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Road User Charging: The Global Relevance of Recent Developments in the United Kingdom

By

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ABSTRACT: Charging users of the roads for the costs they impose on the system is not new. Economists have been promoting its virtues for as long as arguments about economic efficiency have been in print. What is different today is that a growing number (but by no means all) of decision makers are showing a greater interest and commitment to finding ways to improve the efficiency of the road system, be it through infrastructure expansion and/or other means. Of special interest is the growing level of traffic congestion, and a feeling of almost helplessness, that we seem to have failed in finding a way forward to maintain traffic congestion at levels that are acceptable to the public, and are consistent with principles of good economic practice. The literature abounds with suggestions on how this might be achieved, focused primarily on various pricing regimes that say as much as about levels of charges as they do about the role of the revenue raised, the latter as controversial as the former. The current state of technology provides a capability to introduce sophisticated charging mechanisms. We are at a stage in the evolution of 'solutions' to dealing with inefficient road use and provision of road funds that offers real prospects of delivering outcomes that can align with political, social and user demands and expectations. This paper provides a global perspective on the road to efficiency, using the UK contributions in the special issue as a backdrop of what can be done. The issues and challenges are sufficiently global to enable the contributions to be of immediate relevance beyond the UK.

KEY WORDS: ***User charges, road pricing, congestion, integrated technology***

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1. Introduction

The funding of roads from common sources (e.g., fuel taxes) is becoming more problematic than ever before. While in some jurisdictions it is a matter of allocation, in other contexts, it is a more serious concern about the total amount available to allocate. In California, for example, a Road User Fee Task Force Program recently issued a White Paper from the Californian Performance Review (CPR). Initiated by the Californian Governor with reporting back directly to the Governor's Office, it has been promoted in response to the diminished proceeds from fuel taxes. Funding 'by the gallon' from fuel-use taxes no longer suffices, despite some additional Federal Government contributions. Paying by the mile is now on the political agenda. As little as 0.1 of a US 1 cent fee per use-mile, it is suggested, would generate annually $US310m towards the road funding bill in California.

Regardless of what regime currently exists and what the future holds for existing funding sources, there is a growing recognition that we need to realign the revenue streams to better reflect the use of the road system. While the debate is more than just how to reduce traffic congestion, the latter has been the stimulus to seek out other ways of improving the performance of the road network, as evidenced by the focus in the papers to follow on congestion and various pricing regimes (see also Kalmanje and Kockelman 2004). Pricing car and heavy vehicle use is being taken more seriously – tolling of roads constructed under public-private partnerships (PPPs), experiments with distance-based user charges (e.g., Oregon, see Forkenbrock 2004, O'Mahony et al. 2000, Hug *et al*. 1997) and the introduction of cordon-based congestion charges in London and Durham, have certainly sent a signal that *widespread* pricing linked to tolling and congestion is on its way – it is not *if* but when and *where*.

Whereas some of the motivation is linked to the commercial realities of delivering improved infrastructure (often under a fast track program), such as setting tolls to deliver a sufficiently attractive environment within which to raise debt and equity to fund a specific road project; the push is now on to broaden the pricing regime to recognise the benefits from economic efficiency in pricing of road use, regardless of commercial commitments. What makes the London congestion charging scheme so special from a global perspective, regardless of what one might think about specific aspects, is that it has been introduced into a large unambiguously western city where political parties can be ousted at the very thought of such a charging impost, and has as a consequence got the ear of politicians of many persuasions throughout the world. Although Singapore was there first and has a much more sophisticated electronic road pricing scheme (Toh and Phang 1997), it has rarely been held up by other countries as something which is doable, politically and socially; whereas the London system has. I doubt whether the fact that London introduced congestion charging almost 30 years after Singapore's initial area licensing scheme is the driving force for growing global support – it is simply that it occurred in London, which is easier for many other jurisdictions to relate to.

