White Paper

Technology Options for Road Pricing in the UK

a guide to technologies, operations and related policy options for charging and enforcement in the UK

Executive Summary

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Note
This document has been extracted from the full White Paper that will be available to all members of ITS (UK) at www.its-uk.org.uk. Contact ITS (UK) for more details.

Contributors

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Terms of Reference

Road pricing (otherwise known as road user charging) schemes worldwide already demonstrate that meeting charging policy requirements may need more than a single component technology. Technology choice is often not a choice between technologies but simply a selection of an appropriate bundle of technologies that meets the local needs in the context of a regional or national charging policy.

A variety of technologies for charging is emerging in each of these areas, including Dedicated Short Range Communication (DSRC) for communication and localisation, Global Navigation Satellite System including GPS, EGNOS and Galileo for positioning, GSM/GPRS/UMTS for communication between vehicles and the charging scheme and Automatic Number Plate Recognition (ANPR) for enforcement and for identification of occasional users. Augmentation options include automatic vehicle classification, odometer and other on-board sensors, map matching and Electronic Registration Identification (ERI).

To create this White Paper a series of meetings by volunteers from the RUC IG focused on feasible and emerging technology options through presentations and moderated consensus-building discussion. UK examples have been used wherever possible so that there is minimal confusion about the regulatory and operations context.

The intention was not to directly compare discrete technologies but to create an understanding of the capabilities of current technology in the context of UK National Road Pricing. The focus was to elaborate *"…on technology options for RUC [with] emphasis on technologies for charging and [their] impact/relationship with enforcement subsystems"*

Executive Summary

Our conclusion is that the key technologies for charging and enforcement that could contribute to National Road Pricing are already commercially available.

1. Background

Charging for the use of a road has become a significant political issue and, if not already being implemented, it is on the agenda of many governments, city authorities and road operators across the world. Typically, fees collected can be used to fund the development and operation of road infrastructure and potentially charging offers a demand management measure to manage (and reduce) congestion and pollution or provide an alternative form of motoring taxation.

The ongoing reduction in the cost of motoring in real terms is one of many factors that have led to a greater use of the UK's roads and an increase in the levels of congestion in towns, cities and on the strategic road network. Growth in population and households in the next 30 years is expected to lead to continuing increases in congestion, if left unchecked.

Pricing of road use not only informs users of the external costs of road use but also provides a mechanism for incentivising users to make informed choice of mode thus reducing their contribution to congestion. Pricing can take account of a user's location and time of day on the road network and provide a targeted approach to congestion mitigation than fuel duty taxation can hope to achieve by itself.

DfT has embarked on a phased programme that is intended to include on-street trials to prove scale at local and regional level and to establish the appropriate legislative, operational, organisational, usability and technological requirements for a possible move towards National Road Pricing (NRP). Charging and enforcement technologies provide only some of the components that would be required to enable NRP. Legacy schemes will also need to be accommodated; currently the UK has a few existing tolling and congestion charging schemes, each already aimed at meeting local or regional objectives.

2. Objective

The objective of the study was to establish that technology is available, does work and could underpin a feasible approach to an enforceable charging policy for the UK at a local, regional or national level.

RUC scheme planning needs to reflect the policy context from several perspectives including organisational, institutional, legislative and technological. The assessment of potentially suitable technologies therefore needs to reflect the policy context of road user charging, and meet functional and operational requirements. Technologies should be regarded as a means to an end rather than the end itself.

Within the current national policy framework the primary targets of Local Authorities are congestion reduction and mitigation of the environmental impact of road usage. A secondary but nevertheless important requirement is that a scheme needs to raise revenue to fund complementary transport measures. Hypothecation of revenues to invest in such measures appears to increase public acceptability. Furthermore, alternative scheme objectives as part of NRP may regard charges as full or partial replacement for fuel duty.

3. Policy Context and Options

3.1 Define the Policy Context

The behaviour change that results in reduced traffic levels at defined times and locations is the compound effect of individual travel decisions, including use of alternative modes (public transport, walking, cycling, car sharing), changing time of travel to avoid the most congested periods, changing route to avoid the most congested areas of the road network, reducing the numbers of trips, and “trip-chaining” to include several activities in one trip. Less desirable outcomes, at least from an economic perspective, include changes to the destination and reduced accessibility to areas or routes that are subject to a pricing regime. As part of the planning phase, scheme operators, including local authorities need to decide on the area where traffic reduction or environmental improvement is sought, the time of day of the reduction, quantified targets for improvements and revenue generation, road user groups that would be subject to pricing such as commuters or through traffic and take into account specific needs of other stakeholder groups.

