



## 10 thoughts for next generation mobility pricing

Our road networks are critical to social mobility, economic prosperity and providing access to opportunity, but the price paid for their use is by no means equitable, fair or proportional to the amount of travel undertaken. Mobility pricing, in its myriad forms, provides an opportunity for our society to rebalance the scales of transport consumption, and allow us to adopt a fairer, more responsible approach.



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## Purpose of this document

This document forms part of a series of 30 thoughts on the future of mobility. The thoughts represent a selection of potential challenges, opportunities and changes we believe will have tangible impact in our cities.

In developing these thoughts, we have consulted a range of Arup and external thought leaders, and considered the potential implications across next generation mobility pricing, low emission, shared, connected and autonomous mobility.

Some thoughts are specific to their area, while others transcend their assigned category into other areas. This document is intended to increase awareness, foster collaboration and develop discussion around the opportunities and challenges that our societies will face in the near, medium and potentially far future.



# At a glance

## 10 THOUGHTS FOR NEXT GENERATION MOBILITY PRICING

### AT A GLANCE: 10 THOUGHTS FOR NEXT GENERATION MOBILITY PRICING

- 01 02 03 04 POLICY
- 05 06 07 USER EXPERIENCE
- 08 09 10 TECHNOLOGY AND INFRASTRUCTURE

- 01 THE TIME TO ACT IS NOW**  
Changing lifestyles, disruptive business models and new technologies are creating a window of opportunity to develop a new approach to mobility pricing.
- 02 THIS ISN'T JUST ANOTHER TAX**  
Blunt instruments used to price roads penalise road users. It's time for a fairer solution.
- 03 EQUITY MUST COME FIRST**  
In a globe looking to 'build back better' post COVID-19, contemporary mobility pricing must be built from the principle of creating more equitable opportunity and access for all.
- 04 SYSTEMS SHOULD BE FLEXIBLE BY DEFAULT**  
Developing a system that can evolve relatively simply to meet the expectations of different policy drivers, emerging business models, and desired outcomes, is critical for the long-term success.
- 05 CREATE A SIMPLE AND CONVENIENT EXPERIENCE**  
A new solution can provide users the control, transparency, and quality of service they expect.
- 06 PROVIDE A LITTLE CARROT AND A LITTLE STICK**  
Design to incentivise positive behaviour while deterring less desirable behaviour.
- 07 MOVE TOWARDS A FULLY INTEGRATED FUTURE**  
Pricing systems enable individuals, organisations, and regulators to better manage the transition to a more integrated mobility environment.
- 08 INTRODUCE FRICTIONLESS TECHNOLOGY**  
Mobility pricing needs to harness the capabilities of in-vehicle and in-hand technologies to deliver a frictionless and reliable functionality.
- 09 CREATE SEAMLESSLY INTEROPERABLE PAYMENTS**  
Despite a myriad of payment systems, security protocols and competitive closed-systems, there remains a need to establish a customer experience that spans multiple mobility options.
- 10 ENABLE A TRULY DYNAMIC FUTURE**  
Using the intelligence of the system to truly understand the transport network enables charging that is clear to users and loyal to goals.



# What is Mobility Pricing?

Mobility Pricing or Road User Charging encompasses any form of charging where the road network user pays at the point of use.





# 01 The time to act is now

Changing lifestyles, disruptive business models and new technologies are creating a window of opportunity to develop a new approach to mobility pricing.

## NO REGRETS DECISIONS

- Consider which behaviours you wish to encourage and which behaviours you wish to diminish. Clearly define and solidify your objectives for the future of mobility in your city
- Develop internal organisational understanding of what mobility pricing is and what it is not, the problems it can help manage and the challenges to its delivery

### BUILD BACK BETTER: A SOCIETY AND TRANSPORT NETWORK FOR THE POST PANDEMIC WORLD

The COVID-19 pandemic is changing the world around us, our priorities and the expectations of our governments. Building back better, means harnessing the growing recognition of the indirect impacts of vehicle use on our health, our cities and our environment, to shape a more sustainable transport future.

### SPACE CONSTRAINTS REQUIRE MORE EFFICIENT USE OF URBAN SPACE

Space is at a premium in cities, with significant amounts of land earmarked for cars for free use; the growing imperative to price this free land is reflected in the recent popularity of reducing free parking and, in select cities, the introduction of dynamic parking prices that are linked directly to demand.

