SUBMISSION

PRODUCTIVITY COMMISSION INQUIRY INTO ROAD AND RAIL FREIGHT INFRASTRUCTURE PRICING

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WESTERN AUSTRALIAN
LOCAL GOVERNMENT ASSOCIATION

SUBMISSION OF WA LOCAL GOVERNMENT ASSOCIATION TO PRODUCTIVITY COMMISSION INQUIRY INTO ROAD AND RAIL FREIGHT INFRASTRUCTURE PRICING

1 Introduction

The Western Australia Local Government Association (the Association) welcomes the opportunity to make a submission to the Productivity Commission's Inquiry into Road and Rail Freight Infrastructure Pricing. The submission addresses those issues and specific questions that the Association regards as the most relevant to its member Local Governments.

The Association regards the Inquiry as extremely important given the growth in freight transport and freight vehicles in Australia and particularly in Western Australia (WA) in recent years (see Bureau of Transport & Regional Economics, 2003a). Moreover, the road freight transport task is projected to grow substantially in the future, with a doubling of the land freight transport task projected by 2020 from its level in 2000 (see National Transport Council, 2006a).

2 Overview of Freight Transport in Western Australia

The changes in freight vehicle population in WA and Australia as a whole are set out in Table 1.

Table 1: Number of freight vehicles by vehicle type, WA and Australia, 1995 & 2001

Vehicle type per selected jurisdiction	Number of vehicles ('000)		Share of total (%)		% change 1995 to 2001
	1995	2001	1995	2001	
LCVs (light commercial vehicles)					
WA	187.2	216.2	12.3	12.2	15.5
Australia	1,527.2	1,769.6	100.0	100.0	15.9
Rigid trucks					
WA	43.0	44.4	12.8	13.1	3.1
Australia	337.4	338.4	100.0	100.0	0.3
Articulated trucks					
WA	6.7	7.7	11.6	12.3	13.7
Australia	58.3	62.6	100.0	100.0	7.3
All freight vehicles					
WA	237.0	268.3	12.3	12.4	13.2
Australia	1,923.0	2,170.6	100.0	100.0	12.9

Source: BTRE (2003a)

It must be noted that the number of freight vehicles has increased in WA between 1995 and 2001, with the State accounting for an increasing percentage of the total number of rigid trucks and articulated trucks, and experiencing a faster rate of increase than the national fleet for these vehicle types. This implies that there are more heavy vehicles using the State's road infrastructure, and WA may have to deal with relatively higher rates of increases (than the rest of the country) in the numbers of these vehicles.

The trend in the role of rigid and articulated trucks in WA is set out in terms of total tonne-kilometres (1991, 1995 and 2001) in Table 2.

Table 2: Shares in total tonne-kilometres, Western Australia, 1991, 1995 & 2001

Vehicle type per selected jurisdiction	Share of total tonne-km (%)			Change in shares (%)		
	1991	1995	2001	1991-1995	1995-2001	1991-2001
LCVs	12.8	12.1	11.3	-0.7	-0.9	-1.5
Rigid trucks	12.4	13.9	11.2	1.5	-2.7	-1.2
Articulated trucks	12.2	12.5	11.6	0.3	-0.9	-0.6
All freight vehicles	12.3	12.8	11.5	0.5	-1.3	-0.8

Source: BTRE (2003a)

Table 2 shows that the WA's share of LCV tonne-km has decreased steadily from 1991 to 2001, while the WA share of rigid and articulated trucks tonne-km relative to other states and territories has fallen from 1995 to 2001. These numbers indicate that the WA share of freight tonne-km for rigid trucks and articulated trucks has been below the national average between 1995 and 2001. However, it does not mean that tonne-km in WA have decreased in absolute terms. A number of factors including changes in logistics practices, fleet mix changes and freight task mix changes around Australia over this period are likely to have affected the relative shares.

2.1 Twice the Task (NTC, 2006a)

In terms of the Twice the Task study (NTC, 2006a), land freight transport as projected by the BTRE is set to double nationwide from 2000 to 2020. The underlying conclusion from these projections is that freight transportation is likely increase significantly in coming years. The study indicates that the greatest impacts of these increases in freight transport will be in urban areas where any increase in freight vehicles will have to share road space with increasing numbers of passenger cars. The study forecasts that most of the growth will be in terms of road freight, with annual growth forecasts for the capital cities included showing Perth reaching the third highest position at 2.93%, after Darwin (3.53%) and Brisbane (2.98%), and followed by Canberra (2.78%), Sydney (2.74%), Melbourne (2.52%), Hobart (2.05%) and Adelaide (2.01%) (NTC, 2006a).

The pressure on urban centres is projected to increase. Inter-capital movements (long-haul) on corridors such as the Eastern States-Perth route, and short haul road freight movements in metropolitan centres such as Perth are projected to increase both in terms of freight movements and tonne-km (see Table 3). Inter-capital road freight movements from the Eastern States to Perth are projected to increase from 3.31 billion tonne-km in 2000 to 6.03 billion tonne-km in 2020, placing more demand on the road networks in the State and ultimately on the capital city. Likewise, short haul freight movements are projected to increase by over 3 billion tonne-km between 2003 and 2020 to over 6 billion tonne-km, doubling over the period to 2020.

Table 3: Inter-capital (long haul) and Metropolitan (short haul) road freight movements for Perth to 2020

Movement type	% change p.a.	Total change in tonne-km
Inter-capital movements (long-haul), 2000-2020 **Eastern States-Perth**	3.04%	2.72bn
Metro short haul, 2003-2020	2.93%	3.02bn

Source: NTC (2006a)

3 Western Australia Local Roads Assets and Expenditures – Key Issues

The following key issues about WA local road assets and expenditures are important for the Inquiry's work on infrastructure pricing (see the Association's Report on Local Government Road Assets & Expenditures, 2004):

- Like all Local Governments in the country, those in WA face major road network needs to ensure sustained economic development in the future. However, at the same time, also experience significant funding shortfalls that place substantial pressure on Local Governments throughout the State. This is primarily because revenues accruing from road use are not necessarily channelled back to road expenditures in the jurisdictions in which they occur
- Councils in WA contributed over 50% of road expenditures (out of a total WA Council road expenditure in 2003-04 of $371m), placing substantial pressures on their rate base – any additional road needs arising from road damage by heavy vehicles are likely to exacerbate these funding demands on limited revenue sources. NTC (2006c) indicates that WA rural arterial road expenditure has decreased between 2001-02 and 2004-05, while urban arterial road expenditure has increased during the same period (See Appendix A)
- Councils in WA already spend over two thirds (68%) of road expenditures on such activities as road maintenance and renewal combined, and only less than one third (32%) on network expansion and upgrading. However, the latter categories needs are increasing at a faster rate than preservation expenditures because of development requirements – any additional road needs arising from road damage by heavy vehicles will result in Councils having to divert scarce funding to network preservation and away from network expansion, with knock-on limiting effects on potential economic development
- While metropolitan Councils have greater revenue capacity to meet road needs from their own resources than rural Councils, they will also have to deal with increasing freight traffic in the future, as indicated in the aforementioned NTC studies. This implies additional road freight traffic and increased loads will have to be priced to take account of road damage; and revenues collected will have to be channelled back to the Councils that have to maintain and where necessary enhance these road networks
- Rural Councils have far less revenue capacity to meet road needs and limited capacity to raise additional funds to narrow the gap between road preservation/upgrading needs and funds they receive. This implies that the Inquiry must take account of the fact that rural roads servicing remote communities are for basic access (more like 'pure public goods') and for that reason the bulk of the infrastructure expenditure would need to be funded from general government revenue sources. This is unlike busier roads that are of more 'commercial' or 'economic' importance and can be priced to better reflect the heavy traffic demand (i.e. more likely to display 'private goods' characteristics).

