



Sir Humphrey If you want to be really sure that the Minister doesn't accept it, you must say the decision is "courageous"

Bernard And that's worse than "controversial"?

Sir Humphrey Oh, yes! "Controversial" only means "this will lose you votes". "Courageous" means "this will lose you the election!"

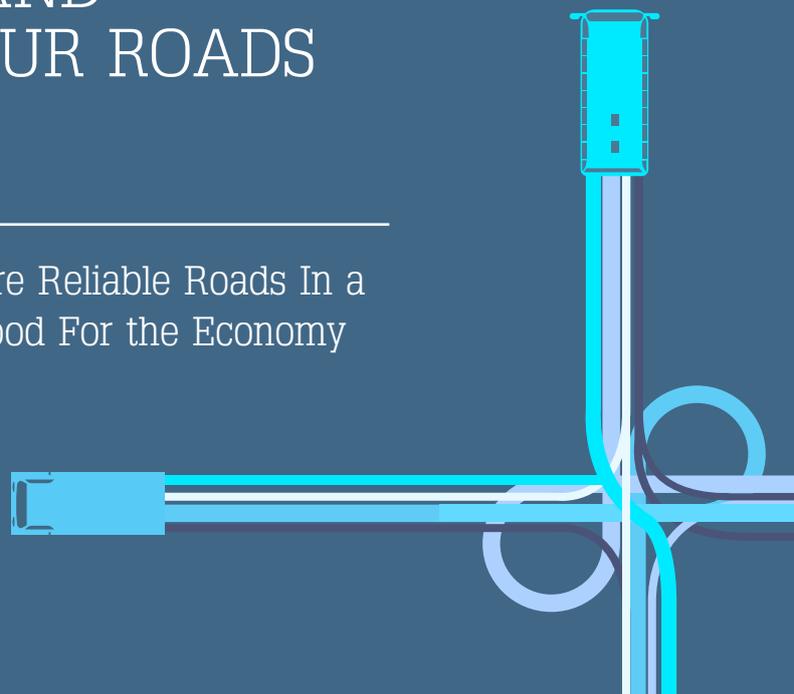


# A COURAGEOUS DECISION

## CUSTOMER-LED DEMAND MANAGEMENT FOR OUR ROADS

2017 Wolfson Economics Prize Submission  
Jamye Harrison & Russell King

How Can We Pay For Better, Safer, More Reliable Roads In a Way That is Fair To Road Users and Good For the Economy and the Environment?



WOLFSON  
**ECONOMICS PRIZE**  
———— MMXVII ————

A COURAGEOUS DECISION  
CUSTOMER-LED DEMAND MANAGEMENT  
FOR OUR ROADS



## Jamye Harrison & Russell King

### Customer-Led Demand Management

Jamye Harrison has over 20 years of experience in strategy, design and delivery spanning customer experience, technology and business architecture. He is a former Partner with Deloitte in Australia where he led the firm's national Transport practice. As Co-Founder of Clearways, Jamye is passionate about addressing traffic congestion along with integrating our roads with broader transport networks – ultimately enabling people and goods to move easily through cities and regions. Jamye is an Adjunct Professor at the University of NSW in the Faculty of Engineering's Research Centre for Integrated Transport Innovation and Chair of the Transport Taskforce at the Committee for Sydney - an independent policy think tank.

Russell King's experience spans policy development, strategic planning and program delivery in transport, education and financial services. For more than 20 years Russell has pursued a passion for economic and social policy reform, most recently in Sydney as Policy Director for the NSW Minister for Transport & Infrastructure. As a Cabinet Member for Strategic Planning & Transport at Wandsworth Borough Council, he led significant policy innovation and service delivery reforms in inner London.

The Wolfson Economic Prize invites entrants from around the world and all sorts of backgrounds to propose original, well-argued and informed solutions to big national challenges. The aim is to bring forward fresh thinking to help people, governments and businesses develop practical policies.

This year the prize addresses an issue at the heart of every country's economic future: road infrastructure, and

how can we pay for better, safer, more reliable roads in a way that is fair to road users and good for the economy and the environment?

The way cars are powered, driven and owned is being revolutionised. Soon a world of cleaner, automated vehicles will arrive and old annual charges and petrol taxes will no longer work. A new kind of driving will take a new kind of road and a new kind of funding – ideas needed not just in Britain but around the world.

The five shortlisted submissions – of which this is one – show that it is possible to come up with potential answers that can help road users, improve safety, protect the environment, and support our economy.

## Prize Team



SIR JOHN KINGMAN

Chairman of the  
Judging Panel



BRIDGET ROSEWELL  
OBE

Judge



LORD DARLING

Judge



LORD WOLFSON

Founder



ISABEL DEDRING

Judge



JULIAN GLOVER  
OBE

Prize Director



LORD FINKELSTEIN

Judge

## What Happens Next

Shortlisted entrants will be offered the chance to submit a revised and expanded submission. Shortlisted entrants are free at this stage to join up with others to help develop their proposals, including entrants whose submissions were not shortlisted.

These finalists will be given until June 2017 to expand their submissions before the Judges consider the winner. All shortlisted entrants who provide expanded submissions will receive £10,000. The winning entry, designated by the judges, will receive £250,000 in total. The Judges expect to announce the winner in July 2017.

The Judges also have the discretion to award further smaller prizes to recognise entrants whose submissions address aspects of the Prize Question in innovative, creative or otherwise outstanding ways, in particular giving weight to the use of technology. The winners of any such awards may not comprise a full entry for the £250,000 prize.

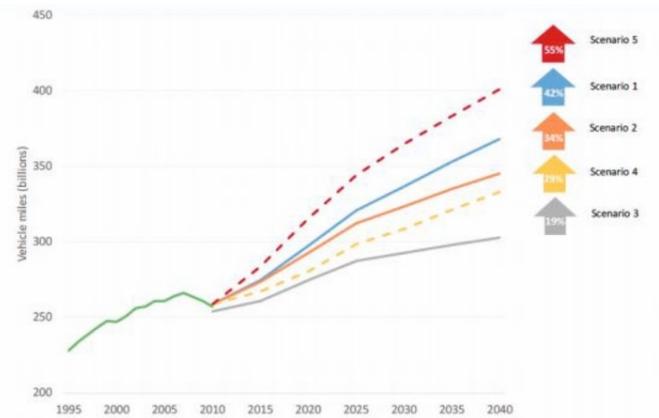
[The Judges' decision is final.](#)

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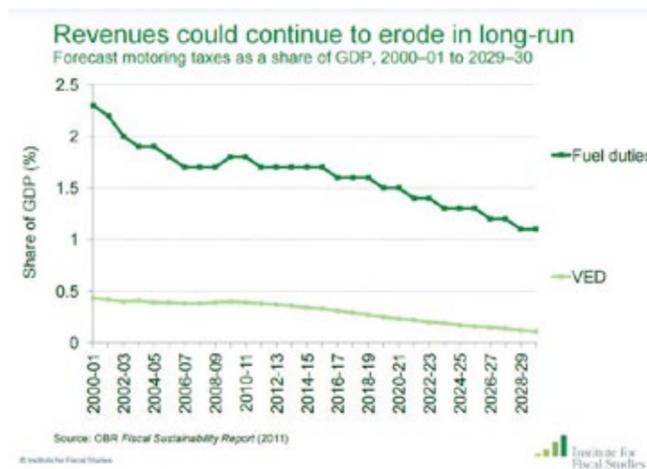
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# The burning platform

Congestion is expected to get worse as a result of ever growing demand for road space, from population growth, internet deliveries, autonomous vehicles, and other trends.



At the same time, as a result of more fuel efficient vehicles, the switch to electric vehicles and political resistance to increasing fuel taxes, governments will see a continuing fall in their revenues used to fund roads.



The impacts of congestion are pernicious and often underestimated. Impacts include:

- Increased vehicle emissions.
- Increased demand for new roads and road upgrades, destroying green space.
- Reduced economic productivity.
- Increased rates of road accidents.

Innovative (courageous) policy reform is required to fix these problems.

# Policy reform barriers

The policy answer - Pay As You Drive (PAYD) road usage - has been known for 50 + years. However, there have been many barriers to implementation.

In particular, a successful political pathway has never been found.

 <p><b>Roads are free</b> People perceive roads to be free</p>	 <p><b>Winners and losers</b> Pricing roads would likely produce winners but also a significant number of losers.</p>	 <p><b>Privacy</b> Privacy concerns about government tracking vehicle location.</p>
 <p><b>Fairness</b> Road pricing would disproportionately hit people from lower socioeconomic groups.</p>	 <p><b>Clunky technology</b> Fixed infrastructure has traditionally been needed to track road usage.</p>	 <p><b>Implementation</b> The capabilities needed to rollout a broad-based PAYD scheme have not been readily accessible.</p>

These barriers need to be overcome if we are to successfully implement a PAYD road usage scheme. Some of these barriers are falling away due to improved technology and changing social norms around privacy. However, to date, governments have proven themselves to be poorly placed to develop a solution to remove all of these barriers and implement a successful scheme.

# A customer-led solution

Looking at PAYD road usage from a customer perspective means that we need to think about it as a new product. This means that it needs to be feasible, desirable and viable. To meet this need our solution has five elements, outlined below.

- 1** Opt-in  
Empower consumers by allowing them to voluntarily opt-out of paying for fuel excise and opt in to a PAYD road usage system.
- 2** Leverage trusted retail brands  
Harness the capabilities of trusted consumer brands to educate customers about fuel excise and sign them up to the PAYD road usage scheme
- 3** Compelling customer proposition  
A PAYD product that is attractive to customers, with embedded and optional services that deliver travel insights and convenience.
- 4** Mandate Electric Vehicles  
Address fairness issues and deliver a fiscally neutral scheme by mandating Electric Vehicles to adopt PAYD road usage.
- 5** Phased market entry  
Adopt private sector market entry methods for a successful implementation.