The biggest challenge over the last 30 years has been in getting pricing on the agenda of the political process[1]. Now it is there, to some extent[2], and technological support has come a long way, we have many more options in how we introduce charging regimes than ever before. In many senses the 'popular' cordon-based charging regimes like that in London (Transport for London 2003) are not the best way of implementing a charging regime; reflecting in part the fact that technologically, London (and most of the UK) is way behind countries that have invested extensively in electronic tolling systems that are interoperable across the system. For example, Sydney, Melbourne and Brisbane have a growing number of tolled roads that are fully interoperable, requiring a single electronic tag (ETAG). Payment disbursement amongst owners of each toll road is undertaken through a clearinghouse, just as banks do. So what is the future likely to be?

A true road user charge will be facilitated by GPS/speed sensor vehicle tracking, calculated by onboard electronic accumulating odometers, remotely assessing travel from central computers that are capable of applying a range of charging regimes. These include uniform road-use charges and congestion pricing (differential charging according to traffic conditions) including adjusted-upward charges for road use in remote areas (perhaps excluding local residents) where maintenance costs are high and distances travelled are relatively less. Graded distance fees can also be introduced if desired – possibly on equity grounds.

The tracking/distance reckoning and road use assessment system integrates the vehicle and the refuelling setting (Joseph 2004). Tracking can be defined spatially within a particular jurisdiction such as a State (with an on-board electronic odometer (OEO) shut-down capability when out of State via the GPS system); and within a local jurisdiction[3]. An electronic odometer records distance within jurisdiction. There would be a central computer wirelessly intercommunicating with the OEO, which calculates the road-use charge and applies it at point of sale, at the fuel pump. Once the charge has been paid (through a system such as EFTPOS) the system turns OEO back to zero, re-initiating the road-user charge procedure.

This is more than a dream – it is now linked to legislation in one state in the US. House Bill 3946 passed in 2001 in Oregon State Legislative Assembly has a mandated mission

> *"To develop a revenue collection design, funded through user pay methods, acceptable and visible to the public, that ensures a flow of revenue sufficient to annually maintain, preserve and improve Oregon's state, county and city highway and road system"*

ODOT is required to develop alternatives to current highway taxing use through fuel taxes. The Bill does not stipulate distance based charges, however. Is this applicable to other jurisdictions? Very much so. It is feasible from financial and administrative perspectives and also has compliance with Privacy Acts. This is ultimate economic

[1] In 2000 Hensher was a peer reviewer to the NSW government Action Plan for Sydney. The drafted chapter on pricing was removed from the document by the advisers to the Minister and the best we managed to achieve was a statement at the very end of the report, in one sentence, that pricing was something worthy of consideration at a later date.

[2] Not everyone wants congestion charging, like London has adopted. More than 74% of residents of Scotland's capital, Edinburgh, have recently voted against City Council plans to introduce congestion charging, similar to London's scheme. Donald Anderson, leader of Edinburgh City Council admitted that the planned scheme is now "dead and buried".

[3] In addition this system provides an excellent capability in use accounting even without charges.

application of intelligent transport and logistics systems and technology (GPS, GIS etc.).

The German lorry road users charging (LRUC) scheme has paved the way in Europe for a distance-based charging regime, applied to all heavy good vehicles with a total permissible weight of 12 tonnes or more that use the 12,000 km German autobahn network. Of the 1.2 million plus heavy good vehicles using the network in Germany, it is estimated that over 470,000 of these vehicles are registered outside of Germany. The location of Germany makes it a major transit 'corridor' connecting trade between other European countries. This is the first large scale operation road user charge scheme to use satellite-based electronic fee collection technology (ITSinternational 2004). An on-board unit identifies the (pre-registered) vehicles location and calculates the charge for a specific vehicle class (based on number of axles and emission rating). This data is transmitted to the Toll Collect control centre.

With this background, we now take a closer look at the UK-based papers in this special issue and seek out their contribution to the global program. We then discuss some other developments in other countries, concluding with some thoughts on the ongoing challenges for pricing and revenue disbursement.

2. Elements of a UK Perspective: What is being offered?

What do the papers in this Special Issue have to say about road user charges in general and congestion charging in particular?

Sumalee *et al*. demonstrate the inefficiency of judgmental cordons in road pricing schemes. The discussion is limited to cordon systems, hence omitting the potential for direct comparisons with other road pricing systems. They suggest that policy makers may sacrifice considerable efficiency when implementing road pricing if judgmental cordons are used. Utilising optimal cordons can offer significant increases in net benefits to stakeholders; the loss of these benefits is a high cost to pay for simplicity.