Additional road freight damage on rural roads will have to be charged according to the amount of road damage caused, but rural Councils are likely to also require increased assistance from Commonwealth and/or State Governments, because these roads also have a basic access role. This points to a need for more transparent links between sources of where revenues accrue and where expenditures occur.

- Finally, a key issue in WA is that of the poor condition of bridges at a local level. Giummarra (2000) showed that 74% of local road bridges in WA were in poor[1] condition which was well over the national average of 15%, mainly because most of these were timber structures. Those local bridges in WA listed as in good[2] condition were estimated at 10% and those in fair[3] condition 16%. This shows that Local Governments (especially those in remote areas) in WA are responsible for infrastructure that will come under significant pressure in the future if road and rail infrastructure pricing issues and lack of infrastructure funding, are not addressed more directly at the Local Government level.

The submission will now address selected issues raised in the Inquiry's Issues Paper.

4 Costs of Providing and Maintaining Road and Rail Freight Infrastructure

What are the major common (non-separable) costs of providing road and rail infrastructure? How significant are they?

Road Infrastructure

Common (non-separable)[4] costs of providing road infrastructure are those costs that cannot be allocated to various vehicle classes based on their use of the road (BTRE, 2003c) and normally account for about 70% of total operating costs (NRTC, 1998). Non-separable costs generally account for the largest part of allocable costs (60%) (NRTC, 1998), and at a national level over 90% of non-separable costs are allocated to light vehicles. Examples of non-separable costs include road cleaning costs, mowing grass on verges, basic costs of providing a road at minimum standard (BTRE, 2003c), signage, traffic management equipment (e.g. traffic lights), safety expenditure (e.g. guardrails) (NTC, 2006b), enforcement costs and costs of maintaining roads to an acceptable minimum standard. To this extent, a certain level of capital and maintenance costs would, to a significant degree, be non-separable, unless it is known how much expenditure is incurred that can be directly attributed to specific vehicle classes, e.g. upgrading a road to a higher standard so that it can carry heavy vehicles.

Currently, the greater portion of non-separable costs at a local level is attributed to light vehicles (about 96%) and the remainder to heavy vehicles. The reverse situation is the case regarding separable costs, with heavy vehicles accounting for 65% of these costs (NTRC, 1998). This is because non-separable costs are allocated in proportion with the number of vehicles and vehicle kilometres travelled (VKT). However, generally, the magnitude of non-separable costs is greater than that of separable costs (separable costs being an estimated 80% of non-separable costs) and these costs are attributed to light vehicles because of this allocation process.

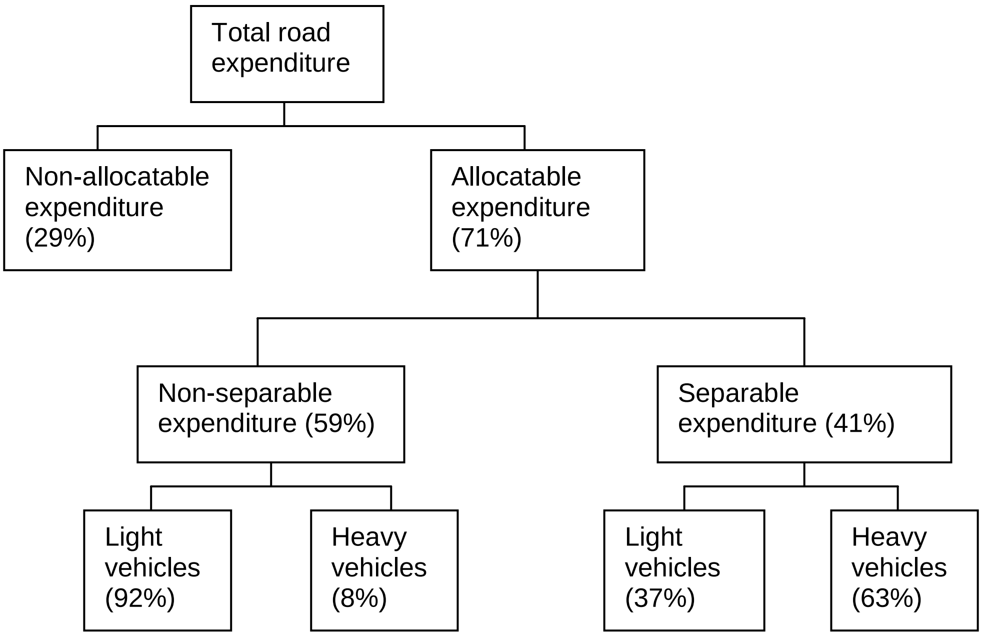
[1] Poor condition defined in Giummarra (2000) as bridges of inadequate strength for general freight vehicles and currently with a load limit and/or require major rehabilitation or replacement.

[2] Good condition defined by Giummarra (Ibid) as of adequate strength for general freight vehicles and requiring only minor or routine maintenance over the next 10 years.

[3] Fair condition defined by Giummarra (Ibid) as bridges currently unrestricted for general freight vehicles but requiring major maintenance, rehabilitation or replacement within 10 years.

[4] *Common* costs are defined in Martin (1991) as those costs that are attributed to two or more road user groups or vehicle classes in proportions that can be determined on a cost-occasioned basis. *Non-separable* costs are only regarded as joint costs, excluding common costs, in the long run. In the short run, common costs are not regarded as variable with road use and for this reason are included with joint costs as a component of the non-separable costs. *Joint* costs are unavoidable even where the vehicle class concerned does not feature in traffic and cannot be attributed to vehicle classes on a cost-occasioned basis.

Allocatable expenditure accounts for 70% of total road expenditure (see Figure 1), while the remainder is accounted for by non-allocatable expenditure. This affects all light vehicles, passenger as well as freight, and is therefore likely to grow in the future if the number of passenger cars and light commercial vehicles increases. The allocation of non-separable costs applies at all levels of road, but especially local roads, because of the high VKT by light vehicles at this level (NRTC, 1998). At a local level, 79% of all total allocated expenditure attributed to light vehicles is non-separable costs, with the remainder being separable. Similarly, at a local level 93% of allocated expenditure attributed to heavy vehicles are separable costs, with non-separable costs accounting for the remaining 7% (see NRTC, 1998). The detailed split between separable and non-separable costs across road classes (local, arterial & national) and vehicle classes (light & heavy) is presented in Appendix B.



Source: NRTC (1998), reproduced in BTRE (2004)

Figure 1: Road expenditure allocation process

Non-separable costs are identified in Vuong and Mathias (2004) as the minimum costs for the provision and maintenance of roads/bridges which are to be shared by all vehicle classes on the basis of light vehicles and measured in terms of VKT. The apportionment of separable and non-separable costs across vehicle related expenditure categories and shares are set out in Appendix C (NRTC, 1998 in Vuong & Mathias, 2004).

There is also no widespread consensus on what constitutes non-separable costs. For example, there are differences in the definition of non-separable costs between the Port Jackson Partners (2005) report on the 'Future of Freight' (see Australasian Railway Association, 2005) and the NTC approaches (see NTC, 2006b). The PJP approach proposes using 'PCU-km' to allocate non-separable costs, while the NTC approach uses 'vehicle-km traveled' (VKT) for estimating these costs. A detailed comparison of road cost allocation methodologies between NTC and BTRE across road cost categories is also presented in Appendix D.