# Compelling customer proposition

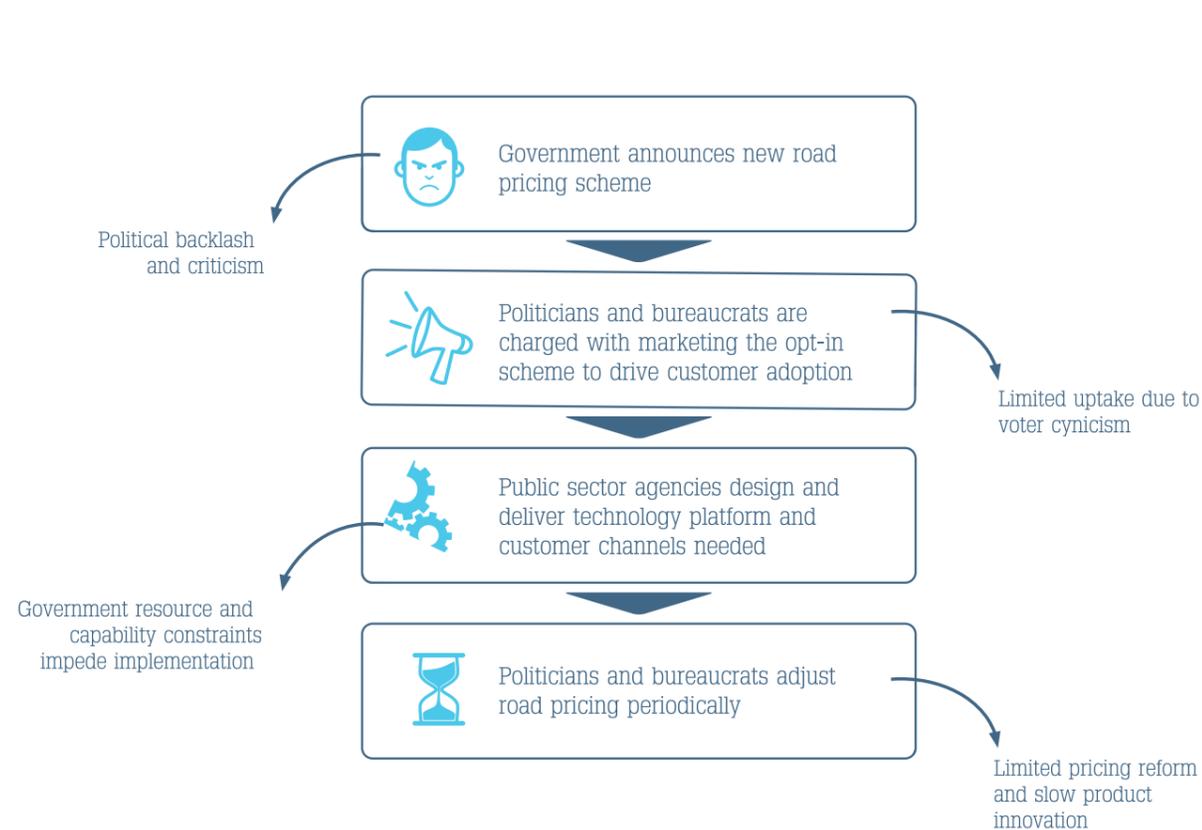
Our customer proposition means that it is easy for customers to sign-up to the scheme, easy to use, delivers a better mobility experience, delivers financial savings and opens access to great new products



# Government driven policy reform and market entry is not the answer

Proposed Pay As You Drive (PAYD) road usage schemes have typically envisaged a government designed, promoted and administered scheme.

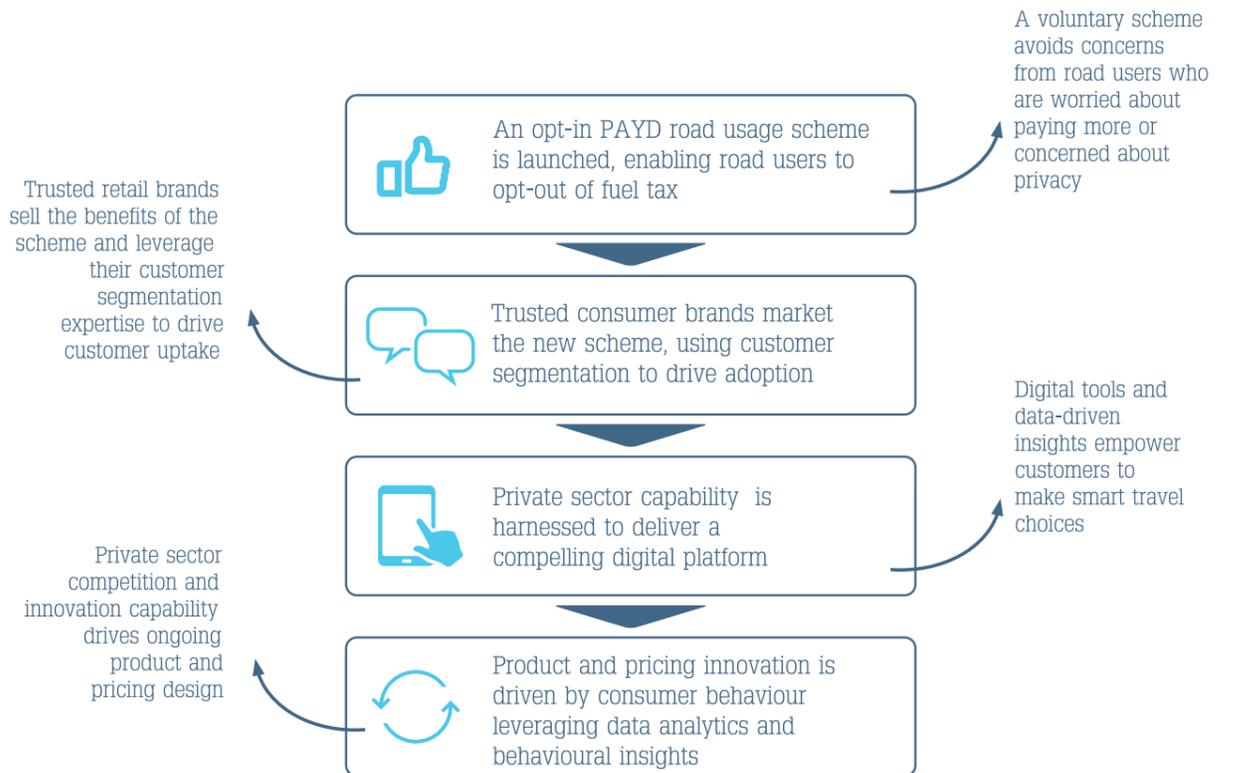
Traditional government led policy reform has not worked in this area because the capabilities required do not play to governments' strengths.



A government led approach will not result in a successful scheme because of a lack of trust in government, a lack of expertise in marketing and designing consumer products that dynamically respond to changing customer needs.

# Customer-centric policy reform is the solution

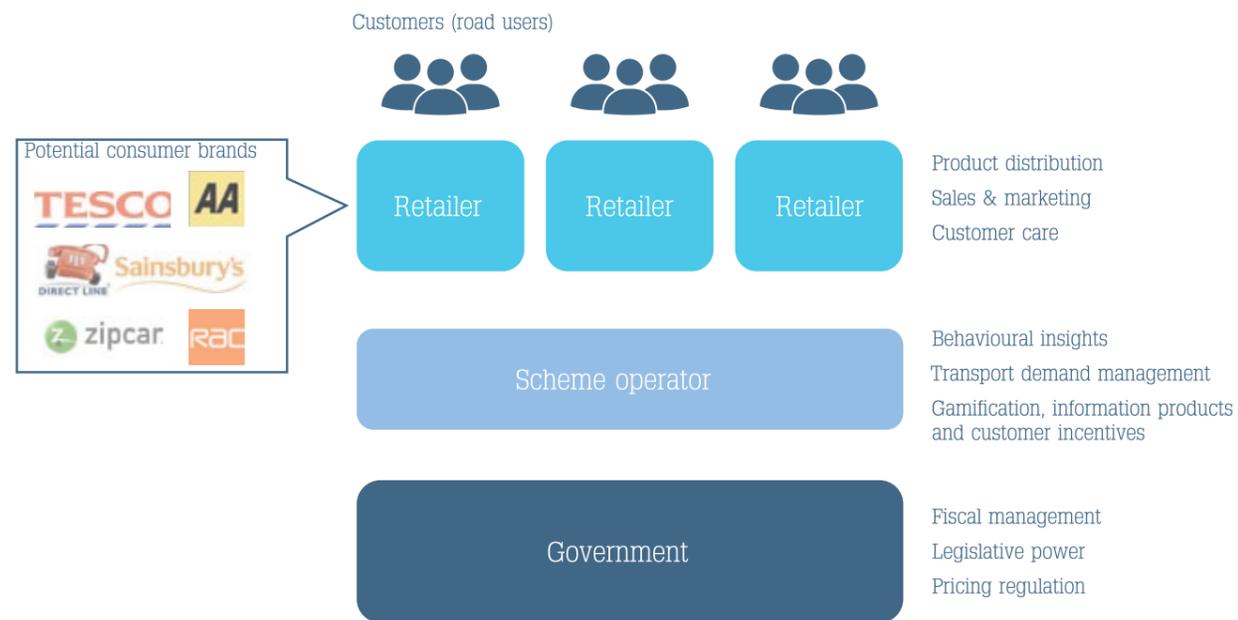
Our solution pulls together a number of innovations in order to produce a customer-led PAYD road usage scheme.



Customer segmentation, marketing and mass customisation are inherent strengths of the retail sector. Coupled with appropriate commercial returns and transport demand management expertise, a PAYD road usage scheme can be launched and marketed successfully to a broad customer base.

# Playing to your strengths

A partnership between Government, a PAYD scheme operator and retailers allows each party to bring its strengths to the table for a successful scheme.

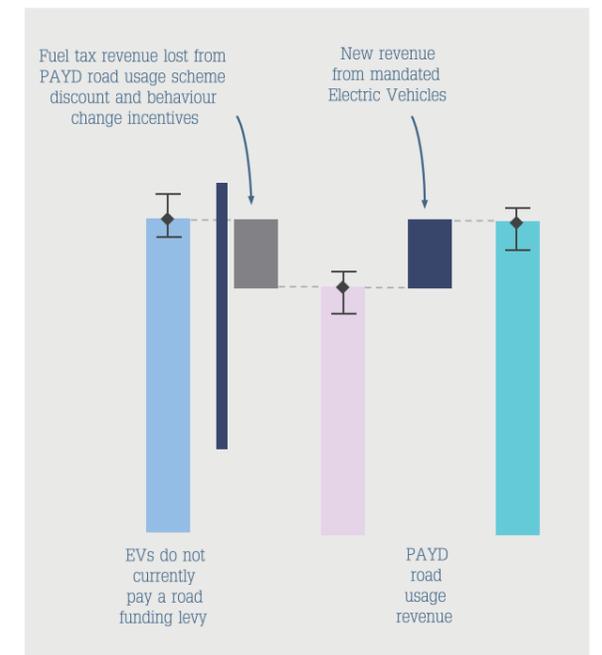
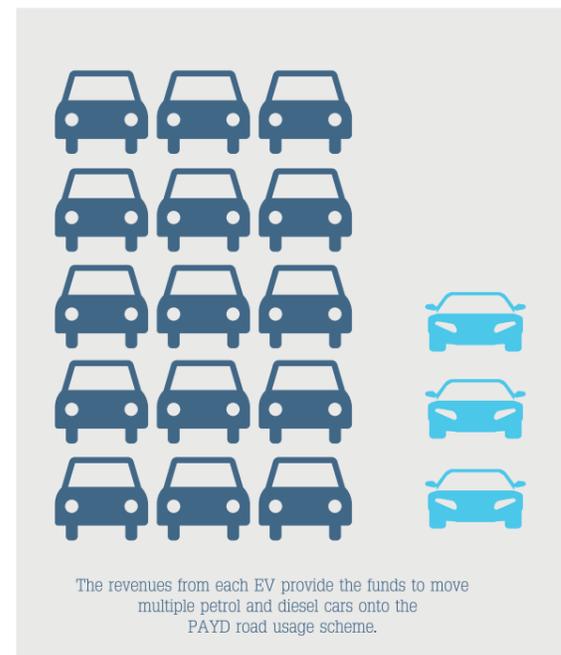
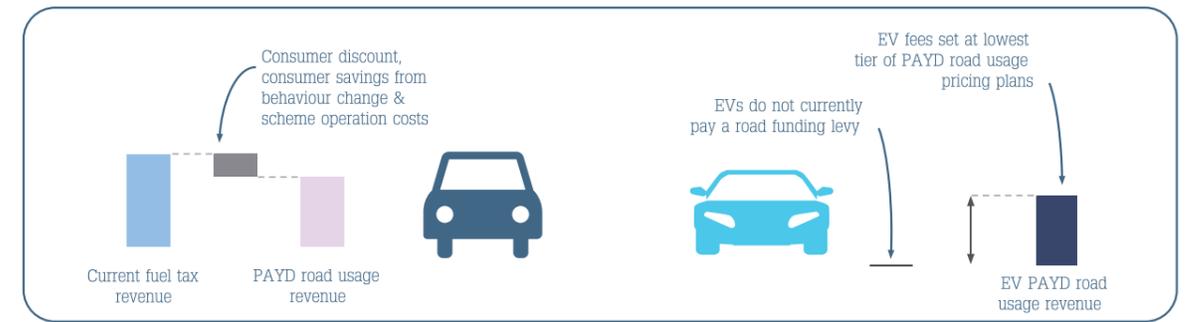