### WE MUST ACT ON CLIMATE CHANGE

Cities need a tool with which to discourage behaviour contributing to greenhouse gas emissions, air quality, and the unsustainability of the standard vehicle lifecycle.

### REVENUE FROM USER FEES IS DECLINING

Fuel taxes have traditionally provided a source of transportation funding, but revenue is declining due to improved fuel efficiency and a failure of the tax to keep pace with inflation.



## Case study

### GREEN LIGHT: NEXT GENERATION ROAD USER CHARGING FOR A HEALTHIER, MORE LIVEABLE, LONDON

Arup worked together with the Centre for London (CfL), an established, influential and independent policy focused think tank, to explore how London could harness the best of innovation and policy to create a simpler, smarter and fairer approach to road user charging.

**GREEN LIGHT: NEXT GENERATION ROAD USER CHARGING FOR A HEALTHIER, MORE LIVEABLE, LONDON**



## 02 This isn't just another tax

Blunt instruments used to price roads penalise road users. It's time for a fairer and better solution.

### NO REGRETS DECISIONS

- Mobility pricing should not be explored in isolation. Consider other mobility network improvements that would help to achieve the target outcome
- Develop rapid tools that enable you to quickly explore the relative merits, impacts and affordability of various forms of mobility pricing in conjunction with a suite of other tools, so that these trade-offs can be communicated clearly to the public

### CHANGING PERCEPTIONS OF CHARGING

Road users often view traditional approaches to road pricing as an additional tax, particularly when pricing mechanisms are not tied to clear benefits. In reality, road users are taxed using blunt and ill-fitted instruments. It is time for a better solution.

### SUBSTITUTING EXISTING TAXES

In order for mobility pricing to be politically and publicly acceptable, it should be employed as a substitution for existing tax regimes, not an additional tax. New systems should promote initial revenue neutrality, transparency and clear hypothecation to be successful.

### ONE OF A NUMBER OF MECHANISMS

Mobility pricing is a tool that can be highly effective at delivering desired societal outcomes, but it is most effective and acceptable when implemented in conjunction with other mechanisms.



### Case study

#### CAMBRIDGE CITY ACCESS: DEMAND MANAGEMENT OPTIONS ASSESSMENT

The Greater Cambridge Partnership (GCP) has an ambition and committed government funding to explore potential tools for managing road use demand in the urban centre, while simultaneously delivering wider socio-economic benefits. Arup worked closely with the GCP, pulling together a multi-disciplinary team of experts to undertake a rapid policy optioneering exercise on demand management in Cambridge.





## 03 Equity must come first

In a globe looking to ‘build back better’ post COVID-19, contemporary mobility pricing must be built from the principle of creating more equitable opportunity and access for all.

### NO REGRETS DECISIONS

- Establish clear equity targets and requirements for the design and implementation of any new forms of mobility pricing
- Embed methods for measuring the potential equity impacts of a scheme into the design process

#### AN ECONOMIC RECOVERY FOR ALL

As the world feels the economic impact of the pandemic, many of the world’s most vulnerable people face increased levels of poverty. Governments are focused on stimulating economic recovery and creating opportunities for all. If designed correctly, mobility pricing can both stimulate our urban economies and also help to ensure those most vulnerable are supported.

#### DISPROPORTIONATE NEGATIVE IMPACTS

Too often, air quality impacts, network congestion and public health impacts are not accounted for in current transport pricing mechanisms. These indirect impacts are often absorbed as social, economic and environmental externalities of driving. Low-income groups are disproportionately impacted as they are more likely to live in highly polluted thoroughfares or have restricted access to mobility services.

#### MOBILITY PRICING TO REDRESS IMBALANCE

To avoid inequitable taxes and regressive pricing mechanisms, policy and implementation must focus heavily on addressing imbalances in social and environmental inequity. Putting ‘equity first’, and being transparent throughout public participation processes, will ensure societal benefits and financial imperatives are clearly communicated and balanced against each other.



### Case study

#### ROAD PRICING IMPACT STUDY

Arup and Transport Infrastructure Ireland are collaboratively developing an impact study to consider and investigate the cost, price, and distribution of road use across Ireland. The study will explore equity and potential inequities, helping to understand the true baseline price of road use versus the direct and indirect costs to society. Using both traditional and innovative transport modelling, the partnership is developing an Agent-Based Simulation to determine how road use is currently valued.





