

A full review of the last 10 years of electronic toll collection would necessarily include most of the political twists and turns, industry growth (and partial consolidation), technology battles, standardisation start to finish in Europe (start and restart in the US), enabling legislation on both sides of the Atlantic and growing public acceptance that maybe roads are not 'free' after all. The author investigates further...

Tolling Stones

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The technologies that determine when and how road users accounts are charged have been a subject area examined by *TTi* since it was first published in 1994 when digital mobile communications was a luxury and the size of your mobile phone was perceived as being proportional to your business success. The assisted migration from a dependency on assured defence contracts to the much shorter term civilian markets was gathering momentum. In this year 1994 the term 'ITS' had been accepted to signify the beginning of a renaissance in the applications of communications, sensors, display devices and positioning technologies integrated into the transportation infrastructure and vehicles.

Islands of success

In 1994 Electronic Toll Collection (ETC) was serving isolated pockets of road users in the US, UK, Norway, Hong Kong and France amongst other countries as a means of revenue collection for new infrastructure projects or to augment existing cash collection operations.

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Commercially, the market demand for interoperable technologies had not yet been fully established although the early example set by the tri-state area InterAgency Group (IAG) is often forgotten. In 1994 the *E-ZPass* initiative enabled one tag (although proprietary) to pay tolls at any participating *E-ZPass* facility and, when the clearing system was finally in operation, by opening only one account. Meanwhile, in Europe toll operators were procuring local solutions on a competitive basis from multiple ETC technology suppliers and system integrators. The drivers for interoperability nevertheless remained local.

In 1994 the ETC industry and market was projecting exponential growth from a zero billion dollar starting point. Technologies were proprietary. Vehicle-to-roadside communications standards were being developed by industry in Europe by CEN TC278. Automatic debiting from a multi-application onboard 'electronic purse' was seen as the

future for road services and smart card vendors were anticipating a large short-term market, stimulated by expectation that the Singapore's Electronic Road Pricing scheme would be replicated worldwide for cities. Well, at least the successful start to Italy's 'Telepass' ETC services in Italy from 1990 showed what was possible. Users on both sides of the Atlantic were told that, one day soon, a single smart card would enable payments to be made for my coffee and tolls in the morning and everything from my dry cleaning to customised traffic reports on the drive home in the evening.

In 1994 traffic congestion continued its relentless march towards gridlock (average speeds in London were about 18kph during the working day), the principles of marginal cost pricing had not yet reached the breakfast tables of road users and tax on fuel was an infinite reserve to be exploited by governments. And the first GPS satellite had just been launched. In 1994, the seeds of the future industry and market development had already been sown although the expected direction of growth was not as expected.

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Technology choice explosion

Manufacturer interest in road user charging was maintained by what was probably the world's largest ETC technology comparison - on the A555 in Germany in 1994/95. Mass market road user charging was visibly and publicly on the map in Europe. The stability and emerging maturity of the vehicle-to-roadside communication link known as DSRC was being tested against Infrared, GPS, GSM and all possible combinations polarised around either positioning- or DSRC-based methods. The project showed more than technology options, however. Interest in road user charging was also developing outside of the 'traditional supply chain'; new players included telecommunication operators, the aerospace industry, vehicle manufacturers, automotive electronics manufacturers and financiers. Trials work continued: the UK's Department of Transport conducted a DSRC technology trial in 1996/97 followed by the HK Transport Department's DSRC and GPS/GSM trial for urban road user charging from late 1998.

New ideas, new companies

The Dutch '*Rekening Rijden*' programme to charge for road use within the Randstad area of The Netherlands was intended to reduce congestion whilst capitalising on Europe's highest penetration of electronic purses (Integrated Chip Card, ICC) per capita. Paying to use the highway would be, in theory, as easy as paying for a newspaper. A tendering process was concluded in 1998 leading to the selection of four industry consortia contracted for the simulation, factory testing and on-road testing of open highway multi-lane charging. After initial technical success, during which vendors grappled to

accommodate the existing ICC card designs into their system architectures, this multi-stage ambitious project collapsed due to political uncertainty.

Power shift

Highway owners and operators had collectively not, at that time, influenced the direction of technology or road use charging policy development in Europe. Private and public toll operators were continuing to procure separately in the US, Australia, Philippines, Portugal, Spain, UK and many other countries - pursuing focused commercially driven objectives relating to infrastructure financing that could be satisfied by pre-standard technologies, invariably based on DSRC. From its roots in the Poids Lourds programme in the early 1990's the innovative Télépéage Intersociété (TIS) programme emerged in France, driven by highway operators. In parallel, the European CARDME initiative was aimed at establishing the requirements for contractual interoperability to benefit the highway operators and their patrons.

The conclusion of the CEN DSRC specifications was still proving to be elusive although European DSRC technology vendors were still finding success outside Europe. In general though, DSRC was still developing rapidly and became integrated into a new generation of multi-lane free flow fully enforced highways. A small pilot on the Tauern Autobahn in Austria was eclipsed by ETR 407 in Canada as the world's first fully electronic highway. Projects were getting larger and the number of companies that could compete for the new generation interurban tolling systems was getting fewer. The Melbourne City Link, Cross-Israel Highway and Santiago Area concessions stimulated international competition. The customers of the electronic tolling industry were no longer interurban highway operators but instead highway infrastructure developers.