This difference in approach is significant due to the effect that it has on the magnitude of what is defined as non-separable costs. The use of 'PCU-km' as a basis for allocation as opposed to 'vehicle-km' allocates a significantly greater proportion of these costs to trucks, as indicated in the preceding paragraphs. The NTC (2006b) study argues that while the statement in the PJP report that PCUs are 'more closely representative of the impact of different vehicle types on the need to incur non-separable costs' may be partially valid for some capacity-related capital costs, this would not be the case for the bulk of non-separable operating costs such as mowing of grass verges, maintenance of signage, guardrails and maintaining roads to an acceptable minimum standard.

The NTC approach of relying on VKT is argued to be more appropriate for cost allocation and results in more costs being categorised as separable, e.g. expenditures on signage and road markings because while they assist the driver generally, and are not ostensibly related to vehicle size, they are argued to be more attributable to light vehicles and even more so in the case of safety expenditures. The NTC would then regard these as separable costs and allocate them in terms of VKT in the case of safety related costs and PCU-km in the case of traffic flow related costs. The NTC approach goes on to divide asset extension/improvement costs into separable and non-separable components using a mix of VKT, PCU-km[5], and ESA-km[6] allocation parameters (NTC, 2006b).

In terms of the NTC approach, 55% of new pavement costs are categorised as non-separable (allocated by VKT) and 45% as separable (allocated by ESA-km). Bridge construction costs are categorised 85% as non-separable (VKT) and 15% separable ('PCU-km'). All other costs, including land acquisition, earthworks, and other extension/improvement expenditure, are considered to be 90% non-separable (VKT) and 10% separable ('PCU-km'). Owing to the fact that pavement costs are a relatively small proportion of overall capital costs, the NTC approach results in approximately 85-90% of costs being categorised as non-separable and therefore being allocated by VKT (NTC, 2006b). This approach does not reflect the true cost of heavy vehicle usage of road infrastructure and will certainly not do so in the future as local authorities are likely to bear more of the infrastructure costs. For example, in the presence of congestion caused by both heavy and light vehicles, the contribution of heavy vehicles is predicted to be significant (Twice the Task projections, NTC 2006a). This could suggest that a rethink may be required on the apportionment of non-separable costs across all spheres of government.

A greater emphasis on pricing for road use by heavy vehicles to accurately reflect road pavement damage on different pavements and on passenger cars according to pricing for road space and congestion will be more equitable than a charge and allocation system simply based on number of vehicles and VKT. A switch away from 'vehicle –km' and number of vehicles and towards actual road use might be more equitable for users as an allocation approach. The Inter-State Commission (1987 in Starrs 1996) also argued against the use of 'vehicle –km' as a means of allocating non-separable costs because 'distance-related' parameters should not be associated with common (fixed) costs, because by definition they cannot be unambiguously related to vehicle travel.

Rail Infrastructure

In terms of rail, the approach to rail track charges in the UK has been for freight operators to pay a negotiated charge covering their avoidable costs and making a contribution to fixed and common costs in line with their ability to pay (Nash, et al, 2004). This was because most rail infrastructure costs have been found to be common between operators, at least in the short term. Bertie (2003) has defined common (or joint) costs in the rail context as those costs that are required to support the operation of commuter, intercity and freight train types on a particular link or terminal within a rail network and cannot be attributed to any one of the three train classes separately.

The current system in WA of the Australian Rail Track Corporation (ARTC) owning or selling access to operators is different to that of one organisation being operator and infrastructure owner, but it raises the difficult question of how to allocate costs amongst different users of the same line or network and most closely resembles the open access model adopted by the European Union (EU) in which track ownership is required to be separate from train operations (Resor & Patel, 2002). It will therefore be up to the infrastructure owner to become more specific

[5] PCU stands for passenger car (equivalent) units.
[6] ESA stands for equivalent standard axles.

as to the allocation of costs between train classes and/or operators and for these to be reflected in access charges. Charges that were applied in the Railtrack experience in the UK have been argued to be poorly structured and resulted in under-investment in infrastructure and over utilisation of track (BTRE, 2003b). This would be disastrous in the case of road and rail infrastructure in Australia that is not priced properly, because neither would be used optimally. Typical common costs for rail would include costs for (Ibid):

- Track maintenance
- Signal maintenance
- Communication systems maintenance
- Other maintenance of way costs
- Law enforcement costs
- Safety costs.

Association's View

The Association is of the opinion that many Local Governments are struggling to provide the infrastructure required for heavier vehicles on networks that are not at the required standard. The general view of Councils in WA is that if the infrastructure is provided at a standard to take heavy vehicles, it can take all other classes of vehicle. However the majority of the cost is associated with upgrading networks to accommodate heavy vehicles and this needs to be taken account of by pricing of heavy vehicles to better reflect pavement damage.

5 Full Economic and Social Costs of Road and Rail Freight

What are the major externalities associated with road and rail freight infrastructure use?

Externalities are defined as: 'The effects of economic activities which are experienced by third parties, but which are not reflected in the prices of the activities. Since producers and consumers make their decisions on the basis of prices, the external effects are not taken into account' (Tepper and Tsolakis, 2000).

The existence of external costs and benefits creates a divergence between marginal social cost (MSC) and marginal private costs (MPC), where MSC is greater than MPC. Failure to price resources at their marginal social costs results in a deadweight loss to society, a reduction in the overall social benefit and distortions in the allocation of scarce resources. Therefore, externalities are third party effects arising from the production and consumption of goods and services for which no appropriate compensation is made.

Transport use results in four main categories of externalities for road and rail: congestion, accidents, environmental costs (including air pollution, global warming, noise and water pollution, nature and landscape and urban separation). Additionally, road damage is also considered as an externality. This includes increased repair cost of the road, borne by the road infrastructure provider, and the increased vehicle operating costs for the other road users (Mayeres, 2002).

Externalities are highly interrelated, whereby one cannot be considered independent of the other. For example, congestion is considered to impose relatively high costs to the transport system, and affects the level of other externalities, such as accidents, noise and noxious emissions (BTCE, 1993). However, externalities are not always perfectly correlated. The marginal external costs vary widely in respect of the network considered, the volume of traffic, vehicle type and other factors (Mayeres, 2002). Additionally, externalities vary significantly by location and time of day and other dimension such as by vehicle class, mass, distance traveled, type of road and extent of vehicle use (BTRE, 2003c). As many externalities are location specific, they are estimated to impact many local communities and impose social costs.

Table 4 provides a summary of environmental effects of road and rail transport.

Table 4: Environmental effects of road and rail

Item	Air	Land	Water	Noise and vibration	Waste	Risks of Accident	Other impacts
Road transport	Air pollution (carbon monoxide (CO), particulate matter (categorised by particle size PM_{10} and $PM_{2.5}$), oxides of nitrogen (NOx), sulphur dioxide (SO_2), sulphur oxide (SOx), non-methane volatile organic compounds (NMVOC), lead (Pb) (of declining concern due to the phasing out of leaded fuel), and low-lying ozone (O_3) and refuelling activities	Land reclaimed for road transport infrastructure and maintenance works: extraction of building and other material types (eg. for energy usage), pattern of urban development and regional structure	Pollution of groundwater and surface water by run-off, including leakages: modification of overland flow paths from construction of transport infrastructure: altered hydrology may affect vegetation	Noise and vibration from cars, buses, heavy vehicles, rail etc. along roads; noise from road construction and maintenance works	Road vehicles removed from surface; waste oil and other products from maintenance activities; spoil material from road works; rubble material from disused infrastructure; waste from end-of-life tyres	Injuries, death and property damage from road accidents including injury and death of fauna; risk of transportation of hazardous substances into the natural environment (e.g. air, land, water); risk of structural failure of road infrastructure	Loss or segregation of fauna habitat; loss of agricultural land; urban separation; congestion.
Rail transport	Diesel emissions (e.g. soot) from the combustion process in non-electrified trains, typically for freight purposes; emissions produced by energy production activities	Land reclaimed for infrastructure and rolling stock facilities (usually less than that required for road transport systems); extraction of primary resources for energy use; pattern of urban development and regional structure	Embank-ments affect drainage paths	Noise and vibration around terminals; marshalling yards and along railway lines; noise and vibration generated by trucks and trailer hauling goods to and from rail yards via the road system.	Disused rail equipment removed from service; disused rolling stock; washdown water; waste oil and other products from maintenance activities.	Derailment or collision of passenger trains; derailment or collision of freight carrying hazardous materials	

Source: Adapted from Johnston and Morris (1998).

