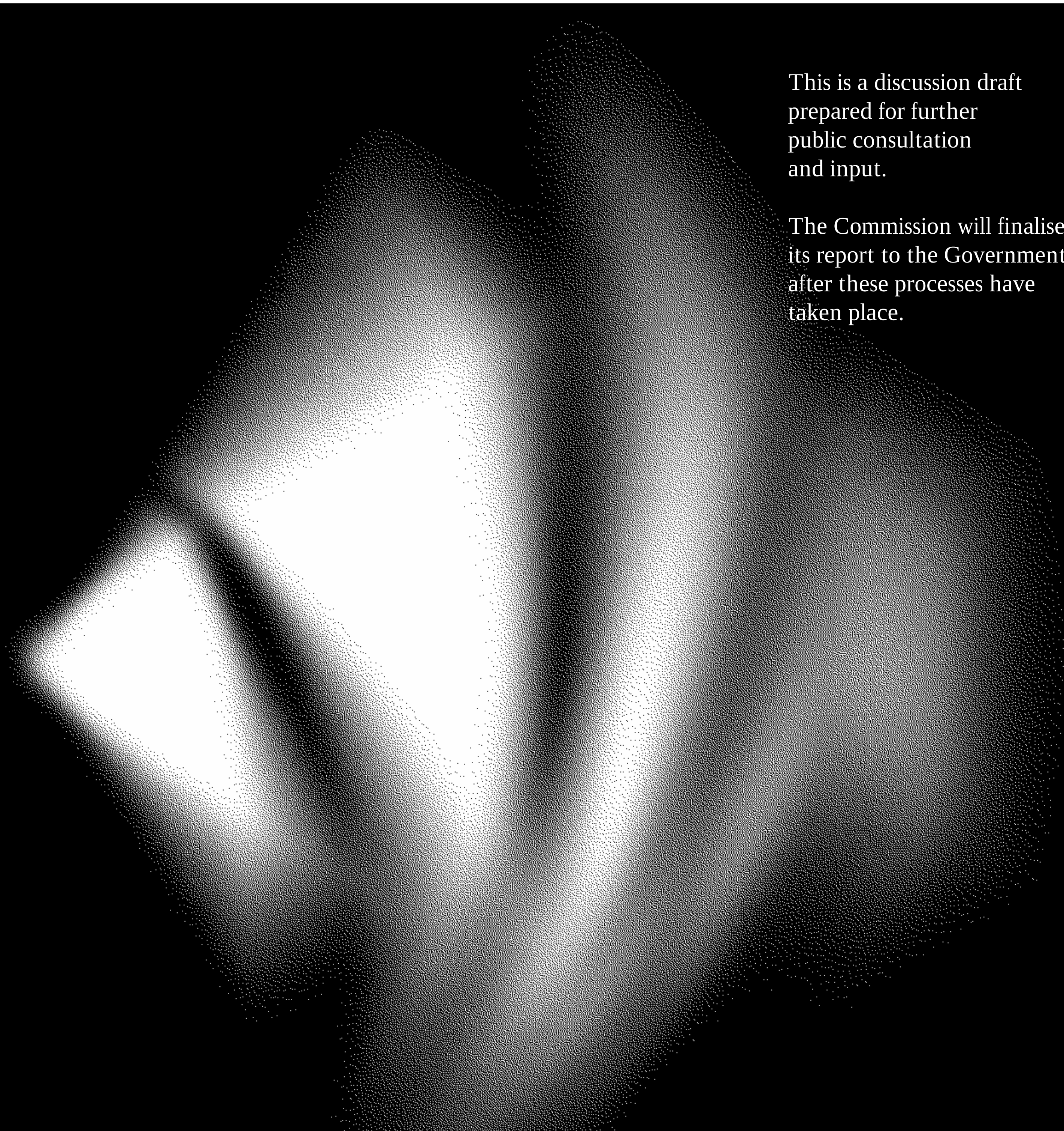
Australian Government
Productivity Commission

Road and Rail Freight Infrastructure Pricing

Productivity Commission Discussion Draft



This is a discussion draft prepared for further public consultation and input.

The Commission will finalise its report to the Government after these processes have taken place.

This publication is available in hard copy or PDF format from the Productivity Commission website at www.pc.gov.au. If you require part or all of this publication in a different format, please contact Media and Publications (see below).

Publications Inquiries:
Media and Publications
Productivity Commission
Locked Bag 2 Collins Street East
Melbourne VIC 8003

Tel: (03) 9653 2244
Fax: (03) 9653 2303
Email: maps@pc.gov.au

General Inquiries:
Tel: (03) 9653 2100 or (02) 6240 3200

An appropriate citation for this paper is:

Productivity Commission 2006, *Road and Rail Freight Infrastructure Pricing*, Discussion Draft, Canberra, September.

JEL code: C, R

The Productivity Commission

The Productivity Commission, an independent agency, is the Australian Government's principal review and advisory body on microeconomic policy and regulation. It conducts public inquiries and research into a broad range of economic and social issues affecting the welfare of Australians.

The Commission's independence is underpinned by an Act of Parliament. Its processes and outputs are open to public scrutiny and are driven by consideration for the wellbeing of the community as a whole.

Information on the Productivity Commission, its publications and its current work program can be found on the World Wide Web at www.pc.gov.au or by contacting Media and Publications on (03) 9653 2244.

Opportunity for further comment

You are invited to examine this discussion draft and comment on it in writing and/or by attending public hearings. Written responses should be received by the Commission on, or before, Friday, 27 October 2006.

Public hearings will commence on Wednesday, 25 October. They will be held in locations where there is sufficient interest from participants. Additional hearings may also be held via telephone or video conference for those people unable to attend venues. Confirmation of dates and venues will be advertised through our circulars, in major newspapers and on our website.

The Commission will refine and develop its analysis for the final report in the light of comments and new information received. The final report will be submitted to the Commonwealth Treasurer by end December 2006.

Commissioners

For the purposes of this inquiry and discussion draft, in accordance with section 40 of the *Productivity Commission Act 1998*, the powers of the Productivity Commission have been exercised by:

Gary Banks	Presiding Commissioner
Clifford Walsh	Associate Commissioner

Contacts

By mail: Road and Rail Freight Infrastructure Inquiry
Productivity Commission
Locked Bag 2
Collins Street East
Melbourne Vic 8003

By fax: 03 9653 2302

By email: freight@pc.gov.au

Further information is available from the inquiry website:
http://www.pc.gov.au/inquiry/freight/index.html

For administrative matters, please contact: Andrea Coulter Ph: 03 9653 2181

About the inquiry, please contact: Susan Stone Ph: 03 9653 2129
Steven Bailey Ph: 03 9653 2141

Freecall number for regional areas: 1800 020 083

Telephone Typewriter (TTY): 1800 803 344

Terms of reference

REVIEW OF ECONOMIC COSTS OF FREIGHT INFRASTRUCTURE AND EFFICIENT APPROACHES TO TRANSPORT PRICING

Productivity Commission Act 1998

I, PETER COSTELLO, Treasurer, pursuant to Parts 2 and 3 of the *Productivity Commission Act 1998*, hereby refer the economic costs of freight infrastructure and efficient approaches to transport pricing to the Commission for inquiry and report by December 2006. The Commission is to hold hearings for the purpose of the inquiry.

Background

The purpose of the review is to assist COAG to implement efficient pricing of road and rail freight infrastructure through consistent and competitively neutral pricing regimes, in a manner that optimises efficiency and productivity in the freight transport task and maximises net benefits to the community.

Scope of the inquiry

The review will estimate the full financial costs of providing and maintaining freight transport infrastructure on major road and rail networks. It should be based on the principle that prices charged should reflect all costs in each mode and that there are benefits in a national pricing regime. In estimating these financial costs, the review will take account of the extensive research and studies on this issue, including by the National Transport Commission and the Bureau of Transport and Regional Economics.

The review also will assess the full economic and social costs of providing and maintaining road and rail freight infrastructure, if it judges this to be feasible. Such costs would include environmental and safety impacts of different transport modes. The review would assess existing studies of these economic and social costs and comment on the strengths and weaknesses of methodologies used. The review should also assess what information or future research could improve the quality of the estimates.

The review will investigate options for transport pricing reform, including moving to mass, distance and location charging of freight transport. In considering distance based charging regimes the review will:

a) consider principles and practical options for the structure of the different pricing regimes;

b) estimate the impact of charging regime options, including on transport operators and users and specific locations;

c) consider options for implementing any new pricing regime, including the practical costs and benefits of alternative technology options; and

d) provide advice on options for the design of and timeframes for implementing mass distance location based charging regimes, taking into account adjustment issues. The review will not address fiscal implications which will be assessed by governments following the review's completion.

The review will also identify any other competition, regulatory and access constraints on the economically efficient pricing and operation of road and rail freight transport and related infrastructure networks and assets, including access to and competition between inter-modal facilities, and make recommendations on the options for removing these impediments and increasing efficiency.

In undertaking the review, the Commission is to consult widely with stakeholders on its contents and recommendations and to produce a draft report. The final report is to be presented to COAG by December 2006.

PETER COSTELLO

COAG Communiqué

COUNCIL OF AUSTRALIAN GOVERNMENTS' MEETING
10 FEBRUARY 2006
COMMUNIQUÉ

Relevant extract from the COAG communiqué:

Transport

The dispersed nature of Australia's population and markets underlines the importance of efficient transport infrastructure to improving productivity. Transport already generates approximately five per cent of GDP and Australia's freight task is expected to almost double over the next 20 years. COAG has agreed to improve the efficiency, adequacy and safety of Australia's transport infrastructure by committing to high priority national transport market reforms including to:

- ask the Productivity Commission to develop proposals for efficient pricing of road and rail freight infrastructure through consistent and competitively neutral pricing regimes, in a manner that maximises net benefits to the community, in particular rural, regional and remote Australia. The Productivity Commission will make recommendations to COAG by end 2006 on optimal methods and possible implementation timeframes. The inquiry will include analysis of how particular communities might be impacted. When COAG considers this report it will ensure that the interest of rural, regional and remote Australia are addressed.

Attachment B:

Decision 3.1
(a) COAG agreed to a Productivity Commission inquiry … to be presented to COAG by end 2006 which will, *inter alia*:-

(i) identify the optimal methods and timeframes for introducing efficient road and rail freight infrastructure pricing in a manner that maximises net benefits to the community,
(ii) determine the full financial, economic, social and environmental costs of providing road and rail infrastructure,
(iii) identify other barriers to competition in road and rail transport, and
(iv) recognise transport operators and users and remote and rural communities will need sufficient time to transition and adjust to pricing arrangements.

Contents

BOXES

FIGURES

TABLES

Abbreviations

AAA	Australian Automobile Association
ABS	Australian Bureau of Statistics
ABRD	Australian Bicentennial Road Development
ACCC	Australian Competition and Consumer Commission
AGM	average gross mass
ALC	Australian Logistics Council
ALTA	Australian Livestock Transporters Association
ANR	Australian National Railways Commission
ARA	Australasian Railway Association
ARRB	Australian Road Research Board
ARTC	Australian Rail Track Corporation
ASR	Australian Southern Railroad Group
ATA	Australian Trucking Association
ATC	Australian Transport Council
ATO	Australian Taxation Office
BAH	Booz Allen Hamilton
BTCE	Bureau of Transport and Communications Economics
BTE	Bureau of Transport Economics
BTRE	Bureau of Transport and Regional Economics
CEDA	Committee for Economic Development Australia

CEO	Chief Executive Officer
CES	constant elasticity of substitution
COAG	Council of Australian Governments
CoPS	Centre of Policy Studies
CPI	Consumer Price Index
CSO	Community Service Obligation
CVP	continuous voyage permit
DAC	depreciated actual cost
DAFGS	Diesel and Alternative Fuel Grants Scheme
DFRS	Diesel Fuel Rebate Scheme
DOI	Department of Infrastructure
DORC	depreciated optimised replacement cost
DOTARS	Department of Transport and Regional Services
DTUP	South Australian Department of Transport and Urban Planning
ERA	Economic Regulation Authority (WA)
ESA	equivalent standard axle
ESC	Essential Services Commission (Victoria)
ESCOSA	Essential Services Commission of South Australia
FIAB	Freight Infrastructure Advisory Board
FIRS	Federal Interstate Registration Scheme
FMG	Fortescue Metals Group
FRC	Federal Roads Corporation
FTI	Fuel Tax Inquiry

GDP	gross domestic product
GPS	Global Positioning System
GRV	gross replacement value
GSP	gross state product
GST	goods and services tax
GTE	Government Trading Enterprise
GTK	gross tonne kilometres
GVM	gross vehicle mass
IAP	Intelligent Access Program
ICT	information and communication technology
IPART	Independent Pricing and Regulatory Tribunal (NSW)
Kilotonnes	thousand (1000) tonnes
km	kilometres
LCV	light commercial vehicle
LRMC	long-run marginal cost
MMRF	Monash Multi-Regional Forecasting model
NAFI	National Association of Forestry Industries
NCC	National Competition Council
NCP	National Competition Policy
NEPM	National Environment Protection Measure
NLTF	National Land Transport Fund
NPV	net present value
NRA	National Reform Agenda
NRC	National Rail Corporation

NRTC	National Road Transport Commission
NSWGIAC	New South Wales Grain Infrastructure Advisory Committee
NTC	National Transport Commission
OBU	On Board Unit
OECD	Organisation for Economic Co-operation and Development
ORAR	Office of the Rail Access Regulator
PBS	Performance Based Standards
PC	Productivity Commission
PCU	passenger car (equivalent) units
PJP	Port Jackson Partners
PN	Pacific National
QCA	Queensland Competition Authority
QR	Queensland Rail
RAG	Roading Advisory Group
RIC	Rail Infrastructure Corporation
SCTL	SCT Logistics
SKM	Sinclair Knight Merz
SRMC	short-run marginal cost
SVP	single voyage permit
tkm	tonne kilometre
TPA	Trade Practices Act
VECM	Vector Error Correction Model
VKT	vehicle kilometres travelled
VMT	vehicle miles travelled

Glossary

Access regime	Procedures to govern access to rail track. Includes setting an access pricing policy, criteria for permitting access, and operating conditions.
Articulated trucks	Trucks that consist of a prime mover and trailer(s).
Bulk freight	Comprises commodities such as coal, iron ore, other minerals and grain.
Ceiling price	Generally set by regulators as the full economic cost of providing a particular service, including provision for an adequate return on capital.
Community Service Obligations	A community service obligation arises when a Government requires carrying out of activities which an entity would not elect to do on a commercial basis or which it would only do commercially at higher prices.
Declaration	A minister may 'declare' an infrastructure service. Declaration establishes a right for any party to negotiate terms and conditions of access with the service provider. If negotiations fail, declaration also gives an access seeker the right to seek binding arbitration.
Floor price	Generally set by regulators as equal to the marginal or incremental cost of providing a particular service.
General freight	General freight includes consignments not classified by commodity, empty used containers and other empty used packaging, mail and postage packages and personal effects (such as household items and motor vehicles).

Identified (untied) local road grants	Identified local road grants are distributed by the Commonwealth Government to each State's local government grants commission. They are distributed on the basis of fixed shares inherited from a former Federal programme of tied road grants. Once in the hands of Local Government, the funds may be spent according to the priorities of each local governing body (that is, they are untied).
Just-in-time stock management	A logistics management system allowing for production inputs and outputs to be ordered and transported as required, saving on both inventory and storage costs.
LCVs	Light commercial vehicles which include rigid trucks less than 3.5 tonnes, utilities, panel vans and vans without rear seats.
Non-bulk freight	Generally refers to those types of freight that would be damaged if dropped or poured. Comprises commodities such as general freight, motor vehicles, food, and general merchandise.
Passing loop	A place on a single rail line where trains travelling in opposing directions can pass each other.
PAYGO	A PAYGO (or pay-as-you-go) approach to estimating the cost of road service provision, recovers expenditure on roads in the period in which it is incurred.
Rail gauge	A measurement of the distance between the rails that form the running surface of the rail track. Narrow gauge track is 1067 mm, standard gauge track is 1435 mm and broad gauge track is 1600 mm.
Reference tariff	Indicative price for a 'typical' service designed to assist negotiations between access seekers and below-rail operators.

Rigid trucks	Motor vehicles exceeding 3.5 tonnes GVM, constructed with a load carrying area, including rigid trucks with a tow bar or other non-articulated coupling on the rear of the vehicle.
Rollingstock	A railroad vehicle that is not a locomotive; also known as a railroad car.
Tonne-kilometre	One tonne of freight moved one kilometre.
Vertical separation	The separation of track infrastructure from above-rail train operations.

OVERVIEW

Key points

- Efficient use and provision of both road and rail freight infrastructure are of great importance given Australia's dispersed population and production centres.
  - Competitive neutrality is needed for efficient modal outcomes, but is best achieved though efficient pricing of infrastructure services in each mode.
- While rail has broadly maintained its share of the overall freight task and its dominance of the bulk freight market, it has lost ground to road in the growing non-bulk market, particularly on east-coast inter-capital corridors.
- Within the existing PAYGO system of road charging, heavy trucks in *aggregate* more than cover their assessed costs.
  - This will soon change, however, if road expenditure continues to rise and road charges remain unchanged.
- B-doubles currently do not cover the costs attributable to them on a network average basis. However, from the available evidence on the actual costs of them using major corridors (where rail and road compete for non-bulk freight), it is not clear that raising their charges would promote competitive neutrality or enhance efficiency.
- The level of policy-relevant externalities generated by trucks using major corridors is likely to be low, given that most impacts occur in urban areas and that many are already being dealt with, to some extent, by regulations and other measures.
  - A uniform externalities 'tax' on road freight would be an ineffective and costly way of dealing with remaining externalities.
- Government financial contributions to rail infrastructure allow access charges to be maintained below the economic costs of providing some rail freight services, further clouding assessment of competitive neutrality across modes.
- If road charges were to rise, any shift to rail is unlikely to be large, even under optimistic assumptions. This largely reflects different service characteristics of the two modes and the small share of road charges in road freight costs.
- New road pricing instruments using electronic and satellite technologies are becoming technically feasible, but whether their use makes economic sense depends on their costs, how charges are structured, and their effects on the efficiency of both road use and road provision.
  - These outcomes are not independent of the institutional settings in which roads are provided and used.
- Changes involving more fundamental institutional reform for road provision — such as the creation of an independent road fund, or direct road user charging combined with commercially-oriented management of major freight routes — offer the potential for substantial efficiency gains. But there are many difficult issues to be worked through on which the Commission is seeking further input.
- In the interim, efficiency in each mode would be promoted by regulatory reforms to reduce costs and by improved investment decision-making processes.

Overview

Most goods produced and consumed in the Australian economy are transported at some stage. With Australia's dispersed population and production centres, the efficiency of freight transport and infrastructure are important ingredients in overall productivity performance and will continue to be, particularly as the freight task is projected at least to double over the next 20 years.

This inquiry, which stems from a decision of the Council of Australian Governments, focuses on potential causes of inefficiency in road and rail freight. In particular, it addresses concerns that the different charging arrangements for use of road and rail freight infrastructure might be distorting modal choices and leading to inefficient infrastructure investment decisions. It examines claims that large articulated trucks (particularly B-doubles) do not pay their fair share of costs, resulting in excessive use of road freight.

It also investigates the economic impacts of new road pricing instruments (using electronic and satellite technologies) which are becoming technically feasible and are regarded by many as the solution to achieving consistent pricing in road and rail, thereby promoting 'competitive neutrality'.

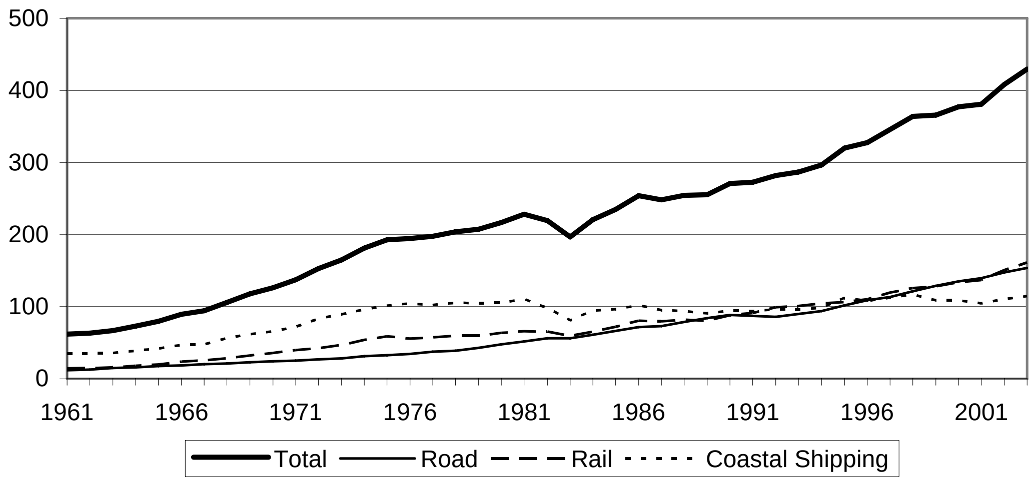
While competitively neutral pricing between road and rail freight is important, efficiency in land transport has several other dimensions, not least how efficiently each mode is provided. New road pricing instruments open up the prospect of a shift to more commercially-oriented provision of road services, underpinned by road user prices rather than taxes.

Consequently, in investigating the scope for road pricing reform, this report also examines the prospects for running roads more as a business, including the feasibility of the institutional changes necessary to do so. Although rail services, unlike road, are priced and provided within a commercial structure, the Commission also examines the extent to which the performance of the rail sector is impeded by regulation and other arrangements.

Is rail losing market share to road?

There is concern that rail is losing market share to road, because of an ‘uneven playing field’. Rail is under pressure in some markets, but it is performing well in others. Indeed, for the past 20 years or so, road and rail have carried roughly equal shares of the total freight task, and both have increased their market shares at the expense of sea freight.

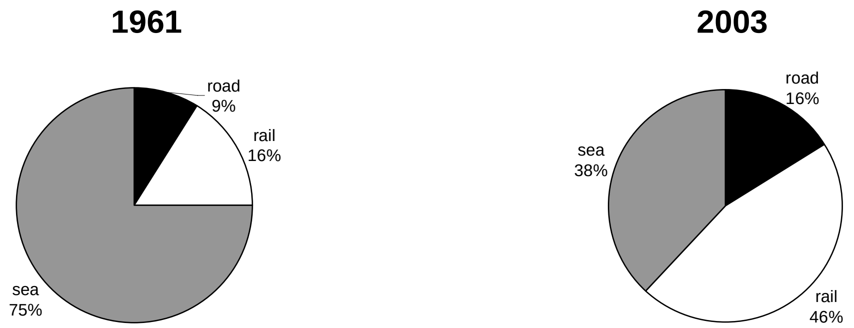
Figure 1 **Both road and rail freight have expanded, at the expense of sea**
Billion tonne kilometres



However, the types of freight that rail and road carry are substantially different. Rail is suited to heavy bulk commodities with regular, large volumes, and also long-haul cargoes. Consequently, rail dominates the bulk freight task (especially the carriage of coal and other minerals) and containerised non-bulk freight on the long-haul east–west corridor.

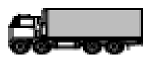
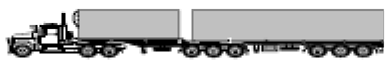
Figure 2 **Rail dominates the bulk freight task**

Tonne kilometres



Road is more flexible than rail (which often requires double-handling of freight) and is especially suited to carrying perishable, fragile, time-sensitive freight. This flexibility, together with improved on-board communications, has facilitated the use by business of just-in-time stock management, smaller inventories and door-to-door delivery, which require more frequent and generally smaller, shorter-haul deliveries. The productivity of road transport also has improved with new-generation B-doubles and B-triples, which combine flexibility with economies of scale.

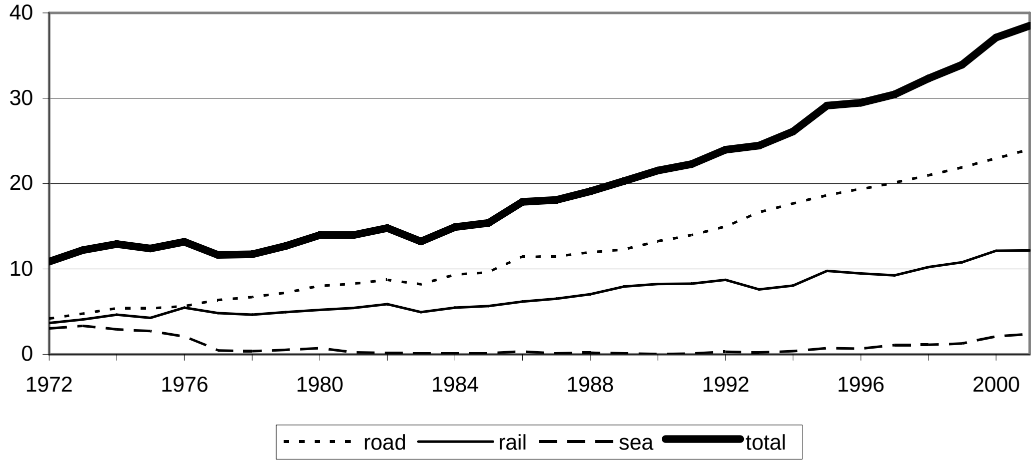
Table 1 **Truckspotters' guide**

Rigid truck	
Semi-trailer	
B-double	
Road train	

Hence, road dominates the non-bulk freight market (especially manufactured goods, food and livestock and non-containerised general freight), including the mainly non-bulk freight task on the east-coast corridors. The non-bulk task has been growing more rapidly than the bulk task, and road's share of non-bulk freight has been growing at the expense of rail and sea.

So while rail has been increasing or maintaining its share of some long-distance non-bulk tasks and most bulk tasks — especially in coal, metal ores and grain — it has performed less well on the shorter intercapital, predominantly non-bulk, freight corridors on the east coast. These are the principal focus of the debate about road–rail price neutrality, although road and rail also compete for bulk freight in some regions.

Figure 3 **Road dominates the growing intercapital non-bulk market**
Billion tonne kilometres



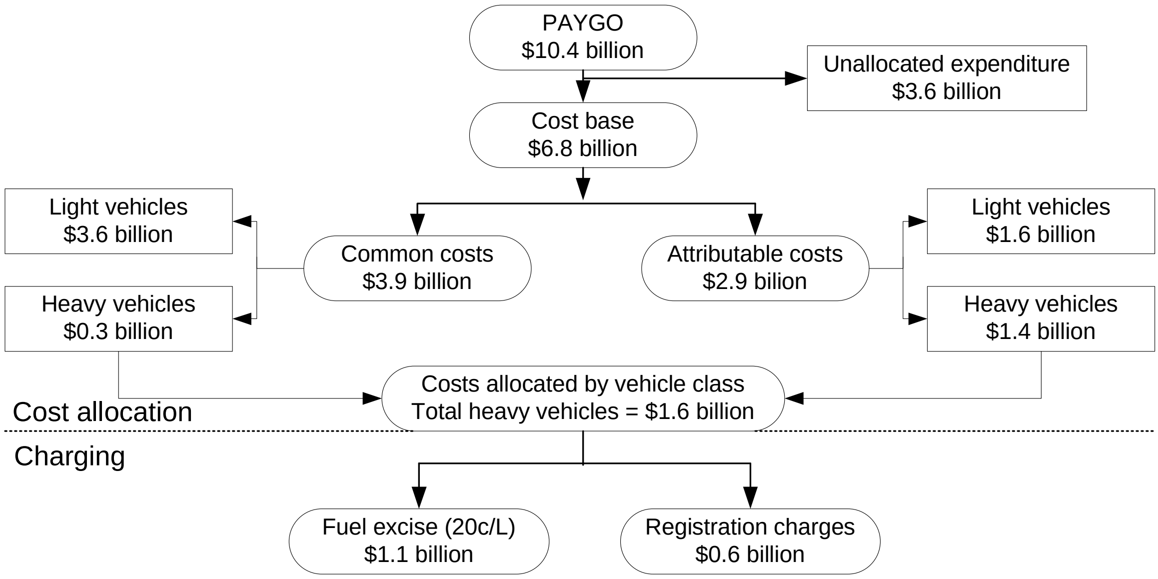
Are heavy trucks 'paying their way'?

Heavy vehicles currently pay registration charges (which vary by truck type to capture varying axle-load damage) and a diesel fuel excise (net of rebates) of just under 20 cents per litre. The National Transport Commission (NTC) sets these charges to recover road expenditure attributable to heavy vehicles (over 4.5 tonnes), plus an allocated portion of spending that cannot be separately attributed to any specific class of vehicle (so-called common costs).

Of total road spending Australia-wide of around $10 billion (the annual average for the three years to 2004-05), heavy vehicles were required to pay $1.6 billion. It is argued by many participants that this is too low.

A threshold question in assessing this is which costs, in principle, trucks should pay. Provided trucks, overall, pay at least the costs *attributable* to their use of the road network — and each truck class and truck at least its avoidable or marginal cost — then strictly speaking their road use is not being subsidised. In other words, trucks are not being subsidised provided those otherwise paying for the network pay no *more* when trucks also use it. (Common costs of providing roads must be covered somehow, but even if certain trucks or truck classes do not contribute, they are not necessarily being subsidised. However, the allocation method chosen could affect modal choice.)

Figure 4 **Heavy vehicles' share of road spending**



In principle, efficient pricing relates to the *economic* costs of infrastructure provision; that is, the cost of providing and maintaining an optimal network. Estimating these costs for the road sector would be a formidable task even if data were available, and has been infeasible in the context of this inquiry. Thus, 'cost recovery' as applied here for road refers to recovery of actual outlays or so-called financial costs.

'Spillover' costs imposed on the community (such as the costs of accidents and air pollution) also should be incorporated in road freight costs and prices — although, as discussed later, not necessarily through current road user charging methods.

Does PAYGO subsidise heavy vehicles?

Under the existing pay-as-you-go or 'PAYGO' methodology applied by the NTC, road spending allocated to heavy vehicles, both capital and current, is recovered in the period it is made. Several participants argued that in recouping *capital* costs this approach significantly subsidises road freight, because users are not charged a fee that includes provision for a rate of return on the capital outlaid.

The Commission disagrees that there is a subsidy 'in principle', since road users actually pay for the capital spending as it is incurred, but acknowledges that the application of PAYGO, particularly with gaps of several years between road pricing determinations, means that spending spikes (and troughs) may not be brought adequately to account in charges (box 1). However, claims by some that today's road users are benefiting from the use of roads built in the past and funded by taxpayers are not supported by the evidence. Even though heavy vehicle road charges as such have applied only since the mid-1990s, diesel fuel excise has applied since 1957, being introduced for the express purpose of contributing to road costs.

Box 1 **The economics of PAYGO**

Under a pay-as-you-go approach (known as PAYGO), capital spending is recovered in the period in which it occurs so that users of roads rather than road providers effectively fund the investment. In principle, therefore, PAYGO does not inherently subsidise freight infrastructure users compared with an approach where users are charged an amount each year that covers asset depreciation and a return on capital. The net present value of the stream of capital payments under a PAYGO or annualised approach will be the same.

Clearly, however, the *time pattern* of payments can differ. In years when capital spending is higher than average, users in a PAYGO system will pay more than those paying on an annualised basis, and they will pay less in years in which capital spending is relatively low. In some years, payments might coincide. Even if payments do not coincide, however, over time there is no inherent subsidy under PAYGO to road users as a group.

The PAYGO system operating in Australia attempts to reduce the potentially uneven path of charges and potential for cross-subsidisation among road users over time by spreading charges for road investments across *all* network users and by using a 3-year spending average to calculate charges for each pricing determination. This averaging process means that annual road network capital charges change comparatively little from year to year.

Are trucks covering their average network costs?

Within the framework of the present cost recovery model, the Commission's assessment is that heavy vehicles *as a group* currently more than cover their assessed attributable costs (and, therefore, make some contribution to common costs), although this will soon change if road expenditure continues to rise. However, B-doubles as a class currently do not even cover their *attributable network* costs (box 2).

Box 2 **Are current cost attributions reasonable?**

- There is seemingly endless scope for debate about how costs should be attributed to trucks, largely reflecting imperfect understanding about contributions to road damage. The Commission is not the appropriate body to adjudicate on engineering issues, but observes that the NTC has adopted a conservative approach in attributing road costs to heavy vehicles. As it acknowledges, NTC estimates are towards the lower end of various attribution methodologies.
- The NTC currently excludes a significant proportion of road expenditure from the cost base, particularly the costs of local access. The Commission accepts that local access costs, in most cases, are more appropriately recovered through local council rates and developer charges than through the heavy vehicle charging system. But regulatory enforcement costs, net of revenue from fines, should be included.
- Estimated common costs of road service provision are very large — nearly $4 billion. Even if the NTC took a less conservative approach to attributing road costs, common costs are still likely to be large, given that roads would continue to be provided for passenger vehicles (which account for about 80 per cent of all road use), albeit not to the strength required for trucks.
- Under the current charging system, there is some over and under-recovery by vehicle class. This reflects constraints imposed by the current structure of charges, and, in the case of B-doubles, a deliberate attempt to influence the choice between them and road trains. Registration fee increases proposed in the 3rd Heavy Vehicle Pricing Determination would have reduced under-recovery of network costs allocated to B-doubles.
- Vehicles travelling longer than average distances and/or carrying heavier than average loads are cross subsidised by other vehicles within the class.

Are trucks covering their actual costs of road use?

Importantly, however, the network-wide averaging of costs (which smooths intertemporal variations within a PAYGO system) creates another source of cross-subsidisation — from those using lower-cost roads to those using high-cost roads and, indeed, to those benefiting from roads that may be justifiable on social but not economic grounds. Thus, even if some truck classes (especially B-doubles) do not meet their attributable share of network expenditure, ascertaining whether they are being truly subsidised or not requires some knowledge of the roads they use. For instance, B-doubles tend to operate on major interstate corridors, whereas smaller trucks tend to operate in urban areas. Road trains operate only in rural areas.

There is some evidence that the unit costs of heavy vehicles using major freight corridors are lower than the costs from their use of arterial roads and rural roads and, thus, lower than assessed network-wide average costs. This is not really surprising, as the marginal costs of using major corridors — which are designed and built to carry heavy vehicles — are very low. Although the total capital costs of these roads are high, there is evidence that their *unit* capital costs also are relatively low, given high traffic volumes and economies of scale in road construction.

A lack of adequate data about corridor costs and traffic flows precludes a definitive conclusion. Yet, without specific data, neither can it be concluded that increasing charges for trucks competing with rail, on the basis of network-wide cost allocations, would necessarily promote competitive neutrality or efficiency.

Community impacts must also be taken into account

The spillover costs that trucks impose on local communities, and on other road users, reduce community wellbeing. They are also a potential source of competitive distortion because the external impacts of road freight are generally much larger than for rail freight. These 'spillovers' or 'externalities' include:

- accident costs (borne largely, though not entirely, by users);
- environmental impacts including noise and local air pollution and amenity, including so-called intrusion impacts (borne by the local community);
- greenhouse gas emissions (which may have global impacts); and
- congestion (borne by infrastructure users, including those who take action to avoid peak periods).

In practice, the costs imposed by externalities are difficult to measure and estimates are subject to considerable variation, especially those involving valuations of human life. But the fact that trucks are involved in accidents or create pollution does not necessarily mean that some effective actions are not already being taken. Indeed, a variety of measures currently address external impacts and, in some cases, appear to do so to a significant extent. Moreover, some of these measures impose high costs on road freight operators, which are passed on in freight prices (box 3).

Even if current measures to address externalities from heavy vehicles are considered inadequate, it is highly unlikely that imposing a uniform tax on *all* road freight vehicles, regardless of where they travel and when, would be the best-available, or even an effective, remedy. This is because most external impacts of freight transport occur in urban areas, yet harmful impacts would only decline to the extent they were linked to overall network use. In addition, applying a tax only on freight transport to reduce, say, air pollution or traffic congestion in an urban area, would at best only partially address the problem, because light vehicles also produce these impacts. Greenhouse gases raise similar issues — imposing higher charges on

Australian road freight (which contributes less than three per cent of Australia's total greenhouse emissions) could have perverse impacts.

Box 3 **How some 'external costs' of road freight are being addressed**

Accident costs are internalised to a significant degree by liability laws, road safety programs, road laws, policing and fines and expenditure which improves the safety of roads. Various initiatives in road design, road rules enforcement, measures to influence driver behaviour, motor vehicle design and safety features, and drivers' concern about road safety, coincided with an 18 per cent decline in road deaths between 1996 and 2003. Fatalities involving articulated trucks declined by nearly 12 per cent.

New standards for *emissions* from diesel vehicles began in 2002-03, delivering considerable reductions in emissions, particularly for particulate matter and nitrous oxides.

New trucks must comply with *noise emission* standards relating to engine and exhaust technologies that produce lower noise emissions. In addition, there are movement restrictions on specified types of vehicles to limit noise pollution.

Is rail freight paying its way?