The equity of road pricing schemes over physical space is shown to be sensitive to the specification of the scheme. Stakeholders in some areas are likely to be impacted differently to those in other areas, and the degree of inequity may vary highly across potential schemes. Hence, horizontal equity concerns are justified when designing a road pricing scheme. Sumalee *et al*. highlight a potentially severe trade-off in net benefits and horizontal (spatial) equity. That is, should policy makers desire to preserve a particular degree of horizontal equity when designing a road pricing scheme, the net benefits of the resulting scheme may be much lower than without the equity constraint.

Farrell and Saleh centre their discussion on the allocation of revenue from road-user charges as a pivotal issue when implementing a charging scheme. They corroborate the implications of the extant literature by showing the need to hypothecate revenue to public transport, in order to gain both public acceptance and long-term viability. Kocak *et al*. support this, citing the need to include road-user charging as part of a broader package of improvements to the transport system. This includes the hypothecation of

charge revenues to public transport, along with other infrastructure improvements, as a means of gaining public support for the charging system. Farrell and Saleh, however, state that it is not sufficient to determine the area towards which funds should be designated (e.g., buses, trains, road maintenance). Rather, the specific uses within that area must take the preferences of stakeholders into account.

When considering hypothecation to public transport, there are myriad ways to utilize hypothecated funds. As public transport ridership is likely to increase under congestion charging, absorbing some displaced drivers, both the quantity and quality of public transport service provided must increase concurrently. This assumes that the price elasticities deliver such a switch![4] Farrell and Saleh demonstrate that, whilst fare and frequency improvements are important to stakeholders, other factors impacting service are important, as well. This holds for both tangible and intangible elements of service. Specific technological improvements, such as real-time information and integrated ticketing, may be desired uses of revenue hypothecated to public transport. On a broader scale, stakeholders indicated that funds should also be designated for improved reliability and network coverage.

Bonsall and Kelly investigate the marginalisation of low-income drivers under various congestion charging policies. Under a hypothetical charge of two pounds (with some other levels tested, as well), congestion charging was shown to have varying negative welfare effects on low-income users depending upon the specification of the charge. The effects were shown to vary across space, as well, confirming the work of Sumalee *et al*. Similarly, the discussion in Bonsall and Kelly confirms the implications in Farrell and Saleh, by highlighting the need to provide adequate alternatives to private vehicles when low-income stakeholders are priced out of driving under road-user charges.

An important point is that, when efficiently conceived, a congestion charging scheme could reduce social exclusion through improved provision of public transport. However, for some people on the margin, the loss of access to a private vehicle could significantly impair their participation in society. Not only could charges be prohibitive, but the equipment required to participate in the scheme (e.g., GPS devices or smart cards) may also be too expensive for some people who currently have the ability to drive. Kocak *et al*. confirm this, adding that lower-income drivers may have relatively lower access to bank cards needed to participate in some charging systems.

Bonsall and Kelly underscore the complexity of equity considerations when implementing road-user charging. There are wide-ranging effects of each possible charging configuration, influencing welfare across age, gender, race and location, at aminimum. Another important trade-off when implementing road-user charging involves concessions made to those threatened by social exclusion or other welfare losses: Offering concession to those who may suffer losses under road-user charging may significantly reduce the effectiveness of the charging scheme.

The significant role of equity in the discussion within this *Special Issue* underscores the broader barrier to the implementation of road-user charging discussed by Kocak *et al*., namely, public support. The acceptability of a road pricing system to the public tends to be quite low upon first mention of the system, due to concerns of equity, effectiveness

[4] As was the case in the City of London.

and preservation of privacy. Kocak *et al*. propose a holistic programming approach to achieving the goals of a road-user charging system, whilst raising sufficient public support concurrently. Each of the concerns held by the public are justifiable in their own right, yet Kocak *et al*. show that these concerns can be alleviated through practical means.

Bagchi and White argue that the availability of advanced data collection instruments, such as smart cards, has brought about a serious privacy dilemma. Whilst the information collected via such instruments is highly valuable to some stakeholders, such as transport providers and policy makers, society runs the risk of having privacy violated. The law offers protection to citizens' privacy, but it not absolute. Kocak *et al*. argue that privacy can be maintained under current technology; however, guaranteeing the preservation of privacy is another issue.