Congestion

A recent report conducted for the Victorian Competition and Efficiency Commission (VCEC) titled ‘Defining Transport Congestion’ (Naude *et al.* 2006), highlights the fact that although congestion is such an apparent problem in many urban centres and apparently imposes enormous costs on the economy, there is no consensus on what constitutes a standard, generally acceptable definition of congestion (see Boarnet et al., 1998 & Gerondeau, 1999 in Naude *et al*. 2006).

Congestion is usually related to outcomes such as reliability and cost of travel, and high congestion is seen as undesirable. However, in some quarters it is argued that congestion can be desirable as either an indicator of activity or as a somewhat crude demand management tool (Taylor, 2002 in Naude *et al.* 2006).

An economic approach to congestion is based on the increasing cost (marginal cost) arising from additional vehicles, which involves both increases to the costs incurred by individual users themselves (marginal private cost of users through, for example, increased vehicle operating costs and time costs), as well as increases in the costs to society as a whole (marginal social cost to society through, for example, congestion and other externalities such as vehicle emissions) (Newbery, 1990 in Naude *et al*. 2006).

As additional vehicles make use of the road and congestion increases, the costs to society become higher, and increase more rapidly, than the costs to individual road users, particularly in urban areas. However, unlike these increased private costs that are paid directly by road users themselves, the increased costs of congestion incurred by society as a whole are not normally covered by the road users who have caused them. Congestion therefore needs to be reduced because leaving road users to simply queue for access to the road network is wasteful of society's resources (Naude *et al.* 2006; VCEC, 2006).

In addition, the economic approach to valuing congestion argues that to eliminate congestion to the point where traffic flows freely would not be desirable because road infrastructure would then not be utilised efficiently and economic activity would also be constrained. Rather, the economic approach argues that there is an 'optimal' level of congestion that needs to be reached where some road users either do not travel at all, postpone their trips to another day, travel at different times of the day (off-peak) or travel on other modes (public transport) or with other users (ridesharing) (Naude *et al.* 2006; VCEC, 2006). How the 'optimal' level of congestion is reached may be through any combination of travel demand management techniques that are appropriate to the situation (Newbery, 1990 and Verhoef, 2005 in Naude *et al.* 2006).

The way in which the different transport modes interact influences the level of congestion, either because they directly share road space (private cars, buses and freight vehicles) or because the infrastructure they require is placed on a shared transport corridor (e.g. the Melbourne tram system shares transport corridors with road traffic). The number of private cars using a road system may cause congestion and may impact on the reliability of public transport timetables and freight/logistics schedules when they directly share road space. Public transport and freight vehicles will also affect the general traffic flow (and in turn road congestion) because they require more road space and are slower to accelerate than passenger cars. Congestion affects public transit systems through the speed at which these services can operate as well as their reliability. This will affect other public transit services that are linked to these operations. It might also increase labour costs through extended working hours, as well as increased numbers of vehicles and drivers (Naude *et al.* 2006; VCEC, 2006).

The issue of congestion on rail is also fundamentally different from that on road. This is because access to the road network is generally open, whereas access to the rail network is invariably obtained only at a price, whether it involves rail operators bidding for a slot on the rail network or rail customers who have to pay for rail services (as freight customers or passengers) (ECMT, 1999 in Naude *et al.* 2006).

Crashes

Some externality costs are more difficult to define than others. These include the evaluation of crash costs. Mayeres (2002) notes that an additional vehicle to the traffic flow results in three types of safety related costs to society:

- the individual transport user is exposed to crash risk – the social cost is consistent with the individual's own utility loss due to the crash risk (internal) e.g. output loss, medical costs, police costs etc;

- the additional transport user may have an impact on the crash risk of the other infrastructure users and hence associated costs for society and these other users;
- other transport users will adapt their behaviour when confronted with a changed traffic condition. The extent of avoidance costs depends on the liability and compensation rules etc.

There also exists uncertainty in the proportion of crash costs that are internal or external. Martin (2006) notes that the ISC (1990) define external crash costs as the difference between insurance premiums and total crash costs, which draws on the logic that if insurance serves as the mechanism to internalise the external costs of crashes and if the total cost of crash exceeds the total insurance premiums, the difference must, by definition, be external. However, insurance is only one mechanism for internalising costs and road users may opt to carry some risk themselves. Hence, Martin (2006) notes that to count only the insurance premiums would completely ignore the residual costs borne by the road users.

According to BTRE (2000), the average cost of a road fatality was estimated at $1.5 million, a serious injury $325,000 (requiring hospitalisation) and a minor injury $12 000. Estimated crash costs in 1996 have increased by $6 billion over the estimate for 1988 (when both are expressed in 1999 dollars). Among the more significant contributors to the increase were the inclusion of a cost estimate for long-term care ($2 billion) and an improved estimate of costs associated with traffic delay (about $1 billion more than the 1988 estimate) (BTRE, 2000).

For rail, the BTRE (2003b) notes that the average economic cost of rail crashes was estimated to be approximately $133 million in 1999 dollars. This figure was based on a real discount rate of 4 per cent. Additionally, the total cost of level crossing crashes was estimated to be $32 million in 1999. About $10 million of this is thought to be due to level crossing crashes involving motor vehicles. Rail-related suicides and attempted suicides were estimated to have cost $53 million and the total cost of all rail-related incidents was estimated at $196 million. It is noted that crash costing is an inexact science. Cost estimates depend on the particular costing approaches used, the number of crash cost components that can be estimated, the quality and quantity of available data and the value of key parameters used (such as the discount rate) (BTRE, 2003b). This is often declared as an area requiring further research (Laird, 2005). Finally, the portion of rail crash costs that can be attributed to rail freight is difficult to determine.

Environmental Effects

Society places a high value on a clean and healthy environment. This includes monitoring the issues of air pollution, global warming, noise and water pollution, nature and landscape and urban separation. Most negative externalities are directly correlated with demographic and location aspects. Analysis of these environmental impacts requires identification of the dispersion of pollutants to different locations and how they have been transformed (Kahn, 1998). Hence many environmental externalities are highly location specific and impact directly onto local communities in the forms of adverse health effects, degraded visibility, loss of biodiversity, and damage to infrastructure such as discolouration of stone, erosion and building soiling (BIC, 2001).

The OECD (1996) notes that localised noise pollution is generally perceived by society to be the first and foremost problem associated with road traffic. It is estimated that nearly 40% of Australia's population is exposed to undesirable traffic noise and a further 10% to excessive traffic noise (NRTC, 2001). Noise may also lead to a number of health impacts, through a variety of direct and indirect effects, and arises from tyre contact and from vehicle engines, though there may also be noise from auxiliary systems such as compression brakes, refrigeration and from other intermittent sources (e.g. loads) for heavy vehicles (BIC, 2001). At low speeds, engine and drive-train noise are dominant. At higher speeds (e.g. above 45 kph), tyre/road contact noise becomes dominant and differences between engine noise are less important (BIC, 2001). Additionally, noise pollution is associated with rail freight due to locomotive noise, vibration, wheel squeal, which in turn has been linked to health impacts such as annoyance, sleep disturbance, and possible increased risk of cardiovascular disease.