In contrast to road provision, Australia's rail infrastructure now generally operates within a commercial structure, typically with maximum (two-part) access charges based on regulators' assessments of the economic costs of providing services. The nature of rail means that it is much easier to attribute costs to particular trains, according to their weight and distance travelled. This, together with horizontal separation of rail networks, means that rail charges involve far less cost averaging than for road. Indeed, rail infrastructure providers are likely to be able to structure access charges such that the variable charge broadly reflects marginal costs of track use.

Despite commercialisation, prices for many rail services fall well short of the economic costs as assessed by regulators, at least if the expectation is that current service levels will continue. (The exceptions to this are generally in the bulk freight areas, particularly coal.) In practice, there appear to be substantial periodic injections of public funds to major rail corridors and some regional lines, with no apparent expectation of recovery from users (box 4). At least some of these contributions are intended to keep lines open that otherwise would not be commercially viable.

Some of these contributions are also clearly intended to assist freight services. Sometimes the justification given is that rail generates lower external costs than road freight. But even if road externalities are not being adequately addressed, shifting some of the freight task to rail is unlikely to be the least-cost means of remedying the problem and could reduce the overall efficiency of freight transport.

Box 4 **Some recent government 'contributions' to rail infrastructure**

Under the AusLink Investment Programme, the Australian Government is providing $550 million to improve the line between Melbourne and Brisbane, plus $270 million to install concrete sleepers. Another $544 million is being provided for other rail and intermodal projects on the AusLink network (DOTARS 2006).

In 2005, a deal was struck between the Australian and South Australian Governments to contribute $30 million towards upgrading the Eyre Peninsula rail system. The Australian Government will provide $15 million to be matched by the South Australian Government, industry and local councils. The Eyre Peninsula rail line carries over two million tonnes of grain each year, but is in very poor condition. Government funds are regarded as essential to the ongoing viability of the line (Anderson and Conlon 2005).

Under a proposal to maintain the Tasmanian rail service (which has otherwise been threatened with closure), the Australian Government will provide $78 million for capital works, and the Tasmanian Government $4 million a year for 10 years (Cox 2006).

Pacific National made its most recent proposed access arrangement in Victoria contingent on obtaining $31 million from the Victorian Government for 'freight support'.

Some contributions to rail are called community service obligations (CSOs) because they support access to particular communities. The incidence of the subsidy, rather than its label, is what matters. However, the extent to which such contributions provide subsidies to rail freight is difficult to determine, because of a lack of transparency regarding their objectives and their incidence.

What are the implications for competitive neutrality?

In the Commission's view, the evidence that heavy vehicles competing with rail freight on major corridors are relatively subsidised is not compelling. The assessment of any (true) subsidisation of road is clouded by network-wide cost averaging and the paucity of corridor-specific cost data. For rail, significant government financial contributions allow access charges to be set below the economic costs of providing freight services on major corridors.

The limited location-specific data that are available suggest that heavy vehicle cost allocations based on network cost averaging may actually involve significant cross-subsidies from users of major freight corridors to rural road users. Competitive neutrality, therefore, may be more of an issue in regional areas where the two modes compete for some bulk freight tasks (the haulage of grain, for example). That said, cross-subsidised charges for use of rural roads might also assist rail to the extent that rural roads are used to deliver freight to railheads.

The major 'policy-relevant' external costs generated by trucks using major corridors are accident costs and greenhouse gas emissions. Trucks generate much higher levels of both compared with rail. However, road accident costs are internalised to a significant degree, while the extent of the advantage to road freight of the absence of a greenhouse emissions abatement program depends on the costs of achieving a given level of abatement. The highest externality costs of road freight (and road passenger) transport occur in urban areas. Since inter-urban rail freight tasks generally need trucks for pick up and delivery, externality costs such as air pollution, noise and traffic congestion in urban areas will largely be common to road and rail freight journeys.

While it does not appear that higher road charges are justified for competitive neutrality reasons, it seems unlikely that modal shares would alter significantly even if heavy vehicle charges were to increase. The Commission has modelled impacts on truck use and modal shares if heavy vehicle charges were increased or redistributed among truck classes (figure 5). Even under optimistic assumptions for cross-modal substitution and a large increase in road user charges, the switch to rail was found to be comparatively small in aggregate. This is mainly because of different service requirements for different types of freight and because user charges comprise a very small part of total road freight costs. These results are supported to some extent by anecdotal evidence that customers value service reliability and flexibility. The fact that prices for non-bulk rail freight on the major inter-capital corridors have decreased relative to road at the same time as road's market share has increased, adds some weight to this (figure 6).

Moreover, these simulations assumed that rail responds to an increase in road prices by expanding output rather than increasing charges. Where rail infrastructure charges and revenue currently do not cover the total costs of providing services, it might be appropriate for rail prices to increase in line with road prices. This would leave modal shares unchanged. That said, with higher prices, rail would be better positioned to maintain services over time, with reduced levels of government support.

Figure 5 **Limited modal shift from increasing road charges**

% change, tonnes carried

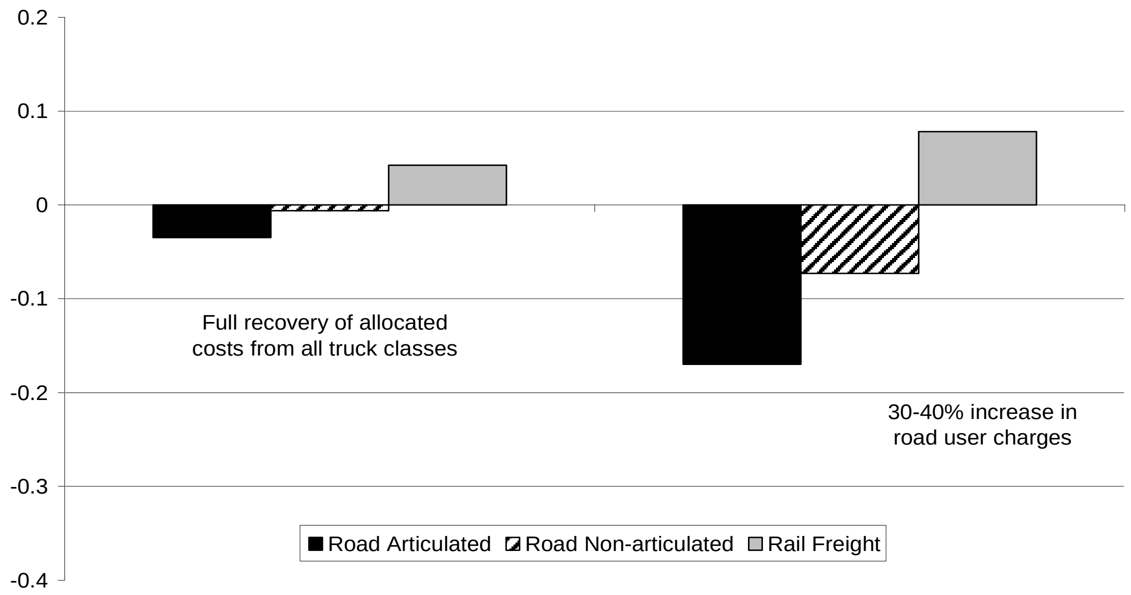
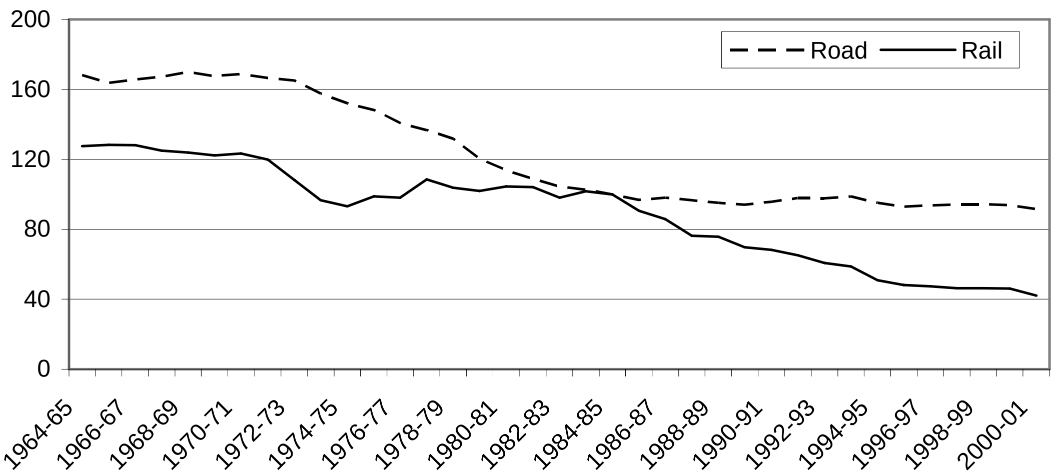


Figure 6 **Rail's interstate non-bulk freight rates have fallen compared with road**

Index: 1984-85=100



More efficient road pricing would still be potentially beneficial

Although the Commission has not found a compelling case to increase road user charges solely for competitive neutrality reasons, there are likely to be significant benefits from reforming road charging arrangements. Reducing the degree of network averaging has the potential to provide better signals to road users and providers, improving the efficiency of road use and provision, as well as the efficiency of choices of truck class and transport mode. Moving from recovery of actual road spending to prices that reflect the *economic* costs of providing road infrastructure services also has the potential to promote more efficient outcomes.

What are the main road pricing options?

Most of the discussion regarding road pricing reform centres on mass–distance and location-based charging technologies, which have the capacity to reflect the costs of road use better than fuel taxes (box 5).

Mass–distance charges

Measuring distance travelled by heavy vehicles over a defined period appears to be the most technically feasible option for road pricing reform. The major potential benefits of distance charging would be to give users a somewhat better signal about the average network damage they impose and to reduce the potential for cross-subsidisation across heavy vehicles within the current network cost allocation parameters. Simple mass–distance charges could also provide an intermediate step from an input tax to a form of direct road price.

The industry and community impacts of distance-based charging would, in practice, depend on the types of freight carried by those trucks travelling greater than average distances each year. While it is often assumed that this would disadvantage rural and remote areas, it is unknown whether trucks undertaking long rural trips travel greater than average *annual* distances (for their truck class).

Mass–distance location-based charges

Mass–distance *location-based* charges represent a quantum leap compared with simple mass–distance charges. Location-based charges could be set to reflect marginal costs of using particular roads or road types, with an access fee reflecting an appropriate contribution to network-wide capital and common costs. Alternatively, they could be set on a ‘stand-alone’ basis: that is, two-part charges for a particular road (or, more likely, road type) could reflect the operating and capital costs of that road or road type. This latter approach is advocated by rail infrastructure providers for major road corridors because it emulates pricing of rail corridors.

The effects on levels of charges of 'stand-alone' location-based charging compared with current network-wide averaging are not entirely clear, although the evidence is suggestive that charges for some heavily used major corridors could decline. Conversely, charges for lightly-used rural and some arterial roads could increase significantly. For example, the *attributable* costs of a B-double using a local road are as much as 50 per cent higher than the cost of them using an average arterial road.

Box 5 **What are mass–distance and location-based charges?**

Mass–distance charges

Measuring distance travelled is the most technically feasible option for road pricing reform. In its simplest form, mass–distance charging would involve measurement of the distance travelled by trucks over a defined period. This would reduce the need for averaging of costs within truck classes, and provide a better link to truck costs across classes than the fuel excise (because the effect of differences in fuel efficiency would be removed).

With currently available technologies, distance-based charges would not differentiate trucks by *actual* load mass — charges could vary by vehicle class only. If not linked to location, mass–distance charging would continue to average costs across the network.

Options available for monitoring distance include on board units (OBUs) — such as odometers or hubodometers — distance licence systems, or toll stations at the entrances and exits of particular roads.

Mass–distance location-based charges

The monitoring of location would allow heavy vehicle charges to vary by road type. Once charges can be varied by location, they could also incorporate time-related, location-specific congestion and possibly noise and air pollution charges.

Internationally, there is no example of charges being varied by location to account for the damage done to different road types by a vehicle, although some systems have some limited capacity to track vehicle location. The Intelligent Access Program in Australia aims to monitor compliance with designated higher-mass truck routes.

The monitoring of a vehicle's location could be achieved by one or a combination of tolling stations, communications beacons, driver logs and OBUs, including GPS technology. Driver logs and/or GPS systems could be cross checked by the random placement of beacons/cameras. Telematics could be used to collect charges, possibly in real time, in a manner similar to current eTolling arrangements. The implementation of location-based charging would require accurate mapping of Australia's road system.

But would road pricing reform yield net benefits in practice?

While technological developments such as satellite monitoring have improved the feasibility of such charging instruments, technical feasibility is a *necessary but not sufficient condition for change*. Whether or not pricing reform actually delivers net benefits depends on:

- *The structure and level of charges*. The capacity to monitor and charge for road use may not promote efficiency if charges are set at inappropriate levels. This requires better understanding of the relationships between road use and road damage as well as appropriate pricing structures that minimise consumption distortions while covering total costs. Who sets the charges, and the incentives they face, will also be relevant.
- *The transaction costs* of implementing and enforcing new systems, including technology costs. In Germany, the *direct* costs incurred collecting road user charges from freight users of autobahns amount to one quarter of total revenue (about $1 billion per year). Compliance costs are not known. *Cost-effective* location-based charging is probably some years away.
- *The extent to which charges elicit efficient responses by users and providers.* The scope for efficient responses to price signals will be influenced by the institutional and regulatory environment within which services are provided. The benefits of more cost-reflective pricing may be limited if regulations simply prohibit some trucks from using particular roads or if investment decision-making does not respond to improved price signals, for example, because providers of roads (government road agencies) do not directly receive revenue from the charges.

Although there could still be benefits from location-based charges if revenues did not flow to the governments responsible for funding the roads, it is doubtful that the potentially more substantial gains from improving the efficiency of decisions about the level and pattern of road spending would be realised. Given the implementation challenges and costs associated with introducing location-based charges, it would be desirable to ensure that the greatest possible benefits could be achieved by establishing a more direct link between road charges and road provision. Moreover, linking road revenues to spending would be likely to improve community acceptance of such a reform.

Linking demand and supply is the key

Participants representing a wide range of interests regarded the disconnect between road charges and road spending decisions to be a major problem, leading to inefficient investment and maintenance decisions. One study has estimated that there is a backlog of beneficial road projects totalling some $10 billion. The Australian Livestock Transporters Association documented road bottlenecks that constrained achievement of substantial savings in freight costs, the correction of which its members would be willing to pay for.

Box 6 The disconnect between road prices, revenues, expenditures and investment — participants' views

Another feature of the current arrangements is the institutional separation of decision-making on investment and access prices. Decisions regarding expenditures on road infrastructure are made by government road agencies at various levels of government and independently of pricing decisions made by the NTC and of revenues generated by the charges. (ACCC, sub. 44, p. 5)

A major policy issue for consideration during the review is the linkage between past and future expenditure on transport infrastructure with the revenue raised through charging for its use … it is a major issue for the road system, with no clear linkages evident to users. (Tasmanian Government, sub. 36, p. 3)

There is little relationship between the cost of maintaining freight transport infrastructure, the revenue raised from the freight sector by the fuel excise or expenditure by the Commonwealth on roads. (New South Wales Government, sub. 50, p. 14)

Measures to strengthen current decision-making processes for road spending would be a step in the right direction. Road infrastructure funding mechanisms should include a clear project selection process, stakeholder involvement and public transparency, including formal procedures for public consultation. These principles have been broadly adopted as part of the AusLink framework for investing in the national highway system. Their application across all jurisdictions would be desirable.

But even if projects are undertaken according to their benefit–cost ranking, a question would remain whether charging-cum-taxing arrangements unduly constrain overall road spending. Linking revenues from road user charges to road spending has the potential to promote efficient levels as well as allocations of road spending. There are various alternative models, involving different degrees of independence as well as having different implications for road pricing (box 7).

Notwithstanding the significant implementation challenges, two options warrant further consideration — a road fund and more commercially-oriented management of part of the network. A national road fund could operate with current network charges or with distance-based charges. More commercially-oriented management of part of the network (for example, the major freight corridors), on the other hand, would only be possible with cost-effective location-based charges. Both models could operate side-by-side. While there would be benefits from both approaches, each poses significant challenges.

Box 7 Different institutional models

1. *Departmental model, with hypothecation of road revenue* — roads are managed, and investment decisions made through a government department, but with hypothecation of revenue from road charges to fund road expenditure.
2. *Dedicated road fund* — devolution of responsibility for management and funding of roads to an autonomous fund manager/agency. Revenues are paid directly to the fund, usually from road-related taxes and charges. The fund is responsible for allocation of road funds in an efficient and transparent way.
3. *Public utility model* — road companies are established which have responsibility for all or parts of the road network. Road companies are owned by governments and run on commercial lines with appropriate governance and profit objectives. Road companies have the authority to charge road users directly for road access and use.
4. *Privatised model* — private ownership and management of all or part of the network.

A national road fund?

The major potential benefits of a road fund would be the explicit linking of charges and road spending, forward looking charges linked to efficient future spending, and greater transparency in project evaluation. Compared with present arrangements, a road fund could facilitate more efficient decision-making, funding and provision of road infrastructure.

Whether these benefits are realised would largely depend on the independence and governance of the fund. Transparency and other mechanisms to preserve independence and to promote application of consistent investment criteria to road spending would be essential. While each jurisdiction could operate its own fund, a single national road fund would provide a more direct and transparent linkage between heavy vehicle charges and efficient road expenditure. However, there are a number of issues that would require inter-jurisdictional agreement, including which revenues would be hypothecated to the fund, how future revenue requirements and heavy vehicle charges would be determined, and criteria for efficiently allocating funds to road projects and between road agencies.

The Commission is seeking participants' views about the feasibility of establishing a national road fund, particularly how inter-jurisdictional issues might be resolved.

Commercially manage major freight routes?

The main benefits of commercially-oriented road management are that it is likely to be more efficient, innovative and responsive to user demand. In addition to the need for cost-effective direct road user charging systems (which are likely to become available in time), this option would require managing a number of implementation issues which are far from trivial and which, if not appropriately dealt with, would affect both community acceptance and the economic pay-offs. They include:

- *how location-specific charges would mesh with rest-of-network charges.* For example, would location-based charges be discounted (or users directly reimbursed) to reflect network-wide charges applying through the fuel excise? If this were not done, road users would be paying twice, which would likely encourage inefficient route substitution as well as hinder road user acceptance of change; and
- *how non-freight use (particularly passenger traffic) would be charged for*. Stand-alone, location-based charges require *all* users to pay for the asset so that efficient charges can be set to raise adequate revenues. Non-freight use could either be charged for directly or by apportionment of fuel taxes or registration charges to the road owner.

Other transitional issues arise from the need to shift from a PAYGO system to annualised charges over the life of the asset. Road users are more likely to accept road-specific charges for new or greatly enhanced roads, rather than for existing roads for which they may justifiably consider they have already paid. And, although limited application of location-based charges might appear to limit distributional impacts, there could be ripple effects for users of other roads, because the residual network spending 'pool' would be reduced.

The Commission is seeking participants' views about the feasibility of introducing more commercially-oriented management for major freight routes, particularly in relation to potential benefits and costs, and how pricing, network 'boundary' and other implementation issues could be resolved.

Making the current systems work better

While changes involving fundamental pricing and institutional reform of road provision offer the prospect of significant gains, they also will entail substantial costs and pose considerable challenges (not least those created by Australia's federal system). In particular, more work needs to be done to test both the technical and economic viability of location-based charges, as well as potential social impacts.

Meanwhile, some changes could be made that would clearly promote greater efficiency in each mode, which modelling suggests could generate significant economic benefits. These changes generally relate to reforming regulatory arrangements and improving investment decision-making.

Improving road's performance

Although, under the current charging system, road freight operators receive only a rough signal about the costs they generate by using particular roads, the Commission is not confident that there are significant changes that could be made under current charging and information constraints that would unambiguously improve efficiency. That said, increased transparency of funding of road CSOs, among other things, would help ensure that these expenditures were well-targeted and not being paid for by the road freight sector. And, as noted earlier, it is likely that, with current charges and increasing road spending, heavy vehicles in the aggregate will soon cease covering their attributed network costs.

There are a number of other actions that would improve efficiency in the road infrastructure sector. They include strengthening current road spending decisions by making them more transparent and consultative, and fostering mechanisms to facilitate better links between road users and road providers. For example, arrangements between freight operators and road providers to upgrade particular roads and remove infrastructure bottlenecks, should be encouraged.

Government road agencies typically regulate road access by heavy vehicles, prohibiting truck use of certain roads and/or by prohibiting certain types of vehicle, in order to contain road maintenance and replacement costs. There appears to be considerable scope to replace these prescriptive regulations with performance-based approaches, facilitating continuous productivity gains and innovation in the road freight sector. More generally, regulations affecting the road transport sector should be rigorously evaluated in accordance with regulatory impact criteria, to identify least-cost approaches and demonstrate net benefits. The appropriateness and cost-effectiveness of existing regulations should also be systematically reviewed, consistent with COAG's commitment that all governments undertake targeted annual public reviews of existing regulations.

Improving rail's performance

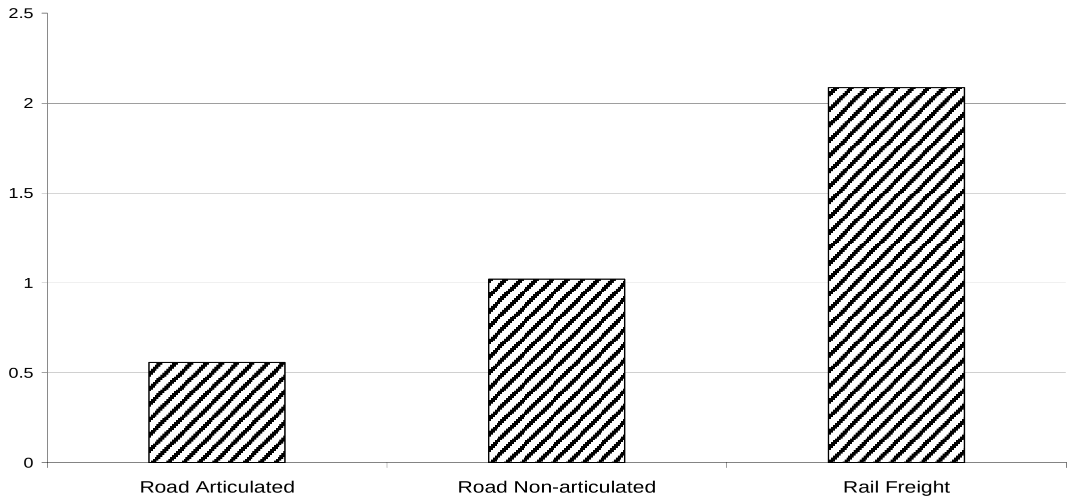
A number of impediments appear to constrain rail's performance. These include the legacy of a century of inconsistent state-based regulation, as well as issues arising from the comparatively recent structural separation and commercialisation of rail networks and accompanying access regimes.

- On the regulatory front, there are several worthwhile initiatives underway aimed at streamlining incompatible regulations, especially safety regulations. These reforms have significant potential to reduce rail freight costs, particularly on interstate corridors, and should be implemented as soon as possible.
- Vertical separation and access regulation, designed to encourage above-rail competition, might constrain scope for efficient price discrimination across users and impede efficient investment, thus reducing the long-run viability of some lines. While COAG's decision to promote national consistency and coordination in rail access regimes is a welcome advance, the Commission considers that there is scope to wind back access regulation where vertically-separated below-rail operators face strong competition from road (and, indeed, sea freight). Nor should efficient price discrimination by below-rail operators be discouraged.
- Stricter application of the corporatisation model to government-owned railways would lead to improved industry performance. Priorities include greater clarification and transparency of objectives, improved transparency of the external governance role of ministers, and a general strengthening of accountability. A commercial focus also requires that any CSOs required to be provided by private operators are funded directly and transparently by governments, with objectives clearly enunciated.

In the Commission's assessment, these measures would have a more beneficial impact on rail's freight share than any plausible increase in road charges on the intermodal routes. Modelling suggests that rail output responds significantly to productivity improvements. Indeed, rail freight was found to expand relative to road following equal productivity improvements in each — in part because of rail's relative capital intensity, which allows it to expand at relatively low cost (figure 7). Rail also carries major export commodities, which respond strongly to lower freight prices.

Figure 7 **Equal productivity improvements give rail freight an edge**

5% productivity improvements, % change, tonnes



Concluding remarks

That heavy vehicle charges are estimated based on network-wide spending, rather than reflecting the economic cost of road services actually consumed, is neither deliberate nor accidental — until recently, there has been no alternative. Flawed as these charges are, however, there does not appear to be a compelling case for change on competitive neutrality grounds.

Nonetheless, technological developments have opened up the possibility of a new approach to charging for and providing road services. Tantalising as that may be, major issues would need to be resolved before it could become reality, not least devising an appropriate institutional architecture. The challenge is to match the aspiration for a more efficient, commercially-oriented approach to road pricing and provision with implementable, low-cost solutions that would gain broad support.

In the interim, there are measures that could be taken that would unambiguously improve efficiency within each mode. They include regulatory reform as well improved investment decision-making frameworks. They would at least begin to make a link between what trucks pay and road spending that is undertaken, promoting broader understanding and acceptance of charges and any warranted increases in them.

Key draft findings and recommendations

Draft recommendations and those draft findings which most directly address questions raised in the Terms of Reference are presented below. Recommendations for policy action are confined to areas in which the Commission is confident that the proposed action would bring net benefits. At this stage, the Commission is not recommending more fundamental pricing or institutional reforms for road, but two possible reform options are presented to elicit further input from participants. Requests for comment on these are appended to the draft findings and recommendations.

Key draft findings

DRAFT FINDING 3.1

Differences in approaches to charging for the use of road and rail infrastructure largely reflect the different characteristics of each mode. These, in turn, are reflected in their different institutional arrangements — commercial provision of rail and public provision of road.

DRAFT FINDING 4.1

Under a PAYGO approach, heavy vehicles as a group will pay their way over time, although inter-temporal cross-subsidies could arise if expenditure fluctuates. This has not been a significant feature of the PAYGO system to date, primarily because of national aggregation of the cost base. However, network averaging itself has created cross-subsidies between heavy vehicles accessing different parts of the network.

DRAFT FINDING 4.8

Based on the most recent data available, road user charge revenues from heavy vehicles more than cover their attributable infrastructure costs and just cover their fully allocated cost. However, following rejection of the Third Determination, cost recovery is unlikely to be maintained if road expenditure continues to rise with no increase in charges.

DRAFT FINDING 4.9

The deliberate reduction in B-double prime mover charges by the National Transport Commission (so that they do not exceed those for road trains) means that, as a class, they do not cover the network-wide costs attributable to their road use. Implications for competitive neutrality are unclear, however, given that network averaged costs allocated to B-doubles operating on the major inter-capital corridors, where road and rail most directly compete, may be higher than their corridor-specific costs.

DRAFT FINDING 4.10

The current road user charging system results in significant cross-subsidies within some vehicle classes. Vehicles travelling longer than average distances and/or carrying heavier than average loads are, all else equal, cross-subsidised by other vehicles within the class. Similarly, vehicles that travel more than average on higher unit cost roads (such as local roads) are, all else equal, cross-subsidised by those using lower cost parts of the network.

DRAFT FINDING 5.8

Rail infrastructure operators generally are unable to fully cover economic costs and often are reliant on government subsidies of various forms to maintain viability. These subsidies are potentially significant in affecting competition between road and rail freight.

DRAFT FINDING 6.3

There is a range of externality costs related to freight transport. However, the externality component is often difficult to determine, both in principle and empirically. Estimated costs of particular externalities range widely due to different methodologies and assumptions. What can be said is that:

- ***external costs of freight transport are generated jointly with passenger transport, are much higher in urban areas than in rural areas and are higher for road freight than for rail freight;***
- ***there appears to have been significant internalisation of externalities (except for greenhouse emissions) through regulation, legal liability and various other means.***

DRAFT FINDING 6.5

An all-encompassing, uniformly applied, externalities charge on freight operators would be an inappropriate and inefficient mechanism for reducing freight

transport externalities, many of which are time and location specific. It effectively would impose a tax on freight transport, rather than bringing about cost-effective externality abatement.

DRAFT FINDING 6.10

Further research into transport externalities in Australia is required to assist the introduction of the most cost-effective policies for attaining efficient abatement of external costs. Research should focus on:

- ***the nature and size of transport externalities; and***
- ***the extent to which these externalities already are internalised, particularly by policies affecting the decisions of passenger and freight transport users.***

The BTRE is best placed to undertake this research.

DRAFT FINDING 7.1

Based on the available evidence, there is no compelling case for increasing charges for road freight infrastructure users on competitive neutrality grounds. If charges were to increase for road, modelling suggests that even substantial increases are unlikely to have a significant impact on rail's modal share.

DRAFT FINDING 8.1

The technical feasibility of more finely-tuned road user charges, such as mass–distance and location-based charges, is a necessary but not sufficient condition for them to be economically worthwhile. In particular, the potential benefits of direct road user charging will be heavily influenced by the institutional setting within which such charging operates, as well as by the transaction costs of the pricing system itself.

DRAFT FINDING 8.11

Introduction of simple mass–distance charges solely to remove one of many levels of averaging in the current system may not justify the costs (and possible distributional impacts).

- ***However, distance-based charges could establish a 'technological' platform for location-based charging, providing an intermediate step from an input tax to a form of direct road pricing.***
- ***Mass–distance charges also could provide a dedicated (and certain) source of funding for a road fund.***

DRAFT FINDING 8.12

Mass–distance location-based charges have the potential to bring substantial efficiency benefits. But they also could entail substantial costs and pose some formidable implementation challenges. In particular, institutional arrangements for providing roads would need to change to deliver the full benefits of pricing reform. This suggests that a cautious, incremental approach would be warranted to allow satisfactory resolution of these issues.

DRAFT FINDING 9.2

Heavy vehicle road-user charges, as currently determined and applied, understandably appear to road operators more like taxes than prices. Moreover, they offer, at best, weak signals to decision-makers about the desirable level and pattern of future road spending and, combined with funding arrangements for road spending, create incentives for road managers to preserve existing road assets rather than facilitating their optimal use.

DRAFT FINDING 9.3

Current road funding arrangements potentially lead to inefficiencies and distortions in road management and investment decision-making.

The Commission is not in a position to assess the many claims suggesting that road infrastructure expenditure is, and has been for some time, inadequate. However, a range of evidence suggests that there is scope to improve investment outcomes by making decisions more responsive to the needs of road users.

DRAFT FINDING 9.8

Compared with present arrangements, a Road Fund model would facilitate more efficient decision-making, funding and provision of road infrastructure. Appropriately-designed, a Road Fund could provide a regular and reliable source of road finance, improve governance of road funds and efficiently discipline road spending. However, to be effective, a Road Fund needs to have a dedicated source of funds, a significant degree of autonomy and transparent processes for allocating funds efficiently.

Implementing this model in Australia would pose a number of particular challenges, principally because of different responsibilities of different levels of government. While each jurisdiction could operate its own fund, a single national road fund would provide a more direct and transparent linkage between heavy vehicle charges and efficient road expenditure. However, there are a number of issues that would require inter-jurisdictional agreement, including:

- ***which road-related revenues would be hypothecated to the Fund (vehicle registration fees, fuel excise taxes and/or some form of mass-distance charge);***
- ***how future revenue requirements and heavy vehicle charges would be determined; and***
- ***criteria for efficiently allocating funds to road projects and between road agencies.***

DRAFT FINDING 11.1

A national road fund has the potential to improve the efficiency of road spending decisions, but, to achieve this, it would need to operate with a high degree of autonomy reinforced by appropriate governance arrangements and transparent processes, and also would require inter-jurisdictional agreement about processes and criteria for setting heavy vehicle charges and allocating funds. These are complex issues on which further input is sought.

DRAFT FINDING 11.2

Location-based charging on major freight routes has the potential to bring significant additional efficiency benefits, especially if accompanied by more commercially-oriented road infrastructure provision. But the formidable implementation issues, including how to resolve 'boundary' issues and how to charge for non-freight road use, as well as the potential distributional implications flowing from a breaking down of network averaging and cross-subsidisation within current charging arrangements, require detailed investigation.

Draft recommendations

DRAFT RECOMMENDATION 11.1

The corporatisation model should be more strictly applied to government-owned railways in order to improve industry performance. Particular priorities include greater clarity of objectives, improved transparency of the external governance role of ministers, and a general strengthening of accountability.

Greater transparency of funding of Community Service Obligations — including enunciation of objectives, and demonstration of how contributions will achieve stated objectives at least cost — should be introduced as soon as possible, among other things, to facilitate fully commercial provision of rail freight operations.

DRAFT RECOMMENDATION 11.2

National consistency and coordination in rail regulatory frameworks — including of safety, operational and technical standards — should be expedited.

DRAFT RECOMMENDATION 11.3

Progress in implementing the February 2006 COAG agreement to adopt a nationally-consistent approach to regulation of all nationally significant infrastructure, should be monitored in relation to rail to determine whether there are likely to be additional benefits in moving to a single national regulatory regime and regulator.

The objects clause, declaration thresholds and pricing principles (which, among other things, allow for multi-part pricing and price discrimination when they aid efficiency) now embodied in Part IIIA of the Trade Practices Act should be incorporated in all rail access regimes.

DRAFT RECOMMENDATION 11.4

There appears to be scope to moderate or even revoke access regulation where pricing by vertically-separated below-rail operators is significantly constrained by competition from road and sea freight transport operators. Building on COAG's agreement to promote nationally-consistent access regulation of major infrastructure, a process should be established for reviewing the need for access regulation of vertically-separated rail networks.

DRAFT RECOMMENDATION 11.5

Given the mixed success of vertical separation in encouraging above-rail competition, whether allowing vertical reintegration of particular rail lines or networks would promote their commercial viability should be subject to detailed independent examination.

DRAFT RECOMMENDATION 11.6

Prescriptive regulations that restrict particular types or configurations of heavy vehicles from using all or some roads, should be replaced, where possible, with performance-based regulations to promote flexibility, innovation and greater productivity in the road freight sector. The proposed package of Performance Based Standards to be agreed upon and implemented by all jurisdictions by end 2007 is a major step forward and it is important that the announced timetable is met.

DRAFT RECOMMENDATION 11.7

Regulations applied to the road transport sector should be rigorously evaluated in accordance with regulatory impact criteria, to identify least-cost approaches and demonstrate net benefits. The appropriateness and cost-effectiveness of existing regulations in the sector also should be systematically reviewed, consistent with COAG's commitment that all governments undertake targeted annual public reviews of existing regulations.

DRAFT RECOMMENDATION 11.8

To improve existing investment decision-making frameworks, road infrastructure funding mechanisms should include a clear project selection process, stakeholder involvement and public transparency, including formal procedures for public consultation. These principles have been broadly adopted as part of the AusLink framework for investing in the national highway system and endorsed by COAG. They should be applied across all jurisdictions as soon as possible.

Requests for information

The Commission is seeking further information and advice from participants on a range of matters, including about:

- *the potential costs and benefits of reintegration on specific rail networks;*
- *the feasibility of establishing a national road fund, particularly how inter-jurisdictional issues might be resolved; and*
- *the feasibility of introducing more commercially-oriented management for the major freight routes, the potential benefits and costs, and how pricing, network 'boundary' and other implementation issues could be resolved.*

PART 1

1 About this inquiry

1.1 What has the Commission been asked to do?

Australia’s size, dispersed population centres and distance from overseas markets place a premium on the achievement of an efficient, reliable and integrated domestic freight transport system. This is highlighted by the fact that each tonne of freight carried in Australia is transported more than 200 kilometres on average.

This inquiry addresses concerns that current charging arrangements for the use of road and rail freight infrastructure might be resulting in distorted modal choices and inefficient infrastructure investment decisions, which retard the productivity of the land freight transport sector.

The inquiry stems from a decision by the Council of Australian Governments (COAG) on 10 February 2006 to ask the Productivity Commission to conduct a review which, as set out in the Communiqué, would among other things:

- identify the optimal methods and timeframes for introducing efficient road and rail freight infrastructure pricing in a manner that maximises net benefits to the community;
- determine the full financial, economic, social and environmental costs of providing road and rail infrastructure;
- identify other barriers to competition in road and rail transport; and
- recognise transport operators and users and remote and rural communities will need sufficient time for transition and adjustment to pricing arrangements.

The Australian Government subsequently forwarded formal terms of reference to the Commission. These indicate that the overarching purpose of the review is:

> … to assist COAG to implement efficient pricing of road and rail freight infrastructure through consistent and competitively neutral pricing regimes, in a manner that optimises efficiency and productivity in the freight transport task and maximises net benefits to the community.

The terms of reference draw from and elaborate on the COAG communiqué. They specify, for example, that in identifying efficient pricing options for road and rail freight infrastructure, the Commission should ‘investigate options for transport pricing reform, including moving to mass, distance and location charging of freight transport'. Non-price barriers to competition in road and rail transport also are to be addressed. In particular, the terms of reference state that the review:

> … will also identify any other competition, regulatory and access constraints on the economically efficient pricing and operation of road and rail freight transport and related infrastructure networks and assets, including access to and competition between inter-modal facilities, and make recommendations on the options for removing these impediments and increasing efficiency.