In this model, governments commission an operator with the objectives of running the scheme, driving customer uptake and applying demand management techniques to achieve desirable behaviour change and reduce congestion. The scheme operator partners with trusted brands to retail the PAYD product, market the product and provide customer support.

An approach that exploits the respective strengths and capabilities of both the public sector and the private sector can deliver a scheme that removes the barriers to PAYD road usage adoption.

# Fiscal responsibility

A PAYD road usage scheme needs to be fiscally responsible as well as delivering a compelling customer proposition. In our scheme, governments use the revenues from mandating electric vehicles to subsidise petrol and diesel vehicles to move to our scheme without a negative fiscal impact.



Governments can also increase take up of the scheme by moving funding from building new roads (increasing supply) to the PAYD road usage scheme (reducing demand).

# A comprehensive approach

Demand management and sustainable funding, in the form of Pay-As-You-Drive road usage, can be launched without undue political risk - which has been widely recognised for decades as the primary barrier to entry.

Governments the world over continue to face an uphill battle in addressing the social and economic impact of congestion. This is largely because governments are

fighting congestion without a complete toolkit - their arsenal largely consists of supply-side measures. Build more roads or invest in more public transport - or do both.

Our proposal provides a comprehensive solution to the Wolfson Economics Prize challenge, in addition to addressing the traditional policy reform barriers in this area, as outlined in the table below.

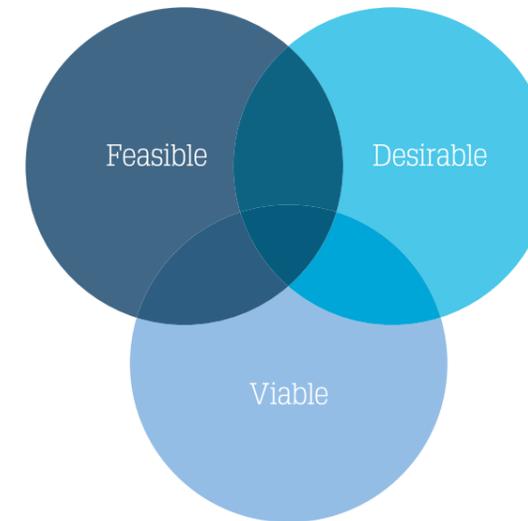
	<i>Perception that roads are free</i>	<i>Potential for winners &amp; losers</i>	<i>Concerned about privacy</i>	<i>Fairness</i>	<i>Clunky technology</i>	<i>Poor implementation capability</i>
Opt-in approach	Core	Core	Core	Core		
Leverage trusted retail brands	Enabler	Core	Core	Enabler	Core	Core
Compelling customer proposition	Enabler		Core		Core	Core
Mandating Electric Vehicles	Core	Enabler	Core	Enabler		
Phased market entry	Enabler	Core	Core	Core		Enabler

# Customer-led reform must meet three objectives

Economists, traffic engineers, politicians and bureaucrats - globally - have proposed, researched, studied and advocated for road pricing for well over 100 years. What is needed is for this body of knowledge to be applied in the real world.

To do this in any meaningful way, it is essential that any road pricing scheme:

- is able to be implemented in the real world (it is feasible)
- meets the needs - and wants - of customers (it is desirable)
- can be afforded by government, customers and society-at-large (it is viable)



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- meets the needs - and wants - of customers (it is desirable)
- can be afforded by government, customers and society-at-large (it is viable)

# The time is now

We have a unique window of opportunity to adopt the PAYD road usage scheme and embedded demand management mechanisms we have described here. Technology innovation is already delivering significant disruption to transport systems, the advent of autonomous vehicles, shared ownership and electric vehicles will deliver even greater disruption including to government road funding models. Put together, this is creating a burning platform for road reform in the form of demand management.

“Maybe part of the problem has been the emphasis on models. When the intellectual focus is on capturing the universe in a model and solving for optimality, the intellectuals tend to neglect many practical human and institutional arguments that ought to weigh heavily in a judgment between alternative arrangements.”

Robin Lindsey, 2006

For these reasons - and more - now is the time to move road pricing and active demand management from the realm of theory to customer-led adoption. Not only does this help to complete the toolkit of government in tackling congestion and future funding for our roads - it enables our roads to be properly integrated into the innovation taking place across the mobility spectrum including mass transit and on demand transport services.

“However, overcoming the political implementation problems is much more difficult. If they cannot be overcome, then electronic road pricing may forever sit unused on the economist’s shelf.”

Sandford Borins, 1988

# A Courageous Decision Customer-led demand management for our roads

## Introduction

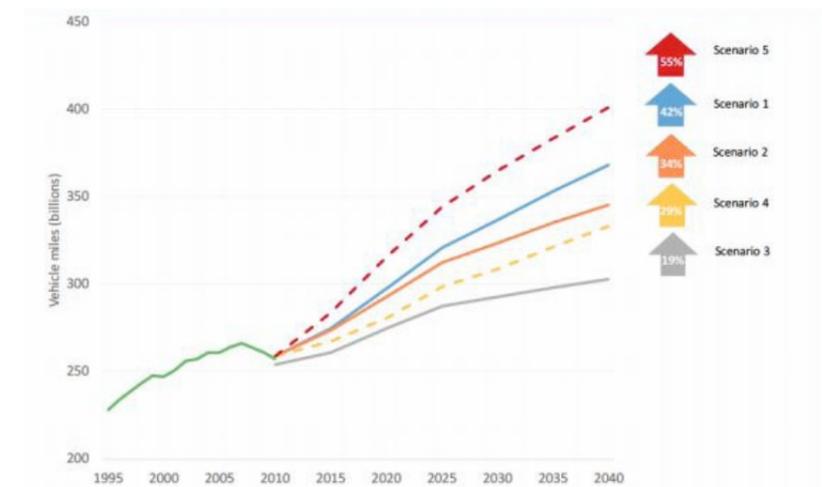
The answer to the question as to how we can pay for better, safer, more reliable roads in a way that is fair to road users and good for the economy and the environment has been known for decades - network-wide Pay As You Drive (PAYD) road usage.

To date, the barriers to a network wide PAYD road usage scheme have been significant, not least the political

obstacles. These can now be overcome.

In addition, we can be much more effective through the use of big data and behavioural science to amplify the effect of price signalling in order to manage demand for our roads.

Congestion is expected to get worse as a result of ever growing demand for road space, from population growth, internet deliveries, autonomous vehicles, etc.



This figure from the UK Government in 2015 shows congestion getting worse in all the scenarios they envisaged.

The impacts of congestion are pernicious and often underestimated. Impacts include:

- Increased vehicle emissions.
- Increased demand for new roads and road upgrades, destroying green space.
- Reduced economic productivity.
- Increased rates of road accidents.

Congestion is bad for the environment, bad for the economy, bad for people's health and liveability.

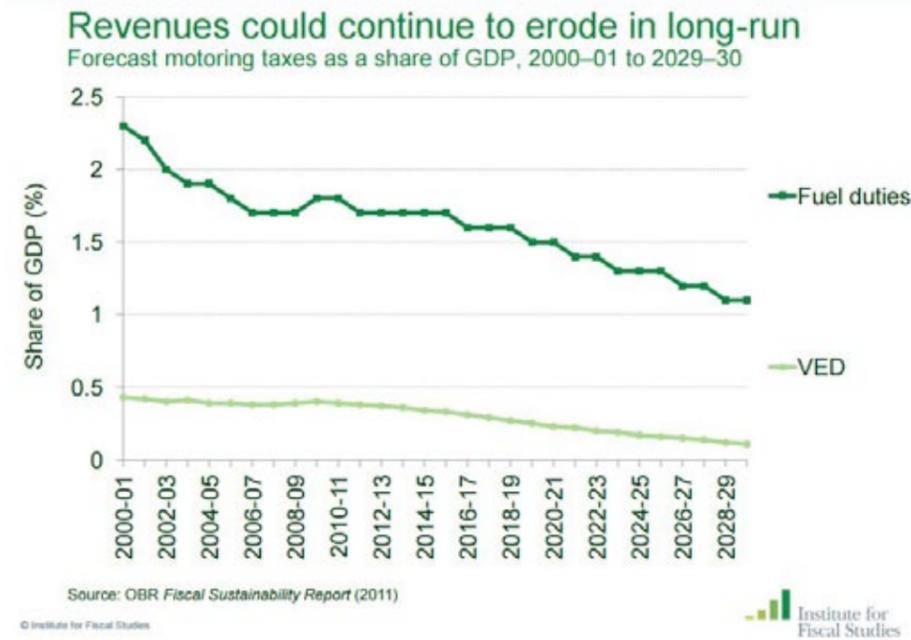
Whilst congestion is forecast to get worse, the way that we predominantly

pay for roads through fuel taxes needs to change. Across the world, the major

funding mechanism for roads is through fuel taxes. As a result of more fuel

efficient vehicles, the switch to electric vehicles and political resistance to

increasing fuel taxes, governments will see a continuing fall in their revenues used to fund roads.



This graph from the Institute Fiscal Studies in 2011, shows fuel duties falling throughout the 2020s.

