Pricing opportunities for Australia: Paying our way in land transport
Policy Paper 1

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Paying our way in land transport

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Foreword

This research policy paper is part of a series of six publications aimed at decision and policy makers, academics and students. This Policy Series focuses on land transport, land use, integrated planning and urban development challenges in Australia.

The Policy Series has been developed by the Bus Industry Confederation (BIC) of Australia and the Institute of Transport and Logistics Studies - Sydney University, and addresses specific subject matters and issues raised in the BIC’s previous reports: “Moving People - Solutions for a Growing Australia” and “Moving People - Solutions for a Liveable Australia.” Both publications are available at www.ozebus.com.au.
1. Context

In *Moving People: Solutions for a Liveable Australia* (BIC 2012), the Bus Industry Confederation argued that Australia needed to reform the way it priced road use, for reasons of both improving resource allocation efficiency in the transport sector and to generate additional revenue to improve the land transport asset base and transport services. That report also looked in some detail at the type of infrastructure priorities that are likely to emerge from taking an integrated approach to land use and transport planning in Australian capital cities.

Since that report was released:

- Infrastructure Australia (2013) has released its latest report on infrastructure priorities, arguing again for users to make a direct contribution to infrastructure costs and get a say in the levels of service that are provided (what IA calls ‘user pays-user says’)
- NIEIR (2013) has argued persuasively that additional transport investment in Australia’s major cities will result in increasing economic returns and increased taxation revenues, that could be used to help fund the associated infrastructure
- the Business Council of Australia (BCA 2013) has supported greater use of user pays pricing for infrastructure but noted the lack of a political appetite for such reform
- the Deputy Governor of the Reserve Bank, Philip Lowe, has pointed to Australia’s looming productivity challenge from declining terms of trade and an ageing population, highlighting the role of infrastructure investment in responding to this challenge and user charging as one means of helping to pay for that investment, while also improving the efficiency with which infrastructure is used (Lowe 2013)

The present paper further develops some of the ideas in BIC (2013), building on these more recent contributions. It also takes the opportunity to bring in the results of some important studies that examine congestion pricing using integrated land use/transport and computable general equilibrium economic models. These new approaches provide some fresh insights into pricing opportunities for Australia.

Section 2 of this paper summarises the recent NIEIR (2013) research that makes a strong case for increased Australian infrastructure investment, particularly transport spending. Section 3 briefly introduces the idea of user pays, with section 4 discussing the possible application to road use. That section looks at fuel tax and vehicle kilometre charges as different ways of charging users for the costs attributable to their road use and considers both light and heavy vehicles. It includes reference to emerging European trends in heavy vehicle pricing. Section 5 presents the paper’s conclusions, which are primarily about setting a pathway for pricing reform in Australian land transport. The focus is mainly urban, since that is where the external costs of transport are most marked and the urgency of reformed pricing is correspondingly most urgent.
2. The Transport Infrastructure Gap

The Council of Australian Governments has set out the following agreed National Objective for Australian cities (COAG 2009, p. 15):

To ensure that Australian cities are globally competitive, productive, sustainable, liveable and socially inclusive and are well placed to meet future challenges and growth.

Moving People: Solutions for a Liveable Australia (BIC 2012), and other sources, have argued, inter alia, that the pursuit of this National Objective will require an increase in infrastructure investment and that, in turn, this will require that new ways be found for funding/financing this increased infrastructure investment. This is partly because of the reluctance of the Federal and State Governments to test the size of their budget outcomes but also because the land transport sector can do much more with beneficiary (including user) pays pricing, if the political courage exists.

Recent analysis undertaken by NIEIR (2013) for the Australian Local Government Association provides some illuminating macro-economic insights into Australia’s transport infrastructure needs. NIEIR points out that metropolitan transport should be a high priority for increased infrastructure investment. Australian transport infrastructure investment averaged 1.6 per cent of GDP from 1975 to 1985 (having been an even higher share before that time). It declined over the subsequent few years to about 1.2 per cent, where it broadly remained for about 13 years. During the first decade of the current century, the share recovered slightly to 1.3-1.4 per cent, with a short term spike back to 1.6 per cent. The medium term outlook remains at about 1.2 per cent of GDP, or even lower if governments further tighten their fiscal control.

NIEIR (2013) suggests that, after three decades of low transport infrastructure investment, the marginal productivity of transport investment is higher than that of non-mining business capital investment (recognising that there is some complementarity between the two). Importantly, the NIEIR analysis identifies that there are increasing returns from expanded transport infrastructure investment, partly reflecting the decades of relatively low investment. NSW and Victoria, in particular, are identified as having marginal returns from substantially increased transport investment that are well above the marginal returns from continuing with the current rate of investment. These increasing returns suggest that traditional project based economic evaluations of transport investment will systematically undervalue the worth of major programs of increased new investment.