3.2 Identify Complementary and Alternative Measures

Complementary and alternative measures also need to be considered; including network management measures (urban traffic control, traveller information, network infrastructure improvements) and whether or not traffic restraint is needed; employer-based green transport incentives (such as telecommuting) and improved public transport are examples of non-restraint measures. Areas of severe congestion or need for environmental improvement are candidates for restraint-based measures but represent greater barriers to implementation, including public acceptability. These measures include the reallocation of road space, traffic control zones (“cells”), public parking restraint through control of charges and work place parking levies, access control, and low emission zones for vehicles meeting emission criteria. Charging for road use is considered to be a form of traffic restraint.

3.3 Identify the Charging Policy Options

The charging policy also needs to define the basis of charging. There are many options, including point-based charging (typically used for toll roads), closed charging (distance related charging between defined points), area pricing and entry permit schemes, cordon charging schemes, multi-cordon / zone-based charging schemes, distance-based charging schemes, time-based charging schemes and time-based

(driven time) charging schemes. NRP reflects a combination of one or more of these bases of charging.

In the UK, Dartford Thurrock Crossing is operated as a point-based charging scheme and London Congestion Charging is an area scheme enforced at the boundary and within the area itself. Area licensing or permit entry schemes are simple to understand but can only practically influence demand on a daily or "peak times" basis rather than a more granular or 'per trip' one, and as such have more limited charging options. There are no cordon schemes in the UK although Singapore and Oslo are notable international examples; each charging to enter rather than drive within the prescribed zone and therefore likely to generate boundary effects, particularly relating to trip origins or destinations located just inside or outside the cordon. Multiple cordons can mitigate some of the disadvantages of a simple cordon scheme and can be adapted more closely with traffic movements although this approach is potentially more expensive to implement and intra-area trips are not charged (although the smaller the areas the lower the problem).

Distance-based charging schemes levy charges proportional to distance travelled, so reflect a usage-based approach more accurately than other policies and can be applied to dense road networks. Toll roads in France, US and Australia for example charge more for a longer distance travelled. This approach is also applied to the Austrian lorry RUC scheme; similar charging schemes in Germany and Switzerland impose a finer granularity of charges; the German scheme charges only on high quality roads on a segment-by-segment basis whilst the Swiss scheme is applied to the driven distance, regardless of the type of road or its location. Any NRP scheme introduced could extend this to a wider scale; determining road usage charges based on the vehicle's position, distance travelled (as measure of usage) and time of day.

Charging based on the time a vehicle spends within an area, either travelling or stationary, is also considered. However, measuring this and ignoring the actual time driven does not fully reflect road usage and actual contribution to congestion. However, charging on the basis of driven time within an area may incentivise unsafe driving whilst not providing any certainty of likely charges. Neither of these time-within-an-area options is regarded as a feasible option – certainly no such schemes are in operation at the time of writing.

In all cases, variations may be considered; for example differentiating the level of charges according to the grade of road (including strategic routes) or varying charges based on vehicle occupancy (currently the technology is not mature enough to do the latter). Time of day pricing and combination of the charging policy options with vehicle class differentiation are also possible.

Whichever option or options are considered, the practical implementation needs to allow for the extent of congestion or pollution, simplicity and ease of understanding by road users, impact on through traffic, availability of alternative modes, equity and land use issues, the potential for increased activity at the boundary, implementation and operating costs, expected use of revenues, definition and operation of

exemptions and whether or not charges vary by vehicle classification or declared emissions category.

Finally, a range of other policy issues needs to be assessed, including data security, the protection of a road user's privacy and the prevention of fraudulent behaviour and attacks on the scheme operations. A charging scheme will inevitably be subject to evasion, so there must be some alternative means of deterring or detecting and identifying evaders. Theoretically offences relating to non-payment can be prosecuted under a civil or criminal enforcement regime although this will depend on the local context and whether the fees collected from road users are charges for use of the road network, or taxes. For example, enforcement of the London Congestion Charging is based on a civil enforcement regime since the charge is applied for use of the road network.