## 04 Systems should be flexible by default

The social and political priorities of today are unlikely to remain the largest policy drivers in the future.

### NO REGRETS DECISIONS

- Consider how new political priorities, business models, technologies and user expectations could change the requirements and design of a mobility pricing system
- Embed flexibility and policy evolution as a priority throughout the design process

### MOVING BEYOND HEAVY INFRASTRUCTURE REQUIREMENTS

One of the biggest challenges facing many mobility pricing schemes in place today is their reliance on expensive and bulky hard infrastructure that has been designed to implement a specific charge and is not particularly flexible. A next generation scheme has the opportunity to take advantage of emerging technologies that enable them to limit the need for permanent infrastructure. Many of these technologies are already being embedded in emerging connected vehicles.

### OUTCOME-FOCUSED PRICING REQUIRES FLEXIBILITY

The future of mobility pricing should be focused on outcomes and delivering to specific targets, such as improving the environment, air quality, equity, journey time reliability, public health and more. A future scheme needs the flexibility to adapt its pricing levers to continuously deliver against its stated outcomes in order to remain effective.



### Case study

### PUBLIC VALUE OF FUTURE MOBILITY RESEARCH

Arup researched the role of regulation and governance in the future of mobility to help public and private bodies consider their role in the future mobility market and focus on generating net positive Public Value. This research identified areas of focus to uphold, maximise, and optimise public value in the future.





## 05 Create a simple and convenient experience

Societal expectations for quality services tailored to individual needs are continuously increasing, accelerated by the focus on user experience of other modern services.

### NO REGRETS DECISIONS

- Incorporate user experience into the heart of the policy optioneering and design process to be able to properly consider how individuals interact, engage and use mobility pricing platforms
- Learn from other industries that have mastered user experience to capture the best of innovation and engagement strategy, while recognising there are different responsibilities and expectations in the public sector

### UNDERSTANDING WHAT PEOPLE CARE ABOUT IS CRITICAL

The future of mobility pricing is not about designing the most technically advanced and economically efficient policy. Instead, success hinges on the ability to attract users and stakeholders to support and participate in the scheme. If their support is critical for success it is imperative that their ambitions are put at the centre of scheme design.

### INSPIRATION FROM SUCCESSFUL USER EXPERIENCE ORIENTED SERVICES

People value quality service and in many cases are willing to pay more for it. Convenience, entertainment and engagement are seen as a critical ingredients for attracting user to software services like Amazon, City Mapper and Uber.

### A RECOGNITION OF RESPONSIBILITIES

To ensure credibility and to maximise desirability it is essential that a future user experience centralises decisions for urban mobility becoming the solution for the user rather than an additional service that can be deemed superfluous.

However, the centralisation and individualisation of the user experience must be carefully balanced with the requirements and expectations of data and personal privacy that people expect from modern digital services.



### Case study

### TRANSPORT FOR WALES CATERING SERVICES

Transport for Wales (TfW) is transitioning its catering services and operational staff in-house.

TfW has ambitious goals to use this as an opportunity to 1) incentivise local economic growth through building a Welsh-led supply chain 2) deliver improved customer service to the public and 3) empower and ensure welfare for its staff.

To move forward, TfW needed more awareness of actual consumer behaviours and needs to make the right choices.

To prepare for the transition, TfW engaged Arup to provide stakeholder engagement and passenger research. The goal of Arup's work is to synthesise TfW customer facing challenges today and deliver research-based understanding of what passengers expect from catering. From this research, Arup is working with TfW to deliver an overall experience strategy, identifying priority actions and staff/stakeholder actions.



## 06 Provide a little carrot and a little stick

The future of mobility pricing needs to be equally focused on incentivising positive behaviour as it is focused on deterring undesirable behaviour.

### NO REGRETS DECISIONS

- Explore how public policy can encourage positive behaviours through rewards and gamification, extracting the best from the private sector and adapting it to the responsibilities and expectations of the public sector

#### CONNECTING REWARDS AND PENALTIES TO CONSUMER CHOICES

If we want to encourage healthier lifestyles and more sustainable mobility it is critical that we design any future mobility pricing scheme to incentivise desired behaviours.

#### INCENTIVISING THE RIGHT BEHAVIOURS

By harnessing existing digital infrastructure, transport authorities and policy makers can encourage positive societal outcomes in a palatable way. For example, rewarding individuals who walk or cycle, either through monetary incentives or a variety of other consumer reward programmes.