However, although users, industry, road operators, governments and the press were focusing on the tangible evidence of RUC, namely the on board units and the technology they employ, the greatest risks at that time lay in the operation and interfaces of the central systems. High profile contracts in Canada and Australia in particular were suffering from either overloaded central systems or poor system integration. This proved to be a short-term glitch in an otherwise rapidly maturing combination of operating policies, technologies and public relations for interurban highways.

A time for reflection

So, whilst party-goers were celebrating Millenium New Years Eve the foundations of Road User Charging (RUC) had been firmly established: multiple market segments, broadening technology options and expanding policy options: RUC policy options can both influence, and be influenced by, available methods of charging.

Whilst the US was focused on a new national standardisation programme with a WiFi-derived platform to accommodate broader telematics options, Europe was taking a new top-down approach as part of the development of a 10 year community-wide transport

policy strategy. Selective infrastructure development, making better use of existing infrastructure and inducing intermodal shifts were primary. The trigger was the increasing need to signal the total external cost of a trip, internalize it through road fees and ensure feasible alternatives for short and long-term decision-making.

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In theory, charging technology and the systems to support them were secondary to enabling charging policy. Upto that point, GPS and DSRC had pursued completely separate development tracks. Whilst attempting to set technology direction, the European Commission triggered vigorous debate amongst toll road operators, road transport associations, national transport authorities on the future of charging technologies in the European Union. The aim was to drive the adoption of road user charging policies at the level of the member state, starting initially with heavy goods vehicles then all vehicles. The underlying principle was that a nationally-procured solution would naturally be optimised for national use. So community-level guidance was felt to have been needed to ensure that national solutions could be adopted but within an EU-wide framework. In short the vision was to enable road use fees to be paid with a 'single box, single account' whilst travelling across borders within Europe. In 10 years time we may see if this vision was realised - the challenge of community level policy instruments will be to drive EU-wide harmonisation whilst ensuring local relevance within countries that have mixed legacies of transport infrastructure capacity.

If congestion is an indicator of economic activity, congestion also highlights imbalance between capacity and demand for the same mode and, invariably, it is the urban highways and streets that are congested not the rail or underutilised inland waterways network. Tolls are obviously not always tolls. Instead, the imposition of fees for existing infrastructure attempts to match or at least contribute to the external costs imposed. Sophisticated, multi-level apportionment of funds to reduce environmental impact through modal shift is part of what may be regarded as a 'text-book' model adopted by the Swiss LSVA heavy truck charging scheme.

Technology push or market demand?

A glimpse into the potential complexity of national road user charging schemes was highlighted by the first faltering steps taken in Germany to establish a national scheme for the charging of heavy trucks on the country's motorways. This ambitious project suffered from an apparent mismatch between project complexity, charging policy and timetable. The much-hoped for successful implementation was rescheduled for 1-Jan 2005 for the manual trip registration scheme followed on 1-Jan 2006 by a GPS/GSM/digital map hybrid to automatically determine road charges based on distance travelled. The UK will

follow Germany, Austria, Switzerland, US and New Zealand amongst others in charging for heavy trucks based on distance travelled.

Political and institutional barriers can also be used to explain the stop-start evolution of RUC from the desks of economists onto the streets of our cities over the last 10 years. Whilst Singapore's ERP system was founded on its Area Licensing Scheme, securing the necessary public and political acceptance in London was another matter. Although 17 Feb 2003 (the scheme launch date) is already regarded as a political and project management success, the acceptance of paying £5 (€8) to enter the heart of Europe's largest city was confirmed on 10 June 2004 when the Mayor of London was re-elected. The fee may only be one part of the transport strategy but it serves as an easily understood trigger for rational and emotional debate. Providing local, direct and visible benefits to road users and the community may become the principal drivers for successful urban congestion charging scheme in the future. 'Success' of course can be measured in many ways but we can safely leave that to the politicians...

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Future direction

Lack of interoperability for road users travelling from one charging scheme to another is expensive - a road services provider (new 'RUC speak' for road operator) would need to provide facilities for all road users on a non-discriminatory basis. The prospect of a GPS positioning device being presented as a means of payment at a toll plaza demonstrates how a clash of charging policies (tax versus fee) and technologies (distance versus point payment) could appear in a worse case scenario. So, a minimum level of interoperability is desirable, regardless of the primary method of charging that a road user or road services provider would normally use. The image of a windscreen covered with multiple OBUs can no longer be seen as the future even though we may be quite familiar (and comfortable) with having 3 credit cards, 5 airline affinity cards and 5 store cards - all (probably) technically interoperable but contractually not.

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Over the last 10, 'interoperability' is now seen as critical goal and a means of stimulating competition in procurement (e.g. TIS) and equally applicable to the management of evidential enforcement records (e.g. EC-funded VERA 2). Compliance testing, environmental risk assessment, provision of payment audit trails, system threat analysis

and compliance with Data Protection laws are now routinely required for the implementation of RUC schemes. Public acceptance also helps, of course.

So, in 10 years the concept of locally-optimal infrastructure development funded by tolls has become only one strand in a much more sophisticated environmentally-conscious transport policy world. The word for 'tolls' has been supplemented by road user (or use) charges, schemes can now be based on different charging policies (distance, emissions category, classification, etc.) and a broad array of technologies are now available as policy enablers.

The future of RUC may already be here but it certainly is not evenly distributed. One thing is certain - the next 10 years of RUC technology development, interwoven with charging policy development, will be as difficult to predict as the future seen from 1994.

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