The traditional approach to PAYD road usage has always assumed a government led and operated scheme. This approach is fraught with political risk and consequently, politicians around the world have avoided this 'courageous' policy. It is time

This proposal will address the current barriers to introducing a PAYD road usage scheme, and introduce our customer-led solution for overcoming these barriers, the benefits of our approach and details on how the scheme would work with consideration of the risks involved.

### The barriers

In order to develop a customer-led approach to introduce PAYD road usage, we need to consider the barriers that have traditionally existed to adopting a suitable scheme. The barriers have included:

- The technology to implement the scheme has been expensive and visually intrusive requiring significant roadside infrastructure.
- Drivers and civil liberties groups have been concerned with the invasions of privacy involved in tracking vehicle location.
- Any mandated change of funding system that is broadly revenue neutral would have a significant number of losers. This makes it difficult to gain widespread community acceptance.
- People perceive roads to be free. Large sections of the community do not realise they are paying for them through fuel taxes and so are suspicious of any politician 'selling' the benefits of an alternative payment system.
- People are concerned that a PAYD road usage system will disproportionately hit lower socioeconomic groups.



Road Pricing infrastructure has traditionally been expensive and visually intrusive.

- The capabilities for successfully implementing a PAYD road usage scheme have not existed either within governments or the private sector.

Any proposed solution for successfully implementing a PAYD road usage scheme needs to tackle all of these barriers.

## A customer-led solution

Looking at PAYD road usage from a customer perspective means that we need to think about it as a new product. This means that it needs to be feasible, desirable and viable. All three aspects need to be in place to make this work.

Our solution has five parts:

- An opt-in approach.
- Leverage trusted retail brands.
- A compelling consumer proposition.
- Mandating Electric Vehicles (EVs).
- A phased market entry.

### An opt-in approach

The first part of our solution is to empower consumers by allowing them to voluntarily opt-out of paying for fuel excise and opt-in to a PAYD road usage system.

By making the change voluntary, many of the barriers to adoption fall away as people are not forced to change to a new system. Drivers who are concerned with privacy or paying more to drive, simply do not move from the existing system.

### Leverage trusted retail brands

The second part of our solution is to harness the capabilities of trusted consumer brands to educate customers about fuel excise and sign them up to the PAYD road usage scheme. Rather than governments and politicians attempting to sell a PAYD system, we will use trusted brands who have established the credibility and capability to market to millions of customers.

We will use consumer brands that have parallel products or services that could be naturally bundled alongside a PAYD road usage scheme, such as PAYD insurance, PAYD roadside assistance and in-car infotainment.

Brands could include motorist organisations such as the AA or RAC, major retailers such as Tesco or Sainsburys and telecommunications companies such as Vodafone or BT.

### A compelling consumer proposition

In order for people to opt-in to a PAYD road usage program, it is essential to create a compelling customer proposition. Our scheme has six parts:

- Financial savings.
- A seamless fuel tax rebate.
- Pricing plans designed for customers.
- Companion products.
- Seamless customer experience.
- Rewards for smart travel choices.

### Financial savings

There are two parts to the financial savings aspect of the customer proposition. Firstly, we will guarantee that no-one who opts-in to the scheme pays more than they would if they had remained paying fuel excise. Secondly, people will be able to make significant savings if they are able to change their driving behaviours in a desirable way through retiming, remodeing, rerouting or reducing their travel.

### A fuel tax rebate

Customers will automatically get their fuel tax rebated when they pay at the petrol station. This will give them a feel good factor when they fill up and save 57.95p per litre, dramatically reducing their bill.

### Pricing plans designed for customers

Customers will be able to choose from a range of pricing plans that enables

them to pick one that suits them. For example, someone who mainly drives at weekends will be able to pick a different plan from someone who mainly drives at peak times during the week.

#### Companion products

Customers will be able to take advantage of the other products that the technology that delivers a PAYD road usage scheme also enables. For example, customers could purchase PAYD car insurance and potentially make significant financial savings with companion bundles.

#### Seamless customer experience

The entire customer experience from signing up to the scheme through their choice of channel to receiving timely information on their road usage and incentives for making smart travel choices needs to be seamless, enabled by technology. For example, we will use OBD dongles (see technology section) with built-in GPS and SIM cards that are easy to install.

#### Rewards for smart travel choices

The final part of our customer proposition is a points based rewards scheme that provides additional incentives to make smart travel choices such as remodeling.

Taken together, these six elements produce a compelling consumer proposition.



Electric vehicles need to be mandated to use a PAYD road usage scheme.

#### Mandating Electric Vehicles

On its own, a voluntary system will not get us to the long term goal of moving everyone to a PAYD road usage scheme. In addition, in our scheme, per vehicle, governments will lose revenue compared to what they would have received under the existing fuel excise regime. This financial hole needs to be filled.

We address both of these issues by mandating that EVs have to sign up to a PAYD road usage scheme. By making the scheme mandatory for EVs, as take up of EVs increases we will automatically enroll an increasing proportion of the vehicle fleet into a PAYD road usage scheme.

This approach comes with some political risks, however, these can be managed because:

- EVs currently make up only a small amount of the fleet (less than 2% in the UK). Therefore, the numbers of people who will be impacted are small.
- Evidence is showing that the low operating costs of EVs is increasing vehicle miles travelled. This will increase congestion if nothing is done.
- There is an inherent unfairness with EVs in that they use the roads but do not pay for them.
- Currently EV owners are disproportionately from higher socio-economic groups and so putting a new charge on them is unlikely to gain wider community sympathy.
- The new revenues generated from mandating road pricing for EVs can be used to reduce the high upfront cost of

EVs. Lowering the purchase

- price of EVs can be used to remove any disincentive from mandating the PAYD road user scheme and encourage further take up of EVs.

As well as EVs, there are other parts of the vehicle market where mandating moving to a PAYD road usage scheme would be desirable and have a low political risk:

- The founder of Zipcar has a public position supporting the move to road pricing. Therefore, car clubs could be considered as a segment to be mandated.

- Shared fully autonomous vehicles are just a few years away. These would be an obvious choice for a mandated PAYD road usage scheme due to the charges being one step removed from consumers.

In order for any scheme to be adopted, it needs to be fiscally responsible, providing an increase in revenues to offset any losses. We can deliver this in a number of ways:

- Mandating PAYD road usage for EVs generates additional revenues to offset losses from other drivers.
- Governments can consider whether to move existing expenditure from building new roads (increasing supply) to moving people onto a PAYD road usage scheme (reducing demand).
- In the longer term, wider economic benefits from reduced congestion and the increase in tax revenues from faster economic growth will generate additional government revenues and potentially reduce public expenditure in other areas (e.g. Health) into the future.
- In the medium term, the reduction in the need for government expenditure on new roads and road upgrades as a result of less congestion will reduce government expenditures.

The financial section below provides further detail of how we deliver a fiscally responsible solution.

### A phased market entry

The final part of our solution is a phased market entry. Implementing a PAYD road usage scheme successfully requires a proper market entry strategy. For our product, adoption needs to happen in a phased way.



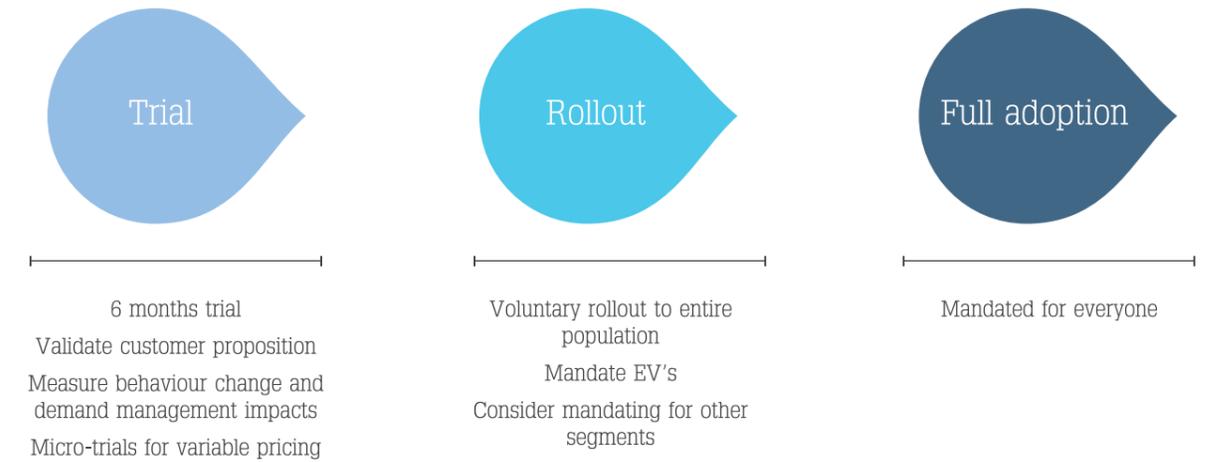
Car clubs should be considered for mandating to use a PAYD road usage scheme.

We have three phases:

Phase 1 - A trial

Phase 2 - Full voluntary rollout and mandatory PAYD road usage for EVs

Phase 3 - Full adoption - Mandatory PAYD road usage for all vehicles



A phased approach is required to get to full adoption of PAYD road usage.

Phase 1 - A Trial

In the first phase, the government gives permission for a PAYD scheme operator to run a trial (around 50,000 cars) for six months empowering people to voluntarily opt-out of fuel excise and opt-in to a PAYD road usage scheme.

A trial approach allows the government and the operator to manage risks and validate assumptions so that an informed decision can be made about the full implementation of a PAYD road usage scheme.

Phase 2 - Full voluntary rollout and mandatory PAYD road usage for EVs

Following a successful trial, the government will tender for a PAYD scheme operator to run a national PAYD scheme. A successful trial would ensure that at least one bidder was able to provide this service to the government. In addition to the voluntary rollout, the government would mandate that all EVs have to use the PAYD road usage scheme. The government can also consider whether to make it mandatory for other vehicle segments to also make the switch to PAYD road usage.

As part of this phase, governments may also consider whether to move other vehicle taxes (e.g. road tax) to a PAYD approach, thereby increasing the price signals that encourage desirable behaviour change.

During phase 2, an increasing proportion of road vehicles will be on a PAYD system with delivering ongoing reductions to congestion.

### Phase 3 - Full adoption - Mandatory PAYD road usage for all vehicles

Once the vast majority of consumers has switched to a PAYD road usage system, the government can consider mandating it for all vehicles as the politics become more favourable.

The five aspects of our customer-led approach: opt-in, retail brands, compelling consumer proposition, mandating EVs and a phased market entry combine to remove all of the barriers that have prevented the adoption of PAYD road usage to date.

The opt-in aspect reduces concerns over issues of privacy (see below for more detail) and fear of paying more. The retail brands combined with the scheme operator provide the expertise and trust to be able to sell the product to consumers. The customer proposition makes it attractive to opt-in and the associated technology removes the need for costly infrastructure. Mandating EVs gives financial sustainability to the scheme and a long term path to universal adoption whilst the phased market approach minimises risks and validates assumptions.

