road transport (The Salter report of the Conference on Rail and Road Transport)*.

3.6 UK Government Treasury revenue receipts from motoring in the UK

3.6.1 Over the last 50 years, motoring in the UK has been a significant, but generally declining, contributor to the Exchequer's income; varying between about 10% and 6%.

3.6.2 Consistently, the vast majority of this income has come from Fuel Duty and the associated VAT on this Duty. Although in recent years, as a proportion of the UK's Gross Domestic Product (GDP), income from Fuel Duty has, in general been declining. There are a number of factors which contribute, positively and negatively, to this general decline, including:

- Increase in fuel efficiency of new vehicles;
- Implications of changes in the tax regime between petrol, diesel and electricity driven vehicles;
- Market driven factors especially price of oil and new vehicles;
- Changes in average trip lengths; and
- 'Freezing' of the 'Fuel Escalator' – the rate of Fuel Duty has in recent times been 'index linked'.

While many of these factors are either determined, or at least influenced, by the UK government, it is generally accepted that across the world revenues from Hydrocarbon Oil Duty (Fuel Duty) are declining.

3.6.3 Currently, at about £38 billion a year, receipts from motoring are some 7% of the Exchequer's income, and less than a third of this is spent on UK's national or local roads.

3.7 The Great Britain/Wales Proportionality question

3.7.1 It should be noted that the total length of the road network in Great Britain is 398,669kms⁶. This includes all roads in Wales (33,796kms) making up 9% of the length of the UK network. If the £38bn was hypothecated to a UK wide road fund, solely on the basis of road length it could be argued that Wales should receive £3.29bn each year.

3.7.2 In fact about £320m per year is spent in Wales by the Welsh Government and Welsh local authorities (£150 million is budgeted for maintenance of roads in the latest Welsh Government budget⁷. There is also £170 million for local authorities to spend on maintenance of roads under the Local Government Borrowing Initiative). It has also been suggested that Welsh local authorities spent 40% less than English LAs on road maintenance in 2018/19⁸.

3.7.3 The above are therefore important matters when considering options for 'Paying for Roads', particularly the 'pros & cons' of hypothecation. Furthermore, there are also many other matters (e.g. Environmental, Transport efficiency, Social/Equality, etc..) which need to be considered when reviewing RUC for Wales.

⁶ Department for Transport (2020) *Road Lengths in Great Britain: 2019 report*.

⁷ Welsh Government (2020) *Draft Budget 2020 to 2021*.

⁸ National Assembly for Wales (2018) *The State of Roads in Wales*.

4. Principles and Theories



4.1 Covid 19 Rider

- 4.1.1** Since the commencement of this review Covid-19 has had a profound impact on travel patterns and habits; in the short term, whilst social distancing measures remain in place, and potentially in the longer term. Given the timescales of RUC implementation, longer term impacts are only discussed in this review on the assumption that social distancing restrictions are lifted or substantially eased.
- 4.1.2** Some of the behaviours generated, and working practices put in place, during the pandemic may well have a lasting impact and need to be taken into account in the context of RUC.
- 4.1.3** The pandemic greatly accelerated the use of cloud based collaborative working and communication tools for a significant proportion of the working population. Whilst time will tell how much of this ‘sticks’, governments (and indeed employers) will surely be eyeing-up potential for congestion reduction and other efficiencies from removing or reducing the need to travel.

4.2 Why do we ‘Transport’? – Principles

- 4.2.1** It is said that ‘transport is (almost always) not an end in itself’. Its purpose is, whatever the mode (Figure 1), to enable people (and/or goods) to travel from point A to point B. Journeys are mainly undertaken to connect and/or deliver.

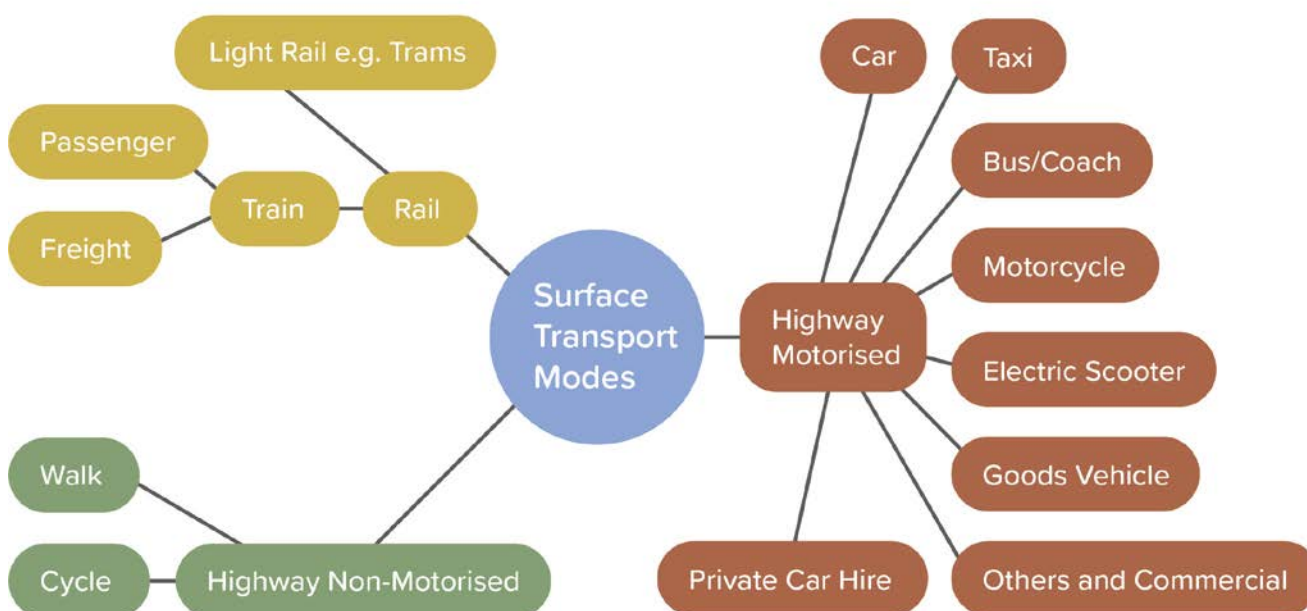


Figure 1: Surface Transport Modes

- 4.2.2** The nature of the use that is made of land (e.g. residential, industry, farming etc..) is therefore the major factor that determines the pattern, type and volume of travel. Ultimately, therefore, effective Land-Use Planning is the key to establishing, and managing, efficient transport.

4.2.3 A sense of realism is, however, important when considering the Planning System. In general, **planning policy** operates at a very strategic level, and as a means to facilitate and enable a wide range of government policies. The **planning controls** are more tactical and deliberately flexible to take into account particular circumstances. Generally, in practise, the application of the controls is significantly influenced by precedent. Thus, changes to the planning regime should be regarded as rather a 'blunt tool', the application of which often takes many years to bear fruit and to have an impact on a nation's roads although the changes that can eventually be achieved can be great.

4.2.4 Arguably **all** travel involves the use of public roads, albeit often for a very short distance, although perhaps surprisingly, the roads used are frequently National Trunk Roads (figure 2 shows national trunk roads in Wales). While transport planners often, talk about "the last (and first) mile" of a journey being on local roads; clearly that is not always the case and many national trunk roads have private property entrances directly from the kerbside.

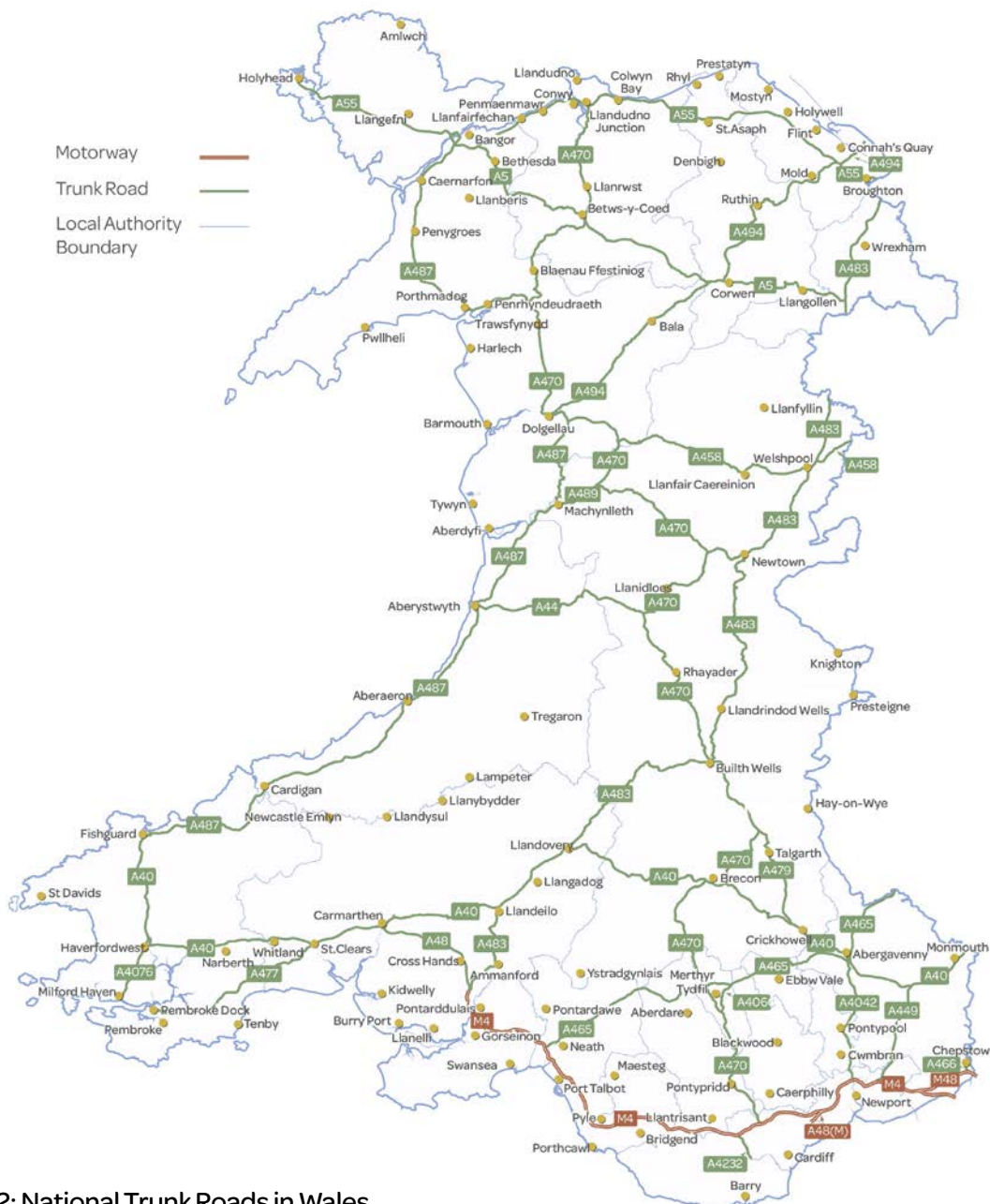


Figure 2: National Trunk Roads in Wales

4.2.5 There is a point of view that substantially rail/metro based transport can provide a more beneficial alternative to substantially road-based transport, especially for the ‘movement’ of people but also for the movement of ‘goods’. While this can never be universally true for longer journeys and heavy freight the point probably has more validity. Nevertheless, very few people or businesses have the benefit of a station, or even a bus stop, immediately outside their front door or gate.

4.3 Commercial Vehicles – Freight, Parcel and other Deliveries.

4.3.1 In transport modelling terms, these are often grouped together but should they be when considering RUC? Certainly, they all have a common feature in that they are not generally used for private or personal travel. But what about ‘White Van Man/Woman’?, Agricultural vehicles?, Coaches?, Buses? – the list of different types of vehicle that are licenced to use the road is very long without adding Emergency and Public Services vehicles etc. If there was a RUC scheme which of these would have to pay? Could some carry out their ‘business’ in some other way? These questions do not always have easy answers but they are certainly relevant when considering the details of a RUC scheme.

4.3.2 Large freight vehicles are often seen as a significant cause of congestion and road damage and are therefore sometimes targeted by RUC schemes. However, this perception is somewhat unfair as freight does not normally comprise a significant percentage of traffic at peak congestion times. Freight is an important sector of the economy, and so any adverse economic impacts caused by RUC need to be carefully monitored.

4.3.3 Rail used to play a greater part in our transport system but its contribution is now constrained by the extent of the network(s). It still carries significant heavy/bulk freight which would otherwise, without doubt, increase the rate of deterioration of the road infrastructure.

4.3.4 Freight is also often indirectly targeted by emission-based RUC schemes. Many freight companies are investing in cleaning up their fleet, however, the cost of compliance for this type of RUC will have economic consequences, especially for smaller-scale operators (about 85% of operators have 9 or fewer vehicles).

4.3.5 Modern Logistics have been developed to optimise the delivery processes and meet the demands of ‘Just-in-Time’ deliveries, Out-of-Town retail parks, centralised storage and consolidation centres, on-line shopping and home deliveries etc.. All of which tend to increase the number of goods vehicles, small and large, on the roads. While RUC may provide a cost for these businesses, by decreasing congestion RUC can also bring benefits – such as increasing journey time reliability. Commercial vehicles therefore give rise to relevant matters when considering RUC.

4.4 Mode Choice

- 4.4.1** The mode of transport is often characterised as a choice between ‘public’ and ‘private’. This, along with the sometimes heard view that public and active transport modes do not use the road network, is an over simplification as can be seen in figure 1, which shows that at least ten modes of transport are users of the road system and would therefore need to be considered when exploring RUC.
- 4.4.2** The issues of pricing/charging and ‘true cost’ as regards choice of mode of transport are complex. In considering pricing for transport in general, and roads in particular; the Nobel Laureate in Economic Science, Professor Vickrey, in 1963⁹ wrote:

“I will begin with the proposition that in no other major area are pricing practices so irrational, so out of date, and so conducive to waste as in urban transportation. Two aspects are particularly deficient: the absence of adequate peak-off peak differentials and the gross under-pricing of some modes relative to others. In nearly all other operations characterised by peak load problems, at least some attempt is made to differentiate between the rate charged for peak and for off-peak service.”

While Vickrey was concentrating on urban transportation, it is clear that he felt the basic proposition he was propounding applied to other areas too; including in all likelihood inter-urban and rural transport.

4.5 The freedom of the open road?

- 4.5.1** There are many ways to categorise a country’s road network. From the viewpoint of this review: ‘ownership’ by National or Local government is probably the key distinction. The trunk roads and motorways shown in figure 2 are the responsibility of the Welsh Government, with other more minor roads normally the responsibility of their respective local authority. For many aspects of RUC it is, however, advisable to consider the degree to which access and use of the roads can be practically controlled and how the adjoining network of roads operate. In this respect, motorways (having limited permitted categories of user and ‘grade-separated junctions’) and to a lesser extent dual carriageways (with restricted permitted turning movements) and One-Way streets (also with restricted turning movements) present differing circumstances and can be regarded as separate categories to ‘normal’ two-way roads.
- 4.5.2** The public’s view and the use of roads has also changed significantly in recent years. For instance, around the middle of the twentieth century, (pre COVID-19, for sure!) it was probably not that uncommon to witness this type of scene and conversation:

“We went for a drive at the weekend”

“Oh, where to?”

“Nowhere, just for a drive, to get out of the flat and have some fresh air after lunch.”

“Roads busy?”

“No, hardly a soul, no lorries and topped 75 mph on the dual bit of A25!”

“Stop anywhere?”

“No, it was great!”

9 Vickrey, W.S. (1963) ‘Pricing in Urban and Suburban Transport’.

Today, COVID-19 aside, this conversation would be much less likely to happen because:

- Main roads are generally busy most of the day, with traffic frequently described as ‘heavy’ throughout most of the day.
- There is a greater proportion of goods vehicles on many roads including at weekends, due to the demand for ‘just in time’ deliveries.
- The proportion of commercial vehicles is often at its greatest at weekends.
- The UK National speed limit, for dual-carriageways is 70mph (National Speed Limits introduced 22nd December 1966) and some busy roads are subject to variable or fixed lower speed limits.
- The A25 having become notorious for ‘traffic jams’ in the 1970s was ‘by-passed’ by the M25 which is now infamous for its own ‘Stop-Start’ conditions and described by some as a “Britain’s Biggest Car park”.¹⁰

4.5.3 It is reasonable to ask **“Why have things changed like that?”** especially as these issues had been thought about, with theories and ideas developed, about 100 years ago!



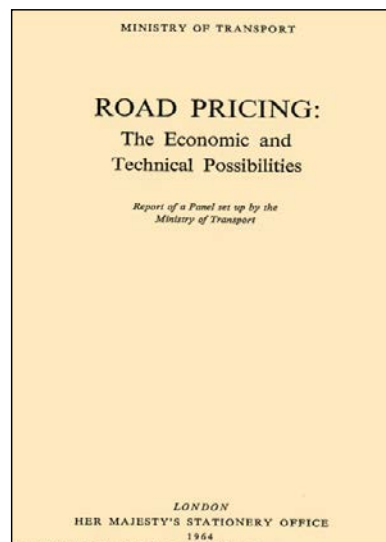
Photographs show M1 in 1959 vs 2019 (Images:PA Images; Shutterstock); The Coventry Evening Telegraph November 2 1959 (British Newspaper Archive)

¹⁰ This is Local London (2013) 'The M25 - Britain's biggest car park, the road to hell and now London motorway is 30 years old'.

4.6 Economic Theory of RUC

4.6.1 Arguably the key classical economic principle of RUC was established by Arthur Cecil Pigou (Professor of Political Economy at Cambridge University) in 1920. See Appendix B.

4.6.2 The detailed origins of RUC theory can be traced back to the work of Reuben Smeed, a UK mathematician and transport researcher. He chaired the government panel of 11 economist and engineers whose report, “Road Pricing: the economic and technical possibilities” published in 1964, has proved to be a seminal work.¹¹



The 1964 'Smeed Report' (Image: University of Southampton)

4.6.3 In essence its guiding economic principle is that users of publicly owned roads should, in addition to their own costs, pay the full external costs that they impose on others. These costs can be said to fall into three broad categories:

i. 'Road Infrastructure' Costs

- a) Construction.
- b) Maintenance.
- c) Operation.

ii. 'Congestion' Costs

- a) Delay and disruption caused to others.

iii. 'Social' Costs

- a) Risk/safety.
- b) Noise.
- c) Emissions.
- d) Environmental.

¹¹ Smeed, R.J. et al. (1964) *Road Pricing: The Economic and Technical Possibilities*.

These three categories cover a ‘multitude of sins’ and are extremely difficult and contentious to reliably calculate and assess. This is especially the case in policy and practical terms when considering the various elements of, or the **full** Social Costs of using roads. The cost to society and tolerable risks associated with safety, for example, differ wildly by mode of travel by rail, road, ship or air. Furthermore, for example, assessing the monetary cost of damage, destruction or complete loss of ancient woodland is notoriously difficult; if not impossible to determine.

- 4.6.4** If applying the above approach special care must be taken to avoid ‘unintended consequences’, particularly in policy terms. While all are likely to agree that roads should be as safe as practically possible, but at what ‘acceptable cost’ to the environment or the ‘cost’ of community severance by a ‘safe’ dual carriageway especially when these ‘costs’ are so difficult to express accurately in monetary terms.
- 4.6.5** Governments are increasingly conscious of the external costs of private car use and many are actively seeking to rebalance transport ‘total cost/ total benefit’ equation. Whilst this section has shown road pricing is not a new concept, advances in technology make it increasingly able to provide an excellent means of achieving fairer and more sustainable transport provision for both direct users and the wider society.