The terms of reference, together with relevant extracts from the COAG communiqué, are reproduced at the beginning of this report.

1.2 Reasons for the inquiry

Australia's domestic freight task has doubled over the past two decades, reaching almost 430 billion tonne kilometres (tkms) in 2002-03 (BTRE 2005b). Over the next 20 years, the freight task is projected at least to double again, reflecting anticipated economic and trade growth as well as increasing specialisation and, consequently, increasing inter- and intra-industry trade within Australia. Given its pivotal role in the economy, the freight task requires the most efficient mix of modes and to have each mode operating efficiently.

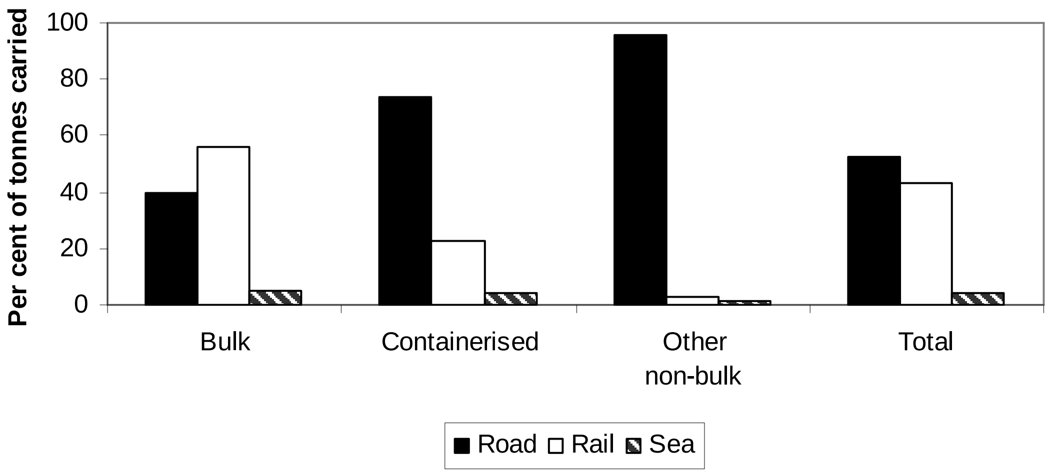
Box 1.1 **Defining the freight task**

The 'freight task' refers to the aggregate movement of freight of all kinds (bulk and non-bulk) within Australia, typically over a year. There are several ways in which it can be measured or quantified, including in terms of tonne kilometres, tonnes, volume or value. Unless otherwise specified, in this report reference to the freight task is in terms of tonne kilometres (where a 'tonne kilometre' is one tonne transported one kilometre).

As discussed in chapter 2, Australia's freight task is dominated by the haulage of coal, iron ore and other minerals and, to a lesser extent, agricultural produce, from diverse regions to ports for export, and the transportation of intermediate inputs and final consumer goods both within and between States. Road and rail operators perform most of the domestic freight task, transporting goods over the major inter-city corridors as well as on urban and regional networks. Coastal shipping carries a small amount of domestic freight over long distances, generally between capital cities.

Modal shares vary significantly depending on the category of freight (figure 1.1). Although rail and road carry roughly equal shares of the total freight task, rail dominates the longer-haul, heavier bulk market (especially coal, iron ore and other minerals) while road dominates the interstate non-bulk and shorter-haul (particularly urban) markets.

Figure 1.1 **Modal shares by freight tonnes**[a]



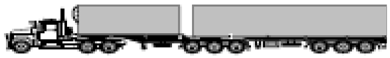
[a] Data are for 2001. Air freight accounted for less than 1 per cent of the domestic freight task. Excludes rail freight in Tasmania.

Data source: ABS (2002a).

There is general agreement that freight carried by both road and rail will increase substantially in the years ahead, but projections of modal shares differ according to assumptions about trends in modal costs and prices, as well as projected growth in different freight tasks. For example, Sinclair Knight Mertz (2006) project that road will increase its share, largely at the expense of coastal shipping. The BTRE (2006a) predicts that both road and rail will increase their shares of the freight task, with growth in road outstripping rail somewhat. In contrast, Port Jackson Partners (2005) project that, with certain reforms and productivity improvements, rail's share of the freight task could increase significantly.

Growth in the road freight task to date appears to have been the result of several factors, including the changing nature of the freight task itself (especially the relatively rapid growth in non-bulk freight on inter-capital routes), and the increasing value placed on flexibility and reliability by businesses. Technological innovation also has played a role. For example, B-doubles and road trains (table 1.1) combine economies of scale with the flexibility of road transport. Advances in communications technology are further improving service quality and reducing transport and storage costs by reducing the need for intermediate warehousing. In effect, improved communications now allow trucks to perform many of these functions.

Table 1.1 **Multiple truck types and sizes**

Rigid truck	
Truck and dog	
6-axle semi-trailer	
9-axle B-Double	
Double road train	
Triple road train	

Source: NTC (2005b).

It is argued that road freight is not paying its way

It is widely considered that current approaches to costing of and charging for road use by heavy vehicles (table 1.2) give them an advantage over rail. In particular, it has been claimed that road charges for the heaviest classes of vehicle, especially those vehicles travelling long distances which are more likely to compete with rail on major corridors, fall short of the economic costs they impose.

If it had been agreed to, the National Transport Commission's (NTC) Third Heavy Vehicle Pricing Determination would have increased diesel fuel excise for all heavy vehicles and increased registration charges substantially for all B-doubles and road trains. But a number of participants have argued that even if those proposed increases had gone ahead, the heaviest vehicles still would not pay their way. The shortfall in cost recovery is attributed to several factors, including that:

- under the pay-as-you-go (PAYGO) system road users, unlike rail users, do not pay for road infrastructure based on a life-cycle approach, which is seen as allowing them to avoid paying a rate of return on capital and making adequate provision for depreciation;
- the allocation of road expenditure to heavy vehicles (in particular, the allocation of common costs) is considered to be too low;
- averaging of costs within each truck class may have the effect that the biggest users of roads (causing the most road damage) are cross-subsidised by similar trucks travelling shorter distances and carrying lighter loads; and
- use of diesel fuel excise as a charging mechanism may mean that more fuel efficient B-doubles are being cross-subsidised by smaller trucks.

Table 1.2 **Current road and rail pricing arrangements**

	Road	*Rail*
Institutions/organisations	National Transport Commission responsible for recommending heavy vehicle charges to the Australian Transport Council	Seven corporatised/privatised vertically integrated/separated entities, responsible for different intra/interstate tracks
	State and Territory Governments responsible for setting registration fees for vehicles under 4.5 tonnes in line with approved determinations	NCC/ACCC and State regulators responsible for regulation of terms and conditions of third party rail access
Two or multi-part pricing:		
• fixed component	CPI-indexed registration fees for trailers/prime movers	Flagfall charge per train
• variable component	Diesel excise at 19.6 cents per litre (net of rebates)	Charge per gross tkm
Charging process	Posted	Access charges negotiated, or arbitrated, within a range determined by regulator
Cost recovery	Based on annual road expenditure averaged over a three-year period (PAYGO system)	Potentially, but actual charges often below allowed levels (capital cost typically based on DORC methodology)
Basis of charges:		
• vary by vehicle/train type?	Yes	Yes
• route-specific?	No	Generally, yes
• mass–distance?	No	Yes
• charge for externalities?	No	No

Source: BTRE (2004).

In addition, while neither land transport mode explicitly incorporates the costs of environmental and social spillovers (such as pollution and accidents) in charges, these effects are estimated to be more substantial for road use than for rail. Consequently, it is argued that failure to account adequately for externalities could in itself encourage overuse of road relative to rail and also distort investment decisions between modes.

Each of these matters is examined in this report.

Should road infrastructure pricing be made more consistent with rail?

New technologies mean that charging directly for some aspects of road use is becoming technically feasible. These developments not only open up the possibility of commercial charging structures for roads, but may also provide an opportunity to deliver road infrastructure services in a more commercial manner.

At present, except for some toll roads, the public road network continues to be provided by governments, with all road users ‘taxed’ via registration charges and fuel excise. While these charges, in aggregate, significantly exceed annual road expenditure (chapter 2), there is no direct link between road provision and the revenue raised. Most rail infrastructure services, by contrast, now are provided by profit-oriented private or corporatised entities. Revenue from rail charges accrues directly to the owner/provider.

1.3 How has the Commission approached its task?

Both the COAG communiqué and the terms of reference for this inquiry cover a wide range of complex and detailed matters. While the Commission has sought to address them all to some extent, the inquiry timeframe, and a lack of reliable data in relation to some issues, has affected both the emphasis and approach. In particular, the Commission has not been able to estimate the *economic* costs of providing road freight infrastructure. Even if data were available, this is an enormous task, requiring judgements to be made about the appropriateness of existing road infrastructure and about efficient future spending.

In its initial consultations, the Commission received broad endorsement of participants for an approach that would focus on establishing principles for the pricing of road and rail infrastructure use, as well as feasible options and paths for implementing them in the medium to longer term. In addition, the Commission has investigated the desirability of, and scope for, fundamental changes in the way road (and, to some extent, rail) infrastructure services are provided. Indeed, in the Commission’s view, for road infrastructure, pricing and institutional reform are inextricably interlinked. A range of institutional arrangements that would better integrate road infrastructure supply and demand are explored in chapter 9.

In developing pricing principles, the Commission has not attempted to replicate or evaluate in detail the (rejected) Third Heavy Vehicle Pricing Determination. Nonetheless, some key issues bearing on cost attribution under current institutional arrangements for road charging are examined in chapter 4.

Some issues relating to the scope of the inquiry

While the focus of the inquiry is on *freight* infrastructure use, issues such as road safety, urban road congestion and other externalities of infrastructure use, and appropriate recovery of common costs of providing road and rail infrastructure are affected by, and have implications for, passenger transport as well. In addition, where relevant, the interface between road and rail freight transport and other transport modes (sea and air) has been considered.

The terms of reference specify that 'the review will not address fiscal implications which will be assessed by governments following the review's completion'. The Commission has interpreted this to mean that fiscal implications for Commonwealth, State/Territory and local governments should not constrain its recommendations regarding efficient pricing structures. As discussed above, the Commission considers the link between infrastructure pricing and investment to be central and, for road in particular, this could entail fundamental institutional reform. Moreover, direct charging of road use would likely affect Commonwealth fuel excise revenue and possibly registration fees that currently accrue to the States and Territories.

The final part of the terms of reference requires identification of 'other' impediments to efficient pricing and use of transport infrastructure. These can include regulatory issues, including in relation to market structure and competition, investment frameworks and the adequacy of intermodal facilities. The efficiency benefits of more flexible pricing may be limited if, for example, investment decisions are made on criteria other than costs and benefits or if infrastructure use and modal choice are constrained by regulation. Where an issue relevant to these matters is being dealt with by another body (for example, rail safety and harmonisation of regulation), the Commission has limited itself to outlining the nature and magnitude of the problem, and noted progress in and the potential benefits of remedying it.

A community-wide perspective

In undertaking this inquiry, the Commission has been guided by the COAG communiqué and the terms of reference as well as by the general policy guidelines and operating principles contained in the *Productivity Commission Act 1998*. In particular, the Commission is required to have overarching concern for the community as a whole. That said, impacts on particular groups must be taken into account. For this inquiry, in particular, the Commission is asked to assess potential impacts of pricing reform options on rural and remote communities, as well as, more generally, on users and transport operators.

In essence, the Commission's task is to explore the most efficient policies for promoting community well-being and, where necessary, to identify ways of facilitating adjustment to resultant structural change.

Efficiency of freight transport infrastructure essentially requires it to be provided to an appropriate standard at least cost, with prices that reflect the full social costs of its use. Social costs include not only the costs of providing the infrastructure, but also costs imposed on the wider community by freight transport operations such as air and noise pollution. With prices reflecting social costs in each mode, not only would use of freight transport be efficient from an overall community perspective, but choices between modes, including road and rail, would also be appropriate.

However, rail and road infrastructure are characterised by significant economies of scale and scope which involve large fixed and common costs. While there are good reasons for requiring infrastructure users to pay for these costs (and the terms of reference suggest that they should), devising efficient pricing structures for each mode, and across modes, becomes more complicated.

Opportunities for public input

The Commission has encouraged broad public participation in this inquiry. Soon after receipt of the terms of reference, advertisements were placed in national newspapers, *Lloyd's List Daily Commercial News* and *Australian Transport News*. The first circular was sent to around 1500 individuals and organisations considered likely to have an interest in the study, including more than 600 regional local government bodies and more than 400 regional media outlets. An issues paper was released in March 2006 to assist participants to prepare their initial submissions.

Commissioners and staff have held informal discussions with more than 50 organisations, including government agencies and departments, industry associations and infrastructure users and providers. Seventy-six submissions were received in response to the issues paper.

In addition, two roundtables were held to canvass views on key issues. The first, held in Emerald, Queensland, provided a forum for more than 20 participants including infrastructure users (mainly agricultural and mining interests), state and local government representatives and service providers, to discuss potential regional and remote impacts of infrastructure pricing reforms. At the second, held in Canberra, around 40 representatives from Commonwealth, State, Territory and local governments and peak industry organisations as well as several transport consultants discussed key issues relevant to the Commission's preliminary findings and recommendations.

In parallel with this inquiry, the Commission was asked by COAG senior officials to investigate potential economic and revenue impacts of the new National Reform Agenda (NRA). For consistency, general equilibrium analysis undertaken for this inquiry uses the same model (Monash MMRF) as the NRA project. Modelling results contained in this report were presented among other results at a workshop for COAG officials held in September.

Details of all individuals and organisations visited, roundtable attendees and submissions received are provided in appendix A. All non-confidential parts of submissions are available on the Internet, at Commission and State libraries, and from Photobition Digital Imaging Centre.

What are the next steps?

Participants are invited to respond to the discussion draft by making written submissions and/or participating in public hearings in late October and early November.

The Commission will refine and develop its analysis for the final report in the light of comments and new information received. The final report will be submitted to the Commonwealth Treasurer by the end of the year.

1.4 Guide to the discussion draft

This discussion draft is presented in three parts.

- *Part 1* comprises this introductory chapter together with chapter 2, which outlines the nature and magnitude of the freight task in Australia, as well as trends in rail and road freight and freight infrastructure provision over time; and chapter 3, which discusses some threshold issues, including criteria for assessing the efficiency of provision and pricing of freight infrastructure.
- *Part 2* examines the extent of cost recovery within road and rail freight transport. In chapters 4 and 5, respectively, recovery of road and rail costs is assessed. Chapter 6 examines spillovers in both modes, while chapter 7 draws together the implications of the previous three chapters for efficiency and competitive neutrality in road and rail freight infrastructure use.
- *Part 3* contains four chapters which consider options for reform and their potential impacts. Efficient pricing, and reform options to secure its implementation, are explored in chapter 8 and the scope for institutional reform of road funding and provision is assessed in chapter 9. Chapter 10 examines a range of other impediments affecting the performance of road and rail.

Chapter 11 brings together the Commission's preliminary recommendations as well as outlining options for road pricing and institutional reform.

The chapters are supplemented by a number of appendixes:

- Appendix A lists individuals and organisations visited, roundtable attendees and submissions received.
- Appendix B is an adjunct to chapter 4, discussing in detail issues related to road cost allocation.
- Appendix C supplements chapter 6, providing additional details of studies that quantify impacts of land transport externalities.
- Appendix D examines road pricing systems and different pricing technologies in several countries.
- Appendix E describes regulatory regimes for rail infrastructure in Australia.
- Appendix F outlines Commission estimates of road and rail freight elasticities.
- Appendix G presents the results of general equilibrium modelling of various pricing and other policy scenarios.

2 Road and rail freight in Australia

Key points

- The freight task in Australia is dominated by the transportation of coal and other minerals, metal ores and agricultural produce from diverse regional locations to ports for export; the interstate transportation of non-bulk freight; and short distance movements of freight within urban areas.
- Inter-capital non-bulk freight carried by articulated trucks and public access rail is the predominant area of contestability between road and rail. It currently makes up around 10 per cent of Australia's total freight task.
- For some types of freight there is little scope for intermodal substitution, even where there are two modes available, as each mode is best suited to transporting different cargos over different distances.
- The road network is far more extensive than the rail network and there are many more road than rail freight operators. As a result, the road freight sector contributes significantly more to the economy than rail.
- Road dominates the carriage of non-bulk freight and the total freight task on most major corridors (except for the east–west corridor), and is used by most industries at some point in the logistics chain. Often there is no alternative to road transport.
- Rail dominates the bulk freight task (particularly the carriage of commodities generated by the mining sector), and the total task on the east–west corridor.
- Although future growth is projected to be slightly lower than in recent years, the freight task is projected to double between 2000 and 2020. Infrastructure requirements will be substantial.
- Non-bulk freight has been growing more rapidly than bulk, and road's share has been growing more rapidly than that of rail. However, rail has been increasing or maintaining its share of some long distance non-bulk tasks, and of the coal, metal ores and grain tasks.
- Recent and projected trends in modal shares reflect different characteristics of each mode and the changing nature of the freight task, but also relative productivity performance and differences in the way in which road and rail are funded, charged for and regulated.

This chapter provides an overview of the freight transport industry in Australia, past and present. Section 2.1 briefly describes the freight task. Section 2.2 examines the road and rail sectors, with particular regard to infrastructure and freight operators, the interaction between the two, and the roles of road and rail freight transport in the carriage of the freight task and the wider economy. Section 2.3 examines the changing nature of the freight task and how and why the roles of road and rail freight transport have changed over time. Section 2.4 assesses the role of government in each sector, and the current regulatory environment.

2.1 The freight task in Australia

The freight task in Australia is dominated by the transportation of:

- coal, metal ores, metal scrap and, to a lesser extent, agricultural produce, from diverse regional locations to ports for export;
- the interstate transportation of intermediate inputs and final consumer goods; and
- short distance movements of consumer goods, mail, and construction and waste materials in urban areas — for example, between docks, warehouses, retailers and consumers.

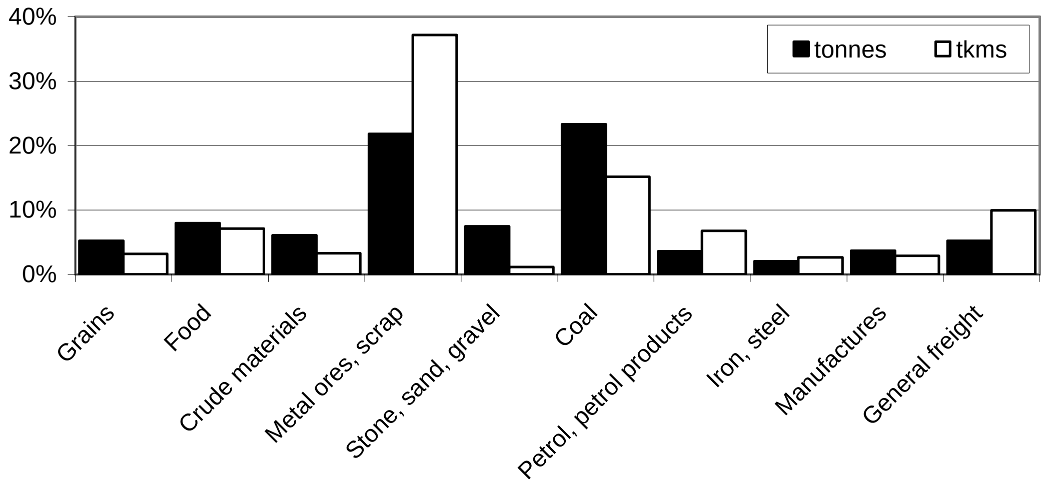
The mode chosen to transport these goods is influenced by the nature of the goods (bulk or non-bulk commodities), their perishability and fragility, their weight and volume, and the distance they are to be transported, as well as prices for each mode.

In 2002-03, the freight task totalled around 430 billion tonne kilometres (tkms). Just over 2 billion tonnes of freight were carried in 2000-01 (the most recently available estimate), indicating the long distances each tonne of freight travels, on average.

Transport of coal (mainly in New South Wales and Queensland), and of iron ore and other minerals (mainly in Western Australia), together account for around half of Australia's total freight task in terms of tonnes and tkms (figure 2.1).

Figure 2.1 **Commodity composition of the freight task, 2000-01[a]**

Percentage of total tonnes and tkms

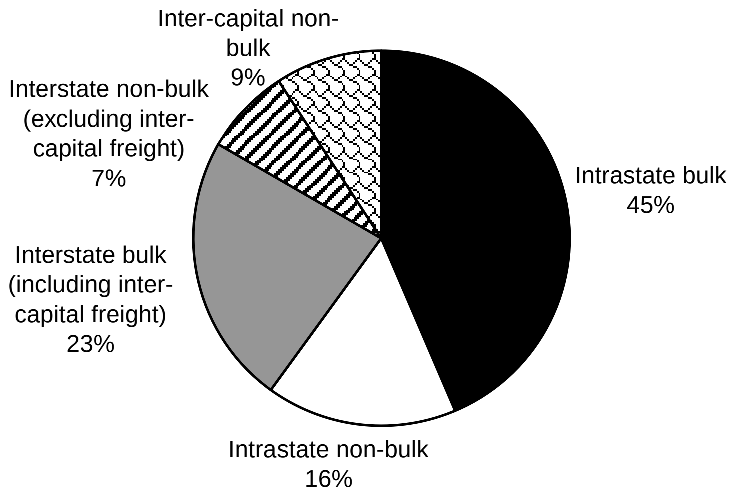


a These commodities account for over 85% of tonnes and tkms. Excludes rigids, LCVs and Tasmanian rail.

Data source: ABS (2002c).

Non-bulk freight (box 2.1) — comprising mainly food, so-called ‘general freight’ and manufactured goods (including iron and steel) — accounts for roughly one quarter of total freight tonnes. The majority of this is not containerised, the main exceptions being general freight and food.

Figure 2.2 **Interstate versus intrastate freight tkms[a]**



a 92% of total freight *tonnage* is intrastate freight, 8% is interstate freight.

Data source: BTRE (2006b).

On average, non-bulk freight is carried over longer distances than bulk freight, and it dominates freight carried along the major inter-capital corridors. Bulk freight movements occur predominantly within states (figure 2.2) and originate from regional areas. As described later, modal shares of freight largely reflect these broad differences in the nature of the freight task.

Box 2.1 **Some definitions**

Intrastate, interstate and inter-capital freight

Intrastate freight is freight for which the origin and destination are within the same state. Interstate freight is that for which the origin and destination are in different states. Inter-capital freight is a component of this.

Urban and non-urban freight

Urban freight is freight carried within capital cities and provincial-urban areas. It consists of goods movements, courier parcel services and mail delivery, bulk materials associated with building and construction and waste management and the urban component of long distance inter-urban freight transport. Urban freight is almost exclusively carried by road. Non-urban freight is the sum of interstate freight and all other non-capital city, non provincial-urban freight movements.

Bulk and non-bulk freight

While there is no precise differentiation between the two, bulk freight generally refers to those types of freight that can be dropped or poured without damage, and non-bulk freight is effectively all other types of freight. Some commodities such as timber, cement and fertilisers can, in some instances, be classified as either bulk or non-bulk freight.

Above- and below- road and rail operations

Above-rail and road operators run vehicles that haul freight (for example locomotives or trucks). Below-rail and road operators fund and/or manage the rail and road infrastructure on which these operators run their vehicles.

Ancillary and hire and reward operations

Ancillary operations are undertaken by organisations whose main business is not freight transport. Hire and reward operators' main business is securing freight consignments on a contractual basis from freight forwarders or freight consigners.

Freight forwarders and freight haulers

The hire and reward sector consists of these two types of operator. Freight forwarders act as intermediaries between consigners and freight haulers to combine consignments and achieve optimum loads. Freight haulers are fleet or independent operators that secure consignments on a contractual basis.

(Continued next page)

Box 2.1 (continued)

Private and public access rail

Private railways are built and owned by private companies. They include the iron ore railways of north–west Western Australia and the sugar-cane railways of the Queensland coast. Public access rail corresponds roughly to the previously State government-owned railways.

Sources: ABS (2002c); BTRE (2003a, 2006b).

2.2 A comparison of road and rail freight

Australia's road network is far more extensive than its rail network, with more than 800 000 km of roads compared to around 44 000 km of rail track.

- The *rail network* consists of: the national interstate corridors on the AusLink National Network (box 2.5); public access, state-based networks connecting the hinterland to capital cities or ports; private lines owned by mining companies in Western Australia and South Australia, and sugar companies in Queensland; and urban passenger networks that are used by freight trains in Melbourne, Sydney and Brisbane. Different sections of the rail network are able to support varying combinations of axle mass, train speed, train car width (broad, standard or narrow) and train length.
- The *road network* consists of: the AusLink Network (box 2.5); state highways; main roads; privately operated toll roads; local roads; and unsealed rural roads and tracks. Most of the road network has a bitumised, concrete sealed or other type of improved surface (for example, gravel or crushed stone) (Austroads 2005).

Road freight operators

Within the road freight industry, the so-called 'ancillary sector' (box 2.1) has around four times more business operators than the 'hire and reward' sector.[1] Ancillary operations account for most heavy vehicle fleets and just under two-thirds of heavy vehicle numbers. (ACIL Tasman 2004; BTRE 2003a)

1 Ancillary operations are found predominantly in the agriculture and forestry industries, though significant numbers also exist in wholesale and retail trade, building and construction, and manufacturing (BTRE 2003a).

While the hire and reward sector is smaller, it uses mainly heavier vehicles and accounts for more than half of the total kilometres travelled by the road freight sector. Nearly all businesses in the hire and reward sector are freight haulage operations (as opposed to freight forwarding operations) and half of these are believed to be owner operators. Generally, the sector is highly competitive and industry concentration is low. Major hire and reward operators include Toll Holdings, K&S Corporation, Linfox and Scott Corporation. The trucks used by these operators are described in box 2.2. (BTRE 2003a; NRTC 1999)

Box 2.2 **Which trucks do what?**

- *Light commercial vehicles (LCVs)* weigh between 3.5 and 4.5 tonnes gross vehicle mass (GVM). They make up over three quarters of road freight vehicles but travel only a very small proportion of the industry's tkms. The average tonnages they carry each year have been increasing while the average tkms they travel each year have been decreasing. This reflects changing logistics practices for delivering urban freight, which require shorter, more frequent movements of freight.
- *Rigid trucks* are motor vehicles constructed primarily to carry loads, but they also may haul trailers. They tend to be associated with ancillary operations. Rigid trucks make up just under one fifth of total road freight vehicles and the majority of heavy road freight vehicles. The average tonnages and tkms they account for each year have been increasing slowly. Within the road freight transport sector, rigid trucks carry the largest tonnages of inedible crude materials, manufactures and general freight.
- *Articulated trucks* consist of a prime mover plus at least one semi-trailer. They tend to be associated with hire and reward operations. They comprise a short, medium (a B-double) or long (a B-triple) combination, depending on the number of semi-trailers they are hauling. They make up just under one fifth of heavy road freight vehicles and only three per cent of total road freight vehicles, yet travel the majority of the industry's tkms. From 1991 to 2001, the average annual tonnages and tkms they accounted for increased rapidly (by 5 per cent and 6 per cent per annum on average respectively). Articulated trucks carry the highest tonnages of food, mineral fuels, chemicals and machinery within the road freight transport sector.

There is a growing trend towards the use of larger articulated trucks (that is, those with more than six axles, and B-doubles) and LCVs. From 1991 to 2001, LCV and articulated truck numbers increased respectively by 2.5 per cent and 1.7 per cent per annum on average, while rigid truck numbers were stable.

Sources: BTRE (2003a, 2005b); NRTC (1999).

Rail freight operators

The number of rail freight operators has increased since reforms in the 1990s (section 2.4). Most are hire and reward operators, the largest of which (in terms of tonnes carried) is the publicly-owned operator, QRNational (table 2.1).

Table 2.1 **Major above rail operators**

Operator	*Private ownership*	*Public ownership*	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*
ASR	✓		✓			✓			
QRNational		✓	✓		✓		✓**a**		
NRG Flinders[b]	✓					✓			
Pacific National	✓		✓	✓	✓	✓	✓	✓	✓
FreightLink	✓					✓			✓
SCTL	✓			✓			✓		
Silverton Rail	✓		✓						
Interrail	✓		✓						

a QRNational recently bought WestNet Rail's above rail operations. **b** Ancillary operator.

The trains used by these operators consist of one or more locomotives and multiple railroad cars (rollingstock). There are a number of different types of railroad car, including 'flatcars' for transporting containers, 'low loader' wagons for transporting road vehicles and open-topped wagons for transporting bulk minerals. The number of cars hauled is limited by the length of 'passing loops', which generally restrict train length to less than 1.5 km.

Uses of the road and rail networks differ

Uses of the road and rail networks differ greatly. For example, the road network is shared by passenger cars and freight vehicles — no public roads are specifically for freight use, though some are off limits to heavy vehicles. Of total vehicle kilometres travelled on the AusLink road network, less than one fifth is by heavy vehicles (Austroads 2005). In contrast, passenger use of the rail network is minimal outside metropolitan areas.

Further, anyone with a truck driver's licence and a registered truck can operate a hire and reward road freight transport business on any road. In contrast, when and by whom parts of the rail network can be used must be explicitly managed. This typically is done by managing 'train paths' which specify entry, exit and journey times for a train on a particular network or corridor. Rail is inherently less flexible than road, therefore, because a train only can access the network when scheduling permits it.

Also, barriers to accessing the road network are fewer, as the costs involved in negotiating terms of access are avoided. Heavy vehicle road user charges are set, and reset periodically, through a process involving detailed assessments and recommendations (‘determinations’) by the National Transport Commission (NTC) to the Australian Transport Council (section 2.4) whereas price and non-price terms and conditions governing access to the rail network are negotiated under the relevant access regime (chapter 5).

The economic importance of road and rail freight transport

In part due to the number of freight transport operators in the sector, the wide coverage of the network and its inherent flexibility, road freight transport contributes more to the carriage of the freight task and the economy than rail.

- Road is the dominant mode of transport for most commodities, and is used by nearly all industries at some stage in the logistics chain.
- Reflecting its higher share of the freight task (figure 2.3), value added in the road freight haulage sector as a whole is more than four times that in rail (table 2.2).

Table 2.2 **Economic contribution of road, rail and sea transport**

Sector	*Contribution to GDP*	*Employment*[a]
	%	Number
Hire and reward road freight haulage	1.21	152 900[b]
Rail transport [c, d]	0.54	41 400
Coastal shipping [d]	0.06	11 600
Transport industry	**4.18**	**474 300**
Ancillary road freight operations	1.21	n.a.
Total road freight transport	**2.42**	**n.a.**

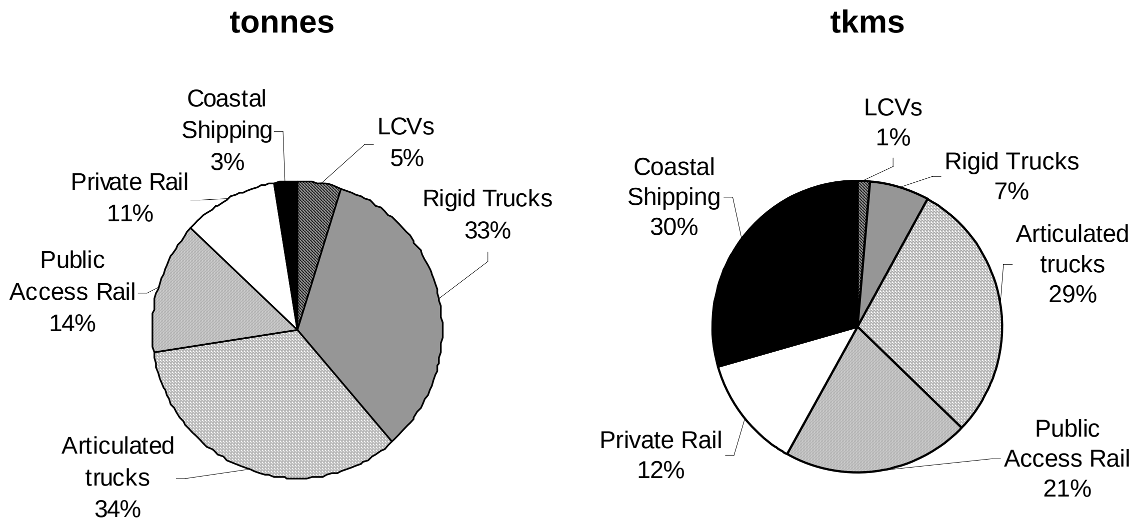
[a] May 2006. [b] Excludes self employed owner operators. Estimates of the number of these ranged from 23 000 to 30 000 in 2002 (ACIL Tasman 2004; BTRE 2003a). [c] Excludes ancillary rail freight operations. [d] Includes passenger services.

Sources: ABS (2005a); ABS unpublished figures; BTRE (2003a).

Although road and rail together dominate freight tonnages, coastal shipping makes a significant contribution to total freight tkms because of the long distances over which sea freight is carried (figure 2.3).[2]

2 Excluding freight shifted by LCVs and rigid trucks, in 2000–01 road accounted for 28 per cent of tkms, rail 42 per cent and sea 30 per cent (ABS 2002c). There are some data inconsistencies in measuring modal shares, both across and within surveys.

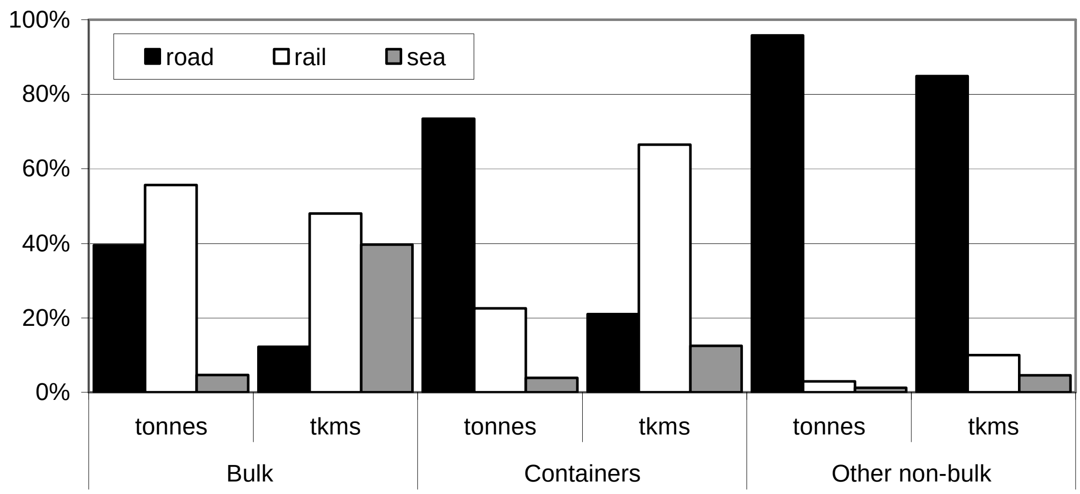
Figure 2.3 **Modal shares of the total freight task, 1999-00**



Data sources: ABS (2005b); BTRE (2006b).

Road undertakes most of the non-bulk freight task (figure 2.4). This includes carrying containers over short distances (for example, between ports and intermodal terminals) and carrying most of the remaining non-bulk task over a broad range of distances. A small amount of non-bulk freight, particularly containers, is transported long distances by rail (typically between capital cities).

Figure 2.4 **Modal shares by freight types, 2000-01[a]**



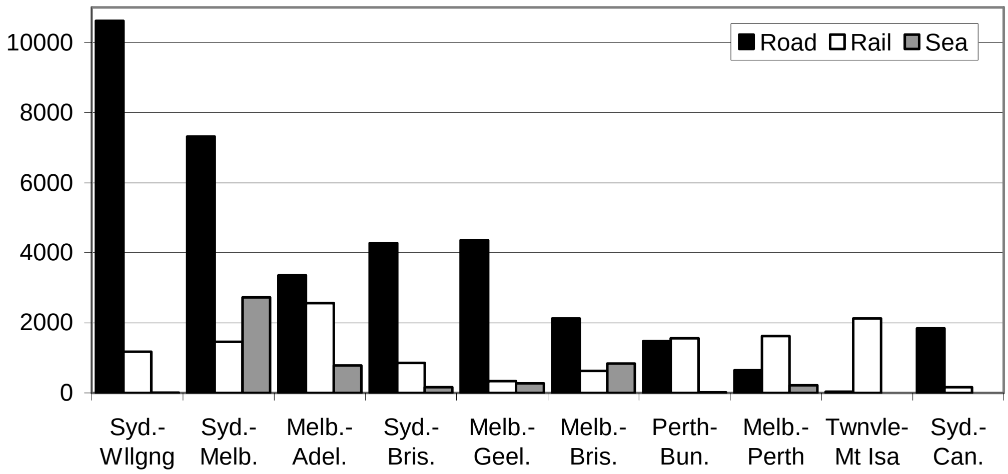
a Air accounts for less than 1% of freight tonnes and tkms. Excludes freight carried by rigid trucks, LCVs and by Tasmanian rail.