## The benefits of our scheme

Our scheme delivers a number of benefits:

- Reduced congestion
- Financial sustainability
- Improved environment
- Improved road safety
- Improved equity and fairness
- Economic benefits

## Reduced congestion

A key benefit of our scheme is its ability to significantly reduce congestion. In order to achieve this, it is not enough to simply sign people up to the scheme, they also need to change their behaviour in a way that causes less congestion. The scheme will produce behaviour change in a number of ways:

- Through pricing plans that incentivise not driving in the peak.
- Partnering with transport authorities to provide incentives for taking public transport, e.g. discounted fares.
- Using a points based reward system which provides additional points/ incentives for not driving in the peak and driving safely.
- Working with transport providers to provide alternative congestion friendly options such as on demand transport, new bus routes or pooling options.
- Sending out pro-active messages to customers providing them with information which may improve their journey such as better routes, better times or alternative modes.
- Reducing barriers to alternative, congestion friendly options. For example, some jurisdictions have begun offering a fixed number of free taxi/rideshare trips a year for parents who are worried about the need to be able to quickly pick up their children from school if they are sick.

These approaches will be refined during the trial phase in order to maximise behaviour change in the most cost effective way.

## Financial sustainability

Fuel excise revenues are projected to fall as more efficient vehicles and EVs make up an increasing proportion of the vehicle fleet. This has the advantage of creating a need for national treasuries to move away from the existing tax system. However, treasuries will be keen to replace as much of the lost revenue as possible, especially given the current fiscal climate and so will need to be convinced that any alternative is able to achieve financial sustainability.

Fortunately, our scheme is designed to be broadly revenue neutral and replace lost fuel excise revenues as they occur.

In order to understand the financials, it is important to understand the costs of running the scheme. There are two main costs:

- The financial incentives given to consumers. This is the money that consumers obtain from the scheme compared to what they pay today. These amounts will be larger where people are able to change their behaviours.
- The payments given to the road pricing operator. This is the remuneration that the operator gets for signing people up to the scheme (via the retail brands), for running the scheme and for getting drivers to change their behaviour.

Based on our modelling, these costs are equivalent of giving up twenty percent of the current fuel excise revenue per vehicle to pay for the scheme. Without new income streams this would be unaffordable. However, our scheme includes mandating road pricing for EVs. The income from each mandated EV can offset the costs of five cars in our scheme.

Therefore, as a do minimum option, governments could roll out our scheme at a pace dependent on the uptake of electric vehicles. The greater the EV uptake the more vehicles are allowed onto the scheme.

Government could also choose to use the money it spends on upgrading and building new roads on reducing demand through the PAYD road usage scheme instead. This would increase uptake of the scheme and deliver the benefits quicker.

The ability to generate a significant reduction in congestion also has the potential to both increase revenues for the government through greater economic productivity feeding through to greater tax revenues and reduced spending due to reduced demand for upgrading roads.

If a government was willing to invest at least some of these potential additional revenues and savings into the PAYD road usage scheme, then adoption could grow even quicker.

## Improved environment

Transport has a major impact on the environment, whether it is through pollutants such as carbon dioxide emissions from vehicles or the replacement of green space for the construction of roads.

Our PAYD road usage system will be priced for each individual based on their existing driving habits (how much they drive, when they drive (peak versus off-peak)), the carbon dioxide rating of their car (higher charges for the least economic cars) and providing incentives for people to reroute, remode, retime or rethink their journeys.

This approach will lead to reduced emissions through reduced congestion, encouraging the uptake of low emission vehicles, reducing distances travelled and more efficient driving.

Reduced congestion will also reduce demand for new roads and upgrades therefore reducing road construction at the expense of green space.

## Improved road safety

Our proposal will improve road safety in a number of ways:

- By reducing vehicle miles travelled (VMT). All other things being equal, this will reduce the number of accidents.
- Research evidence shows that congestion increases the rate of road accidents. By reducing congestion, we will reduce the rate of road accidents

and improve safety.

- Our points based reward system will seek to reward people for good driving behaviours such as keeping within the speed limit. These rewards can be aligned with government safety messages and campaigns.
- We will be able to analyse routes and provide safer alternatives to avoid road safety risks such as passing schools and avoiding routes with poor safety performance.

## Improved equity and fairness

The existing fuel tax is regressive. Not only is it a flat rate, regardless of income, it also disproportionately impacts people who drive older, less efficient vehicles - usually those from lower socio-economic groups. This makes it easier to improve equity from where we are today.

Historically, one of the arguments put up against the move to road pricing were concerns about equity. This argument was based on the idea that the existing system was fair and setting a market value for the use of the roads would be regressive, disproportionately hitting people on low incomes whilst the charges on the richest people would be only a small share of their income and so have a negligible impact on them or their behaviour. This argument was usually based on making additional charges for roads as opposed to replacing the existing fuel tax with a PAYD road usage system.

Our voluntary opt-in approach with a guarantee that no-one will pay more means that no-one on lower incomes will be worse off than they are today. In addition, the savings on offer will be more significant to them as a proportion of their incomes, improving their cash-flow and making these drivers disproportionately better off.

In phase three of our scheme, the system would be fully mandatory. At this

point new opportunities to improve equity and fairness may arise. At this time, with the data we have on driving, politicians would have an increased number of options for helping people from lower socioeconomic groups with mobility.

## Economic benefits

In 2013, congestion in the UK cost the economy £13bn. It has been estimated to be over £21bn by 2030. By significantly reducing congestion, our scheme will lead to significant economic benefits.

## How our scheme works

This section provides more detail on how key aspects of our proposal work:

- The trial.
- The opt-in approach.
- Privacy.
- Scheme architecture.
- Behavioural science.
- Measuring behaviour change.
- Pricing.
- Technology.
- Data.

### The trial

The trial is designed to achieve a number of objectives.

**Objective 1** - Establish the financial costs and benefits to the government, consumers and the scheme operator

A key reason that governments need to look at moving away from paying for roads through fuel excise is due to falling revenues from ever more fuel efficient vehicles and the switch to electric vehicles. Therefore, the trial needs to provide governments with visibility around the financial costs of transitioning to a PAYD road usage system.

There are a number of costs and benefits that need to be accurately assessed through the trial. These include:

- The amount of fuel excise revenue being given up. This is the current cost to a consumer of their fuel excise bill, which is the same as the level of revenue that goes to the government.
- The operating costs of the PAYD road usage system. This includes the costs of the technology, maintaining the systems, handling queries, paying the retail brands, etc.
- The revenues obtained from the PAYD road usage scheme. This is how much this is how much the consumers will pay in the PAYD road usage scheme. The lower this figure the greater financial incentive the customer has to opt-in resulting in less revenue for a government. The trial will establish what this figure is so that enough people will opt-in to the PAYD scheme and change their peak driving behaviour.

### Objective 2 - Establish what impact the scheme will have on congestion

A key reason for moving towards a PAYD road usage scheme is the potential for it to be used to manage demand on our roads, especially at peak times, and reduce levels of congestion. Therefore, we need to look at whether the PAYD road usage system changes the behaviour of drivers at peak times and if so, by how much and what these implications are for road congestion.

### Objective 3 - Prove that the technology works

Currently, there are no schemes like the one we are proposing around the world. Therefore, the proposed technical solution has not been tested on an end-to-end basis for a sustained period of time. However, all the individual elements of the technical solution we are proposing have been tested in the real world. The trial will be able to prove that the complete technology solution works.

### Objective 4 - Establish the support of the public for a PAYD road usage scheme

Road pricing is a politically controversial subject. Although our proposed approach is designed to remove the political barriers there are likely to be some people who will still object. Therefore, managing the messaging around the trial, monitoring public perceptions and establishing widespread community support will be important.

### Objective 5 - Establish that the voluntary PAYD road usage scheme can be scaled up

A key aim of the trial is to prove that this approach can be rolled out successfully across the country. In order to do this, we need to establish estimates of the numbers of people who are willing to join the scheme at a financial cost that the government is willing to incur and the level of behaviour change that we can expect to see, and ultimately the overall reduction in congestion that we can expect to see.

### Objective 6 - Conduct a number of mini trials in order to test assumptions and optimise the approaches taken

As part of the trial, a number of mini trials will take place in order to test a range of approaches including different:

- Ways of engaging and messaging consumers.
- Pricing models.
- Baseline approaches.
- Non-financial ways of achieving behaviour change.

In order to get sufficient data and make it statistically significant for the number of mini-trials that we want to run, the trial would run for six months with at least 50,000 vehicles.

### The opt-in approach

Our proposed scheme is based on the premise that many road users would respond to our consumer proposition. In order to make a voluntary scheme work in large numbers, a number of principles would need to be set:

- The scheme needs to reward congestion-reducing behaviour rather than punish existing driving habits.
- The scheme needs to save people money, especially if they make changes to their behaviour that reduces congestion.

Our voluntary scheme would work in the following way:

- The Government enables a scheme operator to switch road users voluntarily from paying fuel excise to a PAYD road usage scheme.
- A small number of organisations with trusted consumer retail brands, working with the scheme operator, are enlisted as consumer champions, who undertake marketing and customer acquisition activities to sign-up road users to the PAYD road usage system.
- Pricing products are offered to customers which are designed to influence road usage through price signals and behavioural science.
- Customers save money by not being charged fuel excise and instead making informed choices about road usage and paying appropriately for use of the roads.

In order to ensure that both the scheme operator and the retailers are aligned with the government objectives of reducing congestion, a suitable remuneration scheme needs to be developed. Considerations that need to be taken into account include:

- Paying by distance travelled. An incentive scheme that paid a share of the road usage charge would incentivise the PAYD road usage scheme to encourage more driving not less.
- Ignoring the costs to government. Pricing the scheme too cheaply would result in larger take up and behaviour changes. However, this would be at the expense of government revenues. Other incentives designed using behavioural science should be used to create the desirable outcomes.
- Retention on the scheme. It is important for consumers to stay on the scheme (unless they give up their car altogether) in order for the congestion benefits to be realised.
- Not all customers are as valuable in reducing congestion. Customers who do not drive in the peak will have a much smaller impact on congestion than those who regularly drive in the peak. Remuneration needs to encourage high congestion impact consumers to be signed up.

- ① Behaviour change that produces congestion reducing behaviours needs to be rewarded.
- ② Congestion reducing behaviour change needs to be ongoing not temporary.
- ③ Some users will come off the scheme because they have given up their car and switched to alternative forms of transport. Unfortunately, this is very hard to track and therefore very hard to reward appropriately without rewarding people coming off the scheme for unrelated reasons such as emigrating, passing away, etc.
- ④ In an ideal world it would be desirable to reward the scheme based on reducing congestion. This comes with significant challenges in separating out the myriad other factors that affect congestion (growing population, economic growth, roadworks, etc) from those that reduce congestion through the PAYD road usage scheme. As a consequence, a proxy is required.

