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Urban Transport Challenge:

A DISCUSSION PAPER ON A ROLE FOR ROAD PRICING IN THE AUSTRALIAN CONTEXT

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Executive Summary

This discussion paper considers the potential role for a national road pricing scheme in Australia. This paper considers how reform of transport taxation could both act as a transport management tool and assist Australia to fund its next generation of public transport and road projects.

This paper does not suggest that road pricing reform is an easy - or an immediate - option. Rather, this paper is designed to inform and shape the public debate about the merits and the challenges posed by such significant reform. Even if consensus can be achieved, it is likely that implementation would take between five and ten years.

Everyone can see that Australia faces profound challenges in managing and expanding its transport infrastructure network. Over the coming 25 years, demand for passenger and freight transport will double; with demand across the freight network to triple by 2050.

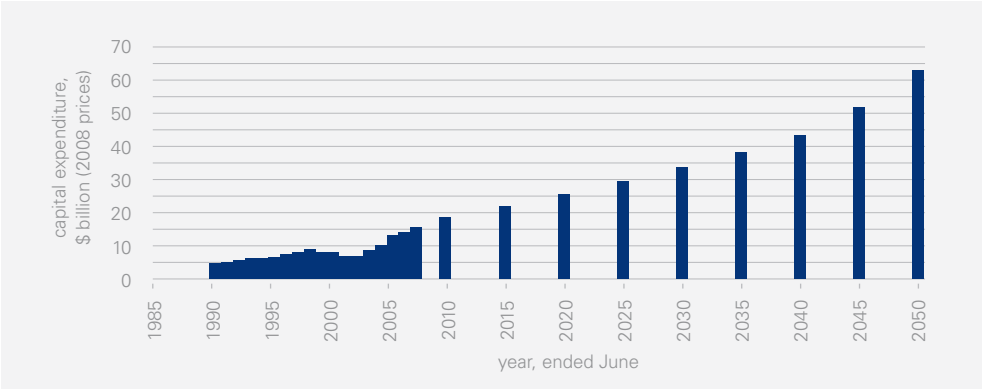
Congestion already costs Australia $9.4 billion every year. Without action, these costs will more than double to $20.4 billion by 2020. Inefficient, congested freight networks also have a significant impact on national productivity, with each one per cent improvement in supply chain efficiency estimated to save Australia more than $1.5 billion in deadweight logistics costs.

Forecasts prepared for Infrastructure Partnerships Australia show that population growth and economic development will require transport infrastructure investment to double by 2030 and increase four-fold by 2050 across all transport modes. Indeed, these estimates of future funding requirements may be conservative. In recognition of existing infrastructure shortfalls Australia's governments boosted their investment in road infrastructure by more than 26 per cent above historic levels between 2005-06 and 2006-07. Sustaining the required levels of investment over the long decades ahead is likely to require significant change.

▼ Figure 1

Transport Infrastructure Investment, 1990-2050

Source: IBIS World (2008)
Note: Excludes airports



▼ **Table 1**

Road-related Revenue and Expenditure, 2005-06 to 2007-08
Source: BITRE (2009d)

	ROAD EXPENDITURE ($ BILLION, 2007 PRICES)					ROAD-RELATED REVENUE ($ BILLION, 2007 PRICES)				
	TOTAL	FEDERAL	STATE	LOCAL	PRIVATE	**TOTAL (INC GST)**	**TOTAL (EXCL GST)**	FEDERAL (INC GST)	STATE	TOLLS
2007-08	**13.9265**	2.7238	7.3354	3.1273	0.740	**-**	**-**	-	-	-
2006-07	**12.1412**	2.9598	5.9708	2.6778	0.5328	**22.808**	**17.998**	15.551	6.126	1.131
2005-06	**10.4113**	4.7756	2.7349	2.2685	0.6324	**22.577**	**18.277**	15.765	5.881	0.931

Australia's transport sector is facing a range of significant challenges which require sustained focus from government and industry alike. These challenges include:

- **Historic under-funding of transport infrastructure development and maintenance** – resulting in an inefficient transport system that inhibits Australia's productivity and international competitiveness.

- **Demand pressures** – pressure from a rapidly growing population and economy are exacerbated by shifting demographics, an ageing population and the impacts of adjusting to climate change and carbon abatement.

- **Inefficient use of transport infrastructure** – leading to increased urban congestion, vehicular emissions and operating costs.

- **Ineffective taxes and charges** – taxation and road user charges can be in conflict and send insufficient and confused price signals to road users.

The scale and complexity of Australia's transport challenge has seen road pricing attract renewed attention from policymakers in Australia. Utilities like water, energy and telecommunications have already undergone significant and ongoing reform in terms of how monopoly infrastructure is priced - and how demand is managed. Under most of these regimes, revenue generated from access to monopoly infrastructure is reinvested to improve overall performance and promote efficiency.

Our research finds that the international experience of road pricing schemes has been broadly positive. For instance, the London Congestion Charge has shown that congestion pricing can be very effective in concurrently raising revenue for improvement of the transport system, while managing transport demand by pricing externalities. After three years of operation, the decline in congestion was broadly in line with the 30 per cent reduction realised in the first year. The Singapore Road Pricing Scheme had achieved a 31 per cent reduction in traffic levels in 1988, relative to levels prior to its introduction. Other jurisdictions, such as the Netherlands and the US State of Oregon are now considering the implementation of similar schemes.

Global experience has shown that growing congestion and environmental degradation, declining liveability and fewer opportunities to support new investment have been important preconditions in the public's acceptance of the need for road pricing.

The same conditions are now affecting Australia's major urban centres. These challenges are complex and will likely require a coordinated, long-term strategy which balances the provision of new infrastructure with considered ways of shaping and managing demand.

There is a public consensus that new investment in transport infrastructure must be a first order priority for all Australian governments; however there is also a growing consensus that building new infrastructure will only take us part of the way there. Global experience has shown that an approach that blends supply and demand management presents the most effective strategy to manage congestion - and provide a new revenue stream to fund major projects.

This discussion paper considers whether road pricing can change the game in Australia. Under the status quo, Australia faces an array of inconsistent fees, taxes and charges that contribute to the cost and complexity of transport, without encouraging behavioural change to meet economic, social and environmental goals.

This research discusses how a national road access pricing regime, coupled with substantial taxation reform, might replace existing registration, licensing and fuel excises. Through a sound scheme design, a national road pricing scheme could deliver a fairer, more balanced system that would see high-end road users pay more and those who access roads less frequently, or during periods of low demand, pay less than they do under the status quo.

A road pricing scheme based on distance, location and time of travel would improve equity outcomes across society by:

- Increasing the accountability of road users for the impacts arising from their road use;
- Removing upfront fees and charges that act as barriers to vehicle ownership – thereby reducing the impacts of social isolation; and,
- Reducing the current, disproportionate fees and charges that apply to some heavy vehicles.

The introduction of an Australian road pricing regime could also play a central role in managing demand, and help to fund the next generation of major transport infrastructure projects. Road pricing could be set at a level that achieves revenue neutrality once existing road taxes and charges are removed; or at a level which increases revenue to allow expanded investment in the maintenance and construction of projects that promote a sustainable transport system, including road, rail and public transport.

Modelling undertaken for this discussion paper has shown that current road-related expenditure of $11.371 billion (2006-07) could be derived with a light vehicle road user charge averaging just 4.6c/km. A charge averaging 10.4c/km for light vehicles could generate revenue equivalent to that currently derived from road related fees and charges. Assuming full revenue hypothecation to transport projects, this approach would provide an additional $10.857 billion per annum for investment in new transport projects.

The model of road pricing ultimately discussed in this paper would deliver a charge for the average motor vehicle of just 7.9c/km and replace all existing road related taxes and charges (barring the Goods and Services Tax and Fringe Benefits Tax). At this price, the scheme would also recover externalities like congestion and air pollution. Under this model, an additional $4 billion annually would be made available for investment in transport infrastructure.

While FBT would not be removed under the model proposed in this paper, significant issues remain with the interaction of this tax and road use. As part of the broader review of taxation, the FBT should be reformed to remove existing incentives that actually promote road use - and provide neutrality between the treatment of motor vehicles and public transport.

The consideration of the implementation of a national road pricing scheme with the broader review of the taxation system offers the potential to:

- Hypothecate revenue for investment in transport infrastructure;

- Vary the revenue collection functions and capabilities of government, including the transfer of funds between the Australian Government and the state and territory governments; and,

- Change the expenditure requirements of governments – for instance, new costs associated with the development of the scheme, and the elimination of costs associated with the collection of current fees and charges.

The allocation of revenue collected through the scheme would require transfers between the Commonwealth, state, territory and local governments to provide for ongoing expenditure in line with the road management responsibilities of each jurisdiction. The distribution of the additional revenue collected under a national road pricing scheme could be centralised through an infrastructure fund (such as the Building Australia Fund) which could determine the redistribution of revenues through an objective determination of investment priorities. In this case, a board comprising representatives of the Australian and state governments should determine the allocation, based on a rigorous and transparent assessment of each project's benefits and costs.

The potential benefits of a well-designed, well-delivered national road pricing scheme in Australia could be significant. There has been a long-term policy reform trend towards the use of mass-distance-location pricing for heavy vehicles through the National Transport Commission (NTC) and other agencies, such as the Productivity Commission.

But even if a firm commitment from government and broad public acceptance is achieved, it is likely that implementation of a scheme would likely take between 5 and 10 years due to technology challenges, scheme design and the requirement for pilot programmes.

The purpose of this paper is not to solve all of these issues - but rather to begin an informed and seasoned public debate about the relative merits of a national road pricing scheme - and its potential to change the way Australia funds and manages its transport infrastructure.

The central focus of this debate must be the development of a harmonised national scheme that promotes competition and drives productivity through renewed investment in transport infrastructure.

Fundamental Considerations for a National Road Pricing Scheme

The introduction of a national road pricing scheme should seek to deliver more efficient use of existing transport infrastructure while generating funds for investment in new transport infrastructure. In moving towards a pricing scheme, the following issues need to be considered within the public debate:

1. **Should a scheme be developed on a national basis with uniform charges, or on a state-by-state, or city-by-city basis using a common framework?**

   The net benefit of moving toward a national scheme needs to be weighed against proceeding with a state-based scheme and whether a national scheme should be extended to include a centralised registration system encompassing a common clearing house for collection and distribution of revenues.

2. **What effect should a scheme have on current road user charges and government revenue?**

   A national road pricing scheme could be developed to be revenue neutral (maintaining the overall budgetary position of each jurisdiction) or revenue positive (providing additional funds for investment in key infrastructure).

3. **How should current road user charges be changed?**

   The impact of replacing the current system of fixed registration charges with distance based registration charging needs to be assessed in terms of its likely effect on changing user behaviour. The current review of Commonwealth taxes also needs to take into account:

- Trade-offs between road price and excise to fully recover road expenditures;
- Incentives for private vehicle use derived from the Fringe Benefit Tax; and,
- Possible taxation reforms in other areas to offset any potential deficit in general revenue caused by the hypothecation of revenue to transport infrastructure, as a move toward a more equitable basis for taxation.

4. **How should revenue be spent?**

   International experience suggests that public acceptance of road pricing is enhanced when the revenues collected are hypothecated to an infrastructure fund used to improve the transport system (including both road infrastructure and public transport). Governments need to agree on a strategy to expand infrastructure capacity, including priority investment classes, the distribution of surplus revenue between jurisdictions and criteria for project prioritisation.

5. **What other practical issues need to be considered?**

   The potential benefits of road pricing are clear, but other important practical issues need to be considered as part of the debate. Among others, these include:

- Making sure the system is transparent and can be easily understood by road users;
- Ensuring the objectives for the system, including pricing framework, privacy and practicality considerations, drive the technology adopted and not the reverse;
- Ensuring the right balance between transport outcomes and the cost of administration; and,
- Balancing efficiency and equity objectives to ensure that low income groups are not disadvantaged in their access to broader community needs.

6. **What type of framework should be adopted for a road pricing system?**

   A pricing system could be founded on a number of different components, e.g. a base charge for road use paid by all road users, premiums for excessive wear on the network and the generation of externalities such as noise and emissions in urban areas. As a first step, a pricing regime could include time of day pricing on key road corridors.

A Road Map Proposal

1. **Implementation of a National Road Pricing Scheme for all Vehicle Classes**

   Australia should consider implementing a national road pricing system applying to all vehicle classes. The scheme would provide dual systems of heavy vehicle and light vehicle road pricing, reflecting the differing impact on the road network and the generation of externalities, such as congestion and noise pollution.

   The introduction of a national road pricing scheme would necessarily require a long-term implementation agenda of 5 to 10 years. As next steps to facilitate the implementation of a scheme, the Australian, state and territory governments should consider:

a) **Implementation of heavy vehicle mass-distance-location charging across urban and non-urban road networks;**

b) **Phased implementation across light vehicles to enable equipment roll-out and transition by road agencies to distance and efficiency-based charging;**

c) **Inclusion of a time of day mechanism to apply to urban road networks to encourage more efficient use of infrastructure during peak periods;**

d) **Investment in public transport and "transport system deficiencies" to provide road users with a viable alternative to private vehicle use, particularly during peak periods;**

e) **Development and staging of trials in capital cities to demonstrate:**

   i. Technology options;

   ii. Changes in travel behaviour, including incentivisation of travel outside periods of peak demand;

   iii. Trade-offs between fixed charges and variable charges based on vehicle use rather than vehicle ownership; and,

   iv. Options available to employers to allow adjustment of work patterns for commuters to avoid peak demand for road use.

▼ Table 2

The Key Principles of an Australian Road Pricing Scheme

KEY OBJECTIVE	Focus on vehicle use rather than on vehicle ownership
VEHICLE CLASSES	Heavy vehicle: mass-distance-location system Light vehicle: per kilometre system, reflecting vehicle efficiency
PRICING STRUCTURE	A three-tier tariff: • **Road use base charge** – per kilometre reflecting vehicle class • **Urban road use charge** – reflecting externalities associated with the use of congested roads in major Australian cities, including initially: - Sydney; - Melbourne; - Brisbane and neighbouring South East Queensland; - Adelaide; and, - Perth • **Urban peak road use charge** – reflecting externalities associated with the use of heavily congested roads during peak periods, and to encourage behavioural change.
CURRENT CHARGES	Removal of current taxes and charges associated with road-use, excluding privately collected tolls, the Goods and Services Tax (GST) and Fringe Benefit Tax (FBT). These reforms should be undertaken as part of broader reform of taxes and charges paid by all sectors of society.
SURPLUS REVENUE	Invested in an infrastructure fund and used for the construction and maintenance of infrastructure to facilitate mobility, including roads and public transport.
IMPLEMENTATION	Staged to facilitate the introduction of a heavy vehicle scheme, followed by the two stage roll-out of a light vehicle system.
PRIVACY	A central consideration in the final structure of the scheme. Special concessions should be made to reflect privacy concerns; however these must not undermine the basic policy structure of the scheme.
TECHNOLOGY	Must be driven by scheme design, with final technological solution to be determined through trials and a competitive tender.

2. Integrating a National Road Pricing Scheme with National Transport Policy

The introduction of a national road pricing scheme should not be viewed as simply taxation reform. Rather, it must form a central component of ongoing reform of Australia's transport policy. An effective national road pricing scheme would have as central tenets efficiency of infrastructure use and investment in new transport infrastructure.

The move to a national road pricing scheme must form part of a broader reform of transport infrastructure and services. These reforms must include:

- A commitment to long-term transport planning;
- The integration of land-use and transport planning;
- Promotion of sustainable transport solutions, including encouraging greater modal neutrality;
- Project prioritisation and a committed funding pipeline; and,
- Regulatory and governance reform to promote productivity.

The introduction of a national road pricing scheme should be coordinated with national transport reform processes including:

a) Harmonisation of State Transport Regulations Through the COAG Reform Agenda

The lack of consistency and uniformity across jurisdictions in their approaches to transport regulation has increased the cost of doing business in Australia. In addition, the duplication of activity has imposed a significant administrative cost on society. The Council of Australian Governments (COAG) reform agenda requires full support from all governments and industry if these burdens are to be removed and cohesive reform of the transport market is to take place.

b) Current National Heavy Vehicle Reforms, including the Heavy Vehicle Charging Scheme and National Licensing Scheme

Heavy vehicle reforms provide a platform for the rollout of a mass-distance-location pricing regime, as well as the further harmonisation of existing fees and charges. Commitment should be given to the established reform process including the expansion of these reforms to give regard to their role as a mechanism for a national approach to a road pricing scheme for all vehicles.

c) Harmonisation of Existing City-based Tolling Schemes and Extension of Demand Management-based Solutions

Australia's three largest cities – the greatest contributors to national congestion costs – benefit from established, harmonised electronic tag-based tolling systems. The reform of existing tolling arrangements to support harmonised schemes within each city's toll road networks could aid in the delivery of many existing transport policy objectives, such as transparency, effectiveness and efficiency.

Expanding the role of tolling from recouping infrastructure financing costs to include demand management could offer further important reform in advance of the implementation of a national road pricing scheme.

1. Introduction

Australia faces major challenges in maintaining and enhancing its transport networks to meet the twin challenges presented by rapid population growth and economic development. To meet these demand pressures, new transport infrastructure capacity is already urgently required. Forecasts conducted for Infrastructure Partnerships Australia show that Australia will need to double its investment in transport infrastructure by 2030 across all transport assets; and fund a four-fold increase by 2050[1].

The development of new transport infrastructure in recent decades has been fundamental to maintaining national productivity and improving connections between regions and communities. However, Australia's next generation of transport infrastructure will be of an unprecedented scale and complexity. The effects of the Global Financial Crisis, high profile failures of some large transport projects and the sheer size of future transport projects means that it is now time to consider new, stable funding mechanisms for Australia's transport system.

New investment in roads represents the lion's share of transport infrastructure investment, reaching $12.14 billion in 2006-07. A considerable proportion of this investment is associated with maintenance, comprising $4.19 billion in the same year. Despite of the considerable annual investment in road infrastructure, it is apparent that demand for highway and local road networks is fast outstripping the capacity of governments to deliver new projects, with urban congestion a common feature across all major Australian cities.

Addressing congestion will require new transport capacity, coupled with innovative asset management to ensure that finite capacity at peak times is utilised by journeys which best contribute to the nation's economic, social and environmental objectives.

The concept of road pricing has been debated for many years. It is advocated as a way of managing demand for road space, while also generating new revenue for investment in transport assets. Internationally, several jurisdictions have successfully implemented road pricing systems, with more complex and far ranging schemes, such as a national scheme in the Netherlands, due in the near future.

Setting appropriate price signals for road infrastructure can:

- Better match the demands of road users with the available capacity or 'supply' of road space;
- Provide a basis for replacing outdated and inappropriate taxes and fees, and provide a fairer set of charges which match charges and payments to actual road use and the impact this has on society; and,
- Provide a more sustainable and transparent funding mechanism for maintaining and improving the transport system.