The transport investment ‘hole’ resulting from the decline in share of infrastructure investment spending has been assessed by NIEIR (2013) at $111b. This is of a similar order to the transport projects in the Infrastructure Australia (2013) priority list (which totalled $82-91b as at June 2013 across all Infrastructure sectors but dominated by land transport proposals). Recognising the productivity benefits from increasing returns, NIEIR argues that transport infrastructure spending needs to get back to about 2 per cent of GDP by 2020, before settling back at about 1.7 per cent, with an additional $220b of new transport capital stock added over the period to 2031 (in 2011 prices). This is predicted to increase average annual GDP growth by about 0.26 per cent p.a. over the 2011-31 period, the governmental revenue dividend from which would go some way to helping fund the requisite investment. Up-front financing will still be required, of course.
3. User Pays

The idea that people should pay the costs that result from their consumption, production and/or product disposal choices (often known as ‘user pays’, or ‘polluter pays’ in some contexts) is widely accepted throughout our community and has been increasingly applied in the traditional governmental utility sectors (which are increasingly being privatised), such as energy and water. Infrastructure Australia (2013), for example, promotes the concept of ‘user pays-user says’, for urban transport, arguing that this charging framework should include congestion costs. The NSW financial audit has suggested that efficient congestion pricing could raise up to $5b gross revenue annually in that state, with a net gain of about $2b after allowing for abolition of some existing charges (NSW Treasury 2011).1

The land transport sector in Australia has probably made least progress in applying user pays principles for use of infrastructure and services (BCA 2013). While fares are applied for use of public transport (usually well short of full cost recovery, for solid public policy purposes2), toll road users pay road tolls (also often short of full marginal social cost recovery, because of the focus on infrastructure costs), heavy road vehicles are charged an explicit (albeit averaged) charge for road use (infrastructure cost focussed) and private car users pay their personal direct car costs (e.g. time, fuel), most land transport infrastructure/service use is not explicitly priced to users on a social cost basis.

Economically efficient road use pricing, as an example, is based on the idea of users paying the marginal social costs attributable to their road travel choices. Any jurisdiction seeking to pursue such pricing has some fundamental considerations to resolve, such as (for example):

- how to ensure that cost recovery targets are met, if a jurisdiction believes this is important (where the usual answer is to price at short run marginal social costs and raise any additional revenue required to meet cost recovery targets by charging higher prices to users who are least deterred by higher prices, called Ramsey (1927) pricing);
- how to calculate relevant marginal social costs, when there are frequently many joint and common costs involved in provision of transport services and the analytics of costing is still emerging. The European Commission has supported substantial valuable research to improve relevant marginal social cost estimates, with Maibach et al. (2007) a comprehensive source; and,
- how to design a pricing scheme that will be acceptable to voters (also the subject of a wide literature, with many commentators proposing dedicating (or hypothesating) the revenues that are raised to specific transport and/or closely related applications and upgrading alternative travel options prior to implementing charges, to give people a choice.

BIC (2012) identified that government revenue streams which might notionally be seen as charges for road use (esp. fuel excise and registration) are now barely meeting the direct costs governments spend on road construction and maintenance. When the wider ‘external’ costs of road use are taken into account, BIC (2012) suggests that Australian road users pay governments less than half the social costs that are attributable to their road use. This problem is compounded by declining fuel excise collections, under such influences as a lack (since 2001) of indexation, improving vehicle fuel economy and declining per capita car use in our cities.

Notwithstanding the complexities of implementing marginal social cost pricing, the conjunction of:

- a substantial Australian land transport infrastructure backlog, with increasing economic returns in prospect from tackling this backlog
- current road user taxes/charges barely covering direct road expenditure costs and being well short of covering the external costs of road use and
- declining fuel excise collections,

in a fiscal environment where governments are wary of increased borrowings, demands a new approach to how Australians pay for road use and how transport investment is funded. User pays should be one foundation for this new approach, better reflecting all the marginal social (external) costs of road use that are amenable to reasonable measurement in relevant prices. BIC (2012) argued that wider application of beneficiary pays approaches is also important (user pays being one category of beneficiary pays). The increasing returns to scale identified by NIEIR (2013) supports an argument for continued and increasing funding support for land transport investment from general government revenue streams, as does the social safety net role played by some land transport services (e.g. a core set of public transport services).

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1 Market failures associated with ‘public goods’ (such as defence and law and order) and ‘merit or quasi-public goods’ (such as a decent base level of public education, disability support services and a core public transport ‘social safety network’) would typically all outside a full user pays framework.

2 The failure to price the external costs of car use argues for financial support to public transport, because of the savings in external costs of car use that result. The social safety net role played by public transport also argues for some governmental financial support.
4. Road Pricing Reform

4.1 Some Basics

A vast literature on road pricing has emerged over the past fifty years. The small number of live examples where this has been applied, however, means that most of this literature is largely theoretical. However, it now includes some recent very useful modelling work, which brings together land use/transport/computable general equilibrium modelling (LUT/CGE). This analysis, and the experience from the handful of live examples where an element of road pricing reform has been implemented, is very valuable for thinking about what might work in Australia.