Road-user charging could lead to violations of privacy in two ways: (1) the use of electronic toll payment devices by participants in the charging scheme[5]; and (2) the use of smart cards by those who switch to public transport under the charging scheme. There are significant trade-offs in economic efficiency gains that could arise from the utilisation of sensitive travel data, and the preservation of privacy. Finding an appropriate compromise is argued to be a difficult, yet important goal.

Dodoo and Thorpe argue that improvements in information technology have brought more complex road-user charging systems into the realm of possibility. Whilst the majority of discussion regarding road pricing centres on passenger vehicle travel, Dodoo and Thorpe demonstrate the potential to improve existing heavy vehicle road-use charging regimes. The scope of road damage caused by heavy vehicles is significant enough to warrant methodologies to recover road maintenance costs from heavy vehicle operators; as these costs are high, the implementation of an equitable and efficient cost recovery system is desirable.

An efficient heavy vehicle road-user charging regime would need to account for the many factors that determine the marginal road damage of each trip. Whilst such a regime was prohibitive in the absence of present technology, this is simply not the case anymore. Crude charging regimes involving fuel taxes and registration fees may have the potential to recover costs on the aggregate, but with the consequence of failing to induce economically-efficient behaviour by heavy vehicle operators. Charging with respect to axle configurations, distance travelled, mass carried, and road and environmental characteristics would lead toward equitable charging for all heavy vehicle operators. Efficiency gains could be realised in terms of trip volumes and distances, and frequency of overloading.

Hu and Saleh (2005) examines the potential impacts of congestion charging on shopping trips in Central Edinburgh. Hu and Saleh project that, under congestion charging in Edinburgh, peak spreading would be dominated by rationalised trips and spatially-redefined trips. That is, respondents indicated that a given set of current trips would be replaced, in general, by a lower number of trips into the city centre, with some trips shifted to other destinations. .When considering factors that would lead to an increase in trips into Central Edinburgh, respondents stated that congestion itself is not

[5] Electronic payments on tolled roads have been in place in Australia for at least 10 years and there has been no case of privacy violation.

the primary concern. Rather, Hu and Saleh shows that sources of disutility outside of congestion discourage travel into the area. Many of these impediments are congestion-related, however. A congestion charge could feasibly improve the function of the public transport system, ease demand for parking spaces, and improve access to parking spaces, each of which were indicated to improve the attractiveness of trips into the city centre more than the alleviation of congestion. Whitehead (2005) confirms this through a series of interviews. Respondents suggested that congestion charging may improve the attractiveness of city centres such that a premium may be placed on central urban locations. Hence, the anecdotal evidence provided suggests that a congestion charge could potentially remove significant barriers to the acceptability of central Edinburgh as a shopping destination, through the provision of direct benefits of congestion reduction and indirect benefits relating to public transport and parking.

Overall, Hu and Saleh shows that congestion charging may influence the demand for goods in Central Edinburgh through the elimination and re-direction of shopping trips. This reduction in shopper traffic demand may, however, allow heavy goods vehicles to access the city centre with greater ease, partly offsetting any traffic gains. This points is the central issue addressed by Whitehead - the likely long-term net impacts of congestion charging on economic activity. That is, once the indirect effects of congestion charging are accounted for, what is the expected long-run outcome for commercial stakeholders? Whitehead discusses the complex and important web of indirect effects, including two fundamental spatial issues: the relocation of activities, and the augmentation of commercial facilities in response to increased demand. Most importantly, Whitehead confirms that these effects are likely to occur slowly and interactively; hence, the likely long-run impact may not be apparent after gauging the initial reactions of stakeholders.