Data source: ABS (2002c).

In contrast, around half of bulk freight tonnes and tkms are accounted for by rail, and rail currently dominates the bulk freight task in all states. Most of the remaining bulk freight task is transported short distances by articulated trucks (for example, between mine sites and rail loading points) and to a lesser extent, long distances by sea (for example, interstate shipments of petrol from Victoria). Coastal shipping and road dominate the carriage of liquid bulk products. (ABS 2002c)

Road dominates the freight task on most major AusLink corridors, which include all inter-capital corridors (figures 2.5 and 2.7). For example, in 2001, road carried over three quarters of non-bulk freight tonnes across the inter-capital corridors, compared to 20 per cent for rail. The only inter-capital corridors for which rail dominates are the Melbourne–Perth and Adelaide–Perth corridors. (BTRE 2003b; 2006a)

Figure 2.5 **Top 10 AusLink corridors by tonnage, 1999**
’000 tonnes



Data source: BTRE (2006a).

Road and rail: complements, substitutes, or both?

Competitive neutrality between road and rail freight is a key focus of this inquiry. One important issue is the extent to which freight currently carried by road could readily switch to rail, and vice versa, were relative prices of the two modes to change.

For much of the freight task, there is no alternative to road transport as the rail network is far less extensive than the road network. Even where two modes are available, as is especially the case on the major inter-capital corridors, scope for intermodal substitution will in part reflect different service characteristics of each mode:

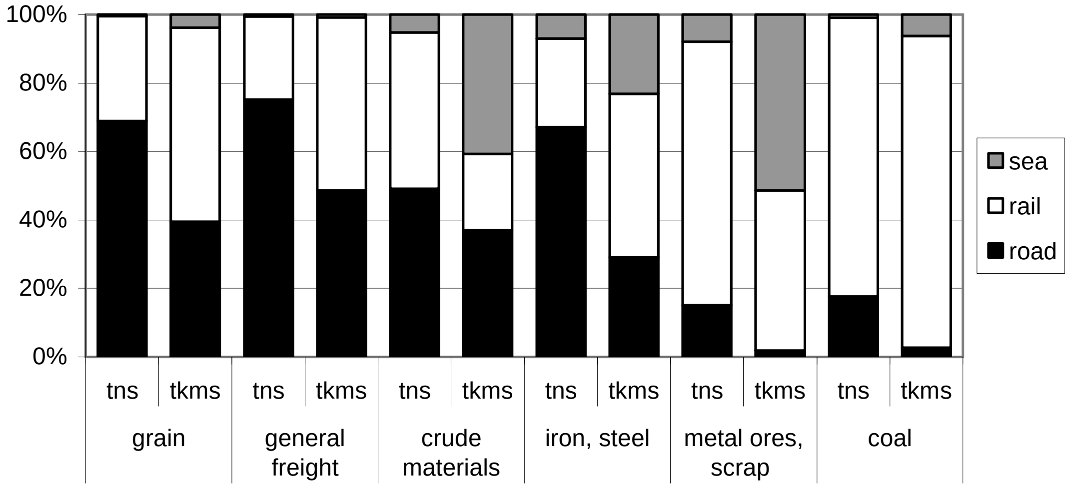
- Rail is suited to transporting bulk commodities with regular, large volumes and is less suited to servicing industries with low and/or irregular output, and regions with low levels of freight demand.
- Perishable or fragile, time sensitive freight (which tends to be non-bulk) is better suited to road given its flexibility. Also, road is more suited to just-in-time stock management systems and door-to-door delivery, which require more frequent shorter-haul deliveries and involve more dispersed origins and destinations.

Highlighting this, the major commodities transported by rail (in terms of tonnages carried) include minerals and metals (particularly coal and metal ores), unprocessed materials, grain and general freight in containers. While road also transports large tonnages of unprocessed materials, it carries much larger tonnages of manufactured goods, food and livestock and non-containerised general freight.

In addition, each mode is suited to transporting cargos over different distances. Figure 2.6 shows differences in the average distance commodities were carried by each mode in 2000-01. For example, although articulated trucks carry the largest tonnages of iron, steel, general freight, grain and crude materials, these commodities tend to be transported by rail or sea when travelling longer distances. Although some commodities are transported by a single mode over all distances (for example, livestock), the logistics chain in many industries requires the complementary use of several modes (box 2.3). In particular, where freight is transported by rail, it often is distributed by road to or from the rail network. The double handling cost incurred means that road is often more cost-effective than rail over shorter hauls.

Figure 2.6 **Modal shares of selected commodities, 2000-01[a]**

Percentage of total tonnes and tkms



[a] Air accounts for less than 1% of freight tonnes and tkms. Excludes freight carried by rigids, LCVs and Tasmanian rail.

Data source: ABS (2002c).

Box 2.3 **The increasing importance of effective logistics chains**

Logistics includes any activity involved in the movement, storage and handling of freight, including through points of production, transformation, consumption and disposal. This encompasses a broad range of complex, interdependent activities.

Recognition of the importance of efficient and effective logistics systems is growing. In an environment of globalisation, industry restructuring, new production processes and technological advances, logistics systems can be a source of competitive advantage, both for the firm and at an industry level.

Example 1:

The logistics chain in the mining sector is typically dependent on road, rail and sea freight transport. Rail shifts a large proportion of the mining sector's tonnes and typically is used for long distance movements from mine sites to ports or processing plants. Road is used over short distances between mine sites and rail loading points, or if it is the only mode available for accessing high value minerals at remote locations. Sea also is used for transporting the sector's output over long distances.

Example 2:

The logistics chains in the agriculture, forestry and fishing industries generally rely heavily on road freight transport. For example, nearly all produce generated by the livestock, meat and meat products industry is transported by road. Also, around 95 per cent of round logs are transported by road. Rail typically only is used at the end of the logistics chain in areas that have established rail networks.

The grain sector is an exception. Although articulated trucks carry the largest tonnages of grain, grain tends to be transported long distances by rail and only short distances by articulated trucks. Generally, road and rail directly compete for movements from silo to export port and a small proportion of silo to silo movements.

Example 3:

In the 1990s, road began to dominate the steel logistics chain, as the need to compete with imports meant that domestic steel producers had to supply smaller, more frequent shipments. Although the cheaper mode, rail lacked the required flexibility. Currently, steel producers and above-rail operators are collaborating, with some success, to improve rail's service offering and attract freight to rail, particularly over medium to long hauls.

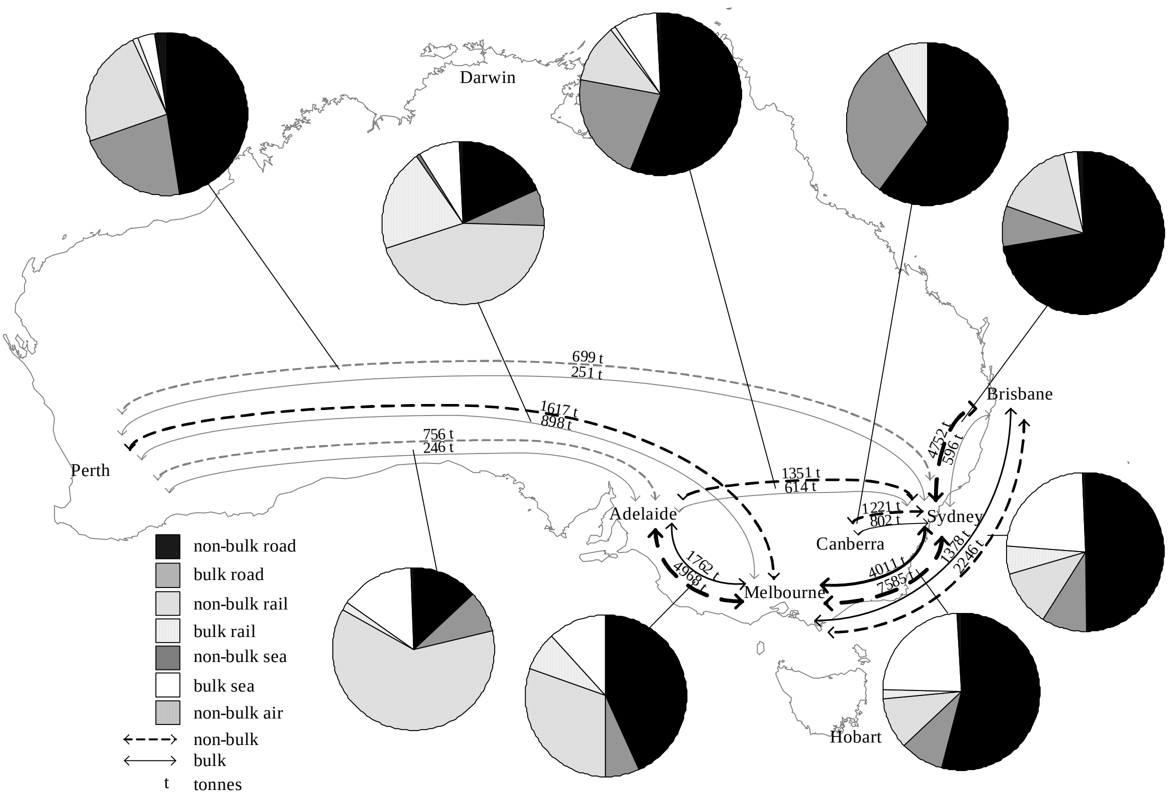
Sources: ABS (2002c); ALTA (sub. 38); BTE (2001); DOTARS (2006d); DTUP (2003); LUCIS (2005); NAFI (sub. 37).

Similarly, although there is some potential for 'intermodal shift' across truck classes, different segments within each mode generally undertake different freight tasks:

- Both the public and private access rail tasks are dominated by mining — the public access system by coal mining in Queensland and New South Wales and the private system by iron ore mining in Western Australia. But public access rail undertakes all of rail's interstate freight task and transports freight over longer distances on average.
- Articulated and rigid trucks (box 2.2) each carry just under half of the road freight industry's tonnages, but articulated trucks typically travel much longer distances, accounting for around three quarters of the road industry's tkms. Most freight carried by articulated trucks is either bulk freight transported over short distances or non-bulk, non-containerised freight transported over long distances. Around half of articulated truck tkms are generated by interstate movements of a very small proportion of their total freight task tonnage.
- Articulated trucks tend to be used for freight transport between urban areas, whereas over half of the tkms travelled by LCVs and rigid trucks occur within urban areas.

Inter-capital non-bulk freight carried by articulated trucks and public access rail is seen as the largest arena of road–rail contestability (figure 2.7).

Figure 2.7 **Inter-capital freight tonnes by corridor**



Data source: BTRE (2006a).

The inter-capital non-bulk freight task makes up around 10 per cent of total tkms, a relatively small, though not insignificant, proportion of the total freight task (figure 2.2). Articulated trucks carry a broad range of commodities between capital cities, including general freight, manufactured goods (for both further processing and final consumption), machinery and transport equipment, and food and live animals (ABS 2002c). The freight rail transports is mostly containerised general freight, steel and bulk freight (NTC, sub. 17).

Modal shares across these corridors to some extent reflect the different types of freight on each route, as well as relative distances and tonnages. For example:

- Road freight dominates the Melbourne–Brisbane corridor. One third of road freight on the corridor is food and live animals, whereas denser, usually containerised non-bulk freight is the most contestable between road and rail (Pacific National, sub. 41). According to Coles Myer (sub. 47), the freight they transport by rail on this route is primarily dry foods and goods, whereas the freight they transport by road is primarily fresh produce.
- In contrast, rail dominates the Melbourne–Perth route, in part reflecting the lower levels of time sensitive commodities shifted on the corridor.

2.3 How freight transport is changing

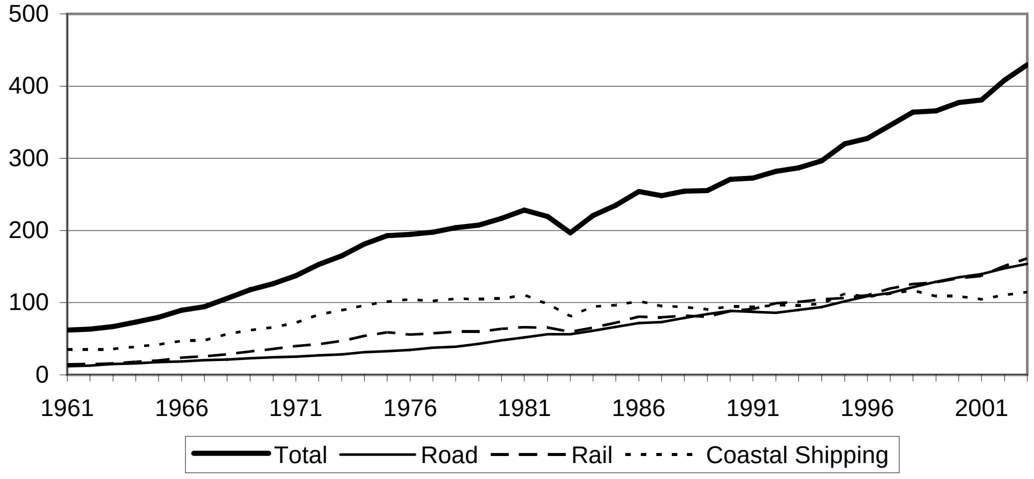
The freight task has quadrupled since the 1960s (figure 2.8),[3] driven by:

- growth in domestic economic activity, including increased demand for imported commodities such as consumer goods and raw material inputs;
- increased transport intensity in the production and distribution of many goods as a result of changes in industry management and structure;
- increasing global demand for Australian commodities such as minerals and agricultural produce; and
- substantial reductions in real costs of land freight transport.

3 Data for total freight tkms prior to 1961 and inter-capital non-bulk freight prior to 1972 are not available.

Figure 2.8 **The freight task, 1961–2003**

Billion tkms



Data source: BTRE (2006b).

Although growth in the freight task has been projected to be slightly lower than in the recent past (largely because of a projected fall in the rate of economic growth), the freight task is still estimated to double between 2000 and 2020 (BTRE 2006b). However, this does not take into account the effects of broader economic changes, such as increased demand from Asia for bulk commodities, and rising fuel prices. Absolute growth in the freight task and subsequent infrastructure requirements will be substantial.

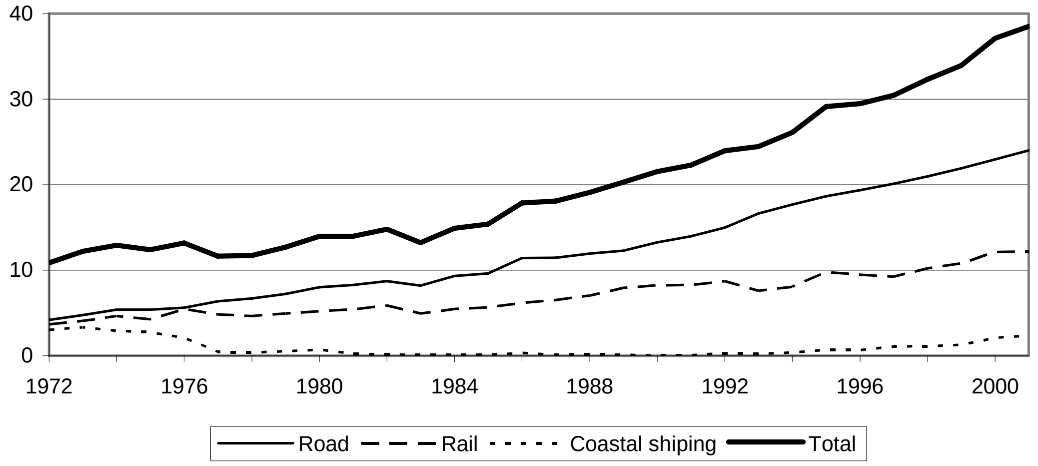
The non-bulk freight task is projected to grow by nearly 4 per cent annually in the period to 2020 in tkm terms, almost double the growth rate for bulk. Growth in the bulk freight task tends to be dependent on export demand, whereas growth in the non-bulk task is primarily influenced by domestic economic activity (appendix F). Also:

- increased specialisation in production makes the production of non-bulk freight more transport intensive;
- the concentration of warehousing and the shift towards national distribution by manufacturers, wholesalers and importers result in more frequent and longer trips; and
- the increasing use of just-in-time stock management systems and door-to-door delivery make the distribution of non-bulk freight more transport intensive.

The changing roles of road and rail freight transport

Over the past 40 years or so, rail's share of the total freight task has kept pace with road (figure 2.8).[4] However, road's share of the inter-capital non-bulk freight task has increased rapidly at the expense of rail and coastal shipping (figure 2.9). These trends are projected to continue if influences on relative competitiveness between the modes, such as prices and service quality, do not change.

Figure 2.9 **Trends in carriage of inter-capital non-bulk freight**
Billion tkms



Data source: BTRE (2006b).

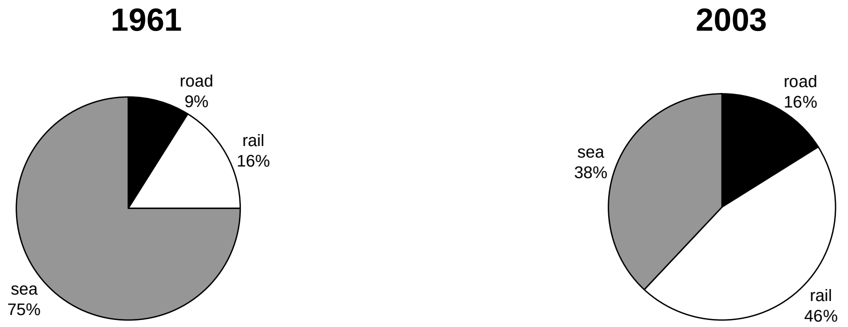
The decline in rail's share of inter-capital non-bulk freight has been more pronounced on shorter corridors — the only corridors for which rail's share has not been declining are the Melbourne–Brisbane and east–west corridors. For example, between 1995 and 2003, rail's share of land-based non-bulk freight tonnages between Melbourne and Adelaide fell from 30 per cent to 13 per cent. In contrast, on the east–west corridor, rail's share increased from 57 per cent to 71 per cent (BTRE 2006b).

While rail's share of the non-bulk freight task has been declining, its share of bulk freight tkms has increased relative to road (figure 2.10). In particular, the private access rail task has grown rapidly. Rail currently is increasing its share of the carriage of coal and other minerals and maintaining its share of the grain task, but losing share of the carriage of the smaller agricultural bulk commodity, livestock, fertiliser, cement and timber tasks to road.

4 The modal shares presented in figure 2.9 differ slightly from those in figure 2.3. This is due to differences in the tkm data presented within BTRE (2006b).

Figure 2.10 **Modal shares of bulk freight, 1961 to 2003**

Tkms



Data source: BTRE (2006b).

The average annual tkms carried by coastal shipping have been stagnant since the mid-1970s. As a result, coastal shipping's share of the inter-capital non-bulk freight task has declined on all routes except Perth–eastern states, and its share of the bulk freight task has also fallen. In part, this is because coastal shipping has been particularly prone to service discontinuations, and coastal shipping freight rates are influenced by Australia's cabotage policy (box 2.4).

Box 2.4 **Cabotage policy has constrained shipping**

At various times over the past four decades, road and rail have gained share of the freight task at the expense of coastal shipping. In terms of non-bulk inter-capital freight, whether the freight lost by coastal shipping on a corridor is more readily picked up by road or rail generally is reflected by their share of the land based freight task on that corridor.

Coastal shipping freight rates are influenced by cabotage policy. Cabotage policy in Australia requires foreign vessels to obtain a licence and employ crew under Australian conditions and rates of pay whilst operating in Australian waters. However, if licensed ships are unable to meet all coastal shipping demand, single or continuous voyage permits may be issued by the Minister.

A single voyage permit (SVP) allows a vessel to travel a single voyage between designated ports for the carriage of a specified cargo or passengers. A continuous voyage permit (CVP) is issued for a period of up to three months and enables a vessel to carry specified cargo between specified ports for that period.

These permits allow foreign vessels to operate without having to satisfy cabotage requirements. In the 1990s, the use of SVPs and CVPs led to falls in coastal shipping

(Continued next page)

Box 2.4 **(continued)**

freight rates and an increase in coastal shipping's freight share. In 2002-03, around 23 per cent of the loaded coastal task was transported using permits.

More recently, an Australian flagged shipping line, Pan Shipping, has commenced services between the eastern state capital cities, Adelaide and Perth. This is likely to affect the number of voyage permits on issue, and possibly coastal shipping's share of the freight task. Pan Shipping has committed to employing an Australian crew under a collective agreement rather than employing guest workers.

Sources: BTRE (2003b, 2005a); PC (2005c).

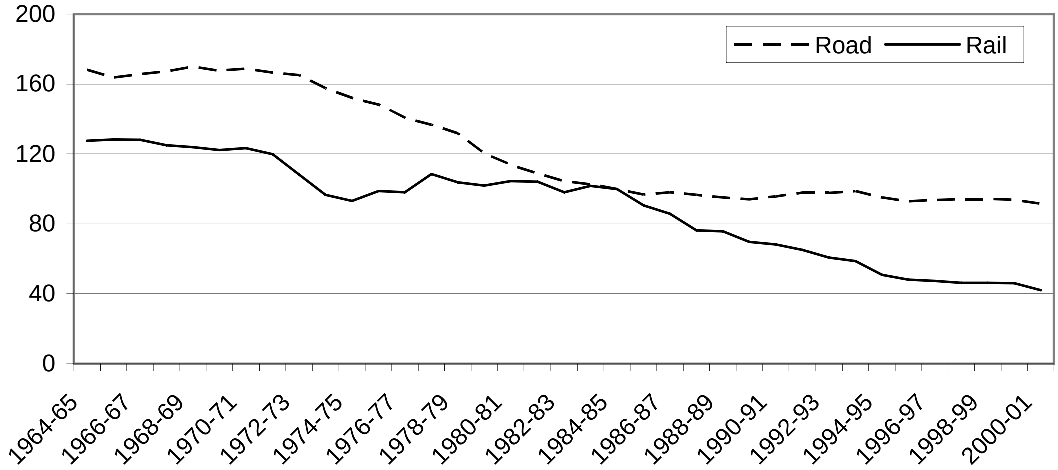
Role of relative productivity performance

Past trends in modal shares, in large part, would appear to reflect different characteristics of each mode, and the changing nature of the freight task. However, to some extent, changing modal shares also reflect changes in each sector's productivity. Productivity in the road freight transport sector has been increasing since the 1970s, and rail transport has made major productivity gains since the 1990s.

Within the road freight transport sector, technological change has delivered productivity improvements and lower prices. In particular, the development of vehicles designed to haul greater volumes and heavier loads (for example, B-doubles) has meant that fewer trucks are required to shift a given freight task. In turn, fuel and labour costs per tkm have fallen — an articulated truck's fuel consumption per tkm is less than half that of a rigid truck. High levels of above-road competition have compelled operators to pass these benefits on to customers in the form of lower road freight rates — since the introduction of large articulated trucks in the 1970s, non-bulk interstate road freight rates have almost halved in real terms (figure 2.11). (BTRE 2003a, 2002a)

In addition, developments in information and communication technology have improved communication between road freight consigners and carriers and the tracking of road freight consignments. Larger road freight transport operators, in particular, have been investing in ICT since the mid–1980s. In part, this has allowed existing vehicle capacity to be used more efficiently, reducing the need for investment in additional vehicles. Better information flows also improve the integration of logistics systems and the coordination of production and distribution which, in turn, save storage and handling costs. (PC 2004b)

Figure 2.11 **Real road and rail interstate non-bulk freight rates**[a, b]



a Index: 1984-85 = 100. **b** Rail freight rates do not include pick-up and delivery costs.

Data source: BTRE (2002a).

For rail, longer trains and higher axle mass limits have reduced the cost per tonne of freight carried. Productivity also has increased as a result of increased utilisation of the network following major investments (such as longer passing loops and terminal siding track lengths) and structural and regulatory reforms. For government-owned railways as a whole, productivity increased by nearly 10 per cent per year over the period 1990–1998, driven by improvements in technical efficiency and labour productivity (PC 1999a).

Rising productivity has seen real freight rates fall in both modes (figure 2.11). Indeed, in recent years, rail freight rates have fallen by more than road freight rates. Road's share of the inter-capital non-bulk market increased from the mid-1970s, coinciding with road freight rates converging toward rail freight rates (figures 2.9 and 2.11). However, although road's price has increased relative to rail's since the mid-1980s, rail's share of interstate non-bulk freight has declined rather than increased. This supports the observation that the price of each mode is only one factor influencing freight consigners' choice of mode, with service characteristics playing an important role.

Scope for further productivity gains

There would appear to be potential for further productivity improvements in both road and rail. Opportunities identified by participants for productivity gains in road freight transport include:

- achieving higher mass limits for trucks throughout Australia (Australian Trucking Association, sub. 9; NSW Minerals Council, sub. 10); and
- the extension of Performance Based Standards in order to give greater flexibility to designers and operators of road vehicles to meet objectives in low cost ways (NTC, sub. 17).

Opportunities for productivity gains in rail freight transport that have been identified include:

- improving coordination between above- and below-rail operators. For example, timely and accurate information sharing between above- and below-rail operators (such as container tracking) would improve the performance of the rail system as a whole (for example, by minimising lost or delayed containers) (PJP 2005)
- synchronising investments in track, terminals and rollingstock to ensure that investments such as longer trains are accompanied by parallel investments in longer passing loops (ARTC, sub. 11; Pacific National, sub. 41);
- the promotion of more responsive signalling and communication systems to enable better access to train paths and thus increased track capacity (Queensland Rail, sub. 53); and
- determining the optimal rail design standards to achieve increased productivity, for example higher axle load limits and greater clearance to enable increased use of double stacking (NTC, sub. 17; PJP 2005).

For rail to realise productivity improvements and gain modal share, it has been argued that obstacles related to vertical separation, regulatory fragmentation, and inconsistent funding decision-making criteria between road and rail infrastructure would need to be addressed (ARTC, sub. 11; PJP 2005). Road’s ability to realise productivity gains is also seen as being limited by current regulatory and institutional arrangements (NSW Minerals Council, sub. 10; NTC, sub. 17). The extent to which these factors constitute impediments to productivity gains is discussed in Parts 2 and 3 of this report.

2.4 Regulation, funding and charging arrangements

Regulatory and funding arrangements in the road and rail freight transport sectors have differed, and continue to differ, significantly in some important respects.

Funding road construction and maintenance

Road provision in the late 19th and early 20th centuries largely was the responsibility of Local and State Governments. The Australian Government began investing in road infrastructure projects in the 1920s. In the 1940s and 1950s it increased its financing of road construction substantially and, by the mid-1970s, had assumed full responsibility for funding the construction and maintenance of 'National Roads' (the major links between the State and Territory capital cities). In the 1980s, a substantial upgrading of the road network, particularly of National Roads, was undertaken: from the mid–1970s to 1988, more than $5.1 billion was spent by the Australian Government on National Roads projects. (DOTARS 2005)

In the early 1990s, road funding responsibilities across jurisdictions were formalised. The Australian Government continued funding National Roads, but increased the coverage of the network and began funding urban links. State and Territory governments accepted responsibility for funding arterial roads and Local governments for funding local roads. Table 2.3 provides an overview of road related revenues and expenditure from 1999-00 to 2002-03.[5]

Table 2.3 **Government road revenues and expenditure 1999-00 to 2002-03**

	1999-00	*2000-01*	*2001-02*	*2002-03*
		$b		
Total road related revenue[a]	**14.8**	**13.9**	**14.3**	**15.1**
Commonwealth[b]	8.7	8.8	9.1	9.4
State[c]	5.7	4.5	4.5	5.0
Total road related expenditure	**7.0**	**8.6**	**8.9**	**9.6**

[a] Includes estimates of tolls. [b] Fuel excise and Federal Interstate Registration Scheme (FIRS) payments [c] Vehicle registration fees, stamp duty on registration fees, driver's licence fees, fuel franchise taxes/fees (until 2000-01), and road transport and maintenance taxes.

Sources: ABS (2001, 2002d, 2003, 2004); BTRE (2005e).

In 2004-05, the national land transport policy 'AusLink' was implemented to achieve more consistent national land transport funding and investment decision-making across the modes (box 2.5). Over three quarters of Australian Government directed land transport funding and investment is now undertaken under the AusLink banner. Funding provided independently of AusLink includes that for 'Identified Local Road Grants'; some South Australian local roads; an upgrade of the mainline interstate railway track; the Federation Fund; Australian Rail Track Corporation (ARTC) grants; and the Eyre Peninsula rail upgrade.

5 Figures in table 2.3 differ slightly from NTC expenditure estimates presented in chapter 4 of this report. This reflects differences in the expenditure categories reported by the ABS and the NTC.

Box 2.5 **What is AusLink?**

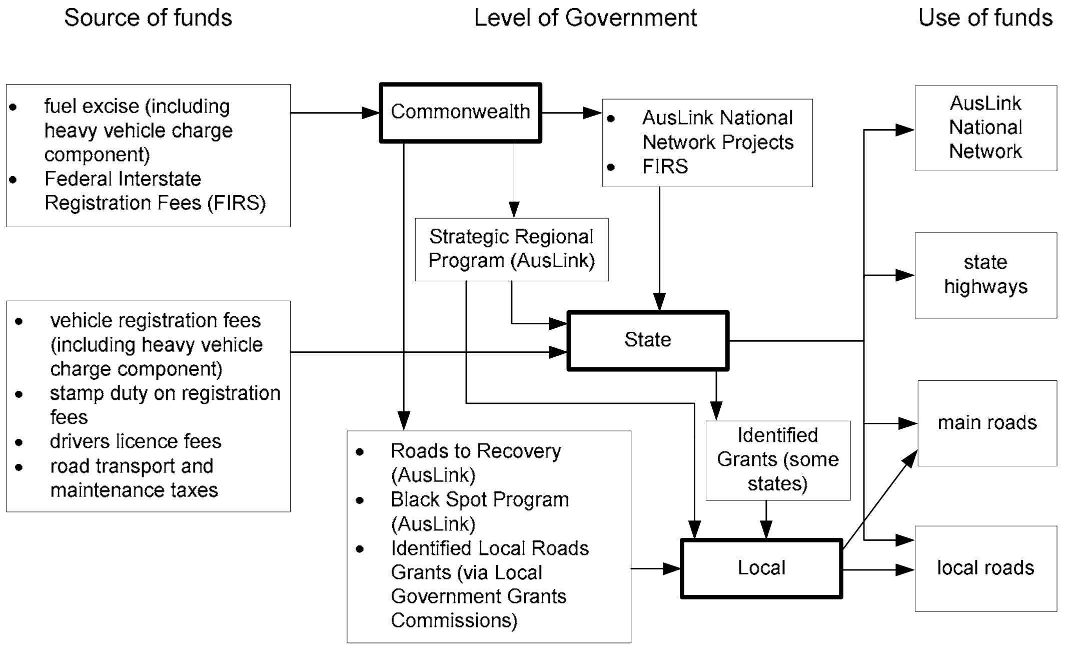
AusLink is the Australian Government's current policy for land transport infrastructure planning and development. It has the following core components:

- a defined National Network of important road and rail infrastructure links and their intermodal connections. This includes major road and rail links connecting capital cities and major industrial centres (including connections through urban areas), links to ports and airports and other rail, road and intermodal connections. This network provides the focus of the Australian Government's investment under the AusLink Investment Programme.
- the National Land Transport Plan, which outlines the Government's approach to improving and integrating the National Network, and the investments it will make. Within this plan, the AusLink Investment Programme establishes the Australian Government's investment priorities for land transport infrastructure from 2004-05 to 2008-09. Under the Programme, the Australian Government is providing at least $7.5 billion in funding to projects on the AusLink National Network and existing rail and intermodal construction projects and $1.5 billion for road maintenance. Australian Government funds for these projects are pooled into a single fund and allocated using a strategic merit test and multiple cost–benefit analyses. The strategic merit test determines whether a project will address relevant government objectives.
- separately earmarked funding for local and regional transport improvements under the Roads to Recovery, Strategic Regional and Black Spot programmes. Under the AusLink Investment Program, the Australian Government is providing at least $1.9 billion in funding to these programmes. This is in addition to the funding described above.
- new legislative, intergovernmental and institutional mechanisms. These include arrangements with the States and Territories and the private sector to share the costs of some projects in the AusLink Investment Programme. Typically, the States' contribution to a project is at least equal to that of the Australian Government.

Sources: DOTARS (2006a, 2006b, 2006c).

Currently, public expenditure on roads is not directly linked to the revenues received from road users, which flow into consolidated revenues at each level of government (with some exceptions) (figure 2.12).

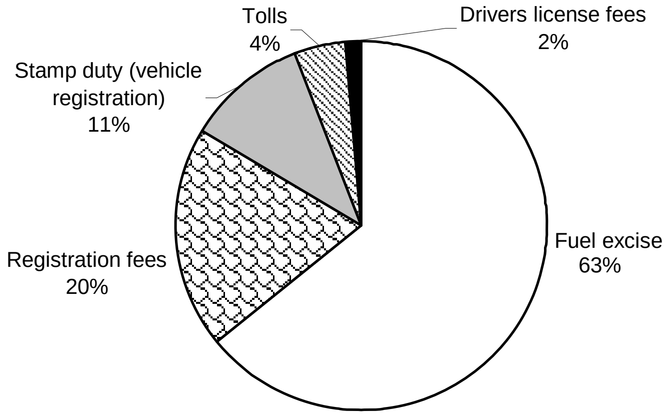
Figure 2.12 **Source and use of road related funds**



Data sources: Austroads (2005); (BTRE (2003a); DOTARS (2006b, 2006c).

Of revenues received from road users, the fuel excise makes up by far the largest proportion (figure 2.13).

Figure 2.13 **Selected motor vehicle charges and taxes, 2002-03**



[a] Revenue from the FIRS makes up less than 0.5 per cent of motor vehicle charges and taxes, as do road transport and maintenance taxes collected by the states.

Data source: BTRE (2005e).

Charges paid by heavy vehicles under the current Heavy Vehicle Pricing system are made up of the first 19.6 cents of the diesel fuel excise, and an annual registration fee that varies by vehicle class. (The full diesel excise of 38.14 cents per litre is paid by all heavy vehicle operators, but eligible heavy vehicle operations claim a rebate of 18.51 cents per litre. This leaves the net fuel-based road use charge of 19.6 cents per litre.) Estimates of the revenues received from heavy vehicle charges range from around $1.4 billion to $1.8 billion per year. The fuel excise component contributes around 70 per cent of this. (Australian Trucking Association, sub. 9; NSW Government, sub. 50; NTC, sub. 63)

The system is administered by the NTC and was developed with the establishment of the NTC's predecessor, the National Road Transport Commission (NRTC). Prior to its introduction, registration charges were set by individual State and Territory governments and varied considerably for the same type of vehicle. The current system was established to apply uniform charges to the same vehicle type regardless of the jurisdiction in which it was registered, and to ensure each heavy vehicle class met its 'fair share' of road construction and maintenance costs.

Box 2.6 **A brief history of fuel excise**

Petrol excises have been paid by road users since the early 1900s, initially as customs duty on imported fuels, then from 1929, as an excise on locally produced petrol at the rate of one penny per gallon (0.18 cents per litre). The excise base was expanded significantly in 1957 with the introduction of the diesel excise. From 1926 to 1959, fuel excises were formally hypothecated as roads grants to the States for construction and maintenance. The rate of excise was adjusted periodically to ensure that revenue collected was in line with funding for the expanding road network. Generally, grants did not exceed excise collected over the period.

Hypothecation was re-introduced in 1982 under the *Australian Bicentennial Road Development Trust Fund Act 1982 (ABRD Act)*. The ABRD program was designed to substantially upgrade the road network, particularly National Roads, by 1988 and was financed by a surcharge on the existing fuel excise of one, then two, cents per litre. The component of the fuel excise that was directly linked to road expenditure varied during the 1980s (up to around six cents per litre). The ABRD program and surcharge ended in 1988.

Although a small proportion of the fuel excise was earmarked for road funding under the *Land Transport Development Act 1988* from 1989 to 2000, the Australian Government has set road funding in the budget process since 1991-92. The rate of excise has been reduced twice since the introduction of the GST in 2000, and currently stands at 38.14 cents per litre.