1 Infrastructure Partnerships Australia and PricewaterhouseCoopers (2008)

While there is now a general consensus about the theoretical benefits of road pricing, in policy terms the concept has often been put in the too-hard basket; yet road pricing is again being debated in the Australian context. It is important to understand why the concept now receiving increased attention.

Continuing advances in technology, and the benefits demonstrated by schemes in other countries have helped break down some of the barriers which have previously prevented the introduction of more efficient road use charging arrangements.

Policymakers are beginning to accept that the implementation of a road pricing scheme could play a critical part in the reform of infrastructure funding toward a more efficient and coordinated approach. Critical to the success of a road pricing scheme are considerations like the scheme's reach, equity considerations and the opportunity to fundamentally reform the existing myriad of fees and charges to deliver a fairer, more transparent charging mechanism.

It is recognised at the outset that the approach proposed may warrant some re-thinking of Australia's existing taxation arrangements for transport with implications for the Commonwealth-State fiscal balance. However, it is critical the delivery of transport policy objectives, must be the focus of the reform process, not simply the creation of new taxation revenue.

The Review of Australia's Future Taxation System (the Henry Review) provides an opportunity to consider opportunities for reforming taxes and other charges that distort the economics of transport use. Central to this consideration should be the impacts of these fees and charges on the objectives of the Council of Australian Governments (COAG) transport reform agenda.

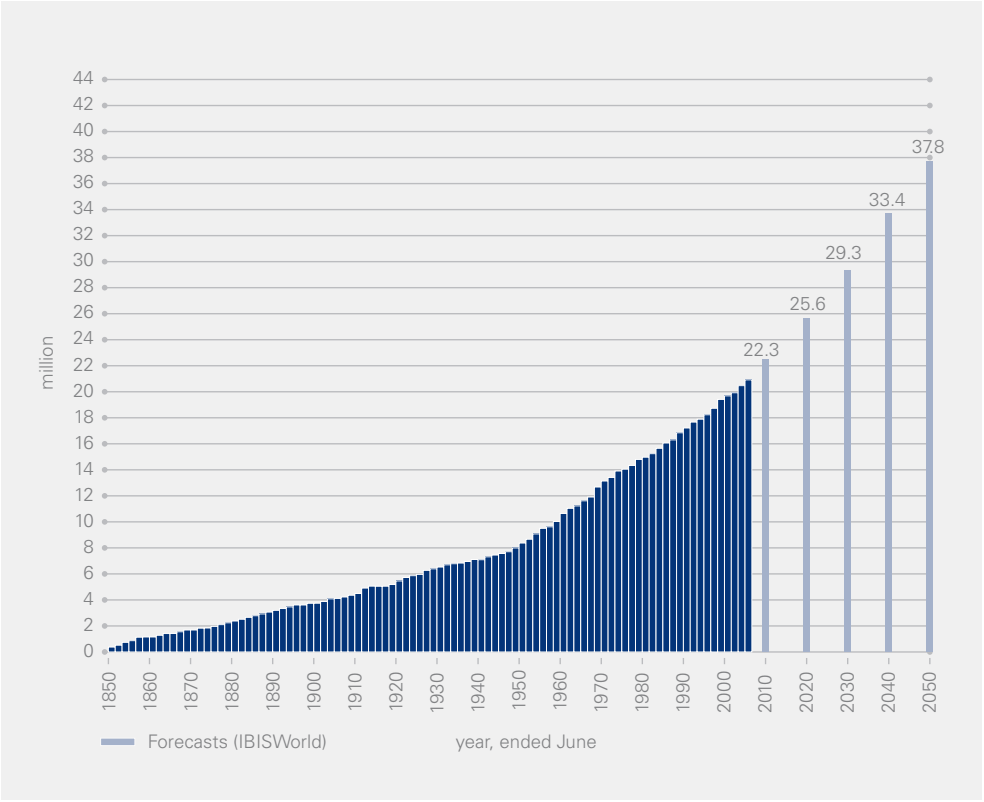
2 Setting the Scene: Why Do We Need Road Pricing?

Australia's population growth over the past 20 years has accelerated the demand for infrastructure and services, particularly in our capital cities. Population projections prepared for Infrastructure Partnerships Australia suggest that Australia's population could reach 37.8 million in 2056[2].

▼ Figure 2

Australian Population, 1850 - 2050

Source: IBISWorld (2008)



It is apparent that the scale of population growth is outstripping the capacity of Australian governments to supply the required supporting infrastructure. The sectors most affected by this supply and demand side imbalance are transport, health, education and utilities. In transport, demand management measures offer an opportunity to enhance productivity across the national economy and to better meet the expectations of the community in terms of access to functional, reliable and efficient transport networks. This growth is expected to continue over the coming 25 years as the freight and passenger tasks double in line with population and economic growth.

2 IBIS World (2008)

2.1 The Established 'Hands Off' Approach to Managing Transport

Over recent decades, regulatory reform has played a critical role in better managing the supply and demand for monopoly network infrastructure, such as energy, telecommunications and water. These continuing reforms have played an important part in modernising access to finite assets within these infrastructure classes.

This approach contrasts markedly to the 'hands off' approach to the management of transport networks, where it has been assumed that the inherent costs of accessing transport infrastructure like fuel and vehicle maintenance, will of themselves act as a signal to dampen demand for access to road space.

The expectation that underpins this approach is a belief that people will adjust travel behaviours according to trade offs between the way they value time and the levels of service offered by the road network. Costs of travel include lost time, fuel and vehicle maintenance, which increase during periods of high demand, such as peak hour congestion. As a result, people who place a high value on their time (e.g. work commuters) will be less flexible in their use of the transport system compared to other people (e.g. leisure travellers), who may be prepared (and more able) to access the road network at less busy times of the day.

However, in reality, this 'hands off' approach by transport policy makers has done little to manage the impact of unrestrained growth in travel demand and its effects on infrastructure use and society more broadly. This lack of success can in part be attributed to the inability of road users to access information regarding the true costs of road use, expected periods of high demand and limited access to viable alternatives, such as public transport.

While road users bear the direct cost of their transport activities, their decisions to consume transport resources may not be based on the correct 'signals' or information. In economic terms, there are three key shortcomings or sources of 'failure' in transport markets, notably:

- **Inappropriate taxing arrangements for road transport users** – the amount road users pay to access the road system does not accurately reflect when, where and how frequently they use the road network. This creates inequity across road users since many transport system users are charged more than they should really pay, while others are charged much less.

- **Failure to price externalities** – while transport users who decide to travel during peak hour may incur some delay themselves, they do not pay for the effect they have on other users of the system, or for other externalities, for instance the additional pollution caused by choosing to use the network at a busy time.

- **A lack of a direct relationship between infrastructure charges and asset provision** – there are a range of different taxes and charges collected by governments from transport users, but there is not a clear link between the allocation of these funds back into the transport system for the benefit of those users.

2.1.1 Transport Externalities

The mismatch between demand growth and the provision of new road infrastructure has seen the impact of urban congestion continue to grow markedly over the past decade. These pressures have real impacts on roads user, the productive capacity of the Australian economy as well as the secondary, longer term negative effects on society and environment.

According to Bureau of Infrastructure Transport and Regional Economics (BITRE) estimates, the total cost of congestion will rise from $9.4 billion in 2005 to $20.4 billion in 2020[3]. Excessive congestion has a negative impact on economic productivity and reduces the liveability and efficiency of Australia's cities. The study also concluded the dead weight – or recoverable – costs of congestion equalled about $5.6 billion in 2005, rising to $12.6 billion by 2020.

Around 11.7 per cent (or $1.1 billion) of the total cost of congestion comprised additional air pollution. These and other costs associated with congestion are generally referred to as externalities, since the cost is not directly borne by the road user.

In addition to the costs identified by BITRE, a number of additional costs were not factored into the study including reduced personal safety and impacts on the personal health of drivers (e.g. through stress factors), as well as broader health impacts on society. Other studies have indicated that these costs can be considerable, with the total cost of externalities accounting for as much as one third of the total cost of congestion.

Negative externalities, such as air pollution and noise, are not shouldered by the road user but instead met by the community. Road pricing provides the opportunity to internalise many of these costs. The externalities produced by road transport increase considerably due to the impacts of congestion. For instance, it has been estimated that vehicles consume between 30 and 40 per cent more fuel consumption between free-flow versus stop-start, congested conditions.

2.1.2 Capacity Augmentation and Demand Management

Under the established system, state and territory governments independently undertake transport planning, as well as development and maintenance of the road network, largely funding expenditures through their own budget processes.

The past five years has seen a step change in transport planning and project delivery through programmes like AusLink, the Nation Building Programme (AusLink II) and more recently, through the Infrastructure Australia infrastructure audit and prioritisation process. These reforms have seen the Commonwealth markedly increase its role in assessing and funding road infrastructure. AusLink and the Infrastructure Australia prioritisation process have been important to developing cohesive, long-term road infrastructure plans to alleviate bottlenecks on the nation's most significant transport corridors.

Between 2006-07 and 2008-09, road-related expenditure jumped significantly from the established long-term trend to $16.745 billion. This represented an increase of approximately two-thirds over the long-term funding trend, which averages around $10 billion per annum for at least the five years following 2001-02.

3 BITRE (2007)

▼ Table 3

National Road Expenditure, 2000-01 to 2007-08 or 2001-02 to 2008-09
Source: NTC (2009)

	ESTIMATED ARTERIAL ROAD EXPENDITURE ($ MILLION)							
	2001 - 02	2002 - 03	2003 - 04	2004 - 05	2005 - 06	2006 - 07	2007 - 08	2008 - 09
URBAN	1710	2059	2130	2177	3164	4441	5157	6338
RURAL	2629	2425	2591	3018	2941	3173	4049	4752
TOTAL	4339	4484	4721	5195	6105	7614	9206	11090
	ESTIMATED LOCAL ROAD EXPENDITURE ($ MILLION)							
	2000 - 01	2001 - 02	2002 - 03	2003 - 04	2004 - 05	2005 - 06	2006 - 07	2007 - 08
URBAN	2560	2675	2593	2589	2670	2741	3016	3409
RURAL	1578	1679	1702	1748	1700	1687	1891	2246
TOTAL	4138	4354	4295	4337	4370	4428	4906	5655

Despite the recent and significant escalation of investment in transport infrastructure, several recent studies have highlighted the deficiency in investing in Australia's transport infrastructure. Infrastructure Australia recently identified around 40 projects that need to be considered to achieve an efficient and sustainable transport system in the longer term. Together, these projects total almost $60 billion of capital investment. The range of projects in the Infrastructure Australia priority list covers roads, terminals, ports, airport facilities and public transport. For the roads sector alone, twelve high priority projects have been identified, totalling $15.5 billion worth of capital investment.

It is important to recognise that this investment plan does not take account of the high cost of maintaining existing infrastructure. The funding challenge is compounded when consideration is given to the ageing of our transport infrastructure, particularly in the rail sector.

There is no doubt that the augmentation and extension of major road networks is essential, but governments should also embrace concurrent strategies to make better use of the existing road network. It is a commonly accepted phenomenon that by increasing the capacity and ease of access to the road network, the added convenience of new infrastructure often increases traffic volumes over and above the projected traffic growth rates for the established infrastructure.

As a result of this, a study of a number of the world's leading cities by the Commission for Integrated Transport (CfIT) in London has found the only way to reduce car use is to balance the development of new capacity with a measure of demand management that in turn complements public transport investment[4]. This finding is becoming more commonly accepted and is resulting in a change of thinking among transport planners. Rather than merely adding to the stock of road infrastructure to increase road capacity and meet demand, planners in many cities are now openly considering charging for road access as a means of managing increased congestion.

The Victorian Government undertook a review of options for managing transport congestion in 2006, Making the Right Choices. A key message of the report was the need for further work to explore the benefits of road use charging.

4 CfIT (2009)

The New South Wales Government made a modest first step toward the use of pricing to manage demand on Sydney's harbour crossings through the introduction of a time of day toll price in January 2009, the first in Australia to do so. The Victorian Government has also made a modest commitment to exploring demand management techniques through the use of ramp metering, a physical method of managing traffic entering a roadway to improve the operation of some freeways in that state.

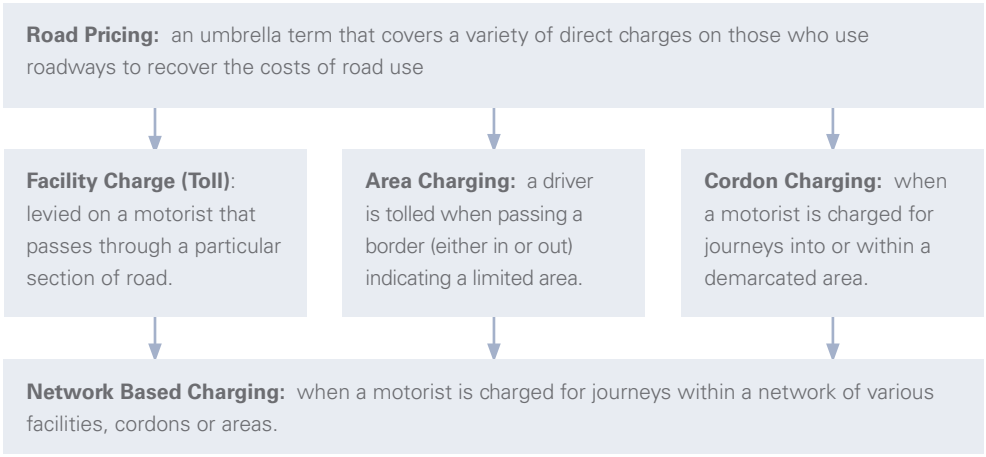
Despite this progress, a consistent approach to demand management is absent from long-term transport planning at both the national and jurisdictional levels. The creation of a national road pricing system has the potential to balance demand for road space with road supply, and generate a new source of revenue to finance the expansion of the network.

2.2 What is Road Pricing?

Road pricing is the direct application of a price for road use. Road pricing is a common feature of the road transport systems in many countries throughout Europe, North America and Asia. The application of tolls to motorways, bridges and tunnels in Sydney, Melbourne and Brisbane are also forms of road pricing.

▼ Figure 3

Classifications of Road Pricing



Facility Charge (Tolling)

Tolling is principally a financing mechanism to fund infrastructure provision and has been used extensively in Australia to develop urban tollway networks in Brisbane, Sydney and Melbourne. Tolling in Australia has traditionally been based on the costs of construction and maintenance of that facility. The use of road tolls has a long history in Australia stretching back to 1802. The introduction of travel behaviour influencers, such as time of day charges, to manage demand is common through Europe, Asia and North America.

Cordon and Area Pricing

Both systems refer to a charge for providing access to a defined part of an urban network, usually associated with a central business district. The primary purpose of such an approach is to ration demand within an area which is characterised by a highly concentrated level of activity. An area scheme differs from a cordon scheme in that it charges for movements within the specified area, as well as movements into and out the area. Examples include London, Trondheim, Oslo, Stockholm and Singapore charging schemes.

Network Based Road Pricing

Network-wide road pricing is a more comprehensive approach to charging for road use and could potentially encompass elements of all of the above schemes. A network-wide pricing system could be levied on both urban and non-urban based traffic and may be varied to reflect location, time of use and distance travelled. Additional factors may be added to each charge to reflect factors influencing the cost of externalities.

A fully dynamic network-based road price, varying to match demand for and availability of road space in real time, is theoretically the optimal method for managing the efficient use of road space. However, in practice no country in the world has yet achieved such a dramatic shift in the way that the entire network is managed. The Dutch Government has committed to the implementation of a national road pricing system using a per kilometre charge based on environmental and economic efficiency of a vehicle, as well as peak period surcharge. The system is planned for introduction in 2018, an earlier version having been delayed for political reasons.

A network-based road pricing scheme theoretically provides the greatest net benefit from the total road asset. It involves pricing all links of the road network to achieve that end.

2.2.1 Role of Road Pricing in Delivering Transport Policy Objectives

Road pricing can contribute substantially to the two key objectives of transport system management:

- **Revenue generation** - revenue could be generated for a range of purposes, however most frequently for the recovery of costs associated with construction and maintenance of an existing road asset, or for capacity augmentation; and,

- **Demand management** - road pricing can also be used to ration limited road space. Through the application of a price, demand for use of a road asset can be better managed. Drivers may be influenced to travel at particular times, on particular routes or to reduce unnecessary travel.

In many cases the price is designed to require road users to more closely meet the costs of their actual use of the road network, such as the costs of road maintenance, air pollution and in some cases congestion. Central to this concept is the recognition that road users do not currently meet many of their costs for use of the road network, imposing these costs on society. While there are many fees and charges that apply to road use, most notably Fuel Excise, vehicle registration fees, Stamp Duty and road tolls, these charges either are:

- **Variable** - providing only partial reimbursement for full cost of road development and maintenance; or,

- **Flat** - not reflecting actual road use. As a result, these charges over-charge some users and under-charge others.

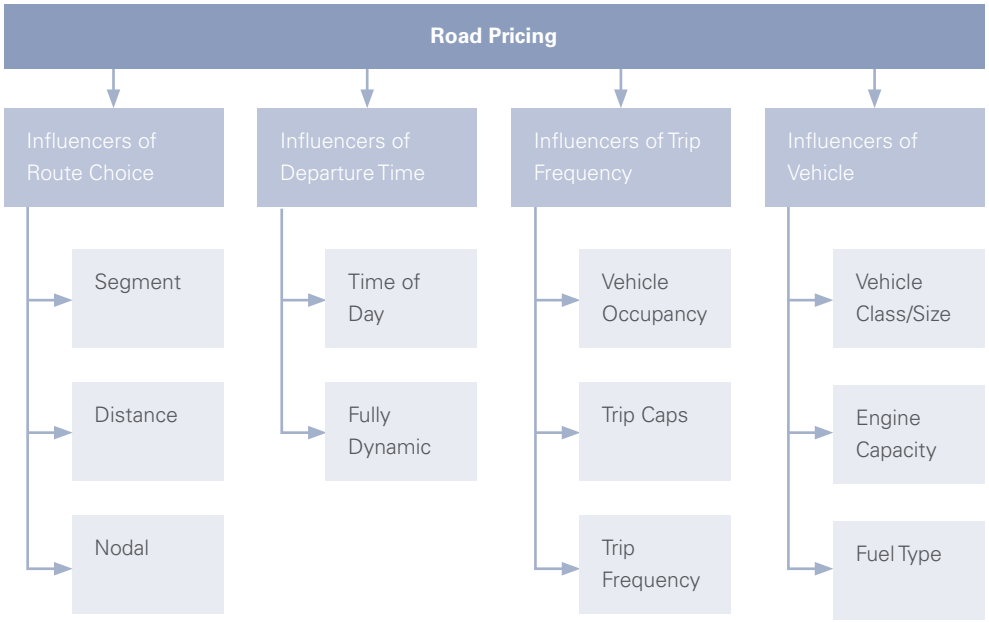
2.2.2 Using Road Pricing to Influence Behaviour

Road pricing can be used to influence travel behaviour in various ways based on the objectives and structure of a scheme. Road pricing may be used to influence the decision to travel or avoid the reason for the journey, and to influence the travel behaviour of an individual should they choose to travel. In order to influence behaviour, a road price may be structured to reflect specific factors that influence the cost of road use, such as time of day, distance travelled, frequency of journey or vehicle type.