5. General Matters and Potential Issues associated with RUC



5.1 Car / Vehicle Ownership

- 5.1.1** Car ownership can be measured in a number of ways – in absolute terms it is the total number of cars owned/registered. In transport planning terms it has often traditionally been related to the number of cars available per household or per licenced driver. In this respect for many years it was considered that car ownership would ‘saturate’ at about ‘80%’; i.e. out of 100 households, 80 would have cars. Until recently, car ownership in the UK has been on an upward trajectory. It appears that this may now be slowing down.
- 5.1.2** In some major cities various forms of car sharing and car clubs are becoming established and the car rental market seems to be continuing to grow. In addition, in urban areas, it appears that younger generations are more inclined than their predecessors to cycle, walk and use public transport rather than acquire and use a car.¹²
- 5.1.3** When considering RUC, however, it should be borne in mind that car/vehicle ownership does not directly correlate with road use. Furthermore, the rate of increasing car ownership in many areas is slowing and attitudes about car ownership are changing.

Conclusion: The rate of increase of car/vehicle ownership is declining and arguably it is becoming less of an ‘Issue’ in many areas. Nevertheless, RUC is aimed at vehicle use, generally, not ownership although clearly both are related.

5.2 The Role of Regulation

- 5.2.1** The role of regulations in general, although unlikely to be directly related to RUC is nevertheless important. There are four main areas of governmental (European/International, UK, Welsh and local) regulation (or standards) which need to be considered related to governing or controlling:
- i. Vehicle construction, use and emissions.
 - ii. Air quality.
 - iii. Use of public roads.
 - iv. Various procedural matters e.g. the courts, offences, taxation.
- 5.2.2** Regulations related to motorised vehicles are generally national, local or International. They are used to categorise vehicles by general type; by engine type, by emissions standards and relate vehicles to their owners, keepers and their addresses. As such they provide key useful mechanisms for the development and operation of RUC schemes.
- 5.2.3** Air, by its nature as a mixture, varies widely from place to place and in its constituent parts. Air Quality regulations pertain to the content of that mixture and can, in practise, be generated by all levels of government. For RUC these regulations can be used to create goals, targets and standards that a Charging Authority is seeking to achieve.

¹² Chatterjee, K et al. (2018) *Young People’s Travel – What’s Changed and Why? Review and Analysis*.

- 5.2.4** The regulation of the use of public roads, by means of applying RUC, could be regarded as means to achieve improvements in, and gain compliance with, air quality, and vehicle and emissions regulations.
- 5.2.5** All the above require procedural and enforcement regulations which can sometimes create constraints on the development of effective, efficient, economical and politically acceptable RUC schemes.

Conclusion: The role of regulations when considering RUC is important.

5.3 Connected, Automated Vehicles (CAV)

- 5.3.1** Technologists have been steadily developing the ‘automation’ of vehicles for decades. In the last few years, however, there has been an increasing interest in CAV particularly from the media and especially following the development, production and publicity surrounding ‘Tesla’ vehicles. Nevertheless, it is clear that a lot of the reporting has been sensationalised and the predictions highly speculative indeed possibly unrealistic.
- 5.3.2** The government’s approach to this subject has been to recognise the significant opportunities that the development of CAV can bring to the UK with its established world leading research, development and testing capabilities in these matters. Furthermore, the UK has long been recognised an international leader in the development of safety and ‘regulatory’ regimes associated with roads and vehicles; a key requirement if these technologies are to reach their potential.
- 5.3.3** Under the auspices of the government an independent company, Zenzic Ltd., has been established to help facilitate the UK’s activities in CAV. As part of this it has produced a Road-Map ‘Appendix A’. This outlines the likely delivery dates associated with CAV and from which it can be seen that any likely practical impact of CAV on the topic of RUC is unlikely to happen before 2030 without substantial and significant government intervention. Within the CAV ‘community’ it is generally accepted that CAV in rural areas is the greater challenge than urban areas or strategic main roads/motorways. Thus, it is generally accepted that increased ‘connection’ between vehicles (V2V) and with the ‘infrastructure’ (V2I) coupled with increased ‘automation’ is likely to happen more quickly than the widespread adoption of completely driverless autonomous vehicles.
- 5.3.4** One major potential benefit of CAV is the ability to ‘platoon’ vehicles, to operate with small separation and for them to synchronise much more ‘sweetly’ at junctions. This could significantly increase the capacity and efficiency of the road network.
- 5.3.5** The boundaries of private and public transport could readily become blurred by CAV, complementing changing attitudes to private car ownership. The growing success of Uber and Lyft show how levels of automation reduce the cost of the service to offer competitive alternatives to private car ownership. Bus operators are also starting to make use of Demand Responsive Transit technologies to offer more comprehensive and efficient services. CAV will likely accelerate these trends.
- 5.3.6** The timescales over which widespread CAV adoption could be seen on the ground across Wales and the UK are uncertain but it is important when developing RUC policies and schemes to ‘horizon scan’ the potential of this technology and where possible, futureproof for it.

Conclusion: The widespread adoption of CAV is unlikely to feature as a major 'Issue' when considering RUC in the short/medium term, except locally and/or in major roads.

5.4 Changing Fuels

5.4.1 During the twentieth century the means of propulsion for roads users was almost entirely the internal combustion engine; apart for the muscle power of horses and humans (cycling and walking). While this has largely remained true in the twenty-first century; for cars in particular there is now a much longer list of possibilities. The DVLA VED records; including:

- ICE - Fuelled by Hydrocarbon Oil (Petrol [58.2%] and Diesel [39.9%]);
- Electric - Re-charge able fuel cells/batteries [0.2%];
- ICE – Fuelled by Gas [0.1%] (Propane, Hydrogen and Hybrid/Gas);
- ICE/Hybrid Electric – Dual Fuelled (Hydrocarbon Oil/Electric [1.7%];
- 'Other' [> 0.1% inc. Hydrogen Fuel Cells].

Note: [] = % of total 32.493m UK registered motorised vehicles in 2018.¹³

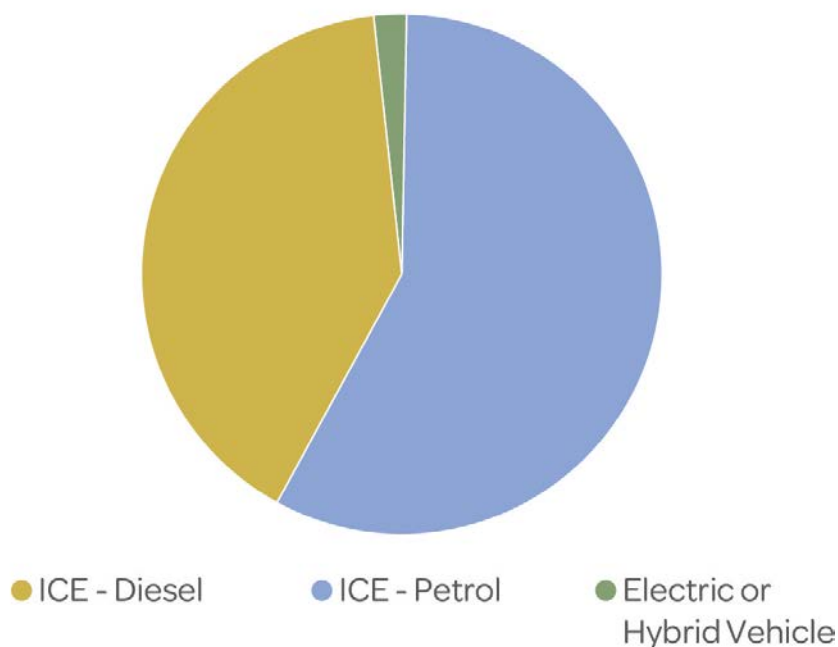


Figure 3: Percentage of UK registered motorised vehicles in 2018

¹³ Department of Transport (2019) *Vehicle Licensing Statistics 2018*.

- 5.4.2** Also, since 2018 the DVLA records indicate that the move away from diesel cars, has continued; as has the increase in electric power both ‘pure’ electric and hybrid electric.
- 5.4.3** Since March 2001, the rate of Vehicle Excise Duty (VED) has been based on the vehicle’s CO₂ emissions. This has encouraged consumers to buy lower carbon cars, and also manufacturers to design greener cars.
- 5.4.4** In addition, EU legislation has set mandatory, increasingly challenging, CO₂ emission targets for new cars since 2009. The latest regulations came into effect at the start of 2020 with manufacturers facing steep fines for missing targets.¹⁴ The UK government have pledged to maintain high air quality standards after Brexit to meet World Health Organisation (WHO) recommendations.
- 5.4.5** Although vehicle manufactures are making significant strides to reduce emissions from new vehicles joining the fleet, the rate of the renewal of the existing fleet to cleaner, less polluting vehicles is still very slow. There are a great many issues contributing to this including:
- Increasing longevity of vehicles – the average age of a car or van in the UK has been increasing since 2003 and currently stands at 8.2 years¹⁵;
 - Cost of acquiring a new less polluting vehicle; and
 - Changing government guidance / incentives.
- 5.4.6** The UK Government has been encouraging consumers towards electric cars in recent years. Fully-electric vehicles are exempt from VED, and the plug in grant given to vehicle dealerships and manufacturers can reduce prices of electric cars by up to £3,000.¹⁶
- 5.4.7** The UK government has recently announced that its aim is that by 2035 no new cars or vans will be registered for use in the UK that are powered, or partially powered, by hydrocarbon fuels¹⁷. The normal rate of new vehicle registration is significantly slowing¹⁸, which would suggest that even if that aim is achieved there will still be a considerable number of hydrocarbon fuelled vehicle using the country’s roads unless substantial additional interventions (incentives and/or penalties) are made across the UK.
- 5.4.8** The Welsh Government supports the ambition of phasing out new hydrocarbon fuelled vehicles, publishing aims for Wales’ taxis and bus fleet to be non-hydrocarbon powered by 2028. The Welsh Government is also working alongside the UK government, local authorities and business to roll out electric vehicle charging infrastructure across Wales.
- 5.4.9** The switch to electric cars will reduce air pollution and carbon emissions. Other low carbon innovations, such as hydrogen fuel cells, biofuels and renewable energies are also being developed and as time passes they will help to reduce the environmental burden of ICE.

Conclusion: RUC can be used to ‘nudge’ a change in the fuel used to power vehicles.

¹⁴ European Environment Agency (2019) *Emissions of air pollutants from transport*.

¹⁵ Department of Transport (2019) *Vehicle Licensing Statistics 2018*.

¹⁶ Department of Transport (no date) *Low-emission vehicles eligible for a plug-in grant*.

¹⁷ BBC (2020) *Petrol and diesel car sales ban brought forward to 2035*.

¹⁸ Department of Transport (2019) *Vehicle Licensing Statistics 2018*.

5.5. Sustainability

5.5.1 This is a somewhat emotive topic. Clearly, the resources of the world are finite and the demands being made upon them are continually increasing as is public and political concern about the myriad environmental and sustainability issues that we are facing. In 2017 nearly a quarter (21% , and rising) of the UK's contribution to Green House Gases was due to road Transport.¹⁹

5.5.2 The best means to improve transport sustainability is, of course, reducing the need for travel, for example through more home/remote working. Many transport professionals, however, regard RUC as an important potential part of the 'basket' of measures which could be used to improve the sustainability of our use of road based transport:

“Encouraging modal shift requires sustained policy interventions: [We] see opportunities with pay as you go funding to address both congestion and carbon. The London congestion charge has successfully reduced congestion, journey times and the number of cars. Whilst making public transport more effective. The scheme demonstrates the potential benefits of road pricing schemes.” Chartered Institution of Highways & Transportation, 2020²⁰

“The case for National Road User Charging needs to be revisited. Studies over a number of years have indicated that despite fuel duty and Vehicle Excise Duty raising significant funding (estimated to be over £30bn per annum), this does not cover the external cost of congestion alone. Not considering other external costs of motoring such as health issues and environmental pollution.” Transport Planning Society, 2019²¹

5.5.3 In Wales around 13% of total greenhouse gas emissions are caused by transport, largely due to hydrocarbon-fuelled road vehicles. These emissions are almost all Carbon Dioxide (CO₂). Vehicle emissions in Wales have remained fairly static since 1990, as the growth in demand for private vehicles has offset any overall gains in transport efficiency.²²

5.5.4 As time passes new resources and technics are discovered and developed e.g. Hydrogen Fuel Cells, Home/Remote Working, Renewable Energy Sources etc.. helping to manage the various sustainability 'loads' on the environment. It is, however, very clear that sustainability is an important 'Issue' that should be included when considering RUC.

Conclusion: Sustainability is now generally regarded throughout society as a significant 'Issue'. RUC can be used to 'nudge' the adoption of more sustainable transport.

19 Office for National Statistics (2019) *Road transport and air emissions*.

20 Chartered Institution of Highways & Transportation (2020) *Response to the Committee on Climate Change call for evidence on the sixth carbon budget and welsh emission targets*.

21 Transport Planning Society (2019) *Six things the new government should do to improve transport planning in the UK*.

22 Welsh Government (no date) *Greenhouse Gases*.

5.6 Air Quality

5.6.1 Widespread academic, public and political concern about the ‘quality’ of the air we breathe in terms of pollution continues to grow. It is not, however, a new phenomenon in this country. Dickens in ‘Hard Times’ described in 1854 “... **a town of machinery and tall chimneys, out of which interminable serpents of smoke trailed themselves for ever and ever, and never got uncoiled.**” It takes but a little imagination to replace ‘**tall chimneys**’ by ‘tail pipes’ and perhaps add to ‘**smoke**’ ‘and pollution’ to then to arrive at many of our towns today!

5.6.2 To these conditions, over the years, government has responded with various pieces of legislation notably the 1956 and 1968 Clean Air Acts which primarily deal with the use of coal as fuel. Until relatively recently, vehicular emissions, as much as they were considered at all, were dealt with through ‘Construction and Use’ Regulations. Then in 1993, European emissions standards were introduced for passenger cars and vans. In order to meet the standards, all new petrol cars in the UK have, by law, to have a catalytic converter fitted to the exhaust. This resulted in a sharp drop in NO₂ levels – as can be seen in figure 4.²³

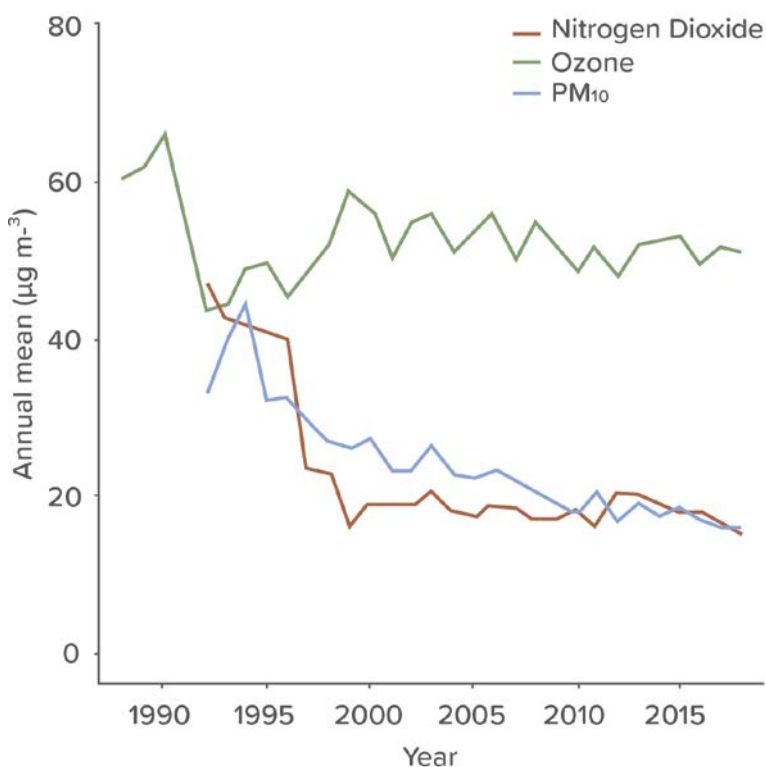


Figure 4 Ambient Pollutant Trends in Wales 1990 – 2018

5.6.3 In 2013, the European Commission adopted a Clean Air Programme for Europe, setting limits for common air pollutants, including those caused by transport such as nitrogen oxides, particulate matter and ground-level ozone (ozone is a secondary pollutant caused by nitrogen oxides reacting with particulate matter in sunlight.)

5.6.4 Nevertheless, today transport is still a significant source of air pollution, particularly nitrogen dioxide. It is responsible for more than half of all nitrogen oxide emissions, mostly due to exhaust emissions.²⁴

²³ Welsh Government (2019) *Air Pollution in Wales 2018*.

²⁴ European Environment Agency (2019) *Emissions of air pollutants from transport*.

5.6.5 While, over the years, the nature of air pollution may have changed, in Wales and the other parts of the UK, today air pollution has become significant due to vehicular traffic powered by ICEs. The current, largely invisible, emissions particularly in petrol and diesel exhaust by volume are shown in Table 1:

ICE Exhaust Composition (Approximate)	Principal Hazard	Petrol % by volume	Diesel % by volume
Nitrogen (N ₂)	---	71	67
Carbon Dioxide (CO ₂)	Environment	14	12
Water Vapour (H ₂ O)	---	13	11
Oxygen (O ₂)	---	---	10
Trace Elements such as Be, Cd, As, Se, Pb, Sb, Hg, Ti, and V	Health	<0.6	~0.3
Nitrogen Oxides (NO _x)	Health	<0.25	<0.15
Carbon Monoxide (CO)	Health	1.5	<0.045
Particulate Matter (PM ₁₀ , PM _{2.5})	Health	---	<0.045
Hydrocarbons	---	<0.25	<0.03
Sulphur Dioxide	---	Trace	<0.03

Table 1: Emissions contained in petrol and diesel exhaust by volume

5.6.6 The principal air pollutants in terms of health are nitrogen oxides and particulate matter. The background NO₂ levels, and how NO₂ is associated with urban areas and major roads is shown on figure 5.

5.6.7 In 2018, in addition to the high background concentrations, there were seven local roadside areas identified in Wales as exceeding EU limit values for nitrogen dioxide, which is an annual limit value of an average of 40 micrograms per cubic metre. These areas were:

- i. A494 at Deeside
- ii. A483 near Wrexham
- iii. A470 between Upper Boat and Pontypridd
- iv. M4 between Junctions 41 and 42 (Port Talbot)
- v. M4 Junctions 25 and 26 (Newport)
- vi. Woodside Terrace, Caerphilly
- vii. Castle Street, Cardiff

5.6.8 In response, 50 mph speed limits were introduced at the five sites under Welsh Government control by mid-June 2018 (the first five roads listed above). Analysis for the 2019 calendar year indicated that air quality had improved as a result, although only at Deeside were levels under EU limits.