4. Interoperability

Existing and planned RUC schemes in the UK, unless strictly local, will also need to comply with the requirements of the European Interoperability Directive as a precursor to the future European Electronic Tolling Service (EETS); one contract, one in-vehicle device. This is similar to the mobile telephony service in meeting many of the same expectations for convenience and transparency when crossing from one service provider's domain to another. Whilst interoperability is desirable, the delivery of this does not solely depend on the capability of the charging technologies employed.

According to the Directive, all new charging schemes (described as 'Electronic Toll Collection' or ETC) in Europe shall use one or more of the following technologies:

- Satellite positioning;
- Mobile communication using the GSM-GPRS standard; and
- 5.8-GHz microwave technology, using dedicated short-range communication.

A 'one contract, one device' account implies interoperability. To date standards development and working examples of ETC have shown that national and bilateral interoperability can be realised (e.g. between Spain and Portugal and between Austria and Switzerland). The Directive aims to extend this throughout the EU, hence the need to limit technology divergence. The work to define EETS also includes harmonising vehicle classification descriptions and setting a timetable for enactment of its provisions. Technology choice is only part of the decision that a charging authority needs to make; there is also the creation of the appropriate contractual interface to allow road users with a valid contract issued anywhere in the EU to be charged on any applicable roads. In particular the definition of EETS, expected by mid-2007, will cover DSRC and GNSS/GPRS technologies, and is expected to mandate that in any such schemes, each operator must offer interoperable equipment on request alongside any local solution that may be employed. This obligation is expected to apply from mid 2009 although this is still to be confirmed by the European Commission.

5. Functional Requirements

We identified several functional requirements to assess the most feasible combination of technologies to implement and enforce road pricing. These functions are time, communications and positioning supported by vehicle identification, distance measurement and charge calculation.

Charging for road use includes both time and space. For example, a time-differentiated charge can be applied within an area, such as in the case of the London Congestion Charging scheme. Alternatively, time differentiated charges can be applied to specific roads or road corridors. Typically, the generation of charging events on a 'per trip' basis depends on two-way communication between vehicles and the RUC 'back-office'. For point-based charging the event can be localised to a specific point on the road network (or toll lane in the case of toll collection plazas). However, a distance-based charging scheme cannot always depend on discrete communication locations (the infrastructure may be uneconomic or otherwise impractical) so wide area communications such as those offered by GSM and GPRS would be more suitable.

Positioning is also fundamental to charging, for example at a specific location or on a defined road segment. Similarly, although enforcement may not depend on any in-vehicle technology it may be necessary to prove that a vehicle was inside a particular zone, or was travelling along a particular road at a particular time.

Also, if a discrepancy exists between declarations issued by any in-vehicle equipment and parameters measured at an enforcement location then this may trigger the capture of enforcement images showing vehicle presence with other supplementary data.

In order to issue correct charges to users and to avoid issuing penalty notices to legitimate users, it is vital that vehicles are correctly identified. Electronic declaration from in-vehicle equipment can provide this identification. Alternatively, if a scheme does not mandate fitment of in-vehicle equipment (e.g. occasional users would be unequipped) then vehicles will need to be identified using Automatic Number Plate Recognition (ANPR). This relies upon cameras which capture at least one image containing the vehicle's number plate from which the Vehicle Registration Mark may be read. Other context images may be required to build a secure, high quality record for use as primary evidence as part of the enforcement regime.

Whilst technology performance is important the efficiency with which the end-to-end process generates charges is more important to scheme operators and, of course, road users. The accuracy needed for missed or incorrectly reported use of road segments creates performance requirements on two parts of the operation: positioning confirmation (relative to the correct chargeable road segment) and the determination of appropriate charges. Incorrect identification of the road segment, a missing point charge or other internal process failures can create billing errors;

consequently workflow processes should aim to minimise these errors to maintain scheme credibility.

All scheme operators also need to consider physical security and data security. Each of these is well-understood and should apply equally to the scheme operator and other entities within the road pricing organisation structure, including ensuring protection for data transferred between these entities.

Privacy and the use, management and deletion of user data are covered by the Data Protection Act. Data gathered for billing and enforcement purposes should be destroyed within statutory limits. The organisational structure for a scheme does not necessarily mean that all entities need to access the same data, either relating to the use or the road usage itself.