Europe has shown strong interest in pricing road use. The European Transport White Paper (EU 2011), for example, argued that:

Getting prices right and avoiding distortions

58. Price signals play a crucial role in many decisions that have long-lasting effects on the transport system. Transport charges and taxes must be restructured in the direction of wider application of the ‘polluter-pays’ and ‘user-pays’ principle. ... Wider socioeconomic benefits and positive externalities justify some level of public funding, but in the future, transport users are likely to pay for a higher proportion of the costs than today. It is important that correct and consistent monetary incentives are given to users, operators and investors.

62. For passenger cars, road charges are increasingly considered as an alternative way to generate revenue and influence traffic and travel behaviour. The Commission will develop guidelines for the application of internalisation charges to all vehicles and for all main externalities. The long-term goal is to apply user charges to all vehicles and on the whole network to reflect at least the maintenance cost of infrastructure, congestion, air and noise pollution.

The basic theory of road pricing in the presence of negative externalities is pretty simple: following Pigou (1932), pricing a negative externality at its marginal social cost is the way to maximise economic welfare. However, applying such ‘first-best’ pricing principles on every road in a network is clearly very difficult, given such complexities as differing time costs/values of individual drivers (travel time being the major congestion cost), different speed-flow relationships on different road types, different road damage functions for different vehicle types and, in the past, technological difficulties of actually charging for use (a problem that can be largely overcome now by GPS technologies). One consequence of these difficulties has been that actual implementation of road pricing schemes has been kept simple, in terms of both the range of costs that are included and the refinement of the pricing method. Congestion pricing schemes (for example), typically charge:

- users who cross a designated cordon (cordon charging, as in Stockholm, Singapore or Bergen; exemptions may be provided) or
- users who travel on a particular link (e.g. as with some US ‘hot lanes’).

Congestion reduction has usually been the main motivation behind implementation, although the various Norwegian cordons have primarily had a revenue raising purpose and the Milan scheme has been largely aimed at reducing local pollution.

Cordon and zonal charging schemes have the advantage of simplicity but are crude as means of seeking to reflect external costs in charges. There are too few examples of each around for strong conclusions to be drawn about relative merits but cost-benefit studies of the Stockholm and London schemes are both supportive. Satellite-based (GPS) systems will probably be the long term answer, with some existing European heavy vehicle applications and a Seattle pilot leading the way. The Netherlands almost got over the line on a GPS system a few years ago but a change of government was highly correlated with a change of heart.

4.2 Integrated land use/transport modellling and pricing

As noted above, integrated land use/transport and computable general equilibrium (LUT/CGE) modelling is now being used to explore the implications of congestion pricing and of wider road pricing reforms. Anas and Hiramatsu (2013), for example, analyse three hypothetical toll cordons in Chicago as ways of incorporating congestion costs in road use charges. The benefits of the alternative schemes are assessed in terms of the monetary sum of:

1. Consumer Welfare (or utility) gain, measured via the usual compensating variation, as an indication of willingness to pay, plus
2. Government toll revenue (net of costs, which are not included in the analysis), plus
3. Real estate benefits in the form of windfall gains in the value of building floor space or land (an important inclusion in terms of the idea of ‘value capture’ as a means of beneficiary pays pricing).

Anas and Hiramatsu (2013) find that a cordon focussed on the Chicago CBD is likely to see loss of jobs and residences from the centre to the suburbs, likely to be undesirable in view of the high agglomeration benefits of the central city. Conversely, a cordon enclosing the centre and inner suburbs was expected to lead to more centralised jobs and residences, decreasing urban sprawl (as people move to avoid crossing the cordon). This suggests that a land use policy intention to encourage agglomeration benefits might gain from such a wider cordon pricing approach. The presence of a good public transport system was seen as very important in providing people with the opportunity to avoid the toll.

An important conclusion from the Anas and Hiramatsu research was that the largest benefit component from each of the three cordon options they examined was the increase in real estate income, underlining the potential importance of value capture within the policy armoury for effective policy implementation. Consumer welfare fell with
the wider cordons, being dependent on revenue recycling (from government toll revenue and/or the real estate gain) to achieve a net gain for consumers.

Safirova et al. (2007) analyse three cordon options for Washington DC, together with a freeway road toll, a comprehensive road toll and a vehicle mile tax (VMT). Unlike Anas and Hiramatsu (2013), they include both congestion and a number of other external costs of road use (air pollution, accidents, climate change, oil dependency, noise) in their pricing options. They find that comprehensive tolls (to approximate the ‘first best’ pricing solution) and the VMT deliver the highest benefits, with benefits increasing as the scope of the pricing initiative is broadened from just congestion costs (the largest single externality) to all social costs. The VMT they analyse is a toll that is fixed at the same level on all links and time periods, while the comprehensive tolls seek to capture external costs more precisely. They also find a tendency for cordon tolling to move jobs and population towards the centre of the region and for public transport to provide a vital escape valve for people to avoid cordon tolls, in line with the later findings of Anas and Hitamatsu (2013).