In Australia, debate has historically centred on the use of a road price to capture the additional costs of congestion and environmental impacts created by road users and not directly recovered. By structuring a road price in this way, a scheme seeks to either to discourage a particular behaviour or recover the costs associated with a specific aspect of road use, for instance noise and greenhouse gas emissions.

▼ Figure 4

Behaviour Influencing Road Pricing Models



Influencers of Route Choice

- **Segment** – road networks, particularly motorways, can be divided into tolled segments. The value for a section may vary due to construction cost, length, capacity or numerous other factors.

- **Distance** – vehicles are charged a rate per kilometre travelled, which is calculated dependent on their entry and exit points on the network.

- **Nodal** – applies a charge based on the capacity of traffic to be passed through a node, portal or gateway, to another section of the road network. A nodal toll typically applies where traffic must travel the length of the segment, prior to being given the option to leave the motorway. This could be the distance between intersections, motorway off-ramps or changed traffic conditions (such as the introduction of additional lanes).

  Nodal tolling recognises the requirement to travel a full segment and delineates prices based on attributing values, such as capacity, speed limit and on-road conditions, of each section.

Influencers of Departure Time

- **Time of day** – demand for travel is relatively predictable, meaning that congestion occurs in predictable patterns across the day. Time of day tolling sees lower tolls charged at times of low demand to spread demand across the day.

- **Fully dynamic to traffic** – effectively auctions road space and sees the rate of toll change moment by moment to maintain free flow traffic. Theoretically, this allows demand to be managed to ensure optimal use of the roadway.

Influencers of Vehicle Type

- **Vehicle size or class** – tolls already vary according to vehicle class (for example, motorbike, passenger cars, heavy vehicles and buses) on many but not all of Sydney's motorways. Similar systems utilising vehicle weight or number of axles are used across Australia to determine indirect fees and charges and internationally to determine tolls.

- **Engine capacity** – similar to vehicle class and size however based on vehicle specifications, like engine capacity or fuel consumption.

- **Fuel type** – vehicles using particular fuel types, such as alternate or renewable fuels like biodiesel, or low emission fuels, such as LPG, receive discounted tolls. In doing so, regulators can encourage the adoption of renewable and low emission fuels and reduce the environmental costs of congestion.

Influencers of Trip Frequency

- **Vehicle occupancy** – High Occupancy Vehicle (HOV) or car-pool lanes are utilised in various jurisdictions with and without tolls attached to their use. Under this model, access or toll is dependent on the number of occupants within a vehicle. Typically single occupant vehicles pay the highest rate of toll, with lower charges for dual and treble occupancy.

- **Trip caps** – an equity measure which can limit the impact of multiple or distance based tolls. This approach encourages longer journeys, smoothing the impact of multiple charges on users from outlying areas. Caps can also be used, where appropriate, to discourage the use of a network for short 'local' journeys by providing a discount rate for longer journeys.

- **Trip frequency** – a discounted toll for particular users who access the network multiple times within a specific period. By discounting frequent use, road users, such as heavy vehicles, mass transit or taxis, can be encouraged to use the tolled network rather than diverting to free routes during periods of low demand.

2.2.3 Examples of Behaviour-based Road Pricing Schemes

Beyond the management of demand to limited road space, road pricing systems have in many cases been developed to influence the behaviour of road users around one or several of these factors.

Congestion Pricing

Congestion pricing is perhaps the most common behaviour-linked road pricing model. Under a congestion price, the charge for road use is set at such a level to ration road space by discouraging discretionary access by vehicles. Prices are set to balance the supply of infrastructure and the demand for use of that infrastructure, as distinct from the cost of the provision of infrastructure. In this way, a congestion charge seeks to limit the impacts of externalities from vehicle use.

A congestion charge could incorporate various behaviour influencers, such as a nodal charge to reflect the capacity of a particular segment or road, or time of day charging to discourage road use during times of peak demand.

Congestion pricing may take the form of charging to use specific roads, a broader network wide pricing or cordon pricing (i.e. a specific area or zone). The concept of congestion pricing was raised in the COAG *Review of Urban Congestion, Trends, Impacts and Solutions* as a means of containing the forecast growth in the cost of congestion in Australia's capital cities. As the impacts of congestion are most prevalent in major cities, it is likely that any use of a congestion charge in Australia would focus primarily, if not exclusively, on capital city urban road networks.

Heavy Vehicle Charges

Beyond the use of pricing to influence access to specific locations, road pricing can also be used to influence the use of specific vehicle types, such as heavy vehicles, or public transport, such as buses.

Heavy vehicles generate substantially greater wear and tear on road pavement surfaces than light vehicles. The American Association of State Highway and Transportation Officials place the relative damage at a factor of four times the number of axles on a vehicle. However, the damage associated with heavy vehicles varies markedly depending on the maximum load capacity of the vehicle as well as the weight actually carried[5].

The National Transport Commission first introduced heavy vehicles charges for the road freight industry in July 1995 for vehicles greater than 4.5 tonnes gross vehicle mass (GVM).

5 Bridle & Porter (2002)

Before their introduction, registration charges varied markedly by vehicle class across jurisdictions, and there was no real correlation between vehicle mass and registration charge in most jurisdictions. The pay-as-you-go (PAYGO) approach was used to recover expenditures on road construction and maintenance attributable to heavy vehicle use of the road network, and comprise registration fees and a net fuel charge. The registration charge is set at a uniform rate for each vehicle class to reflect the mass of the vehicle and its capacity to cause road damage. However, the current vehicle registration charge system is not capable of accounting for the true cause of road damage, vehicle load mass. A heavy vehicle will only result in substantial road damage when carrying a substantial load and therefore, on average, are overcharged for journeys when unloaded.

2.3 The Role of Governments

2.3.1 Road Related Revenue Collection

Road transport is an essential component of the Australian economy. Access to efficient road transport supports productivity within the national economy, including the cost effective provision of goods and services. Recent work by Ernst and Young examining the economic contribution of the Sydney Motorway Network placed the net present value of the economic contribution of the toll road network at $22.7 billion[6]. The Australian Bureau of Statistics found the road transport and associated storage industry contributed $17.988 billion to Gross Domestic Product (GDP) in 2007-08[7].

As the benefits of cost effective transport are shared throughout the economy, the established practice in Australia has been to support the provision of public road infrastructure funded through general revenue. Hypothetically, this approach would provide the greatest access to funds for the development of the road network. However, over time the provision of funds for investment in roads has diminished relative to the growing demand for new capacity and indeed the level of government revenue derived directly from road-related revenue and competing priorities in government service provision.

Road users are subjected to a range of government taxes and charges for access to and use of road networks, imposed by all levels of government to varying degrees. These taxes and charges are identified in Table 4.

6 Ernst and Young (2008)
7 BITRE (2009)b

▼ Table 4

Road-related Revenue Collection ($million, 2005-06)

Source: BITRE (2009d)

SOURCE	REVENUE ($ MILLION)
Australian Government	**15 551**
Fuel Excise	9 124
Federal interstate registration scheme	51
Goods and Services Tax (GST)	4 600[8]
Fringe Benefits Tax (FBT)	1 776
State/Territory Government	**6 126**
Registration charges for light and heavy vehicles	3 911
Stamp Duty	2 004
Licence fees	211
Private Sector	**1 131**
Tolls for use of private motorways	1 131
Total Revenue	**22 808**[9]

The various taxes and charges associated with the road sector are among the most important to government. Fuel Excise is the fourth largest individual source of revenue for the Australian Government, while tax and motor vehicles taxes provide approximately 10 per cent of state government revenue, although the exact amount varies across states and territories.

The array of taxes, charges and expenditures for the road transport sector raises the question of whether these revenue and expenditure streams could be handled more efficiently through a national approach. For the most part, taxes and charges imposed on the transport sector do not encourage efficient use of infrastructure. In particular:

- The rate of Fringe Benefit Tax falls with distance travelled, thereby encouraging more travel;
- Registration charges are fixed costs to the road user and hence higher vehicle use has the effect of reducing the average fixed costs associated with vehicle registration. This also applies to other fixed costs of vehicle ownership, such as Stamp Duty;
- There are also very few examples of registration charges reflecting vehicle fuel use efficiency to encourage shift toward more energy efficient vehicles; and,
- While Fuel Excise varies with vehicle usage, it is non-discretionary and ignores location or time of travel (although vehicle operating costs, including fuel consumption, increase with higher levels of congestion).

8 Forecast based on historical GST growth from 2001-02 to 2004-05.

9 In addition to the revenue shown in this table considerable additional revenue is collected by governments through mechanisms such as: the Commonwealth luxury car tax, import duties and sales taxes on new vehicles, state and territory permit fees for heavy vehicles, insurance levies on Compulsory Third Party Insurance (CTP), revenues from infringements and penalties and parking levies, and local government parking charges and penalties.

High reliance on Fuel Excise as the principal form of revenue derived from road use will face further pressure as a result of the changing nature of road transport. The increased use of alternative fuel vehicles, such as hybrids, may over time result in the diminution of the Fuel Excise revenue base. During 2001, the US State of Oregon commenced a programme of work examining the impacts on the State's Gas Tax revenue base. The review culminated in the Mileage Fee Concept and Road User Fee Pilot Program which recommended the phasing out of existing fees and charges, including the Gas Tax, and their replacement with a State-wide road pricing system. The review further concluded the introduction of congestion pricing in the pilot program produced a 22 per cent decline in driving during peak periods.

In its consideration of road pricing, the Dutch Government dismissed the concept of increasing fuel taxes on the basis that such increases would have no effect on the times and places people drive, and hence it would not have a significant effect on reducing congestion[10].

The vast array of Commonwealth taxes send conflicting signals to road users. The rate of the Fringe Benefit Tax reduces with distance travelled; Fuel Excise is a relatively efficient form of tax collection but its position is likely to be degraded overtime and is not related to location or time of infrastructure use. The range of taxes imposes an administrative burden on users and government which contributes to the overall cost of transport. The use of a single charge would help to promote Australia's international competitiveness by improving administrative efficiency and transparency of fees and charges for all road users.

2.3.2 The Provision of Capacity and Maintenance

Provision of transport infrastructure including roads, is a fundamental responsibility of all three tiers of government in Australia. It is estimated that Australia has some 815 074 kilometres of roadway, ranging from Grade A motorway to cleared paths. The cost of providing and maintaining these assets varies markedly according to the type, location, age and quality of each asset. Issues including isolation and competition for skills and materials can significantly increase the cost of even the most basic assets in many regional and remote communities.

▼ Table 5

Australia's Road Network by Type, 2007

Source: BITRE (2009)b

ROAD TYPE	LENGTH (KM)	PER CENT OF TOTAL
Bitumen or concrete	337 979	41.46
Gravel, crushed stone or other improved surface	293 691	36.03
Formed only	136 876	16.79
Cleared only	46 528	5.71
Total	**815 074**	**100.00**

10 Netherlands Ministry of Transport (2009)

Although the responsibility for the provision of road infrastructure is shared across governments, there are distinct differences in the role provided by each level of government. Local government is responsible for the maintenance of more than 80 per cent of the total Australian road network (652 000 kilometres), while the largest recipient of road-related revenue, the Commonwealth Government, is responsible for 22 500 kilometres of roadway through the Nation Building (formerly Auslink) Network.

▼ Table 6

State Jurisdictional Road-related Expenditure ($ million), 2008-09

Source: NTC (2009)a

EXPENDITURE CATEGORY	NSW	VIC	QLD	SA	WA	TAS	NT	ACT	TOTAL
Servicing and operating	430	132	209	49	7	16	27	10	881
ROAD PAVEMENT AND SHOULDER CONSTRUCTION									
Routine maintenance	69	59	137	46	74	12	30	2	429
Periodic surface maintenance	150	100	143	6	37	4	8	3	451
Bridge maintenance/rehabilitation	100	33	57	5	13	11	2	1	221
Road rehabilitation	345	70	148	49	154	6	4	3	779
Low-cost safety/traffic	183	249	199	15	89	11	1	3	750
ASSET EXTENSION/IMPROVEMENTS									
Pavement improvements	370	214	965	116	132	49	26	58	1930
Bridge improvements	337	181	326	54	200	4	29	5	1136
Land acquisition, earthworks, other extensions/improvement expenditure	1234	596	1643	185	310	16	2	0	3986
OTHER MISCELLANEOUS ACTIVITIES									
Corporate services	83	14	162	31	109	7	3	5	414
Enforcement of heavy vehicle regulations	69	12	14	6	9	-	3	0	113
Vehicle registration	96	105	51	33	69	-	6	3	364
Driver licensing	79	53	31	11	36	-	3	1	214
Loan servicing	48	0	72	0	2	-	0	0	122
Totals	**3594**	**1817**	**4159**	**606**	**1242**	**135**	**142**	**95**	**11790**
OTHER ROAD-RELATED PAYMENTS									
Financial assistance to councils for work on council managed arterials	276	0	0	0	41	-	0	0	317
Payment to councils for contract work on state managed roads	157	11	177	0	2	-	9	0	355
Spending on local access roads in unincorporated areas	2	0	0	1	2	-	40	0	44
Direct spending on council managed local access roads	37	20	0	0	109	1	0	0	169
Any other direct state spending on local access roads	0	0	8	0	3	-	17	0	28

Reforms to the distribution of funding for the maintenance and rehabilitation of road infrastructure should be targeted to better reflect the role of each level of government in road infrastructure management. Critical to this process must be the development of agreed standards of asset availability and associated reform. The reform of revenue collection through a single charging mechanism may provide the opportunity to link the distribution of revenue to the achievement of key policy reforms.

The reform of revenue collection and distribution could also provide the opportunity to modernise, and potentially, rationalise, duplicated administration functions. For instance, considerable opportunity exists for the reform of state-based licensing and vehicle registration systems potentially through a single national system. Under the current system of state-specific fees and charges, the National Transport Commission estimates that administrative functions cost $578 million across all states and territories each year.

2.4 Is it Time for a New Approach?

In a theoretical sense, if we consider road space as a commodity in a market where there is a demand for travel, then just like other commodity markets, price can be used as a way of rationing demand. Currently, in Australia's road sector there is no direct pricing system used to ration demand for finite road space, apart from the limited application of variable, time-of-day, motorway tolls. In simple terms, as long as we are prepared to meet vehicle running costs, we can travel as much as we wish between any origin and destination without directly paying for our use of road space – a finite commodity.

The same argument applies in relation to when we use the network. If we choose to travel in an urban area during peak times, our travel decisions have a greater impact on other road users and society overall. However, as a road user we do not bear those indirect costs.

In most markets, consumers have a general appreciation of the price they expect to pay for the commodity or service in question. Consumers can make informed decisions, based on the value proposition presented relative to the price of the good or service. By and large, prior knowledge of prices does not apply to the use of transport resources. While transport system users who choose to travel during peak periods may incur indirect costs in the form of congestion and delays, the true cost associated with the journey may be hidden due to their fixed nature or indirect payment. Also, transport system charges do not generally vary in response to levels of demand.

As a general concept, road pricing can help solve some of the current shortcomings of our transport system, and help deal with some of the future challenges we face. Pricing can make road users think more carefully about when they use the network, which can result in demand being better matched to supply, using the network more efficiently and getting more out of existing transport assets.

A new approach to access pricing could see the development of a more equitable system that only charges road users according to what they use and ensures the proceeds are invested back into the transport system delivering a direct benefit to road users. Pricing reform also offers the opportunity to redress outdated and inappropriate taxes and charges which do not vary according to how people use the network, and provide a more stable link between road use and investment in the transport system.

Given the general benefits that can be provided by pricing instruments and recent advances in technology, why has the concept not been introduced more widely? A number of practical issues need to be considered:

- What key objectives should pricing instruments fulfil in the context of transport?
- Which locations and regions should they be introduced in?
- What types of vehicles and transport modes should they be applied to, and what current road user charges should they replace?
- How can price signals be applied to complementary transport options, such as public transport, to ensure the most effective use of infrastructure across networks?
- Can a system be designed that is efficient from an economic perspective, but also be capable of producing the desired changes in the travel behaviour of members of the general public?
- How can equity of access across different socio-economic groups and regions be ensured?

These are not easy questions to answer, especially given the complicated regulatory and political environment that characterises our transport systems. Before considering these questions in more detail, it is important to consider road pricing schemes which have already been introduced in other parts of the world, and the objectives they were designed to meet.

3 Infrastructure Market Reforms – Lessons for Transport in Australia

3.1 The Rise of Demand Side Responses in Transport Policy

Recent government forecasts estimate Australia's population will increase beyond 35 million by 2050 and forecasts produced for Infrastructure Partnerships Australia suggest the population will reach 37.8 million over the same period. This dramatic increase in Australia's population will drive considerable economic growth and in turn, demand for transport. Forecasts produced by IBISWorld estimate that demand for freight will triple over the same period to 1,540 billion tonne kilometres by 2056, while demand for passenger transport will double to 2030.

As growth pressures intensify, so too will the requirement for governments to provide supporting investments in transport infrastructure. However, the ability for governments to continue to provide capacity is inhibited by conflicting demands on limited public funds, with many other core areas of government business equally stretched by growth in demand for services including education, health, justice and utilities.

Retrofitting transport alignments in established urban areas also adds significant complexity and expense to developing new road and rail projects. The lack of preserved corridors for transport projects has resulted in a necessary shift to more expensive forms of transport infrastructure, such as tunnelling, in Australia's largest cities. While tunnelling is an important strategy to facilitate the development of new road corridors and support additional capacity, the costs associated with development of this infrastructure are considerably higher than a comparable surface road. The cost and complexity of tunnelling is a handbrake on badly needed projects, most notably the long-planned M4 East Motorway extension in Sydney and the east-west tunnel in Melbourne.

As a result, the capacity to efficiently deliver new road capacity to accommodate increased demand has become increasingly constrained. Compounding the impetus for governments to look to demand-side techniques to respond to congestion and associated economic, environmental and social costs.

Governments throughout the world are progressively accepting the requirement for demand-side management initiatives to deal with increasing congestion problems. Demand-side management schemes have a long history in Asia and Europe. Notably, the Singapore Area Licensing Scheme was implemented over 30 years ago and has been highly successful. Various jurisdictions across every continent are now considering the introduction or extension of similar schemes for city (London), state (Oregon) or national (Netherlands) road networks. Australia's first demand-management pricing strategy was introduced on Sydney's harbour crossings in January 2009.