6. Environmental

Road usage imposes external effects on others and on the environment, including noise, accidents, congestion, pollution and visual intrusion on the landscape. Internalising a vehicle's external costs is one of the goals of road pricing. Heavy goods vehicles contribute greater damage to road infrastructure than other vehicle so, on this basis also, may be required to internalise a greater cost. Charging a vehicle without requiring it to stop or slow down reduces traffic noise and related emissions -- two benefits of ETC compared with traditional toll plazas. One of the positive benefits of demand management, as highlighted by Transport for London, is the reduction on harmful emissions -- PM10 and NOx.

7. Back Office Processing, Architectures and Organisation

The central system or 'back office', whether publicly or privately funded, plays a critical role in enabling an effective business operation for road user charging. The functions that comprise a central system can be split into several areas, including:

- Account registration and fulfillment (e.g., meeting users' requests for OBUs);
- Capturing 'basic' data on road usage (e.g. where position is used to determine usage then capture geographical/location data / calculate charging data / aggregate charge data up to thresholds)
- Accounting, including charge and payment reconciliation
- Customer Relations Management, including account set-up and management
- Billing
- Enforcement
- Interfaces to other public agencies and specialist service providers;
- Management Information Systems (MIS)
- Provisions for data security and disaster recovery.
- Policing of security (internally and users)
- Detection of fraudulent activity
- Protection of privacy

Although each of these functions needs to be present it is not necessary that each scheme operator is required to develop them. Instead, most may be available as a service from a third party and depending on the third party's scope and business

model may be performed by either a public or a private sector organisation. This approach may, in fact, enable a Local Authority to access a central service at lower cost (whether measured on a per event, journey or period basis) than an internally developed service. Aggregating demand from several scheme operators will bring economies of scale, enabling a more efficient and lower cost operation.

Traditionally, point-based charging schemes depended on capturing discrete single events. Distance-based charging schemes measure, collect and aggregate road usage data with greater granularity for billing purposes. The reconciliation process maps the obligation to pay (by event or journey) against declarations (direct or indirect) and payment (pre-and post). The enforcement process may also require access to the charge data collected to respond to other scheme operator enquiries or to challenges from road users.

In many cases, RUC and electronic toll collection schemes require that all vehicle passages are associated with an account or (ideally) a pre-paid amount. This is the role of the payment systems part of the central services. Ideally, multiple payment channels should be offered to enable road users every opportunity to pay the charges whether on a pre-payment basis (the majority of schemes worldwide) or within a period of grace after the trip has been completed (the London scheme permits payment next day). Each payment transaction has an associated transaction cost, cash payment being the most expensive to handle but internet or other automated interfaces being the cheapest to provide. Although this should not preclude a broad spectrum of channels being offered, the operator should incentivise the use of payment options with the lowest transaction cost. For congestion charging the dilemma is ensuring that the user is fully aware and understands the meaning of the charge (to stimulate behaviour change) whilst facilitating the payment transaction itself.

A system architecture at national level is needed to accommodate charging at a national and local level. The DfT-sponsored DIRECTS project is a research project whose objective was to demonstrate the operation of Road User Charging (RUC) systems for open road multilane motorways and urban roads. In addition it is preparing technical specifications, proving equipment interoperability and confirming the feasibility of a functional end-to-end architecture including full back office functionality.

8. Technology Options

There are currently only three primary technologies for the measurement and recording of road usage: Dedicated Short Range Communication (DSRC), Global Navigation Satellite System / Cellular Network (GNSS/CN) and Automatic Number Plate Recognition (ANPR). Each of these technologies has different capabilities and are not directly comparable but can complement each other as part of the charging and enforcement process. A fourth option is the odometer that can measure distance travelled but not the vehicle's position, so is not considered further here. Additional technologies that may be needed include vehicle detection and vehicle classification

although the use of these is more suited to a differential charging scheme based on vehicle class.

(a) Dedicated Short Range Communication (DSRC)

A DSRC-only scheme (i.e. Dartford Thurrock Crossing) relies on a small battery-powered transponder (On-Board Unit – OBU), usually mounted on the vehicle windscreen to communicate at 5.8GHz with roadside equipment mounted on a pole or gantry. DSRC also complements GNSS/CN since it can be used for localised vehicle identification for enforcement purposes. DSRC requires ground-based infrastructure for charging. It is a proven technology which is applicable to both toll plazas and open road free-flow applications.