Another localised environmental externality effecting communities is air pollution from both road and rail freight modes. Recent studies identify a strong link between air pollution and increases in adverse health effects imposed on society as a result of transport, particularly in urban areas (Pratt 2002). Air pollution externalities, pollutants of greatest concern to society include carbon monoxide (CO), particulate matter (categorised by particle size PM_{10} and $PM_{2.5}$), oxides of nitrogen (NOx), sulphur dioxide (SO_2), sulphur oxide (SOx), non-methane volatile organic compounds (NMVOC), lead (Pb) (of declining concern due to the phasing out of leaded fuel), and low-lying ozone (O_3), a main constituent of photochemical smog (Johnstone, 1999; RCG/Hagler Bailly, 1994). According to the BTRE (2005), the mid-range estimate of annual health related costs from air pollution associated with motor vehicles was $2.33 billion in 2000. As air pollution is associated with the level of population, it has been shown that urban areas, where population levels are highest are exposed to higher levels of air pollution than less populated areas.

Though greenhouse gas emissions and climate change are independent of location, they are of serious concern to governments, industry and the community. According to the BIC (2001) carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) are the main emissions of concern from transport fuel production and use. As these emissions are not localised, it is considered that a tonne of CO_2 released from upstream fuel refinery processing can be treated in an identical manner to a tonne of CO_2 released from a vehicle in an urban area (BIC, 2001). This is particularly important when determining the greenhouse impacts relating to passenger rail which are electricity operated. The generation of electricity requires the production of greenhouse gas emissions, therefore should be accounted for in the costing of emissions associated with rail. This is known as a life-cycle analysis.

Finally, other environmental externalities include water pollution, nature and landscape and urban separation, which are perhaps less publicised within the community. Water pollution results from transport e.g. run-off from roads from vehicles: engine oil leakage and disposal, road surface, particulate matter and other air pollutants from exhausts, tyre degradation (Tepper and Tsolakis, 2000). Nature and landscape externalities and urban separation effects are also highly location specific. These include effects such as loss of natural areas, ecological impacts (to land, water and biodiversity) and reductions in quality of landscape (Austroads 2003). Urban separation effects are the constraints to mobility of pedestrians and are also known as 'barrier effects'. For example, the existence of infrastructure or use of infrastructure may create delays or danger to pedestrians crossing roads (Pratt, 2002).

Damage Costs

According to the ARTC (2001), the damage to the road pavement is caused from the number of axle loads across a section of highway. Pavement damage is related to the mass of the axle load and freight vehicle type. The damage from passenger cars is considered almost negligible. Other influencing factors affecting pavement damage include weather conditions which account for a significant fraction of road deterioration. Empirical work has identified that there exist user costs associated with the damage to the pavement such as those including increases in the operating costs of vehicles.

As noted above pavement damage is also associated with the proportion of heavy vehicles on roads. With increases in freight vehicles on roads, this may result in increased pavement damage, in turn adding significantly to local government road expenditure. This is also an argument by rail advocates to encourage the movement of road freight to rail as a way of reducing vehicle numbers on roads and subsequent associated road pavement externalities.

Another externality associated with road transport is the waste associated with end-of-life tyres. In other words, this refers to the extent of any market failures applying to the management of end-of-life tyres in Australia (i.e. whether there has been a failure of the market to efficiently allocate the resource value contained in end-of-life tyres). Illegal dumping of end-of-life tyres is of concern to local communities whereby it has been associated with environmental and human health risks.

In the last decade, significant progress has been made within Australia in developing robust externality values to assist in internalising externalities. These studies include, Austroads (2003; 2004), ATC (2004), Pratt (2002), Laird (2003; 2005), Port Jackson Partners (see Australasian Railway Association 2005), BTRE (2004), ARTC (2001), Affleck (2002), ACIL (2001), BIC

(2001), BTE (1999), Meyrick (1994), the EPA Victoria (1994), and recently NTC (2006b). Whilst considerable research has been undertaken for road external costs, there is evidence that rail valuation requires additional consideration. Many rail externality benefits are associated with diverting tonnage from road to rail (ARTC 2001).

Association's View

In terms of externalities, the Association submits that externalities should be properly accounted for and internalised. A possible mechanism is through incorporating these costs into road freight infrastructure pricing based as far as possible on actual road use in terms of the allocative efficiency principle. Because the impacts of externalities such as congestion, accidents, noxious emissions, greenhouse gas emission, noise, amenity costs and road damage are primarily felt by Local Governments, revenues derived from road freight transport pricing, incorporating externalities, should be allocated to this sphere of Government where permitted.

6 Options for Pricing Reform

What are the key attributes of road use likely to affect road infrastructure costs (for example, vehicle and load mass, the distance travelled, the location and type of road)? What is the nature of the linkages?

Should costs of some or all external effects associated with freight transport be incorporated in road and rail charges? Which ones? Why or why not? Is it feasible to incorporate costs of some or all externalities in road and rail prices?

The key attributes impacting on road infrastructure costs as far as heavy vehicles are concerned lie in the mass-distance relationship of the vehicles, but also on the pavement type and condition, as well as soil type and rainfall. While it is important that an improved pricing approach takes account of the mass-distance traveled by heavy vehicles it is equally important that the approach take account of the road types actually used because the effect of the same load on a weakened pavement type will be far worse than on a properly-maintained or higher standard of road.

Mass-distance charging for heavy vehicles is efficient because it links road use with road damage or the need to upgrade road infrastructure, including bridges, to accommodate heavy vehicles. Mass-distance charges are also efficient because the costs associated with road-wear increases exponentially with axle loading (BTRE, 2003c). Variable heavy vehicle charges such as mass-distance charges are efficient because they link the marginal cost of road use of heavy vehicles to payment for this use, thereby aiming to eliminate roads being over-used by heavy vehicles. In turn, this linkage provides appropriate road investment signals (BTRE, 2003c).

Registration charges are aimed at vehicle ownership as opposed to road use and so are more applicable as a tax or general charge, although they are undoubtedly easier to administer and useful at raising revenues. If registration charges are structured to vary with vehicle or engine size that might increase the efficiency of the system. Fuel taxes are also useful if the objective of the scheme is revenue raising and ease of administration, usually because these schemes involve collection by fuel companies. However, as vehicles have become more efficient, the revenue from fuel taxes stands to fall in relative terms, paving the way for a pricing approach based on road use. Also, the fuel excise on diesel, which accounts for just under 70% of total heavy vehicle charges, is not optimal as a variable heavy vehicle charge (BTRE, 2003c). This is because with heavy vehicle economies of scale, fuel consumption increases at a declining rate as vehicle load increases.

According to the BTRE (2003c) there is no charging for externalities in either road or rail modes. Whilst it is noted that externalities are generally lower for rail freight than for road freight, the BTRE (2003c) acknowledges that it would not be appropriate to charge heavy road vehicles (and/ or freight trains) and exclude light vehicles (and/or passenger trains). For example, in terms of greenhouse gas emissions, emissions from intermodal freight movements in Australia have been estimated at between 31% and 54% of those of 6-axle semi-trailers and between 41% and 70% of those of 9-axle B-doubles (BTRE 2003c).

A well-designed framework for charging for externalities has the benefits of presenting users with the social cost of their behaviour and would thereby improve the efficiency of land transport infrastructure use (BTRE 2003c). These are the positive aspects of incorporating external effects into a charging system.