Based on the US modelling work and analysis of the effects of the London and Singapore schemes (May 2010, Anas and Lindsey 2011), it seems unlikely that either a cordon or zonal (area) based road pricing system would be of great value in an Australian setting, unless it was framed to include parts of the middle suburban areas of cities, as well as the centres and inner suburbs. This may then be a means of encouraging increasing densification of our cities, in line with most current State planning policy intentions. Those cities where cordon/area charging has worked have generally got high density central areas, clear geographic boundaries for scheme application (e.g. Stockholm is a set of islands; London uses its Inner Ring Road as a natural boundary) and very extensive public transport systems providing a good travel choice. However, most Australian cities lack these combined requirements. More importantly, as soon as such a relatively extensive urban scheme area is considered for scheme application in a US type city, the Safirova et al. (2007) research suggests pretty clearly that it would be better to simply move to a VMT, which captures a larger part of the potential benefits, and that it is better to extend beyond just congestion costs when seeking to price external costs.

### 4.3 Fuel Tax or VMT?

Fuel is a convenient base on which to charge for road use, its major advantage being that it has the benefit of administrative simplicity: countries have fuel taxes and it is possible (but seems politically hard in many jurisdictions!) to change the tax rate to achieve a rough proxy for external costs. However, it has long been recognised that fuel is also an imperfect tax base, if the intent is to make users pay the costs associated with their road use. The main reason is that only a minority of the external costs of road use are highly correlated with fuel use, these being costs associated with climate change and energy security. Air pollution, noise and accident costs are likely to be more strongly correlated with distance travelled than fuel used, as is the largest single externality of congestion, where time and place (as reflected in the level of congestion) are also very influential on the size of the external cost. A further disadvantage, of increasing importance, is that the fuel tax base is declining over time in many countries, as vehicles become less dependent on fossil fuels (e.g. as fuel economy standards tighten).

Parry and Small (2005) have developed an economic model that can be used to identify optimal fuel taxes to recover external costs of road use. Stanley and Hensher (2011) use the Parry and Small model to derive an optimal fuel tax for Australian cars, including:

1. a range of external costs of road use (local pollution, greenhouse gas emissions, energy security, accidents, congestion), to enable calculation of what is sometimes called a Pigovian (externality-reducing) tax, which prices the marginal costs of the relevant externalities;
2. an adjustment to allow for the efficiency trade-off between commodity taxation and income taxation (or Ramsey (1927) tax, which allows for the excess burden of different taxes within the welfare optimising framework). This component recognises that welfare maximising revenue arising from commodity taxation should impose higher taxes on those commodities that have lower price elasticities of demand (such as petrol and diesel used for motoring); and
3. a congestion feedback component, which relates to a positive impact on labour supply, and social welfare, of reduced congestion. The effect of this element is minimal within the total.

The relevant external costs are nominally estimated as marginal social costs but a lack of detailed knowledge about the shape of the relevant damage functions for a number of externalities, and the requirement to strike a single fuel tax rate, means that marginal and average social costs per unit are effectively assessed to be equal. External costs that correlate more closely with distance than fuel use are converted to a fuel charge equivalent. The effect of higher fuel prices is allowed to feedback to vehicle choice and to the fuel economy rate, which means the optimal fuel tax is less than might be implied by simply estimating external costs for the current vehicle fleet. Parry (2009), for example, estimates that about half the reduction in fuel use associated with optimal fuel taxation would come from improved fuel economy and half from reduced vehicle use (resulting from mode shift, and reduced miles per vehicle).

The Stanley and Hensher (2011) analysis suggests that Australian fuel excise on petrol needs to be raised to better reflect the external costs of car use (heavy vehicle charges were not assessed), the suggestion being that an increase of perhaps 14c/L would be appropriate, with congestion accounting for the largest component of the charge. Such a charge would raise an additional $5b a year, Stanley and Hensher arguing for separately quarantining urban and rural/regional revenue collections for use in those respective areas, recognising the absence of congestion costs in rural/regional settings. An increase of this magnitude will obviously be difficult to achieve in one jump, such that a series of cumulative increases of 3-4c/L over several years would probably be needed to have any chance of implementation. In this regard, it is noteworthy that New Zealand has announced increases in its petrol excise duty of 3c/L on 1 July, 2013, 1 July 2014 and 1 July 2015, to deliver the Roads of National Significance program, with road user charges
to increase by an equivalent amount, suggesting that such increases are achievable if there is sufficient political will.