(b) Global Navigation Satellite System / Cellular Network (GNSS/CN)

A GNSS-based solution uses an on-board unit which combines a GNSS location system (augmented with inertial or other sensors if appropriate) and a communications link (usually a cellular radio network - CN), with a digital map either on-board or in the 'back office'. The OBU measures the vehicle's position which is used to identify the road segment (or to confirm the vehicle's location within a discrete charging zone) to enable the correct charge to be assessed. Lack of visible (i.e. line of sight) satellites caused by tunnels or 'urban canyons', for example, can be mitigated by data processing techniques such as map matching, infill beacons or other in-vehicle sensors. Galileo is further expected to increase the number of visible satellites and improve the geographic availability of usable satellite data.

(c) Automatic Number Plate Recognition (ANPR)

ANPR depends on the capture of images of a vehicle that contain its number plate. ANPR processes the image to extract the number plate (otherwise known as the Vehicle Registration Mark -- VRM) to aid matching with a pre-registered list for charging un-equipped users (assuming non-mandatory fitment of OBUs) or to automate the enforcement process for vehicles by identifying those that have not completed the required actions by a prescribed deadline or otherwise to help prosecute any other infringements of scheme rules.

None of these technologies on its own was considered sufficient by the study; in fact the three primary technologies were regarded as complementary: DSRC to permit vehicles to be localised, account-related data to be reported and for enforcement purposes; GNSS/CN for distance-based measurement and reporting; and ANPR to identify occasional users and to capture image-based evidence for enforcement. The Universal On Board Unit study (a recently completed EU project) highlights the feasibility of a hybrid OBU that incorporates both GNSS/CN and DSRC technologies to meet many of the charging policy options studied. The hybrid approach also offers policy flexibility, highlighted in the 'technology mapping' process that concludes the White Paper.

Overall, the key technologies for charging and enforcement detailed above that could potentially contribute to National Road Pricing are already commercially available.

9. Enforcement

Whichever technology is chosen for charging to enable a charging policy will require infrastructure for enforcement whether this is fixed or mobile.

A charging regime cannot exist without enforcement; to ensure compliance with charging scheme rules, to deter against non-payment and to collect any revenues due, including any additional charges that may be imposed due to non-compliance. There are three main areas which may be enforced or controlled depending on the nature of the scheme; non-payment of fees, non-compliance with permissions or local regulations and mismatch between declared and measured vehicle parameters.

The capture of evidence of a vehicle's identification and presence in the charging area at a prescribed time is a primary requirement of any charging regime that does not depend on physical restraint such as barriers. Additional evidence includes vehicle characteristics at the enforcement location and any other information that can help ensure a successful prosecution – the end point of the enforcement process. Invariably, in the UK this evidence is primarily image-based. Information extracted either automatically (e.g. by ANPR) or manually from the image such as the VRM and data read from an OBU (if present) can be used to help automate the enforcement process but this is unlikely to be regarded as primary evidence in court. It is essential that evidential data is protected using well-developed data security techniques to ensure its integrity and authenticity.

10. Future Technologies

Each of the identified technologies continues to evolve: improved performance, fully resolved standards, increasing knowledge of their performance (and shortcomings), and migration towards multi-functional hybrid devices (as in the UOBU study); meeting the requirements of the Interoperability Directive and EETS. New communications options are evolving such as Universal Mobile Telephone System (UMTS or '3G' in Europe), WiMax and Ultra Wide band (UWB) although none are being created specifically to support road user charging. Standards are being developed to enable interoperability of GNSS-based OBUs – standardised reporting mechanisms will help the convergence between competing GNSS solutions. Finally the development of Electronic Registration Identification (ERI) that relies on an identification device that is part of the vehicle could replace the need for images. This, however, will require acceptance by the courts, and is not within the time horizon of this technology options assessment.

11. Regulatory, Governance and Standards

The Secretary of State for Transport set up a comprehensive study (the Feasibility Study) to examine how a new system of charging for road use could help make better use of our road capacity. The study considered whether and how road pricing might work, not whether it should be adopted.
The relevant legislation and regulations applicable to road user charging in the UK include:

- Local and national charging orders for tolling at bridges and tunnels in the UK and evolutions of these appropriate for barrierless tolling;
- Greater London Act 1999 and Transport Act 2000 that enabled road pricing by local authorities;
- London Scheme Order (consolidated) related to the Greater London Area;
- Home Office Scientific Development Branch specifications for automated recording equipment, appropriate for image-based evidence gathering at fixed and mobile enforcement locations;
- SI 2001/2793 (Road User Charging and Workplace Levy (Classes of Motor Vehicles) (England) Regulations 2001) and SI 2003/282 that define 18 different vehicle classes; and
- The EU Interoperability Directive and its enactment in UK law

In future, the provisions of the Interoperability Directive are expected to be a part of the EETS that will be applicable to all charging schemes that are not substantially local.