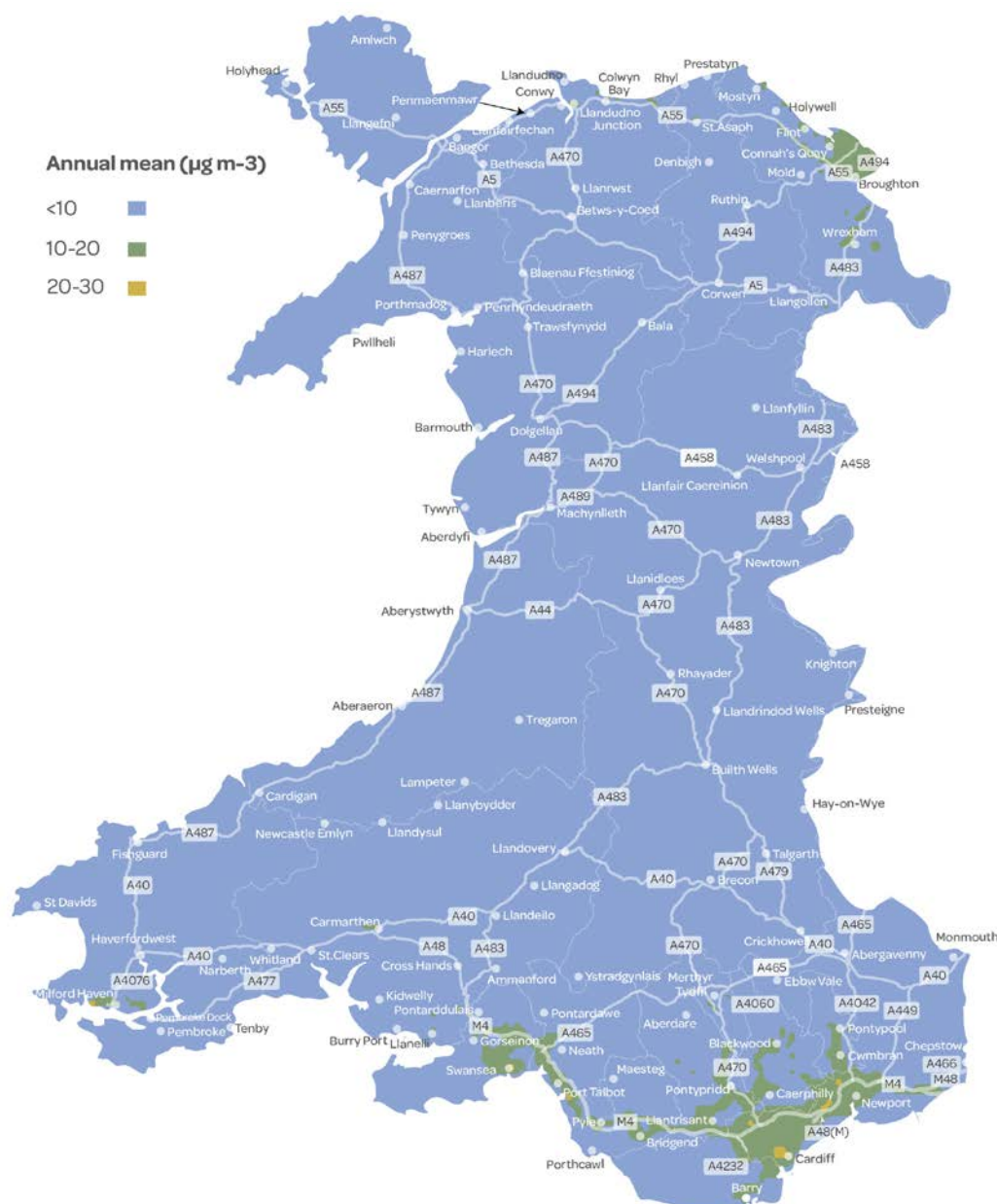


Figure 5: Background Concentrations of Nitrogen Dioxide in Wales, 2018

5.6.9 The Welsh Government published “The Clean Air Plan for Wales” in August 2020. In the report they state they **‘expect to see Clean Air Zones established in towns and cities throughout Wales to reduce the impact of transport emissions on health. Some of these may be supported by a charging element.’** They plan to publish their “Clean Air Zone Framework” in spring 2021, taking into account the findings of this “Independent Review of Road User Charging in Wales”. (The Air Quality aspects of LEZ and ULEZ are discussed in 6.9.)

In as far as RUC can influence any or all of the above, along with the amount, type, speed and general patterns of transport, the design of RUC schemes have real potential to influence Air Quality.

Conclusion: Air Quality is generally accepted as an ‘Issue’ and there is little doubt that most if not all RUC schemes could result in improvements in local Air Quality

5.7 Is RUC's main aim to Raise Nett Revenue or Reduce Congestion?

- 5.7.1** The answer to this question is largely a matter of policy and the associated legislative framework. Nevertheless, there are a number of matters, common to both strategies, which should be considered.
- 5.7.2** As a public policy of this nature RUC may reasonably be expected to at least cover its running cost and contribute to its set up cost. There are, however, a number of questions behind that 'reasonable' view, such as:
- a) Are the fines for non-compliance to only cover the cost of enforcement or can they be set at a level to make a nett contribution to the overall project income?;
 - b) What happens if the compliance is very high?;
 - c) Is the implementation of the scheme outsourced and combined with the running of the scheme?;
 - d) Assuming nett revenues, what are the monies to be spent on?;
 - e) Are the alternative modes of travel being subsidised?;
 - f) Are displaced journeys to be catered for, if so how and where is the funding coming from?; and
 - g) How is the de-congested road space to be used?

And these are only a few of the 'Issues' that would need to be considered under this heading.

Conclusion: Whether the main aim is to raise nett revenue or reduce congestion the matters referred to above are very real 'Issues' when considering RUC. This was clearly demonstrated during the development and operation of the Central London Congestion Charging Scheme, see para. 6.3.

5.8 Role of technology and privacy

- 5.8.1** Technology and privacy are often thought about together as 'Issues'. For some time now, however, technological limitations are no longer considered a significant issue for RUC.
- 5.8.2** The advent, development and widespread acceptance of mobile 'phone technology, and CCTV/ OCRs has not removed concerns about 'privacy and data security but has led to these being accepted as reasonably manageable.

Conclusion: Technology limitations and privacy concerns should no longer be considered insurmountable 'Issues' for RUC.

5.9 Asset Management

5.9.1 Funding any infrastructure properly costs a lot of money. It is particularly important that in the case of new roads or substantial improvements the key principles of ‘whole life costing’ and whole life Asset Management should be adopted. Historically this has rarely happened and in the case of the existing road network, much of which is centuries old, the backlog of maintenance and pot hole repairs in many areas is very large. Furthermore, at some point major reconstruction or renewal of the roads and bridges will be necessary.

5.9.2 As already mentioned; who should meet these costs is often the question at the heart of the RUC debate.

Conclusion: The degree to which, and how, proper ‘Asset Management’ should be funded is a real key ‘Issue’ for RUC.

5.10 Public and Political opinion

5.10.1 Arguably this is the key matter, and either or both have often been the critical stumbling blocks for advocates of RUC schemes in the past. There is, nevertheless, perhaps a paradox in this view.

5.10.2 Many members of the public are **fearful of the very idea** of any RUC scheme especially one that they **perceive** would adversely affect them. For the politicians, when informed of the public’s fears, it often quickly becomes a case of ‘perception **is** reality’ and opinion quickly coalesces against the very concept and principle of RUC.

5.10.3 The evidential proof to support the view that the public actually reject a RUC scheme, when having experienced it, is however, very slim indeed.

5.10.4 In London and Stockholm, the two main examples of where schemes have been introduced, the residents when having experienced the reality of ‘their RUC scheme’ and given the opportunity to vote against its retention, in both cases those against the schemes lost and the schemes were retained. (For details of these two cases see para. 6.3. and para 6.5.2. Furthermore, in both cases, over 15 years later, substantially the same schemes remain in place and operating successfully.

Conclusion: The public’s and the politician’s negative perception of RUC can be a major ‘Issue’, but when having experienced the reality of RUC, the clear majority support its retention. Those considering and developing RUC must therefore clearly articulate the benefits to everyone in order to tackle apprehension and garner support. Strong advocates from within and outside the promoting government are essential for success in overcoming this ‘Issue’.

6. Range of Global RUC Experiences and Key Lessons



6.1 General

- 6.1.1** There are a large number of individual schemes, previously proposed or implemented, which could be regarded as falling within the wide definition of RUC (See para. 2.2.2.) that has been set for this review.
- 6.1.2** While each scheme is unique there are a number of key distinguishing features which enable them to be categorised and grouped as follows:
- i. **Cordon Based:** Charge based on crossing a line.
 - ii. **Area Based:** Charge based on moving within an area i.e. including journeys which do not leave the area.
 - iii. **Single Road/Toll Roads and Toll Lanes:** Charge for the use of a road.
 - iv. **Distance Based Charging Schemes:** Charge related to distance travelled.
 - v. **Truck' Charging:** Charge related to specific types of vehicle
 - vi. **Workplace Parking Levies:** Charge related to number of off-street non-residential parking places.
 - vii. **Retail Park Levies:** Charge related to 'shoppers' parking at retail parks.
 - viii. **Low Emission Zone (LEZ):** Charges linked to air pollutant levels rather than congestion.
- 6.1.3** The schemes referred to have been introduced or have had significant preparatory work/studies undertaken globally in the past 50 years to either provide particular key lessons or as examples of a generic type of RUC.

6.2 Singapore - Scheme Types: Area; Cordon and Distance based

- 6.2.1** Singapore is often given as an example of RUC; although arguably within the Island City-State of Singapore there are a particularly unusual set of circumstances. The population density (> 7,000 people/sq. km compared with Wales 148 people/sq. km and Cardiff 2,500 people/sq. km) and income, when represented by GDP/capita, of \$64k (giving an IMF estimated 2019 global rank of 8th; compared with UK global rank of 21st at \$41k; Wales global rank of 35th at \$24k and Cardiff, if considered a 'nation city-state', global rank of 101st at \$5k) are amongst the highest in the world. Singapore also has a strict and effective control on car ownership resulting in only about 11% (a declining %) of the population having cars. Additionally, it has a particularly fine public transport system. Furthermore, compliance with State Regulations and the acceptance, and adoption, of technology are particularly high.

6.2.2 Singapore has for many years played an important role in the development and application of RUC, as can be seen from information taken from ‘Straits Times’²⁵ below; where the prices quoted are in Singapore dollars (S\$):

- **Area Licensing Scheme** – introduced in 1975 when car ownership was on the rise and there was a growing need to curb its usage, particularly in the Central Business District (CBD), about 2 square miles. Motorists had to pay for a supplementary licence if they wanted to cross the cordon to enter the CBD’s restricted zone. At S\$3 a day or S\$60 a month, motorists with the licence were able to enter the restricted zone for an unlimited number of times during that period. Those who were caught without a licence faced a S\$50 fine. Other traffic management measures in operation at the time included a Park-and-Ride, Car-Pooling schemes and 33% increase in bus services.
- **Area Licensing + Certificate of Entitlement** – in 1990, to control the vehicle population, a vehicle quota system was also introduced. It required owners to obtain a Certificate of Entitlement for their vehicles.
- **Electronic Road Pricing (ERP)** – introduced 1998 following the Singapore Cabinet having in 1989 given the go-ahead for an ERP system (the initial target to introduce it was in five years’ time). The gantry-based ERP system was implemented in a number of stages over two years, beginning with the CBD. Prior to the launch, motorists had to make appointments at vehicle inspection centres and workshops to get their vehicles fitted with an in-vehicle unit or ‘Tag’. The unit communicates with the antennae on the ERP gantries to allow the correct toll to be deducted from the Cash-Card slotted into the unit.
- **ERP 2.0 (Satellite - based system)** – being introduced from 2020 following the Land Transport Authority announced in 2016 that it will build the next generation ERP system from 2020, costing over S\$556m. Instead of physical gantries, ERP 2.0 will rely on satellite navigation technology and will have the ability to charge for distance travelled. It will also be able to facilitate coupon-less street parking and automatic charging for off-peak car usage and push out real-time traffic information to all road users through an intelligent onboard unit.

6.2.3 Some said that the aim of the Area Licensing Scheme was to be generate revenue which it certainly did. The annual at S\$6.8m being over ten times the operating costs. The additional requirement in 1990 to have a Certificate of Entitlement while generating more revenue was also trying to cap the number of vehicles. The ERP scheme cost around S\$200m to introduce and generates an annual revenue of over S\$150m. Furthermore, the weekday traffic entering the zone dropped by 24% from 271,000 to 206,000 and average speeds increased from 30-35kph to 40-45kph. Generally, the public have reacted favourably to the pricing and accompanying package of transport improvements.

Lessons from Singapore:

- a) **The Singapore RUC scheme has evolved over the last 45 years.**
- b) **There can be a long time between an in-principle decision being taken and a scheme coming into operation –in this case 9 years.**
- c) **The importance of effective information and on-ground experience.**
- d) **Public acceptability and reduced traffic volumes is possible while raising substantial nett revenues and improving traffic speeds.**

25 Huiwen, N. (2018) ‘Electronic Road Pricing turns 20 in April: Notable milestones over the years’. *The Straits Times Singapore*, April 16.

6.3 Central London – Scheme Type: Area

6.3.1 Since Smeed’s seminal report in 1964 the concept of RUC has been continuously explored for ‘Central London’. The Greater London Council (GLC) supported a preliminary “Supplementary Licensing Study” in 1965 followed by a detailed study in 1973 which concluded that congestion pricing in central London will improve traffic and environment and raise revenues. A decision was made, however, not to proceed in favour of greater investment in public transport. Subsequently, in 1985 the GLC was abolished and the London local authorities became the Highway Authorities for all but the Trunk roads in their area. In 1991 the Office of the Traffic Director for London was established with responsibilities for the Trunk and main LA roads (but not Central London i.e. inside the Inner Ring Road) also for co-ordinating London’s programme of bus priority measures. In 1995 a further research programme concluded that London’s economy would benefit from congestion pricing²⁶ (95% of the 1 million trips/day into central London were by public Transport, travel costs were increasing, vehicle speeds declining to below 11mph with 50% of their time spent in traffic queues. Overall it was estimated that delays were costing people and businesses £4-£8m per week). In anticipation of the election of a ‘Mayor for London’ the government set up a study – Review of Charging Options for London (RoCOL)²⁷ which reported in 2000 that a Congestion Charging Scheme and a ‘Workplace Parking Levy’ were both considered as viable options for a newly elected Mayor to propose for Central London.

6.3.2 In 1999 Primary Legislation created the Greater London Authority and the elected Mayor for London; plus, the Mayor’s transport authority Transport for London (TfL). The legislation also enabled the Mayor to introduce a RUC whose primary aim had to be traffic management. Only Ken Livingstone, who stood as an Independent, was the only candidate to include implementing RUC during their first term in office in their manifesto. Indeed, it was one of Livingstone’s very top priorities and he was duly elected in May 2000.

6.3.3 Although the RoCOL report provided a sound base it was clear that a great many detailed design matters would now need to be considered. Figure 6 shows a high-level summary of the wide range of technical, yet politically sensitive issues that would require rapid firm decisions to be taken. It was clear that to meet the Mayor’s desire for the scheme to be operating early in 2003 significant dedicated resources would be needed. A separate Division TfL’s newly created Street Management Directorate was therefore established and about 80 people were recruited to it plus a number of consultants appointed to support the staff.

²⁶ MVA Consultancy (1995) *The London Congestion Charging Research Programme: Final Report*.

²⁷ Turton, E. (2000) *Road Charging Options for London: A Technical Assessment*.

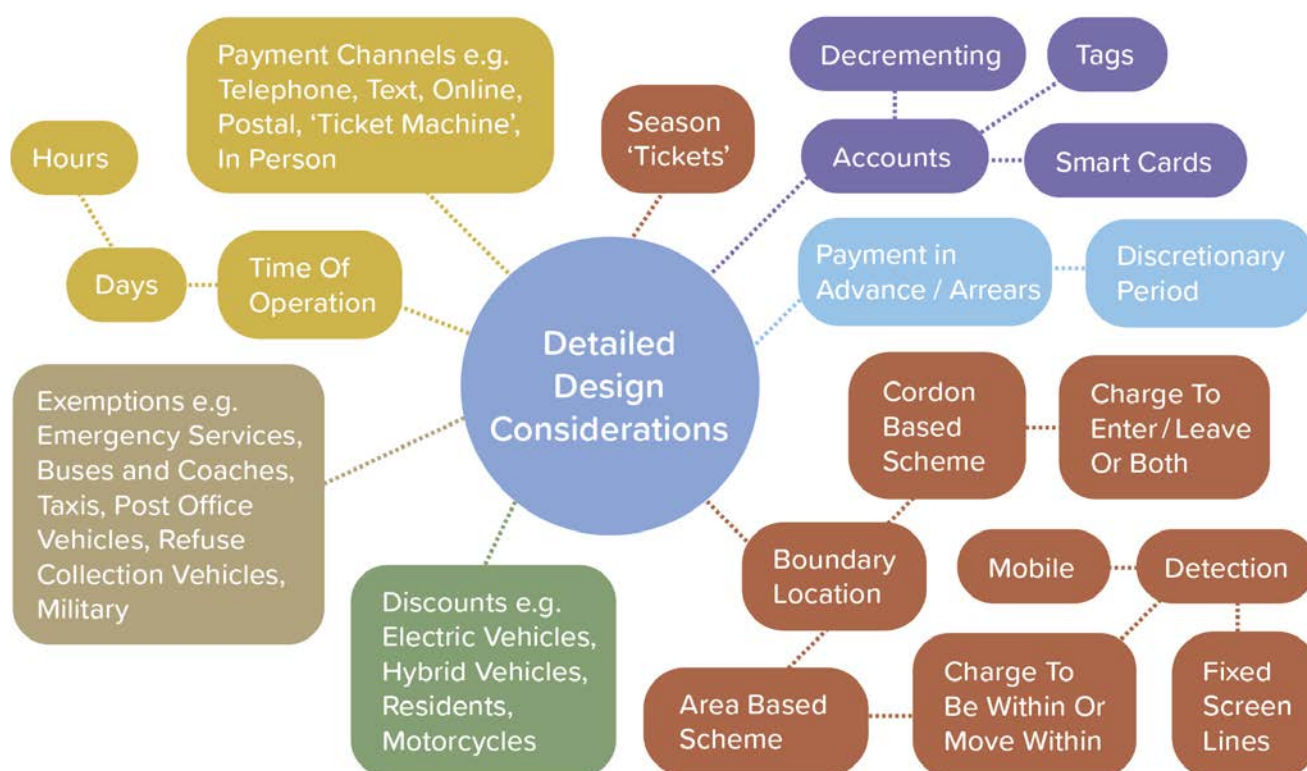


Figure 6: Congestion Charging Detailed Design Considerations

6.3.4 It was decided at the outset that an ‘area’ scheme was to be developed for central London whereby vehicles crossing into or moving within the 8 square mile zone bounded by the Inner Ring Road were subject to a £5/daily ‘congestion’ charge with the clear implicit intention to reduce traffic and explicit intention to reduce congestion. (It is noteworthy that the scheme was deliberately given the title/description “Congestion Charge” rather than “Road Pricing” – with the implied connection that ‘Charge’ was being levied on creators of ‘Congestion’ - something which was bad!). Extensive consultation for about 18 months was undertaken on the policy and details of the scheme and its associated measures, and as a result some amendments were made. The Mayor’s decision to then proceed with the amended scheme was challenged in 2002 by Westminster City Council, and others, in the High Court. The Court found in the Mayor’s favour and implementation proceeded (Residents within the zone received a 90% discount with buses, taxis, emergency service vehicles, electric and hybrid vehicles and powered two wheelers exempt from the charge), The scheme successfully went live on 24th February 2003. A high-level summary of the elements that had to be managed to achieve this is given in figure 7.