▼ Table 7

Established International Large Area Road Pricing Schemes

	SINGAPORE	LONDON	TRONDHEIM	STOCKHOLM	GERMANY
TYPE OF SCHEME	Cordon Pricing	Area Pricing	Cordon Pricing	Cordon Pricing	Network Pricing (autobahn only)
DATE OF IMPLEMENTATION	• First road pricing scheme, known as the Area Licensing Scheme (ALS), was introduced in the Restricted Zone (RZ) in 1975 • Scheme was subsequently extended to major expressways with the Road Pricing Scheme (RPS) • In September 1998, the ERP system replaced the manual system for the RZ and expressways • In September 1999, ERP was extended to some key arterial roads beyond the RZ[1]	February 2003	• Cordon based scheme implemented in 1991 • Changed to network system (based on cordons or zones) in 1998[2] • Pricing system scrapped at end of 2005[5]	• Trial system with 19 toll plazas from 3 January to 31 July 2006 • After successful trials the system was continued from mid 2007 [8]	• January 2005
MOTIVATION FOR SCHEME	Regulate traffic in order to increase accessibility (through maintaining target speed).	Reduce traffic, finance transport investments	Finance new, transport-related infrastructure	• Reduce congestion, improve the environment and increase accessibility [9]	• Recover system costs to finance ongoing maintenance, repair and improvements • Promote environmental improvements • Reduce deadheading [12]
CHARGING AREA	CBD and expressways	21 km² area of CBD	Formerly city centre based scheme, now a zone-based system with differentiated prices depending on the time of day.[2]	29.5 km² area of CBD[8]	Entire German motorway network for vehicles greater than 12 tonnes
SYSTEM TECHNOLOGY	RFID based tolling technology - smart card inserted into in-vehicle unit; scanned by on-site gantries around charging area using short range radio	Video camera system Automatic Number Plate Recognition (ANPR) with character recognition software	Tolling technology known as AutoPASS. It is intended that the system will provide a platform for additional functionality in the future (e.g. electronic payment, access control, traffic monitoring, and exchange of information between vehicles and roadside). AutoPASS is now the Norwegian standard for EFC-systems.[2]	Electronic toll collection using microwave technology, supported by Automatic number Plate Recognition	System employs a manual declaration and payment method for infrequent users accessed through roadside toll stations or the internet. For more frequent users, GPS and GSM technology is employed in an automatic electronic system using on-board units.

▼ Table 7 Continued

Established International Large Area Road Pricing Schemes

	SINGAPORE	LONDON	TRONDHEIM	STOCKHOLM	GERMANY
INFRASTRUCTURE	At least 60 overhead gantries on roads heading into charging area	700 camera in 230 positions, mobile units, data centre, pay machines and internet kiosks	20 unmanned and two manned toll booths with cameras for detection of cars without an AutoPass account[5]	18 roadside control points located at Stockholm city entrances and exits[10]	300 gantries and 150 checkpoints for stationary monitoring, 280 vehicles for mobile enforcement [13]
REDUCTION IN CONGESTION	10-15 per cent	Vehicles by 20 per cent, congestion by 30 per cent (reductions greater than expected; resulted in reduced revenue)	Less than 5 per cent (congestion reduction not the aim of scheme)[3]	• 20-25 per cent (original target was 10-15 per cent)	• Number of loaded runs increased by 2 per cent • 15 per cent reduction in number of empty runs • 7 per cent increase in number of containers on rail [13]
ANNUAL OPERATING COSTS	USD$16 million[6]	USD$64 million[7]	N/A	USD$26 million[11]	USD$810 million[15]
ANNUAL REVENUE	USD$80 million[6]	USD$160 million[7]	USD$150 million[5]	USD$105 million[11]	USD$2,860 million[15]
OTHER	• Fees revised every three months • Fees variable according to congestion levels; displayed on billboards at each gate • Revenue goes into a national account; not distinguished from other state revenues	• Revenues were 30 million GBP less than expected due to a greater reduction in vehicle usage then envisaged	• Introduced 2nd generation cordon system in 1998 • Charges vary according to time of day (hourly) • Pricing scheme initially implemented to finance infrastructure; following a change in local government, the scheme scrapped from 2005 although there has been some push to reinstate for congestion purposes • Norway uses same card system among a number of cities which have different pricing regimes	• Following the 2006 trial, inner-city queue times were reduced by 30-35 per cent[9] • Inner-city emissions were reduced by 10-14 per cent [9]	• System has proved difficult to extend to other roads • Charges based on distance travelled and vehicle type • Regarded as the first satellite-based road charging system in the world [14] • On board units provided free of charge; installation paid by truck owner [16] • Approximately one-third of the heavy vehicles using the autobahn are registered in foreign countries

Source: (1) Singapore Land Transit Authority (2009)
(2) PRoGRESS Project (2004)
(3) Waersted (2005)
(4) Christainsen (2006)
(5) CfIT (2006)a
(6) CfIT (2006)b
(7) Litman (2006)
(8) KeyResearch (2009)
(9) Booz Allen Hamilton (2007)
(10) IBM (2007)
(11) ITP (2006)
(12) Michie (2008)
(13) Short (2007)
(14) Satellic (undated)
(15) Replogle (2006)
(16) Kossak (2006)

3.2 Lessons from International Road Charging Schemes

Road pricing schemes developed to date been highly successful in reducing congestion levels and raising revenue for transport system improvements.

3.2.1 Singapore

The Singapore Road Pricing Scheme (RPS) was introduced in 1975 as an Area Licensing Scheme (ALS) for which road users purchased a licence to enter the Central Business District. This was a manual system based on paper transactions and achieved an initial 44 per cent reduction in traffic levels in the Restricted Zone. By 1988 there was a 31 per cent reduction in traffic relative to pre-1975 levels despite a 77 per cent increase in the vehicle population. The ALS applied only during peak periods for access to the Restricted Zone. In 1995 the approach was broadened to include expressways under the Road Pricing Scheme.

In 1998, the scheme became fully electronic with charges based on maintaining traffic flow with two road classification rates: CBD at 20-30 kilometres per hour and expressways at 45-65 kilometres per hour. As traffic speeds increase, charges rates are reduced (and vice-versa) to optimise infrastructure usage.

The enhancement of the scheme through the roll-out of electronic technology was part of a package of measures to reduce congestion across the road network in Singapore. In order to achieve this objective, the Singaporean Government also introduced a park-and-ride shuttle service at the fringes of the CBD to encourage lower car use, as well as increasing expenditure on public transport infrastructure and services.

The decision to strengthen the scheme is a central plank in the government's platform of shifting the emphasis from taxing vehicle ownership to pricing road use. In support of this plan the government undertook a 12 month publicity campaign prior to introducing road pricing and ensured privacy concerns were addressed by wiping transaction records from its central database within 24 hours of the transaction being recorded for payment. Vehicle owners retain a copy of all transactions on a memory chip embedded in a stored-value smartcard[11]. Recent policy has changed the basis of charging from average traffic speed to the 85th percentile of traffic speed. Annual revenue has averaged around S$80 million while operating costs have averaged around S$16 million[12].

3.2.2 London

The London scheme shows that congestion pricing can be extremely effective in raising revenue for improvement of the transport system, and for managing transport demand and externalities. Since the scheme was first introduced in February 2003, the scheme has achieved a 21 per cent reduction in traffic entering the charging zone relative to traffic levels in 2002. In 2006, congestion reduction was broadly in line with the 30 per cent reduction realised in the first year of operation. The scheme has also had a positive impact on reducing emissions and improving road safety, with no overall negative impact on the economy of

11 Chin (2002)
12 Christiansen (2006)

central London. A benefit-cost analysis of the scheme suggests it has generated a benefit-cost ratio of 1.5 with the congestion charge set at five pounds in 2004-05 and a benefit-cost ratio of 1.7 in 2005-06 when the charge was increased to 8 pounds[13].

A separate assessment of the central London scheme concluded that the introduction of charges had increased average travel speeds by 37 per cent. The re-investment of revenues collected through the scheme into public transport contributed to an increase in bus patronage of 14 per cent and underground rail use by 1 per cent. The main issue with the scheme appears to be high costs of administration. For 2004-05, total revenues amounted to 190 million pounds while costs were 92 million pounds (or 48.4 per cent), leaving a net revenue of 97 million pounds for investment in public transport[14].

There is some concern that the dramatic impacts of the London scheme may, to some extent, dissipate with time. Increasing charges is one tool which can mitigate this impact, but there could be limits to how acceptable this is to the public. However, road charging schemes should be considered as part of an overall mix including land use planning to ensure shorter trips and better public transport.

3.2.3 Trondheim

One of the main benefits generated by the Trondheim scheme was a shift in morning peak traffic from the tolled to the non-tolled period. As a financial instrument, the cordon has also been a success. The scheme had low operating costs and made a significant contribution to funding of major road projects around Trondheim.

An important side effect of reduced traffic during peak periods has been the improvement in accessibility for public transport vehicles within the tolled area. However, Lundberg (2002) concluded that there was little overall reduction in the total volume of traffic in the region where road tolling was introduced, although this was not a stated objective of the scheme.

Norway's three largest cities, Oslo, Bergen and Trondheim, implemented cordon tolling systems during the 1990s. In the year following their introduction, two of the three cities had experienced a significant increase in public acceptance of the new tolling regime. High acceptance of the introduction of the schemes was attributed to the demonstration of clear improvements in the service offering associated with the tolls and the use of addition revenue in the improvement of the network. Oslo – which did not promote the benefits of the new system – continued to experience relatively high levels of community dissatisfaction.

Despite the apparent success of the Trondheim scheme in financing transport improvements – including 20 per cent earmarked for public transport, safety and environmental improvements – the local government voted not to extend the scheme beyond 2005 on the basis that road improvements should follow demand rather than the road administration principle of using road tolls to fund extensions of the road network. Following the removal of the scheme, there has been a community-based movement for the reinstatement of a refocussed cordon charge to better support the management of congestion within the city.

13 Transport for London (2007)
14 Litman (2006)

3.2.4 Stockholm

The Stockholm scheme is broadly similar to the London Congestion Charge. Like London, the scheme is focused on the CBD of Stockholm and covers a similar sized geographic area but uses a combination of electronic tolling and Automatic Number Plate Recognition (ANPR) technology, as opposed to number plate recognition only.

Results from the trial in 2006 were positive, with congestion reduced by 20-25 per cent against a target of 10-15 per cent. Reductions in queue times and emissions were also achieved[15]. Following a referendum of Stockholm residents in 2006, the scheme was introduced on a permanent basis in August 2007. Public reaction to the scheme appears to have been largely positive.

3.2.5 Central European Truck Charges – Germany, Austria and Switzerland

Road pricing was introduced on the German autobahn for heavy vehicles in 2005. Despite extensive delays in implementing this system, since commencement the world's first satellite-based road charging system has operated without any notable problems. With reliability above 99 per cent, the system is regarded to be technically superior to other forms of road pricing[16]. The main criticisms of this system to date have related to high administration costs (accounting for around 20 per cent of revenue) and difficulties in extending the system to other roads[17].

Austria and Switzerland have also implemented electronic tolling systems for heavy vehicles. In Austria, a system using microwave technology and tolling gantries was commissioned in 2004. The relative simplicity of this system allowed it to be in operation a year before the more complex German system.

Road pricing in Switzerland was introduced three years earlier, using GPS systems with smartcard technology. Both these systems were implemented with similar aims of raising funds for infrastructure and accounting for the cost of heavy vehicles on the road network. The effectiveness of the Austrian system has been around half of the estimated benefits[18]. On the other hand, the Swiss system has been regarded as a success to date in reducing heavy traffic growth and influencing modal shift to rail[19].

A key issue for all three of these countries has been the rise of transit freight traffic as a result of structural changes in the European economy and the rise of manufacturing in Eastern Europe. The introduction of heavy vehicle road pricing has allowed these European member states to deal with inequities between road use and revenue collection/distribution.

15 Booz Allen Hamilton (2007)
16 CfIT (2006)c
17 Michie (2008)
18 (CfIT 2006)d
19 (CfIT 2006)e

3.2.6 Summary of International Schemes

Road pricing schemes in other countries suggest a number of key lessons to Australia. First, schemes implemented to date have largely been restricted to individual cities or regions. There have been significant political and socioeconomic challenges for developing an all encompassing, network-wide road pricing scheme in other countries. A larger scale scheme would need to recognise the varying transport needs of, and alternatives available to, different cities and regions, and would need to contend with complications arising from different political jurisdictions and current vehicle charging regimes.

Secondly, existing schemes have generally focused on specific transport problems and/or raising revenue for transport system improvements, rather than addressing broader network management issues, such as seeding a more transparent and efficient allocation of revenue and expenditure, or delivering a more equitable charging scheme.

Thirdly, technology no longer appears to be a barrier to the introduction of road pricing. Tolling and location based technology have advanced significantly in recent years. With this technology comes the added potential to implement road pricing schemes across wider geographic areas, which can vary according to different periods of the day or levels of service on the road network. Because of the rapid changes in technology, the costs associated with the use of satellite-based technology are likely to continue to fall dramatically.

However it is important to note the costs of implementation and administration of such schemes can vary significantly by system. The London scheme for instance, is extremely expensive to operate.

The London and Singapore schemes highlight the key policy issues which have generated interest in road pricing. The demand for road space has exceeded the capacity available and the availability of funds, and in some cases, public support to continue to "build our way out of the problem". Past experience, based on this approach, has clearly demonstrated this is not a long term solution. Broader societal concerns associated with the liveability and social amenity of Australia's cities, and increasing concerns arising from climate change have combined to raise public awareness of price as a way to better manage transport demand. Paralleling these developments, rapid advances in technology have indicated that mass-distance-location charging is emerging as a practical policy solution to take forward the policy debate on road pricing.

The significant benefits generated by pricing schemes in other countries suggest that the concept warrants consideration in the Australian context. However, the key lessons from past Australian experience is the need for systems to be compatible across jurisdictions, while international experience tells us that most states are now leaning towards systems that incorporate GPS technology.

3.3 Lessons from Unsuccessful Road Charging Schemes

Although the majority of pricing regimes around the world are considered to have largely fulfilled the aims they set out to achieve, there have been a number of unsuccessful attempts to introduce road pricing systems. Two notable instances are Hong Kong and the Netherlands.

In Hong Kong, work began in the early 1980s on implementing an automated electronic charging system to control traffic[20]. However, after a trial in 1983 held two years before full implementation of the system, the scheme was abandoned due to public concerns over whether the system would reveal a person's identity. The use of new technology and as observed by Lundberg (2002) the pending unification of Hong Kong with China in 1997, fuelled concern over whether the system could be used for the supervision of citizens.

Privacy is a key consideration for the implementation of a national road pricing scheme. International experience from Hong Kong, Oregon, London and other schemes has shown motorists may hold strong views regarding the collection, communication, storage and disposal of travel information associated with:

- Travel time;
- Trip distance;
- Location of travel; and,
- Driver identity.

The unique political circumstances surrounding the introduction of this scheme, and the high uptake of electronic tolling technology in many countries including Australia, suggests privacy issues are surmountable. It may however be necessary for an Australian road pricing scheme to provide a 'de-identified' road pricing option to avoid community concern about privacy. This could be achieved through the use of odometer readings to provide distance-based charges or a combination of various other mechanisms such as the use of generalised 'zonal' locations or rigorous data management practices. In the instance that a distance only charge would apply to the de-identified product, it would be necessary to apply the highest rate (urban peak road-use charge) under the broad national scheme.

Plans existed in the Netherlands to introduce a distance-based road user charge in 2004, with the aim of transferring the cost of owning a car to the cost of actual use. It was intended that this kilometre-based charge would replace part of the Netherlands existing vehicle excise charge. It was also planned that charges would be differentiated according to time of day and place of travel. Two years before the scheme was due to be implemented, a change of political majority resulted in a major revision of government policy. It was decided that a road charging system would not be developed until an adequate road network and public transport system was in place, and the proposed system was discarded.

Despite these problems, the debate in the Netherlands has progressed and political parties have reached agreement on a scheme which will be introduced to the National Parliament in 2010. The system now being considered in the Netherlands has a number of parallels with the concept proposed in this paper. The comparison between the two schemes is discussed in section 6.6.2.

20 Lundberg (2002)

The experience of the Hong Kong and Netherlands highlights the importance of a seasoned public debate and degree of political consensus toward the introduction of a road pricing system. While both schemes were founded on strong policy principles and provided the opportunity to deliver substantial benefits to the community and economy, the implementation of both systems were delayed because of a lack of transparency and clear alignment between the outcomes of the scheme and the community's objectives from national transport policies.

3.4 Evolution of Technology

3.4.1 Systems Utilising Fixed Infrastructure

The road pricing scheme implemented in Singapore more than 30 years ago was based on a manual scheme with paper permits. Enforcement personnel were positioned at control points and observed whether vehicles displayed the correct permits. Given the labour intensive nature of this tolling system, a system based on short range radio transmitters was developed in the early 1990s. This system relied on a smartcard inserted into a transponder within the vehicle, which communicated with overhead gantries at control points and deducted the relevant charge from the smartcard. In cases where funds were insufficient or vehicles did not have cards installed, cameras on the overhead gantries recorded the registration of violating vehicles.

The majority of cordon-style pricing schemes around the world employ a system similar to the one developed for Singapore. One of the few exceptions to this is the congestion charging scheme in London, which uses Automatic Number Plate Recognition (ANPR) technology to record the licences of all cars passing through the cordon, and charges the associated fees against that vehicle's registration.

The technology used in each of these schemes is of very limited potential for use in a wider, whole-of-network pricing scheme. They require significant infrastructure with gantries for either radio transmitters or video cameras which need to be installed at many points around the transport network.

The closest example currently available of a whole of road pricing network using these methods in Australia, is the uniform national protocols for tolling systems. This system is currently operating in all eastern seaboard cities and is available for rollout available Australia-wide. The Australian system has significant advantages over other tag-based systems in that there are multiple suppliers of the tags to the same protocol.

Another relevant technology in Australia is 'Safe-T-Cam', which monitors heavy vehicle movements throughout New South Wales. The system is designed to check vehicle registration, speed and driving hours through video capture based on a gantry system. In principle, this type of system could have broader application to road pricing by monitoring distances travelled by vehicles with a potential to encompass mass and location charging. However, given the need to install gantries across the network, the cost of extending any such system across the entire road network is likely to be prohibitively expensive. There remains a significant difference between an enforcement system, which in theory needs capture rates as low as 60 per cent to be a successful deterrent, and a revenue collection system which needs capture rates of above 98 per cent to be an effective revenue source.

Tag-based systems have the potential to provide additional benefits beyond their immediate application to toll roads. For example, tags can also be used for parking, vehicle registration identification and enforcement activities.

3.4.2 Systems Utilising Location Systems

Given the considerations discussed above, the development of a wholly electronic, network-wide pricing regime means that an alternate system is likely to be required. Location-based systems, global positioning system (GPS) technology or Global Navigation Satellite Systems (GNSS) are relevant considerations in developing a state of the art national road pricing scheme.

GPS and GNSS technology holds some advantages over traditional electronic tolling regimes. It removes the need for physical infrastructure in the network, provides a high degree of flexibility and accuracy, allows for distance-time-location based tolling and also comes with the potential for providing value-added services to the road user. The increasing trend for vehicles to come with standard in-built GPS systems means the cost and ease of implementing this system in the longer term is very likely to be significantly less than that of a traditional gantry system.