Taking all of these issues into account, we have designed a scheme that rewards the scheme operator in the following way:

- ⑤ A perpetual monthly fee for signing up and retaining a vehicle on the scheme. This fee will vary depending on the baseline (see below) driving of the vehicle, i.e. higher for peak driving baselines and lower for off-peak driving baselines. This will both encourage the signing up of users who can make the most impact on reducing congestion and keeping them on the scheme.
- ⑥ A perpetual monthly fee for achieving desirable behaviour change. This fee will vary depending on the amount of behaviour change. The greater the reduction in peak driving, the higher the payment. This will incentivise achieving as much behaviour change as possible and maintaining it.
- ⑦ The monthly fees for both sign-up and behaviour change will be based on the average pricing that has been signed up to. The higher the price charged to consumers, the higher the fees. This will create an incentive to maximise the revenues from consumers.
- ⑧ The government will set a floor below which road pricing charges cannot fall. This will prevent governments from paying too much to get a consumer onto the scheme.

The road pricing operator will be responsible for getting a financial agreement with the retailers that aligns with the objectives of the scheme.

- ⑨ With this approach, the scheme operator profits are dependent on:
  - ⑩ Maximising revenues from government through getting the right people to sign up for the scheme and stay on it.
  - ⑪ Maximising revenues from government through getting the maximum level of behaviour change possible and maintaining that change.
  - ⑫ Minimising the cost of marketing and customer acquisition activities.
  - ⑬ The efficiency of operating the scheme.
  - ⑭ Ongoing innovation efforts to increase sign-up and behaviour changes.
  - ⑮ The ability to sell additional products to consumers.

## Privacy

Historically, the idea of the Government tracking someone's location would have brought significant concerns about a Big Brother state. However, today people's location data is routinely shared with many private companies through their mobile phone location data and use of common digital platforms such as social media and mobile navigation services. People have been willing to exchange access to personal information with private companies for services that they value. Despite this more relaxed attitude by consumers to privacy, there are still some people where this will cause concerns. Therefore, we need to manage these concerns.

In phase 1, the trial phase, the scheme is entirely voluntary. People who have concerns about privacy simply do not have to take up the offer.

In phase 2, the vast majority of take up will still be through a voluntary approach and so most people who have major concerns about privacy will again not take up the offer. However, we are mandating tracking of driving in electric cars. Given most people's attitudes to sharing location data, this is unlikely to be a significant issue.

However, there will be some people who will want to purchase an electric car and either have more restrictive privacy settings or not be tracked at all.

Our scheme will offer all road users more restrictive privacy settings and an alternative payment system that does not

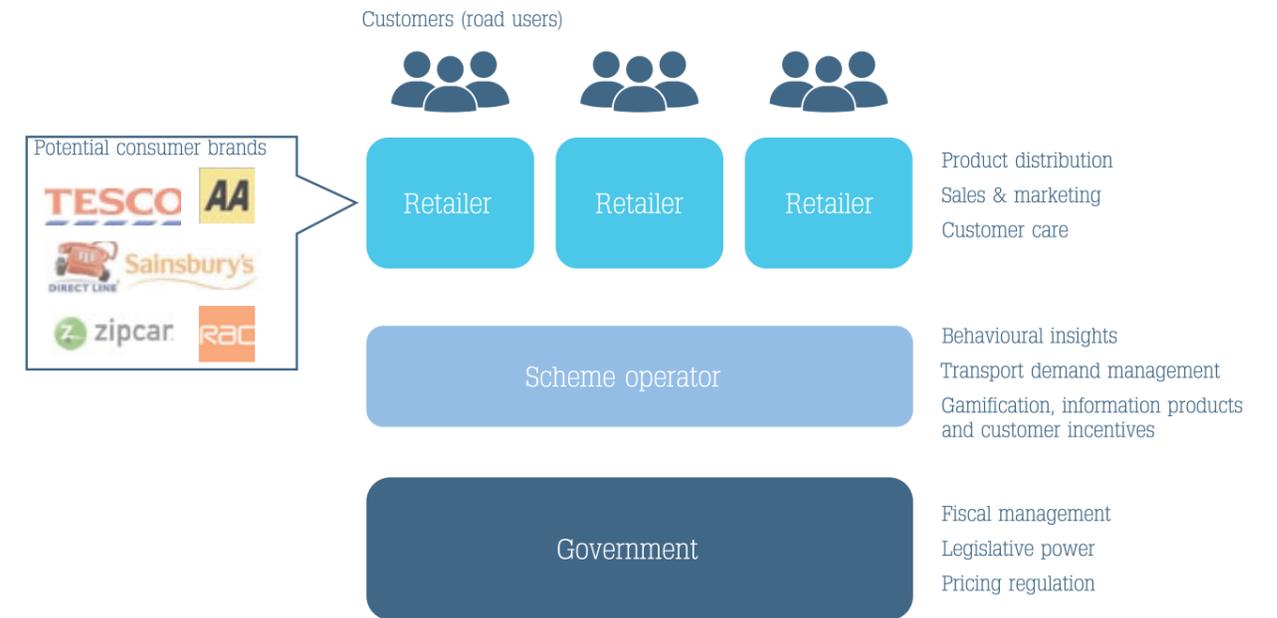
require tracking. For example, a consumer could make a lump sum payment when they renew their road tax. This would have to be set at a price to avoid free riding and therefore will be based on very high levels of distance travelled at peak times.

## Scheme Architecture

In order to make our scheme work, a number of capabilities are needed, along with robust commercial arrangements and associated technology integration.

A partnership between government, a PAYD scheme operator and retailers allows each party to bring its strengths to the table for a successful scheme.

imperative required for PAYD road usage pricing. However, we suggest that government is not best-placed to deliver the broad range of customer outcomes and commercial and technology innovation that will be key to a customer-led demand management solution for our roads.



Retailers, a scheme operator and government work together to bring their respective strengths to the scheme.

In our model, governments commission an operator with the objectives of running the scheme, driving customer uptake and applying demand management techniques to achieve desirable behaviour change and reduce congestion. The scheme operator partners with trusted brands to retail the PAYD product, market the product and provide customer support. An approach that exploits the respective strengths and capabilities of both the public sector and the private sector can deliver a scheme that removes the barriers to PAYD road usage adoption.

## Behavioural Science

As well as getting consumers to change their behaviours through the pricing mechanism, a key aspect of our scheme is to seek to change driving patterns through behavioural science.

Companies already exist that are seeking to gamify the driving experience in order to improve driving behaviour (people get rewarded for safe driving). Our concept will allow this sort of gamification and other forms of 'nudge' techniques. Examples of what this might look like include:

**Remodeing** - We will seek to change behaviours by bundling other mobility products into our scheme to provide incentives for people to remode such as introductory offers with a pooled transport provider.

**Retime** - we will communicate opportunities for people to make changes to the time of their regular journeys that will deliver significant journey time savings.

**Reroute** - we will communicate opportunities for people to reroute their journeys to alternatives that deliver significant time savings and benefit the transport network.

**Reduce** - using our data, we will work with major employers to identify their employees travelling behaviour and work with them to support initiatives that reduce car journeys such as working from home policies.



During the London Olympics of 2012, demand management techniques were used to get people to change how they travelled.

## Measuring behaviour change

A key objective of our proposal is to change behaviours in order to reduce congestion. In order to understand whether we are succeeding in this objective, we need to be able to baseline existing driving behaviour, produce

an appropriate pricing scheme that encourages behaviour change at the lowest possible cost and compare the baseline with behaviours after someone has taken up the scheme. There are a number of issues

**Issue 1 - Self-reporting is onerous.** Asking people to report their existing driving behaviours would require a series of questions. This puts barriers in the way of people adopting the scheme.

**Issue 2 - Self-reporting is subject to error.** Asking people to report their existing driving behaviours may result in responses that are not accurate simply because people are unaware of their existing driving behaviours.

**Issue 3 - Self-reporting is open to gaming.** Some people will 'game' the system in order to try and obtain bigger financial incentives for behaviour changes than should be applied to them.

**Issue 4 - Collecting data after sign-up is open to gaming.** Attempting to carry out a baseline once someone has signed up to the scheme faces the issue of them changing their behaviours to get bigger financial incentives for behaviour changes than should be applied to them.

**Issue 5 - Collecting data after sign-up delays implementation of behaviour changes.** Baseline data needs to be obtained before any incentive for behaviour change is implemented or incentivised. This means that the pricing system with different rates for off peak and peak driving cannot be implemented until after the baseline is taken.

**Issue 6 - Baseline data needs to take into account periodic events such as school holidays.** The collection of baseline data needs to take into account whether the car was driven in a typical or atypical way. For a family with school age children, their car may well be driven differently between term time and the school holidays. Other factors will include holidays, serious illnesses, moving

home, car accidents, etc. In order to collect the baseline data, there are a number of different solutions that either avoid or minimise the issues above.

- Use existing location history data. Apps and online platforms already collect location history for billions of users worldwide. With permission from people who sign up, we can access this data and use it as our baseline. This avoids the self-reporting and after sign-up collection issues

- Use existing car data. A small number of cars are already connected to the cloud and gather location history as part of their data collection. With permission from people who sign up, we can access this data and use it as our baseline. Again, this avoids the self-reporting and after sign-up collection issues.

In cases where people do not have good quality existing location data, then we can baseline after sign-up. The trial will test different ways of doing this in order to assess the pros and cons of different approaches, such as the time taken for collecting the minimum amount of data required to get a valid baseline.

## Pricing

A key part of our proposal is providing consumers with a choice of different road pricing plans. These pricing plans need to:

1. Encourage changes in behaviour that reduce congestion.
2. Be at least as cost effective to the consumer as the existing fuel excise regime in order to encourage take up.
3. Be seen to be fair by the community.
4. Minimise the financial losses to government.
5. Provide the same or equivalent incentives for driving environmentally friendly vehicles as currently available in order to maintain community support.
6. Encourage people to stay in the scheme.

In order to achieve these aims, our proposed pricing plans contain a number of principles:

7. All pricing plans will account for customer segments and individual circumstances in order to achieve the best possible balance in terms of take-up, revenue generation and incentives for behaviour change.
8. All pricing plans will provide incentives to avoid driving during the peak congestion periods.
9. For people who voluntarily opt-in to a PAYD road usage system, they will never pay more than they would under the fuel excise regime based on their current 'baseline' driving behaviour.

10. All pricing plans will seek to replace as much of the lost fuel excise revenue as possible if there are no behaviour changes.
11. All pricing plans take into account the fuel efficiency/pollution footprint of the vehicle.
12. A tie-in period (similar to a mobile phone plan) of at least twelve months to offset the setup costs of a new customer will be in place.

Road users - and transport customers overall - have a variety of needs, wants, lifestyles, constraints and preferences. People also have different access to alternative transport options, along with different incomes, social commitments and discretion regarding their travel time.



Age	27
Lives	Putney
Works	The City
Drives	Volkswagon Golf
Vehicle miles	8,000 mi/yr
Park driving	5%
Off-peak driving	95%

**Sarah**  
**Inner city Accountant**

Sarah is an Accountant for a major firm in London. She takes the Tube to work during the week. She socialises regularly after work during the week, typically taking an Uber home on later nights. On weekends she likes to get out of the city, driving to regional centres within 2-3 hours of London.