Previous work by Parry and Small (2005) suggests that a welfare maximising vehicle mile travelled charge (VMT, or VKT in Australia) as a road user charge will typically involve a greater increase in charges to users than a fuel excise, for reasons such as the lack of the option of the user shifting to a more fuel efficient vehicle to avoid a VKT. That research also suggests that charges based on distance travelled deliver higher welfare gains than if the charging was fuel based, and that welfare gains will be achieved even if the VKT implementation (in place of a fuel charge) aims for revenue neutrality. In short, the case for distance travelled (VKT) as a base for charging for the external costs of road use, rather than just relying on fuel taxes (excise), is strong, albeit that it may be more difficult to implement a new VKT than to adjust fuel tax rates. Parry and Small (2005) suggest an optimal VMT charge in the US of around 14c/mile, or 9 cents a kilometre (2000 prices).

The US National Surface Transportation Infrastructure Financing Commission (NSTIFC 2009) proposed that the US should shift from its current road charging/funding system, based largely on indirect user fees in the form of federal motor taxes, which are in decline, toward more direct user charges, in the form of a vehicle mile travelled (VMT) charging system (NSTIFC, 2009). The Commission adopted six guiding principles as criteria for selecting road pricing mechanisms:

1. Enhance mobility of all system users.
2. Generate sufficient funding on a sustainable basis.
3. Cause users to pay full cost of system use to greatest extent possible.
4. Encourage efficient investment.
5. Incorporate equity considerations.
6. Support broader public policy goals (i.e., energy and environment).

It argued that a VMT best met these criteria (from among the large range of funding options evaluated). Increased fuel taxes were supported in the short term, to restore funding from the Highway Trust Fund, but a VMT was seen as the preferred long term solution, incorporating externalities.

The Commission proposed that the US Federal Government should commit to deploying a VMT charging system by 2020, this timeline recognising the difficulties in implementation. Importantly, the analysis underlying the Commission’s work suggested that a VMT that incorporated external costs would reduce the required rate of increase in net annual US Transport Infrastructure spending by about $US20-30 billion, by encouraging better use of existing infrastructure (including mode shifts from car to public transport and changes in travel times to ease peak loads) and reducing overall travel demands. Investment in transit would need to increase, to cater for modal shifts and growth, but road investment pressures would be eased. The relevant VMT charge could vary by type and weight of vehicle (for example), to reflect varying emissions performance and road damage (especially for heavy vehicles).

The Rand Corporation (2011) has identified eight ways in which a VMT/VKT charge could be levied, agreeing with NSTIFC that it would provide a more stable revenue source than fuel tax in the long term. Table 1 shows those eight options. As one moves down the options in Table 1, the approach moves closer to ‘first best’ pricing. Interestingly, responses to the NSTIFC work frequently cited privacy concerns with on-board devices, a problem that the Dutch plans for GPS-based charging seemed to have resolved. The main Rand conclusion was the importance of implementing trials to test the VMT approach.

Oregon has been a leader in such trialling. The state has been looking at alternatives to the gas tax since 2001 and began its first VMT charging trial in 2006. That study involved using GPS devices to collect data on the number of miles travelled by each motorist in the trial, transferring the data to gas stations and levying the appropriate fee when drivers bought fuel. Oregon wants to offer motorists a range of options for how VMT is collected so that nobody can accuse the system of being an invasion of privacy. Oregon Governor, John Kitzhaber, has recently signed SB 810, and Oregon will create a voluntary program for up to 5,000 motorists who will pay 1.5-cents for every mile they drive instead of the 30-cent state fuel excise tax.

Parry (2012), in reviewing road pricing reform options for Mauritius, has suggested that a transitional pathway for that country could include turning the country’s fixed annual road tax into a variable charge, incorporating a congestion element per unit distance driven, with distances based on total distance driven the previous year (i.e. at the ‘low tech’ end of the eight Rand options). This form of assessment should encourage less driving. Parry suggests taking odometer readings when vehicles are put through a safety inspection and providing an incentive (lower fees) for drivers who can demonstrate (by installing GPS) that most of their driving is rural and/or off-peak. As the proportion of drivers using GPS increases, the charge on those remaining on the odometer system could increase, to encourage further switching and retain government revenue flows, Parry noting that the system could be set up to be revenue neutral if desired.

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3 Light diesel vehicles also pay the road use charge.
4 The low VKT elasticity with respect to fuel cost means that the VKT is an attractive target for Ramsey taxation.
5 In part this is due to the long period over which fuel taxes have not been indexed.
Table 1: Range of VMT-Fee Implementation Options

<table>
<thead>
<tr>
<th>Metering option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-reported odometer readings</td>
<td>Drivers report current mileage each year as part of an annual registration process. A similar approach is used for FBT assessment in Australia</td>
</tr>
<tr>
<td>Required odometer readings</td>
<td>Drivers submit to periodic (e.g. annual) readings at certified locations as the basis for assessing mileage fees</td>
</tr>
<tr>
<td>Optional odometer checks</td>
<td>Drivers are assessed an annual fee based on class average data; those driving fewer miles can submit to annual odometer readings for relief</td>
</tr>
<tr>
<td>Fuel consumption-based estimates</td>
<td>Vehicles are equipped with an AVI device that transmits vehicle fuel economy rating to the fuel pump; this is multiplied by fuel quantity purchased and the resulting fee is added to the fuel cost</td>
</tr>
<tr>
<td>RFID tolling on a partial road network</td>
<td>Vehicles are equipped with an AVI device that communicates with gantries set up along the most heavily trafficked road segments to enable facility-based tolls</td>
</tr>
<tr>
<td>OBU with OBD II</td>
<td>Vehicles are equipped with an On Board Unit connected to the OBD port to estimate distance travelled</td>
</tr>
<tr>
<td>OBU with OBD II/cellular</td>
<td>As above but vehicles are also equipped with cellular communication technology to determine area of travel</td>
</tr>
<tr>
<td>OBU with GPS</td>
<td>As above but vehicles are also equipped with a GPS device to determine specific route of travel</td>
</tr>
</tbody>
</table>