#### CONSIDERING INDIVIDUAL IMPACT

By connecting rewards and penalties across multiple modes, it is possible to enable individuals to be more reflective of their own behaviour, making them more aware of their decisions and the available alternatives.

#### SMART STIMULUS TO INVEST AND SHAPE BEHAVIOUR

Countries and cities around the world have begun some of the largest economic stimulus programmes in modern history. Investing in effective mobility pricing schemes can not only provide lasting behaviour change but it can also generate funds to enable further smart stimulus.



### Case study

#### YORK GAMBIT: GAMIFICATION FOR BETTER LIVING IN CITIES INFLUENCING TOURIST BEHAVIOUR

York GAMBIT was an UK first project utilising gamification techniques on a city wide scale to positively affect change in modal choice. The InnovateUK funded, Arup delivered, project designed a mobile phone application that used gamification techniques to engage and motivate desired user demand and behaviours.





# 07 Move towards a fully integrated future

By aligning the systems and structures we use to pay for multiple mobility modes, we can begin to develop complimentary service offerings that enable regions to get more out of their existing mobility infrastructure.

## NO REGRETS DECISIONS

- Consider how payment systems can be brought together over time to create opportunities for improved operational efficiency as well as network efficiency
- While a fully integrated multi-modal approach to user payments may not be feasible or desirable at the moment, develop policies and systems that are capable of this level of integration in the future without major redevelopment

### ALIGNING THE WAY WE PRICE ROAD USE WITH OUR APPROACH TO OTHER FORMS OF TRANSPORT

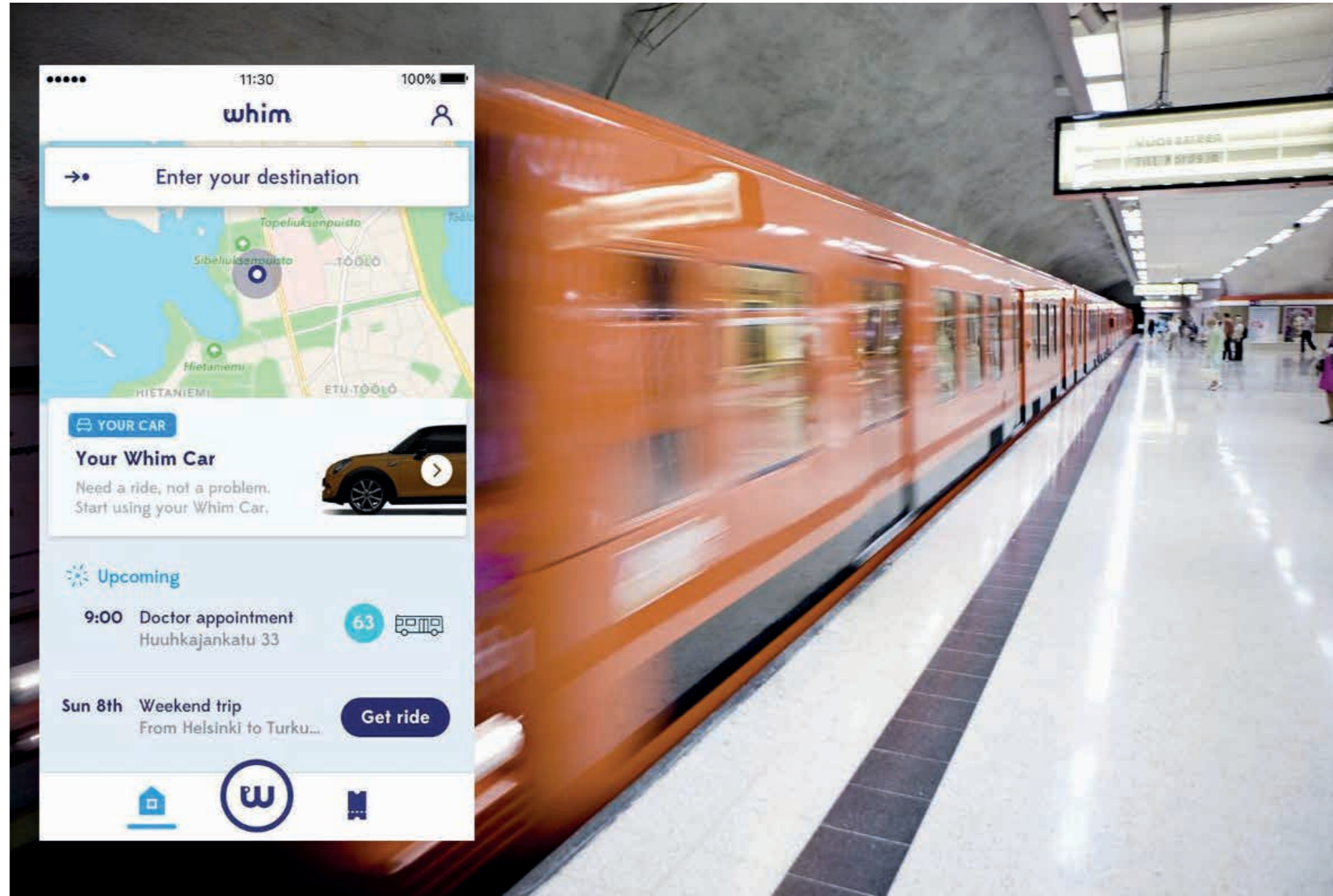
A key way to enable future integration of multi-modal transport services is to move the way users pay for road use more closely in line with that of other services. Rail, bus and metro fares are typically linked to frequency of journeys, time and distance.