Age	35
Lives	Swindon
Works	Farnborough
Drives	Nissan Juke
Vehicle miles	11,000 mi/yr
Park driving	85%
Off-peak driving	15%

**Justin**  
**Car-bound logistics manager**

Justin is a Distribution Manager for a Logistics company in Farnborough. He takes the car to and from work during the week as there are no direct public transport routes near his house in Swindon. Travelling along the M4 Justin is often frustrated by how variable his travel time is-often adding 45 mins to his 15 hour journey to work.



Age	68
Lives	Leicester
Works	Retired
Drives	Ford Focus
Vehicle miles	6,000mi/yr
Park driving	40%
Off-peak driving	60%

**Ethel**  
**Doting grandmother**

Ethel is retired and lives in Leicester. Just after her grandson, Miles was born (three years ago) her daughter and son-in-law moved to King's Heath. She enjoys spending time with her grandson and is now providing regular care for him while her daughter launches a new business venture. Ethel drives to and from King's Heath to care for her grandson 3 days/week. On the other days she uses her car to run errands and visit friends close to home in Leicester.

A successful PAYD road usage scheme needs to accommodate the variety of customer preferences, constraints and socio-economic circumstances.

As well as providing core pricing, the trial will provide an alternative for bundling other products to encourage take up and behaviour change. This might include discounted public transport fares, support for a switch to cycling or incentives for using a pooled vehicle provider.

Pricing plans also have the potential to be varied based on location and individual roads. These other PAYD road usage 'products' can be experimented with during the trial in order to assess their benefits and disadvantages.

### The technology

Our technology infrastructure for the scheme comprises:

1. OBD dongles (small consumer-grade devices that connect to the industry standard vehicle maintenance port).
2. Payment platform for financial transaction management and reconciliation.
3. Security modules for encryption and data rights management.
4. Central (cloud-based) data capture, processing and storage.
5. Analytics and compute engines for interpreting and processing vehicle logs, billing metrics and road usage behaviour insights.
6. Application integration and messaging platforms .
7. Web, mobile and digital channels.

The advantage of consumer digital revolution

From a technology perspective, prevailing tolling, smart motorway and congestion zone schemes overwhelmingly rely on physical infrastructure. The design and architecture of this infrastructure largely pre-dates the

advent of consumer grade mobile technology and consumer GPS adoption. The physical infrastructure and related technologies for traditional tolling schemes and Intelligent Transport Systems (ITS) implementations are expensive to install and maintain, when compared with current and emerging consumer technology and digital architectures.

Physical technology deployment also provides less flexibility in terms of changing pricing schemes, road network configuration or cordon zones due to the time and cost associated with system changes.

Our proposal provides a flexible, cohesive pathway to adopt consumer grade technology for today's car fleet - enabling rapid rollout of a PAYD road usage scheme in the short term - and an open architecture for connecting large fleets, existing "connected cars" and emerging vehicle technology over time.

This approach provides a method for a government to rapidly adopt a PAYD road usage scheme in the short term, at a lower cost than legacy road tolling technologies and ITS deployments that use fixed infrastructure. As a jurisdiction's vehicle fleet mix changes with the increasing adoption of EVs and connected car platforms, our proposed platform can readily integrate newer vehicles.

#### Connecting the vehicle fleet

For a PAYD road usage scheme to be effective, it relies on connecting large numbers of vehicles and providing the ability to apply charges across a large geographic area. The prevalence of GPS technology and related consumer digital innovations make this feasible and more affordable than ever before.

Our proposed scheme requires a minimum dataset from each vehicle in order to apply the range of pricing mechanisms and information services needed for behaviour change and demand management. Our core vehicle dataset requires:

- ① Time-stamped geolocation
- ② Unique vehicle identifier (either VIN or an equivalent unique identifier)
- ③ Fuel consumption

Of course, many vehicle manufacturers are already selling cars with connectivity - often bundling in roadside assistance functionality, navigation and infotainment services. This portion of the vehicle fleet offers the ability to connect via manufacturer or OEM connected car platforms.

The 'legacy car fleet' - comprising the largest number of vehicles in any jurisdiction right now - can be readily connected using inexpensive consumer-grade technology. In 2017 the best fit technology choice is connected OBD dongles. These devices have been used in the United States for recent road pricing trials (for example the Oregon MyOReGO trial). These devices are small, relatively inexpensive and user-installable, plugging into a vehicle's On Board Diagnostics (OBD) port. OBD ports have been mandated in vehicle standards in most jurisdictions for ten or more years - originally required to standardise access to vehicle maintenance functions and allow for competition in the car maintenance sector.

Both of these connectivity options (manufacturers' connected car platforms and OBD dongles) offer the ability to readily connect the vast majority of any country's vehicle fleet (and in instances where manufacturers or OEMs are reluctant to provide platform access for our core dataset, OBD dongles are a cheap and readily available fallback option).

Using these connectivity options and our core dataset, we are able to implement a PAYD road usage scheme that includes a simple but effective method of validating eligibility for a full fuel excise rebate under the scheme.

#### Conceptual architecture

Our proposed solution depends on a technology architecture that enables discrete components of functionality to evolve independently from the overall system. This approach means that our scheme can embrace the latest methods in areas such as intelligent pricing or driving risk algorithms without incurring the cost and risk associated with a complete system upgrade.

The approach is also key to enabling our system to progressively 'bolt-on' new features as the PAYD road usage scheme matures in any particular jurisdiction. For example, it is likely that any country's initial adoption of our road pricing scheme would keep things simple at the outset, focusing on the core road user charging and behaviour change functionality needed to drive adoption. After initial rollout, once the scheme is 'at scale' in a

particular country, additional features such as gamification and more sophisticated price bundling would be introduced - enriching the customer experience and strengthening the range of mechanisms available to effect behaviour change, and hence tackle congestion.



An OBD dongle being installed.

## Information Security

Information Security is crucial to both the consumer proposition in this scheme and the interests of government.

Our proposed scheme will generate and rely upon a number of information assets, each of which will need to be protected against threats to confidentiality, integrity and availability.

A detailed description of our information security design is beyond the scope of this paper. Overall our PAYD road usage scheme presents information security challenges that are no different from digital platforms that are now commonplace in the market. This enables us to adopt readily accepted technical and customer solutions to address service levels for confidentiality, data integrity and system reliability.

This is not to say our scheme can simply leave all Information Security issues to be addressed by “industry standards” - only that our scheme design harnesses current digital technologies and industry solutions.

However it is worth highlighting a key aspect of our scheme design that is critical to the customer promise and overall scheme integrity. By adopting consumer-grade technology, such as OBD dongles, our PAYD scheme can be rapidly implemented and readily adopted by mass market customers. This

means that the integrity of vehicle odometer and location data needs to be managed carefully to assure the validity of usage charges, government revenue and overall scheme credibility.

For instance, a customer enrolled in the scheme could either siphon tax-free fuel for other individuals, or tamper with their OBD dongle to circumvent odometer and location logs.

This exemplifies the approach we have taken across the scheme design to address critical security considerations.

In this scenario, our solution for seamless fuel tax rebate at point-of-sale will automatically validate the integrity of a customer’s critical membership data. This real-time validation step will check the integrity of:

- ① PAYD scheme account status
- ② Current (or recent) vehicle connectivity
- ③ actual fuel consumption vs imputed consumption based on driving history
- ④ Continuity of vehicle odometer and location data

Any minor discrepancies will be flagged for later validation with the customer via their online PAYD account, or another customer channel such as a call centre, as required.

In the event of a major discrepancy or suspected fraud then the customer’s fuel payment can be declined at point-of-sale. The customer can then pay for their fuel - including fuel tax - using an alternate payment method. Their account is then flagged for manual review and validation.

# Risks

We have carried out a risk assessment on our scheme:

Risk	Likelihood	Impact	Mitigation Measures
The scheme is not financially viable.	Low	High	Detailed financial modelling has taken place. The speed of rollout can be adjusted to align with EV take up and keep the scheme revenue neutral. Beginning with a trial allows the financials of the scheme to be established.
The scheme does not deliver the behaviour changes required to reduce congestion.	Low	High	The trial allows experimentation with different pricing and behavioural science techniques to change behaviour. The scheme operator works with leading academics in demand management and behavioural science to develop appropriate techniques based on the best research.
The scheme cannot find retailers to participate.	Low	High	Appropriate financial incentives factored into modelling. Discussion with retailers has demonstrated significant enthusiasm.
The technology does not work.	Low	High	The technology is already deployed in the marketplace, none of it is new or bleeding edge. Technology integration mitigated through use of minimum viable product for trial and early rollout. Prototyping and design validation of the technology is already taking place.
Induced demand prevents significant congestion reduction early in scheme.	Medium	Medium	With significant adoption, demand can be reduced to the point where induced demand does not get triggered.
Political opposition	Medium	High	Customer-led proposition. Opt-in to prevent losers. Use of trusted retail brands to market the product.
Customers do not sign up for the scheme	Low	High	Use of trusted retail brands to market the product. Financial incentives. Compelling consumer proposition.
Data security is compromised	Low	High	Leverage industry standard platform solutions, coupled with procedural controls. Ongoing ISO27001 compliance.

# Other considerations

## Future transport scenarios

Technological change is already disrupting our transport systems. For example, we are already seeing Uber negate the benefits of the London congestion charge. In the next few years, technologies such as driverless vehicles will speed up the pace of change. In most scenarios, the demands on our road network are expected to increase due to additional demand from home deliveries, additional travel from people who can exploit autonomous vehicles who are currently inhibited from travelling - such as the elderly and those without drivers' licenses - and a shift away from public transport as autonomous vehicles successfully compete on price and service with buses for passengers. Given these scenarios, managing the demand on our roads in order to reduce congestion will become even more important.

Amongst the various large-scale disruption trends at play in the mobility and roads area right now, two significant considerations are:

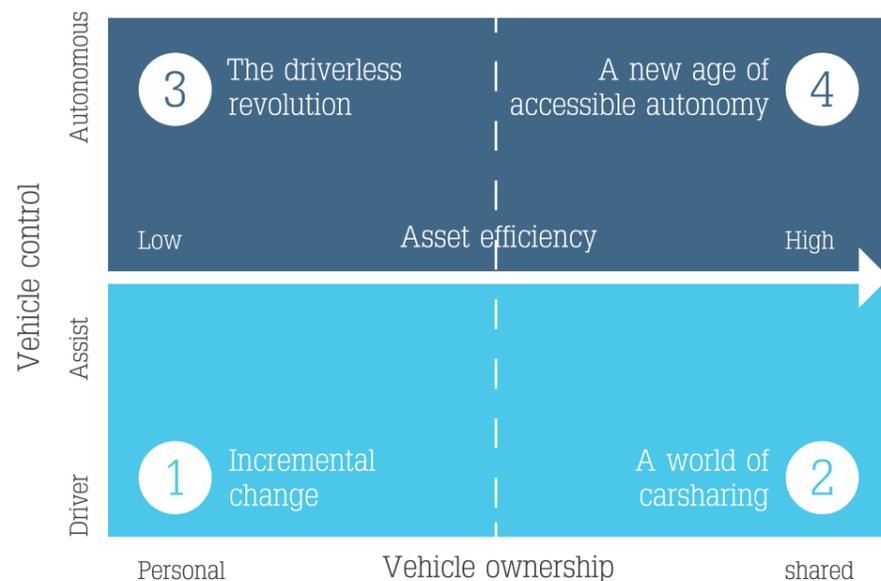
1. The adoption rate and market penetration of autonomous vehicles; and
2. The extent to which the community embraced shared vehicle ownership and shared mobility solutions.