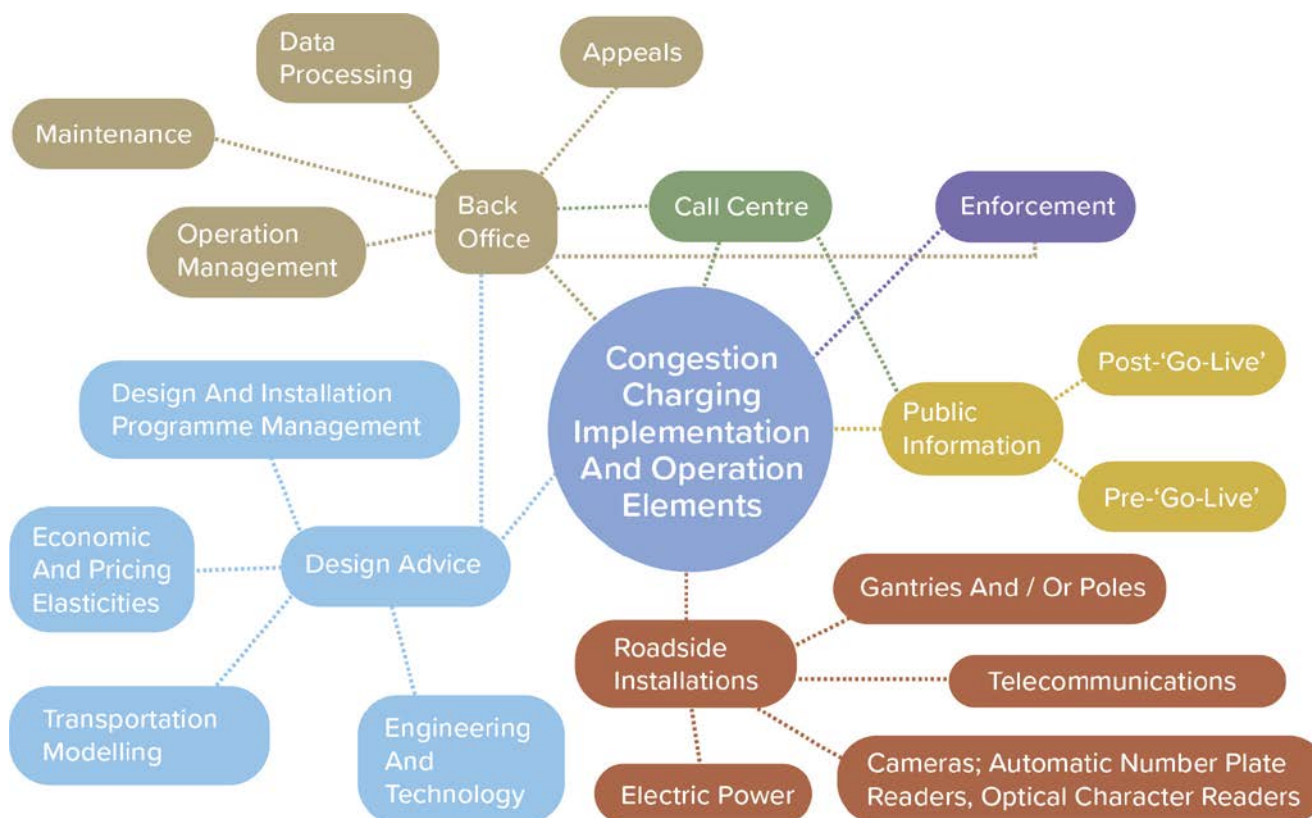


Figure 7: Congestion Charging - Implementation and Operation

6.3.5 Despite huge amounts of scepticism before its introduction ‘history’ now appears generally to accept that the Central London Congestion Charging scheme has been a success and Mayor Livingston was re-elected with an increased majority in June 2004.

6.3.6 After a year’s operation the changes observed have been summarised as:

- i. Traffic circulating within the zone was reduced by 15% during charging hours.
- ii. The number of vehicles entering the zone was reduced by 18-20% of which:
 - a. 50–60% was attributed to transfers to public transport.
 - b. 20–30% to journeys avoiding the zone.
 - c. 15-25% switching to car share.
 - d. the remainder to reduced number of journeys, more traveling outside the hours of operation, and increased use of motorbikes and bicycles.
- iii. journey times within the zone decreased by 14%.
- iv. Slight increases in traffic at some locations on the Inner Ring Road but causing no increased operational problems.
- v. No significantly increased in traffic outside the charging hours or in the area surrounding the charging zone.

- vi. Traffic approaching the charging zone was reduced.
- vii. TfL's view that "...the balance of evidence was pointing to an overall 'background' decline in traffic in central and inner London."
- viii. Traffic delays reduced by 25% and average speeds increased by 30% to about 15mph in the zone.
- ix. Travel time reliability went up significantly.
- x. Bus reliability and journey time improved. Bus use increased by 40%.

These changes were maintained through to at least 2006 when the comprehensive data collection began to cease.

6.3.7 Regarding the costs and revenues associated with the Congestion Charge scheme, TfL reported in 2007, when the charge was £8, that:

- The initial costs of setting up the scheme were £161.7 million.
- The revenues from the scheme were £250m over the financial year (8.5% of TfL's annual revenues). £130m was spent on running the scheme and once other charges were deducted, the congestion charge brought in an annual operating net income of £89m for TfL (By law, this had to be spent on transport in London, including roads).

Lessons from London:

- a) It is possible to design, implement and start operating a RUC scheme in 3-4 years.
- b) A clear imperative and transparency helps public acceptability.
- c) RUC can be successful as part of an overall transport strategy and package of measures.
- d) Substantial nett revenues can be raised by RUC without significant adverse impacts.
- e) The importance of extensive, clear, sensitive and reliable public information.
- f) RUC is not necessarily the 'poisoned chalice' that some people believe and most politicians fear.

6.4 RUC in other UK cities

6.4.1 A number of UK cities, in addition to London, have considered RUC. Lessons that can particularly be learnt from Nottingham (see para. 6.6.3.), Manchester, Durham and Edinburgh are outlined below:

Manchester (Scheme Type: Cordon)

In 2008 an extensive public consultation exercise was undertaken on what proved to be a highly controversial scheme of two concentric cordons covering some 80 sq. miles as part of a bid for funds from central government's 'Transport Innovation Fund' (TIF) which would have 'loaned' the £318m set-up costs. In addition, the TIF was to fund a £3bn package of transport improvements. The essence of the RUC proposal was that:

- a) Morning inbound traffic would be charged £2 to cross the outer cordon and an additional £1 to cross the inner cordon. In the evening traffic would be charged £1 when crossing each cordon. Motorcycles, Taxis and Private Car Hire Vehicles would not have had to pay the charge which would be levied only in the two peak periods via a 'Tag & Beacon' system.
- b) Businesses were heavily divided by the proposals. The Association of Greater Manchester Authorities, however, agreed unanimously to the TIF package, including the Congestion Charge but that it be submitted to a referendum of the residents of Greater Manchester. Only if there was a majority in favour of the proposals in seven out of the ten boroughs, would the proposals go forwards.
- c) Over a million votes were recorded and the proposal was defeated by 4:1. The proposal was dropped. In 2017 a £7.50/day, revenue neutral, charge has been proposed as part of a package of plans for Clean Air Zone in response to the very high air pollution levels in the Manchester area.

Durham (Scheme Type: Single Road)

In October 2002 a £2 RUC was introduced to access the historic City centre World Heritage Site which lies on a peninsula in the River Wear. The charge on Saddler Street reduced the 3,000 vehicles per day traffic flow by 85%. Initially the charge was collected at a barrier monitored by CCTV but subsequently (2011) an ANPR system was introduced. The scheme was the first in the UK to use the enabling legislation albeit in a particularly unusual set of circumstances.

Edinburgh (Scheme Type: Cordon)

Proposals for a RUC in Edinburgh were developed from 2002 leading to a referendum early in 2005. Extensive public consultation exercises were undertaken during the scheme's development and evolution to an extent which almost amounted to fully-fledged 'public participation' to produce what still proved to be a highly controversial scheme. The 'toing and froing', including a 10 week long Public Inquiry in 2004, was considerable eventually leading to the following:

- a) An outer cordon operating during the morning rush hour with the inner cordon from 07:00 to 18:30, both from Monday to Friday and the charge being £2 at each cordon using similar technology as in London. It was estimated that the set-up cost would be around £10m, (shared between the City Council and the Scottish Executive) raising £50m/annum to be spent on a very ambitious programme of mainly public transport improvements. (3 tram networks; 5 Park & Ride sites; new rail services; more frequent bus services and new orbital bus routes; major transport interchanges improvements; live bus stop information displays; city centre environmental and pedestrian improvements; expansion of bicycle routes; 20 mph speed limits across all residential areas and improvements in road maintenance).

- b) Concern was expressed that the question put in the referendum in February 2005 was confusing. The question was: ***“The leaflet enclosed with this ballot paper gives information on the Council’s transport proposals for Edinburgh. The Council’s ‘preferred’ strategy includes congestion charging and increased transport investment funded by it. Do you support the Council’s ‘preferred’ strategy?”***. Out of a potential electorate of 300,000, 133,678 voted ‘For’ and 45,965 voted ‘Against’ (3:1). The scheme was not implemented. £9m had been spent developing the proposals.
- c) The City Council’s project managers (Transport Implementation Edinburgh) have attributed the failure to achieve support to:
- i. A lack of consistent political will.
 - ii. A distrust of the motives of the authority.
 - iii. An absence of a powerful champion for the scheme.
 - iv. Significant stakeholder opposition.
 - v. A commitment to a popular referendum.
 - vi. A difference in perception between the ‘transport professionals’ and stakeholders. Edinburgh’s scheme designers were attempting to introduce a RUC as a proxy for making road users pay the **full marginal cost** for their journeys, while public opinion was that congestion came about because the alternatives to car travel were not viable, yet the scheme showed no commitments to investment in alternatives **before** road pricing would start.

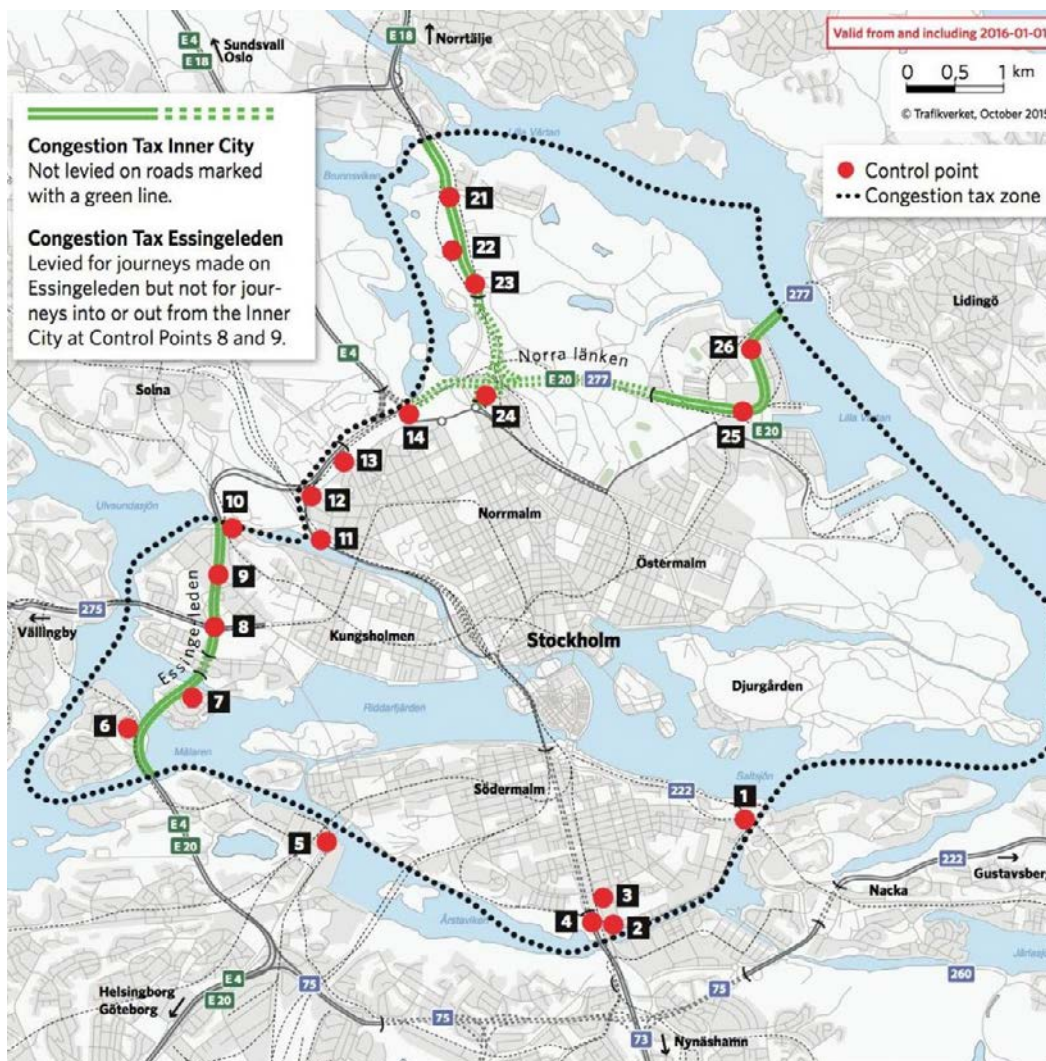
Lessons from UK cities:

- a) **Consultation must always be carried out very carefully to ensure that those being consulted fully, and in detail, understand the proposals and their implications. But no matter how thorough and detailed, no consultation exercise can be a substitute for personal experience.**
- b) **Those considering RUC should visit and experience systems in operation .**
- c) **Unless a strategy for consultation is published consultation can easily be seen as, and become, a referendum. A well planned consultation strategy is essential to be clear to everyone what they are being asked and what will be done with their responses.**
- d) **It is important for politicians when considering RUC issues to distinguish between, and reconcile, their various roles as leaders, policy makers and representatives.**
- e) **The need for a credible, powerful and trusted champion is essential for a successful RUC scheme to ensure widespread confidence is secured and maintained.**
- f) **The importance of consistency.**

6.5 Scandinavia – Stockholm Congestion Tax, and Norway's RUC schemes

6.5.1 Scandinavia, in particular Sweden and Norway, has shown an interest in RUC for over thirty years. As is often the case elsewhere, the aims of the various schemes have been multi-purpose – raising nett revenues, congestion reduction etc.. Nevertheless, the approaches adopted in Stockholm and Norway in Oslo differ significantly and are summarised below.

6.5.2 Stockholm Congestion Tax (Scheme Type: Cordon)



Stockholm Congestion Tax from January 2016 (Image: Swedish Transport Association)

The interplay between National and City politics between 2002 and 2004, when enabling legislation was passed, played a major part in the development of the scheme which was first introduced as a 6 month 'trial' in 2006 of the RUC cordon, expanded transit routes and new Park and Ride facilities. The charge was collected automatically at 18 barrier-free 'control points' that formed the cordon which encompassed the central 20 square miles of the city centre and about half the city's 1.8m population. The charges were effective on weekdays from 06:30 - 18:30 and set at 10, 15 and 20 SEK for off-peak, shoulder and peak periods, respectively when entering or exiting the cordon (The daily maximum charge, for multiple crossings was 60 SEK). There are a number of points that are particularly worth noting:

- a) The early 2004 designs proposed using similar technology to the London scheme based on ANPR, however, the trial used 'tag' technology and initially excluded the large residential island and Essingeleden, its motorway access. The combination of these two factors, when experienced during the trial gave rise to significant disquiet.
- b) From 2004 large amounts of public consultation, education and information programmes, all supported by the success of the 2003 introduced London scheme, were occurring. Nevertheless, in autumn 2005 about 55% felt to proceed with the trial was "rather/very bad decision". This proved to be probably the 'high point' of the opposition for since January 2006 when the trial scheme was introduced and speculation became experience, this percentage steadily declined to 41% in April/May 2006 with 53% believing it a "rather/very good decision".
- c) At the end of the 6 months trial the scheme was 'Switched-Off' and a referendum of the entire city was held in September 2006 on whether to reintroduce the scheme but to base it on ANPR and to include Essingeleden within the cordon. The referendum proposal was accepted by 51.3% of the voters and opposed by 45.5%. The scheme was re-introduced, as modified by the referendum, in September 2007 and remains in place substantially unaltered.
- d) The scheme cost 3bn SEK to implement and 220m/annum SEK to run with a nett surplus of 760m SEK which is being invested in further major road and public transport improvements. In addition, the scheme has resulted in an overall decrease of 18% in traffic crossing the cordon and the number of exempted "green" vehicle increasing by 9%. Worst traffic queues reduced by 30% and journey time reliability improved coupled with, in the inner city a 10-14% reduction in Carbon Dioxide, a 7% reduction in Nitrogen Oxides and 9% reduction in particulates.

6.5.3 Norway's RUC schemes (Scheme Type: Toll Roads)

Norway has long used RUC to fund bridges, tunnels and roads and operates an electronic transponder-based toll collection system called AutoPASS. These tolls are in addition to an annual license fee of about a £300 a car. The main Norwegian cities of Oslo, Bergen and Trondheim introduced tolled ring roads in the late 1980s, followed by many others. Norway does not, however, use RUC solely as a means to raise funds for ring roads and other new road infrastructure but also as a means of congestion charging for the use existing roads and as a 'nudge' towards environmentally differentiated tolls.

AutoPASS is the key common component of Norway's schemes and its main features are:

- i. It is owned by the Norwegian Public Roads Administration (i.e. national government).
- ii. 20+ years of operation of electronic tolling on 60 – 100 projects with full interoperability using 2 million DSRC tags (Notes: (a) Norway has 5 million inhabitants. (b) All vehicles exceeding 3.5T by law must have a valid 'tag'. (c) Non-compliance fine £640.)
- iii. In 1990s it was mainly used to collect tolls to finance major road/tunnel building.
- iv. In 2018 AutoPASS was, in addition to toll collection also being used for 'congestion charging' schemes (e.g. in Oslo - peak hour toll fees; environmental differentiation of fees and extra high fees for all vehicles on days with extreme pollution).
- v. In 1989 70% of the public thought the Oslo Ring road toll, operating 24 hours every day, was a rather or very negative measure. The public held a negative view until 2014. Politicians, however supported the measure throughout.



AutoPASS gantry and fees sign (Image: Shutterstock)

Lessons from Scandinavia:

- a) IVUs are not always needed or acceptable to the public.
- b) Public acceptance increases if the RUC, at least in part, funds public transport improvements and environmental gains.

6.6 Workplace Parking Levy (WPL)

6.6.1 The intention of WPL is to be a means to help ‘manage’ all transport demand, albeit, principally to reduce private non-residential parking and therefore traffic but also to use the money raised to make alternative modes of transport to the private car more attractive. In theory this appears a promising simple proposition. For example, the owner of off-street non-residential parking places would be required to pay an annual licence fee. Nevertheless, the potential complexities and opportunities for deception are many. Consider an office/residential/restaurant multi-storey building with a number of floors of underground parking places. Some could be for workers cars, some residents’ cars, some for customers and some used for storage etc. Verifying the claimed use of each out of sight space would be extremely difficult. Furthermore, in principle the licence would only apply to spaces of workers who can form a small proportion of overall traffic volumes. It is, perhaps not surprising that there have been few of this type of scheme introduced world-wide and only one in the UK.

6.6.2 The RoCOL report investigated ‘new’ transport possibilities in advance of the first London Mayoral election. Of which, one was for a Workplace Parking Levy. Subsequently the Transport Act 2000 enabled both WPL and a scheme for Road Charging, known more commonly now as Congestion Charging. It was, however, almost ten years before the Workplace Parking Levy (England) Regulations 2009 were introduced. These Regulations were used to introduce the first WPL scheme in Nottingham in October 2011 (no fees levied) and fully operational in April 2012.