The interactions between indirect impacts not only progress slowly, but are integral in determining whether a congestion charging system offers a net benefit to society and any subgroup therein. Whitehead suggests that, although these impacts are not entirely straightforward to project, the overall impact of congestion charging on economic activity should be relatively low. Businesses may not be adversely affected by the implementation of congestion charging, and indeed could benefit from improved access to city centres. Businesses that currently struggle to survive may be more susceptible to the impacts of congestion charging, however. Still, an issue for further research is the impact that congestion charging may have on businesses outside of a charging area over time. Indeed, these businesses may stand to experience the opposite effect of those businesses within a charging area.
The UK-based studies reported in this *Special Issue* take no positions that can be described as especially local. They are truly international agenda items. What is possibly limiting in the UK is the relatively small degree of exposure to the experiences involving the private sector in the funding and ownership of roads. For a nation so path-breaking in the road to privatisation in general this is a surprising position. The papers have reinforced the focus on economic efficiency, but not at the expense of distributive injustice. The latter may be accommodated by various equity compensation packages in which hypothecation of road user charges may indeed be a source of funds.

This generally popular support for hypothecation in these papers (especially Farrell and Saleh), contrasts with the position of others, for example, Enoch *et al*. (2004). Hypothecation has pluses and minuses. The *pluses* include the recognition of benefit

theory of taxation, it ensures a minimum level of expenditure for desirable government functions and continuity for specific projects; and it can help in overcoming resistance to new taxes or increased rates. The *minuses* include hampering effective budgetary control, the risk of misallocation of funds (excesses and under provisions), imparting inflexibility to revenue structures (especially in volatile times), the risk of remaining in place long after need, the removal of a portion of fiscal action from periodic review and control impinging on policy-making powers.

Finally, all papers recognise the role of technology in supporting the provision of charging regimes; however the evolving enthusiasm for technology should always be tempered. Do not ask if GPS or OEO is feasible, but ask who the stakeholders are and proceed to investigate how they may best be served. Let technology assist and not lead.

3. Beyond the UK: Tolling as a Precursor to System wide charging

With the exception of Singapore, area road pricing (linked loosely to traffic congestion) is a very recent phenomenon. Tolling is much more popular in many parts of the world (see Larsen and Ostmoe 2001) and is far more advanced than in the United Kingdom. (where there is so little tolling and private sector participation, with the recent exception of a private tollroad in the midlands, which charges trucks 11 pounds and cars 4 pounds). Sydney, for example, has the largest number of road kilometres tolled than any other urban jurisdiction, with over 40 kilometres of new tollroads due to be completed in the next two years, all of which is provided under a 30 year concession to a number of private companies.

Transit New Zealand recently released a consultation report on the Toll Systems Project, which recommends that Transit proceed with the next stages of the Toll Systems Project while maintaining wide stakeholder involvement. New Zealand currently has no tolled roads. “The report found that there is support for the concept of a nationally integrated electronic toll collection system for toll roads in New Zealand” said Transit chief executive Rick van Barneveld. The Toll Systems Project was initiated by Transit to develop a national strategic approach to the standards applying to the collection and processing functions of toll transactions for all toll roads, as a precursor to road user charging. Wide public consultation on the Toll Systems Project was undertaken from early September 2004 to 18 October 2005. But in its full consultation report, Transit says "many individual submitters queried the introduction of toll roads in principle, arguing that significant revenue is already collected through petrol excise tax". Most submitters also said a cost-free route must also be available as well as any toll route. The recent interest in the USA of trading fuel taxes with distance-based use charges, as in Oregon, may well assist in gaining acceptance of tolling, as long as there is a mechanism to facilitate the trade. This is more problematic when charging is road-specific than system wide, although advanced GPS systems are capable of determining the actual kilometres on tolled roads and adjusting fuel prices for this amount of road use.

The rationale for tolling appears to be a desire of government to bring forward the provision of freeway-quality infrastructure in a budgetary environment where

government claims that they could not afford these investments. That is, the focus is on financing as distinct from efficient charging. However as time passes, we start to gain a better understanding of the real motivation for private participation under what are commonly referred to as public-private partnerships (PPPs). It appears to be linked to government funding priorities and not the cost, per se. Indeed, we are increasingly of the view that the involvement of the private sector is a means to deliver more road infrastructure in a context where government sees its relevance, but is not prepared to spend on this, relative to commitments to other areas such as health, education police, etc. Hemming and Ter-Minassian (2004, 31) succinctly express the views of many:

> *"It is by no means certain that they [the private sector] will be more efficient than traditional public investment. Moreover PPPs can be used to move investment off budget and debt off government balance sheet while the government still bears most of the risk and faces potentially large costs that will eventually be borne by taxpayers."*

If PPPs are to deliver high-quality and cost-effective services to consumers and the government, there must be adequate risk transfer from the government to the private sector. The quality of services has to be contractible so that payments to service providers can be linked to performance and the risk of costly contract renegotiations can be minimised. There has to be either competition or incentive-based regulation. An appropriate institutional framework characterised by political commitment, good governance, and clear supporting legislation is needed (Hemming and Ter-Minassian 2004). The government will have to refine its project appraisal and prioritisation skills so it is able to manage a complex PPP program[6].