Charging for externalities is challenging due to their varying dimensions such as location, time of day, degree of the impact (localised air or noise pollution, and congestion), weather conditions, engine efficiency and fuel use (BTRE 2003c). Two main approaches exist in addressing externalities. These include charging users for external costs or limiting externalities by regulating activity (BTRE 2003c). When considering whether the costs of some or all external effects should be incorporated in road and rail charges, it is important to note that some are more complex than others. For example, within Australia and internationally, congestion charging options are being introduced and considered e.g. cordon pricing, link/network pricing (distance- or area-based pricing) and HOT lane pricing. This provides an opportunity to charge for these congestion externalities. Whereas other externalities, such as air pollution are more difficult to measure at any given point of time, hence regulation may be a more feasible approach to use.

Difficulties also exist in charging for some externalities, where some may already be partially internalised e.g. there exists debate on whether crashes are internalised via private accident insurance and compulsory third party premiums. Additionally, some externalities may be compensated for in the market place. For example, noise costs may be reflected in property prices and noise barrier costs.

Consideration is required into which modes and vehicle types should be charged. For example, if only heavy vehicles are to be charged for congestion, operators would be subjected to a charge that results in little change to traffic conditions. This is because heavy vehicles comprise approximately 5% of the vehicle fleet (BTRE 2003c).

Whilst it is feasible to incorporate some external costs into a pricing mechanism, there exist complexities in incorporating all and providing a balance between charging and regulation. A question is raised in whether externality charges should take the place of, or supplement regulatory approaches (BTRE 2003c).

In accounting for damage cost externalities, work is being undertaken by Austroads and the National Transport Commission through consideration of higher mass limits. However, even if regulatory approaches for reducing these effects are to be implemented, it is dependent on data accessibility in order to make these assessments.

Association's View

In terms of the Association's submission, a key issue from Local Government's point of view is that the revenues obtained from an improved heavy vehicle pricing structure based on the mass-distance approach must find their way back to the Local Governments responsible for the roads that are used and therefore impacted upon, in proportion to the impacts. The pricing regime must also apply to usage by heavy vehicles of local roads as well as Federal/State roads to avoid heavy vehicles diverting onto local roads due to a differential pricing structure. It is essential for this approach to be successful that heavy vehicle charges take account of the impact of different heavy vehicle classes or combinations on different pavement types and the Association would therefore support more research into these relationships at a national level.

The Association also submits that the incorporation of externalities into heavy vehicle charges must be complemented by a road funding system that returns revenues to the jurisdictions or sphere of government in which these externalities are incurred, i.e. Local Governments. Local communities are impacted most by heavy vehicle externalities such as road damage and noise and authorities at this level must be provided with the funds necessary to mitigate these impacts. This would include not only heavy vehicle usage of local road networks but also use of other (e.g. national) road networks that traverse Local Government jurisdictions but where externalities impact local communities, such as environmental effects.

7 Impacts of Different Pricing Regimes

> *If, for example, road user charges were directly related to the distance travelled and marginal damage to roads, including regional road networks, what implications might this have for regional and remote communities? What are the major constraints on modal choice in these areas (for example, access to rail or inter-modal facilities)?*

The introduction of pricing for heavy vehicle travel on regional road networks through a mass-distance charging approach may result in higher transport costs with these costs being passed on to the end consumer. However, this depends on pavement type, number and type of vehicles being used and loads involved. However, it may also result in correct pricing signals being given for long distance heavy vehicle road use, especially if rail infrastructure usage is also priced correctly. No choices exist, if rail or inter-modal facilities are not available.

If heavy vehicle road usage is for the benefit of a particular enterprise, e.g. a mine, heavy vehicle road use ought to be priced. Another option explored in Pettet (2005) is for Local Governments to apply a levy to the developer to cover additional funding required to provide infrastructure because of the benefits accruing to the developer from that investment. However, pricing of road use should be considered where roads ‘display private goods characteristics’ or are mostly used for economic purposes (in terms of the economic criteria of excludability and rivalness in consumption). However, roads that are provided mostly to facilitate ‘basic access’ (‘display public goods characteristics) i.e. in terms of non-excludability and non-rivalness in consumption) would not be priced but funded out of general taxation, because they serve a social purpose in providing basic access to remote areas, as well as linking communities and also linking these communities with the wider road network (Way and Chapman, 2004).

This means that roads serving remote/regional communities might be considered as public goods and funded as such to the extent that a minimum standard of road is required. However, where they need to be upgraded to accommodate heavy vehicles, this additional cost should be met from a higher sphere of government or from the transport operator or end business as a commercial cost. Rural road funding requirements are an extremely important part of the road network which frequently goes without adequate funding because of the relatively low political influence rural communities sometimes have – because of their low traffic volumes and low population densities. Czuczman (2003) points to the low political profile of road maintenance activities compared to higher profile activities such as road construction and rehabilitation. In the context of rural roads, this lack of political weight must be borne in mind when safeguarding rural road investment in the long term.

A similar argument could apply to branch rail lines serving rural communities or agricultural industries (see section 9 for more detail).

8 Technical Feasibility and Costs of Pricing Options

> *How well have distance and location pricing regimes performed overseas? What have been their objectives and have these been achieved? Are there lessons for Australia?*

The most notable heavy vehicle charging systems that have been introduced internationally include the following case studies.

LSVA (Switzerland)

The Swiss heavy vehicle, distance-based, charging system (LSVA) was introduced as a result of expected increases in heavy freight vehicle traffic passing through Switzerland, particularly on the Germany-Italy and Italy-France inter-country corridors. One objective of the scheme was to limit increases in traffic when the national mass limit was increased from 28 tonnes to 34 tonnes in 2001, and to 40 tonnes from 2005 onwards. It was also aimed at encouraging a modal shift from road to rail for trans-alpine goods transport. Money raised from the scheme is primarily used for financing the new railway tunnels through the Swiss Alps.

The principles of the scheme were set out as follows:

- the charge involves all HGVs weighing over 3.5 tonnes;
- the vehicle is charged by distance travelled on all roads (including private roads, yards, manoeuvring) in Switzerland and the Principality of Liechtenstein;
- the charge is based on maximum permissible laden weight of the total vehicle train, not actual weight;
- the tariff depends on the emission category of the HGV;
- the charge replaced a flat, time-based charge;
- the owner of the vehicle or the driver of the vehicle (with foreign vehicles only) is liable for the tax (joint liability);

The scheme is operated by the Swiss Customs Authority and started operation on 1 January 2001.

Key Lessons Learned: The scheme has been very effective in terms of reducing traffic. It is also a relatively simple scheme. Enforcement is accomplished via the in-vehicle unit (IVU), which implies very little road-side enforcement and so the scheme is believed to be cost-effective. This has also made the scheme more acceptable because it has good but non-intrusive enforcement.

Lorry Road User Charging (UK)

This scheme was planned as a nationwide Lorry Road User Charging Scheme (LRUC) in 2008. However, it has been very recently stopped as an independent scheme, and it is now to be integrated within a broader road pricing system in the UK.

The lorry road user charge scheme as envisaged was to apply to all lorries of gross vehicle weight over 3.5 tonnes. The aim of the scheme was to ensure that all lorries using UK roads paid the (external) costs they imposed. Foreign heavy freight vehicles entering the UK and about 450,000 British HGVs would have been liable for the charge and, at the same time, eligible for the fuel-duty reduction. The LRUC was to move from a system based on fuel excise to distance-based taxation, so as to remove a competitive advantage accruing to foreign vehicles entering the UK once they had filled up with cheaper foreign fuel. The charge had been designed to apply to all UK roads, thereby reflecting the full costs imposed by all heavy vehicle trips and would also have eliminated the risk of diversion to smaller roads. The objectives of the LRUC program were as follows:

- fairness and efficiency - all users of UK roads should contribute at a level that reflects the marginal social cost of travel in the UK
- positive impact on transport and the environment. The charge should reflect most of the external costs such as greenhouse gas emissions, local air quality, road maintenance, safety, traffic congestion and noise.
- The LRUC program was to consist of three different components:

- main scheme – for frequent road users (using IVU technologies)
- casual/infrequent user scheme – for infrequent road-users (using local IVU technologies)
- offsetting fuel-duty reduction scheme.