GPS based applications for vehicle tracking transfer data from devices in vehicles to centralised computer systems via General Packet Radio Service (GPRS) through mobile phone networks. Recent trials in the United Kingdom have explored GPS mobile phone technology to monitor vehicle movements for potential application in the UK Department for Transport (UK DfT) National Travel Survey; the main issue at this stage is the high cost of data transmission. While this was initially a limiting factor for the vehicle tracking systems, it has become less of an issue in recent years as a result of continuing improvements in mobile phone coverage.

A number of cities have investigated the use of GPS tolling systems. Both Singapore and London have flagged the technology for prospective use in the coming decade. Pilot studies in a number of cities in the United States have also considered its potential use. GPS systems are already commonly used in both the taxi and trucking industries. For example, the German trucking industry has used GPS technology since 2005 in a distance based pricing regime for all trucks using the German road network and a similar system is also used in Switzerland. GPS also provides the basis for the Intelligent Access Programme (IAP) in Australia.

GPS-based solutions provide one option for a large-scale roll-out of location based road charging, but they are not the only option. The use of a trial-based approach to test different technologies prior to the roll-out of a national scheme would provide the opportunity to examine the potential for the use of other technologies, such as telematics.

A common concern of detractors from location-based pricing systems has been the capacity for such systems to provide governments with information relating to the whereabouts of citizens. Recent location based road pricing proposals, such as Oregon, have undertaken several steps to bolster privacy protection for road users. Under the Oregon proposal the provision of privacy protection was seen as a trade-off with the customer service-based audit function, for instance the capacity to challenge billing. The Oregon study identified three system components to support privacy that could be utilised as the basic privacy framework for other future schemes:

- No specific vehicle point location or trip data stored or transmitted;
- All on-vehicle device communication must be short range; and,
- The only centrally-stored data needed to assess mileage fees were vehicle identification, zone distance travel totals for each vehicle and the amount of fuel purchased.

3.5 Public Perception of Road Charging

Past experience shows a common trend in public perception of road charging initiatives. In the pre-implementation phase of road pricing schemes, the experience of other countries has shown a majority of road users and those affected by the charge, are firmly against it. However, in the case of overseas schemes this opposition has tended to dissipate fairly soon after implementation, as network-wide benefits become more apparent.

An example is the London congestion charge. Before the charge was implemented, the plan was widely criticised. The opposition candidate for the Mayor of London position promised to remove the charge if elected. However, within a month of implementation, residents in other areas of London began requesting the charge be employed in their areas. Subsequently, the mayor who implemented the system, Ken Livingston, was re-elected largely on the success of the scheme.

The current Mayor of London, Boris Johnson, has also opposed the extension of the London Charging Scheme, cancelling the planned extension in November 2008. Early in 2009, in the face of public sentiment supporting the scheme, Mayor Johnson softened his position against the use of congestion charges including support for the application of the scheme in the Mayor's Transport Strategy – Public Draft.

Global experience suggests that the general public will be more receptive to road pricing schemes, if the use of revenue from the scheme is transparent and allocated towards transport system improvements. In the case of London, some GBP£90 million per annum ($AUD160 million) has been invested in public transport, walking and cycling infrastructure, ensuring that transport users have sufficient alternatives to vehicular travel. The London scheme also highlights the importance of investment in transport capacity upgrades on both buses and metro-rail, preceding the implementation of the charging scheme providing the necessary alternatives to road users to facilitate mode-switching.

The experience of Norwegian city-based schemes in Oslo, Trondheim and Bergen reinforces the London experience, supporting a critical link between scheme acceptance and hypothesised investment in capacity augmentation. This has also been important to ensuring equity of access to transport users by providing a feasible alternative to private vehicle use.

4 The Policy Context – Is a Road Pricing Scheme Right for Australia?

The July 1991 Premiers Meeting (now the Council of Australian Governments (COAG)), set a new agenda for transport reform in Australia, with the two main planks being the establishment of the National Road Transport Commission (NRTC) and the National Rail Corporation. Both areas of reform were directed toward creating integrated national regulatory environments for road and rail transport.

The continuing commitment to a reform agenda for transport has been implemented through the Australian Transport Council (ATC), the COAG grouping of transport ministers, and this body would be the logical forum for the development of a national road pricing scheme.

In assessing the appropriateness of a national road pricing scheme it is important to assess how such a system would relate to the current transport reform objectives identified by the ATC and the current reform programme being undertaken by the various levels of Australian governments.

4.1 Vision for Australia's Transport Future

Since the formation of the National Transport Commission (NTC), and its predecessor the NRTC, there has been continuous, though modest progress towards the development of a national transport policy. The development of a unified national strategy is a significant and essential reform to ensure the efficiency and effectiveness of the national transport system.

Underlying these reforms should be a firm commitment to delivering the agreed transport vision and policy objectives established by the ATC. The established Australian transport vision states:

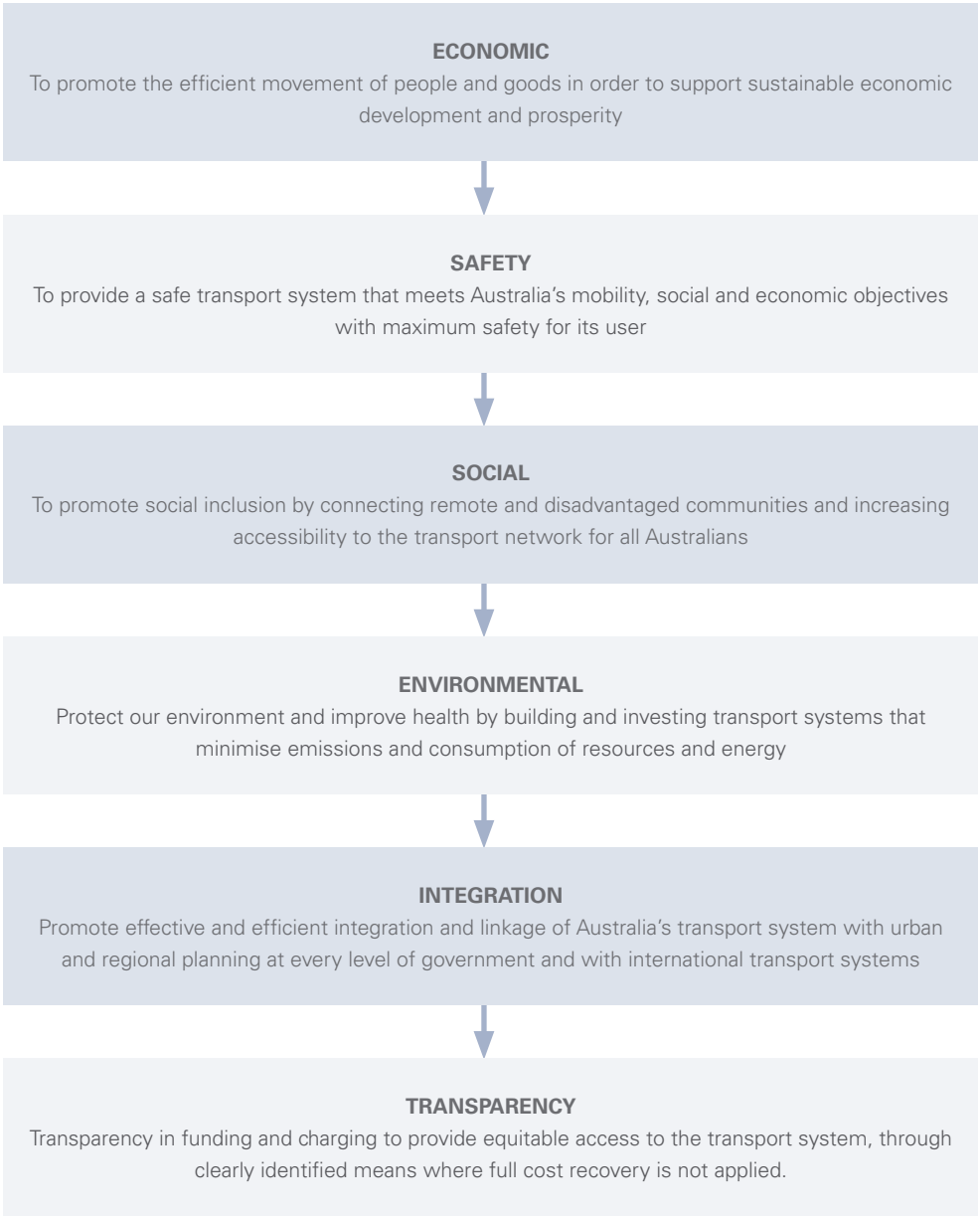
> *Australia requires a safe, secure, efficient, reliable and integrated national transport system that supports and enhances our nation's economic development and social and environmental wellbeing.*

4.1.1 Transport Policy Objectives

In order to determine the appropriateness of a national road pricing scheme for Australia, it is important to assess the capacity of a national road pricing scheme to deliver on established ATC objectives:

▼ **Figure 5**

Australian Transport Policy Objectives
Source: NTC (2009)b



4.1.2 Transport Policy Principles

In order to achieve the established transport policy objectives, the ATC has also identified guiding principles to underpin the delivery of the objectives of the policy framework. The role of road pricing in delivering these objectives must be assessed in order to determine the appropriateness of a scheme in the Australian context:

▼ **Figure 6**

Australian Transport Policy Principles and Their Relation to Road Pricing

Source: NTC (2009)b

4.2 Transport Policy Reform Agenda

In parallel to the transport reform agenda, the Australian Government has embarked on major policy reforms that will affect transport, including:

- National transport reform - Heavy Vehicle Charges and Intelligent Access Programme (IAP);
- Commitment to an emissions trading scheme - the Carbon Pollution Reduction Scheme; and,
- The Review of the Future Taxation System - the Henry Review.

These three policy streams are actively advancing Australia towards a consistent set of national transport regulations and more efficient use of transport.

4.2.1 Heavy Vehicles

Heavy Vehicle Charges

A national heavy vehicle charging regime came into effect on 1 July 1995. An important outcome of the introduction of a nation heavy vehicle charge was the recognition of Fuel Excise as the industry's contribution to road construction and maintenance expenditure. The reform set a nationally uniform set of registration charges for heavy vehicles by vehicle class as the access charge to the network.

Subsequent heavy vehicles charges determinations have built upon the early work of the NRTC. At their meeting in May 2007, in response to the Productivity Commission's report on road and rail pricing, the ATC agreed that the NTC should develop a new heavy vehicle charging regime for implementation in 2009. ATC directed that the new charges determination should ensure the allocation of road infrastructure costs to heavy vehicles should be met in aggregate and that cross-subsidisation across heavy vehicle classes should be removed[21]. In 2008, in line with the COAG reform agenda, ATC agreed to consider the development of a heavy vehicle charging regime based on mass, distance and location[22].

Intelligent Access Programme (IAP)

The Intelligent Access Programme (IAP) was based on developments in technologies surrounding intelligent transport systems including telematics and vehicle tracking systems. The underlying principle for this technology was the ability to send and receive information from Global Navigational Satellite Systems (GNSS), or the Global Position System (GPS) to record a vehicle's location. One of the early applications of this technology in Australia was to improve transport security through the monitoring of trucks carrying high-value commodities. Many operators now use this technology to monitor performance of their vehicle fleets.

21 ATC (2007)
22 ATC (2008)

The development of IAP was progressed through Austroads which conducted a feasibility study on the broader application of IAP[23]. The study concluded that IAP could be both economically and technically feasible and could generate the following benefits:

- Improved road safety;
- Reduction in infrastructure wear;
- Reduction in negative impacts on the environment;
- Better management of public perceptions and expectations of heavy vehicle movements; and,
- Optimisation of road freight policy and on-road enforcement activities.

The system has helped establish the technical feasibility of monitoring vehicle use of the road network by location. The technology also provides a potential connection between use of infrastructure and charging for that use through the application of incremental pricing for higher mass vehicles.

CASE STUDY 1

INTELLIGENT ACCESS PROGRAMME –
LESSONS LEARNED FOR THE DEVELOPMENT OF A ROAD PRICING SYSTEM

In order to minimise the costs and lead times associated with the implementation of a national road pricing scheme, it may be possible to leverage the regulatory framework or technological capability of existing road charging or location schemes.

The Australian Intelligent Access Programme (IAP) is a national programme which uses vehicle telematics (GPS) to monitor truck operator compliance with access conditions set by road authorities in different jurisdictions. Membership of the programme is a precondition for access to Higher Mass Limit (HML) schemes in some Australian states, and the use of non-prescriptive vehicle designs approved under the Performance Based Standards programme in all states. The scheme is administered by a statutory body Transport Certification Australia.

Whilst the system has been designed for ensuring heavy vehicle compliance, it could provide useful lessons for the development of a road pricing system. Many of the challenges that were tackled in the establishment of IAP are likely to be relevant in the context of a charging scheme, for instance developing:

- Common standards for the technology, data communication channels, etc;
- Data storage protocol and privacy considerations; and,
- System governance arrangements, protocols for dealing with state based road authorities.

Australia was the first country to use location-based technology to ensure route compliance and facilitate the uptake of higher productivity vehicles. The lessons learned from this experience, and indeed the system itself, are likely to be very useful in helping authorities transition to a national road pricing system.

23 Austroads (2003)

4.2.2 Road and Rail Pricing Reforms

COAG Transport Reform Agenda

At its meeting in February 2006, COAG agreed to a series of major reforms of the transport sector including:

- Development of proposals for efficient pricing of road and rail freight infrastructure. Undertaken by the Productivity Commission;
- Development and implementation of Performance-based Standards (PBS) for heavy vehicles that enhance freight productivity while reducing road damage;
- Improvement of transport planning and road/rail infrastructure project appraisal processes by adopting the ATC-endorsed National Guidelines for Transport System Management in Australia; and,
- Development of strategies to reduce current and projected urban transport congestion.

The ATC recognised that there would be an advantage in completely replacing the current charging regime for heavy vehicles with a mass-distance-location system. This could result in a number of benefits including better alignment of charges and impacts for users, thereby improving equity and improving administrative efficiency through the introduction of a national heavy vehicle registration scheme.

On 13 April 2007, COAG agreed to a three-phase reform programme (the Road Reform Plan) in response to the Productivity Commission's 2007 Inquiry on Road and Rail Freight Infrastructure Pricing. The Plan included a number of research components looking at incremental charging and mass-distance-location charging.

As part of the charging reform agenda, the ATC is currently considering the feasibility of a mass-distance-location charging scheme to more accurately reflect use of the road network by heavy vehicles.

Productivity Commission Review of Road and Rail Pricing

In response to the COAG[24] decision of February 2006, the Productivity Commission completed a review of road and rail infrastructure pricing. The main conclusions of the review were:

- Heavy trucks had been more than paying their way in aggregate under the heavy vehicle charging system administered by the NTC.
- Competitive distortions between road and rail have been limited and were not a significant source of market inefficiency.

24 COAG 2006

- Efficiency losses are associated with current road charging arrangements through averaging of costs and charges, and a disconnect between road revenue and spending decisions. It was concluded that these provide poor price signals to the transport market, and distort the incentives needed for efficient road use and provision.

- Developments in road pricing technology create the opportunity for use of pricing instruments which offer the potential for substantial efficiency gains.

The implications of the Productivity Commission review for future road pricing policy were:

- Focus of the charging debate to achieve improved equity and efficiency within the road transport industry;

- Recognition of the direct link between use of the road network and charging for that use; and,

- Recognition of the role that intelligent transport systems will play in delivering a more efficient pricing regime across the road network and across road users by better balancing the demand for and supply of road infrastructure.

COAG Urban Congestion Review

Based on overseas experience, the COAG review of urban congestion concluded price-based measures had the potential to moderate demand for road infrastructure when used with other measures such as improved public transport systems. In response to this finding COAG agreed that it would:

- Develop principles and analyse options for variable tolling regimes as a potential congestion management measure (e.g. varying tolls by level of road usage, time of day and/or class of vehicle);

- Consider the costs, benefits and any other feasibility issues for developing congestion pricing mechanisms applicable to a specific corridor or network and suitable for Australian conditions; and,

- Investigate the impact of relevant financial and taxation measures on urban congestion (e.g. FBT, Stamp Duty, payroll tax and Fuel Excise).

At their meeting in May 2008, the ATC agreed to undertake a comprehensive study to improve its understanding of pricing schemes which could be used to manage congestion.

4.2.3 The Impacts of Other Reforms on Transport Policy

The Review of Australia's Future Taxation System

On 13 May 2008, the Australian Government announced a review of Australia's taxation system – the Henry Review. The review panel handed its report to the government at the end 2009. The main aspects to be covered by the review included:

- Improvements to the tax and transfer payment system;
- Enhancing the taxation of savings, assets and investments, incorporating company taxation;
- Enhancing the taxation arrangements on consumption (including excise taxes), property (including housing), and other forms of taxation collected primarily by states;
- Simplifying the tax system, including consideration of appropriate administrative arrangements across Australian jurisdictions; and,
- Interrelationships between these systems as well as the proposed Carbon Pollution Reduction Scheme.

In their background paper for the review, Clarke and Prentice concluded fuel taxes were an imperfect tool for reducing transport externalities including local pollution[25]. However, they argued that from an administrative point of view, Fuel Excise represents an efficient way of raising revenue and could be increased by around 10 cents a litre with other taxes being used as an off-set.

At the same time, Clarke and Prentice argued some taxes applying to the transport sector appeared inappropriate and based on weak grounds for their application. For example, the Luxury Car Tax, which contributed around $464 million to revenue in 2006-07, is difficult to justify in terms of market failure and there is little apparent need for government intervention in this area. From a road safety perspective for instance, the Luxury Car Tax may be seen as counter-productive to the early introduction of more advanced technologies into the vehicle fleet. Clarke & Prentice concluded that:

- Consideration should be given to demand-oriented user charges;
- Current road user charges are geared toward cost recovery and do not help manage travel demand;
- To be successful, road pricing requires an effective public transport system to provide road users with an alternative to private car use in urban areas;
- Electronic road pricing could represent a cost effective approach;
- For cities with high traffic density, cordon pricing may provide an effective intermediate step to full implementation of a road pricing scheme; and,
- Fuel Excise could be a proxy for pricing vehicle emissions, i.e. more fuel efficient vehicles will pay less excise.

An Emissions Trading Scheme - the Carbon Pollution Reduction Scheme

The Australian Government outlined the basic principles of a proposed Carbon Pollution Reduction Scheme (CPRS) in its White Paper of December 2008 and subsequently the proposed CPRS legislation. The main objectives for the CPRS are:

25 Clark and Prentice 2009

- Long-term reductions in Australia's greenhouse gas emissions to 60 per cent below 2000 levels by 2050; and,

- Medium-term emission reductions of between 5 and 15 per cent below 2000 levels by 2020[26].