Off-road users of diesel have been exempt from the diesel excise since its inception. In 1982, the existing exemption system was replaced with the Diesel Fuel Rebate Scheme (DFRS), due to alleged abuse of the existing system. The DFRS exempted a

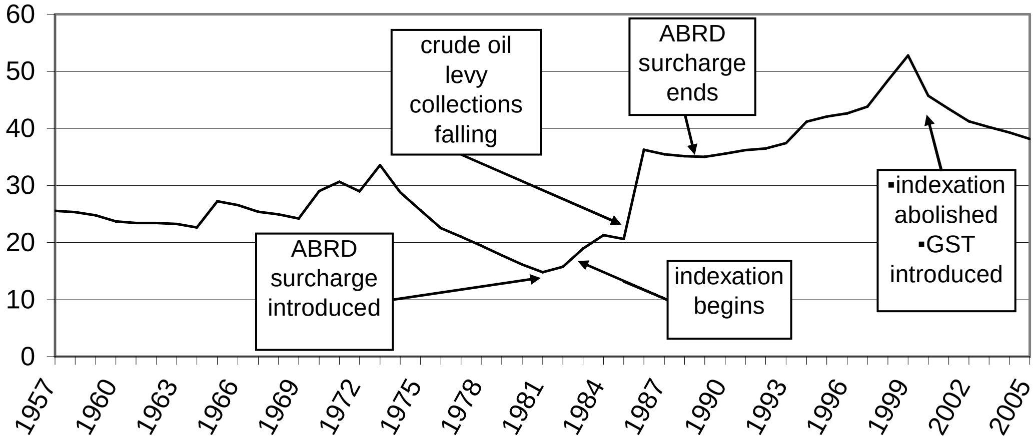
(Continued next page)

Box 2.6 (continued)

narrower range of users, largely in the agriculture and mining sectors. In 2000, the DFRS was supplemented by the Diesel and Alternative Fuel Grants Scheme (DAFGS) for on-road users of diesel. These schemes were designed to assist regional and rural Australia in particular. In 2003, they were replaced with the Energy (Grants) Credits Scheme, which was subsequently replaced in July 2006 with the Fuel Tax Credits Scheme.

Real rate of diesel excise (cents per litre), 1957–2005

$2005



Source: ATO (2000, 2001, 2002, 2003); FTI (2001); James (1996).

Regulating road freight operators

Road transport regulation was historically the responsibility of the States and Territories. This resulted in considerable variation across jurisdictions. The NRTC was established in 1991 to develop uniform national approaches to operational and regulatory reform. This was planned to improve road efficiency, for example, by encouraging the use of larger, more efficient freight transport vehicles.

Since the NRTC's inception, regulatory reforms have taken place in the areas of:

- safety (for example vehicle and driver related safety standards);
- efficiency (for example higher GVM limits and larger vehicle dimension limits); and

- the environment (for example stricter vehicle emission and noise standards).

Current reforms being implemented by the NTC focus on the wider application of Performance Based Standards for heavy vehicles, as the current prescriptive approach to regulation is seen as hindering further productivity gains (chapter 10).

Rail funding and regulation

Ownership, management and funding of the poorly-performing private railways were taken over by State Governments in the mid-19th century. However, whereas the Commonwealth Government commenced a national approach to road design and construction in the 1920s, aside from the establishment of the Australian National Railways Commission (ANR)[6] in the 1970s, a nationally-consistent approach to rail infrastructure development is a very recent phenomenon. When drawing up the Constitution, the assignment to the Commonwealth of responsibility for the railways was rejected by vote. Instead the Constitution permitted the Commonwealth to engage in ‘the acquisition, with the consent of a State, of any railways of the State on terms arranged between the Commonwealth and the State’ and ‘railway construction and extension in any State with the consent of that State’ (Commonwealth of Australia 1900).

The rail industry consequently developed according to state, rather than national, priorities. Rail was used for within-state transport between regional centres and the capital city and little consideration was given to connecting each state’s railway system with those in other states. By 1901, more than 20 000 km of track had been laid with three different track widths. Gauge standardisation began in the 1920s. However, it was not until 1995 that the five mainland state capitals were linked by a uniform width track (table 2.4).

6 ANR included the former Commonwealth Railways’ lines (from Western Australia to South Australia and from South Australia to the Northern Territory), as well as the Tasmanian and South Australian State Government owned lines, which were bought–out by the Australian Government in 1975.

Table 2.4 **Major gauge standardisation initiatives since the 1950s**

Year	*Standardisation initiative*
1962	Opening of a new Melbourne/Wodonga standard gauge line parallel with the existing broad gauge route, linking Melbourne, Sydney and Brisbane by standard gauge.
1969-70	Opening of new standard gauge links between Kalgoorlie and Perth and between Port Pirie and Broken Hill, facilitating through Sydney/Perth services.
1980	Opening of the Tarcoola/Alice Springs rail line, replacing the former route via Oodnadatta and Marree.
1983	Conversion of the Adelaide/Crystal Brook line to standard gauge thus placing Adelaide on the East-West standard gauge network for the first time.
1995	Conversion of the Adelaide/Melbourne broad gauge route to standard gauge, completing standardisation of the interstate network.

Source: PC (1999a).

Apart from investment in ANR lines and some funding for gauge standardisation projects from the 1920s to 1996, the Australian Government did not regularly fund investment in railways. While total public sector investment in railways was substantial (averaging around $840 million per year from 1981-82 to 1991-92, and increasing to around $1.8 billion per annum from 1991-92 to 1995-96), State Governments typically undertook considerably more of this investment than the Australian Government (for example, $1.6 billion compared to $151 million in 1997-98) (PC 1999a).

National Competition Policy reforms of rail infrastructure provision

Instigated by National Competition Policy (NCP) reforms, significant changes to the rail industry's governance arrangements, infrastructure access arrangements and structure were introduced from the mid-1990s through:

- a program of vertical separation, commercialisation and privatisation;
- the establishment of a national access regime under Part IIIA of the TPA; and
- the National Rail Reform Agreement to reduce the costs of transporting interstate freight by increasing train speeds and tonnages, and standardising practices, technologies and access conditions.

As a result of these reforms, ANR was dismantled progressively through a process of vertical and horizontal separation, corporatisation and privatisation. Initially, ANR's interstate above- and below-rail operations were taken over by the National Rail Corporation (NRC). By 1997, almost all of NRC's below-rail network had been transferred to the Australian Government-owned ARTC; and by 2001, NRC's above-rail operations had been sold to private operators.

Similarly, the past decade has seen nearly all State government owned below-rail freight networks leased long term to private track managers —Queensland and New South Wales are the exceptions — and above-rail freight operations sold to private operators (Queensland again being the exception). Consequently, rail infrastructure now is provided largely by corporatised or private entities. Its provision is much more fragmented than the provision of road infrastructure. Currently, there are at least ten public and private, vertically integrated or separated, infrastructure managers, seven regulatory regimes and six regulators.

Rail infrastructure pricing and funding today

Because of its commercialisation, rail infrastructure pricing, maintenance and investment decisions are more directly linked than road infrastructure investment and pricing. Revenues that infrastructure managers earn from rail freight operators' use of the network (flagfall and variable charges) generally are directly negotiated with users. The ARTC plans to invest around $1 billion in its network between 2004 and 2009 that will be funded by revenue from access charges (DOTARS 2006a, 2006c; Pacific National, sub. 41).

Rail infrastructure managers also receive funds from governments for investment projects. For example, rail managers on the AusLink National Network have access to AusLink funds on a similar basis to road, as do managers of regional rail infrastructure under AusLink's Strategic Regional Program. Of the Australian Government's $15 billion commitment to land transport funding from 2004-05 to 2008-09, $1.4 billion has been allocated to rail projects (DOTARS 2006c). A large part of this ($820 million) will flow to the ARTC as grants.

Moving toward nationally consistent rail operations

Moves toward nationally consistent rail safety and operational regulation have been made since the mid-1990s as a result of:

- the reforms associated with NCP, noted earlier;
- the replacement of the NRTC with the NTC, to encompass rail and intermodal regulation; and
- an Intergovernmental Agreement on rail safety and the NTC's 'National Rail Safety Bill' (to be adopted by 2007), which seek to address inconsistencies in the interpretation and application of safety regulations across jurisdictions.

However, there is still a multiplicity of access regimes and overlapping regulatory bodies and standards, the effects of which are discussed in chapter 10.

2.5 Summing up

Australia’s freight task is diverse. Bulk freight, which makes up the largest proportion of freight tonnes and tonne kilometres, is mainly carried by rail. Non-bulk non-containerised freight, on the other hand, is mainly carried by road. There are some notable exceptions, however. In particular, on the east–west corridor, rail has captured a significant share of the (mainly containerised) non-bulk freight task.

For many freight tasks road and rail do not compete and, indeed, often are used as complements in the logistics chain. Modal shares on major inter-capital corridors largely reflect the nature of the freight tasks, as well as distance and volume. While interstate freight movements comprise less than half the total freight task, interstate and inter-capital non-bulk freight tasks have been and are expected to continue to grow rapidly. In the past, this growth has generally favoured road transport. To a large extent, service characteristics of the two modes, differences in productivity growth and the changing nature of the freight task explain their freight shares, but regulatory, funding and charging arrangements are also likely to play a role.

3 Promoting efficient land freight transport: some threshold issues

Key points

- Efficient provision and use of freight transport infrastructure is particularly important for Australia, with its dispersed population and production centres. Challenges in achieving this include natural monopoly and public good dimensions of transport infrastructure.
- Whereas rail networks have been commercialised, roads continue to be provided by governments, partly because direct user charging, until recently, has been infeasible.
  - While commercial provision and pricing of road would address many concerns about competitive neutrality, it is not clear that road provision can or should follow the same commercialisation path as rail infrastructure.
- Subsidies, taxes and cross-subsidies, including the effects of regulations, are pervasive in both road and rail, and distort decisions about the provision and consumption of freight transport services generally, as well as between modes.
  - To promote efficiency and competitive neutrality, it is important to examine all potential sources of distortion, not just a subset of them.
- Failure to account for externalities in road or rail freight prices could distort consumption and production, generating efficiency losses.
  - However, care needs to be taken to identify the source of external impacts and the extent to which they already are incorporated adequately in the costs of freight.
- Inefficient pricing can lead to inefficient investment decisions. However, the impacts of poor investment decisions in the past should be rectified only where investments today would yield an appropriate pay-off in the future.

While there probably is no dispute that the principal objective of reform in the land freight transport sector should be improved productivity and economic efficiency, there are different views about what it means and how to deliver it. This chapter examines potential sources of inefficiency in the provision and use of road and rail transport.

3.1 What is economic efficiency?

In its Review of National Competition Policy Reforms, the Commission observed that 'Australia's size and distance from major overseas markets necessitates an efficient, reliable and modally integrated freight transport system' (PC 2005d, p. xxx). Australian Treasury analysis reinforces this conclusion, finding that Australian productivity levels are disadvantaged relative to most other countries because of the distance from global centres and the distance between major Australian population and industry centres (Battersby 2006). With the freight task projected at least to double over the next twenty years, it is crucial that existing infrastructure is used as efficiently as possible and that investment in additional road and rail capacity is well directed and delivers the highest possible returns to the community (box 3.1).

Box 3.1 **Participants' views on the importance of freight infrastructure**

> Australia needs a freight transport network that is quick, inexpensive, efficient, safe and sustainable. (Coles Myer Ltd, sub. 47, p. 2)
>
> The challenge is to promote more efficient transport connections within and between modes, to increase the economic competitiveness of industry and support economic growth. (Queensland Government, sub. 40, p. 8)
>
> Adequate road and rail infrastructure is essential for rural and regional Australia's economic and social fabric. It must be efficient, reliable, safe and secure while meeting the particular anomalies of Australia; namely its large distances, coastal population concentration and export orientation. (NSW Farmers Association, sub. 39, p. 2)

Although there is no dispute that Australia needs an efficient freight transport system, there is a range of views as to what efficiency actually means. Different interpretations can have quite different policy implications. For example, some equate efficiency with the prices they are required to pay rather than the costs imposed on the wider community. But economic efficiency is broader than the interests of a particular individual or group — the *national* interest is served by efficient provision and use of transport infrastructure. This overriding efficiency objective is recognised in the terms of reference, which state that the purpose of the review is to assist COAG:

> … to implement efficient pricing of road and rail freight infrastructure through consistent and competitively neutral pricing regimes, in a manner that optimises efficiency and productivity in the freight transport task and maximises net benefits to the community.

Essentially, economic efficiency requires that, through time, the appropriate levels and qualities of goods and services are produced at least cost, with optimal levels of consumption and production (and investment), brought about by prices reflecting marginal social costs (box 3.2).

Box 3.2 Private, social and marginal costs defined

- *Private costs* are those costs borne directly by the economic agent making a decision, including costs reflected in the prices of goods and services.
- *Social costs* include all costs of producing and consuming a good or service, not just those borne by those making production and consumption decisions.
  - Thus, social costs include positive or negative externalities (spillovers) borne by others that are not reflected in private costs.
- *Marginal costs* are the additional or incremental costs (private or social) incurred in providing an additional unit of a good or service.

Understanding why land transport infrastructure costs and prices might deviate from broadly efficient levels is fundamental to developing possible solutions. There is a range of possible reasons:

- natural monopoly characteristics of road and rail infrastructure present a number of challenges for efficient infrastructure provision and pricing within and between modes;
- price distortions might be brought about deliberately or unintentionally by government interventions such as taxes, subsidies or regulatory policies;
- spillovers associated with the use of transport infrastructure, such as pollution, accidents or congestion, may mean that the social costs of using transport infrastructure exceed the private costs borne by users.

That said, the ‘transaction costs’ of gathering information, monitoring use and other related tasks, may simply outweigh the benefits of more cost-reflective pricing — in this event, the status quo may be ‘efficient’, in the sense of being the best-achievable given the constraints.

3.2 Efficiency in natural monopoly infrastructure

Both road and rail infrastructure possess natural monopoly characteristics (box 3.3). Investment in below-rail infrastructure (track) is indivisible or lumpy and exhibits significant economies of scale (decreasing costs).

There probably is more scope to vary the standard and capacity of a road than of a rail track (Starkie 1990). Choices include whether the road is sealed or unsealed, the number and width of lanes, the depth of the pavement, and so on. But public roads still are lumpy investments, generally requiring at least two lanes, regardless of levels of use.

Box 3.3 What is a natural monopoly?

A natural monopoly is said to exist if, given the level of demand for a good, service or facility, one firm/entity can produce the required outputs at a lower cost than can two or more firms/entities.

The basic conditions for natural monopoly generally relate to the nature of costs and investment — such as the 'lumpiness' of investment and related economies of scale and/or economies of scope.

A reasonable rule of thumb is that a natural monopoly is more likely to exist where capital costs are large relative to variable costs (implying high average costs compared with marginal costs).

Sources: Baumol, Panzar and Willig (1982); King (2000).

There also are 'economies of scope' in the provision of road and rail services; that is, one road or rail line can provide services to passenger and freight transport more efficiently than separate infrastructure for each.[1] In addition, roads and (to some extent) rail, deliver network benefits. The benefits to users of the interconnectivity of roads, for example, suggest that it is highly unlikely that there would be room for competition from another network provider, even if the existing network were operating at capacity. In these circumstances, it would be more efficient to augment the existing network than to duplicate it.

For efficiency, natural monopoly infrastructure poses several challenges. On the one hand, a single provider can produce services at lower cost than two or more providers. But, on the other hand, a single provider may have significant market power, with an attendant risk of higher prices and lower consumption than is optimal. Even where the two modes directly compete, which is likely to be the case for road and rail infrastructure, if either has excess capacity, pricing at average cost (to recover total costs) rather than marginal cost will inefficiently deter use at the margin. All else given, the greater the gap between average and marginal costs, the greater the marginal efficiency loss arising from average cost pricing. There are various possible 'solutions' to the pricing dilemma created by natural monopoly, ranging from full government provision to (regulated) private provision (box 3.4).

1 However, while serving passenger and freight segments with one road is cheaper than with two, there are diseconomies of scope in building a road for both markets, because the road must be built to carry heavy vehicles even if their use of the road does not determine road capacity. Nonetheless, these additional costs do not appear to be so large as to outweigh the cost savings from building just one road.

Box 3.4 The pros and cons of public and private provision of natural monopoly services

The traditional remedy for provision of natural monopoly services was government ownership and provision, with fixed costs borne by taxpayers. In theory, the conditions for economic efficiency can then be met in the market concerned — that is, optimal provision (assuming optimal central planning of investment decisions) and, by pricing at marginal rather than average cost, optimal consumption or use (assuming all other goods and services in the economy are priced at marginal cost).

But public provision of services subsidised from taxation brings inefficiencies of its own. In the absence of non-distorting lump sum taxes, there will be efficiency losses incurred in raising taxes to fund public investment. Using general taxation to cover the fixed costs of public provision of certain services also may involve undesirable redistributions of income.

Arguably the most serious issue is the risk of inefficient investment and production because of the absence of market signals and commercial disciplines. Even if public sector decision-makers strive to maximise community welfare, if users are required to pay marginal costs, decision-makers may have scant revealed information about the *total* willingness to pay for infrastructure projects, increasing the risk of poor investment decisions. More realistically, without the commercial discipline imposed on managers by a requirement for a return on assets, government providers of infrastructure services may do so at inefficiently high cost, with investment decisions being sub-optimal.

While commercial provision of natural monopoly services brings the benefits of better incentives, inefficiency may arise to the extent that some sales at the margin are forgone if prices exceed marginal costs. However, any ensuing marginal losses must be weighed against the across-the-board benefits of more efficient production and investment. Privatised enterprises, in particular, seem to display a more innovative approach to service provision. At any rate, as discussed in chapter 8, commercially-operated utilities, such as rail, still may be able, as well as have an incentive, to capture marginal sales through discriminatory (Ramsey) pricing. That said, such pricing, though potentially efficient, may be discouraged or even curtailed by regulators (chapters 5 and 10).

Importantly, though, these solutions involve more than different approaches to pricing. Different institutional arrangements have fundamentally different implications for productive and dynamic efficiency. There is a particularly significant risk of inefficient investment and production with government as provider.

In Australia, the manifestly inefficient provision of services, and/or provision of poor quality services, by government utilities, led to the progressive corporatisation and privatisation of communications, electricity, gas and rail networks in the 1980s and 1990s (PC 2005d). The result has been improved productivity and performance.

As discussed in chapter 2, coinciding with reforms in rail in the 1990s, productivity in government-owned railways increased on average by nearly 10 per cent a year. Despite the potential for similar efficiency benefits, roads continue to be provided by government agencies. Possible explanations are discussed in the following section.

Is the road network different from other public utilities?

Unlike rail, except for some privately built and operated toll roads, provision of the public road network has not been placed on a commercial footing in Australia — or indeed in any other country. The Australian road network is augmented and maintained by various public authorities and agencies, with funding from general revenue (although, as noted in chapter 2, road expenditure has been substantially exceeded by revenue from fuel taxes and other vehicle-related charges).

An issue pertinent to discussion of appropriate pricing of road infrastructure is whether roads should continue to be provided in this way. As discussed in chapter 8, road pricing reform within the current institutional framework — where revenue from most road charges would continue to flow into general revenue and road provision would be decoupled from price signals — may provide significant efficiency and information benefits, but is unlikely to capture the full potential benefits. This is because the potential benefits of efficient prices relate to their ability to bring forth efficient behaviour both by road users as well as by suppliers of road infrastructure. But is institutional change feasible? Is the road network a public good and, as such, fundamentally different from other natural monopolies, such as rail infrastructure or telecommunications networks?

The two key characteristics of public goods are that they are 'non-rival' in consumption (one person's consumption does not affect the amount available to others), and 'non-excludable' (people cannot be prevented from consuming the good even if they refuse to pay for their use of it).

- Many goods and services exhibit degrees of non-rivalness (ranging from so-called pure to impure public goods). Natural monopolies, including road and rail, exhibit non-rivalness when they are uncongested. But some degree of non-rivalness would not seem to be a sufficient argument for continued public provision of roads — as noted earlier, even where average costs exceed marginal costs, a commercial provider can potentially structure prices so that the loss of consumption at the margin is minimised.
- Unlike rail, which can easily charge for each train because track access must be managed, the use of roads essentially has been treated as 'non-excludable' because the costs of charging directly for use of a particular road, for example,

have simply been too high. Instead, indirect charging mechanisms have been used, predominantly vehicle registration fees and fuel excise. To some extent, the use of roads for local access is charged for through property rates or developer infrastructure charges. But, provided users have a registered vehicle, they can access any part of the network as often as they wish. (Fuel taxes may influence overall use of the network, but not which roads are used, or when.) Electronic and satellite tracking systems have the potential to make individual user pricing of the road network economically feasible, although currently the costs are not insignificant. New and emerging technologies, therefore, may provide a platform for fundamental change not only in the way road use is charged for, but in the way the road network is provided in future.

Thus, new charging technologies may facilitate more commercial provision of roads. However, the technical feasibility of more finely-tuned road user charging is a necessary but not sufficient condition for pricing and institutional reform. Broadly speaking, the potential benefits are those that have driven corporatisation and privatisation of other utilities — lower-cost and more innovative and customer-focused service provision and efficient investment. But there remain some difficult and, in some cases, possibly intractable problems, including:

- the risk of abuse of market power by a commercial road provider, with possible implications for efficiency. While market power can be regulated, this brings another set of complications, with potential efficiency trade-offs. That said, regulation of market power is not confined to road infrastructure provision and would not appear to be an insurmountable barrier. Moreover, government owners of roads also possess market power, although their actions are likely to be conditioned by possible electoral sanction;
- arguments that the road *network* itself provides substantial social benefits beyond those accruing directly to road users and, hence, should be provided virtually free of charge. According to Blum, these benefits of road networks: '… develop through competition as a creative means of encouraging social and economic innovation' (1997, p. 241). While there is continuing debate about the robustness of this argument (see Greene and Jones (1997)), it is generally agreed that it is more likely to apply in developing countries than in a country such as Australia where the road network is mature;
- substantial practical obstacles to institutional and pricing reform, including privacy implications of road user charges and the fact that the responsibility for the road network currently is spread across all levels of government;
- experience with privatisation of other natural monopolies (including rail) suggests that political considerations are likely to continue to influence pricing

and investment decisions directly or indirectly, possibly limiting the potential benefits; and

- the range of services provided by roads, in addition to motorised access, which are not likely to become amenable to pricing. For example, roads are used by pedestrians and cyclists for access to homes and businesses. In principle, these services could continue to be provided by a commercial operator (for example, via contracts between governments and commercial operators to allow such access), but the costs of writing, monitoring and enforcing contracts may be prohibitively high.

DRAFT FINDING 3.1

Differences in approaches to charging for the use of road and rail infrastructure largely reflect the different characteristics of each mode. These, in turn, are reflected in their different institutional arrangements — commercial provision of rail and public provision of road.

DRAFT FINDING 3.2

More commercial-like arrangements for providing and managing the road network would bring lower-cost, more innovative and customer-focused service provision and more efficient investment. However, there are a number of obstacles, in addition to the need for direct user charging to be cost-effective, including the 'public good' nature of many road services. Consequently, it is doubtful that road provision could or should follow the same commercialisation path as rail infrastructure, although it may be feasible to go some way along it.

The scope for, and desirability of, institutional reform of road provision are examined more fully in chapters 9 and 11.

3.3 Price distortions and efficiency

As discussed in chapter 8, to achieve efficient outcomes, prices should at least cover social marginal costs — in other words, prices should reflect the social costs of consuming an additional unit of a good or service. A price for a good or service is generally considered to be subsidy free if it at least covers the directly attributable or incremental costs, including any spillover effects.

If prices are altered by taxes, subsidies or regulatory interventions, there will likely be efficiency losses, unless the intervention corrects for a market distortion (such as spillovers, discussed in the next section). Explicit and implicit taxes or subsidies (or their regulatory equivalents) can generate economic losses by encouraging:

- too much or too little consumption and/or production of freight services generally, and
- too much or too little consumption and/or production of some freight services relative to other freight services, within and between modes. For example, there is concern that cross-subsidisation of some truck classes distorts both the choice of types of truck and of transport mode (box 3.5).

Price distortions may also skew investment decisions, perpetuating inefficient outcomes over time.

Identifying all sources of pricing inefficiency is necessary

A critical question in assessing efficiency and competitive neutrality is to identify any subsidisation of a transport mode or service or cross-subsidisation within a mode. In doing so, it is important to examine all potential sources of freight price inefficiency, not just a subset of them. But identifying what constitutes a distorting subsidy (or tax) can be problematic. Even if they can be identified conceptually, measuring them in practice is often difficult.

For example, because of the inability to monitor and charge for road use directly, charging instruments have been limited to taxes on vehicles themselves (such as registration fees) and on vehicle inputs as proxies for use of road services (principally fuel taxes). Notional road user charges for heavy vehicles, therefore, have to be estimated using a fully-distributed (financial) cost approach which, in the absence of full information about road use, inevitably must average road expenditure across broadly-defined truck classes. As discussed in chapter 4, the significant averaging involved in the current PAYGO heavy vehicle charging arrangements effectively precludes definitive conclusions being drawn as to whether particular freight carried by particular trucks on particular trips is being subsidised or not.

Box 3.5 Why competitive neutrality matters

The terms of reference for this inquiry emphasise the need for consistent and competitively neutral pricing to promote efficiency in road and rail freight infrastructure. As outlined in chapter 1, to some extent, the focus on consistent and competitively neutral pricing reflects a view that current approaches to costing of, and charging for, road use might be giving road freight an unfair advantage over rail. In particular, there is a suggestion that if some heavy vehicles, especially B-doubles travelling long distances, were required to pay more for their use of roads, competitive neutrality between the modes would be promoted.

The original interpretation of competitive neutrality emerged from Competition Policy Agreement principles, requiring government-owned enterprises to charge prices that reflected all costs that a private sector enterprise delivering the same goods or services would face — including an appropriate rate of return on assets and all relevant taxes and charges. In this context, promoting competitive neutrality with a view to increasing competition in the provision of goods and services previously provided by (often inefficient) government monopolies, would promote efficient outcomes for the community. In the present context, assessing competitive neutrality is more complex because it is being applied more broadly to two transport modes which provide substitutable but often somewhat different services.

If prices of road and rail did not reflect their relative costs, there could be inefficient diversion of freight from a lower cost to a higher cost mode. Additional inefficiency could arise if prices for one or both modes were subsidised: there then also would be ‘over-consumption’ of freight services overall. However, because the two modes have quite different cost structures and institutional arrangements, ascertaining the extent of relative (and overall) subsidisation is difficult.

A fundamental issue is that, unlike rail, deemed road user charges are based on the financial cost of supplying an average bundle of *network* services and are not directly linked to the *economic* cost of providing road services *actually consumed* by particular users.[2] Actual trip costs may vary significantly from the network average when costs of different types of road vary. As the ACCC observes:

> Under the framework in which the NTC makes determinations for heavy vehicle access charges, costs are not measured directly and access prices are set to recover allocated expenditures rather than reflect costs associated with individual services. (sub. 44, p. 1)

Furthermore, the lack of commercial discipline and market signals under current institutional arrangements may detract from the efficiency of road provision. Thus, even if a certain class of truck that competes on transport corridors with rail were to meet its *network* cost allocation, a question would remain as to whether some trucks

2 Prior to reforms in the 1990s, similar problems characterised the rail sector, with some users (especially the coal industry) cross-subsidising other parts of the network (PC 1998 and 1999c).

are effectively cross-subsidising either inefficient road provision, or road spending undertaken for community service obligation (CSO) reasons (box 3.6).

Box 3.6 **When are CSOs just subsidies?**

Some apparent subsidies to rail and road infrastructure may be used to purchase services that benefit the community at large, or particular remote communities (so-called Community Services Obligations or CSOs), and that would not be commercially viable. The costs of such services are appropriately borne by the community rather than freight infrastructure users.

Nevertheless, freight infrastructure users should at least pay for the marginal costs of their infrastructure use, whether or not that infrastructure has been provided for non-economic reasons.

Simply labelling government payments a CSO does not necessarily mean that they are not subsidising a particular mode. The incidence of the subsidy, rather than its label, is what matters. For example, payments to upgrade a road or rail line to carry freight from a particular region would directly assist transport operators and some local producers, albeit with some flow-on benefits to the local community. But if the intention is to assist the local community, there are likely to be more direct, less-distorting approaches.

Community objectives of CSO payments therefore should be clearly set out, and their objectives should be achieved as efficiently as possible. For example, if the objective is to provide access to a remote community, what is the least-cost means of providing access?

The point is that, without knowing the efficient cost of the services a truck consumes on a particular trip, bringing about 'competitively neutral' pricing based on existing network cost allocations may not promote economic efficiency. It could detract from both efficiency and competitive neutrality if road were, absent the cross-subsidy, the lower-cost mode on some corridors for contestable freight.

Unlike road, infrastructure prices for rail are much more closely related to costs of actual use, and commercial incentive structures should help promote least-cost provision. But the efficiency of rail infrastructure pricing, provision and use is also affected by economic and other regulation. For example, rail freight costs may be inefficiently high because of fragmented safety and other regulations (chapter 10). Economic regulation of rail infrastructure pricing, moreover, might constrain rail infrastructure prices and revenues, possibly diminishing the long-run viability of some lines. Governments also continue to invest in rail infrastructure for a range of reasons, including as a means of addressing road externalities and for community access reasons (chapter 5). While some of these contributions can be considered to be funding CSOs, others appear to be simply funding freight infrastructure without any apparent expectation that these contributions will be recouped from rail users.

Government owners of rail infrastructure also appear to tolerate relatively low rates of return. This may or may not constitute a subsidy, depending on the duration of poor returns as well as whether the rail service will continue to be provided in the future.

DRAFT FINDING 3.3

A full assessment of subsidies and other potential sources of price distortion in both road and rail is required to enable judgements to be made about whether competitive neutrality and broader efficiency objectives are being compromised. For example, without knowing the efficient cost of the infrastructure services a truck consumes on a particular trip, price adjustments based on network average cost allocations may not be efficient.

Efficient prices and spillovers

Economic efficiency requires that prices reflect the full social costs of producing and consuming goods and services. Thus, freight prices ultimately should incorporate costs (or benefits) imposed on others (box 3.7). For example, if external costs are not appropriately incorporated in freight prices, social welfare will be lower than otherwise, and use of freight services probably too high. If external costs differ significantly between modes and are not efficiently internalised in both, then modal choice (and investment decisions) may be distorted.

As discussed in chapter 6, there is a range of external impacts imposed by both road and rail freight transport. These include congestion costs (borne by infrastructure users, including those who take action to avoid peak periods), accident costs (borne largely, though not entirely, by users), environmental impacts, including noise and local air pollution (borne by the local community), and greenhouse gas emissions (which have global impacts).

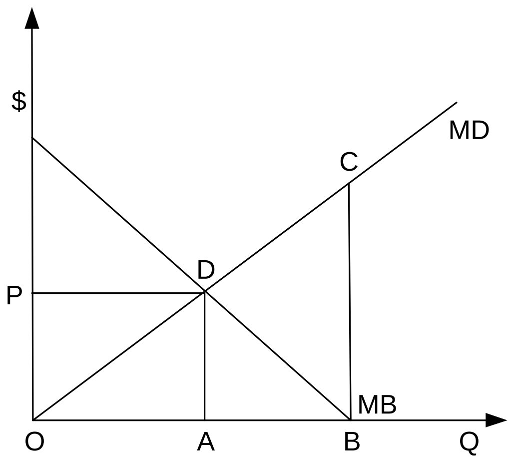
That accidents and pollution resulting from trucks and trains are observed does not mean necessarily that actions are not already being taken by freight operators to reduce them appropriately, although whether they efficiently internalise the impacts, is a matter for assessment. If there are no remedial measures in place, or if existing measures are inefficient, the issue then is which instrument would lead to efficient abatement, recognising that the socially-optimal level of external impacts is unlikely to be zero. This is because actions that generate external costs simultaneously generate benefits — the socially optimal level of the activity is where the marginal social benefit equals the marginal social cost (figure 3.1). Abatement measures also are likely to involve significant transactions costs.

Box 3.7 **The economics of externalities**

Externalities refer to situations where the actions of a decision maker affect the welfare of other individuals, but where the decision maker does not have an incentive to take these effects fully into account. These 'spillover' effects may be positive or negative. If they have a positive effect, it may be desirable to encourage more of the activity, depending on the marginal cost–benefit trade-off. If the impact is negative, social welfare may be improved by a reduction in the harmful activity.

The 'optimal' level of an externality is unlikely to be zero, because the production generating the externality creates benefits (to the producer of the externality) at the same time as imposing costs on others. Figure 3.1 is a stylised representation of the marginal damage (MD) and (net) marginal benefits (MB) flowing from generation of an externality, such as air pollution. Without intervention, the 'producer' of the externality produces to the point where the MB of the activity is zero, that is, at output level OB. At this point, MD exceeds MB (by BC) and the externality is said to be 'policy-relevant'. The optimal level of the activity (and externality) is at OA, where MB and MD balance. Any further reduction in the activity (to a level less than OA) would result in net social losses, because the loss of benefits (from otherwise undertaking the activity) would exceed the additional benefit from further reductions in damage. At OA, external damage continues to exist, but is 'internalised' and is no longer 'policy relevant'.

Figure 3.1 **The optimal level of an externality (Point D) is not zero**



Where external effects are confined to a relatively small area or a small number of individuals, they can be 'internalised' in a variety of ways without government intervention. For example, neighbours negotiate, local communities form 'clubs', firms integrate. Where very large numbers of people or businesses are affected by externalities, private solutions may not be feasible. The high costs of negotiating solutions and the problem of 'free-riding' (that is, some people not paying for their share in the benefits of remediation), are possible reasons. In this circumstance, policy intervention may be required. Efficiency requires measures that deliver the optimum externality level at least cost, such as a unit tax on the externality, equal to AD.

Consequently, care must be taken in identifying which effects are policy-relevant externalities (not appropriately accounted for in transport prices) and which are not. Simply adding up the total costs of observed pollution, for example, and applying a tax equal to the average pollution cost across all road freight users, is unlikely to generate an efficient outcome because it neglects to take into account the benefits foregone by reducing the activity.[3] It also is unlikely to target the source of the externality. Applying a tax on all freight network use to reduce, say, air pollution in an urban area would address the problem only partially (because passenger use would be exempt), and would do so indirectly and inefficiently (pollution would only fall to the extent it was linked to a reduction in overall network use, resulting in too little reduction in urban areas and too much in non-urban areas).

Some claimed external *benefits* of the road or rail network may not be true externalities. Although as suggested by some participants (for example, Coles Myer, sub. 47) road and rail freight generate significant benefits for downstream users, such flow-on benefits generally are not additional to the direct benefits accruing to immediate users, and will be embedded in the (derived) demand for freight infrastructure services.

That said, there may be some positive, pervasive externalities from providing transport networks, such as the scope for increased social interaction and access to remote regions and community services. Such benefits would not be taken into account by a commercial network provider because of the infeasibility of charging for them, but governments could purchase them from a private provider or provide them on the community's behalf.

DRAFT FINDING 3.4

Failure to account for policy-relevant externalities in road or rail freight prices would distort consumption and production, generating efficiency losses. Care needs to be taken to identify the extent to which external impacts already have been internalised.

3.4 Pricing distortions and efficient investment

If prices are distorted, investment decisions also are likely to be distorted, thus perpetuating and possibly exacerbating inefficient outcomes over time. For example, if some heavy vehicle charges are below their efficient levels (because of

[3] If the externality had already been internalised, imposing a tax equal to the average cost of observed pollution would reduce the level of the polluting activity below the optimum, reducing community welfare.

inaccurate road infrastructure cost allocation or a failure to account appropriately for externalities), then use of road freight will be greater than otherwise. This additional use of roads may encourage investment in additional road capacity and, conversely, discourage use of, and investment in, rail infrastructure.

Different institutional arrangements for road and rail infrastructure provision may also distort investment decisions. It is suggested, for example, that road investments are favoured over rail investments because the former are based on an assessment of all social costs and benefits whereas rail investment must be privately profitable. For example, the Queensland Branch of the Rail, Tram and Bus Union commented:

> A key strategy to ensuring a balanced transport system is to have a consistent evaluation methodology for investment across all transport modes, with due consideration of externalities. (sub. 8, p. 18)

In the presence of external costs and/or benefits which are not adequately incorporated in the costs of freight, social and commercial investment criteria will deliver different outcomes. For example, private rail investments may be below their socially efficient level because rail operators cannot charge beneficiaries of, say, a reduction in road congestion or air pollution brought about by a switch in demand induced by improved rail services. Conversely, if road and rail externalities were efficiently internalised and reflected in both road and rail freight prices, commercial and social investment criteria would deliver the same, efficient outcome.

Several participants have also suggested that the prospects for an efficient freight transport system and efficient intermodal substitution are likely to be constrained by the legacy of past decisions, which may have been influenced by distorted modal prices. In particular, it is claimed that longstanding under-investment in rail infrastructure is a major cause of current service difficulties which reduce rail's ability to compete with road (box 3.8). In its review of the rail industry in 1999, the Commission observed that government-owned rail operations appeared to suffer from a lack of investment and maintenance funding (PC 1999c).