Source: Based on Rand Corporation (2011).

NSW Treasury (2011) looked at replacing the state’s light vehicle taxes with a state-wide per kilometre charge, with a resulting charge rate of 4c/L for revenue neutrality. They noted that a change of this nature would tend to favour urban motorists over those in rural areas, where travel distances are typically longer. However, as noted previously, they suggested that congestion pricing could accompany this change in charging base. The NSW research then looked at a lower state-wide light vehicle base charge of 2.5c/km plus hypothetical congestion charges of 3.83c/km in the weekday am peak, 2.65c/km in the inter-peak and 3.46c/km in the pm peak. Weekend congestion charges were modelled at a lower level (NSW Treasury 2011). The resulting charging scheme was estimated to raise about $2b net from light vehicles. This work is the most advanced published work on congestion charging by an Australian state government that BIC has identified.

More recently, Hensher and Bliemer (2012) and Hensher and Mulley (2013) have taken a lead from NSW Treasury (2011) and Parry (2012) and proposed converting part of the Sydney (NSW) fixed annual vehicle registration charge to a vehicle kilometre charge (VKT) for peak period road use, as an early stage towards a reformed road user charging regime. A major rationale for these two Australian papers is to tackle the problems of implementation that beset most attempts at road pricing reform (particularly congestion pricing). Their proposals would provide Sydney drivers with an opportunity to save money, by shifting away from peak travel, and assure the NSW State Treasury of at least revenue neutrality, to encourage implementation. The Hensher and Mulley (2013) proposal does this by reducing the Sydney annual vehicle registration fee to $185, a reduction of over 50%, adding a new charge of 5c/kvm for peak travel for those who opt-in to this payment scheme. Total peak vkms in Sydney are projected to fall by 4.7 per cent, which would deliver significant increases in travel speeds and associated time savings benefits. Fuel tax revenues (collected by the Federal Government) are projected to decline marginally with reduced vehicle use.

4.4 Heavy vehicles

Australia

The Australian heavy vehicle road charging system, first introduced by the (then) National Road Transport Commission in the early 1990s, included a road use charge, as a designated component of the fuel excise (with the difference between this designated amount and the total excise rate being refunded to operators), and a registration charge, which varied by vehicle axle category. Charges were only to recover infrastructure and related costs of road system provision and operation and were based on several averaging processes. This ensured that probably no single vehicle/operator paid the correct costs attributable to their road use but that the overall total collected was about right and the distribution between vehicle types was probably about right. Vehicles that travel long distances for their axle class, however, have tended to pay too little, while those that are lighter than their axle class average pay too much.

It has taken about two decades for any real progress to be made in refining this initial charging system, with the COAG Road Reform Plan (now called the Heavy Vehicle Charging and Investment Reform, or HVCI (2013)) examining ways to, inter alia: improve cost recovery; better connect charges, infrastructure planning and investment expenditure and funding flows to road managers; and provide for a greater industry input in investment prioritisation (via state road infrastructure co-ordinators). The HVCI program is examining three major charging options, from a modified version of the current arrangement (putting more emphasis on the road use charge and less on registration), to a simplified version of a mass-distance-location (MDL) charging scheme (not charging for actual mass, which would not be measured at the individual vehicle level) and then to a refined MDL model, based on in-vehicle technology.

6 Approaches such as New Zealand’s distance-based charging scheme, using hubodometers, are in this middle ground.
The HVCI approach should improve some aspects of the way Australian heavy vehicle road use is charged, priorities are determined and authorities are funded, as these matters relate to heavy vehicles. However, the discussion remains limited to direct road costs, excluding other externalities, and excludes light vehicles. This is a serious limitation. HVCI (2013) points out that only $2.8b of the $17b spent on Australian roads is attributable to heavy vehicles. However, if external costs are included along the lines indicated in BIC (2012), that $2.8b represents less than 10 per cent of total external costs. With apologies to the bard, this reformed charging approach might be called 'much ado about very little', unless it is a precursor to a more radical overhaul of the way road use is planned, charged and funded. There is no suggestion as this stage that this is the case.