### IT'S ABOUT MOVEMENT AND JOURNEYS NOT MODES AND TRIPS

Increasing alignment means that it is possible to begin to explore service offerings focused on journeys and movement, rather than a particular mode. This enables users to explore more efficient multi-modal journeys without additional costs for switching between mode.

### BETTER USE OF OUR EXISTING NETWORK AND ASSETS

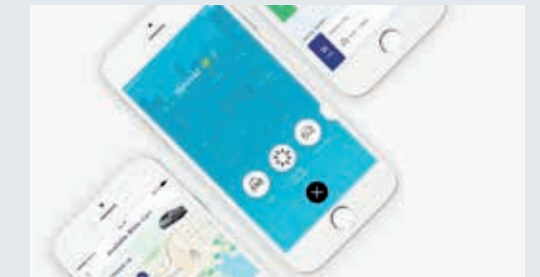
By better integrating multiple transport modes it is possible to improve the efficiency of services as well as making better use of the available network assets. By providing information and interconnection between services, agencies can direct users through real-time information and incentives to manage crowding and improve utilisation.



## Case study

### MOBILITY-AS-A-SERVICE

We collaborated with the world's first operator in Mobility-as-a-Service, commonly known as MaaS. MaaS is about providing an alternative to owning a car, and looks at the provision of different transport options to offer a more sustainable and smarter way to travel. Our collaboration assisted MaaS Global with how to achieve a level of mobility that rivals the convenience offered by the private car, in as many cities as possible throughout the world. The work combined our expertise in transport systems with our relationships and knowledge of a wide range of cities to facilitate MaaS Global's expansion goals.





## 08 Introduce frictionless technology

Consumers expect seamless experiences with no wasted effort on behalf of users.

### NO REGRETS DECISIONS

- Back end interoperability needs to be built in conjunction with the front end user in mind. Users expect to be able to access various systems under a single umbrella set of account credentials

#### MAKE IT EASY

Technology enables us to capitalise upon a different mobility pricing model. To achieve the desired outcome, we must lever the model effectively, appropriately and efficiently – maximising the user experience throughout.

#### GENERATE LOYALTY

Ensuring an increased proportion of Machine to Machine (M2M) protocols is crucial to establishing a frictionless interaction for any mobility pricing service. Ensuring the successful provision of a frictionless suite of services, both in-vehicle and on handheld devices will promote continuity of use and generate user-loyalty.

A move towards the next generation mobility pricing is ultimately a conceptual move towards an integrated, intelligent and frictionless mobility payment system. The experience of users must be one of total front-end simplicity, cost transparency and long-term sustainability.

#### READY FOR THE NEW NORMAL

The COVID-19 pandemic is further accelerating the drive towards a cashless and reduced contact society. Contactless technology limits the spread of infection and protects the wellbeing of the most vulnerable in our society.



### Case study

#### M50 DUBLIN ELECTRONIC TOLL COLLECTION

Electronic Toll Collection (ETC) involves the electronic detection of the passage of a vehicle using detection equipment at the toll point and a device mounted in the vehicle or other means of uniquely identifying the vehicle such as the licence plate.