As noted earlier, road users also may bear costs of inappropriate or inadequate maintenance and investment. Under current institutional and funding arrangements for road, heavy vehicles pay a charge to fund road expenditure, regardless of its economic merit. Although road investments generally are subject to cost–benefit analysis, the decision-making process is neither transparent nor consultative and is open to political influence. According to the Australian Logistics Council:

> … current [road] funding arrangements mean that commercial pressures to invest and operate efficiently are muted or absent and there are limited incentives to be efficient in allocation of investment funds in the road sector. (sub. 7, p. 5)

Box 3.8 Under-investment in rail — participants' views

> Rail infrastructure has been allowed to run down in many parts of the country. (Country Women's Association, sub. 2, p. 1)
>
> The VFF is also concerned that the capacity of the rail network has been run down through underinvestment to such an extent that it is severely limited in its ability to compete with road transport regardless of equal approaches to assessing infrastructure pricing. (Victorian Farmers' Federation, sub. 18, p. 1)
>
> Capital expenditure to repair the exponential damage occurring to rail infrastructure, nationally, has to be adopted to undo the years of neglect which have created such inefficiencies, which have forced commodities onto the road system. (Lachlan Regional Transport Committee Inc., sub. 25, p. 1)

However, although poor decisions may have been made in the past in both modes, any rectification would need to yield a *future* pay-off in its own right. In other words, decisions taken today must be based on *expected* net benefits (appropriately measured). The policy focus, therefore, should be on minimising the likelihood of future mistakes. Efficient prices for providing land transport infrastructure would signal whether increased investment in either mode is warranted. Appropriate institutional arrangements would help to ensure that price signals motivate efficient investment decisions.

DRAFT FINDING 3.5

Inefficient pricing can lead to inefficient investment decisions. However, the impacts of poor investment decisions in the past should be rectified only where investments today would likely yield an appropriate pay-off in the future.

3.5 Concluding comments

Efficient transport infrastructure is fundamental for a country such as Australia with its dispersed population and often remote production centres.

Both road and rail infrastructure have natural monopoly characteristics, posing challenges for their efficient provision as well as for pricing of land transport services. The tensions generated by commercial provision of rail infrastructure and public provision of road infrastructure (and the related differences in charging arrangements), arguably lie at the heart of this inquiry. It is doubtful that road provision can follow the same commercialisation/privatisation path as rail infrastructure because of the special features of the road network — including the range of services it provides, as well as the transaction costs involved in individual user pricing — although it may be feasible to go some way along it.

A broader interpretation of competitive neutrality would seem to be required for comparing road and rail than that used for comparing enterprises producing the same services. In particular, confining analysis to only some apparent pricing distortions could give a misleading picture — like should be compared with like. To promote efficiency and competitive neutrality between transport modes, it is important to examine all potential sources of freight price inefficiency, not just a subset of them.

PART 2

4 Road infrastructure costs

Key points

- Road user charges applied to heavy vehicles should be set to recover at least the (maintenance and capital) costs attributable to their use of the road network.
- In principle, the PAYGO approach to estimating the costs of road service provision does not provide a subsidy to heavy vehicles over time. In practice, network averaging of expenditure can create cross-subsidies among users accessing different parts of the road network.
- In setting heavy vehicle charges, the National Transport Commission (NTC) currently excludes a significant proportion of expenditure on roads from the cost base prior to cost allocation. Most of these exclusions appear justified. Expenditure on roads for local access is more appropriately recovered by local governments.
- The common costs of road provision loom large because roads provide services for passenger vehicles as well as freight.
  - The current approach to allocating these costs (based on vehicle kilometres travelled) is likely to be more efficient than alternative approaches that allocate a greater share of common costs to the largest vehicles.
- There is considerable debate about the parameters used to attribute road costs across vehicle classes. The NTC takes a conservative approach to attributing costs to heavy vehicles, which it acknowledges. Accordingly, it may be appropriate to allocate more, particularly in terms of pavement maintenance expenditure.
- Road user charge revenues from heavy vehicles currently more than recover the costs attributed to their use of the road network, and include a contribution to common costs. However, if road expenditure continues to increase, recovery of even attributed costs will not be maintained without some increase in charges.
- Under the current charging system, there is some over- and under-recovery by vehicle class. This reflects constraints imposed by the current structure of charges, and, in the case of B-doubles, an intention to influence fleet choice.
- The charging system also results in considerable cross-subsidies within vehicle classes. Vehicles travelling longer than average distances and/or carrying heavier than average loads are cross-subsidised by other vehicles within the class.
- There potentially also are significant cross-subsidies according to location of travel. Road user charges are not differentiated by location but there is some evidence that costs of heavy vehicle road use are significantly lower on the inter-capital corridors.
- It is difficult to determine the 'true' level of cost recovery by heavy vehicles because of the highly aggregated nature of road expenditure and traffic data.

The terms of reference require the Commission to assess the costs (both financial and economic) of providing road and rail freight infrastructure, and to recommend alternative pricing arrangements, based on the principle that prices should reflect all costs in each mode. This chapter examines the capital and operating costs of providing road infrastructure services and, in particular, the attribution of these costs to freight transport vehicles. It aims to identify any subsidies to, or between, heavy vehicles, arising from the current cost allocation methodology or the level and structure of road user charges. The level of cost recovery of rail infrastructure providers is discussed in chapter 5.

As pointed out by the Australian Logistics Council (sub. 7), an efficient road pricing regime would provide signals to infrastructure users about the optimal use of, and to providers about the optimal investment in, the road network, rather than merely recover historical costs. This chapter focuses on the degree to which the actual (financial) costs already incurred in the provision of road infrastructure are recovered. However, the Commission acknowledges that it is the *economic* costs (the costs of providing efficient infrastructure services into the future) that are, in principle, relevant for transport efficiency. The potential to move to a forward-looking, life-cycle costing and pricing methodology for roads is discussed in chapter 8.

In addition to any deficiencies in the charging regime, there may be regulatory constraints on the operation of efficient road infrastructure. Regulations which restrict the way heavy vehicles can utilise the network also impose a cost on the industry (chapter 10) which should be borne in mind when considering the degree of cost recovery.

The issue of which costs road freight vehicles should be required to pay for under a ‘fully allocated cost’ approach to road infrastructure cost recovery is discussed in section 4.1. Section 4.2 focuses on determining the costs of road service provision, while section 4.3 looks at how these costs should be distributed across road users. Section 4.4 seeks to identify the level of cost recovery from heavy vehicles under the current road user charging system.

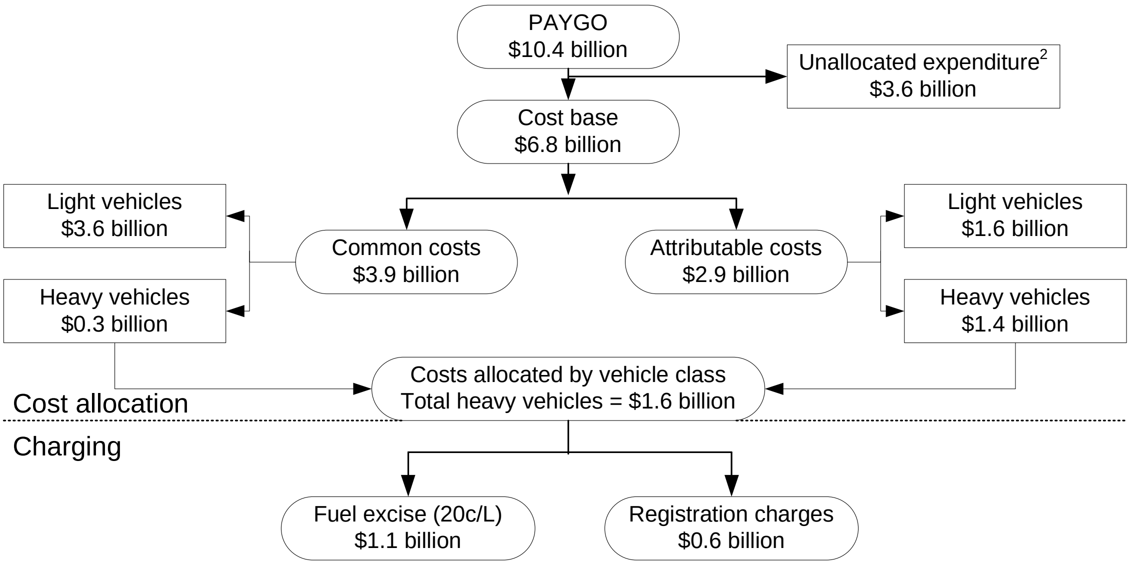
4.1 What costs should heavy vehicles pay for?

Under the current road user charging system (box 4.1), the National Transport Commission (NTC) is required to set charges to achieve full recovery of heavy vehicles’ *allocated* infrastructure costs and to minimise both the over- and under-recovery of costs from different classes of heavy vehicle.

Box 4.1 **The road user charging system**

The road user charging system applies to 'heavy' vehicles only (those in excess of 4.5 tonnes). Charges are recommended by the NTC and decided by vote of the Australian Transport Council, comprising Ministers for Transport from all jurisdictions. Charges recommended by the NTC are set such that aggregate charge revenue will recover heavy vehicles' estimated share of road expenditure. This share of expenditure is determined through the NTC cost allocation model.

The cost allocation model separates costs into non-attributable (common) and attributable costs. Attributable costs are distributed across all vehicle classes (including passenger vehicles) based on various measures of road use. Common costs are distributed across vehicle classes by vehicle kilometers travelled. The diagram illustrates the cost allocation and charging process, based on averaged expenditure and road use data from the Third Determination (NTC 2005b).[1] The Second Determination cost allocation parameters are used to allocate costs by vehicle group. (The cost allocation process is described in more detail in section 4.2.)



The charges comprise a per litre diesel fuel excise, and an annual registration charge which varies by vehicle class. The charges are based on broad estimates of costs imposed on the road network by class. The fuel excise component of the road user charge is currently set a 19.6 cents per litre — the 38.1c/L general fuel excise minus the 18.5 c/L heavy vehicle diesel fuel rebate. In 2005-06, registration charges varied from $334 for a 2 axle rigid truck under 12 tonnes to $5561 for a B-double or road train prime mover, with additional charges per trailer axle.

1 Expenditure data are based on a three year average of expenditure (actual expenditure in 2002-03 and 2003-04 and budgeted expenditure for 2004-05) converted into 2005-06 dollars using the BTRE Road Construction and Maintenance Price Index.

2 Unallocated expenditure includes: expenditure recovered through other fees and charges; interest on borrowing and; local access services (section 4.2).

More specifically, heavy vehicles are required, in aggregate, to recover their attributed costs (the costs of road maintenance and capital expenditure that is incurred because of their use of the road network) in addition to their allocated share of the common costs of road provision. Box 4.2 explains these cost concepts in more detail.

Box 4.2 **Costs of road infrastructure provision: some definitions**

Marginal (avoidable) costs: The costs associated with an unit increase in use of the road network at the current level of infrastructure provision. The (short-run) marginal cost imposed by an individual truck is the current expenditure component of its attributable cost: that is, it excludes any incremental impact on capital spending.

***Attributable costs*:** Costs incurred as the result of a particular road use. For heavy vehicles, attributable costs include costs of repairing structural damage to roads caused by the passage of heavy vehicles. The additional costs of building roads and bridges to withstand truck mass and to cater for truck size — deeper pavements and larger turning circles, for example — are also attributable to heavy vehicles. For individual trucks, attributable costs (long-run marginal costs) relate to their incremental impact on road condition and, ultimately, the need for additional maintenance or capital spending.

***Common (non-attributable) costs*:** Capital or operating costs that cannot be attributed to a particular use (across passenger or freight uses, or across different classes of truck). Examples include costs of road signage and marking, road deterioration attributable to age and weather and the costs of constructing the minimum standard of roads for cars/light vehicles.

Allocated costs: The costs of providing road infrastructure to be recouped through the charging system. For individual users, allocated costs are their attributable costs plus their allocated share of common costs, where common costs are distributed according to a formula (for example, vehicle kilometres travelled), willingness to pay (Ramsey pricing) or any other allocation method.

Cost recovery, as set out in the terms of reference, requires that prices charged ‘should reflect all costs in each mode’. The current system of road user charges focuses on recovering the actual expenditure incurred on road capital and maintenance activities. Road user charges are, therefore, a function of governments’ past investment decisions.

Full recovery of financial road infrastructure costs requires that revenues from charges imposed on all vehicles (including passenger vehicles) recover the total capital and maintenance costs of road provision, including common costs.

If heavy vehicles are to ‘pay their way’, their use of the road network should not be subsidised by other parties (other road users, or taxpayers, for example). Consistent with Faulhaber (1975), *the pricing structure is considered to be 'subsidy free' if those otherwise paying for the road network pay no more when heavy vehicles also use the roads*. For this to hold, heavy vehicles must at least cover their attributable costs.

If the principle of minimising subsidies between vehicle classes is to be retained, each heavy vehicle *class* should cover its attributable costs. Further, to promote efficient use of the *existing* road network, each individual truck should at least cover its avoidable/marginal cost.

So, provided total road costs are covered and truck classes overall pay their attributable costs, and each truck at least its avoidable cost, it is difficult to claim subsidisation.

Under the current road user charging system, subsidies may arise from the approach to measuring road infrastructure costs (section 4.2), the methodology for allocating these costs between road users (section 4.3) or from the level and structure of charges (section 4.4). Although these sections discuss potential refinements to the NTC cost allocation methodology and the structure of road user charges, they are not a re-run of the Third Determination. Rather, the analysis seeks to identify where subsidies might exist in the current charging system.

4.2 Estimating the cost of road service provision

This section focuses on issues involved in determining the appropriate cost base to be allocated across road users. It addresses three questions:

- How should the cost of providing the current level of road services (to all users) be estimated?
- Of this cost, what proportion is appropriately attributed to use of the road system by motorised vehicles, as opposed to other functions such as local access and amenity?
- Which other costs are appropriately excluded from the cost base?

In each case, potential subsidies generated by the current approach to determining costs are identified.

Does PAYGO provide a subsidy?

Under the current PAYGO (or pay-as-you-go) approach to estimating the cost of road service provision, current expenditure on roads (construction, operation and maintenance) is intended to be recovered in the period in which it is incurred. The

NTC (2005b, p.14) states that the PAYGO approach is based on the assumption that 'current expenditure provides a reasonable proxy for the annualised cost of providing and maintaining roads for the current vehicle fleet'. The PAYGO system is summarised briefly in box 4.3.

Box 4.3 **How does PAYGO work?**

The PAYGO approach employed by the NTC estimates the cost of road service provision from the average of road expenditure over the previous two years and the current budget year. The expenditure recovered includes road capital and maintenance expenditure at all levels of government. In this sense, capital expenditure is recovered in full in the (three year) period in which it is incurred.

Based on NTC (2005b), annual road expenditure will be a reasonable approximation of the annualised costs of road provision (the costs of providing the existing road network smoothed over its useful life) under the following conditions:

- the network is neither expanding nor contracting, nor is the pavement or bridge condition changing significantly;
- network wide expenditure does not fluctuate markedly over time; and
- traffic growth is relatively steady.

PAYGO will coincide with the annualised *economic* cost of road provision if the above conditions are met and the existing network, and the road work undertaken to maintain it, are optimal.

Some parties have argued that the PAYGO approach provides an ongoing subsidy to road users. These views are based on the claims that:

- PAYGO does not provide a return on past investment; and
- expenditure fluctuations over time mean that some users do not pay the full cost of their road use.

Further, the national aggregation of the cost base under the NTC's PAYGO approach may lead to cross-subsidies across users of different parts of the network. These potential subsidies are discussed in more detail below.

Does PAYGO provide a return on capital?

It has been suggested that, because PAYGO does not include a rate of return on capital, road users, unlike rail users, do not bear the full economic cost of providing network infrastructure. For example, the Australian Rail Track Corporation (ARTC) stated:

> PAYGO is unlikely to recover the cost of capital investment, nor provide adequate incentives for efficient future investment. Whilst the PAYGO approach recovers the cost of undertaking an investment, it does not recover the financing or investment cost associated with funding the investment. Depreciation may be recovered, but no return. (sub. 11, p. 32)

The Northern Territory Government commented:

> … the pricing framework for road freight infrastructure does not provide for a return on sunk capital — this does not recognise the opportunity cost of capital and given the long life of assets and capital intensive nature of freight transport infrastructure provision, this could potentially advantage road freight operators over rail … (sub. 28, p. 8)

The rationale for allowing a (regulated) infrastructure provider to receive a return on sunk capital is to compensate for the opportunity cost (including risk) of undertaking the investment, thereby encouraging future investment activity. However, in the case of the road network, capital costs are recovered by the infrastructure provider in the period in which they are incurred. In this sense, road *users* fund the investment and assume the risk. Consequently, it would be double counting if PAYGO were to incorporate an explicit rate of return — in principle, the net present values of investments under a PAYGO and lifecycle approach are identical (box 4.4).[3]

In a paper prepared for the Australasian Railway Association (ARA, sub. 33, attachment B), NERA effectively acknowledged this point. However, it also argued that as the three-year PAYGO averaging period involves a lag in expenditure recovery, the government should receive a rate of return to compensate it for the cost of financing investment over this period. NERA recognised this would only be necessary to the extent that road capital expenditure is *growing* over time. (If capital expenditure were the same each year, the amount returned through the PAYGO system would equate to the amount spent.)

Given the relative stability of real road expenditure in aggregate over time, the difference between expenditure in a given year and the three-year average is not likely to be significant. However, if aggregate expenditure were to increase

3 This is also evident in the simplified comparison of road capital expenditure methodologies prepared by the ARTC (sub. 11, attachment A). The table demonstrates that the net present value of capital investments under the lifecycle (renewals annuity) approach is identical to the net present value of the same investments recovered in the year in which they are incurred. The difference in the net present value of the ‘PAYGO’ approach as shown in the table is the result of the 3-year moving average of expenditure (which creates a lag in cost recovery).

significantly in a period, this issue may warrant further consideration. This may indeed arise with the budgeted increase in road spending under AusLink.

Box 4.4 **PAYGO and return on capital: a stylised example**

This example compares the capital cost to road users from a single road under the PAYGO and lifecycle methodologies. Assume the road costs $100 million to build, has a five-year life and zero salvage value. The required risk adjusted rate of return for the investment is assumed to be 10%.

Under a lifecycle approach, the costs to road users are smoothed over time, such that users pay for the road over its five-year life. An operator investing in the road will expect to receive at least a net present value of $100 million (year 1 dollars) over the life of the asset or, put another way, $100 million plus a risk-adjusted rate of return over five years. Road users would therefore be required to pay approximately $24 million per year plus operating costs.

Under a PAYGO system, costs are recovered in the year they are incurred so that road users would pay the $100 million cost of road construction in the first year and only the operating costs in subsequent years. The $100 million cost of capital is shifted to road users, who will either borrow (and incur interest payments over the period of the loan) or self-finance (and forgo the potential to earn returns on other investments).

Assuming no difference in the cost of capital between the road user and provider, the net present value of the cost to road users is identical under the two approaches. The time path of payments, however, differs significantly with annual payments smoothed over the life of the asset under the lifecycle approach in contrast to the 'lumpy' nature of capital cost recovery under PAYGO.

Year	*Lifecycle approach*		*PAYGO approach*
	$m	Year 1 $m	$m
1	24	24	100
2	24	21.8	
3	24	19.8	
4	24	18.0	
5	24	16.4	
Net present value		**100**	**100**

Other participants argued that as PAYGO only recovers expenditure associated with new investments, road users pay nothing for historical investments. In a paper prepared for the ARA, NERA claimed:

> The road regime does not include any costs for historical assets whatsoever in current charges. This reflects the full cost recovery for new infrastructure, and assumes that earlier assets should be valued at zero. (sub. 33, attachment A, p. 31).

This is potentially an issue to the extent that some road assets pre-date the road user charging system. However, while the national heavy vehicle charging regime has only existed since 1992, the diesel fuel excise was introduced in 1957, with the express purpose of contributing to road costs (box 2.6 in chapter 2). Even prior to this, road users paid petrol excise (introduced in 1929). Similarly, registration fees were in place for heavy vehicles well before the introduction of the road user charging regime. It is not possible to assess how revenue from these sources compared with the cost of providing road infrastructure for freight transport in each year. However, it can be said that at least part of the costs of road infrastructure attributable to heavy vehicles before 1992 have been met by road freight users.

Does PAYGO lead to intertemporal cross-subsidies?

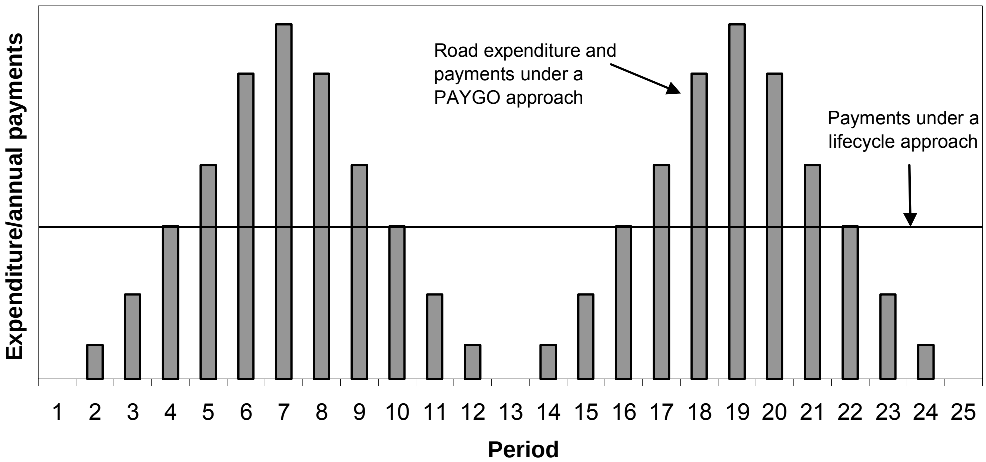
If road investments are lumpy and sporadic, there may be *intertemporal* cross subsidisation under a PAYGO approach. In those years when capital spending is high, users in a PAYGO system will pay more than they would if they paid on an annualised basis. On the other hand, they would also pay less in years in which capital spending is relatively low (box 4.5). In addition to the incentive this might create for users to shift their use of the asset to periods when spending is low, the outcome might also be inequitable.

Importantly, even though explicit payments for the two approaches may not coincide in a given period, there is no inherent subsidy to users (as a group) under a PAYGO system. In principle, the trucking industry will pay its way *over time* under PAYGO.

However, an issue with PAYGO as it currently is applied is that road expenditure is averaged over a three-year period, with the last three price determinations occurring at intervals of about seven years (NTC, sub. 73). This implies that in each seven-year period, four years of expenditure data have not been taken into account in setting the level of road user charges. In practice, PAYGO may over (under) recover over time if expenditure in the four years of data excluded from the analysis is, on average, lower (higher) than the three years captured. However, the extent that PAYGO under- or over-recovers does not appear to be systematic. In any case, the NTC has considered introducing a longer PAYGO averaging period to address this issue (sub. 73). Ideally, this would match the full period between adjustments to charges.

Box 4.5 **PAYGO and intertemporal cross-subsidisation: a stylised example**

This example compares the annual payments under a PAYGO and lifecycle approach for a road network with cyclical capital expenditure. Assume that capital expenditure for a road (or group of roads) varies cyclically as shown in the diagram below. Payments under a PAYGO system fluctuate according to the amount of capital spending undertaken in that period. A lifecycle approach, on the other hand, smooths these payments over the life of the assets such that users pay the same amount in each period.



It is apparent from the figure, that when capital spending is high, users pay more under a PAYGO approach. When capital spending is low, the converse is true. For example, as capital spending is zero in the periods 1, 13 and 25, users pay nothing under a PAYGO approach. In periods 7 and 19 users will pay significantly more than those paying on an annualised basis.

Importantly though, users (as a group) pay the same amount, *in total*, over the life of the asset. As a result, even though actual payments vary from year to year under the two approaches, there is no inherent subsidy under a PAYGO system.

It is not evident that lumpiness in expenditure over time is a significant issue. Real national road expenditure has been reasonably stable since the late 1990s, reflecting the existence of budget constraints. The three-year intertemporal averaging of expenditure under PAYGO further dampens any residual lumpiness. However, if the expenditure profile were to become more ‘lumpy’, further attention would need to be given both to the equity implications of intertemporal cross-subsidisation and to the potential cost recovery issues from the mismatch of the PAYGO averaging period and the time between pricing determinations.

Does network averaging of road spending result in cross-subsidies?

Although the national aggregation of road expenditure reduces intertemporal cross-subsidisation, it introduces another form of potential cross-subsidisation across road users. Each year, users pay for a bundle of whole-of-network spending, which over time reflects the cost of providing the 'average' level of network services. However, the services in the part of the network that a given truck actually uses might differ significantly from this average. For example, a B-double travelling on the inter-capital corridors receives a very different bundle of road services to a rigid truck transporting freight in urban areas. This was noted by the NTC:

> National aggregation of the cost base has the advantage of producing a nationally consistent charging scheme. However this must be considered in light of the [not just] equity problems posed by vehicle cost allocations being based on a cross section of road use which may not reflect actual operations of individual vehicles, and the level of service that is provided in their specific area of operation. (sub. 17, p. 58)

Even for a truck using the average bundle of network services, network average charges will over- and under-recover when the truck travels on particular parts of the network. To the extent that particular trucks/freight types tend to access certain parts of the network, this may involve cross-subsidies (section 4.4).

On balance, it would seem that the PAYGO approach, as currently employed, results in subsidies *between* road users — across the network, and, to a lesser extent, over time — but it is not clear that, of itself, it generates a subsidy to heavy vehicles in aggregate.

A valid question, is whether other approaches would do better. Lifecycle costing, often put forward as a superior approach to PAYGO, would smooth expenditure over time, but intertemporal lumpiness is not significant in any case. Subsidies across the network would still persist under a lifecycle approach unless it was accompanied by a move to location-based charging. As discussed in chapter 8, the benefits of moving to a lifecycle costing approach may be limited in the current institutional framework.

DRAFT FINDING 4.1

Under a PAYGO approach, heavy vehicles as a group will pay their way over time, although inter-temporal cross-subsidies could arise if expenditure fluctuates. This has not been a significant feature of the PAYGO system to date, primarily because of national aggregation of the cost base. However, network averaging itself has created cross-subsidies between heavy vehicles accessing different parts of the network.

Which costs should be *excluded* from the cost base?

The NTC removes a considerable proportion of road expenditure from the cost base prior to cost allocation. This expenditure, considered not to be relevant to road charging, amounted to about $3.9 billion of the estimated $10.4 billion average annual road expenditure in the period 2002-03 to 2004-05 (box 4.1).

Expenditure removed from the cost base at this point includes:

- expenditure recovered through other fees and charges (administering registration and licensing systems and expenditure on roads financed through tolls);
- interest on borrowings;
- a proportion of local road expenditure to account for other services provided by these roads — local access and amenity, for example; and
- heavy vehicle enforcement expenditure (NTC 2005b).

This section considers the appropriateness of excluding this expenditure.

Interest payments and expenditure recovered elsewhere?

The $500 million[4] spent by State and Territory road authorities on administering registration and driver licensing systems (which are recovered through administration fees) and on roads being financed through tolls, is appropriately excluded from the cost base to avoid double charging.

Similarly, recouping the approximately $160 million in loan interest repayments would overstate the capital costs attributable to heavy vehicles as they already pay these costs upfront under the PAYGO system. Because governments receive the income for road spending outlays in the (three-year averaged) period in which they occur (albeit notionally for State and local governments because of the fiscal imbalance in the charging system), the decision to finance these outlays through borrowing is a financing decision, rather than a cost of providing road infrastructure.

Local access and amenity services?

In addition to providing a means of ‘through travel’, roads provide passenger and freight vehicles, as well as non-motorised road users, with access to homes and businesses. Further, the construction standard of roads (particularly local roads) is

4 Based on expenditure data in the Third Determination (NTC 2005b).

commonly higher than can be justified based on motorised road use. Examples are curbing and guttering for public health reasons and footpaths for pedestrian access.

Based somewhat loosely on a survey of government engineers, the NTC estimates that 75 per cent of urban local road expenditure and 50 per cent of rural local road expenditure is incurred solely to provide local access and amenity. This expenditure, amounting to $1.3 billion for the Second Determination and $2.9 billion based on the updated data used in the Third Determination, is excluded from the costs to be recovered from road users.

Excluding such a significant component of expenditure from the cost allocation process has attracted criticism, and claims that it provides a subsidy to heavy vehicles. Several participants' views are presented in box 4.6.

Box 4.6 **Participants' comments on excluding local access spending from the cost base**

Both Pacific National (sub. 41) and the ARTC (sub. 11) noted that the amount of local road expenditure excluded from the calculation of road user charges for the Third Determination was more than the amount allocated to heavy vehicles in total. The ARTC went on to claim:

> Given this, assertions by the road industry and other agencies that road is paying its way (particularly in the context of certain vehicle classes) must be considered doubtful. (sub. 11, p. 29)

While Pacific National observed:

> Much of the excluded cost is in areas like curbing, guttering, all-weather access and vegetation. The approach is also inconsistent with road's main competitor, rail operators, who are required to cover these equivalent costs in their access charges. (sub. 41, p. 8)

Engineers Australia (sub. 5, p. 4) commented that they do 'not support the arbitrary exclusion of some costs' and in particular the ' … "engineering arguments" which may be used to suggest that some roads are built for non-motorised use'. They further noted:

> The main purpose of roads is to facilitate the carriage of passengers and freight. When the main purpose is something else, such as foot-traffic, bike-traffic, or even visual amenity, one does not build a road. Cheaper and more aesthetic options are available. (sub. 5, p. 6)

Similarly, the Australian Automobile Association commented:

> '… there is a surprisingly large amount of local road funding ($2870 million, or 65 per cent of the total) which is excluded from the cost allocation process because it is regarded as being unrelated to motorised road use; it is argued by NTC — and we think it is difficult to sustain — that it is to provide access, amenity or to provide for non-motorised road users …' (sub. 45, p. 8).

A number of these criticisms relate to the NTC claim that this expenditure is excluded from the cost base because it 'is not related to motorised road use' (NTC 2005b, p. 15). As both Engineers Australia (sub. 5) and the Australian Automobile Association (AAA, sub. 45) point out, it is difficult to justify excluding such a significant proportion of expenditure on this basis because, in the absence of motorised road users, a very different (and cheaper) means of access would presumably be constructed.

Nonetheless, a major function of the local road network is to provide access (including for motorised users) to homes and businesses. Home and business owners are therefore likely to be also the major beneficiaries from spending on local roads. Local council rates provide a mechanism to target these groups directly for the benefits they receive from their local roads (through access opportunities and higher house/business values). Recovering local access spending through road user charges, on the other hand, would recover from each road user the cost of some 'average' level of local access services, leading to significant cross-subsidies by local area.

Indeed, a considerable proportion of local road spending is currently financed through council rates or developer charges. Recouping these costs through the heavy vehicle charging system would constitute double dipping. In cases where the rate base is inadequate to maintain local roads (such as for many remote communities), higher-level governments may decide to fund these roads as a community service obligation (CSO). The costs of meeting these CSOs are more appropriately met by general taxation than heavy vehicle charges (see below).

However, even if all local road expenditure were included in the cost base for attribution, sensitivity analysis reveals that most would be attributed to passenger cars, because heavy vehicles make limited use of local roads. For example, NTC (2005c) calculated that increasing allocated expenditure by 25 percentage points on both urban and rural local roads, increased total expenditure allocated to heavy vehicles by $212 million (13 per cent). The remainder of the increase, $896 million, was allocated to passenger vehicles, reflecting their proportionately higher use of local roads.

Nonetheless, as local access is such a significant component of expenditure, more work needs to be done to ensure that it is appropriately quantified. As the ARTC noted:

> The exclusion is based on [a] survey of historical engineering estimates from local road authorities. A more thorough assessment, difficult as it may be, may well result in a very different outcome for heavy vehicles. (sub. 11, p. 29)

Further, the proportion of local expenditure which is included in the cost allocation process, is allocated using the arterial road template, as the NTC has yet to develop one for local roads. The NTC acknowledges that development of a separate local road allocation template 'is preferable in the longer term' (sub. 17, p. 109).

DRAFT FINDING 4.2

Expenditure on local roads to provide access to homes and businesses is more appropriately recovered through council rates and charges than through the heavy vehicle charging system. Even if more of these costs were included in the cost base, most would appropriately be allocated to passenger vehicles, given their much greater use of the local road network.

Heavy vehicle enforcement expenditure?

The NTC excludes expenditure on enforcing restrictions on vehicle mass and speed from the cost base because of perceived difficulties in assessing which types of enforcement expenditure should be included and because of differences in the definition of this expenditure across states (NTC 2005b).

Pacific National argued that the exclusion of enforcement expenditure is one of the sources of inconsistency between the charging regimes for road and rail:

> … heavy vehicle enforcement expenditure is currently excluded from the cost base for heavy vehicles, contrasting with the approach in rail, under which PN and other rail users are required to cover the costs of systems to monitor mass and speed limits. (sub. 41, p. 8)

Both the national and the Queensland branches of the Rail, Tram and Bus Union (submissions 43 and 8) also expressed support for including this type of expenditure in the cost base.

The NSW Farmers Association, on the other hand, argued that if costs were allocated using a beneficiary pays principle, some enforcement costs would be borne by society:

> … heavy vehicle enforcement should not be included in the cost allocation. The gain in increased safety from enforcement is shared by society as a whole, and as such, enforcement costs should be borne by the broader community. (sub. 39, p. 11)

In considering cost recovery by government agencies, the Commission (PC 2001a) found that in most cases it is efficient to recover the administrative costs of regulation from the regulated industry. The gains from heavy vehicle regulations, improved road safety and reduced road damage due to overloading, primarily accrue to road users. Heavy vehicles complying with mass limits benefit from their enforcement because they meet some of the cost of additional damage to roads caused by overladen vehicles through road user charges. Thus, to the extent that these regulations, and the enforcement activity undertaken to police them, are efficient, it is appropriate to target the industry directly for recovery of these costs. A number of other countries recover heavy vehicle policing costs in road charges (appendix B).

To avoid recovering these costs twice, however, any costs allocated to heavy vehicles for enforcement activities should be net of penalty revenues. This was supported by NERA in a paper prepared for the ARA:

> … revenue received from fines … should ideally be netted out of any costs that are transferred to road users (sub. 33, attachment B, p. 22).

The enforcement expenditure figure of $93 million from the Third Determination (NTC 2005b) is not net of penalty revenues. NERA investigated an alternative measure of enforcement costs: that is, police traffic control expenses, net of penalty revenues. They estimated net costs, including the costs of enforcing regulations for passenger vehicles, to be $153.8 million. Heavy vehicle enforcement expenditure would represent a fraction of this.

NERA concluded that these costs were too small to be of any consequence for freight competition:

> Given the relatively small value of police traffic control costs, it is unlikely that including these costs in charges to road users would have a significant impact on competition in the freight market. This is in part because the allocation of police traffic control costs to freight operators is expected to be relatively low compared to passenger vehicles. (sub. 33, attachment B, p. 22)

DRAFT FINDING 4.3

The costs of enforcing heavy vehicle mass and speed restrictions are appropriately recovered through road user charges. Any costs recovered should be net of penalty revenues. However, the inclusion of these costs is not likely to have a significant effect on heavy vehicle charges.

Community service obligations?

The NTC (2005b) notes that a percentage of road expenditure in remote areas may not be justified based on traffic levels but is undertaken to meet the needs of remote communities. After consulting road authorities, the NTC estimate that CSO-related expenditure accounts for between 2 and 7 per cent of total road expenditure.

The NTC (sub. 67) further observe that under the current system, some of the cross-subsidies generated by the network averaging of charges (sections 4.3 and 4.4) could be considered implicit CSOs to freight transport operators. In particular, as rural and regional roads tend have higher than average unit costs, trucks using these roads are subsidised by users of other, lower cost, parts of the road network, benefiting the communities accessed by these roads. The NTC commented:

> Whilst the Community Service Obligation is provided, it is not explicit, it has not been quantified and does not respond to any specific government policy. It is, in effect, indiscriminate. (sub. 67, p. 5)

However, as noted in chapter 3, CSO expenditure should be explicitly related to a government policy objective, otherwise it is more appropriately viewed simply as an operator subsidy. In this case, the subsidy is largely financed through higher heavy vehicle charges paid by users of lower-cost parts of the road network.

In the NTC's Third Determination, the costs allocated to road trains (that operate primarily in these remote areas) were adjusted downwards to reflect the NTC estimates of CSO expenditure. The AAA commented:

> … road expenditure on unsealed roads in remote areas has been deducted because the provision of these roads in remote areas has been regarded by NTC as a Community Service Obligation (CSO) — however, the transport operator is presumably benefiting from these roads and therefore ought to make some contribution towards the cost … (sub. 45, p. 8)

To the extent that the provision of such roads can be identified as a genuine CSO (chapter 3), and does not overlap with the local road expenditure excluded from the cost base for local access and amenity, the fixed costs of such roads may be appropriately excluded from the cost allocation process. There is no reason why this adjustment should occur only for road trains. However, heavy vehicles should at least be charged for the avoidable costs associated with their use of these roads.