6.6.3 In the **City of Nottingham** about 25,000 spaces are subject to the WPL; that is about 42% of total number of spaces. In 2019, the WPL licence cost employers £424/annum/space if they provided 11 or more liable places, which about 18% of employers do. Since charging began, over £44 million of revenue has been generated with 100% compliance of liable employers. Over 99.9% of revenue has been collected without the need for any legal actions. The operating costs are less than 5% of revenue. The balance of the revenues is spent on support for public transport including 45 new electric buses, at the time Europe’s largest all electric bus fleet. The levy focuses on commuter parking as commuters account for about 60 - 70% of congested peak traffic in Nottingham. Congestion has been estimated to cost Nottingham £160m/annum. The employers are required to pay the WPL licence fee but they can choose to pass it to their employees (VAT is not payable by the employers to the Council on the WPL fee, but any charges an employer introduces for its employees are subject to VAT).

Lessons from Nottingham:

- a) The Nottingham WPL scheme is generally regarded as being successful and Leicester, Reading, Edinburgh, Glasgow, Cambridge, Bristol and Local Boroughs of Hounslow and Camden are understood to be consideration WPLs.**
- b) Much of the parking stock is at ground level.**
- c) The scheme achieves high levels of compliance and it has proved cheap to run.**
- d) The impact on congestion has been hard to assess.**

6.6.5 One of the other notable WPL schemes is in the Central Business District (CBD) of the **City of Perth**, Western Australia. **All** non-residential parking including public car parks is required to pay the Perth Parking Levy about £400/annum/space. The income from which is spent on reducing the need for, and impact of cars, on central Perth. This includes free access to the Central Area Transit. The city council has compliance officers with the power to inspect properties and collect information for the purpose of enforcing the Levy.

6.6.6 A study found that 10% of car parking spaces were ‘mothballed’ when the scheme was introduced. The number of people travelling to work by car reduced, from 66% to 58%, with a corresponding increase in the number of people using public transport up from 30% to 37%. The report concluded that the Perth Parking policy had contributed to lower traffic volumes with lower levels of congestion but that the scheme has probably moved the problems elsewhere.

Lessons from Perth, Australia:

- a) Compliance is poor and requires enforcement with powers of entry to the car parks.**
- b) The Levy is a very small proportion of the overall cost of parking in the Perth CBD.**

6.7 Toll Roads and HOT Lanes as RUC

- 6.7.1** As a topic Toll Roads encompasses a wide range of schemes even when restricted to RUC. In the UK the **M6 Toll** (east of the M6 in the West Midlands) is the only strategic road, apart from bridges (e.g. Dartford Crossing, east of London), where road users are directly charged to use the road. The M6 Toll is operated under a 53-year concession by Midland Expressway Ltd. whose predecessors originally funded and constructed the dual three lane road to motorway standards in 2002/3. The amount that the Tolls are set at is entirely at the discretion of the concessionaire. (The largely parallel M6 is operated by Highways England on behalf of the S.o.S. for Transport and is **not** tolled. This has led to a number of people to suggest that ‘the wrong road is tolled’ or that both roads should be tolled so to ‘even out the flows’.) The Toll (rate varies - around £6/car - £11/HGV in each direction) can be paid by cash or card at the Toll Plazas or a radio-frequency identification ‘Tag’.
- 6.7.2** While tolling a road or bridge is fairly rare in UK it is fairly common overseas, e.g. USA, Europe, Australia, where long concessions of 30 years or more for the design, funding, construction, maintenance and operation of individual roads, or relatively small networks of roads, have been awarded to private companies. The ‘gearing’ of these schemes is generally set to pay-off the cost of construction in a short period. In time, towards the end of the concession period, these schemes start to be profitable.
- 6.7.3** In the UK ‘shadow toll’ schemes are more common. Traffic volumes are counted and the availability of the road free of roadworks etc. is assessed. The government, rather than the Road User, then pays a fee (charge) to the concessionaire accordingly. This arrangement does not require enforcement technology e.g. camera gantries and is often used for Design, Build, Finance and Operate (DBFO) schemes such as the M25.
- 6.7.4** The increasing number of independently operated toll roads in particular areas, e.g. south east Australia, has highlighted the importance of ‘interoperability’ between the various forms of technology being used to avoid the road user’s wind screen needing to be fitted with multiple different tags.
- 6.7.5** North America has also seen the development of High Occupancy Vehicle (HOV) Lanes, that are similar to Bus Lanes, into HOT Lanes (High Occupancy Tolerated lanes). With a HOT lane a driver can enter the lane that is restricted to high occupancy vehicles by the payment of a charge. Generally HOT lanes are physically segregated from the other traffic lanes to assist compliance/enforcement. The user is paying, generally with a DSRC tag, for a superior more reliable decongested service compared to the other general traffic lanes. The detailed design of the entry/exit arrangements and the signing of these schemes has required particular attention.

Lessons from Toll Road Operations:

- a) **The financial profile for the schemes and risk transfer arrangements require special consideration and negotiation.**
- b) **Neither Tag technology nor toll booths are pre-requisites for tolling.**
- c) **Legislation to toll an existing road has not been used in the UK.**

6.8 Truck charging

- 6.8.1** Throughout Europe and the UK, the road freight industry can be regarded as highly regulated by the use of a series of definitions particularly regarding laden/unladen vehicle weight and permitted driver hours. (Gross vehicle weight (GVW) being particularly important as it defines operator licensing, driver licensing, drivers' hours, tacho requirements above 3.5 tonnes GVW).
- 6.8.2** In the UK there are a significant number of independent vehicle/owner/driver/operators and, in essence, the DVLA records the gross weight of all vehicles. For trucks these records enable a differentiated system of VED to be charged, to in part recognise the substantially disproportionate damage to road infrastructure caused by HGVs. The records also enable the differential charge to be enforced via ANPR technology.
- 6.8.3** The UK also currently operates a vignette system which charges trucks from overseas with a total weight of 12T+ an additional time-based charge. This system is similar to that which operates on mainland Europe. The charge is determined by: vehicle type (HGV, HGV + trailer over 4T, Tractor Unit with two axles, Tractor Unit with 3+ axles); total weight and number of axles.
- 6.8.4** Using the above mechanisms, it would probably be possible, in theory at least, to develop a local based vignette RUC scheme for trucks. The implications for the local community and economy of such a charge would, however, require very detailed study and consideration.

Lessons learned from Truck Charging:

- a) **Although apparently a 'captured market' the number of chargeable trucks, even at a regional level is likely to be very small.**
- b) **The reason and implications of introducing a regional/local RUC for trucks require very careful thought.**

6.9 Low Emission Zones (LEZ) and Ultra Low Emission Zones (ULEZ)

- 6.9.1** Globally the degree of concern about air quality and carbon emissions continues to increase. In the UK emissions from hydrocarbon fuelled vehicles are one of the major causes for concern especially the amount of particulate(s) emitted by poorly maintained engines, and additionally those from all diesel engines that are run 'cool' for short periods at 'low' load. (The emission levels for diesel engines are classified by numbered Euro standards, e.g. Euro IV, thereby enabling a RUC system for them to be potentially developed and enforced.).
- 6.9.2** These concerns have led to a series of air quality and emissions regulations limiting either emissions or requiring measures to be introduced to meet published air quality standards. Which in turn have led to a number of authorities introducing local LEZs. The aim of the various legislation and regulations is, of course, to improve air quality but to date it has been recognised that a complete ban on 'polluting' vehicles would currently be likely to create major practical difficulties for the motorised users of the roads within the zone. In many cases the pragmatic way to overcome this has been to introduce a 'permit-based system' with the price of the permit linked to the engine type/emissions rating etc. as recorded on DVLA vehicle registration and measured/checked through the MOT certification system. 'Spot checks' of actual emissions could also be undertaken.

6.9.3 London is an example of the above approach with its LEZ (operates midnight to midnight 365 days a year), and its Ultra Low Emission Zone (ULEZ-operates midnight to midnight every day except 25th December) in central London which is coterminous with the Congestion Charging Zone.

6.9.4 The ULEZ in London was introduced in April 2019. Vehicles which do not meet emission targets for nitrogen dioxide and particulate matter are subject to a charge which is additional to Central London Congestion Charge. As a result, by September 2019 there were 13,500 fewer polluting cars being driven into central London each day, with roadside nitrogen dioxide pollution reduced by 36 % in the zone.²⁸

Lessons learned from LEZs:

- a) The use of LEZs to improve air quality is gaining acceptance.**
- b) Introducing large LEZs primarily to raise revenues is probably 'regressive'.**

28 Mayor of London Office (2019) *ULEZ reduces 13,500 cars daily & cuts toxic air pollution by a third*.

7. What are the constraints and challenges for Wales?

7.1 Geographical and transport considerations

- 7.1.1** Wales is a relatively small sparsely populated rural mountainous nation apart from the main concentrations of population in the southeast, centred around Cardiff and Newport and the northeast (Wrexham). As a whole its main road network is also relatively sparse, and while it has retained a reasonable rural rail and bus network, it still relies heavily on its significant network of comparatively minor roads to link farms and rural communities to traditional 'market' towns
- 7.1.2** The nature of the country's geography and its transport systems, as outlined above, are likely to constrain RUC in Wales. See 7.3.6.
- 7.1.3** The country has many hundred points of entry/egress by road (e.g. Motorway = 2; "A" class Trunk Road = 5; other "A" Class Roads = 10+; "B" Class Roads = 20+; Other Roads = 200 +) plus a number of sea ports which are entry points to the UK including:
- Newport
 - Cardiff Docks: containers, steel, forest products, dry and liquid bulks
 - Barry Docks
 - Swansea: ferry to Cork, Eire
 - Pembroke Dock: ferry to Rosslare, Eire
 - Milford Haven
 - Fishguard: ferry to Rosslare, Eire
 - Port Penrhyn: slate and aggregate shipments
 - Port of Holyhead: ferry to Dublin, Eire; amongst others
 - Mostyn: Airbus A380 wing trans-shipment

The most notable ports from the RUC view point are probably the Holyhead and the Fishguard vehicular ferries; which, in effect, formed part of the EU's Trans European Road Network (TERN) from Eire and remain part of the International E-road network (E22 and E30 respectively). Clearly also of international significance is the major fuel port at Milford Haven.

- 7.1.4** It is particularly well-recognised that the interaction between either side of the river Severn needs careful consideration hence the work of the South East Wales Transport Commission etc.. See 11.4. Similarly, the route of the A483 slips relatively seamlessly between Wales and England and at its northern end serves Chester (England) and Broughton (Wales) with the regionally vital and UK-important Airbus site.

7.2 Geo-political considerations

- 7.2.1** Wales is one of the UK's devolved administrations and some of the aspects of transport's administration, regulation, finance and taxation that are involved when considering RUC have been devolved to the Welsh Government.
- 7.2.2** If due care is taken in terms of definitions and procedures that are used, Wales could have a large degree of autonomy regarding the RUC matters covered in this review. Nevertheless, the long boundary with England does not always form a natural transport 'watershed'. Indeed, often communities straddle the national boundary falling in part in both countries. Consequently, very many local, as well as strategic, movements occur frequently each and every day between the nations.
- 7.2.3** If RUC were introduced in Wales and as a result raised, as it could, significant nett revenues there could be a real risk that the UK government would 'adjust' the overall allocation of monies provided to Wales regardless of any assurances about hypothecation.

7.3 Other general constraints and challenges

- 7.3.1** When considering RUC one of the important and key challenges is striking the 'right' balance between published 'fines' and 'fees'. This in turn relates to the complex relationships between enforcement, deterrence, compliance/willingness to pay and the costs of the various operations. These relationships vary on a scheme by scheme basis and, over the years, should not be relied upon to remain unchanging.
- 7.3.2** Experience shows that technology is unlikely to be a critical limiting constraint when designing a RUC scheme. The rate of change/renewal in the vehicle fleet, and thereby the implementation of new technology related to RUC is, however, likely to be a constraining factor on the adoption of the latest technological developments ('Independent' retrofitted technology such as currently tags could minimise the implications of this constraint).
- 7.3.3** There are a number of procurement and funding challenges that would need to be considered when developing and operating a RUC scheme including:
- The degree to which a proposal can, and would, be outsourced coupled with the nature and duration of any contracts;
 - Maintenance and refresh arrangements;
 - Who should be responsible for managing any 'integration' and 'revenue' risks?;
 - Who is responsible for the interface with public agencies e.g. the Courts?; and
 - Who deals with the public and the media?
- 7.3.4** There are very many matters, constraints and challenges which need to be considered when developing a RUC scheme – public reaction and acceptability, political issues, practicalities, money matters - figure 8 indicates just a few of these.

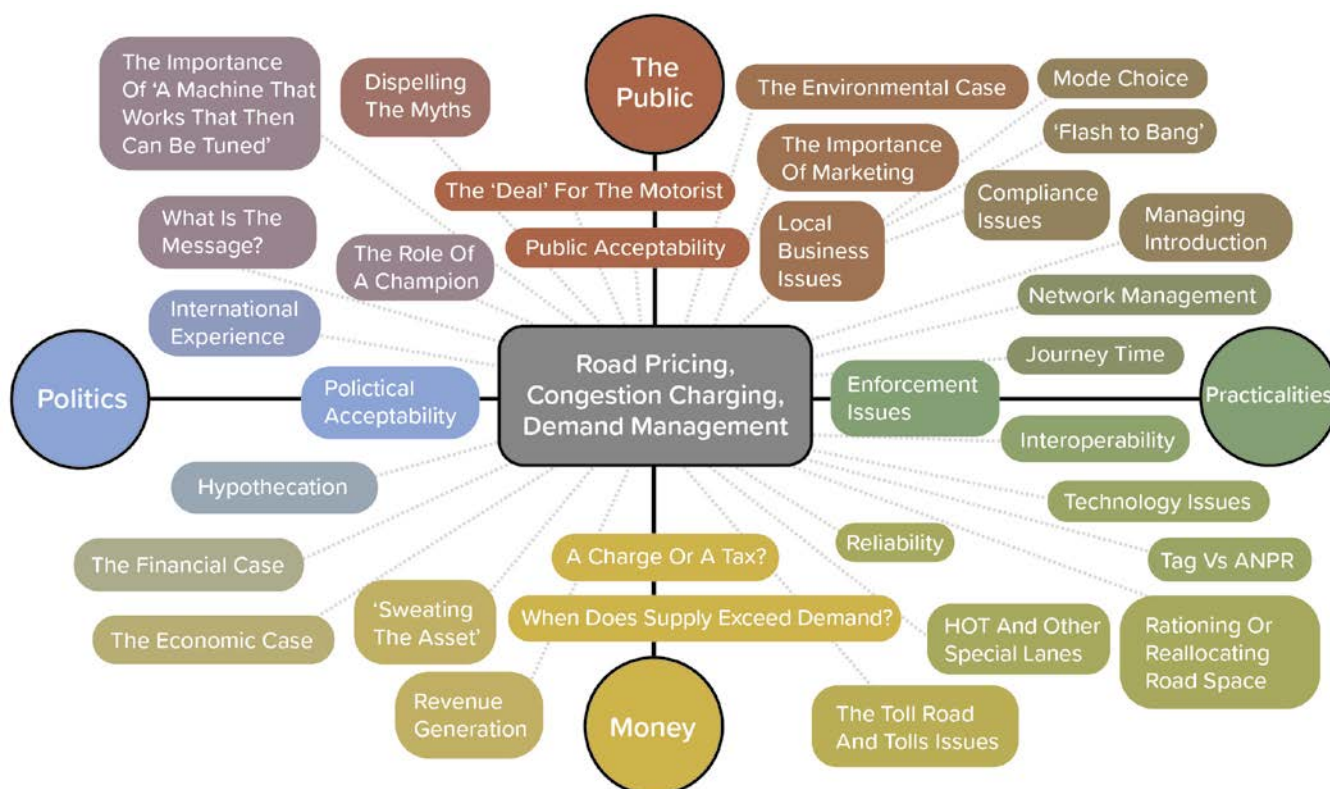


Figure 8: Road User Charging - Many matters need to be considered

7.3.5 The traffic data for Wales to support this review is in Appendix E

7.3.6 It would not be wise to consider Wales as homogenous when examining 'RUC in Wales'; for in essence the country falls into three broad geographical areas:

- i. Southeast/South Wales – the developed areas of Newport, Cardiff, Swansea and the Valleys.
- ii. Central Wales – the rural areas.
- iii. Northeast/North – Wrexham and the developed north coast.

As a result, the development of a single RUC scheme just for the whole of Wales, while not impossible, would be difficult to envisage due to the very different nature of these three areas. In particular the rural areas' transport needs especially their use of roads is inherently very different from the more developed urban/sub-urban areas. Fairly frequently, however, journeys with either their origin or destination in a rural area have the majority of their length and/or time within urban areas or on inter-urban/main roads.

7.4 Summary of Constraints and Challenges for RUC in Wales

7.4.1 In principle there are few constraints and challenges. In practise, however, the main ones are likely to be:

- a)** Dealing with the ‘interaction’ between rural and urban areas of Wales would be a significant challenge for the development of any successful RUC scheme.
- b)** Dealing with the any ‘interaction’ across the Wales/England border would require careful management to avoid it becoming a major challenge or constraint.
- c)** Dealing with unavoidable issues and implications arising from the relationship between the Welsh and UK governments.

7.4.2 The above position may well change significantly if the UK government were to adopt RUC to any significant degree; for example if VED and/or fuel duty were replaced by a UK wide RUC scheme. In these circumstances a case could be made for the Welsh Government to be able to decide the charging levels on its trunk roads.

8. Attitudes and Implications



8.1 Public acceptability Issues

- 8.1.1** It would be generally fair to say that the very idea of RUCs is not very popular with the general public. The cry can frequently be heard ***“That’s what I pay my VED, fuel duty, income tax and council tax for!”***. As mentioned elsewhere (para 8.10), people’s views tend to become less negative when they have actual personal experience of a RUC scheme themselves. It certainly appears to be the case that when there is a clear and relatively severe problem that acceptability increases especially if either the measure is specifically directed at the problem or that any nett monies raised is used to fund a specific solution.
- 8.1.2** A further frequent refrain is ***“... but there is no alternative!”***. For some journeys, especially in rural areas, that may be true; nevertheless, targeted improvements in public transport in terms of reliability as well as capacity, reduced journey times and subsidised fares in built-up areas have been shown to provide an acceptable ‘carrot’ to the perceived RUC ‘stick’. Also, increasingly support for sustainable transport e.g. cycling and walking, both in terms of ‘take-up’ and investment are playing an important part. The key to the success, and acceptability of RUC, appears to be to develop and commit to a comprehensive realistic ‘Transport Strategy’ and include RUC as an integral and vital, part of the basket of measures within that strategy.
- 8.1.3** There can be no doubt that a large scale very carefully managed Public Information exercise starting many months before the introduction of any RUC scheme is essential to ensure the ‘doubters’ properly understand all of the issues. Furthermore, to assist/lead in this task, experience has shown the advantages of having a convincing ‘champion’.