A serious problem with the HVCI proposed approach is that it relies in part on being able to disentangle the interests of heavy vehicle users from those of the remainder of the vehicle fleet, particularly the far more numerous cars, in the infrastructure prioritisation process. In cities, for example, there are few road initiatives that can stand on their own feet solely with respect to what they do for heavy vehicles. HVCI (2013) acknowledges that light vehicles exist and that light vehicle planning will need to be addressed but has no useful insights into how an integrated approach that encompasses all modes might be implemented, when one mode (heavy vehicles) is proposed to have its own infrastructure co-ordinators but no such people speak for light vehicles! The HVCI efforts to improve heavy vehicle charging are to be commended but it is a retrograde step to even contemplate further siloed planning for heavy vehicles in our cities, at a time when the COAG Reform Council (2011) has pointed out how much more we need to do to have effective integrated urban land use/transport planning.

Europe

European countries use time-based (vignettes) or distance based (tolls) charging methods for heavy vehicles. Countries can be classified into six categories in terms of how they price road use by heavy vehicles:

1. Vignettes: a time-based charge based on prepaying for network access for a period ranging from one day to one year. Four countries have national vignettes and five others are part of the common ‘Eurovignette’, with some of the latter countries having plans to replace this system.
2. Countries developing vignette systems (UK, Latvia).
3. Electronic network wide tolling with distance charging: six countries, including the well known German and Austrian systems.
4. Countries developing electronic network wide tolling (four countries at present).
6. No tolls (2 countries plus the two that are developing vignettes).

The Eurovignette charging system goes back to 1999 and covered charging for heavy vehicle use of about half the 30,000 kms of the motorways in the Trans European Network (TEN-T). Individual jurisdictions can also charge for roads that are not part of that network, under local arrangements (which need to meet EU requirements in terms of, for example, proportionality and non-discrimination). The heavy vehicle charging system was initially set up for only infrastructure costs but charges were able to be differentiated by vehicle emission performance, with Germany being a well known example of a variable charging regime dependent on emission performance.

In 2011, EU Directive 2011/76/EU introduced several important changes:

- It allowed member states to calculate separate explicit heavy vehicle tolls based on the cost of traffic-based air pollution and noise, as well as infrastructure costs.
- It provided for differentiation of infrastructure toll rates to help congestion management (provided such toll variations were revenue neutral in total).
- Revenue collected from the air pollution/noise externality charge is to be used to reduce the sources of the externalities, which includes such applications as developing alternative transport infrastructure, R&D into clean technologies, etc.
- The network over which charging is to take place is the whole 30,000 kms of the TEN-T network.

The external cost charges are set at a level that would see heavy vehicles paying 20-30% more than under the previous arrangements, compared to where just infrastructure costs are charged. EU Member States can, of course, also set charges for roads outside the scope of this Directive (i.e. roads that are outside this network), Switzerland, which is not part of the EU, is well advanced in charging heavy vehicles for external costs.

The European Environment Agency (2013) has recently reported on suitable air pollution charge levels for vehicles under Directive 2011/76/EU, with charges varying by vehicle axle category, emission performance rating, location and country, as a reflection of the underlying causes of the external cost levels. Table 2 includes some relevant examples for three vehicle types, two emission performance levels and four countries. The table shows that air pollution costs for any vehicle class, emission rating and road type are much higher in a country with a large alpine component (Austria). The level of variability is much less between the other three countries shown, increasing most markedly with vehicle mass and reducing as the level of applicable Euro emission rating improves. Variability is less marked across the different road speed environments shown (speed assumptions are 35 kph on suburban roads, 55 kph on interurban roads and 80 kph on highways). It is not compulsory for any particular jurisdiction to apply the relevant charges but the EU Directive sets up a framework within which countries that wish to apply charges need to operate.

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Table 2: Air pollution costs for a sample of European countries, heavy vehicle types, emission performance ratings and operating environments

<table>
<thead>
<tr>
<th>Country/Vehicle</th>
<th>Emission technology</th>
<th>Suburban €c/km</th>
<th>Interurban €c/km</th>
<th>Highway €c/km</th>
</tr>
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<td><strong>AUSTRIA</strong></td>
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<td></td>
<td></td>
<td></td>
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<tr>
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<td>Euro III</td>
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<td>6.4</td>
<td>7.0</td>
</tr>
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<td>3.1</td>
<td>4.8</td>
<td>5.1</td>
</tr>
<tr>
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<td>15.4</td>
<td>12.0</td>
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<td>6.7</td>
</tr>
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<td>20.8</td>
<td>15.9</td>
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<tr>
<td></td>
<td>Euro IV</td>
<td>12.6</td>
<td>9.6</td>
<td>8.6</td>
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<td></td>
<td></td>
<td></td>
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<td>2.1</td>
<td>1.9</td>
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<td>Euro IV</td>
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<td>3.7</td>
<td>2.0</td>
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<td>Euro III</td>
<td>2.4</td>
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<td>2.6</td>
</tr>
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</table>

Source: drawn from EEA (2013).