These factors exemplify the potential for near-term disruption to produce massively different economic and social outcomes.

Looking at extremes in the diagram below - and considering the likely impact on congestion and road funding - the Incremental change scenarios leaves us dealing with relatively predictable mobility impacts.

However if we see a future that is akin to A new age of accessible autonomy, it is possible that vehicle miles travelled - and congestion - increase due to customer uptake of previously discretionary road travel. We do not yet know whether this demand increase will be offset by the efficiency of multiple occupancy mobility services, or greater service integration with mass transit (ie. first- and last-mile connections).

In any of these scenarios our proposed scheme will help to deliver better outcomes.



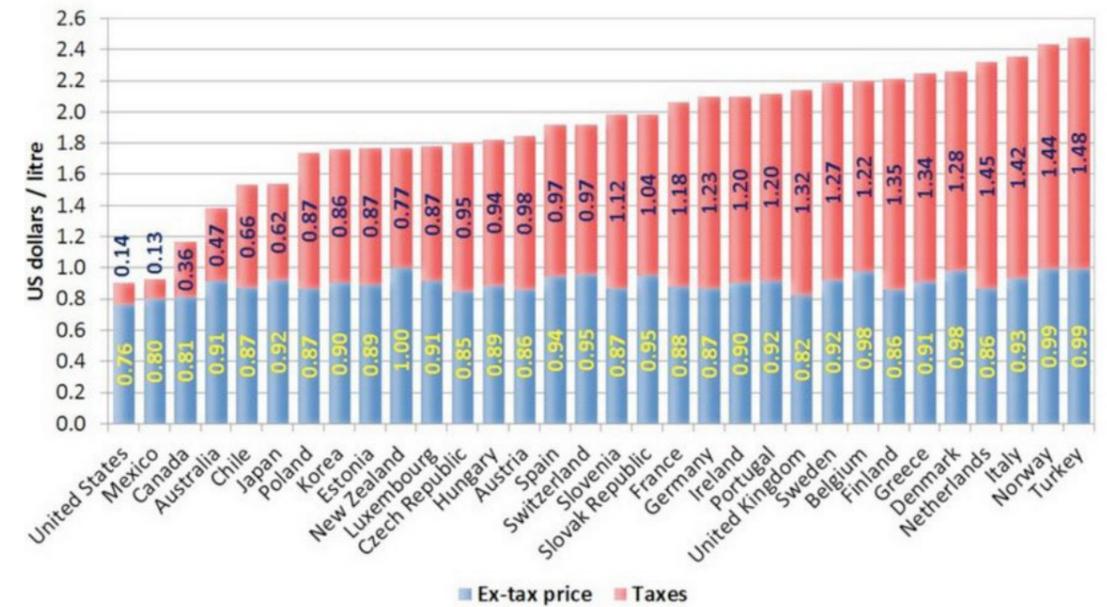
[Deloitte, The Future Of Mobility, 2015](#)

Many future scenarios look at future vehicle ownership versus vehicle control.

### A global perspective

Our approach, has the potential to work in almost all countries across the world. All countries in the OECD, with the exception of Mexico, have a fuel tax. In the case of the United States where the level of fuel tax is so low that the potential savings are too small to provide incentives for moving to a voluntary scheme, governments may want to mandate road pricing for electric vehicles and implement a PAYD road usage scheme as EV uptake increases.

Both India and China with large populations, increasing motor vehicle penetration and increasing congestion have fuel taxes, providing the potential to adopt a scheme like ours.



[IEA, Energy Prices & Taxes, Q2, 2014](#)

The vast majority of OECD countries have significant fuel taxes.

### Mobility-as-a-Service (MaaS)

Regions such as the West Midlands are beginning to roll out MaaS services that enable people to pay for their mobility through one account to access a much wider range of mobility providers than has traditionally been the case with a service like the Oyster card. In the future, a MaaS platform could integrate seamlessly with our PAYD road usage scheme.

### Platooning

Transport operations centres in some cities are beginning to consider the possibility of coordinating traffic signals and smart motorway controls to facilitate 'platoons' of vehicles. This is one of the mooted benefits of vehicle-to-infrastructure (V2I) solutions, and some uses of vehicle-to-vehicle (V2V) solutions. These solutions typically rely on large-scale upgrades to existing traffic control infrastructure and/or a major refresh of the vehicle fleet.

Our PAYD road usage scheme - once at large-scale adoption - would deliver a connected car fleet across today's vehicle population. This offers the potential to deliver platooning, without requiring significant roadside infrastructure investment, or a fleet refresh.

### Price regulation

The mandating of EVs will require some form of price regulation. For fairness with non-EVs and for simplicity, in the short term, this could be set as a price guarantee that an EV driver will not pay more in road charges than a fuel efficient non-EV would pay in fuel excise for the distance travelled.

In the longer term, when more dynamic pricing may be required to manage congestion, more thought will need to be given to pricing and potential regulation. Currently, transport economists have put forward a myriad of ways for pricing the road system. However, there is no consensus on which approach is the best. As a result of our scheme, there will be significant research and evidence as to the effectiveness of our pricing plans and behavioural science that can help to inform future government decision making.

### Induced demand

An important consideration for reducing congestion is the phenomenon of induced or latent demand. This is the concept that there is demand for people to use a congested road but they avoid it due to the congestion. Therefore,

if the congestion is reduced they are more likely to use the road, re-creating the congestion. This effect is normally associated with increasing road

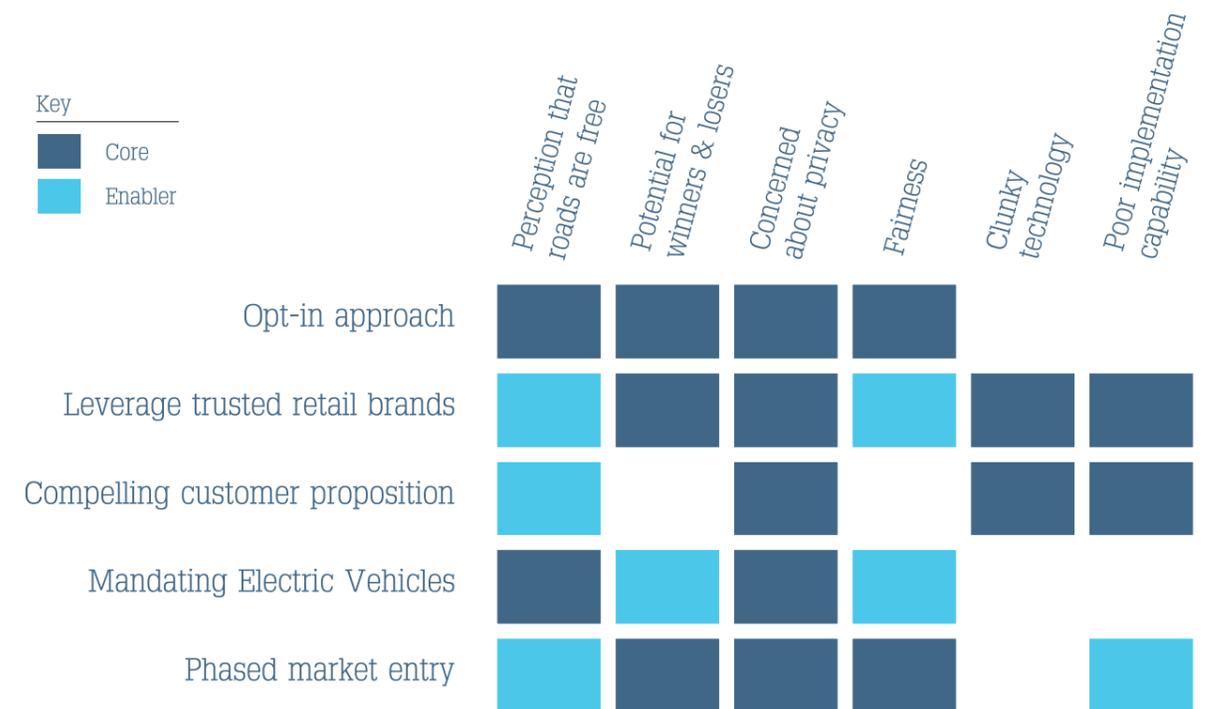
supply. However, by our PAYD road usage scheme reducing congestion, latent demand might be realised limiting the reductions in congestion that we are able to realise. This will particularly be the case when only a small proportion of vehicles are on the scheme. This may mean that significant congestion reductions will only be realised once a significant proportion of the vehicle fleet is on the scheme. The speed of adoption could be an important factor in how quickly congestion can be reduced.

## Conclusion

Demand management and sustainable funding, in the form of Pay-As-You-Drive road usage, can be launched without undue political risk - which has been widely recognised for decades as the primary barrier to entry.

Governments the world over continue to face an uphill battle in addressing the social and economic impact of congestion.

This is largely because governments are fighting congestion with an incomplete toolkit - their levers largely consist of supply-side measures. Our proposal provides a comprehensive solution to the Wolfson Economics Prize challenge, in addition to addressing the traditional policy reform barriers in this area, as outlined in the diagram below.



Economists, traffic engineers, politicians and bureaucrats - globally - have proposed, researched, studied and advocated for road pricing for well over 100 years. What is needed is for this body of knowledge to be applied in the real world.

To do this in any meaningful way, it is essential that any road pricing scheme:

- ① is able to be implemented in the real world (it is feasible)
- ② meets the needs - and wants - of customers (it is desirable)
- ③ can be afforded by government, customers and society-at-large (it is viable)

We have a unique window of opportunity to adopt the PAYD road usage scheme and embedded demand management mechanisms we have described here.

Technology innovation is already delivering significant disruption to transport systems, the advent of autonomous vehicles, shared ownership and electric vehicles will deliver even greater disruption including to government road funding models. Put together, this is creating a burning platform for road reform in the form of demand management.

For these reasons - and more - now is the time to move road pricing and active demand management from the realm of theory to customer-led adoption. Not only does this help to complete the toolkit of government in tackling congestion and future funding for our roads - it enables our roads to be properly integrated into the innovation taking place across the mobility spectrum including mass transit and on demand transport services.



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