8.2 Fairness Issues

- 8.2.1** The goal of RUC is frequently about changing behaviours, often by using a ‘carrot and stick’ approach as part of wider policy goals. An assessment of the ‘fairness’ of the component measures is therefore generally expected despite, almost inevitably, it having a degree of subjectivity associated with it. This is especially so when money is being used to influence behaviour due to affordability issues etc.. Furthermore, the provision of a ‘reasonable’ alternative may not be always be required or necessary; indeed undesirable, if the decision has been taken to prohibit and stop the underlying particular activity. These are complex matters which require careful detailed research and analysis to avoid wider, unintended consequences. As a result of these considerations and on top of the ‘willingness to pay’ aspects; compliance rates, deterrence factors e.g. level of fines and ultimately how the particular RUC issues fit into the legal and criminal justice systems will also all need to be assessed. (See Appendix C).
- 8.2.2** Experience from, for example London and Stockholm, suggests that the following matters are considered as important ‘fairness’ matters:
- a) The availability of a reasonable alternative.
 - b) How, where and upon what any nett revenues are spent.
 - c) The nature, and severity, of ‘the problem’ (and of the solution!).
 - d) Varying implications on differing societal and economic groups.
 - e) Proportionality.

8.3 Public Transport Issues

- 8.3.1** As mentioned previously public transport, especially in Wales, plays an important part in the overall transport system. Currently all types of public transport receive, to varying degrees, some subsidy to their fares. In summary, in Wales, the cost of travel for the Welsh Government, by different modes is 11 times more per km for bus than road and 15 times more by rail than road due to devolution particularities.
- 8.3.2** If a RUC scheme were to lead to an increase in public transport ridership the amount of the subsidy needed could decrease. Alternatively, if the subsidy were to remain the same the increased ridership could enable fares to be reduced which in turn may attract additional riders. These can become complex issues particularly if capacity increases become necessary or there is a desire to enhance service levels.
- 8.3.3** In built-up areas, if a RUC scheme were to result in reduced use of private vehicles, and hence reduced congestion and also improved bus reliability; there is in turn likely to be an increase in PT ridership with the potential that the causal affects described above will occur.
- 8.3.4** The issues surrounding 'discretionary' use of PT can be very profound and intransigent regardless of the presence of a RUC scheme. Unfortunately, this can lead to increased uncertainties when carrying out economic analysis and predictions about RUC schemes. To understand and reduce these uncertainties extensive in-depth 'willingness to pay' and 'focus group' studies are almost certain to be necessary.

8.4 Political Issues – with a small 'p'!

- 8.4.1** People's views on matters such as devolution, autonomy, regulation, taxation, localism, regionalism, and many others topics should be considered when assessing attitudes to, and the implications for, any RUC scheme. Again, this can be challenging area for policy advisors, officials and decision makers and it may be necessary to undertake widespread in-depth focus groups to understand these matters before, and during, any RUC related information exercises.

9. 'The Case For & The Case Against' RUC in Wales



9.1 The principal case for RUC in Wales

- 9.1.1 At present it is probably difficult to make a good case for a RUC scheme that would apply **throughout** Wales. Such a scheme, dependent on its design, could be possible but would either be very blunt or extremely complicated if it were to tackle the very many differing sets of circumstances – urban/rural, commuter/non-commuter, cross boundary traffic etc.. A case for such a scheme would, however, be much easier to make if England had a similar scheme. For instance, if motoring taxation or funding for roads were to be changed to a variable distance-based charge (For Wales to unilaterally pursue a similar scheme, while likely to be theoretically possible, would be contentious, involve high set up costs and be expensive to operate).
- 9.1.2 Despite the above a convincing case could probably be made for a RUC scheme, or a number of discrete RUC schemes **within** Wales. This is because Wales has a number of transport related problems which could in principle lend themselves to being alleviated by RUC measures such as is shown below:

Issue / Problem in Wales	Example of possible RUC measure
Through traffic causing congestion	Congestion charging
Air quality	Low Emission Zone
Sustainability	Road pricing / Ultra Low Emission Zone
Workplace parking	Workplace parking levy
Public Transport delays	Congestion charging
Funding issues	Road pricing / Tolls / RUC generally
Commuting by car	Workplace parking levy / Congestion charging

Table 2: Issues/problems and corresponding possible RUC measures

In some cases, it would also be possible to devise a combination of the above schemes. Although there is a possibility that this may give rise to an additional ‘public acceptability/fairness’ risk if it is seen as potentially a form of ‘double jeopardy’.

- 9.1.3 It seems probable that a reasonable case could be made for RUC to be developed in one or more places/areas in Wales with the aim to change road user’s behaviour and/or raise nett revenues to improve the transport system as a whole, especially its efficiency and reliability; improve the environment, primarily air quality; increase sustainability, particularly by encouraging sustainable modes of travel. This is mainly the case if nett revenues were ring fenced and hypothecated to transport.

9.2 The principal case against RUC in Wales

- 9.2.1** The strong case against unilaterally introducing a single RUC scheme to cover the whole of Wales was made in para. 9.1.1 above.
- 9.2.2** A case is often made by some people that the ‘cure is worse than the disease’ and/or that the solutions being offered should wait until the problems get far worse. These, and similar arguments, are also made in the Climate Change debate; the key counter argument being that it may already be too late and the changes may not be reversible.
- 9.2.3** It is also sometimes stated that ***“it’s not my fault we are in this position, why should I pay again – this is what we pay our taxes and council charge for”***. This point of view is, to a degree, understandable and the case can quickly become one of politics and democracy.
- 9.2.4** Possibly the strongest against case that can be made is that the implications of RUC schemes involve too many, and too great, unknowns and unintended consequences. This may be have some validity but it is reducing as understanding from practical experience of RUC schemes increases and there is greater recognition that an integrated approach to dealing with these issues is needed rather than seeing RUC as the sole measure, and to be a panacea for all transport ills.

10. The range of RUC concepts and technologies relevant to Wales



10.1 Cordon Based RUC concept

10.1.1 A charge based on crossing a line that can be varied by time of day/day of week, vehicle type.

10.1.2 Road-side technology required would be cameras and OCRs plus good links from 'back-office' to DVLA.

10.1.3 The set-up cost for this type of scheme is significant although the average transaction cost can be low. This tends to encourage out sourcing of the scheme's operation. Table 3 shows a 'SWOT' analysis for a generic Cordon based RUC scheme:



Table 3: 'SWOT' for a Cordon Based RUC

10.2 Area Based RUC concept

- 10.2.1** Charge based on moving within an area i.e. including journeys which do not leave the area. (This is the type of scheme that was introduced in central London.) It can be varied by time of day/day of week, vehicle type.
- 10.2.2** Road-side technology required would be cameras and OCRs plus good links from the ‘back-office’ to DVLA to deal with vehicle type. The issue of detecting movement can be overcome by on-street patrols and careful creation of check/enforcement ‘screen-lines’.
- 10.2.3** The costs associated with this type of scheme are similar to cordon schemes. Table 4 shows a ‘SWOT’ analysis for a generic Area based RUC scheme.



Table 4: ‘SWOT’ for an Area Based RUC

10.3 Individual Toll Roads RUC concept

10.3.1 This is regarded by some as the ‘classic’ RUC – charging for the use of the Road or part of it. They are, in principle, no different from a cordon scheme (see 10.1.) with one/two crossing points and they use similar technology. (The River Severn Trolled crossings and the M6 toll road are examples) Payment of the Tolls is often by cash at gated toll booths. The management of potential diversion routes remains a significant issue for this type of scheme especially where the tolled road is newly constructed, e.g. a new by-pass.

10.3.2 By careful designing the location of the tolling points it is possible to, for all practical purposes, create a ‘distance-based charge using this method. Although there would be likely to be large amounts of road side infrastructure.

10.3.3 ‘Toll’ roads have traditionally been all about making money. Initially to pay off the debt associated with the construction and then to maximise the operator’s nett revenues. Removing the Toll Booths from an existing toll road to improve traffic flows is possible (e.g. M25 - Dartford River Crossing but is disruptive to introduce. A ‘SWOT’ analysis for a typical Individual Toll Road RUC scheme is shown in Table 5:



Table 5: ‘SWOT’ for Individual Toll Road RUC

10.4 Tolled Lane RUC concept

10.4.1 These premium, generally expressway, lanes originated in U.S.A.; often in combination with High Occupancy Vehicle (HOV) lanes to create High Occupancy Tolled (HOT) lanes. Continuous surveillance is really required unless physical separation is provided especially if congestion in any toll-free lanes is bad. Some of the lanes have operated dynamically i.e. price varying with time of day and/or congestion levels.

10.4.2 Road side technology would be similar to Toll Roads although the enforcement of the High Occupancy element by technological means has proved to be challenging. Toll gates on entry are not recommended,

10.4.3 A 'SWOT' analysis for an Individual Toll Lane RUC scheme is shown as Table 6:

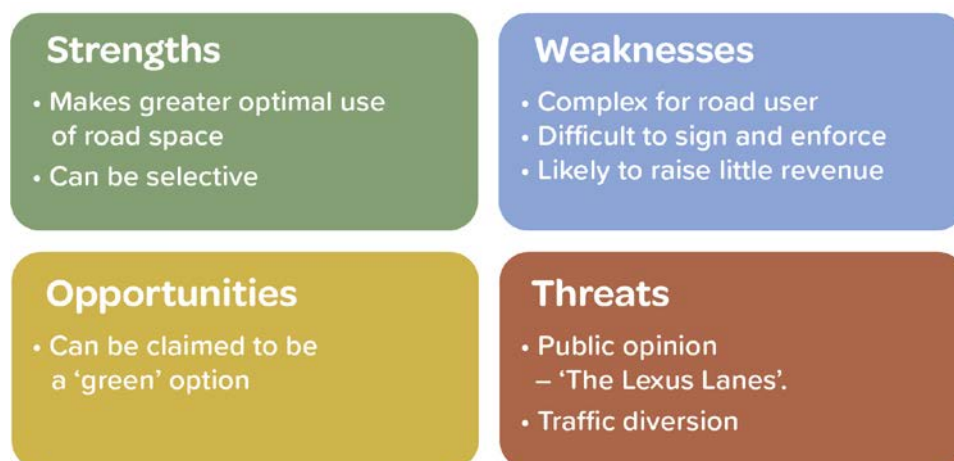


Table 6: 'SWOT' for Individual Toll Lane RU

10.5 Distance Based RUC concept

10.5.1 The charge is related to distance travelled within an area or along a particular road. On a relatively 'closed system', such as a motorway this can be a calculated charge by recording when a vehicle joined and left the system. Alternatively using GPS, it is possible to calculate a vehicle position and hence the distance travelled.

10.5.2 The appropriate technology (road-side and in-car) is developed but not widely deployed, activated and used in a suitable way. There could be boundary issues using this approach in even in a deployment the size of Wales especially in rural areas where 'poor reception' causes GPS and internet problems. The enforcement technology would be similar to that used for area and cordon-based RUCs.

10.5.3 SWOT' for Distance Based RUC is shown as Table 7:



Table 7: 'SWOT' for a Distance Based RUC

10.6 Truck/vehicle type specific RUC concept

10.6.1 Most, if not all, types of RUC schemes can be formulated to differentiate between the vehicle classes recorded by the DVLA. Trucks are an obvious example and, in addition, systems already exist to record ‘drivers’ hours’ – the Taco-graph. No particularly new enforcement challenges are envisaged.

10.6.2 ‘SWOT’ for truck or vehicle type Based RUC is shown as Table 8:



Table 8: ‘SWOT’ for a Vehicle Type Based RUC

10.7 Workplace Parking Levy RUC concept

10.7.1 This RUC targets private parking provided at places of work. It is therefore only really applicable in urban areas and then only if accompanied by a comprehensive parking strategy for the area. The aim is to discourage the use of motorised transport for the journey to/from work. It is also capable of being a source of limited nett revenue. From the very limited UK experience of this form of RUC compliance has been good and therefore the potentially challenging issues associated with undertaking enforcement have not been tested.

10.7.2 ‘SWOT’ for Workplace Parking Levy RUC is shown as Table 9:

<p>Strengths</p> <ul style="list-style-type: none">• Can be seen as encouraging sustainable transport for commutes• Relatively quick and easy to introduce and modify	<p>Weaknesses</p> <ul style="list-style-type: none">• Complex if dealing with mixture of rural and urban areas• Access for enforcement can be complicated• Total nett revenues likely to be relatively low
<p>Opportunities</p> <ul style="list-style-type: none">• Carry out a review of on-street parking controls in the area	<p>Threats</p> <ul style="list-style-type: none">• Business and public opinion• Non-compliance

Table 9: ‘SWOT’ for Workplace Parking Levy RUC

10.8 Retail parking Levy RUC concept

10.8.1 This generally, in principle, aims to discourage ‘out-of-town shopping in retail parks by car’ or at least obtain from the motorist an additional contribution to the ‘public cost’ of making the journey to that facility. The concept could be seen, and applied, as extension to the overall management of the parking stock in the area. Like Workplace Parking Levy it would need to be part of a parking strategy for the area to be effective. Their widespread use under the overall heading of a RUC is unusual.

10.8.2 ‘SWOT’ for Retail Parking Levy RUC is shown as Table 10:



Table 10: ‘SWOT’ for a Retail Parking Levy RUC

10.9 Low Emission Zone (LEZ) RUC concept

10.9.1 For practical purposes LEZ, in this review, are being treated as a RUC measure. The prerequisite for a 'charge' could be regarded as non-compliance with the requirements of the Regulations. The Regulations are, however, often drafted in such a way as the motorists pays for a 'licence' to drive in the area despite not meeting the principal requirements of the Regulations.

10.9.2 'SWOT' for generic Low Emissions Zone (LEZ) RUC is shown as Table 11:



Table 11: 'SWOT' for a Low Emissions Zone (LEZ) RUC

10.10 Technologies relevant to Wales

10.10.1 As stated previously, in general terms, RUC is no longer limited by technological considerations although the cost of implementing the technology to introduce and enforcing a distance-based RUC covering every road in Wales would clearly be prohibitive.

10.10.2 The physical infrastructure requirements – signs, gantries, cameras etc. are all available as is the computing to create an effective 'back-office' to carry out the necessary processing. So too, in technology terms, are the 'communications systems' needed to feed the 'back-office' and the user. A likely constraint on the design of a RUC system covering some areas of Wales would be the current availability and reliability of the Internet and/or cellular networks especially in some rural areas.

10.10.3 The detailed design of any scheme would need to take into account the 'occasional user' but this would not necessarily prevent the use of in-vehicle technology. The constraint there being the degree of 'penetration' of the overall fleet of likely users not the available technology.

11. Summary and 'SWOT' of current "RUC in Wales" related studies



11.1 A RUC scheme for Cardiff?

11.1.1 Cardiff Council's Cabinet is investigating a form of charging mechanism to be introduced in 2024. It is intended that it would exempt its residents and that it would be aimed at helping:

- a) Tackle climate change
- b) Reduce congestion
- c) Improve air quality
- d) Provide ring fenced funding to invest in public transport initiatives.

11.1.2 The Council's Cabinet believe that a cordon type road user charging scheme with a minimal charge, say £2, for vehicles coming into Cardiff could work and reduce the number of vehicles coming into the city, whilst achieving reductions in carbon emissions, improving air quality, reducing congestion and helping raise the money for improvements to their transport network.

11.1.3 The following 'SWOT' analysis of a cordon type RUC for Cardiff has been undertaken as part of this 'Independent Review':



Table 12: 'SWOT' for Cordon Based RUC for Cardiff

11.1.4 It has possible that a Workplace Parking Levy could be introduced in combination with, or instead of, the cordon RUC. A combination approach while technically possible and giving rise to the higher nett revenues would be likely to be regarded as unfair by many people seen as introducing a scheme involving ‘double jeopardy’. If it were similar to the Nottingham scheme, (the only RUC scheme in Nottingham), it has been estimated that 26,000 workplace parking places would pay a charge of around £424/annum giving rise to a nett revenue of about £11m/annum for investment in public transport improvements.

11.1.5 The following ‘SWOT’ analysis of a Workplace Parking Levy type RUC for Cardiff has been undertaken as part of this ‘Independent Review’:



Table 13: ‘SWOT’ for a Workplace Parking Levy type RUC for Cardiff

11.2 A RUC scheme for Newport

11.2.1 The close proximity of Cardiff to Newport results in its Council being very concerned about the potential ‘knock-on’ effects from the introduction of any RUC in Cardiff. A Workplace parking levy has been considered for Newport on the basis that about 8,600 spaces would be paying the charge it would be likely to raise around £3.7m/a nett.

11.2.2 The following ‘SWOT’ analysis of a ‘stand – alone’ Workplace Parking type RUC for a Newport Council has been undertaken as part of this ‘Independent Review’:



Table 14: ‘SWOT’ for a Workplace Parking Levy type RUC for Newport

11.3 A RUC scheme for part of the M4?

11.3.1 Initially setting aside the matter of RUCs for the use of the Severn Crossings. The M4 in Wales forms part of the UK’s Motorway system, however, at present it is believed that it would probably be possible for the Welsh Government to introduce a RUC on the Welsh sections of the M4. An argument for RUCs to be applied to a length of the M4 has been made. This gives rise to a series of M4 related questions of ‘principle’ e.g. Would the scheme be intended to charge ‘through’ traffic, all traffic, traffic entering/leaving the motorway via particular junctions, or any combination of these?

11.3.2 It would be unlikely that there would be any major technical issues in designing a scheme. Nevertheless, care would need to be taken to avoid unintended consequences arising especially for adjacent roads and communities as throughout most of the 24-hour day the number of vehicles using the motorway in this particular area is rather large.

11.3.3 The following ‘SWOT’ analysis is for a ‘generic’ RUC scheme for the M4. It could change significantly dependent upon the details of the specific scheme that is being considered.



Table 15: 'SWOT' for a 'Generic' RUC scheme for the M4 in the vicinity of Cardiff and Newport

11.4 The South East Wales Transport Commission (SEWTC)

11.4.1 The SEWTC, chaired by Lord Burns, were appointed in 2019 by the Welsh Government to review alternatives in light of the First Minister's decision not to proceed with the proposals for a new section of motorway South of Newport. The Commission's programmed to report by the end of 2020, so is on a similar course to this review. Indeed, it may possibly have published in advance of this report.

11.4.2 From the Commission's Terms of Reference and direct discussions with them via online sessions, it is clear that they have a broad remit across the region and are taking a holistic view at reducing congestion and encouraging mode shift away from private cars. RUC clearly sits well within that and their July 2020 "Emerging Conclusions" report stated in para.198:

"We will focus on considering the options for charging (for example, road user charging, a workplace parking levy or other forms of parking management) and the interactions with our other emerging recommendations, including on the timing of any implementation."

11.4.3 It is encouraging that RUC is being looked at 'in the round' alongside other measures such as enhancing public transport and reviewing governance. The lessons of successful schemes show us this is very beneficial, if not essential.

12. Conclusions of the Review



12.1 “RUC in Wales”

12.1.1 The issues encompassing RUC in Wales are wide ranging, and very important for the Welsh nation and its government. They require urgent consideration and action now. This “Independent Review of Road User Charging in Wales” has attempted to cover:

- a) **What’s the issue?**
- b) **Why is it a matter for Wales?**
- c) **Why is necessary to consider it now?**
- d) **Why it can’t all wait?**

12.1.2 RUC can be an excellent tool to help the Welsh Government and Welsh Local Authorities deliver a more equitable, efficient and sustainable transport system directly for all road users and for others across the wider transport system. Furthermore, in the spirit of the Well-being of Future Generations Act²⁹, it can help Government achieve wider economic, societal, cultural and environmental priorities such as improving air quality, sustainability and benefiting ‘placemaking’ and health.

12.1.3 Wales’ transport issues are not geographically homogeneous, with transport demands, needs and networks varying vastly between urban and rural areas, topographies and borders. Nevertheless, among the wide range of schemes which come under the general description of RUC, there may well be means of assisting the Welsh economy, transport, sustainability and environment of all the different constituent parts of the country. An important issue for the Welsh Government highlighted by this review is whether, and if so how, to deal with and co-ordinate these RUC schemes, and their design, if/when they be proposed.