This discussion on PPPs is very pertinent to broadening interest and commitment to congestion charging. Banks are expressing interest (e.g., Standard and Poors) in going beyond the financing, through debt and equity, of toll roads, to area-wide congestion charging schemes. We suggest caution in automatically inviting the private sector, at least until there is greater transparency in the financial obligations and a fairer sharing of risk and reward between the private and public sectors.

The London experience has not adequately addressed a growing concern in many other major metropolitan areas. Will congestion charging limited to the many Central Business Districts (CBDs) of major metropolitan cities be the best way forward, despite the successes reported for the City of London (complete with all its exemptions and a generally low incidence of residential dwellers)? Maybe the ease with which a cordon-based charge can be introduced centrally (in the absence of advanced electronic charging), where car use is already a very small percentage of all trip activity (less than 12 percent), helped to justify this location? In many other metropolitan areas such as Sydney, Melbourne, Toronto, Pittsburgh, Paris (Downes 2004), congestion is at its worst on approaches to the CBD; and so will we be able to have much impact on it by charging in such a narrow zone as the CBD? For example, in Sydney, much of the traffic moving in the areas adjacent to the CBD does not go through any proposed CBD charging zone. With CBD-destined high commuter modal share in favour of public transport in peaks in many major cities, the balance of commuter passenger trips by car that terminate in the CBD are typically in vehicles that are company cars, often with

[6] Currently there are no international accounting standards for reporting PPPs. The lack of such a standard raises concerns about transparency, especially regarding the longer-term implications of such schemes. Discussions with Professor Jean Shaoul (Manchester Business School) have been valuable in clarifying the costs of public involvement.

permanent parking. There is often limited casual parking[7] and indeed the sensitivity to price will be very low indeed. In contrast to London[8], we might anticipate a far greater continuation with car and a more positive outlook for revenue raising.

What is needed in many US, Canadian and Australian cities, in particular, is a more serious effort to use (at least part[9] of) the charging revenue to improve the door-to-door travel opportunities for public transport from deep into suburbia, where public transport is clearly the best investment in delivering improved accessibility. With congestion charging limited to the CBD (which often has a small and declining percentage of all jobs), we might expect in time to see a move of jobs out of the CBD to other locations where such charging is not in place. This shows the downside of not taking a system wide view and focusing narrowly on the CBD. There is an interesting paradox here – congestion charging limited to the CBD might be expected, in the long term, to induce the relocation of offices. These jobs will relocate to locations where public transport is not so good and where greater circumferential travel is required, encouraging the growth in car use. Hence, the system wide impacts of CBD-centred charging schemes will be counter-productive.

4. Concluding Comments

The success of the London initiative as the first congestion charging program in a major European city is important for many other nations in demonstrating the political feasibility of pricing10. This strong political commitment is crucial. Other metropolitan areas that have invested heavily in advanced capability in interoperable electronic tolling and associated administrative support systems in the supply chain are well placed to benefit. What we must ensure, however, is that any congestion charging system is not selected for the convenience of an appealing cordon such as the CBD, but for broader system wide efficiencies. A more considered approach is required. The papers in this Special Issue serve a useful purpose in stimulating the debate on how best to deliver improved efficiency and equity outcomes in the delivery of improved accessibility for all and not just the few.

[7] For example, in Sydney the actual amount of parking in the CBD is about 37,179 parking spaces excluding Darling Harbour and Pyrmont. Short stay non-commuters use some of this parking, although the amount is unknown. The total amount of parking spaces demanded for commuters and non-commuters is 49,567. This is greater than the available supply of 37,179, by 33.3 percent. This is the valid statistic when discussing supply and demand for parking spaces, not the commuters only who clearly are less than the amount of parking space. The 37,179 spaces are not commuter parking spaces as indicated in the City of Sydney Council document PO4-00388 (dated 13/8/96) titled 'Off street parking policy - short stay car parking stations'. They represent total parking.