An advantage of some of the alternative institutional models for road funding, particularly the 'road fund' model discussed in chapter 9, would be to make CSO-related road expenditure decisions more transparent.

DRAFT FINDING 4.4

That proportion of road spending undertaken solely to meet remote community needs is appropriately excluded from the costs to be recovered through heavy vehicle charges. Any adjustment for community service obligation expenditure in the cost allocation process should apply to all vehicles. However, heavy vehicles should still pay the marginal costs of accessing roads financed through community service obligations.

4.3 What costs should be allocated to heavy vehicles?

Under the current 'fully allocated cost' approach to road infrastructure cost recovery, road use expenditure is recovered from heavy vehicles in line with their allocated costs. As discussed in section 4.1, the costs allocated to heavy vehicles include both their attributed costs (which reflects their use of the road) and their allocated share of the common (non-attributable) costs of road provision. The formulae for linking road use to road expenditure and the methodology for allocating common costs therefore have a significant bearing on the final cost allocation. It is not surprising that these have been subjects of debate.

The NTC allocates costs across vehicle classes using a series of cost allocation templates. Common costs are distributed across road users based on vehicle kilometres travelled. Other types of expenditure are attributed to vehicles using measures of road use:

- vehicle kilometres travelled (VKT)
- passenger car unit equivalent kilometres (PCU-km)
- average gross mass kilometres (AGM-km)
- equivalent standard axle kilometres (ESA-km).[5]

While VKT and PCU-km relate to traffic volumes and road capacity respectively, AGM-km and ESA-km are more closely related to road wear. The choice of parameter has a significant impact on the final attribution of costs between vehicle types. Heavy vehicles are attributed almost all costs if using AGM-km and ESA-km as the parameter (84 and 94 per cent respectively). Using VKT or PCU-km, on the other hand, results in a much smaller share of costs attributed to heavy vehicles (7 and 16 per cent) (NTC, sub. 17, p. 53).

The percentage of each category of expenditure currently attributed across vehicle classes by each of these road use measures is presented in table 4.1. Table 4.1 also

---

5 Equivalent standard axles are a measure of the relative road wear caused by heavy vehicles on pavements. ESAs are measured by calculating the ratio of the actual load to a reference load (where the reference load depends on the number of axles in the axle group and the type of tyres the truck is fitted with). A power function is then applied to this ratio, with the power chosen dependent on the type of pavement distress that is expected to occur. A power of 4 is thought to be the best approximation of pavement wear across a road network (NTC 2005b). While some have criticised the applicability of the so called 'fourth power rule' to Australian conditions, no generally accepted alternative currently exists (Kinder and Lay (1988) cited in P.G Laird (sub. 23); Martin 2000 cited in BTRE (forthcoming)).

All ESA estimates underlying the calculations in this section are estimated from average gross mass data using the NTC's predictive formulae (NTC 2005b).

highlights the percentage of each type of expenditure considered to be non-attributable.

Table 4.1 Current cost attribution parameters

Expenditure Category	*Cost attribution parameters*[a]
A. Servicing and operating	VKT (100%)
B. Road pavement and shoulder maintenance	
Routine maintenance	AGM-km (50%) Non-attributable (50%)
Periodic surface maintenance (sealed roads)	AGM-km (50%) Non-attributable (50%)
C. Bridge maintenance and rehabilitation	AGM-km (33%) Non-attributable (67%)
D. Road rehabilitation	ESA-km (45%) Non-attributable (55%)
E. Low cost safety/ traffic improvements	VKT (80%) PCU-km (20%)
F. Asset extension/improvements	
Pavement	ESA-km (45%) Non-attributable (55%)
Bridges	PCU-km (15%) Non-attributable (85%)
Land acquisition, earthworks, other	PCU-km (10%) Non-attributable (90%)
G. Other Miscellaneous Activities	
Corporate services	Non-attributable (100%)

a The figures in parentheses are the percentage of total expenditure in the category attributed by that variable. These are based on the Second Determination cost allocation template. Third Determination attribution parameters are the same other than for pavement maintenance expenditure. In the Third Determination routine pavement costs were attributed 37% by AGM-km and 37% by PCU-km (26% non-attributable) and periodic maintenance costs were attributed 60% by AGM-km and 10% by PCU-km (30% non-attributable).

Source: NRTC (2000).

The percentage of expenditure treated as common, along with the choice of road use variable(s) for attributing the remaining expenditure, are informed, to varying degrees, by engineering and econometric models of cost causation.

The engineering or econometric models currently available are not capable of quantifying with any precision the cost of damage generated by a particular truck (given its size, gross mass, axle loadings and configurations, tyres, suspension etc) passing over a particular pavement or structure. Rather, all that these models can do is provide guidance on the historical relationship between road use and costs, based on the available data.

While the following sections discuss some of the criticisms levelled against the current cost allocation methodology, the Commission does not consider itself able to pass judgement on what are essentially engineering debates. It is worth noting, however, that these very debates highlight the difficulties in establishing the relationships between road expenditure and heavy vehicle road use.

How should common costs be allocated across road users?

Common costs exist in the provision of road infrastructure because roads serve several functions. Using the Second Determination attribution parameters such common costs are estimated to be substantial, accounting for about $3.9 billion of the $6.8 billion total allocated road expenditure (figure 4.1). However, there is considerable debate about both the magnitude of these costs and their distribution across vehicle classes.

How big are these costs?

To quantify the common costs of road service provision, the NTC estimates the proportion of each type of expenditure that does not relate to road use. Examples of costs considered to be non-attributable include the costs of building a minimum standard of road and the cost of repairing the wear to pavements and structures due to age and weather.

There is some question about whether all the costs defined by the NTC as non-attributable are genuinely common. For example, Pacific National argued that:

> … there is considerable scope to re-classify a number of cost items as attributable. This move would significantly reduce the level of non-attributable or “common” costs (sub. 41, p. 9)

If it were the case that some costs currently treated as common are actually attributable, this would imply a cross-subsidy from light to heavy vehicles.[6]

Much of the debate on common costs has centred on the magnitude of these costs in relation to pavement maintenance expenditure, notwithstanding that this cost category represents only 14 per cent of allocated expenditure. For example, Engineers Australia criticise the NTC claim that a percentage of pavement maintenance expenditure is due to the influence of weather. They argue ‘the influence of the weather on road pavement is not independent of road use’ (sub. 5, p. 5). In contrast, a number of studies, for example Martin (2002), conclude that a

6 Reclassifying common costs as attributable will lead to a higher cost allocation to heavy vehicles. This occurs because over 40 per cent of attributable costs are allocated to heavy vehicles compared to only 7 per cent of common costs (NTC 2005b).

significant portion of road wear is caused by environmental factors, not related to traffic load.

Considerable research has been undertaken to establish the magnitude of common costs. For example, in a statistical analysis of pavement maintenance costs for the Third Determination, the NTC estimated that about 26 per cent of routine maintenance and about 30 per cent of periodic maintenance could be classified as common. Bureau of Transport and Communications Economics (BTCE 1988) and Bureau of Transport Economics (BTE 1999a) on the other hand, treat almost all pavement and bridge maintenance costs as attributable. Appendix B summarises the estimates of common costs from these and other studies.

Changing the estimates of common costs in the cost allocation process would have a significant bearing on the costs allocated to heavy vehicles (appendix B). For example, adopting the BTE (1999a) common cost estimates would lead to $2100 million[7] being allocated to heavy vehicles compared to $1632 million using the current estimates.

The significant variation in estimates of common costs across studies demonstrates the sensitivity of the results to the modelling technique and the associated assumptions. Based on the available evidence, it is difficult to claim one set of estimates is superior to another. It is notable, however, that the estimates of common costs used in the Second Determination (the basis of current charges) are at the upper end of estimates produced by other studies (appendix B).

The Commission understands that the NTC intends to undertake further work on cost allocation for certain types of expenditure, including quantifying common costs.

DRAFT FINDING 4.5

There is considerable debate about the proportion of expenditure which should be defined as 'common', particularly for pavement maintenance expenditure. The National Transport Commission estimates are at the upper end of those in other available studies.

7 This estimate is based on adopting the BTE's common cost estimates for pavement and bridge maintenance expenditure only. Estimates of allocated costs applying the complete BTE (1999a) template, including alternative attribution parameters are presented in appendix B.

And how should common costs be distributed?

The NTC distributes common costs across cars and trucks according to vehicle kilometres travelled. This is based loosely on the principle that vehicle classes travelling further in aggregate are likely to access a greater proportion of the network and therefore benefit from more of the common expenditure. Some parties have put forward alternative ways to allocate these costs (box 4.7).

Box 4.7 **Views on the allocation of common costs**

Port Jackson Partners (2005) advocated allocating common costs 'at a minimum' by PCU-km. They argued that allocating these costs based on a capacity measure (essentially the space taken up on the road) 'is more closely representative of the impact of different vehicle types on the need to incur non-separable costs' (p. 33).

Queensland Rail (sub. 53) argued that non-separable costs across vehicle types 'should reflect both distance and mass allocators, not just a distance allocator' (p. 57).

The AAA, on the other hand, expressed support for a measure not related to vehicle road use:

> … the number of vehicles – perhaps expressed as PCUs – would seem to be a preferred parameter for allocating non-attributable costs rather than VKT, particularly since these costs are unrelated to road use (we acknowledge that this may result in a higher proportion of non-attributable costs being allocated to light vehicles) … (sub. 45, p. 8)

As noted in section 4.2, a subsidy to heavy vehicles can only be claimed if the costs to be borne by other parties (light vehicles and taxpayers) are higher as a result of heavy vehicles' use of the road network. Provided heavy vehicles at least cover their attributable costs, the cost allocation structure is strictly subsidy free. Thus, even though heavy vehicles are currently allocated a relatively low share of common costs (7 per cent) this does not imply a subsidy.

There is no 'cost recovery' justification for the alternative allocations put forward, particularly for using capacity measures such as PCU-km. If bigger trucks are responsible for additional road capacity, the additional costs *should* be attributed to them. However, once common costs are correctly estimated, the only rule for efficient allocation is Ramsey pricing (see below) — any other allocation is arbitrary.

Different allocations of common costs will affect charges and activity levels (including across modes). For example, allocating common costs by PCU-km would result in $664 million in common costs allocated to heavy vehicles compared to $279 million under the current approach. The impacts of other allocations are summarised in appendix B.

Further, some allocations of common costs will be more efficient than others. A number of participants advocated a move to using more efficient mechanisms for allocating these costs, such as Ramsey pricing. For example, Pacific National commented:

> … the NTC needs to examine which allocation approach would be most consistent with economic efficiency and maximisation of the community's welfare. (sub. 41, p. 9)

The South Australian Government noted:

> … where marginal cost usage charges lead to under-recovery of financial costs, efficient pricing requires that the revenue gap be raised with minimum efficiency loss. (sub. 61, p. 5)

Using Ramsey pricing principles, common costs would be allocated across road users (or more likely groups of road users) based on their relative responsiveness to price changes (elasticity of demand). Those road users whose road use decisions are most sensitive to price changes should be allocated the smallest share of common costs under this approach. Allocating common costs with regard to consumer willingness to pay acts to minimise distortions in demand from pricing above marginal cost. As Queensland Rail commented:

> As for rail, such price discrimination is likely to be efficient and desirable because common costs constitute a significant proportion of the total road costs to be apportioned and different traffics have differing capacities to pay. (sub. 53, p. 59)

Is Ramsey pricing feasible?

A key difficulty with Ramsey pricing is that it requires an understanding of the elasticities of demand for different users of road infrastructure. Given the range of services provided by roads, and the fact that for many of these the elasticity is highly situation-specific, this would seem unachievable beyond allocations based on broad groupings of road users.

BTCE (1988) investigate applying Ramsey pricing principles to allocate the fixed costs of road provision across road users. Their allocations are based on estimates of the price responsiveness of five groups of road users: heavy freight vehicles; light freight vehicles; long-distance buses; cars for domestic use; and cars for business use. Drawing on a range of studies, they treat demand for road use in all five groups as inelastic. In relative terms, passenger cars for domestic use and long distance buses are taken to have the more elastic demand, and heavy freight vehicles and cars for business use, the least.

While acknowledging considerable uncertainty about the elasticity estimates, they point out that provided groups can be ranked according to their price responsiveness, distributing common costs according to these rankings is likely to yield a more efficient distribution than some other allocation. As the Department of Transport and Regional Services (DOTARS) noted:

> … Ramsey pricing does not necessarily have to be perfect to achieve a more economically efficient outcome than the alternatives. (sub. 69, p. 33)

Further, Ramsey pricing usually is applied in an iterative manner. Initially, prices for particular groups may be set based on quite limited information; these can then be refined as user responses to price changes are observed. Of course, revising charges is not a costless exercise, nor is it without political implications.

To gain the most efficiency benefits from a Ramsey pricing approach, passenger vehicles would need to be included. However, even some basic price discrimination between freight vehicles may yield benefits. This may be possible by broad truck class, which is related to freight type (chapter 2). There is some evidence that such price discrimination already exists in rail, with commercial track operators allocating the largest share of common costs to particular types of freight such as coal (chapter 5).

A commercial operator of road infrastructure would likely act in a similar way, allocating the largest share of common costs to vehicles with the greatest willingness to pay (which will tend to be those carrying freight for which there is least potential to substitute to other vehicle classes or transport modes).

DOTARS (sub. 69) argued that it is reasonable to assume constant elasticity of demand across truck classes. Under this assumption, the relative mark-up over marginal cost would be the same for all truck classes, and, in absolute terms, the classes with the highest marginal costs would pay the most. DOTARS suggested that marginal costs increase at a decreasing rate by vehicle size, leading them to conclude that a charge per litre of fuel consumed (which also increases at a decreasing rate by truck size) may be an (easy) way to approximate Ramsey pricing.

If demand elasticities are constant across truck classes, the current approach to allocating common costs — by vehicle kilometres travelled — would allocate somewhat lower costs to those classes of truck that use more litres of fuel per kilometre (the bigger, heavier trucks), compared to a Ramsey approach. For example, six-axle articulated trucks account for 23 per cent of heavy vehicle kilometres, but represent almost 28 per cent of heavy vehicle fuel consumption.

However, the Commission's elasticity modelling suggests that there *are* differences in demand elasticities across truck classes. The Commission's estimates suggest that freight travelling on articulated trucks is the most price sensitive of all road freight (appendix F). Therefore, allocating common costs by vehicle kilometres travelled

— which effectively gives a smaller mark-up to articulated trucks — may not be a bad proxy for a Ramsey allocation. Allocating by VKT also seems preferable on efficiency grounds to alternatives (such as PCU-km) that may result in higher mark-ups for the biggest trucks such as B-doubles that are likely to have relatively elastic demand because of the availability of rail as a substitute.

Determining the efficient allocation of common costs across all vehicle classes (including passenger vehicles) is more difficult still. However, the NTC suggest that applying Ramsey principles could lead to trucks being allocated a *lower* share of common costs than the current allocation:

> … car use may well be more inelastic than inter-capital truck use, as roads provide access and mobility benefits to private car drivers that they value highly and are willing to pay for. Applying Ramsey pricing in this case may lead to an even larger proportion of shared costs being attributed to light vehicles (and a lower share to trucks) than at present. (sub. 17, p. 55)

The major hurdle to the introduction of any type of discriminatory pricing for use of road infrastructure is the potential for substitution within the mode, opening up the possibility of arbitrage across truck classes. For example, a road operator attempting to allocate costs to a particular type of freight via higher charges for the truck classes carrying that freight, risks the freight switching to other truck classes with lower charges. Further, there may be resistance to introducing any type of discriminatory pricing regime because of perceived equity issues.

DRAFT FINDING 4.6

Although heavy vehicles currently bear a small share of the common costs of road provision, this does not mean that they receive a subsidy.

The most efficient way to allocate common costs is using Ramsey pricing principles. However, there are limits to achieving this in practice. The available evidence suggests that the current approach to allocating these costs (based on kilometres travelled) is likely to be more efficient than alternative approaches that allocate a greater share of common costs to the largest vehicles.

How should expenditure be attributed across road users?

There is considerable debate about the appropriate way to attribute various types of expenditure across road users. Much of the debate about how to attribute costs serves to illustrate how arbitrary some of these attributions can be, given the current state of data and engineering knowledge. As the NTC commented:

> Lack of information on the relationship between variable costs and road use means that the form and nature of cost functions for roads can only be roughly estimated.

> Establishing these relationships is particularly difficult … because of the limited engineering knowledge of how they perform in a technical sense. (sub. 17, p. 41)

The Commission has reviewed a number of Australian and international studies of road cost attribution (appendix B). Given the continued uncertainty about the relationship between road use and damage, the Commission it is not in a position to advocate any particular model.

However, it is worth noting that most of the Australian studies attribute a greater proportion of costs to heavy vehicles than the current model (tables B.1 and B.2). In particular, most studies (and a number of other countries) attribute pavement maintenance costs across road users on the basis of ESA-km, whereas the NTC uses AGM-km, resulting in a lower allocation to heavy vehicles (box 4.8).

Box 4.8 **Approaches to attributing pavement maintenance costs**

A notable difference between the NTC cost allocation model and that adopted in other studies is the parameter for attributing road maintenance expenditure. In the First Determination, maintenance expenditure was attributed by ESA-km, but the NTC moved to attributing this expenditure on the basis of AGM-km for the Second Determination, resulting in a lower share of costs attributed to heavy vehicles.

All the Australian studies reviewed in appendix B, other than the NTC's statistical analysis for the Third Determination (NTC 2005b), attribute road maintenance costs on the basis of ESA-km. Similarly, a number of other countries, including the United States, United Kingdom, New Zealand and Germany also attribute pavement maintenance costs on this basis.

However, the AAA (sub. 45) support the use of AGM-km, because of 'the predominant influence of load on pavement wear' (p. 8). However, they express concern about the NTC's move in the Third Determination to attribute a percentage of this expenditure on the basis of PCU-km.

The NTC (sub. 17) argue that the factors influencing pavement expenditure are not well understood. They claim that a mix of road use factors generate the need to incur this expenditure including 'tyre passes, horizontal pavement forces produced by scrubbing of tyres, axle loads, dynamic loads and spatial repeatability of loadings' (p. 65).

Source: appendix B.

At the upper end, applying the BTE (1999a) cost attribution parameters and common cost estimates to current expenditure data would allocate 37 per cent more expenditure to heavy vehicles relative to the current approach. The NTC (2005b, executive summary, p. 3) acknowledges the 'conservative and sympathetic approach' taken in its own cost allocation judgements. In a paper examining the NTC's cost allocation methodology, Synergies (2006) concluded:

> In light of the overwhelming evidence, both in relation to the proportion of attributable costs and the causation between equivalent standard axle kilometres and maintenance related cost, there is considerable doubt as to whether [the percentage of expenditure allocated to heavy vehicles] is sufficient … (p. 15)

While it is unlikely to be worthwhile to refine the cost estimates and attribution methodology to the nth degree, further work, particularly in the area of cost attribution by road type, may improve the attribution of costs under the current framework, and would almost certainly be necessary for any system of charges disaggregated by location. The NTC has recently received funding from Austroads to undertake further research in this area (sub. 76).

DRAFT FINDING 4.7

There is considerable debate about the relationship between road expenditure and road use. The National Transport Commission cost attribution model results in a lower attribution of costs to heavy vehicles than most of the alternative approaches considered. The Commission supports the National Transport Commission's decision to undertake further work in this area.

How does network-averaging affect cost allocation?

The debates about cost allocation, discussed above, are in the context of allocating some network-wide bundle of expenditure (albeit with an arterial/local and rural/urban split) across vehicle classes. However, it is likely the costs of heavy vehicle road use differ by road type beyond this high level split — by construction method, traffic volume and climate, for example (NTC, sub. 76). To the extent that the use of the road network by certain classes of truck differs from the 'average' for all vehicles, the cost allocation model will not give an accurate indication of the costs imposed on the network by vehicle class, nor indeed by vehicle.

The NTC has attempted to address this issue for road trains through an adjustment which allocates costs to road trains based on expenditure incurred in the geographic regions where these vehicles are permitted to travel (section 4.4). It would not be straightforward to implement such an approach for other vehicle types, however, because they do not exhibit such a clear geographic pattern of operations (NTC 2005b).

The extent to which the current averaging of charges is an issue in practice depends both on the variation in the unit costs of road use, and the distribution of travel by truck class within the network. For example, if the costs of heavy vehicle road use are similar for all roads within the current arterial/local rural/urban categories, averaging is unlikely to significantly distort cost allocations. Similarly, even if road use costs differ significantly within categories, if each truck class does the same proportion of its travel on each type of road, the allocated cost by truck class will not depart significantly from the average costs of road use by class.

The NTC suggested that that the unit costs of road use for inter-capital corridors may be lower than on other roads because of economies of scale in pavement design and the higher traffic volume on these routes (NTC, sub. 17). The Victorian Government also considered that the costs may be lower on these roads:

> The Victorian Government also notes that the aggregation and averaging of cost data leads to cross-subsidisation on the basis of location … location based charging would likely result in relatively lower unit prices for access to high volume routes like Melbourne to Sydney, as opposed to low use routes. (sub. 55, p. 4)

Similarly, a recent study commissioned by DOTARS (Ernst and Young et al. 2006) noted:

> Trucks using the high durability roads between Melbourne, Sydney and Brisbane would likely incur lower road user charges than charges which assume trucks use roads of average durability. (annexure 5, p. 9)

Few studies have estimated the cost of road use by road type, however, and this was not feasible for the Commission in the timeframe for this inquiry.

Two studies of the costs of road use on the inter-capital corridors, BTE (1999a) and BTRE (forthcoming), estimate that the avoidable cost of road use on most of the major corridors — particularly the Sydney–Melbourne and Melbourne–Adelaide corridors — is significantly lower than for the arterial road network as a whole. This is not surprising given that these roads are built to accommodate substantial heavy vehicle traffic. More importantly, they also estimate that total costs (including attributable capital and common costs) are lower per kilometre on the corridors, given the high traffic volumes and economies of scale in pavement durability (box 4.9).

Other corridor studies have tended to be constrained by the lack of specific expenditure and road use data. For example, both Pacific National (sub. 41) and Port Jackson Partners (2005), derive their unit cost estimates for below-road operating and maintenance costs from the NTC's aggregate expenditure and road use data and assume these are applicable to particular corridors. To the extent that unit costs are actually lower on the corridors, their analysis will overstate the costs of road freight transport.

If costs attributable to heavy vehicles are indeed lower on the major corridors, it would imply that truck classes that travel proportionately more on these routes would be allocated more than the actual costs of their network use. These potential impacts of network averaging should be borne in mind when considering the degree of cost recovery (based on network-wide costs) in the following section.

The NTC (sub. 76) has investigated classification of the road network for cost allocation purposes. However, it points out that the real benefits of more detailed cost information by road type will only be delivered if road user charges are able to vary accordingly (section 4.4).

Box 4.9 **How do truck costs on the inter-capital corridors compare?**

BTE (1999a) and BTRE (forthcoming) estimated the avoidable road wear costs for trucks using the major inter-capital corridors. These avoidable cost estimates are based on a lifecycle model of road maintenance, which estimates the future costs of road maintenance treatments (including rehabilitations) based on traffic growth projections. The estimates of the avoidable costs are derived from the estimated average annual maintenance expenditure over that period.

BTE (1999a) estimated the avoidable road wear cost of a six-axle semi using some of the major inter-capital corridors to be 5.7 cents per kilometre (c/km) on average (ranging between 2.9 c/km on the Melbourne–Sydney corridor to 10.0 c/km on the Adelaide–Perth corridor). The avoidable cost of the same truck travelling on the arterial network was estimated to be 15.0 c/km[8]. BTRE (forthcoming) estimated the avoidable costs on the inter-capital corridors to be even lower, between 1 and 2 c/km on the east coast corridors for typical inter-capital articulated truck combinations, and about 8 c/km between Adelaide and Perth (BTRE, sub. 69).

BTE (1999a) also estimated the average cost of heavy vehicle use on some selected inter-capital highways (including capital costs) based on estimates of the replacement value of these roads. Using their cost allocation template, they estimated the average cost of road use for a six-axle articulated truck (carrying a 20 tonne load) on some inter-capital highways — Sydney–Melbourne (19.1 c/km), Sydney–Brisbane (11.5 c/km), and Melbourne–Adelaide (19.1 c/km) — was below the cost imposed by the same truck on the average arterial road (23.2 c/km). Of the inter-capital corridors considered, only Adelaide–Perth (26.7 c/km) had a higher than average unit cost.

A similar analysis in BTRE (forthcoming), this time applying the NTC (Second and Third Determination) cost allocation parameters to actual National Highway spending suggests that the unit total cost per kilometre of a 20 tonne six-axle truck on the National Highway system is below the current variable fuel-based charge.

Sources: BTE (1999a); BTRE (sub. 69); BTRE (forthcoming).

8 All figures from BTE (1999a) have been updated to 2002-03 prices using the BTRE Road Construction and Maintenance Price Index.

4.4 Do road user charges achieve cost recovery?

While the previous sections focused on cost allocation to heavy vehicles, on the other side of the cost recovery equation is the level of charges currently paid by road users. This section looks at the extent to which the current charging system achieves the minimum cost recovery hurdles outlined in section 4.1.

It should be noted that all analysis in this section takes the NTC cost allocation methodology as given. If it were considered that changes should be made to this methodology based on the discussion in the preceding two sections, the cost recovery figures would need to be adjusted accordingly.

Further, all the estimates of heavy vehicle cost recovery are based on the current network wide cost allocations. Consequently, any 'subsidy' identified refers to under-recovery by a particular vehicle, or vehicle class, based on network expenditure and road use averages.

Cost recovery in aggregate

The NTC (sub. 17, p. 39) states that there is 'general agreement that the road sector currently recovers expenditure associated with road infrastructure through charges'. Indeed, at the time of the Second Determination, charges were set to recover $1.4 billion, more than the approximately $1.3 billion allocated to heavy vehicles (NRTC 2000). Based on more recent expenditure and road use data (NTC 2005b), current road user charge revenues ($1.6 billion), more than cover the costs attributable to heavy vehicles ($1.4 billion) and just cover their total allocated costs (their attributable costs, plus their allocated share of common costs).

However, the Australian Trucking Association (ATA) argues that currently trucks are *more than* paying their way under the current approach. Using data on total diesel fuel usage from the Australian Department of Industry, Tourism and Resources, they estimate that diesel fuel usage by heavy vehicles is significantly above the NTC estimates. However, the Commission understands this is due to the inclusion of fuel use by some vehicles that fall outside the heavy vehicle road user charging system — rigid trucks and buses less than 4.5 tonnes, for example.

Based on their higher estimates of fuel consumption, and hence fuel excise contribution, they conclude that revenues from heavy vehicle charges exceeded their total allocated costs by $274 million (sub. 9, p. 25).

A second issue with this analysis, however, is that the data used on the cost and revenue sides are not consistent. If it is indeed the case that diesel use by heavy vehicles is higher than the NTC estimates, this implies these trucks are also doing more kilometres and hence should be allocated more costs.

Whether charges at present just meet or over-recover the costs allocated to heavy vehicles (and in any case it seems clear that heavy vehicles are more than recovering their attributed costs), the failure of the Third Determination has meant that under-recovery is likely to emerge in the near future. Outside the annual adjustment to registration fees (capped at the rate of inflation), there is no mechanism for a revision to charges before the next pricing determination. If road expenditure continues to increase, at some point cost recovery will no longer be achieved for heavy vehicles overall. This is indeed likely to be the case with the planned increase in road infrastructure investment under AusLink. As the NTC noted:

> Given the considerable growth in infrastructure investment in the transport sector over the coming years, it is highly unlikely that this methodology means that the road sector will continue to recover its costs. This is particularly so with the rejection of the 3rd Determination. (sub. 17, p. 40)

DRAFT FINDING 4.8

Based on the most recent data available, road user charge revenues from heavy vehicles more than cover their attributable infrastructure costs and just cover their fully allocated cost. However, following rejection of the Third Determination, cost recovery is unlikely to be maintained if road expenditure continues to rise with no increase in charges.

Cost recovery by vehicle class

Under the current system, the road user charge component of the fuel excise is set to recover the costs imposed on the road system from the smallest (two-axle rigid) trucks. As heavier trucks impose higher costs, the fuel excise alone is not sufficient to recover the costs allocated to these vehicles. The registration charge for each vehicle class is set such that it recovers the difference between the cost allocated to the class and the revenue recovered from the class through the fuel excise.

Although, if applied fully, this would ensure exact recovery of allocated costs for each class, constraints on charges for some vehicle types and ad hoc adjustments have led to varying levels of cost recovery by vehicle class.

- *Rigid trucks*. These trucks fully recover their allocated costs based on fuel excise revenues alone. The registration charge (levied to ensure continuity with vehicles under 4.5 tonnes) leads to over-recovery.[9]

9 To ensure exact cost recovery for these vehicles the fuel excise would need to be set taking into account the registration fee, that is, the fuel excise would be set to recover the allocated cost for these vehicles minus the registration charge. This would result in a significant decrease in the

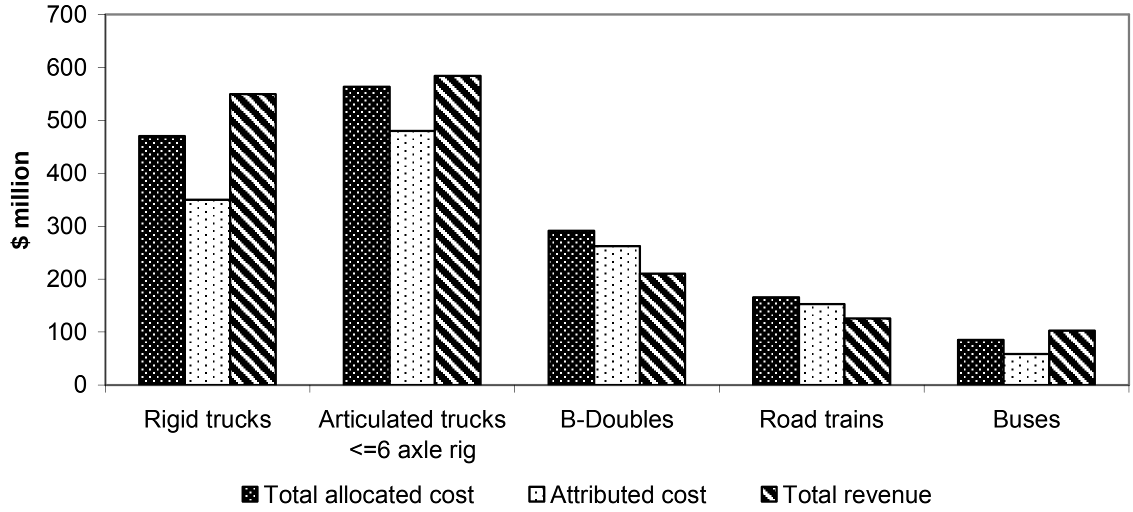
- *Road trains*. Costs allocated to road trains are adjusted for the fact that these vehicles are restricted to travel only on certain routes. The cost allocation is based on rural road expenditure in Western Australia, South Australia and Queensland and total road expenditure in the Northern Territory. The BTRE (2004) argues that providing a geographically-based exception for road trains in an otherwise nationally uniform system introduces inconsistency into the road charging system. However, given the enforced restriction on the movements of these vehicles it would seem appropriate that their charges be based on the part of the network they are permitted access.
- *B-doubles*. Registration fees for B-double prime movers are constrained not to exceed those for road trains. This reflects a deliberate attempt by the NTC to influence fleet choice because of the perceived safety and environmental benefits of B-doubles compared with road trains. The NTC calculates that B-doubles, on average, under-recover their allocated cost by more than $10 000 a year under the current arrangements (sub. 17, executive summary, p. 3).

How significant is over- and under-recovery by class?

The adjustments discussed above affect the level of cost recovery for all vehicle classes because costs removed from road trains and B-doubles are reallocated across the vehicle fleet. Figure 4.1 highlights the resulting levels of cost recovery for some vehicle classes.

fuel charge, to approximately 12 c/L (NTC 2005b). The NTC rejected such an approach because of the very high registration charges that this would imply for the heaviest vehicles.

Figure 4.1 **Under- and over-recovery by vehicle class**[a]



[a] Road expenditure and vehicle use data are from the Third Determination (NTC 2005b). Expenditure data is the average of expenditure in the years (2002-03 to 2004-05). Expenditure is allocated across vehicle classes using the current (Second Determination) cost allocation template. The figures presented do not include the road train adjustment for restricted routes. Revenue estimates are based on the current road user charge component of the fuel excise (19.6c/L) and 2005-06 heavy vehicle registration charges.

Data sources: NRTC (1998); NTC (2005b).

Figure 4.1 demonstrates that all vehicle classes except B-doubles and road trains cover their attributed and allocated costs. As a class, B-doubles pay about $52 million a year less than their attributed cost, equivalent to under-recovery of about $7000 a year per vehicle. This under-recovery would have been reduced significantly (to about $1700 per vehicle) had the charges proposed under the Third Determination been approved by the Australian Transport Council (table B.4 in appendix B).

Table 4.2 highlights the level of cost recovery per litre of fuel consumption by vehicle class.

Table 4.2 **Costs and revenues (per litre fuel consumption)[a]**
By vehicle class

Vehicle type	*SR Marginal cost*	*Marginal revenue*	*Attributable cost*	*Allocated costs*	*Total revenue*
	c/L	c/L	c/L	c/L	c/L
Rigid trucks	12	19.6	19	25	29
Articulated trucks ≤ 6-axle rig	16	19.6	26	31	32
B-doubles	20	19.6	35	39	28
Road trains	22	19.6	37	40	30
Buses	9	19.6	14	20	24

[a] Road expenditure and vehicle use data are from the Third Determination (NTC 2005b). Expenditure data is the average of expenditure in the years (2002-03 to 2004-05). Expenditure is allocated across vehicle classes using the current (Second Determination) cost allocation template. The costs and revenues included for each category are detailed in the footnote to table B.5 (appendix B).

Data sources: NRTC (2000), NTC (2005b).

It is evident from table 4.2 that, not only does the current charging system lead to over- and under-recovery by vehicle class in aggregate, but also that there is over- and under-recovery at the margin. This occurs because the marginal revenue (fuel excise) is set the same for each vehicle class but the marginal cost imposed on the road network significantly differs by vehicle type. As a result, vehicles face distorted signals regarding the incremental costs they impose on the network.

As Queensland Rail noted:

> … in order to send appropriate price signals to users, at a minimum, the price for the use of a road by the vehicle type … should cover at least the incremental cost it imposes on the road infrastructure. … price signals based on average impacts … will not signal to transport operators the full impact of their usage decisions. It also fails to provide an incentive for operators to adopt practices that would minimise the maintenance impact of their vehicles on roads (sub. 53, p. 58)

It is also worth noting that all vehicle classes cover their marginal cost in total (that is, once registration revenue is also taken into account). However, this does not guarantee that individual vehicles within the class cover these costs. This is discussed in more detail below.

Is over- and under-recovery by class a problem?

The ATA (sub. 9, p. 33) recognised that B-doubles under-recover their allocated costs. However, they expressed support for such an approach as ‘the industry as a whole “still pays it way”’. Pacific National (sub. 41, p. 10), on the other hand, claimed:

> … the continuation of the subsidy many years after the market entry of B-doubles is a glaring anomaly which provides a substantial pricing benefit for the heaviest class of truck, at the expense of rail, lighter trucks and passenger cars.

The Commission considers that the moderation of B-double charges on the basis that they are safer and more environmentally friendly than road trains is arbitrary. It would be a coincidence if the adjustment achieved an efficient level of these externalities, given the lack of regard to either their optimal level, or to the existence of (potential or existing) mechanisms to internalise them (chapter 6). This was noted by the Victorian Government:

> The current discount given to B-doubles recognises, amongst other things, the performance of B-doubles relative to other vehicles in terms of emissions and safety. Inclusion of externality pricing would more properly address these issues. (sub. 55, p. 8)

Further, because road trains are restricted to travel only on certain routes (NTC 2005b) the substitution between these vehicle types is likely to be limited. Also, as pointed out by the BTRE (2004), making adjustments to charges for the external effects of road use for some truck classes but not others raises issues of consistency in the application of charges.

The under-recovery from B-doubles is financed through higher charges levied on other classes of truck. These disparities in the level of cost recovery have the potential to distort fleet decisions as well as decisions regarding use of the network at the margin. This may have influenced the changes in fleet structure evident over the last decade. For example, the number of B-doubles increased by over 180 per cent from 1997 to 2003, while, in the same period, the number of six-axle articulated trucks increased by only 9 per cent (NRTC 1998; NTC 2005b). As one participant claimed:

> … the number of the 9 or more axle B-doubles significantly increased … It appears that the appreciable subsidies are encouraging the rapid growth in numbers of these trucks, quite possibly into inappropriate applications (eg using narrow city roads or lightly constructed rural roads). (P.G. Laird, sub. 23, p. 8)

Further, this under-recovery has implications for competitive neutrality as it applies to those trucks competing most directly with rail. However, to the extent that the costs of heavy vehicle road use are actually lower on the main interstate corridors (and B-doubles travel proportionately more on these routes), the costs allocated to these trucks may still be higher than the actual costs they impose on the network (section 4.3).