The European Transport White Paper (EU 2011) indicated that its transport pricing reform pathway would have two stages. In stage one, up to 2016, phasing in of mandatory infrastructure charges for heavy vehicles was envisaged, with provision for air pollution, noise pollution and congestion costs, as discussed above. Directive 2011/76/ EU represents an important milestone along the way. The second phase (2016-2020) envisages full and mandatory internalisation of external costs for heavy goods vehicles (as well as mandatory recovery of infrastructure costs), with the possibility of this being extended to all vehicles.

The European approach to charging heavy vehicle road use goes further in the direction of including external costs of road use than Australia but is still only in its early stages in terms of incorporating external costs. It is not as comprehensive as Australia’s current infrastructure charging system at EU level (e.g. fewer roads are included in the EU cost base) but the institutional environment is easier in this country (e.g. fewer jurisdictions involved than in Europe). Regulatory measures remain the main way in which external costs such as noise and air pollution are internalised for heavy vehicles.
5. Way forward?

The research and analysis reported above suggests that:

> Australia should lift its level of land transport infrastructure investment, with increasing economic returns in prospect

> fiscal positions currently being taken by the Federal and State Governments are unlikely to see such an increase realised, if it is reliant on current governmental funding

> declining fuel excise collections are likely to increase financial pressures on the Federal Government, in particular, when it comes to transport investment

> user pays charging, which includes all the external costs of road use that are reasonably measurable, and wider beneficiary pays approaches based on value capture can provide a foundation for a transport infrastructure funding increase, supported by general government tax revenues (the latter, for example, because of the increasing returns to transport investment)

> user pays charging will also help to improve the efficiency with which existing transport infrastructure is used

> increasing the fuel excise rate and hypothecating the increase to land transport is the administratively simplest way to increase transport-related revenues collected by government in the short term and user pays arguments support such an increase, with the economically warranted increase exceeding 10c/L

> this would be very difficult to achieve in one step but might be contemplated as a series of cumulative annual increases of about 3-4c/L, which should start in the near future. The New Zealand government has shown that cumulative increases of this magnitude are achievable if there is the political will

> however, many important costs of road use are more dependent on distance travelled than on fuel used, and a number of studies suggest that a Vehicle Kilometre Tax or charge can capture a substantial proportion of the economic benefits from (the largely unattainable) “first best” road pricing reform and improve welfare more than pricing through fuel tax, suggesting that a vehicle kilometre charge will provide a more promising foundation for longer term pricing reform than fuel

> this is in line with the HVCI option of moving to a mass-distance-location charging system for heavy vehicles over the longer term, an approach that would benefit by the HVCI model also following the European lead of incorporating charges for external costs associated with at least air pollution and noise within heavy vehicle road charges. The HVCI should move quickly to a more refined distance-based charging system for heavy vehicles, with the inclusion of air pollution and noise external costs, on the way to full MDL charging (including a full range of external costs)⁹

> to begin a pathway towards a VKT based charging system, the Hensher-Mulley and Hensher-Bliemer proposals to give motorists the option of a reduced annual vehicle registration charge, in return for paying a distance-based charge for peak kilometres driven, should be trialled for light vehicles, alongside a staged series of increases in the fuel tax

> there should be an urgent investigation of how externality charging of all vehicles might be applied on urban motorway networks, including on links that are currently tolled

> to support moves towards improved road pricing, that better reflects the external costs of road use, COAG should support a research program to refine estimates of relevant external costs for Australian application, drawing on work such as has been undertaken for the European Commission

> Infrastructure Australia should broaden its pricing studies to include consideration of how all road users, not just heavy vehicle operators, can be engaged in the ‘user pays-user says’ process they have proposed, including consideration of how this can be best integrated with the work of the HVCI. In our major cities, this needs to be an integral part of the land use/transport strategic planning and policy setting process

> as road pricing is reformed to better reflect the social costs of use, public transport price setting should also be reviewed, to enable fares to more closely reflect costs of provision, taking account of the social safety net value of public transport.

A time line for the passage to a new road pricing regime in Australia, including all vehicle classes, should be announced by COAG as an early priority. 2020 should be a reasonable end point, given that Europe and the US have already undertaken considerable bodies of work around similar dates. The pathway to pricing reform could start by accelerating the work of the HVCI on implementation of an improved distance-based heavy vehicle pricing regime for infrastructure (likely to eventually be a mass-distance-location model), adding in some of the European work on air pollution and noise costs as an early priority. Complementary VKT trials should be put in place for light vehicles in a couple of cities within the next two years, along the lines proposed by Hensher and colleagues. Motorway-based charging of externalities should also be an early priority. When a fully fledged VKT charging system is eventually in place (assuming successful trials), fuel excise and registration charges should be largely removed (unless a carbon price is levied through the fuel excise).

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⁹ HVCI should also drop its idea of infrastructure coordinators for heavy vehicles, which is contrary to the current thrust towards integrated approaches to land use and transport.
References


Other policy papers are available from this Policy Set of six publications.

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