The proposed CPRS was defeated in the Senate in December 2009. Despite the defeat of the legislation, the government has reaffirmed its commitment to the implementation of an emission trading scheme, in line with the Carbon Pollution Reduction Scheme model.

The government's intention is to commence the CPRS on 1 July 2011. The scheme will have broad sectoral coverage and will include emissions from stationary energy, transport, fugitive, industrial processes, waste and forestry sectors. The scheme will be among the world's first to incorporate transport emissions.

It is expected that the rise in fuel price resulting from CPRS should encourage the development of new vehicle and fuel technologies and encourage road users to reduce their use of fuel. This could be achieved by changes in driver behaviour, using alternative modes of transport, changing travel patterns, car-pooling and improved vehicle efficiency.

The Australian Government has stated it will cut fuel taxes on a cent-for-cent basis to offset the initial impact that the scheme has on fuel price. While this will reduce the impact of the CPRS on users of road transport, the policy will compound pricing disparities between various transport modes and potentially inhibit moves towards a national road pricing scheme.

The impacts of climate change are real and substantial for Australia's infrastructure sector. The industry is committed towards the delivery of long-term emission reductions as part of a national scheme. In order to support the delivery of these reductions, the infrastructure sector supports the commitment to a framework for emission reductions, based on an appropriate price on carbon, which assists to provide certainty to infrastructure planners and developers.

4.3 Reforms in Other Infrastructure Sectors

Pricing instruments have been introduced in other sectors of the economy, including electricity, gas, water and telecommunications, to balance demand for resources with available supply.

The reform of monopoly infrastructure in Australia with a view to promote competition and efficiency commenced in a meaningful way during the 1990s, following the National Competition Policy (Hilmer) Review. The review promoted the use of pricing and other market structures to promote the most efficient use of monopoly assets, moving away from the established reliance on wholly publicly owned service providers. The reforms of this period, especially those relating to regulated network infrastructure, provide insights to the value harmonised and transparent pricing structures can provide for the transport sector.

26 Australian Government 2008

Reforms introduced under the National Competition Policy have led to a 2.5 per cent, or $20 billion, increase in Australia's GDP since 1990. These reforms have boosted Australia's productive growth and played a key role in contributing to exceptional economic expansion, both in historical terms and relative to other countries. The reforms in the electricity, water and telecommunications sector illustrate that the creation of a well-functioning market is often the result of direct government restructuring. Regulation then plays a crucial role in the operation of the market once this structure has been defined. It is critical that regulation facilitates efficient market structures, not act as a substitute.

While the National Competition Policy agenda led to some reforms within the freight sector, the Productivity Commission noted that:

> *Unlike the energy and water sectors, there has not been a comprehensive and integrated national reform agenda for Australia's transport sector. Rather, reforms have traditionally been developed and implemented in a piecemeal fashion across transport modes and jurisdictions*[27].

The need for a unifying reform agenda is greatest within the transport sector, particularly freight. Unlike passenger transport, freight corridors exist to a large extent across state boundaries. For instance, the north-south east coast freight corridors provides for 5 million tonnes per annum in movements between Melbourne and Brisbane, 7 million between Sydney and Brisbane and over 11 million between Sydney and Melbourne.

Current market structures within the freight sector do not always promote or encourage the most efficient use of infrastructure assets. Disparities between fees and charges across jurisdictions impact the competitiveness of modes over the same route in differing ways. Some of the problems with the existing market structures for freight infrastructure assets include:

- Inadequate levels of innovation in pricing reflective of long history of government ownership;
- Underinvestment in capacity and quality infrastructure due to an absence of competition and limited financial capacity;
- A lack of private sector participation in infrastructure planning and delivery; and,
- An excessive regulatory burden and inefficient market structure, as a result of multiple layers of regulation attempting to force efficiency rather than provide incentives.

27 Productivity Commission (2005)

CASE STUDY 2

WATER RESOURCES MANAGEMENT – LESSONS FOR ROAD PRICING

Background

The early development of irrigation schemes in Australia was justified on several grounds including the need to intensify agricultural activities using scarce arable land and rainfall, development objectives including the promotion of rural communities and social grounds like soldier resettlement schemes.

These broader social and political objectives meant there was no formal economic assessment of the benefits of large irrigation schemes and their impact on national economic growth. As a result, poor pricing polices which under-priced water contributed to over-exploitation of water resources resulting in land degradation, rising salinity levels and the degradation of river systems, for example through increased phosphate levels in the Murrumbidgee and Murray River systems.

In 1963, agricultural economist Keith Campbell argued that:

> *"with the adoption of … more sophisticated methods of investment analysis, it is to be hoped that we shall see the abandonment of the pseudo-economic procedures which have been used in the past to evaluate the financial feasibility of irrigation development … Particularly objectionable from the standpoint of financial accounting are analyses which proceed on the implicit assumption that the government …should pay the full costs of certain irrigation facilities, which are therefore left out of the calculations."*
>
> *Subsequent economic assessment of irrigation schemes in Australia concluded that "significant economic losses exist and can be attributed to over-expansion of the basin-wide irrigation system and misallocation of the available water supply due to inconsistent pricing policies"*[28].

Water Reforms

A series of major reforms have been introduced in the water sector over the past decade or so, and best practice water pricing was a key element of the National Water Initiative in 2009. Under this scheme, governments have committed to achieving consistency in:

- Pricing policies for water storage and delivery across sectors and jurisdictions; and,
- Approaches to pricing and attributing the costs of water planning and management.

Lessons for the Transport Sector

A parallel reform in transport infrastructure investment has been the development and adoption of more sophisticated methods of investment analysis such as those included in Infrastructure Australia's guidelines and the ATC's national guidelines. These methods have replaced traditional engineering-based procedures which have been used in the past founded largely on engineering concepts of time savings, crash costs and changes in vehicle operating costs to assess the financial feasibility of road projects.

However, from the standpoint of economic efficiency, recognition has only recently been given to the costs of externalities imposed on society through the private use of infrastructure and the costs of pollution attributable to road use. In parallel with the inappropriate pricing of water, in the case of roads, there has been no recognition of the higher value which different road users groups would be prepared to pay for less congested roads. The comments made about water provision in 1963 by Keith Campbell appear to be relevant to transport today.

28 Randall 1981

4.4 The Role of Pricing in Future Australian Transport Policy

There has been a significant shift in the development of transport policy over the past decade. Among other issues, the Australian Government has become increasingly involved in urban transport issues. This can be seen through the evolution of national highways.

Under the National Roads Act of 1974, the National Highway System originally terminated at the fringes of Australia's capital cities. With the introduction of the Australian Land Transport Development (ALTD) Act in 1988, the "national route" was extended to include access through capital cities to provide a national link. Later this saw the inclusion of tollways under the NHS with the Gateway Bridge in Brisbane and later the M7 in Sydney. The ALTD Act was then replaced with the Auslink Act in 2005, which reinforced the Commonwealth's role in funding both road and rail infrastructure, including access to major ports and terminals. Through Infrastructure Australia and the Building Australia Fund, Commonwealth funding for transport infrastructure was further extended to include funding and potential long-term ownership through equity investment in public transport and other assets in 2009.

In policy terms, increasing emphasis is now being placed on the use of price as a regulatory mechanism. This has been demonstrated by the development of heavy vehicle charges and their evolution toward a mass-distance-location charging regime. There is also increasing recognition of the need to include demand management within the general mix of policy options available to government for improving the use of infrastructure.

The current review of taxation suggests that while measures now used to price the demand for transport through the taxation system may represent a relatively efficient mechanism to raise revenue, they may not be an effective mechanism to balance the demand for and supply of transport infrastructure nor promote an efficient transport sector.

Hence, the review appears to be placing more emphasis on direct rather than indirect pricing options. The messages emerging from the review appear to complement the proposed CPRS, which places strong emphasis on price signals to contain the forecast growth in emissions. It would be preferable for a national road pricing scheme not to focus too heavily on carbon emission reduction. This view is reinforced by the experience of California, where discounts provided to low emission vehicles under a road price aided the rapid adoption of low emission vehicles, but did not assist in the reduction of other significant costs associated with congestion.

Together, these policy developments suggest that road pricing could play an important role in achieving multiple policy objectives for the transport sector.

5 Delivering National Transport Policy Objectives through Road Pricing

Previous sections of this paper have considered examples of road pricing schemes in other countries and the relevance of pricing to the state and federal policy environment. Bearing this background in mind, this section seeks to answer the following questions:

- What are the main benefits offered by different approaches to pricing road transport in Australia?

- What are some of the potential downsides of these schemes?

This section considers, in qualitative terms, a number of options for a new road user charging framework and the extent to which they could help progress Australian Transport Council (ATC) transport policy objectives. Six specific pricing options are considered in relation to their capacity to achieve the ATC objectives:

- **Registration charges** – mechanisms to regulate general access to road networks, varying by vehicle class.

- **Fuel Excise** – tax imposed on fuel use on a per litre basis which contributes to general government revenue.

- **Cordon pricing** – a localised, fixed charge for travelling into a specific urban area, for the purpose of reducing demand for access to that location. Cordon pricing is usually levied on all types of vehicles, and is essentially a flat charge or tax on using the infrastructure located within a specific region.

- **Congestion pricing** – a fee which is varied according to traffic volumes or time of day, and applied to a specific area or road, or across a group of roads in an urban area. Congestion pricing can be used to manage transport demand across an urban network and is usually applied to most vehicle types.

- **Heavy vehicle charging** – a distance or mass-distance based charge imposed on freight vehicles only, for use of urban and rural road networks. The main purpose of a heavy vehicle charging scheme is to better align heavy vehicle use of the road network with the cost of providing and maintaining the network. Advances in intelligent transport systems and global navigation satellite systems are allowing the extension of mass-distance charging to include location.

- **National road pricing** – a network-wide road pricing system (encompassing both urban and rural roads), involving a combination of fixed and variable distance based access charges. A national road user charging scheme represents an extension of cordon pricing to encompass whole networks. It would represent a direct user pays approach to the use of infrastructure to cover capital and maintenance costs, as well as the cost of externalities (i.e. noise and emissions).

5.1 Registration Charges

Registration charges imposed by state and territory governments are, in practice, access charges to use of the road network. In 2006-07, total registration related vehicle taxes and charges collected by these governments amounted to $5.915 billion[29] with an estimated breakdown comprising:

- Vehicle registration fees: $3.911 billion; and,
- Stamp Duty on vehicle registration: $2.004 billion.

In the same year, funding of road related expenditure by state and territory governments was $6.11 billion[30]. In aggregate, revenues raised by state and territory governments from road users almost balance expenditures on roads.

While registration charges are administratively efficient in collecting revenue for road use, the main issue with registration fees relates to the fixed amount charged by vehicle class. While registration charges do vary within vehicle classes in some states (see Table 8), there is only limited recognition of distance travelled. One example, annual registration charges for vintage vehicles are reduced significantly to reflect the low kilometres travelled. However, for the general category of light vehicles, lack of recognition of distance travelled for registration charges means that low kilometre travellers cross-subsidise high kilometre travellers. Hence, it can be argued that registration charges have no real impact in curbing travel behaviour.

▼ Table 8

Registration Charges by State and Passenger Light Vehicle Type (2008-09)

Source: RACQ Fact Sheet (2009)

CAR TYPE	QLD	NSW	VIC	WA	SA	TAS	NT	ACT	Average
Small	$263.00	$245.20	$178.00	$201.35	$125.00	$181.85	$162.40	$245.20	$200.25
Medium	$380.35	$275.40	$178.00	$265.35	$223.00	$204.85	$231.40	$275.40	$254.22
Large	$514.80	$392.20	$178.00	$313.35	$310.00	$246.85	$298.40	$393.20	$330.85
Method	Cylinders	Weight	Flat fee	Weight	Cylinders	Cylinders	Engine Cap	Weight	-

Notes:
- Small car is defined as a 4 cylinder 2 litre car weighing approximately 1,100kg.
- (Medium) family car is defined as a 6 cylinder 3.5 litre car weighing approximately 1,500kg.
- Large car is defined as a 8 cylinder 5 litre car weighing 1,800kg.

29 ABS (2008)b
30 BITRE (2009)c

5.2 Fuel Excise

Fuel Excise has a long history in Australia, being introduced soon after Federation to fund the development of Australia's road network. The direct relationship between excise and road funding continued until 1959 when hypothecation of revenues from fuel taxation was abolished. At that point, Fuel Excise became a general source of taxation revenue.

In 1982, a surcharge of 1c a litre on Fuel Excise was introduced to fund the Bicentennial Roads Program. This arrangement remained in place until the Fuel Tax Inquiry of 2001, where the informal link between excise and road funding was abolished[31]. The current rate of Fuel Excise is 38.143c a litre and in 2007-08 petrol and diesel excise contributed $13.63 billion to revenue and an estimated $13.27 billion in 2008-09[32].

There are two main issues with using Fuel Excise to price road use. First, it is relatively rudimentary because it does not vary according to either location or time use. Second, under current arrangements, there is no link between road use contributing to revenue through Fuel Excise and road expenditure.

5.3 Cordon Pricing

Cordon pricing is principally a congestion pricing scheme applied to a defined area. Once the infrastructure is in place, the main benefit is that it is relatively easy and efficient to collect revenue.

The impact of cordon pricing on policy objectives varies with the type of cordon pricing scheme implemented. It may lead to more efficient use of infrastructure, provided users have the option to change their travel behaviour, in which case it could have a positive impact on environmental objectives. Various cordon pricing schemes have been implemented to promote the use of more fuel efficient vehicles, including in London and Bologna, Italy.

A cordon price is a transparent form of revenue-raising in that users know they are being charged for their decisions to use road infrastructure by location and potentially time of day (e.g. Trondheim). At the same time, the application of revenue may or may not be linked. In the case of Trondheim, the use of funds to improve transport infrastructure has been transparent, with positive results.

5.4 Congestion Pricing

Congestion pricing refers to a number of pricing structures which reduce congestion by influencing driver behaviour. The time of day pricing on Sydney's harbour crossings is an example of congestion pricing, as is the variable charge imposed by Singapore's Area Licensing Scheme.

31 Australian Treasury (2001)
32 Australian Treasury (2009)

In terms of the ATC's objective of reducing congestion, both the Singaporean and London schemes have achieved a positive impact in terms of promoting more efficient movement of people and goods. Congestion pricing could also generate environmental benefits through factors including improved travel times, reduced vehicle kilometres travelled and promoting mode shift to more environmentally sustainable forms of transport.

CASE STUDY 3

VARIABLE TOLLING ON SYDNEY HARBOUR CROSSING

The introduction of variable tolling on the Sydney Harbour crossings (Bridge and Tunnel) appears to have met the objectives set by the New South Wales Government's Roads and Traffic Authority (RTA), that is, to ease congestion and to change motorists' behaviour to travel outside peak time. Based on preliminary data in the table below the RTA concluded:

> *"…motorists have adapted well to the changes and traffic volumes reflect a marked increase in people travelling before the peak period, with numbers falling again during the peak period between 6.30am and 9.30am on all crossings, including the Ryde and Gladesville bridges, when compared to the same time last year."*

▼ Table 9

Impact of Variable Tolling on Sydney Harbour and Ryde-Gladesville Crossings

		CROSSINGS (TUESDAY)				
	CHARGES AND TRAFFIC VOLUMES	05:30-06:30	06:30-07:30	07:30-08:30	08:30-09:30	09:30-10:30
	TOLL ($)	2.50	4.00	4.00	4.00	3.00
Sydney Harbour Crossings	29/01/2008	4050	10237	11667	10361	7415
	27/01/2009	4287	9097	10646	9468	8043
	Percentage change	+6%	-11%	-9%	-9%	+8%
Ryde & Gladesville Bridges	29/01/2008	2754	6289	6942	5759	4864
	27/01/2009	2808	5928	6290	5707	5282
	Percentage change	+2%	-6%	-9%	-1%	+9%

For all time periods on the day-to-day comparison, total traffic for Sydney's harbour crossings was five per cent lower in 2009 compared with 2008, and for the Ryde/Gladesville crossings, total traffic fell by 2.2 per cent lower. Part of this change in traffic volume could be attributed to the economic downturn. However, part of the greater decline in traffic levels for the Sydney Harbour Crossings would appear to support the RTA's position that the introduction of variable tolling contributed to some change in people's travel behaviour. The New South Wales Government has committed to using the revenues collected from the variable tolling system of the Sydney harbour crossings on improving public transport.

The longer term issue for managing demand for the Sydney harbour crossings is whether the short term response of road users will be sustained, or whether demand will return to trend. The question for road network operators is the extent to which prices need to be increased in order to change travel behaviour.

Long term and widespread use of toll roads in Australian east coast cities and high uptake of tolling tags by motorists means much of the infrastructure is already in place and variable charges could be imposed to better manage demand for that infrastructure. However, this would require re-negotiation of existing commercial agreements with private operators and consideration of broader network management for traffic diverting away from toll roads.

In thinking broadly about public infrastructure assets, urban roads are unique in that they operate at maximum capacity only for a few hours on five out of seven days. Congestion pricing seeks to rectify this problem by 'spreading' the demand for the road over a longer period through pricing mechanisms, achieving a better utilisation of the asset.

Congestion pricing is highly effective in dealing with highly specific transport problems in urban areas, but can be considered weaker on broader objectives, such as social inclusion (unless revenue is spent on transport for communities outside urban areas), integration (it can influence travel decision making, but only in relation to specific routes and areas) and transparency (charges only apply to a section of the network, and are not specifically related to cost recovery).

Given Australian urban sprawl and significance of cross-urban trips, it could be argued that location-specific congestion pricing would have only limited effect in meeting the ATC's broader objectives of improving transport efficiency and reducing the negative impact of transport on the environment.

For instance, the Melbourne East-West Link Needs Assessment concluded:

> *"…over the coming decades, strong growth is expected to continue in Melbourne's outer suburbs … These patterns of growth will create increasing demand for cross-town commuting and freight movements, placing greater strain on Melbourne's cross-city links."*

Congestion pricing has the capacity to assist in the delivery of COAG's transport objectives, including:

- Improvement of the economic efficiency of the urban network;
- Reduction in road trauma through promoting mode switching to public transport;
- Improved environmental outcomes through the reduction of less air pollution, lower noise emissions, and less toxic run-off to dams and water courses;
- Improved transparency in directly charging for road use; and,
- Improved social amenity and liveability of communities and urban areas.

However, the application of road pricing must occur in such a way to balance the benefits against the challenges to its effective implementation, for instance:

- Multiple city-based congestion schemes may add to driver confusion;
- Ensuring consistent, reliable and usable information to road users, allowing informed travel decisions ; and,
- Regressive taxation impacts – lower socioeconomic groups may be impacted by reduced access to transport due to new road-related charges.

5.5 Heavy Vehicle Charging Scheme

If developed, the principal objective of a distance or mass-distance-location based heavy vehicle charge would be more efficient recovery of the disproportionate costs and externalities associated with that class of vehicle.