The in-vehicle technology options are also subject to standards which are necessary but not sufficient to enable interoperability. They have been published for DSRC and are being developed for GNSS/CN. Within EETS, eleven working groups have been established to study proposals for DSRC technologies including harmonising the classification of vehicles, enforcement of offences, definition of certification centres, standards for GNSS/CN technologies for EFC, integration of OBU in vehicles, the role of the financial institutions in the system, a verification of the Italian UNI (e.g. Telepass) specification and verification of specifications for a pan-European satellite EFC system.

12. Technology Mapping

In Table 1 below the basis of charging was mapped onto available technology options to highlight the technological feasibility of implementing a charging policy and conversely the policy that a specific single technology option enables. The table below only focuses on technologies for charging rather than enforcement although in all cases the primary means of enforcement will be based on the capture of images (or by physical barriers for some toll plazas) – provision for this will also need to be made.

Basis of Charging	*DSRC*	*GNSS/CN*	*ANPR [1]*	*Examples*
Point-based charging (tolling)	✓✓✓	✓ *[2]*	✓	*Dartford Thurrock*
Closed tolling	✓✓✓	✓✓✓	✓	*French motorways*
Area pricing and entry permit	✓✓	✓✓✓	✓	*London CC*
Cordon charging	✓✓✓	✓✓ *[3]*	✓	*Stockholm pilot*
Multi-cordon / zone-based	✓✓ *[4]*	✓✓✓	✓	*Proposed Edinburgh*
Distance-based charging	✓✓ *[5]*	✓✓✓	✓	*German lorry RUC*
Time-based (in area)	✓✓✓	✓✓✓	✓	*Lisbon trial*
Time-based (driven time)	***X***	✓✓✓	***X***	*Cambridge trial*
National Road Pricing	***X***	✓✓✓	***X***	*Switzerland lorry RUC*

Table 1: Technology Mapping

X = impractical ✓= possible, ✓✓= worthy of consideration ✓✓✓= best fit

[1] Assumes single point of detection at each charging point or, for distance-based charging, a single point detection on each chargeable road segment.
[2] Whilst technically feasible, the cost for a single scheme might be unrealistic.
[3] Rapid evolution of technology and improvement of accuracy, availability and penetration within vehicle population are likely to improve the fit in the future.
[4] As the number of cordons increase the less practical DSRC becomes.
[5] Simple schemes only

13. Conclusion

The key technologies for charging and enforcement detailed above that could contribute to National Road Pricing are already commercially available.

However, selecting the appropriate bundle of technologies is only part of the story. Operational, policy, organisation and legislative context needs to be supportive to road user charging whether implemented at a local, regional or national level.

Furthermore, the mapping above assumes a single technology choice rather than a hybrid OBU that may embody all in-vehicle technologies to support charging and enforcement purposes. The mapping shows that whilst DSRC may be better suited to point-based charging, GNSS/CN is more suited as the primary method of charging for distance-based schemes, including NRP. Furthermore, although ANPR would appear to be impractical as a primary method of charging for NRP it is likely to be used as the core, alongside DSRC, for localised schemes for fixed and mobile enforcement.

Note

The text in this document was extracted from the full White Paper that will be available to all members of ITS (UK) at www.its-uk.org.uk. Contact ITS (UK) for more detail by email at mailbox@its-uk.org.uk or by phone at +44 (0) 20 7709 3003.

Acronyms

ANPR	Automatic Number Plate Recognition
DSRC	Dedicated Short Range Communications
EETS	European Electronic Toll Service
EGNOS	European Geostationary Navigation Overlay Service
ERI	Electronic Registration Identification
ETC	Electronic Toll Collection
GNSS / CN	Global Navigation Satellite Systems / Cellular Network
GPRS	General Packet Radio Service
GPS	Global Positioning System
NRP	National Road Pricing
OBU	On Board Unit
RUC	Road User Charging
UMTS	Universal Mobile Telecommunications System