In this manner, the vehicle owner does not need to make a manual payment to a toll collector at the toll point and usually, though not always, the driver does not need to stop at the toll point.

Arup has been involved for a number of years in the design, delivery and supporting the operation of the M50 Toll Route in Dublin, through Transport Infrastructure Ireland. This system employs free-flow Electronic Toll Collection technologies to reduce friction and support a more harmonious customer experience.



## 09 Create seamlessly interoperable payments

Fares and payments between pricing operators, users and transport service providers must be simple, clear and concise with adequate levels of competition upheld.

### NO REGRETS DECISIONS

- Work with industry to develop cross jurisdictional policy guidance for system designers and operators that enables cross system interoperability. Industry innovation and competition should be protected
- Build an understanding of how cross jurisdictional and cross modal payment integration can be governed effectively. Similar to telecommunications, identify the role of the public and private sector in the future of mobility payments

### ECONOMIC BENEFITS

In addition to an enriched user experience, integrated mobility payment systems provide significant economic opportunity to public transport operators, private operators and technology providers in cost savings and new revenue.

### INFORMATION IS KEY

Interoperable digital payment technologies facilitate faster, more accurate collection of information on different user modal behaviours and may highlight key strategic investment opportunities to create a more efficient network as well as reducing barriers to modal shifting and encouraging social inclusion. A fully integrated transport payment system provides troves of new data, allowing transport providers and decision makers to create pedestrian-friendly, vibrant cities of the future.

### SECURING BUY-IN

Having full stakeholder “buy-in” is key to delivering a truly interoperable payment platform.



### Case study

#### INTEROPERABILITY MANAGEMENT SERVICE PROVIDER GENERATIONAL UPDATE

As part of Arup’s ongoing work for Transport Infrastructure Ireland’s Tolling Support Services, we are designing and administering the latest generational update to the Interoperability Management Service Provider. This system allows customers with an electronic toll payment unit from any provider to use any toll road in Ireland and be charged through a single account. The system also acts as a data clearing house that captures, exchanges, and processes all tolling transactions across the National Road Network. Arup also designed and managed a testing process in which old and new systems ran in parallel. This allowed for full operational process to prove and reconcile financials of the new system prior to launch.





# 10 Set truly dynamic pricing

Current public sector mobility pricing does not dynamically account for the ever-changing conditions on our transport network.

## NO REGRETS DECISIONS

- Undertake market and key stakeholder research to understand what drives public sentiment around dynamic pricing. What does the public sector need to demonstrate, and how does a pricing system need to be designed to be considered acceptable to the public? This information can help influence the policy optioneering and system design process

### NOT A NEW APPROACH

Dynamic pricing is not new and many markets such as hospitality, air travel and private hire services already use this approach to accurately price services to reflect demand. There is uncertainty over whether the public find the approach acceptable if introduced by a public sector transport operator.

### ACCOUNTING FOR EXTERNALITIES

Trips across most road networks are subsidised as users do not pay for externality costs such as emissions and congestion. Dynamic mobility pricing allows for these costs to be accounted for as the price can be dependent on vehicle type, emissions class, travel mode, and local air quality.

### OFFERING MODAL ADVANTAGE

Incorporating these elements allows the road authority to give a modal advantage to different types of vehicles throughout the day. For instance, the movement of heavy goods could be charged significantly higher during peak travel times.



## Case study

### SHEFFIELD CITY REGION: REVIEW OF FUTURE MOBILITY SERVICES ACROSS THE REGION

Arup worked closely with the Sheffield City Region (SCR) to help understand what the future of mobility means for the SCR and what ‘key moves’ they should be taking today to ensure there preparedness for the next decade and beyond. A key benefit is the opportunity this allows SCR in the future to begin moving towards more dynamic approaches to pricing mobility to deliver desired societal outcomes. It is recognised that truly dynamic pricing is a long term ambition but it is critical to lay the technological and governance foundations that allow progression towards a more dynamic pricing future.





ARUP

The 10 thoughts for next generation of mobility pricing are part of a wider set of ideas from Arup on the future of mobility. Other documents include:

- 10 thoughts for the future of low-emission mobility.
- 10 thoughts for the future of shared, connected and autonomous vehicles.

If you'd like to speak to us about any of our thoughts, contact: [smartmobility@arup.com](mailto:smartmobility@arup.com)

Or visit [www.arup.com](http://www.arup.com)