On 5 July 2005 the scheme was cancelled and the procurement process was halted by government ostensibly so that it could be integrated in wider plans for national road pricing not scheduled to start before 2015. The actual reason behind the cancellation of the programme was the cost of the scheme. The scheme was to be revenue-neutral (all charges to be paid back through fuel duty repayments) and the cost of operation was going to be high, which implied very poor benefit-cost balance.

Key Lessons Learned: The objectives of the scheme have been criticised as too ambitious. The aim to use sophisticated technology and a political requirement for a much differentiated fee (two tariffs according to type of road and differentiation according to time of day) made the system complex and too expensive for the government to push ahead with. Strong political leadership, a critical requirement of any charging scheme, was lacking.

Road User Charges (New Zealand)

A road user charging system for diesel vehicles is in place in New Zealand (see www.ltsa.govt.nz). All vehicles over 3.5 tonnes manufacturer's gross laden weight and all vehicles 3.5 tonnes or less powered by fuel not taxed at source (e.g. petrol) require a road user charges license. These distance licenses are purchased prior to travel by the vehicle and charges are levied according to the weight of the vehicle and the distance envisaged to be traveled, for both powered (haulage unit or truck) and unpowered unit (trailer). The system includes the use of hub odometers to be checked against the distance traveled. The road user (mass-distance) charge is required in addition to the registration charge applicable to the vehicle. Refunds for distances not travelled are made, based on hub odometer reading.

The NZ Ministry of Transport has initiated an electronic road user charging (e-RUC) project to evaluate an electronic system as opposed to the manual system used until now. This project is still underway (see www.transport.govt.nz).

The funds accruing from the road user charges are channeled into the National Road Fund, from where they are allocated to various transport functions (e.g. safety programs, road funding, enforcement and accident compensation) together with revenues obtained from other sources such as motor vehicle licensing and registration charges and fuel duties. Road expenditures are allocated through the Transfund National Roading Program (NRP) according to the priorities developed by Road Controlling Authorities (RCAs) including Territorial and Local Authorities (TLAs).

Key Lessons Learned: The system has been extremely successful in terms of linking road use and payment by various categories of heavy vehicles, revenue-raising and has been efficiently administered with a high level of compliance. It is due to be strengthened with the introduction of the e-RUC system once the required evaluation has been completed. Although revenues accruing from the charges are spent within the transport system, there is no direct linkage between heavy vehicle usage of roads within a particular local jurisdiction and the revenues allocated to them via the NRP.

Mass-distance charging enables more efficient pricing. In terms of the current heavy vehicle charging approach in Australia, the combination of a fixed annual registration charge and variable fuel excise is argued to not be 'optimal' (NRTC, 2003). This is because it does not match the marginal cost of road use of individual heavy vehicles. Those vehicles that are heavily used and are fuel efficient are likely to be undercharged. Similarly, BTRE (1999) argues that heavily laden vehicles are undercharged and those lightly loaded are overcharged with charges not reflecting the road wear costs caused by heavy vehicles. According to NRTC, 2003 and BTRE (1999), an appropriately established and operated mass-distance charges system for heavy vehicles is expected to largely correct these deficiencies.

Heavy Vehicle Toll Collection System (Germany)

A proposal for a heavy vehicle tolling system for Germany has been delayed by government due to technical difficulties. The system was intended to have an onboard computer in heavy vehicles to log their location with satellite signals and report the vehicle's movements by mobile phone. However the system, the most advanced in Europe, was delayed for technical reasons throughout its history and was scheduled to be operational by August 2003.

Association's View

The key issue for the Association is that there is a clear need for revenues obtained from heavy vehicle charges to be returned to the infrastructure providers whose road infrastructure has been used. In some cases this means Local Governments because of the amount of heavy vehicle traffic on roads on Local Government managed networks. The experience of Switzerland and New Zealand hold important lessons for Australia in terms of how a system of heavy vehicle charging might work and these examples merit closer examination by the Inquiry. The direct linkage between charges and actual road usage is an issue that needs to be better understood in the case of application of such a system in Australia given the size of the country and distances travelled. The heavy vehicle charging system applied to Australia would have to involve Local Government because of the usage of their road networks and the fact that heavy vehicles on national networks frequently pass through Local Government areas and the externalities generated impact on local communities.

9 Impediments to Efficient Pricing and Operation of Transport Infrastructure

How can infrastructure investment decision-making be improved? For example, through application of consistent and transparent cost–benefit methodologies. Or are institutional reforms also needed to promote a more commercial approach to road and rail infrastructure provision and pricing? What institutional reforms would be most effective or desirable?

Infrastructure decision-making would benefit significantly from the consistent application of benefit-cost methodologies applied to both road and rail infrastructure. Investment in road and rail infrastructure options can only be compared if the same basic analytical approach is used across modes. With its roots in welfare economics, benefit-cost analysis (BCA) was developed to assess the 'value of economic decisions in terms of their capacity to satisfy the totality of individual wants of all members of society' (Austroads, 2005). BCA enables different projects to be compared and in turn to assist government in the allocation of scarce funds to competing projects. BCA was developed specifically to assess whether public sector investments in large projects that would not normally be provided by the private sector, e.g. transport or road and rail infrastructure projects, would be beneficial to society as a whole. For this reason, BCA is ideally suitable for the evaluation of road and rail infrastructure projects and has been used for this purpose for decades. In terms of Ferreira and Starrs (1993) therefore, 'cost-benefit analysis offers a rational basis for choosing between different projects'. Unlike private sector projects that are usually assessed primarily in terms of a financial analysis, public sector projects are therefore assessed in terms of their economic benefits and costs to society.

Table 5 compares financial and economic analysis approaches. Where financial analysis would use market prices, BCA uses shadow (resource) prices (i.e. prices minus taxes and subsidies). BCA also evaluates future benefits and costs over the appropriate investment horizons via a discount rate, which is often prescribed by government for use in the evaluation of public sector projects (De Brucker et al, 1995). Appropriate discounting of benefits and costs leads to summary estimates of the project worth such as net present values (NPV) and in turn benefit cost ratios (BCR).

Table 5: A comparison of financial analysis and BCA

	Financial analysis	**Benefit–cost analysis**
Area of application	Private sector	Public sector
Objective	To maximize shareholder wealth	To maximise social welfare
Scope	Shareholders	Society
Prices	Market prices	Shadow (resource) prices

Source: Austroads (2005)

BCA is often used in the absence of well developed markets for infrastructure investments - transport infrastructure projects are not like other economic goods for which a market exists with prices determined by supply and demand. It also depends on the principle of consumer sovereignty which holds that in the absence of a market, consumers are the best judges of their own preferences.

BCA, therefore, is the most appropriate method that can be used to evaluate and compare the relative worth to society of large transport and other related investments. For example, competing road and rail infrastructure project investments, using a common numeraire and common methodologies.

BCA is also useful because it enables the evaluation of projects according to their impacts, namely: social, economic (vehicle operating cost, time savings, accident savings) and environmental externalities (noise, air pollution, groundwater contamination) (Berry and Cullinan, 1998).

The results of BCA can also be extended into sometimes complementary Multi Criteria Analysis (MCA) frameworks, which enable decision-makers to determine how best to allocate funds to a range of transport infrastructure projects taking account of mostly benefits that are difficult or deemed inappropriate to monetise by affected communities/parties.