[8] At first glance the experience in London would appear to be more comparable, but the transport setting is much different from that in most Australasian (except Sydney and possibly Melbourne) and North American metropolitan areas. In particular, London's central area is heavily congested; with car trips comprising less than 12 percent of all travel before the introduction of congestion charging. In addition, parking charges are very high, complemented by frequent bus underground, regional rail and taxi services to and within the central area.

[9] The rule of three promoted by Goodwin is a very good marketing position. The merits of the rule of three are discussed in Farrell and Saleh

[10] The fact that we have started and are learning also suggests a success. Some of the costs are an investment in the learning process and can be reduced in future.

References

Bagchi, M. and White, P.R. (2005) Transport Data Collection Policy and Privacy Concerns in the Smart Card Age – What Are the Implications? University of Westminster, Special Issue of *Transport Policy*.

Bonsall, P. and Kelly, C. (2005) Road User Charging and Social Exclusion: The Impact of Congestion Charges on At-Risk Groups. Institute for Transport Studies, University of Leeds, Special Issue of *Transport Policy*.

Dodoo, N.A. and Thorpe, N. (2005) Charging Heavy Good Vehicles for Road Pavement Damage. School of Civil Engineering and Geosciences, University of Newcastle upon Tyne, Special Issue of *Transport Policy*.

Downes, A. (2004) Why traffic congestion is here to stay … and will get worse, *Access*, 25, 19-25.

Enoch, M., Potter, S., Ison, S. and Humphreys, I. (2004) Role of hypothecation in financing transit, Transportation Research Record, 1864, 31-37.

Farrell, S. and Saleh, W. (2005) Road-User Charging and the Modelling of Revenue Allocation, Special Issue of *Transport Policy*.

Forkenbrock, D. J. (2004) Mileage-based road user charge concept. Transportation Research Record, 1864, 1-8.

Hemming, R. and Ter-Minassian, T. (2004), Making room for public investment, Finance and Development, December, 30-33.

Hensher, D.A. (2005) *Competition and Ownership of Land Passenger Transport*, Elsevier Science, Oxford.

Hu, S. and Saleh, W. (2005) Impacts of Congestion Charging on Shopping Trips in Edinburgh. Special Issue of *Transport Policy*.

Hug, K, Mock-Hecker, R, and Wurtenberger, J (1997) Transport demand management by electronic fee collection in a zone-based pricing scheme: the Stuttgart MobilPASS field trial, *Transportation Research Record* **1576** 69-76

ITSinternational (2005) Ensuring German trucks pay, January/February, 50-51.

Joseph, J. (2004) No distance left to run, TOLLtrans Technology Review, 26-31.

Kalmanje, S. and Kockelman, K. (2004) Credit-based congestion charging, Transportation Research Record, 1864, 45-53.

Kocak, N.A., Jones, P. and Whibley, D. (2005) Tools for Road User Charging Scheme Option Generation. Special Issue of *Transport Policy*.

Larsen, O I, and Ostmoe, K (2001) The experience of urban toll cordons in Norway: lessons for the future *Journal of Transport Economics and Policy* **35** (3) 457-471

O'Mahony, M, Geraghty, D, and Humphreys, I (2000) Distance and time based road pricing trial in Dublin, *Transportation* **27** 269-283

Sumalee, A., May, T., and Shepard, S. (2005) Comparison of Judgmental and Optimal Road Pricing Cordons. Institute for Transport Studies, University of Leeds. Special Issue of *Transport Policy*.

Toh, R S, and Phang, S-Y (1997) Curbing urban traffic congestion in Singapore: a

comprehensive review *Transportation Journal* **37** (2) 24-33

Transport for London (2003) *Congestion Charging: Six Months On*, October.

Whitehead, T. (2005) Transport charging interventions and economic activity. Transport Studies Unit, School of Geography and the Environment, University of Oxford. Special Issue of *Transport Policy*.