12.1.4 The Welsh Government has, in the main, appropriate powers concerning most of these matters. Whilst it is the responsibility of local authorities to determine whether and what RUC it deploys on ‘local’ roads, Welsh Government can, rightly, prevent schemes proceeding if it deems them to not be in the best interest of the Welsh Nation. Before potentially exercising this power it is arguably incumbent on the Welsh Government to provide clear guidance to those local authorities on what, in its view, is acceptable and ‘good’ looks like. This is especially so given at a strategic level it can decide to adopt policy making and/or executive roles; although some of the matters do also come directly within the remit of Welsh local authorities and that some Welsh local authorities are already actively considering, and promoting, RUC schemes for their areas.

12.1.5 It is potentially damaging if RUC in Wales were to be developed on a piecemeal basis. It should be a co-ordinated matter for Wales as a nation. Indeed, with appropriate cross border co-ordination with England given the close proximity and significant two-way journeys along the M4 and A55 for example.

12.1.6 In these circumstances there is now a pressing need for a **“National Policy Framework for RUC in Wales”** to be developed and introduced as soon as possible.

²⁹ Future Generations Commissioner for Wales (no date) *Well-being of Future Generations (Wales) Act 2015*.

12.2 Suggested scope of “National Policy Framework for RUC in Wales”

12.2.1 Experience suggests, and during the Review it has become clear that, Wales would benefit if the Framework, mentioned above, were to provide the following:

- a) Guidance on the Welsh Government’s policy, strategy and intentions regarding its national executive responsibilities concerning RUC in Wales and the Welsh motorways and Trunk Roads.
- b) Guidance about the role of the Police concerning RUC schemes.
- c) Guidance to local authorities on RUC schemes aims (e.g. economic, sustainability and environmental) and content, preparation, evaluation, implementation, operation and review.
- d) Guidance on the preparation of RUC schemes involving more than one local authority or those including Welsh Motorways and/or Welsh Trunk Roads.
- e) Guidance on the status and use of any nett revenues arising from RUC schemes in Wales.

An elaboration of the above topics is provided in Appendix C.

12.3 Interim Guidance

12.3.1 As the development of some proposals for RUC schemes is already underway: by Local Authorities, the Welsh Government should consider, depending on their view of the need for speed, whether to adopt a consultative approach. This would inevitably be more cautious, but longer; possibly including a consultative draft and/or ‘Interim Guidance’, before finalising the “Framework”.

12.3.2 It is desirable that, as soon as practicable, consideration should be given by the Welsh Government to producing and publishing ‘Interim Guidance’ covering the suggested scope of the suggested Framework, and any other matters deemed necessary; along with a timetable for the preparation and publication of the Framework.

12.4 Suggestions for: What next, and when?

12.4.1 Based on the above Appendix C provides further details on the preparation and content of the Framework.

12.4.2 Preparation and adoption of ‘Interim Guidance’ on RUC in Wales could be done by Spring 2021; and could include the proposed process and timetable for the preparation and adoption of the ‘National Policy Framework for RUC in Wales’.

12.4.3 Preparation and adoption of ‘The National Policy Framework for RUC in Wales’ could be done by Autumn 2021, taking into account appropriate stakeholder engagement and consultation.

12.4.4 Regardless, a strategy of collaborative and open communication is ultimately key to ensuring RUC in Wales delivers a positive outcomes for all.

Glossary of Abbreviations and Definitions

References and Bibliography

Appendices

Glossary of Abbreviations and Definitions

ANZ – Australia and New Zealand:

While the two countries tend to be aligned on motoring matters New Zealand is sometimes more radical and/or innovative.

ANPR (Cameras) – Automatic Number Plate Reader cameras:

ANPRs are OCRs combined with CCTV cameras.

Bus Lane:

In UK a lane that is exclusively for the use of buses and possibly other vehicles as defined in the TRO.

CAV – Connected, Automated Vehicles:

In some texts Autonomous replaces Automated but in this review it does not. The distinction here being that an Autonomous vehicle would not need a driver to be present but that an Automated vehicle would.

CBD – Central Business District:

The commercial centre of a town/city with few residential properties

CCTV – Closed Circuit Television cameras:

Often used in combination with OCR to create an ANPR system

CIHT – Chartered Institution of Highways and Transportation:

One of the main professional institutions of members who specialise in RUC related matters.

COVID-19:

The pandemic disease associated with the latest strand of the Coronavirus.

DfT – Department for Transport:

The UK government department with responsibility for transport policy and England's Strategic Road Network (Motorways and Main 'A' Roads). It is probably the UK government department with most influence over RUC in Wales, closely followed by the UK Treasury.

DSRC – Dedicated Short Range Communication:

Means of communication between the IVU and Road-side infrastructure i.e. V2I.

DVLA – Driver and Vehicle Licensing Agency:

The agency of DfT holding over 48m of UK's driver records and over 40m vehicle records also collecting £6bn/year in VED.

ETC: Electronic Toll Collection.**ERP - Electronic Road Pricing:**

Using OBUs - either 'dumb tags' or sophisticated electronic technology.

ERT- Electronic Road Tolling.

EU – European Union.**EV – Electric Vehicles:**

Vehicle power source is only electricity.

GDP – Gross Domestic Product:

A widely used measure of a country's economic wealth.

HOT Lanes – High Occupancy Tolled Lanes:

Fairly common in USA – HOV Lanes where access is also permitted on payment of a Toll which is sometimes varied by the degree of congestion in the non-HOV Lanes.

HOV Lanes – High Occupancy Vehicle Lanes:

Lanes which are restricted to the use by vehicles carrying 2+ people/adults. More commonly defined in UK as 'Bus Lanes'.

ICE – Internal Combustion Engine:

Be it petrol or diesel, by far the most common form of power for motorised vehicles.

IG – Interim Guidance.**IMF – International Monetary Fund.****IVU – In-Vehicle Unit:**

Commonly called a 'Tag' – Generally 'leased' from road operators.

LA – Local Authority:

Not all local authorities in the UK are Highway Authorities. Those which are not would not have the necessary statutory powers to introduce the RUC measures considered in this review.

LEZ – Low Emission Zone.**LGV – Light Goods Vehicle****LHA – Local Highway Authority: See LA.****OBU – On-Board Unit: See IVU.****OCR – Optical Character Reader:**

A computer system which recognises alpha-numeric patterns on images.

PT - Public Transport:

Transport available to the public; generally charging set fares and on fixed routes. Originating when 'mass' transport (bus and rail) in contrast to personal/private transport, was owned and operated by public authorities prior to deregulation and privatisation.

RoCOL - Review of Charging Options for London.**RUC – Road User Charging: See Section 3.**

SoS – Secretary of State.

‘SWOT’ – Strengths, Weaknesses, Opportunities, Threats:

Analysis summary technique.

Tag – A commonly used name for OBU or IVU.

Usually using DSRC.

TERN – Trans European Road Network.

TIF – Transport Innovation Fund.

TfL – Transport for London:

The Mayor for London’s Transport Authority which, among other things is the Highway and Traffic Authority for London’s Strategic Road Network.

ToR – Terms of Reference.

TPS – Transportation Planning Society:

A learned society of transport planners whose interests include RUC matters.

Trunk roads – Roads owned and operated by national government.

Welsh government has 1,048 route miles of Trunk Roads, inclusive of motorways.

TRO – Traffic Regulation Order.

UK – United Kingdom:

The United Kingdom comprises Great Britain (England, Scotland and Wales) and Northern Ireland. (Wales and Scotland have devolved governments although many of the matters related to RUC and this review are reserved for the UK government).

USA – United States of America:

The USA is a federation of 50 individual States. Most of the aspects related to RUC are the responsibility of individual States advised by the American Association of State Highway and Transportation Officials (AASHTO) rather the Federal Highway Administration (FHWA) of the national Department of Transportation.

VED – Vehicle Excise Duty:

V-2-I – Vehicle to Infrastructure:

A means of ‘communication’ between IVU and (generally) roadside infrastructure.

V-2-V – Vehicle to Vehicle:

A means of ‘communication’ between IVUs relying on common interoperability standards.

WPL – Workplace Parking Levy:

For the purposes of this review it is a form of RUC.

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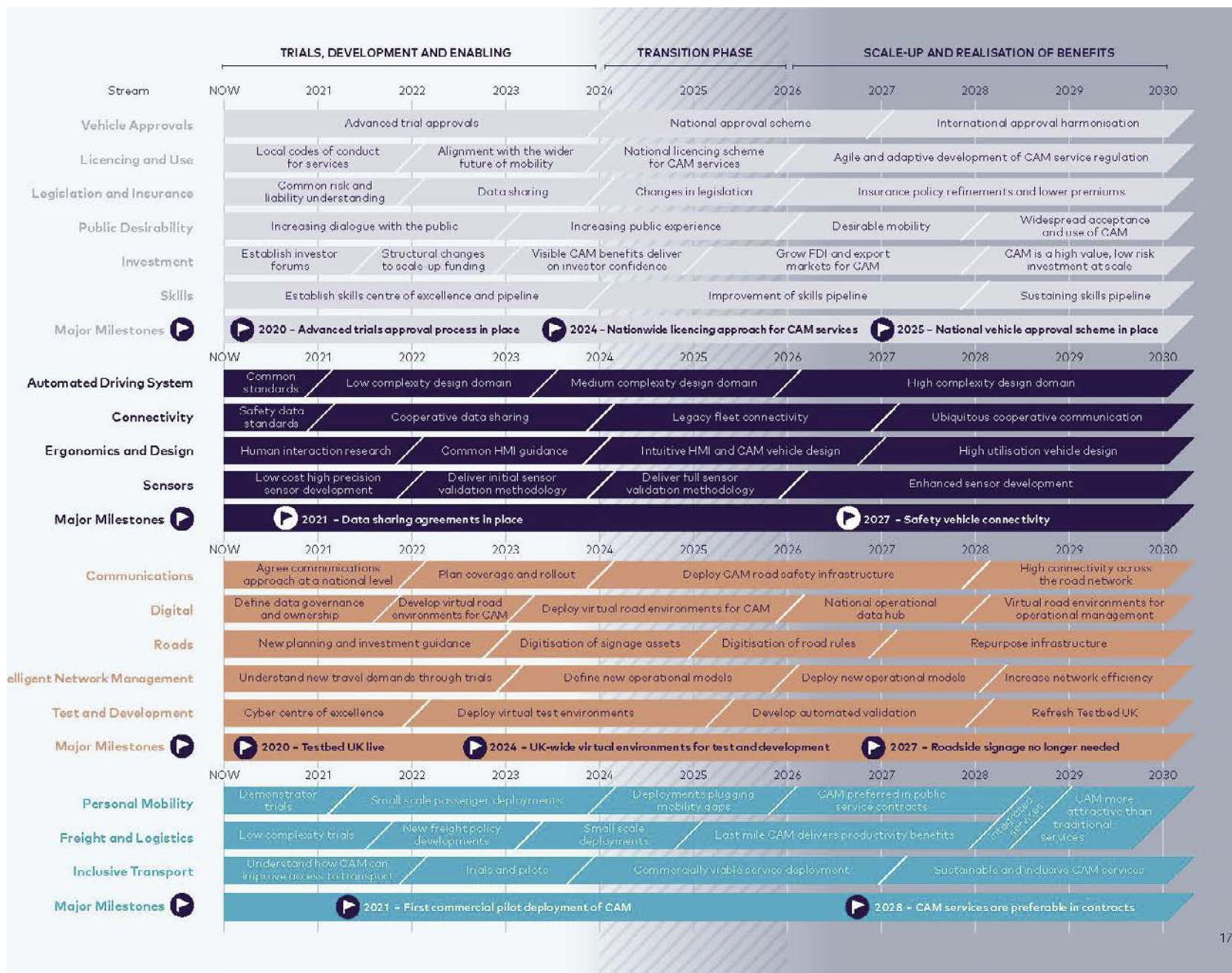
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Appendix A: UK Connected and Automated Mobility Roadmap to 2030



**We have a common goal,
a vision of the future,
towards which we can
all align and collaborate
to 2030**

150+ organisations
contributed
to the roadmap

What makes the roadmap unique?

- It cuts across many traditional sectors, showing how all should work together to achieve a common vision
- 'Golden Threads' are used to allow all to find their journey and bespoke path to 2030 through interconnected 'Milestones'

THE ROADMAP IS MADE UP OF

500+ milestones

By 2030, the UK is benefitting from proven connected and automated mobility, with an increasingly safe and secure road network, improved productivity and greater access to transport for all.

Next-generation services and technology are designed and developed in the UK, powered by high value skills and a strong supply chain, and driven by public demand, we are a world leader.

250+ individuals
contributed
to the roadmap

Created and intended for multiple sectors and industries

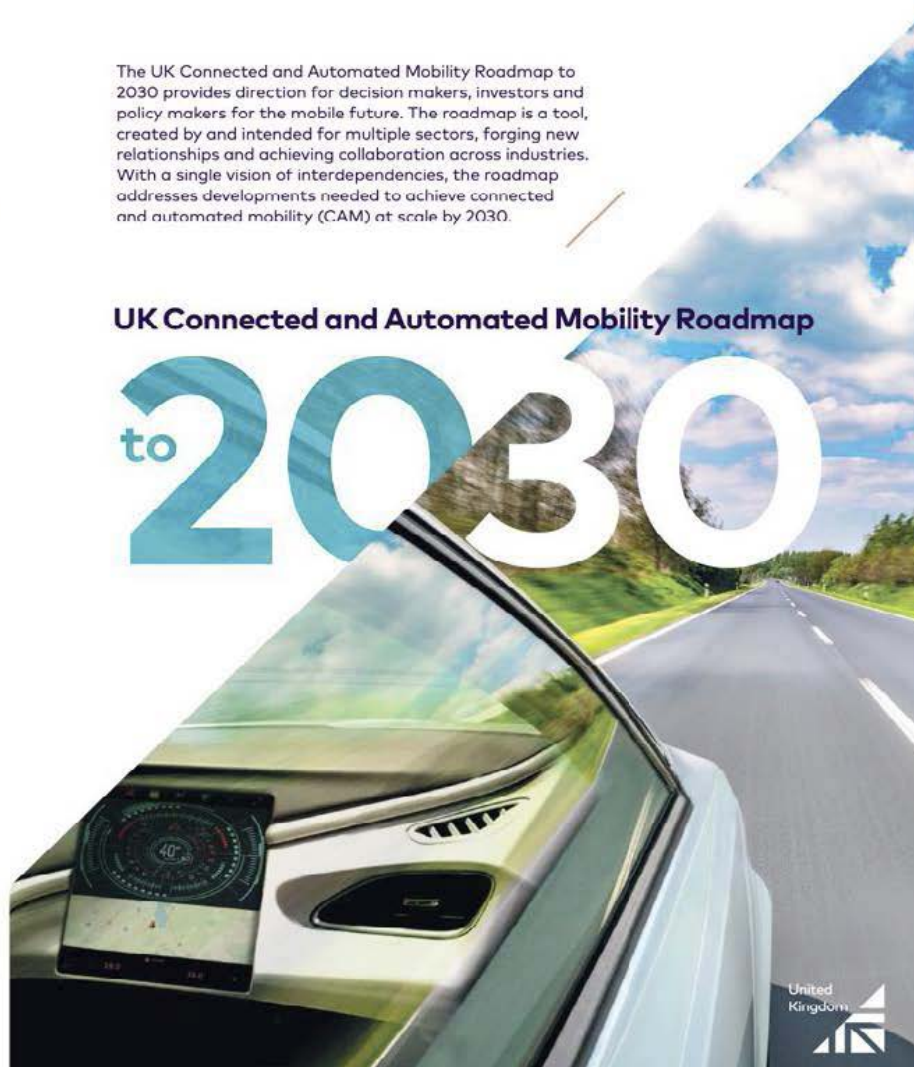


ZENZIC
SELF-DRIVING REVOLUTION

The UK Connected and Automated Mobility Roadmap to 2030 provides direction for decision makers, investors and policy makers for the mobile future. The roadmap is a tool, created by and intended for multiple sectors, forging new relationships and achieving collaboration across industries. With a single vision of interdependencies, the roadmap addresses developments needed to achieve connected and automated mobility (CAM) at scale by 2030.

UK Connected and Automated Mobility Roadmap

to **2030**



United
Kingdom

**Want to find out how the roadmap can
benefit your organisation and CAM projects?**

Download the
roadmap
report at
zenzic.io/roadmap



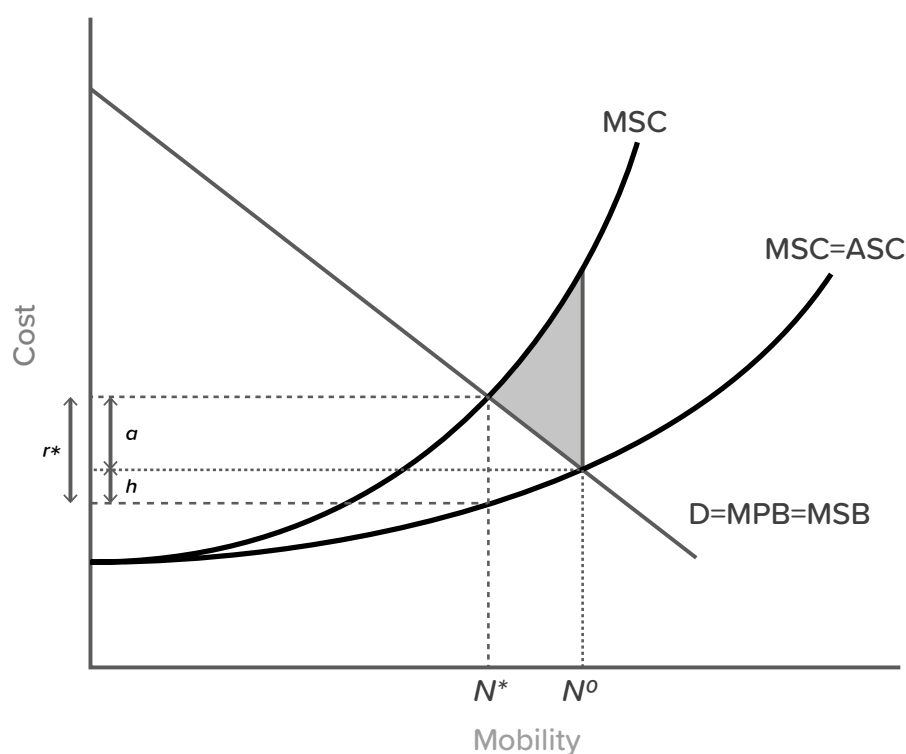
Access the
interactive
roadmap at
zenzic.io/roadmap



Contact the team to book a meeting or workshop and find your route through the roadmap – info@zenzic.io

Zenzic-UK Ltd (147113 09/19)

Appendix B: Pigou's 'Classical' economic principle of Road Pricing



Pigou's economic analysis as presented below is taken from Button and Verhoef.³⁰

"A simple road is assumed with no junctions and uniform lane width. Vehicles are assumed to be identical in terms of their technical characteristics. We are also not concerned with matters such as pollution and safety in this simple framework. In this setting, road users are identical apart from their marginal willingness to pay for a trip, represented by the demand curve $D=MPB=MSB$ (marginal private and social benefits respectively). Due to congestion, marginal social cost (MSC) exceeds marginal private cost (MPC); the latter being equal to average social cost (ASC). The free market equilibrium outcome is N^0 , and the socially optimal road use at N^ . The road price that accomplishes this optimum the Pigouvian charge r^* . This is equal to the marginal external congestion costs ($MSC - MPC$) at the optimum. The welfare gain enjoyed through introducing this charge is given by the shaded area."*

They go on to say that *"... Pigou's insights were extended to regulation of road transport externalities other than congestion. Indeed, ... , economists' answers to market failures in road transport typically still rely heavily on the concept of Pigouvian interventions."*

³⁰ Button, K & Verhoef, E (1998) *Road Pricing, Traffic Congestion and the Environment*.