In addition to BCA, other evaluation methods that may be considered but have not been as widely used or understood include (Johnston & Morris, 1998):

- Cost-effectiveness analysis (a special case of BCA)
- Total cost analysis
- Planning balance sheet
- Goal achievement method
- Goal programming
- Measures of effectiveness.

However, most of these methods are special cases of complete BCA and MCA applications, or are employed to facilitate broader (or more strategy oriented) accounting and decision-making-management evaluation requirements.

Even if institutional reforms were introduced in the area of road and rail infrastructure ownership and management, the organisations involved would not necessarily avoid the need to compare alternative investment options across modes, so BCA methodology would probably still be required. The need for a revised road and rail infrastructure pricing could be part of what Howard (2003) calls a national 'outputs focused' approach that allows individual States to develop their own technical inputs required to meet local and regional road needs which would then be aggregated at the national level and presented to government as the total need for investment in transport infrastructure.

Association's View

The key issue here in terms of the submission is that the funding allocated should be allocated to local needs based on how/where the revenues are collected, once pricing for road use by heavy vehicles is introduced. Moreover, although the Roads to Recovery Program has been very welcomed by Local Government throughout Australia, an effective pricing regime is required to prevent the infrastructure investment made through this Program from being squandered through overuse. It is widely acknowledged that the Roads to Recovery Program is very successful, however there is a need for sustained funding over a period of time to ensure that adequate funding is made available for regular maintenance given that the freight volumes and loading configurations are also likely to increase over time. It should not be part of an *ad hoc* approach to infrastructure funding by government (Lay, 2001) that inhibits comprehensive long term planning by Local Governments.

The current maintenance and enhancement backlog in rail infrastructure owned/managed by the State Government in WA is a concern because, if the freight task is to double in the future, investment will be required to ensure that rail has sufficient capacity to deal with any increase in freight volumes. Similarly, road infrastructure must be adequately funded so that the road system, especially that in local areas can cope with the projected increases. The need to ensure that rural road and rail links are maintained is significant because of limited infrastructure choices in remote rural areas. Where infrastructure in remote areas serves only commercial purposes, a strong role in funding from commercial enterprises is required. Clarity on the pricing of road and rail infrastructure for freight vehicles is essential to ensure that users of the system have real choices and that the proper investment decisions are made and that the transport system is sustainable. This will not be the case under the current regime of ad hoc funding allocation and investment appraisal.

Of particular significance to the Association is the issue related to the diminishing investment by the Commonwealth and State Governments in rail infrastructure, particularly the narrow gauge rail in WA. This will have flow on impacts to roads. The Association's position is that given that each mode, i.e. road and rail will need to increase its share of freight given the well documented, anticipated doubling of the freight task, Commonwealth and State Governments need to consider investing in rail infrastructure to ensure that road is not adversely impacted upon (although the funding should not be just diverted from road, as road will need to increase its share as well, in particular where there are no inter-modal options available, such as rural and remote WA).

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Appendix A: Rural and Urban Arterial Road Expenditure, Western Australia, 2001/02 to 2004/05

Table A1: Rural and urban arterial road expenditure($m), Western Australia, 2001/02 to 2004/05 (% change p.a. in parentheses)

Road type	2001/02	2002/03	2003/04	2004/05
Rural arterials	322.3 NA	371.5 (15.3%)	363.9 (-2.1%)	302.3 (-16.9%)
Urban arterials	180.4 NA	185.4 (2.8%)	232.6 (25.5%)	263.5 (13.3%)

Source: NTC (2006)

Appendix B: Separable and Non-separable Costs by Vehicle Type and Road Type

In this Appendix, the 1998 NRTC estimates for separable and non-separable costs by road category and by type of vehicle are presented in Table B1, Table B2 and Table B3.

Table B1 Costs allocated by road category and vehicle type in $million

Road type & vehicle type	Allocated expenditure ($m)		
	Separable	Non-separable	Total costs
Local roads			
Light vehicles	140	530	670
Heavy vehicles	260	20	280
All vehicles	400	550	950
Arterial roads			
Light vehicles	540	1,970	2,520
Heavy vehicles	920	190	1,110
All vehicles	1,460	2,170	3,630
All roads			
Light vehicles	680	2,500	3,180
Heavy vehicles	1,180	210	1,390
All vehicles	1,860	2,710	4,570

Source: NRTC (1998)

Table B2 Proportion of separable and non-separable costs across road categories

Road type & vehicle type	Allocated expenditure (%)		
	Separable	Non-separable	Total costs
Local roads			
Light vehicles	21%	79%	100%
Heavy vehicles	93%	7%	100%
Arterial roads			
Light vehicles	21%	79%	100%
Heavy vehicles	83%	17%	100%
All roads			
Light vehicles	21%	79%	100%
Heavy vehicles	83%	17%	100%

Road type & vehicle type	Allocated expenditure (%)		
	Separable	Non-separable	Total costs

Source: NRTC (1998)

Table B3 Proportion of separable and non-separable costs across vehicle categories

Road type & vehicle type	Allocated expenditure		
	Separable	Non-separable	Total costs
Local roads			
Light vehicles	35%	96%	70%
Heavy vehicles	65%	4%	30%
All vehicles	100%	100%	100%
Arterial roads			
Light vehicles	37%	91%	69%
Heavy vehicles	63%	9%	31%
All vehicles	100%	100%	100%
All roads			
Light vehicles	37%	92%	70%
Heavy vehicles	63%	8%	30%
All vehicles	100%	100%	100%

Source: NRTC (1998)

Appendix C: Vehicle-Related Road Expenditure Categories and Shares

Table C1: Vehicle-related road expenditure categories and shares

Expenditure category	**Cost allocation (%)**				
	Separable				**Non-separable (all vehicles)**
	VKT	**PCU-km**	**ESA-km**	**AGM-km**[7]	**VKT**
Services & operating expenses	100%				
Pavement & shoulder maintenance					
Routine maintenance				50%	50%
Periodic maintenance				50%	50%
Bridge maintenance & rehabilitation				33%	67%
Road Rehabilitation			45%		55%
Low cost safety/traffic improvements	80%	20%			
Asset extension/ improvements					
Pavement components			45%		55%
Bridges			15%		85%
Land acquisition			10%		90%
Earthworks			10%		90%
Other			10%		90%

[7] AGM stands for average gross mass.

Expenditure category	Cost allocation (%)				
	Separable				Non-separable (all vehicles)
	VKT	PCU-km	ESA-km	AGM-km[7]	VKT
extension/ improvement					
Other miscellaneous expenditures					100%

Source: NRTC (1998) in Vuong and Mathias (2004)

Appendix D: Comparison of Road Cost Allocation Methodologies

Table D1: Comparison of road cost allocation methodologies, NRTC & BTRE

Road cost Category	NRTC % non-separable	BTRE % non-separable	Cost allocation driver used		Parameters used
			Separable	Non-separable	
Routine maintenance	50	20	ESAL-km	PCU-km	% non-sep based on NSW and VIC benchmarks
Reseals	50	20	ESAL-km	PCU-km	
Road rehabilitation	55	20	ESAL-km	PCU-km	
Servicing	100	100	PCU-km	PCU-km	
Bridge Repair	67	33	GVM-km	PCU-km	
Low cost improvements	0	0	PCU-km	PCU-km	
Construction - Bridges	85	55	GVM-km	GVM-km	
Pavement construction	55	55	NA	NA	Excluded from operating cost analysis – incl. in capital analysis
Land	90	90	NA	NA	
Earthworks	90	90	NA	NA	
Construction - other	90	90	NA	NA	
Miscellaneuous works	100	100	PCU-km	PCU-km	
Corporate Services	100	100	PCU-km	PCU-km	

Source: BTRE (1999) and NRTC (1998) in Australasian Railway Association (2005).