A variable heavy vehicle charging system is likely to satisfy other important transport policy objectives such as transparency, safety and enhanced environmental outcomes. This would be achieved by developing a clear set of pricing arrangements which reflect the relative impact different vehicle classes have on infrastructure use.

A variable heavy vehicle charging system is also likely to have a positive impact on road safety. Safety benefits could be achieved by leveraging off an IAP-style specified route compliance system. This type of system could also generate environmental benefits by facilitating a greater uptake of higher productivity freight vehicles. Heavy vehicle charging could also promote social inclusion and integration benefits by providing new revenue streams for local councils, as well as the use of higher productivity vehicles in remote areas, in turn reducing transport costs.

While variable heavy vehicle charging offers a wide range of potential benefits, there are practical issues which have previously presented barriers to the implementation of the scheme, for instance how the costs of development and implementation will be met and the availability of cost effective technology options.

While the implementation of tracking technology is small relative to vehicle capital costs, a full rollout for all 533 000 heavy vehicles registered in Australia and the potential costs associated with the development of fixed infrastructure for a national scheme could be substantial.

There are also a number of technical challenges associated with measuring vehicle mass, which requires more specialised on-board vehicle technology compared to vehicle tracking applications like IAP. Further, given the average age of Australia's vehicle fleet (10.3 years in 2004), retro-fitting is likely to be expensive and a barrier to widespread acceptance and adoption.

In a study on the acceptance of road pricing for heavy vehicles in Europe, Stewart-Ladewig & Link (2005) concluded that industry support for a new charging system would be improved if:

- There was a transparent way of defining the charge;
- A distance-related charge applied to all vehicle classes, including private vehicles;
- There was some form of compensation for increased commercial transport costs;
- The system included interoperability between technical charging systems; and,
- Revenues raised through road charges were allocated back to the road network.

The study also emphasised the importance of implementing a nationally based scheme rather than a jurisdictionally based scheme.

5.6 National Road User Charging

By varying road user charges for all vehicles according to mass-distance-location and time variables, a national road pricing scheme could be used to better manage demand for infrastructure. Revenues generated from road pricing could be used to fund a range of transport-related requirements in terms of both infrastructure and non-infrastructure measures to improve transport efficiency, including public transport.

A national scheme could comprise a two tiered approach – improved cost recovery for the provision and maintenance of roads infrastructure and a component applying to travel within urban areas to incorporate the cost of externalities like noise and emissions in the travel decisions of road users. From this perspective, such a scheme has the potential to satisfy all key objectives and could achieve broader transport objectives such as social integration through improved access to public transport.

The main difficulties of this approach relate to implementation. While there is potential to leverage tolling technology in urban areas, the key challenge arises in extending the scheme to achieve national coverage, which would require location based technology. This raises similar issues to those discussed above for heavy vehicle charging. A national system would also be politically complex given current taxation arrangements. These and other issues relevant to implementation of a national road pricing scheme are discussed in the next section of the paper.

5.7 Considerations for Structuring a National Road Pricing Scheme

The likely impact of the different approaches to road pricing on the governments' objectives for transport are summarised in Table 10. This table provides a comparative assessment of the type of impact of those measures. For example, a flat registration charge across all light vehicles types, without consideration of engine efficiency is seen as having a negative impact on environmental objectives.

From a comparison of the various approaches, a national road pricing scheme would appear to make the greatest contribution to meeting policy objectives relative to other options. However, the extent to which a national scheme would assist in achieving those objectives may depend on the:

- **Basis for determining the road user charge** – for instance, distance, the use of influencers of route choice, influencers of departure time, influencers of vehicle type and influencers of trip frequency.

- **Balance between fixed and variable charges** – with more weight being given to the variable component, it could be argued that users would become more conscious of their travel decisions rather than undertaking journeys because of the high annual sunk costs of operating a vehicle (i.e. if the car sits there, owners think that it should be used to "recover" the sunk costs of registration and insurance).

- **Determination, pricing and inclusion of externalities** – bearing in mind the Australian Government's decision to introduce an emissions trading scheme.

- **Relationship between road pricing and existing taxes, fees and charges** – including existing fees and charges at all levels of government the private sector, e.g., Stamp Duty, Luxury Car Tax, Fringe Benefit Tax, sales tax, Fuel Excise and road tolls.

- **Relationship between revenues from road pricing and investment in transport infrastructure and services** – including:

    - Location of road use as the revenue source and location of expenditure – mismatches between the two may be unacceptable to the general public;

    - The extent of redistribution of revenues to support objectives of improved accessibility and social inclusion of remote communities;

    - Investments to reduce the need to travel through removing demand drivers;

    - Use of revenues for expenditure on broader transport requirements, such as public transport, rail freight, etc;

    - Road pricing as a general infrastructure funding mechanism including funding non-transport infrastructure requirements such as for health and education; and,

    - The extent to which road pricing contributes to infrastructure funding rather than being used as a source of general revenue.

- **Private and public costs of implementing a national road pricing scheme** – the scheme must provide an efficient form of revenue collection, minimising dead weight costs incurred by government and road users.

- **Equity impacts of road pricing** – across road user groups and mechanisms this can address.

- **Administrative efficiency of the scheme** – the capacity of the system to minimise revenue leakage and thereby enhance effectiveness.

- **Interaction between a national road pricing and the government's broader reform agenda** – including taxation, use of technology and acceptance by both public and private sectors.

▼ Table 10

Impact of Measures on Australian Transport Policy Objectives

ATC OBJECTIVES	REGISTRATION CHARGES	FUEL EXCISE	CORDON PRICING	CONGESTION PRICING	HEAVY VEHICLE CHARGING	NATIONAL ROAD USER CHARGING
Economic	-	+/-	+	+	+	++
Safety	0	0	+	+	+	+
Social inclusion						
Remote communities	0	-	0	0	+	+
Accessibility	0	0	-	-	0	0
Environmental						
Emissions	-	+	+	+	+	+
Energy use	+/-	+	+	+	+	+
Integration						
Within transport	0	0	0	0	+	+
Transport and land use	0	0	+	+	0	+
Transparency						
Charging	+	-	+	+/-	+	+
Funding	+/-	-	+/-	+/-	+	+

Key:
+ positive impact
o no significant impact
- negative impact
-/+ positive or negative impact depending on scheme implementation and management/use of funds

6 The Structure of an Australian National Road Pricing Scheme

In finalising the structure of a new road pricing regime to promote the achievement of the Australian Transport Council's (ATC) transport policy objectives, government must consider five fundamental questions:

- **Coverage** – should a scheme be developed on a national basis with uniform charges, or on a state-by-state, city basis using a common framework?
- **Revenue outcomes** – what effect should a scheme have on current road user charges and government revenue?
- **Changes to established revenue streams** – how should current road user charges be changed?
- **Investment of revenue from a road pricing scheme** – how should surplus revenue be spent?
- **The potential structure of an Australian road pricing scheme** – what type of framework should be adopted for a road pricing system?

6.1 Coverage of the Scheme

Australia has had a long history of fragmented and inconsistent transport regulation, which creates a challenge for the development of a national road pricing scheme. Despite recognising the need for a national set of transport regulations as far back as 1991, it is instructive that Council of Australian Governments and ATC are still working towards this objective. The disjointed nature of current road user charges for light vehicles remains a key issue and again demonstrates the need for a single set of charges that gives consistent signals to road users.

The development of a national transport market that promotes competition through consistent revenue collection, licensing and weight management regulations should be the central focus of the move to a national road pricing regime. That is, in order to achieve a national approach to road pricing, a consistent set of charges should be developed and applied across all states and territories. Different schemes with different price settings would be a backward step and counter to the objective of achieving a more efficient transport system.

There is potential to realise further efficiency gains through the development of a nationally based approach to the administration of vehicle registrations and licensing, in contrast to the current situation of different state-based schemes characterised by duplication and lack of mutual recognition in the ownership and use of vehicles.

Fortunately reforms are currently underway which are moving Australia deliberately, albeit slowly, towards a single national transport market place. National road freight reforms are well progressed – registration charges have been harmonised and we are moving towards a national network of routes for higher productivity vehicles and a move to a single licensing authority for heavy vehicles. A challenging issue in the reform agenda is the agreement by the ATC to proceed with the introduction of a mass-distance-location charging regime for heavy vehicles, which could pave the way for a national road pricing scheme for all vehicles.

In order to support network management objectives and reduce evasive 'rat run' journeys by motorists, a road pricing system for urban areas would ideally cover the entire network. Further, the application of a national road price could be complimented through the use of quality-of-service pricing for key corridors, such as privately operated corridors[33].

6.2 Revenue Outcomes

It is important that the scheme's revenue considerations do not overshadow the schemes ability to facilitate a more efficient transport network, however revenue impacts are self evidently an important consideration in the schemes structure.

In considering the revenue approach under a road pricing scheme, government must first determine whether to structure the scheme to achieve an overall revenue increase, reduction or a revenue neutral structure. A critical factor in this decision is the desire to use the scheme to fund Australia's significant and growing shortfall of transport projects.

Forecasts prepared for Infrastructure Partnerships Australia indicate over the next forty years investment in transport infrastructure will need to increase four-fold. Policymakers must consider whether Australia's capital investment is sufficient to meet short, medium and long-term transport requirements. It is apparent that current investment levels are below what is required to ensure efficient delivery of services, providing the case to increase infrastructure funding. The identification of new revenue streams to find this increase is a key policy challenge.

International experience has shown a strong link between community acceptance of road pricing schemes and the hypothecation of revenue to network augmentation. The success of an Australian scheme would therefore be integrally linked to the ability of the scheme to fund transport infrastructure investments.

On this basis, road pricing should be set at a level that increases the revenue base to allow this expanded capacity. For transport, such funds should not be restricted to reinvestment in the roads sector, but must also include other forms of transport that contribute to a more efficient and sustainable transport system overall, particularly public transport. In the urban context, this is important in providing road users with a viable option for modal shift and improving equity of access across different socioeconomic groups.

33 Infrastructure Partnerships Australia has further explored the use of quality of service pricing in the paper Urban Transport Challenge: Driving Reform in Sydney's Roads available from www.infrastructure.org.au.

The revenue implications for governments should be considered against broader changes in the tax system and changes to the responsibilities of government, for instance:

- Hypothecation of revenues for investment in transport infrastructure;
- Variations in the revenue collection functions and capabilities of government, including the transfer of funds between the Australian Government and the state and territory governments; and,
- Changes in the expenditure requirements of governments.

In 2006-07, road-related revenue totalled more than $22.8 billion across all jurisdictions and including private sector tolls. This revenue level is substantially greater than the $12.14 billion that was spent on road-related infrastructure in that same year. Therefore under a revenue neutral structure and assuming full hypothecation of scheme revenue to transport infrastructure, a further $10 billion would be made available for infrastructure investment under a national road price.

Assuming full revenue hypothecation to transport infrastructure, a national road price structured to deliver revenue at a level consistent with historical road-related expenditure could be delivered under a revenue negative scheme. However, under this structure road pricing would not substantially assist in meeting the financing gap.

While a revenue neutral scheme design may ultimately result in increased public acceptance of a new road user charge, given that it will not influence the overall tax burden of government, the linking of road-related revenue reform to that of the broader review of taxation, being undertaken by the Review of the Future Taxation System, could reduce the significance of this consideration.

Alternatively, a revenue positive road pricing scheme would offer the capability to finance additional transport infrastructure development beyond that available under the prevailing revenue model.

In order to secure acceptance by the community and governments, the introduction of a national road user charge and its replacement of the current road taxes and charges, should as a minimum result in the collection of revenue sufficient to cover all existing road maintenance and development expenditure. However, in order for a national road pricing scheme to contribute to the development of additional road and transport infrastructure, it would be preferable that a scheme be structured so as to derive revenue equal to that of all road-related revenue currently collected by all Australian governments, excluding the Goods and Services Tax, Fringe Benefits Tax and privately collected motorway tolls.

It is inevitable that the introduction of a national road pricing system will result in changes in road-related expenditures for governments. For instance, the removal of the need for administration related to existing fees and charges, such as registrations, will remove the requirement for governments to provide these services. Conversely, the new system will develop new administrative costs associated with its development and implementation.

6.3 Changes to Established Revenue Streams

A fundamental aim of a new road pricing scheme should be the formation of better links between road use and the recovery of associated costs. The introduction of a national road price must be accompanied by fundamental reform of the existing fees and charges associated with the road sector.

A key weakness of the current set of charges relating to road use is their disconnection from direct road use. The various taxes, fees and charges that currently apply to road use often have contradictory impacts on road use and inhibit competition, for instance:

- **Fuel Excise** – provides a relatively efficient form of revenue raising as increasing demand for transport generates increased revenue streams, however, a key problem is that Fuel Excise is not related to location or time of day use. There is no relationship between Fuel Excise paid by users and infrastructure spending. An emerging issue for the Australian Government is the potential impact of more fuel efficient vehicles and alternative fuels (including hybrid, electric and fuel cells) on revenue from Fuel Excise.

- **Registration charges** – provide access to the road network. Although we now have a national approach to heavy vehicle charges, registration charges for light vehicles (<4.5 tonnes Gross Vehicle Mass) vary across jurisdictions. A flat fee based approach to registration does not provide the user with any incentive to reduce travel or move to more fuel efficient vehicles – the highest component of the registration charge in New South Wales is the motor vehicle tax which can account for around 85 per cent of the cost of registration.

- **Stamp Duty** – applies to vehicle ownership transfers and varies across jurisdictions which could hamper cross-jurisdictional transfers.

- **Fringe Benefit Tax** – payable on vehicle use, which can have the effect of encouraging vehicle use to lower the Fringe Benefit Tax rate associated with high vehicle use.

CASE STUDY 4

A SAMPLE OF VEHICLE CHARGES AND OPERATING COSTS

For a typical urban journey in Sydney, total taxes and charges (excluding GST) represent between 17-21 per cent of total trip costs, depending on the vehicle type as shown in the Table below. The estimates exclude the capital cost of vehicle, opportunity cost and depreciation and are based on an annual average distance travelled of 15,000 kilometres[34]. With fuel at $1.20 per litre, total taxes payable to the Australian Government amount to 49.05/litre (40.8 per cent) comprising 38.143c per litre in excise and 10.91c per litre in GST.

A similar result holds for Melbourne where taxes and charges range between 12 and 15 per cent of total trip costs.

▼ Table 11

Current Taxes and Charges Applying to a Typical Intra-urban Journey in Sydney and Melbourne

COSTS	SCENARIO 1: CAMPBELLTOWN TO SYDNEY (57.7 KM)		SCENARIO 2: BURWOOD TO MELBOURNE (14.1 KM)	
	HOLDEN COMMODORE	TOYOTA COROLLA	HOLDEN COMMODORE	TOYOTA COROLLA
Stamp Duty	$1.51	$0.90	$0.31	$0.18
Total fuel costs	$9.36	$6.53	$2.29	$1.60
Proportion: Fuel	$7.03	$4.91	$1.72	$1.20
Proportion: Excise	$2.33	$1.63	$0.57	$0.40
Tyres	$0.84	$0.69	$0.21	$0.17
Servicing	$1.08	$0.69	$0.26	$0.17
Rego	$1.52	$1.07	$0.58	$0.58
Insurance-CTP or equivalent	$1.60	$1.60	-	-
Premium	$1.17	$1.17	$0.37	$0.37
MCIS levy	$0.43	$0.43	$0.04	$0.04
Insurance-comprehensive	$2.86	$2.59	$0.84	$0.74
Tolls	$8.80	$8.80	$5.56	$5.56
Total trip cost	$27.59	$22.89	$10.46	$9.41
Taxes and charges (ex GST and tolls)	$5.36	$3.60	$1.50	$1.20
Percentage taxes and charges (excl GST)	20.90%	17.60%	14.30%	12.80%
Cost of Existing Taxes and Charges	**9 c/km**	**6 c/km**	**11 c/km**	**9 c/km**

34 NRMA (2008)

6.4 The Investment of Revenue in Transport Infrastructure

A national road pricing scheme naturally suggests a common clearing house and a centralised administration for apportioning revenues based on network usage. The question that then arises as to what criteria should form the basis of infrastructure expenditure.

A central objective of a national road pricing scheme should be creating a closer linkage of transport infrastructure investment to the collection of revenue from the road transport sector. A transparent, multimodal, long-term investment plan for the nation is therefore critical.

Without a comprehensive transport infrastructure plan, motorists and the community could easily view a national road pricing scheme as just another taxation instrument. Hypothecation of revenue is therefore essential and was a critical factor in making the London, Singapore, Stockholm and Norwegian road pricing schemes palatable to the general public. The London experience also demonstrates the importance of investing in transport system improvements before a pricing scheme is rolled out, as well as after. A price premium for urban areas will trigger major changes in behaviour and facilitate a mode shift to mass transit. It is therefore logical, and indeed necessary, that the public transport and rail freight systems have the capacity to absorb these changes in travel behaviour, or risk frustrating both the objectives of the scheme and indeed governments own transport policy objectives.

Centralising the administration of both road pricing and infrastructure investment on the basis of the source of road use raises two issues:

- Efficiency of expenditure on marginal projects as opposed to projects with a higher benefit cost ratio (i.e. the "over-funding" risk, whereby the scheme could generate funds for projects which would not normally be considered worthwhile).

- Equity of access for people in regional and remote areas – the Community Service Obligation issue (i.e. the risk of "under-funding" where revenue might not support minimum road maintenance activities).

On the other hand, infrastructure funding could be centralised through an infrastructure fund (such as the Building Australia Fund), which could determine the redistribution of revenues through an objective determination of investment priorities. In this case, a board comprising the Australian, state, territory and local governments should determine the allocation based on the economic evidence, environmental factors, demographic changes and community needs.

6.5 Other Considerations

6.5.1 Road User Equity Considerations

The development of a well designed national road pricing scheme based on distance travelled would improve equity outcomes across society by:

- Increasing the accountability of road users for the impacts arising from their road use;
- Removing the upfront fees and charges that act as barriers to vehicle ownership – thereby reducing the impacts of social isolation; and,
- Reducing the current disproportionate fees and charges that apply to some heavy vehicles.

A national road pricing scheme coupled with broad reform of taxes and charges imposed on the road transport sector offers the opportunity to redress the current inequity borne by road users through highly regressive fees and charges. By shifting to a distance-based taxation system, there is a potential to contribute to the broader economic welfare of the community.

In essence, the introduction of a national road pricing scheme will introduce a fairer system that will see people who drive less pay less than under the status quo. The ability to derive new revenues to fund public transport and new road projects will also improve access for people who do not currently enjoy suitable public transport options. A national road pricing scheme offers a step change that could drive a fairer, more sustainable approach to transport infrastructure funding over the long-term.

6.5.2 Relationship to Other Transport Modes

The principle aim of a road pricing scheme must be to ensure the most efficient use of the entire transport network, including road, rail, maritime and air transport. It is therefore critical to consider not only the impacts of such a scheme on the road network, but also on complementary transport modes.