Appendix C: Some further details on the content of the suggested Welsh Government's "National Policy Framework for RUC in Wales"

- i. **The Welsh Government's policy position** – in favour/against the principle of RUC, and why.
Government may wish to set out how RUC should be developed in line with the Well-being of Future Generations (Wales) Act Goals and Ways of Working and to consider all forms of impacts to maximise cross-cutting benefits. That may lead to a more detailed consideration of how RUC sits relative to other policy matters such as Welsh Government's Air Quality Plan, its Economic Action Plan and Planning Policy Wales etc..
- ii. **An overarching strategy** – Possibly including how national, regional and local schemes should sit and be complementary, or at least not conflicting with RUC. Each geographical and policy area should be considered. Neighbouring local authority issues will require particular attention as they often have both high commute rates and differences in economies/types of settlement. Borders with England, and to a lesser extent Ireland, mean that alignment with national Governments and their agencies are also an important consideration. The link between RUC and motoring taxation is likely to be a key point. It is suggested that Wales should be actively monitoring all changes in UK transport related taxes and duties, not least fuel, and considering how this will shape the future of paying for use of roads. Welsh Government should, if not already, be actively engaged with UK Government on this during the development, and ongoing evaluation, of a RUC Framework.
- iii. **Scheme aims** – Cascading from the overall policy and strategy, the Framework should provide guidance to all highway authorities (including the appropriate Welsh Government Departments) on aims for RUC schemes at a regional or local level, especially under the application of the Well-being Act.
- iv. **Methodology** – The Framework should advise on the matters of the detailed activities necessary to conceive, prepare, consult, evaluate, implement, operate and review typical RUC schemes. Indicating probable programmes for those activities to ensure good practice across all highway authorities, reducing the likelihood of money being wasted developing the wrong schemes, avoiding unnecessary duplication and/or abortive work effort.
- v. **Legislative matters** – Clear guidance on the relevant legislation and how bodies considering RUC should apply it. The framework should include appropriate proposals for legislative changes concerning RUC schemes e.g. legal framework/changes, processes/procedures, enforcement and appeals etc.. Or at least set out a programme for government to take a watching brief to evaluate legislation, arising from feedback from bodies on how varying legislation could be improved or simplified to suit RUC. It is suggested that Government should seek to avoid individual authorities 'reinventing the wheel' or going through unnecessary steps if legislation has not kept pace with, for example, technology.
- vi. **Executive responsibilities** – Welsh Government should set out its intentions regarding its national executive responsibilities concerning motorways and Trunk Roads, and the role of Local Highway Authorities as agents, promoters etc. of RUC. The Framework should set out, under what circumstances the Welsh Government would refuse a Local Authority permission to proceed with RUC. How would that process be handled? Whether and if so how there would be a right to appeal? What engagement is appropriate in advance to avoid that situation? Etc..

- vii. RUC schemes involving more than one highway authority** – It is suggested that whether it be inter-local authority, or local authority and Welsh Government, the Framework should provide clear steers on key cross-border issues and to set out how best to the various agencies should engage throughout **all** the steps of developing, implementing and operating a RUC scheme. Experience is that Cross-boundary matters generally compound all matters and issues.
- viii. Enforcement** – Guidance/requirements on how to manage enforcement, and more importantly how to achieve high levels of compliance to avoid or reduce the need for enforcement. The Framework should also give guidance about the role of the Police and the Courts concerning RUC schemes. Experience suggests that this an essential area for the Framework and Guidance.
- ix. Revenues** - Guidance on the financial status and use of any nett revenues arising from RUC schemes in Wales (including guidance on the assessment of ‘sunk costs’, operating costs, enforcement costs, capital costs etc.).
- x. Investment of Funds** – The Framework should set out Welsh Government’s position on how it would spend revenues raised, and similarly how it would expect other highway authorities to spend revenues from their schemes. This becomes especially important for cross-border schemes. The success of previous schemes has often been credited to clear hypothecation of nett funds to within transport so the road user is confident that they can ‘see and feel’ benefit from their outlay.
- xi. RUC Complementary Measures** – Guidance on what systems or programmes which are considered to best complement implementation of RUC Implementing RUC is, for example an excellent opportunity to break engrained travel habits. Workplace and Personal Travel Planning initiatives can be excellent in assisting people reconsidering their travel arrangements in light of the ‘nudge’ of a forthcoming RUC system. It is suggested that the Framework should provide guidance on these matters.
- xii. Technology** – The Framework could issue guidance/requirements that saves highway authorities repeating the same baseline research by providing information on the systems available for implementing RUC, speeding up scheme development, sharing good practice and aiding consistency.
- xiii. Communications** – Guidance on how to best consult with stakeholders and the public, learning the important lessons from preceding schemes such as those described in this report. Information on appropriate communications strategies to secure and hold public confidence in a scheme. Guidance on how to communicate system implementation and operation. Consideration of how communication should be facilitated with or between neighbouring or partnering highway authorities.
- xiv. Discounts, Exemptions and ‘Season’ Tickets**– Welsh Government should set out the ‘pros’ and ‘cons’ of offering discounts, exemptions and ‘season tickets’. Giving indications of their impacts such as on the RUC system performance and economic activity.
- xv. Freight** – Guidance should be provided to highway authorities considering RUC on how to minimise or avoid negative impacts on freight movements and complement positive impacts, e.g. through designing schemes in parallel with freight strategies that include measures such as regional consolidation centres through to micro-consolidation/last-mile depots.

Appendix D: Some suggested details on the preparation and content of 'Interim Guidance' concerning RUC in Wales.

1. Background and purpose of the 'Interim Guidance' (I.G.) document – an early decision will be required as to whether a consultative draft of the I.G. is desirable before finalising the I.G.. (Dependent on need due to the speed of the development of any RUC schemes, adopting a consultative approach would be more cautious but longer.)
2. Proposed timetable for preparation of the I.G.
3. Guidance on the Welsh Government's:
 - i. policy – in favour/against the principle of RUC, and Why?
 - ii. strategy – National/Regional/Local: interface with UK government and its agencies.
 - iii. legislative proposals, if any, concerning RUC schemes e.g. legal framework/changes, processes/ procedures, enforcement and appeals etc.
 - iv. intentions regarding its national executive responsibilities concerning the Welsh motorways and Trunk Roads, and the roll of LHAs as agents, promoters etc. of RUCs.
 - v. role(s) regarding RUC schemes involving more than one highway authority.
4. Guidance about the role(s) of the Police and the Courts concerning RUC schemes.
5. Guidance to LHAs on the appropriate aims for RUC schemes and how they are seen to relate to the Welsh Government's overall strategy (e.g. transport, economic, sustainability and environmental etc..) and the nature/purpose, content, preparation, consultation, evaluation, implementation, operation and review RUC schemes.
6. Guidance on the preparation of RUC schemes involving more than one local authority or those including Welsh Motorways and/or Welsh Trunk Roads.
7. Guidance on the status and use of any nett revenues (including guidance on the assessment of 'sunk costs', operating costs, enforcement costs, capital costs etc..) arising from RUC schemes in Wales; be they arising from Motorways, Trunk Roads or LHA roads or areas.

Appendix E: Wales Traffic Statistics provided by Welsh Government

Trends in road traffic

Chart 1 shows the long term trend in traffic volume from 1993 to 2018. Over this period traffic volume increased by 33.0%, reaching a peak of 29.4 bvkm in 2018. Traffic volume gradually increased up to 2007, and then fell during the economic downturn. Since 2012 traffic volume has turned upwards once again.

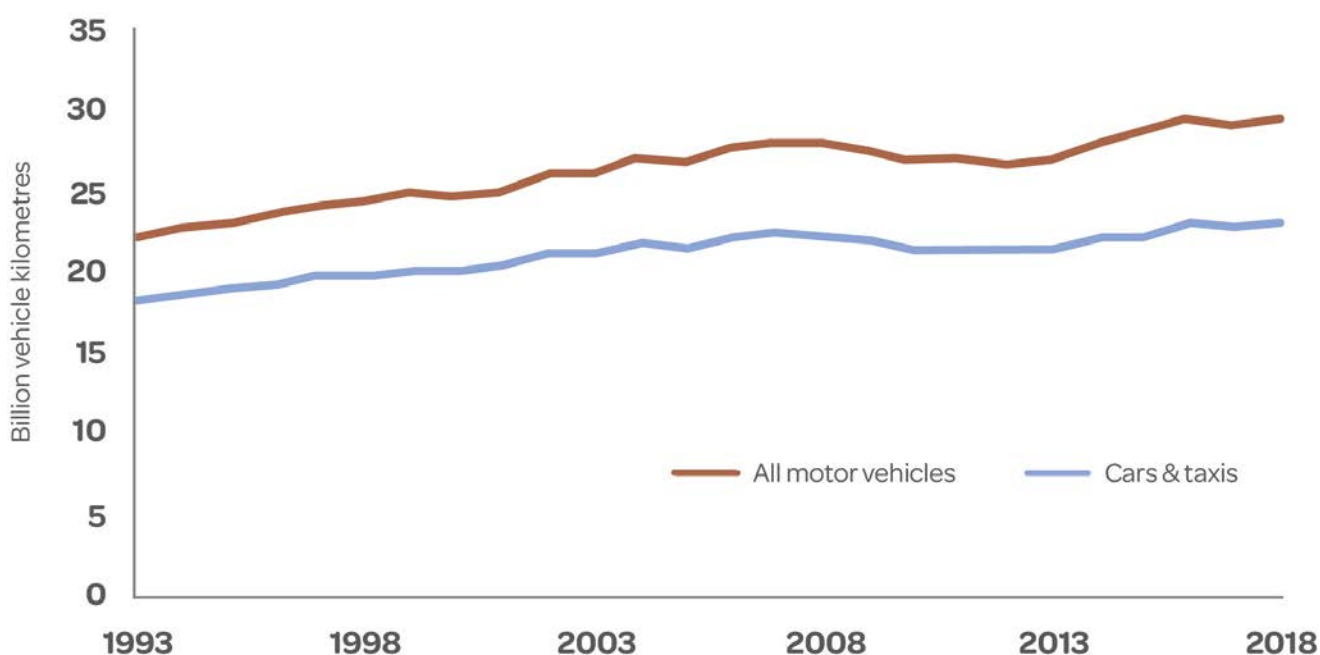


Chart 1: Volume of traffic, 1993 to 2018³¹

There are a variety of factors that have the potential to influence traffic volume. For example, falls in employment levels can reduce commuting traffic; increases in fuel prices might cause motorists to consider shifting to other modes of travel or cutting non-essential trips; increases or decreases in people holidaying within the British Isles, related to the strength or weakness of the pound, can have corresponding impacts on traffic.

³¹ Source: Welsh Government analysis of annual average daily flows (AADF) data.

Volume of road traffic by road classification and years

Traffic by road class

Chart 2 shows that major roads accounted for 66% of total traffic volume in 2018, and minor roads accounted for 34%. This has broadly been the case for the last 25 years, though there has been a larger increase in volume on major roads (up 43.1% since 1993) compared with minor roads (up 16.9%).

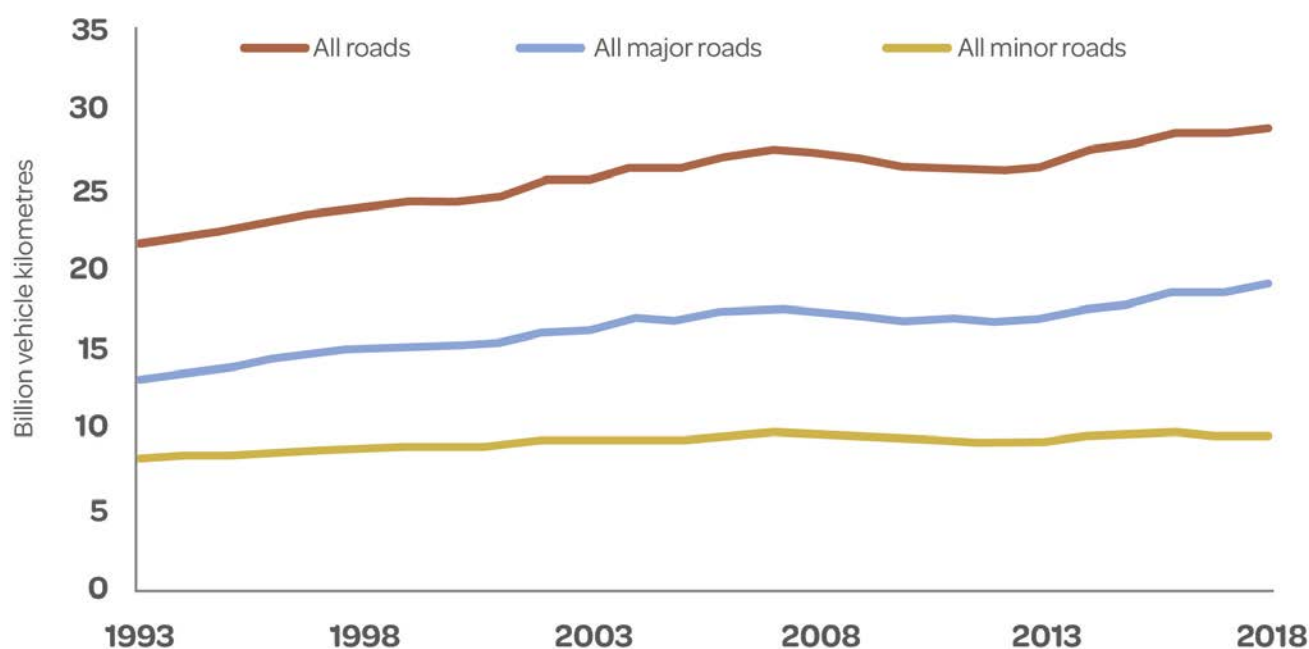


Chart 2: Volume of traffic by main road, 1993 to 2018³²

Major roads are comprised of motorways and A roads (roads intended to provide large-scale transport links within or between areas). 'A' roads are further sub-categorised as 'A trunk' roads (part of the strategic road network owned by and operated on behalf of government) and 'A county' roads (all other A roads). Chart 3 shows trends in traffic volume for the three categories of major roads. A county roads account for more traffic volume than A trunk roads and motorways, though traffic on trunk roads has increased more in recent years. Traffic volume in 2018 increased by 2.4% on A trunk roads, decreased by 0.1% on A county roads and increased by 0.2% on motorways.

32 Source: Welsh Government analysis of annual average daily flows (AADF) data.

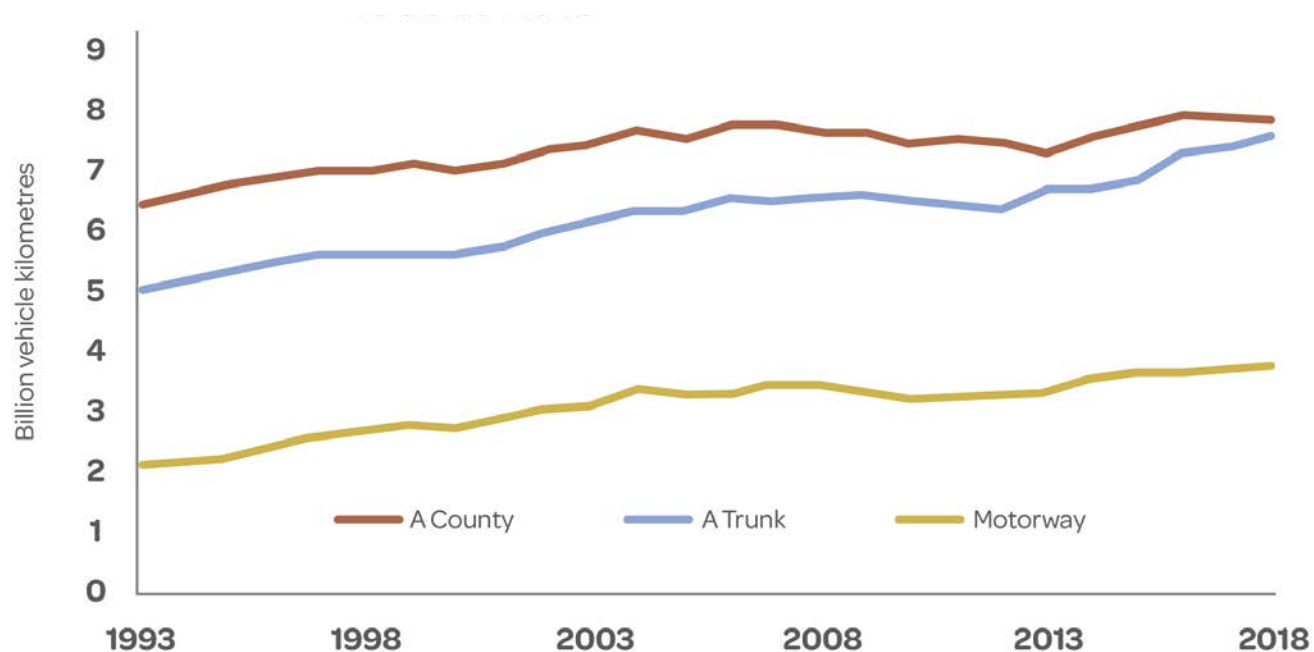


Chart 3: Volume of traffic by categories of major road, 1993 to 2018³³

To help provide context for these figures:

- the length of the motorway in Wales is 135 km
- the length of the trunk road network is 1,576 km
- county roads are 2,773 km in length
- B, C and minor roads total 30,370 km.

Note: The traffic per km of road is far higher on motorways when compared with the other classes of roads.

³³ Source: Welsh Government analysis of annual average daily flows (AADF) data.

Appendix F: Summary of Wolfson Economic Prize Winning Essay, 2017

Gergely Raccuja – His big idea = ‘Miles Better: simple and fair charging’³⁴

“The lighter and cleaner your vehicle is, the lower the per mile charge.

The total amount of tax collected from motorists will be the same as at present, with individuals paying in proportion to the distance they drive each year.

The charge will be collected by insurers who already manage all data necessary for calculating the charge. When a driver pays their insurance, they’ll also pay their ‘road bill’, thus avoiding issues of privacy and reducing administration costs.

The scheme won’t be vulnerable to political interference: the Office of Rail and Road will set the base charge, decide changes to it and ensures a fair proportion of the proceeds are ring-fenced for spending on both local and national highways.

The Treasury wins too. With both the number of vehicles on the road and total vehicle mileage projected to grow, government revenue will rise over time. This will stop and reverse the £2.3m, which the government is currently losing every day in decreasing fuel duty revenues. Gergely proposes scrapping the two main existing taxes on road use, VED and fuel duty, and replacing them with a fairer system that charges people depending on the distance they drive each year and the type of vehicle they own. To keep things simple, and avoid the privacy and technical complications of road pricing, the new tax will be collected through car insurance companies. Overall, drivers would not pay more – meaning many people would gain – and as road use increases there would be more money available for investment, including a guarantee that some of the money would be spent on local roads in the taxpayer’s area. As new vehicle technology becomes commonplace, the system could adapt.”

Gergely Raccuja - winner of the first Wolfson Economic Prize in 2017

³⁴ Raccuja, G. (2017) *Paying for Road Use Could Be Miles Better*.