The introduction of a national road pricing scheme will play a critical role supporting mode switching in both freight and passenger transport. It is therefore critical that the application of fees and charges to these transport modes, such as public transport ticketing prices or rail access charges, give due regard to their impact on the achievement of these broader transport aims, that underscore the structure or a national road price.

In the freight sector, the structure of road pricing scheme must recognise the impact of the scheme on the relative competitiveness of road freight with other transport modes, notably rail and sea freight. Pricing reforms to promote competitiveness between transport modes, through the incorporation of externalities, have been promoted by the freight sector for many years. The introduction of a road pricing scheme provides the opportunity to progress these objectives through examining the most appropriate basis for fees and charges across all freight modes.

The relationship between road pricing and public transport is also a fundamental consideration, particularly during peak periods. For road pricing to drive the desired modal switch, public transport must have sufficient capacity to accommodate patronage growth

and consideration must also be given to complementary fare-setting methods, perhaps through peak period or multiple journey discounts.

The reform of public transport pricing and ticketing has long been identified as a priority for governments across Australia. Despite the existence of considerable public support and political will for the reform of ticketing, there has been limited success in some jurisdictions. Continued reform of public transport ticketing to promote fare simplification and rationalisation is critical and should be considered in a process which complements the move toward a national road pricing scheme.

The implementation of a road pricing scheme, based on a more accurate reflection of the true costs of road use, would also offer the potential for a fairer system of public transport pricing, which balances the desire for the full utilisation of available capacity with true costs of providing public transport.

6.5.3 Technology

Recent technological advances suggest there are no insurmountable technical constraints on introducing a national road pricing scheme for Australia in the short to medium term. Developments in heavy vehicle charging suggest that road freight could provide the springboard for a comprehensive location-based approach to road pricing.

Clearly, the selection of a technology for road pricing must follow the determination of the policy principles of the scheme. That is, the use of a particular technology must be judged on its capacity to deliver the aims of the scheme – rather than the opposite, whereby the principles of a scheme are compromised to facilitate the use of particular technology.

The selection of the most appropriate technology will need to balance a range of practical considerations as well as the capacity of the scheme to deliver on the ATC's transport policy objectives, including:

- Cost for industry/motorists;
- Costs for government;
- Effectiveness; and,
- Relative simplicity of use.

The procurement of the most appropriate technology platform must be focussed on outcomes and provide the opportunity for service providers to develop innovative, leading edge solutions which satisfactorily deliver the scheme's objectives at the best value for money and reliability.

While there may be a capacity for a national road pricing scheme to leverage existing urban and other tolling standards and technology, the costs associated with the development of fixed tolling systems would likely act as a barrier to this technology providing the basis for the national scheme.

6.5.4 Road User Information and Communication

Effective communication with road users during scheme development and post-implementation phases will, in large part, determine the success of these reforms. Government will need to work closely with industry, road-user groups and the community to drive a deep understanding of the requirement for change and the principles that will underpin the scheme's structure and design.

The success of comparable reforms around the globe has relied on a strong relationship between reform and investment of the proceeds in new infrastructure. Therefore, the development of a transparent and accountable system to direct this investment must form a primary component of the scheme's design and debate. Demand management, like infrastructure investment, must be part of a cohesive package of measures to support demand growth in order to ensure their success.

It will be essential for these issues to be considered within the public debate on a road pricing system for Australia. An initial step in this direction could be facilitated by the provision of seed funding for projects to trial road pricing on some key routes. While this may be useful in gauging public reaction, it may not provide an accurate measure for two reasons:

- A feasible public transport option would need to be in place so that road users have an alternative to private car use; and,

- Road users may take short term measures to "avoid" the road price on the basis that it is "just a trial".

During the implementation and eventual normalisation of a national road pricing system, communication of scheme structure and design must be central to the ongoing management of the scheme. The provision of information regarding charge rates, such as those for differing regions or times-of-day, will be critical to altering driver behaviour and achieving the aims of the scheme.

Unlike road use, consumers of most commodities or services know the price of a good or service before the point of transaction. Road users will want to have some understanding of how much they would actually pay to make a journey at any given time before embarking on the journey.

From an economic view, the ideal urban road pricing system would vary according to traffic volumes, that is be fully variable (dynamic) to traffic levels, rather than based on a pre-determined scale. However, the more dynamic a system is, the more complicated and opaque it becomes from a user point of view and could be difficult to implement on a national scale.

6.6 The Potential Structure of an Australian Road Pricing Scheme

6.6.1 Structure of a National Road Price

The Australian Government in negotiation with the states, territories and local government as well as industry and road users, should move to the short-term reform of existing fees and charges associated with road use, including the introduction of a location and distance based road user charge for all vehicle classes.

The structure of the charge should recognise the:

- Need to improve competitiveness, efficiency and transparency of road-related fees and charges;
- Increasing impacts on road wear and tear due to greater vehicle mass; and,
- Increasing costs of externalities associated with rising levels of congestion.

In order to support these themes, a national road pricing scheme should be structured to provide two fundamentally different regimes, the first relating to heavy vehicles (over 4.5 tonnes) and the second for light vehicles. These schemes would both provide distance based charges, with three separate tiers of charges, a base rate and premiums for use of the urban network and the use of the urban network in peak periods.

If road pricing is seen to have a role in progressing a more sustainable and efficient transport system, then consideration needs to be given to a possible implementation path that includes the reform of current taxes and charges paid by road users.

Incremental implementation of a more active system would provide the opportunity for:

- The development, proving and piloting of technology solutions;
- Investment in the development and reform of public transport infrastructure and services to support mode switching; and,
- Communication of the scheme's structure to road users.

The transition period would need to parallel reform of current taxing regimes by state, territory and Federal governments in order to move toward a consistent set of price signals for road use.

Heavy Vehicles

In recognition of the relatively greater impact of these vehicles on the road network and the current phase of reforms to heavy vehicle fees and charges, a variable road use charge based on mass-distance-location for heavy vehicles would ideally be undertaken as a first step towards a general Australian road pricing scheme.

The scheme should recognise three key variables:

- **Distance** – a rate per kilometre travelled based on mass and location.

- **Mass** – a sliding scale of charges should apply for vehicles based on the gross vehicle mass during travel. The potential for onboard, real-time assessment of vehicle mass to facilitate these charges should be examined.

- **Location** – as a first step towards a demand management based charge a three tier tariff system should apply to travel:

    - **Base Rate** - a flat charge across the network should be applied to manage demand and to fund transport infrastructure including capital and maintenance expenditure.

    - **Urban Rate** – a higher rate in capital cities and major urban centres to improve the efficiency of use of infrastructure by providing a mechanism to internalise the external costs of transport (i.e. congestion and emissions). This charge would initially relate to major capital cities, including Sydney, Melbourne, Brisbane and neighbouring South East Queensland, Perth and Adelaide, however consideration should be given to an appropriate mechanism for the introduction of other locations over time.

    - **Peak Rate** – a time-of-day based charge for urban areas to provide a congestion charge for use during high demand peak periods. This charge would relate to the areas covered by the Urban Rate.

A longer term reform opportunity would be the application of differing per kilometre rates to heavy vehicles for the use of freeways and major arterials as compared to local roads. Through the application of this additional tariff, heavy vehicles could be encouraged to use designated corridors (such as freeways) therefore reducing the impact of freight movements on local roads and neighbourhoods.

Light Vehicles

Reform of road user charges that relate to light vehicles should principally provide for the simplification and harmonisation of existing taxes, fees and charges as well as the management of externalities, including congestion, in urban areas. The application of a common charge across all light vehicles would assist in the administration of the scheme and provide transparency for road users.

Stage 1

The current network of tollways in Melbourne, Sydney and Brisbane could provide a framework for improved network management through a fully dynamic or variable tolling regime (as per the newly introduced variable tolling arrangement for the Sydney Harbour crossings). However, two main issues here remain:

- The need to re-negotiate current commercial agreements with private toll road operators; and,

- Partial coverage of the network by toll roads and the potentially negative impacts of road users switching to congested unpriced roads.

Stage 2

Similar to the structure of the heavy vehicle road price, a medium-term structure for a road user charge for light vehicles would consist of a location and distance based scheme. Under this approach, mass would not be included as a tariff class, in recognition of the relatively limited impact of light vehicles on the maintenance requirements of road infrastructure.

Under this scheme, a three tier tariff similar to that for trucks incorporating different Base, Urban and Peak rates of charges would apply.

As technology evolves over the long-term there may be the capacity to further refine an early broad brush approach to better align price with quality of service (i.e. differential pricing according to road surface, performance standards, service levels etc).

CASE STUDY 5:
WHAT COULD A VARIABLE ROAD PRICE FOR LIGHT VEHICLES LOOK LIKE?

The price per kilometre that motorists might be charged under a road pricing scheme is difficult to determine without modelling specific options, but some basic figures can be derived by looking at selected transport statistics and current levels of road revenue and expenditure. For instance, the prices paid by road users could be quite low under most circumstances (e.g. for travel on rural roads) and higher in others (for travel on certain urban roads during peak hour).

While, the figures provided in these scenarios provide a useful benchmark as to the potential costs for households and vehicle owners, the actual usage figures under a road price would vary depending on time and location of use as well as potentially the characteristics of the vehicle, such as engine efficiency.

The table below provides a broad indication of what road user prices might look like under five hypothetical scenarios:

- **Scenario 1 and 2:** demonstrate potential road user charges if a scheme were structured to recover the existing road related expenditure, i.e. assuming that revenue shortfalls (e.g. loss of Fuel Excise) are foregone or recovered by some other means outside the transport system.
- **Scenario 3, 4 and 5**: The second half of the table considers what costs might be charged if the objective of the system was to provide full recovery of revenue, taxes and charges (including estimates of FBT and GST) currently collected from road transport, i.e. if the system was designed to be revenue neutral or revenue positive (BITRE 2009d).

▼ Table 12

Scenario Road User Prices

SCENARIO 1: RECOVERY OF CURRENT ROAD EXPENDITURE ONLY	
Total road expenditures (2006-07)	$11.371 b
Road expenditures attributable to passenger cars, LCV's and motor bikes (1)	$9.565 b
Recovery of road expenditures attributable to vehicles (passenger cars, LCV's, motor bikes)	4.6 c/km
Average annual road use charges per passenger vehicle (2)	$644

SCENARIO 2: RECOVERY OF CURRENT ROAD EXPENDITURES AND COST OF EXTERNALITIES	
Road expenditures attributable to passenger cars, LCV's and motor bikes (1)	$9.565 b
Estimate of externality costs attributable to capital city congestion from light vehicle use (BITRE 2007) (3)	$0.99 b
Average road user charge (including externalities)	5.1c/km
Average annual road user charges per passenger vehicle including externalities(2)	$711

SCENARIO 3: FULL RECOVERY OF TAXES AND CHARGES (EXCL FBT AND GST) AND COST OF EXTERNALITIES ATTRIBUTABLE TO LIGHT VEHICLES	
Revenues attributable to passenger cars, LCV and motor bikes (1)	$14.379 b
Estimate of externality costs attributable to capital city congestion from light vehicle use (BITRE 2007) (4)	$0.99 b
Total light vkt metropolitan areas in 2005 (BITRE 2007)	120.13 b
Average road user charge (including externalities)	7.9 c/km
Average annual road user charges per vehicle (2)	$1 106

CASE STUDY 5: CONTINUED

SCENARIO 4: FULL RECOVERY OF TAXES AND CHARGES CURRENTLY COLLECTED FROM ROAD TRANSPORT	
Average taxes and charges currently collected from road transport (2006-07) - Including FBT ($1.776 billion) - Including GST ($4.60 billion estimate based on 2001-02 to 2005-06)	$22.588 b
Assumed revenues attributable to passenger cars (pcs), LCV and motor bikes (1)	$20.422 b
Total vkt (2006-07) by passenger cars, LCV and motor bikes	205.96 b
Average road user charge	9.9 c/km
Average annual road use charges per vehicle (2)	$1 386

SCENARIO 5: FULL RECOVERY OF TAXES AND CHARGES AND COST OF EXTERNALITIES ATTRIBUTABLE TO LIGHT VEHICLES	
Revenues attributable to passenger cars, LCV and motor bikes (1)	$20.422 b
Estimate of externality costs attributable to capital city congestion from light vehicle use (BITRE 2007) (3)	$0.99 b
Total light vkt metropolitan areas (BITRE 2007)	124.04 b
Average road user charge (including externalities)	10.4 c/km
Average annual road use charges per passenger vehicle including externalities (2)	$1 453

LCV light commercial vehicle
Vkt vehicle kilometres travelled
(1) Road cost recovery from heavy vehicles under PAY-GO approach averaged around 20 percent of total road expenditures (Second Determination), based on average taxes and charges collected from road transport between the above years, this equates to $1.806 b. GST and FBT estimates attributable to light vehicles based on proportionate share of total vehicle registrations which is around 95%.
(2) Based on 14 000 km as the average annual distance travelled by passenger cars with 60 per cent of travel in metropolitan areas.
(3) Assuming light vehicles contribute around 90 percent of pollution costs in capital cities.

These scenarios provide estimates in the range of 4.6 – 10.4 c/km. This provides a preliminary indication of the magnitude of charges that road users might pay under a pricing regime.

However, it is essential to recognise that charges are likely to be most effective if they incorporate a number of different elements e.g. a per kilometre base charge paid by all road users, supplemented with an additional charge for certain roads within urban areas to manage transport externalities. This approach is likely to be more effective from a transport efficiency perspective, but needs to be balanced against the need to keep the design of the system as simple as possible. Road users will not respond to pricing signals unless they are easy to understand.

If road use charges were based on a revenue neutrality basis, then this could generate an additional $10.857 billion in funds for additional infrastructure investment.

Substantial additional revenue could be generated by an even slight increase in the road use charge. For example, if the road use charge were increased from the estimated weighted average (metropolitan and non-metropolitan) of 10.4c/km to 11.0c/km for passenger vehicles, then the increase in revenue for infrastructure spending derived from passenger vehicle use alone would increase by around $1 billion.

6.6.2 Comparison of an Australian Road Pricing Scheme with the Dutch Scheme

While there is no precedent of a national road pricing system to which a prospective Australian scheme could be compared to the road pricing system which will be put before the Netherlands Parliament in 2010 forms the basis for some comparison. Table 12 provides a comparison between the structure of the road pricing concept recommended in this paper and that proposed for the Netherlands.

▼ Table 12

Comparison between Netherlands and An Australian Road Pricing Scheme

	NETHERLANDS	AUSTRALIA
Policy Objective	Removal of current fixed taxes and charges paid by road users to be replaced by a per km charge. Abolition of: • Motor vehicle tax (determined by vehicle weight and fuel type); • Provincial surcharges; and, • Vehicle purchase tax: 40 per cent of net book value of the car.	Reform of current State based taxes and charges (including stamp duties payable on new cars and vehicle transfers) and replaced by a variable distance based charge.
Focus	Vehicle use rather than on vehicle ownership. Other factors include emissions and fuel type.	Vehicle use rather than on vehicle ownership.
Structure	Two-tier tariff: • Base charge; and, • Rush hour surcharge to apply on busy routes during rush hours.	Three-tier tariff: • Base charge; • Urban network charge to incorporate externalities associated with use of congested roads; and, • Peak urban charge to reduce congestion.
Infrastructure fund	Revenues from the per kilometre charge to be hypothecated to a transport infrastructure fund for investment in construction and maintenance of roads and expansion of public transport.	Revenues from the per kilometre charge to be hypothecated to a transport infrastructure fund for investment in construction and maintenance of roads and expansion of public transport.
Associated reforms	Review of working hours and introduction of more flexible work times to allow commuters to avoid travel during rush hours.	Broader reform of taxes and charges paid by all sectors of society (e.g. business, PAYE, etc).
Revenue	Neutral at national and provincial levels.	Revenue neutral – variations in consolidated revenue should be offset by broader taxation reform process.
Implementation	• Stage roll-out between 2012 to 2018 • Trials: 60,000 vehicles • Heavy vehicle: (> GVM 4.5 tonnes) • Light vehicles: phased introduction based on random selection of registration plate numbers.	Similar approach to the Netherlands.
Privacy	Location protected through information basis for charging of kilometre travelled and rate.	Similar approach to the Netherlands. A central consideration in the final structure of the scheme. Special concessions should be made to reflect privacy concerns however these must not undermine the basic policy structure of the scheme.
Technology	Satellite and GSM.	To be determined by competitive tender following policy determinations.

7 Conclusion

The purpose of this paper is to facilitate an informed debate about the merits of a national road pricing scheme in Australia. If effectively implemented, a national road pricing scheme could offer Australia access to a world leading transport management tool, providing a dividend far beyond the role of road pricing in driving revenue from road transport.

The current national debate about the role of infrastructure pricing in driving behaviour change is timely; and is overlaid with a historic underinvestment in transport infrastructure, record urban congestion and a massive forward requirement for new transport infrastructure projects.

The concurrent Federal reviews of both taxation and transport policy provides a once in a generation opportunity to consider the nexus between these two policy areas; and the ability for a fundamental overhaul of taxation to support a new transport planning and pricing paradigm for Australia.

The rise of demand management schemes as a key component of effective transport policy is increasingly recognised throughout the world. Across the globe, political considerations which have frustrated informed debate about the role of road pricing schemes in the past, is declining. There is now growing consensus that a balance between capacity augmentation and demand management is required to provide for long-term transport requirements.

In considering the structure of a road pricing scheme for Australia, it is critical that the aims and objectives of the scheme correspond with the objectives of the Australian Transport Council, which form the basis of the national transport policy. Government should consider six fundamental issues in the design of a national road price:

- **Coverage of the scheme** – should a scheme be developed on a national basis with uniform charges, or on a state-by-state, city basis using a common framework?
- **Revenue outcomes** – what effect should a scheme have on current road user charges and government revenue?
- **Changes to established revenue streams** – How should current road user charges be changed?
- **Other considerations** – what other practical issues need to be considered?
- **Investment of surplus revenue from a road pricing scheme** – How should revenue be spent?
- **Potential structure of an Australian road pricing scheme** – What type of framework should be adopted for a road pricing system?

The infrastructure sector recognises the substantial variation in impact between heavy vehicle and light vehicle use on the road network, as well as progress towards charging reform for both classes of vehicle. It is therefore prudent that the introduction of a road pricing scheme recognises the respective impacts of these vehicles and is structured to ensure vehicles that most heavily impact on the system meet their costs.

Beyond the recovery of the costs of construction and maintenance of the network, consideration should be given to the use of a road price to internalise a range of externalities from vehicle use, including air pollution and the impacts of congestion. Critically, the structure of a national road price should feature a time of day congestion charge to recognise the substantial additional impacts that arise as the result of vehicle use during peak times of day.

Obviously, the recommendations contained in this paper suggest a radical departure from past practices and present significant technical, policy and political challenges. But the scheme design outlined in this research also offers Australia the ability to break the back of its transport management and funding challenges - offering a break-through solution which could put Australia's transport infrastructure back on track for the decades ahead.


AUSTRALIA

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