DRAFT FINDING 4.9

The deliberate reduction in B-double prime mover charges by the National Transport Commission (so that they do not exceed those for road trains) means that, as a class, they do not cover the network-wide costs attributable to their road use. Implications for competitive neutrality are unclear, however, given that network averaged costs allocated to B-doubles operating on the major inter-capital corridors, where road and rail most directly compete, may be higher than their corridor-specific costs.

Cost recovery by individual vehicles

Individual vehicles may under- or over-recover the costs of their use of the road network because of averaging by truck class within the charging mechanism. This occurs both by vehicle use (distance travelled and mass) and type of road.

Potential cross-subsidies by vehicle use

It is has been well documented that trucks that are utilised less than average (travel shorter than average distances or carry lighter than average loads) cross-subsidise other trucks within the class (BTRE 2004, NTC, sub. 17, PJP 2005). The NTC (2005b, p. 24) states '[a] shortfall of the current mechanism becomes evident when vehicles which vary significantly from the average are considered'.

This occurs for two reasons:

1. Fuel excise is a poor proxy for road damage.
2. The registration charge is based on average fleet utilisation.

The ATA (sub. 9, p. 22) argues the current diesel excise 'takes account of truck mass and distance' as fuel use increases with distance travelled and vehicle mass. The rate of fuel excise is constrained to be the same for all classes of vehicle because a differential fuel excise would be 'extremely costly administratively, and potentially subject to rorting' (NTC, sub. 17, p. 68).

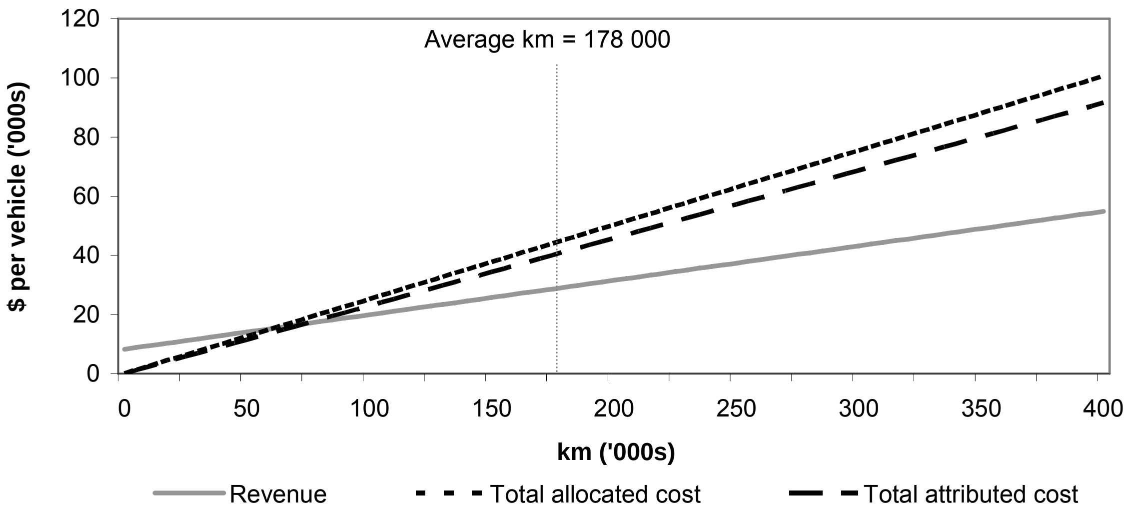
However, the road damage caused per litre of fuel consumed varies significantly by vehicle class. For example, the attributable cost for B-doubles of 35 cents per litre is significantly above their fuel excise contribution of 19.6 cents per litre (table 4.2). Even if a differential fuel charge by vehicle type were to be introduced, the fuel excise would still be a poor proxy for road wear because the charge per net tonne kilometre falls as vehicle load increases but road wear increases with load (BTE 1999a).

The 'gap' between fuel excise contribution and allocated costs is addressed, on average, through the registration fee. The result is that a truck with average utilisation for its class (in terms of distance travelled, average gross mass and fuel efficiency) will fully cover its allocated cost (plus or minus any subsidy for that class as a whole).

However, because the registration fee is fixed regardless of the number of kilometres travelled, trucks travelling greater than average distances have a lower per kilometre registration fee and therefore fail to achieve cost recovery. The same logic applies for those carrying greater than average mass, except under-recovery for these trucks is exacerbated because some attributable costs increase exponentially with vehicle mass, while the fuel excise increases linearly with mass. The more fuel efficient vehicles within a class will also fail to achieve cost recovery (NTC, sub. 17).

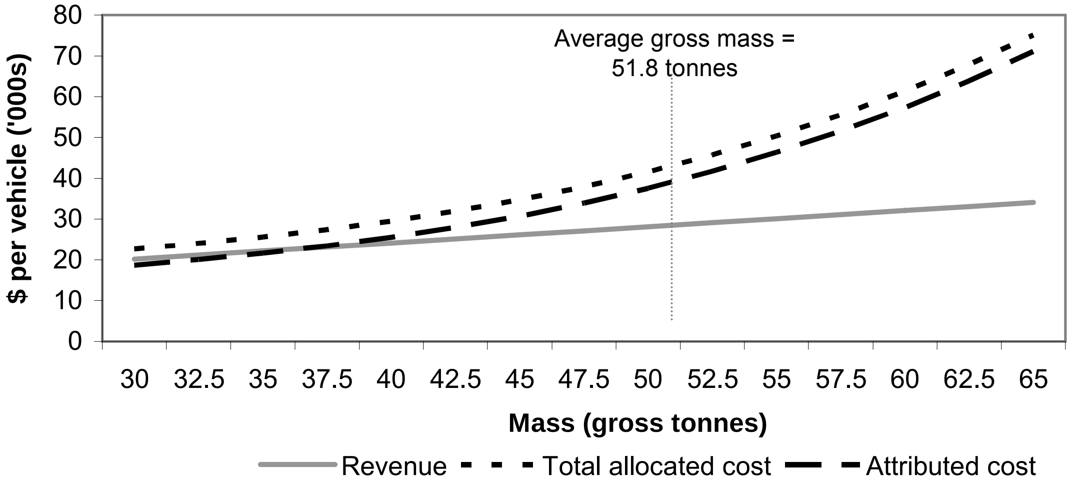
The impacts of distance travelled and average gross mass on cost recovery for nine-axle B-doubles (holding everything else equal) is highlighted in figures 4.2 and 4.3 respectively. These vehicles do not achieve cost recovery on average because of the constraint on their charges (discussed above).

Figure 4.2 **Revenues and costs diverge for 9-axle B-doubles: by distance travelled**



Sources: NRTC (2000); NTC (2005b); NTC (sub.17).

Figure 4.3 **Revenues and costs diverge for 9-axle B-doubles: by mass**



Sources: NRTC (2000); NTC (2005b); NTC (sub. 17).

How significant are the cross-subsidies?

Table 4.3 gives an indication of the possible magnitude of over- and under-charging within vehicle classes as a result of averaging. Estimates of allocated costs and revenues are presented for a few classes of truck at the 25th and 75th percentile of distance travelled.

Table 4.3 **Over- and under-charging for some truck classes[a]**

By percentile of distance travelled

	25th Percentile		*75th Percentile*	
	Allocated cost	Revenue	Allocated cost	Revenue
	$	$	$	$
2-axle 7-12t rigid	100	400	1800	2000
6-axle articulated	5600	8100	26 500	19 900
9-axle B-double	25 800	19 900	57 200	34 200
Double road train	12 500	14 400	50 900	31 600

a ABS (2005b) presents data on distance travelled in 5000 km ranges. The costs and revenues at the 25th and 75th percentile are calculated from the midpoint distance of the range in which the truck at the 25th and 75th percentile falls.

Data sources: NTC (2005c); ABS (2005b).

Table 4.3 (and table B.7 in appendix B), serve to highlight the differences in cost recovery both across and within vehicle classes. Across classes, differences are driven by the pricing constraints and ad hoc adjustments discussed earlier. These result in significant differences in cost recovery at the individual vehicle level. For example, while almost 100 per cent of 7–12 tonne rigid trucks cover their attributable network costs, only 10 per cent of nine-axle B-doubles do.

Within classes, differences in cost recovery can also be significant. For example, while a B-double travelling 102 500 km (the 25th percentile of distance travelled), under-recovers its allocated cost by about 20 per cent, a B-double travelling at the 75th percentile (227 500 km) under-recovers by more than 40 per cent.

It is appears that the current charging system significantly penalises those vehicles that travel shorter than average distances or carry lighter than average loads. This was noted by Coles Myer:

> CML transports are loaded by volume rather than weight. This makes them consistently lighter than similar vehicles hauling for other industries. … Consequently axle weight and impact of the road surface is considerably less than would normally be expected, yet these vehicles pay the same registration fee and receive the same fuel rebate as their heavier counterparts. CML believes pricing structures should recognise or offer incentives for reducing axle weight. (sub. 47, p. 9)

Cross-subsidies by road type

The cross-subsidies within vehicle classes discussed above may be complicated by the presence of cross-subsidies by road type. As discussed in section 4.3, costs allocated to particular truck classes may not reflect the costs of their actual road use due to unit cost differences by road type and differences in the distribution of travel by truck class. However, even if these differences could be captured in the cost allocation process, network averaging of charges could still present cost recovery issues *within* a class, if the pattern of road use differs significantly between individual vehicles within classes.

For example, under the current cost allocation model road expenditure and use is disaggregated by arterial and local roads. Using this data, the estimated unit costs for each truck class is higher on local roads, resulting from the higher marginal costs on these roads, though offset somewhat by the smaller contribution to common costs. Attributable capital costs are about the same on both types of road reflecting the fact that local roads have both lower capital spending and less intensive use (table 4.4).

Table 4.4 **Arterial/local road costs (per litre fuel consumption)[a]**
By vehicle class

	Arterial roads			Local roads		
Vehicle type	*SR Marginal Cost* [b]	*Attributable cost* [c]	*Allocated costs* [d]	*SR Marginal Cost* [b]	*Attributable cost* [c]	*Allocated costs* [d]
	c/L	c/L	c/L	c/L	c/L	c/L
Rigid trucks	10	17	24	16	23	26
Articulated trucks						
≤ 6-axle rig	15	25	30	25	36	38
B-doubles	19	33	38	33	49	51
Road trains	20	35	38	35	52	53

a The road expenditure and use data is from the Third Determination. The current (Second Determination) cost allocation parameters are used to attribute road damage. **b** The short-run marginal costs for each vehicle class are estimated by excluding capital and non-attributable costs from the cost allocation. **c** Attributable costs are the capital and maintenance expenditure attributable to each vehicle class. **d** Total allocated cost is the cost of capital and maintenance expenditure attributable to each vehicle class plus the common costs allocated to each vehicle class on a VKT basis.

Data sources: NRTC (2000), NTC (2005c).

If the relative use of the arterial/local road network for an individual vehicle were to depart significantly from the distribution of use within their class then, everything else equal, under- or over-recovery would result. For example, the average road user charge for a six-axle (or less) articulated truck is set at 31 cents per Litre, equal to the average allocated cost for these vehicles (table 4.2). The average allocated cost is calculated based on estimates that six-axle articulated trucks, as a class, undertake 90 per cent of their travel on arterial roads (NTC 2005c). However, a six-axle articulated truck that travels exclusively on local roads imposes a significantly higher cost on the road network of 38 cents per Litre (table 4.4). These vehicles would therefore be cross-subsidised by those travelling on arterial roads more than the class average.

Of course, it is likely that further cross-subsidies by road type exist — if costs are lower on the inter-capital corridors compared to the rest of the arterial road network, costs may be over-recovered from trucks using these routes, for example. However, such cross-subsidies are not able to be quantified because of a lack of disaggregated road expenditure and road use data beyond the high level arterial/local, rural/urban categories employed by the NTC.

DRAFT FINDING 4.10

The current road user charging system results in significant cross-subsidies within some vehicle classes. Vehicles travelling longer than average distances and/or carrying heavier than average loads are, all else equal, cross-subsidised by other vehicles within the class. Similarly, vehicles that travel more than average

on higher unit cost roads (such as local roads) are, all else equal, cross-subsidised by those using lower cost parts of the network.

4.5 Summing up

Much of the debate over the current road user charging system has centred on the issue of cost estimation and the allocation of historic costs to heavy vehicles. There may be some modest gains, in terms of improving the efficiency of use of the existing network, from refining the current cost allocation methodology. However, much greater gains are likely to come over time from a shift to more efficient pricing arrangements (chapter 8) and from improving the linkages between road demand and investment (chapter 9).

Within the framework of the current PAYGO/cost recovery model, it can be said that heavy vehicles *as a group* cover their attributable costs, although this will soon change if road expenditure continues to rise. B-doubles as a class, however, do not cover their attributable network costs and, within the current network-wide charging framework, an increase in their charges would seem warranted. However, whether efficiency and competitive neutrality would be improved by such an increase — given that these vehicles make relatively intensive use of the lower (unit) cost inter-capital corridors — is unclear (chapter 7).

The biggest source of cross-subsidy within the current framework is the averaging of road user charges — by vehicle mass, distance travelled and location. The potential for mass–distance and location-based charging to provide more cost-reflective signals to road users is discussed in chapter 8.

5 Rail infrastructure costs and cost recovery

Key points

- Rail infrastructure providers are unable to cover full economic costs on many routes and often fall well short of doing so. The exceptions to this generally are in the bulk freight area, and particularly in coal.
- The inability of rail infrastructure providers to achieve full cost recovery means they typically rely on government subsidies of various forms to maintain viability. These subsidies are potentially significant in affecting the terms of competition between road and rail freight.
- Differences between access regimes or regulators in asset valuation techniques and principles for inclusion or exclusion of contributed assets, can result in inconsistencies in measured costs between jurisdictions.
  - Non-inclusion of government-contributed assets in regulatory asset bases can significantly reduce the assessed costs faced by providers and, therefore, the charges allowed by regulators.
- Prices obtained by rail infrastructure providers are constrained by (intermodal) market pressures and determined via negotiation. Except for some bulk freight, market realities typically are a more effective constraint on rail infrastructure prices than access regulation.
- Given the potential efficiency gains from allocating proportionately more common costs to customers who are less sensitive to price changes, regulations and regulatory approaches should facilitate (and certainly not impede) such pricing approaches.

5.1 Introduction

Following years of concern about poor service quality and heavy financial losses, there has been significant reform in the rail sector over the last 15 years. The reforms have included corporatisation, privatisation, expanded use of contracting and, for much of the rail network, vertical separation of above- and below-rail operations (see chapter 2).

Prior to the reforms, infrastructure access was not charged for separately because rail operators were fully vertically integrated and financial transactions were internal. The reform process has seen all jurisdictions, except Tasmania, adopt legislation allowing third parties to access rail infrastructure in order to promote above-rail competition.[1]

Although rail freight is largely commercial in nature, questions remain about whether it ‘pays its way’. Rail still relies heavily on various forms of government contributions, generally for services that would otherwise not be commercially sustainable. At the same time, the financial viability of rail freight infrastructure may be impeded by factors such as access regulation (limiting returns on profitable aspects of operations) or preference being given to passenger trains when allocating train paths. Some see vertical separation as a problem, or at least as contributing to other problems.

In this chapter, the Commission examines the capital and operating costs of providing rail infrastructure services, and seeks to identify levels of cost recovery by rail infrastructure providers and the nature and extent of any subsidies to users. The chapter also details different economic regulatory approaches across jurisdictions, and attempts to assess the impact of economic regulations on rail pricing and levels of cost recovery. Non-economic regulation (for example, to promote safety) is also an important driver of costs and is discussed in chapter 10. Substantive discussion of the merits of vertical separation versus integrated above- and below-rail businesses is also contained in chapter 10. Detailed discussion of the access regimes surrounding rail infrastructure is contained in appendix E.

5.2 Determination of ‘below-rail’ costs

Rail infrastructure provision generally is seen as a natural monopoly (albeit one typically facing considerable competition in the broader freight market, particularly from road). Average costs of providing access to the use of rail infrastructure typically decline with increases in use (meaning the activity is subject to economies of density). Even with only one provider, the minimum capacity that can be supplied may be large relative to the total demand for the use of rail infrastructure.

In those areas of the freight market where road and rail are in competition, road is often perceived to be the ‘price setter’. This confronts rail infrastructure providers

1 The Tasmanian Government is currently seeking to finalise detailed agreements to guarantee access by third parties to the Tasmanian rail network (Cox 2006).

with a dilemma. Failure to match road prices would see a loss of volume which, given its importance, could threaten rail's viability. Charges based on meeting the market, however, may not cover the long-run costs of infrastructure provision. In practice, rail infrastructure charges typically appear to be set with a view to maintaining or increasing market share.

Costs of providing rail infrastructure

Rail infrastructure provision has high fixed costs, associated mainly with construction. Queensland Rail (QR) has estimated that capital costs make up around 60 per cent of the total costs of rail infrastructure provision, with maintenance costs representing around 25 per cent of costs and other operating costs the remaining 15 per cent (sub. 53). These estimates appear to be based on a life-cycle approach to measuring costs (where capital costs are the initial costs of establishing track).

Capital costs comprise the cost of land, earthworks and track construction. Maintenance activities can be categorised as being either routine or major. Routine maintenance activities include inspections, resurfacing, bridge maintenance and general routine track maintenance. Major maintenance activities include track re-layering, re-railing, re-sleepering, ballast replacement, major resurfacing, rail grinding and formation maintenance.

QR has stated that maintenance activity has three distinct phases over the life of a rail track:

- immediately after construction, involving inspections and routine maintenance;
- after around five years, involving more significant activities such as regular rail grinding and resurfacing, in addition to inspections and routine maintenance; and
- around ten years after construction, as track components start to wear out and ballast becomes contaminated, more major maintenance is required to supplement routine maintenance. (sub. 53)

The relationship between costs and infrastructure use

Rail infrastructure regulatory regimes in Australia require that infrastructure charges relate to costs incurred. This requirement broadly accords with the principles for determining efficient prices, although the presence of fixed and common costs to be allocated between different users of rail infrastructure services may require a break in the nexus between marginal attributable costs incurred and prices charged. Nevertheless, there remains a need to establish the relationship between the level (and nature) of infrastructure use and the costs directly incurred as a result.

This is not a straight-forward relationship, however. For example, as for roads, there are trade-offs between maintenance levels and the quality of infrastructure provided: the standard of the initial infrastructure investment affects ongoing maintenance and refurbishment costs and train performance.

Moreover, there is no consensus about the links between wagon suspension, speed and weight and required maintenance levels. It appears that, compared to road transport, relatively little work has been done to try to measure these relationships, presumably reflecting a belief by infrastructure providers that the costs of undertaking such an exercise exceed the benefits. The Bureau of Transport and Regional Economics (BTRE) (2003d, p. 190) has argued that this knowledge gap 'undermines pricing that promotes efficient use of and investment in rail infrastructure'.

To further complicate matters, there also are issues relating to asset valuation methods, appropriate rates of return, equity and asset betas[2] and depreciation rates. These factors can significantly influence measured costs. European Commission research has found that reported estimates of marginal costs vary by a factor of 1 to 20 across Europe (BTRE 2003d).

5.3 Impact of third party access regulation on cost recovery and pricing

In the case of road freight, most of the infrastructure is owned by the public sector and heavy vehicle charges are set by governments to recover the financial costs of road provision and maintenance. So, even though roads exhibit natural monopoly characteristics, there is no need for an economic regulator.

In the case of rail, however, reforms which have led to the commercialisation, corporatisation and privatisation of substantial parts of the rail network have been accompanied by the establishment of regulatory regimes to promote above-rail competition, encourage market diversity and prevent the potential abuse of market power by below-rail operators. In this regard, rail freight operates within a regulatory regime similar to those applied to other commercially provided infrastructure services with natural monopoly characteristics.

2 A beta is used to reflect the likely sensitivity of the return on an individual investment to changes in returns for the market as a whole. An asset beta would be used if the company were fully financed by equity. An equity beta takes account of financing using both equity and debt.

The access regimes

Third party access regimes for rail infrastructure services were introduced as part of the National Competition Policy reform process. The National Access Regime was introduced under Part IIIA of the *Trade Practices Act 1974*, and most State governments have also established access regimes for rail infrastructure.

Each regime sets out principles for access seekers to negotiate with infrastructure providers to attempt to reach agreeable terms and conditions. Each regime also contains provisions and mechanisms for dispute resolution where parties are unable to reach agreement. These provisions and mechanisms vary across regimes.

Under the National Access Regime, existing and potential rail operators can:

- request that the National Competition Council (NCC) recommend that the relevant Minister 'declare' access to the services of a particular access facility. If the facility is declared, the parties enter into negotiation, supported by legally binding arbitration, in order to reach legally agreeable terms and conditions;
- negotiate within the provisions of a legally binding 'undertaking' registered with the Australian Competition and Consumer Commission (ACCC); or
- negotiate within the provisions of state-based access regimes which may, or may not, be certified as 'effective' following a recommendation by the NCC (that is, certified as reflecting the relevant principles contained in the Competition Principles Agreement). (PC 1999c)

In practice, the National Access Regime has only been formally used to provide access to the Australian Rail Track Corporation (ARTC) network (via an undertaking under section 44ZZA), and the Tarcoola to Darwin railway (with the Tarcoola to Darwin access regime being certified under Part IIIA). States have implemented their own access regimes. In the event that a state-based regime is certified by the designated federal Minister, then access seekers lose the ability to seek access under the National Access Regime. However, currently, only the Tarcoola to Darwin access regime has been certified as effective.

A full list of the various access regimes across Australia is contained in table 5.1. More detail is contained in appendix E.[3]

3 One area of particular controversy is the status of privately owned railways. Earlier in 2006 the NCC recommended declaration of part of the Mount Newman railway line, which was not subsequently acted on and is currently under appeal.

Table 5.1 **Regulators and legislative mechanisms for third party access to rail infrastructure[a]**

State and Territory or Regime	*Regulator*	*Legislative mechanism(s)*
ARTC Network	ACCC	*Trade Practices Act 1974*
		Access Undertaking
NSW	IPART	*Transport Administration Act 1988*
		Non-Certified Access Undertaking
Victoria	ESC	*Rail Corporations Act 1996*
		Freight Network Declaration Order 2005
		Dynon Terminal Order 2005
		Rail Network Pricing Order 2006
		Non-Certified Declaration and Access Arrangement
Queensland	QCA	*Queensland Competition Authority Act 1998*
		Non-Certified Access Undertaking
WA	ERA	*Railways (Access) Act 1998*
		Railways (Access) Code 2000
		Non-Certified Legislated Access Regime
SA	ESCOSA	*Railways (Operations and Access) Act 1997*
		Non-Certified Legislated Access Regime
Tarcoola to Darwin	ESCOSA	*AustralAsia (Third Party Access) Act 1999*
		Certified Legislated Access Regime

a Tasmania currently does not have a third party access regime although the introduction of one is proposed.

Source: ARA (sub. 33).

Regulators typically set floor and ceiling prices

In most jurisdictions, regulators have established floor and ceiling prices for access to rail infrastructure. These prices are generally based on the costs likely to be incurred within an access period and the revenue consequently required by the provider to meet those costs.

The floor–ceiling price band is designed to preclude monopoly pricing, while also ensuring access seekers pay at least the incremental cost of their access. The floor price therefore generally is set equal to the marginal or incremental cost of providing a particular service, whereas the ceiling price generally relates to the full economic cost of providing the service, including an adequate return on capital.

The negotiated infrastructure prices actually charged to any individual access seeker fall within the floor and ceiling limits. Generally, prices have been well below ceiling limits except in the bulk freight market. As noted in chapter 2, road transport is typically not as competitive with rail in sections of the bulk freight market (particularly for freight such as coal and minerals) and users have inelastic demand. This means that rates for bulk freight are likely to be closer or equal to the ceiling price and, in the absence of regulation, could sometimes exceed the ceiling price. (Competition from sea transport is likely to provide some constraint though.)

The Victorian Rail Access Regime differs from those regimes in other jurisdictions. Since January 2006, the regime applies to those services declared by the government and establishes reference services, a reference tariff and an access arrangement to apply to each service. The access regime also contains procedures for negotiation of access to non-reference services. The Victorian system involves use of a revenue cap requiring the reference tariff to be set at such a level that, across all declared transport services, the anticipated revenue is equal to a reasonable forecast of the infrastructure provider's efficient cost of providing the services.

Factors affecting measured costs

While most regulators have adopted the floor–ceiling model, there are differences in the definitions of floor and ceiling prices. These include methods of asset valuation and treatment of common costs. There are also different approaches to the relationship between infrastructure use and cost.

These factors are significant in determining whether rail infrastructure providers fully recover their economic costs. For example, the exclusion of some assets from the regulated asset base can significantly reduce the measured costs of providers. Asset recognition practices also affect the split between operating and capital costs.

Asset valuation methods

The most commonly used method of asset valuation is depreciated optimised replacement cost (DORC). This refers to the replacement cost of an 'optimised' rail system less accumulated depreciation. The method is designed to exclude assets that would not be replaced and allows for any cost reductions that would have occurred had service provision been technologically 'optimal'. (The contrast with actual cost valuation methods is discussed in box 5.1.) DORC methodology is used in the ARTC undertaking, for the Tarcoola-Darwin railway regime and also in New South Wales, Queensland, and South Australia.

Box 5.1 Replacement versus actual cost valuations

While there are numerous asset valuation methods available, debate tends to focus on whether an historical cost approach (often termed depreciated actual cost — DAC) or a replacement cost methodology, such as depreciated optimised replacement cost (DORC), is more appropriate.

The DAC method has the advantage of being simple, transparent and objective. Assets are valued at their net book value and depreciated in line with accounting standards or a schedule specified by the regulator. Allowance for inflation is made either through indexation of the asset base, or by adjusting the allowed rate of return.

Under DORC, assets are valued at the cost of replacing their remaining service potential. The replacement cost is 'optimised' in that replicating service potential does not necessarily involve replacing the same physical assets. Hence, if a new technology can deliver the service at a lower cost than the existing assets, those assets will be valued at the cost of the new technology. In this way, DORC is said to emulate what would happen to asset values in a competitive market.

In submissions to the Commission's 2001 National Access Regime Inquiry, use of DORC was not fully supported by either infrastructure providers or users. The optimisation process as applied in the telecommunications sector was criticised for increasing risk to investors. Optimisation in that sector had led to regulated reductions in values because of the emergence of cost-reducing technologies. On the other hand, users of energy infrastructure considered that DORC valuations were highly subjective, allowing infrastructure providers to earn monopoly rents.

Noting 'the myriad of specific issues that arise across infrastructure sectors', the Commission determined in 2001 that regulators should not be bound to use one particular asset valuation approach in all situations (PC 2001b, p. 366). Rather, the Commission noted that the approach used should have regard to specific circumstances within a sector.

Source: PC (2001b).

Some participants in this inquiry have suggested that valuations obtained under DORC are likely to be higher than those obtained using other asset valuation methods. While DORC valuations may be high relative to other valuation methods, regulators' asset valuations typically affect only ceiling prices. The NSW rail regulator, the Independent Pricing and Regulatory Tribunal (IPART), has noted that, because charges are generally below ceiling levels, relatively few customers actually pay access prices that reflect a DORC based rate of return (IPART 1999).

One jurisdiction using an alternative to DORC is Western Australia, where the regulator uses the Gross Replacement Value (GRV) method of asset valuation. GRV can be defined as:

> … the lowest current cost to replace existing assets with assets that have the capacity to provide the level of service that meets the actual and reasonably projected demand and are, if appropriate, modern equivalent assets. (ORAR 2002)

Comparability between costs calculated using the GRV approach and the DORC approach depends on the extent to which the existing rail assets are depreciated and the assumptions used by the regulator in making the calculation (including the discount rate applied, the components of operating expenditures included and the assessed economic life of the rail assets) (ORAR 2002).

Great Southern Railway has criticised costing methodologies employed by rail regulators:

> … the general principle used to cost infrastructure is based on the estimate of the cost of fully replacing the infrastructure which may have no relationship to the market value paid for the infrastructure or the investment program of the asset owner ... In some jurisdictions … the ceiling access price … is so high as to be irrelevant … only at the point that the rail infrastructure becomes profitable is it necessary to regulate access pricing using the cost of providing the infrastructure. (sub. 12, pp. 33-34)

A benefit of using DORC (or GRV) valuations is that the replacement cost of assets is most relevant to determining whether full economic costs are being met. If infrastructure providers are not covering their full economic costs — even though they may be profitable based on the book value of their assets — they may not be viable in the long-run. In other words, infrastructure would not be able to be replaced at the end of its useful life if the decision were based purely on commercial considerations.

DRAFT FINDING 5.1

Replacement cost methods of valuation represent a useful reference point for determining whether rail infrastructure providers are able to recover the full economic costs they incur. Where providers are unable to fully recover economic costs, it is likely that, in the absence of a subsidy, rail infrastructure would not be replaced at the end of its useful life.

Exclusions from regulated asset bases

In Victoria, the regulated asset base for rail infrastructure excludes capital expenditure before 30 April 1999 (that is, before the leasing of rail infrastructure to the private sector). Assets purchased since this date are included at original cost with allowance for inflation, depreciation, subsequent disposals and any relevant capital expenditure by infrastructure providers (ESC 2006c).

Similarly, while New South Wales uses DORC methodology to value assets, only coal lines are considered to have any value for the purposes of calculating the asset ceiling, meaning that 94 per cent of route kilometres within the rail network are attributed no value for regulatory purposes (IPART 1999).

There are significant differences between jurisdictions in the treatment of land in regulatory asset bases. In the ARTC undertaking and the NSW regime, no allowance is made for land, while in South Australia land and foundation works are valued at historical cost (unless leased from the government at nominal rent, in which case they are excluded) (ESCOSA 2004). The Queensland Competition Authority (QCA), however, includes land in the regulatory asset base and values it using DORC methodology (QCA 2001).

Assets contributed by governments typically are excluded from regulatory asset bases. The new Victorian access regime contains a pass-through mechanism which requires infrastructure providers to reduce their cost base by the value of any government funding or investment relating to their infrastructure. The Western Australian regime recognises government funding as a revenue source and therefore deducts it from overall revenue requirements when calculating the floor and ceiling prices.

The Tarcoola to Darwin regime empowers the Essential Services Comission of South Australia (ESCOSA) to make adjustments to the DORC valued asset base to exclude government contributed assets. In practice, the regulator has chosen to include them (except in circumstances where rail is not considered to face competition), making this the only regime in which government contributed assets are included (ESCOSA 2003).

DRAFT FINDING 5.2

Differences in asset valuation techniques and principles for inclusion of assets in regulatory asset bases can result in inconsistencies in measured costs between jurisdictions. These factors can also influence assessments of whether rail infrastructure providers fully recover the economic costs of providing services. Specifically, non-inclusion of assets in regulatory asset bases (such as assets provided by governments) can significantly reduce the measured costs of providers and therefore the charges allowed by regulators. The effect of this on cost recovery is likely to be significant in those market segments where providers are able to charge ceiling prices.

Treatment of common costs by rail infrastructure providers

Rail infrastructure operators incur a potentially significant level of costs that are not specifically attributable to any particular above-rail operator or service provided. These 'common costs' include sunk costs incurred irrespective of use (for example, railway bridges or tunnels) and non-sector specific overheads and operating costs (such as buildings and administration costs).

Common costs are allocated by rail infrastructure providers in proportion to actual infrastructure usage by each customer, although the exact criteria used vary among jurisdictions. In some jurisdictions, decisions about how to attribute common costs are made by the regulator.

How common costs are allocated can significantly affect the division of costs between passenger and freight trains, and provides rail infrastructure providers with opportunities to price discriminate between freight and passenger rail operators. As observed by QR:

> … in allocating common costs, distortions to consumption would be minimised where prices are charged so that products whose output is less sensitive to higher charges pay relatively more of the common costs. As for rail, such price discrimination is likely to be efficient and desirable … (sub. 53, p. 7)

As freight trains are generally heavier, allocating common costs on the basis of weight would mean freight trains would incur a higher proportion of common costs. Given that freight's usage of rail is widely viewed as more price sensitive than passenger use, it might be expected that infrastructure operators would allocate common costs more heavily to passenger trains. This suggests that, in the absence of regulation, it would be expected that common costs would be allocated based on the number of train movements or distance travelled rather than on the weight of trains.

The ARTC allocates 60 per cent of common maintenance expenditure to access seekers on a gross tonne kilometre (GTK) basis and 40 per cent on a train kilometre basis. Other common costs are allocated on a train kilometre basis (ACCC 2002). In Western Australia, non-sector specific operating costs are allocated based entirely on train movements, while overhead costs are allocated 50 per cent on a GTK basis, and 50 per cent on a train movements basis (ORAR 2003). In New South Wales, overheads are allocated on a GTK basis while common non-track costs are allocated based on train kilometres (IPART 1999).

In Victoria, the Essential Services Commission (ESC) has determined that common costs should be allocated on the basis of train kilometres, partly to compensate for the 'un-costed' priority given to passenger trains and partly because one of the

ESC's objectives is to promote the competitiveness of rail in the freight market (with freight usage of rail assumed to be relatively price elastic). While this was consistent with the preferred pricing strategy of Pacific National (PN), the ESC required Connex (the operator of the urban passenger network) to amend its access agreement to allocate common costs based on train kilometres (ESC 2006b).

One of the reasons given for this ESC determination (that is, to 'promote the competitiveness of rail' in the freight market) (ESC 2006c, p. 12) raises issues about regulators having multiple objectives and whether governments should give more guidance about priorities. Further, there is the question of whether such decisions should be made by regulators, or left to rail infrastructure operators — an inefficient allocation of common costs could impact negatively on the viability of some lines.

That said, generally there are potential efficiency gains from allocating proportionately more common costs to customers whose use is less sensitive to price changes. Preventing pricing based on demand elasticities would therefore be inappropriate from an efficiency perspective (and could affect financial viability). Even though no explicit regulatory prohibitions exist, it appears rail infrastructure operators perceive that regulators may not find such pricing acceptable. Pricing principles such as those recently included in Part IIIA of the *Trade Practices Act 1974* would potentially facilitate increased efficiency by explicitly allowing multi-part pricing and pricing based on demand elasticities. This is discussed further in chapter 11.

DRAFT FINDING 5.3

While access regimes do not explicitly preclude rail infrastructure providers from allocating proportionately more common costs to less price-sensitive users, it is not clear that the benefits of such pricing are adequately reflected in the approach of regulators.

The Commission seeks comments from participants on approaches to achieving an efficient allocation of the common costs of providing rail infrastructure.

Some participants have suggested that there is potential for increased efficiency with greater national harmonisation of access regulation, or even that there should be a single economic regulator for the national rail network. These issues are discussed further in chapter 10.

Infrastructure quality

It is sometimes claimed that, to maintain profitability against the backdrop of poor returns, infrastructure providers have allowed the quality of infrastructure to run down. In a recent draft ruling in Victoria, the ESC initially rejected a proposed access arrangement because, among other reasons, PN failed to specify that track provided would be guaranteed as being 'fit for purpose' at prevailing prices.

Following the commissioning of a consultancy report on the 'fitness for purpose' issue, the final decision of the ESC noted that there were a number of potential trade-offs between track quality and cost, and that where track is not used intensively it may be more cost effective to require trains to travel at reduced speed and minimise maintenance costs. Based on this, the ESC was able to give conditional support to PN's revised minimum service standards (while continuing to reject its access arrangement for other reasons) (ESC 2006b).

Considering the nature of the trade-offs between track quality and cost, to suggest rail operators are 'running down' infrastructure to reduce costs may be somewhat simplistic. It would be more accurate to say that there are a number of points on the price–quality continuum at which rail infrastructure providers may offer their service (particularly to freight customers). In some instances, particularly for low volume lines, it may be in the interests of all stakeholders for infrastructure providers to limit investment in particular tracks and, instead, implement restrictive speed limits at which trains can operate safely. In view of the problems of financial viability for many rail lines, such decisions are likely to become more common.

How are prices determined in the marketplace?

In the previous section, it was noted that regulators typically set floor and ceiling prices for rail infrastructure. Within these bounds, the actual prices charged by rail infrastructure providers generally are negotiated and market based, although regulators typically have the power to set an arbitrated charge where agreement cannot be reached.

Rail infrastructure prices may either:

- be set and posted in advance; or
- subject to negotiation; or
- determined via an auction process.

Even where prices are posted in advance, there is still a need for flexibility to reflect differences in services provided (such as different commodities carried and different infrastructure standards or suitability for particular trains). As noted by the BTRE (2003d), there is a trade off between minimising transactions costs and the need for some variation in charging.

The presence of a large gap between regulated floor and ceiling prices means that access seekers may have little indication of what their actual charges will be. To reduce this problem, the ARTC publishes reference prices that fall between these floor and ceiling limits (table 5.2). While these relate only to 'typical' services, they represent a starting point for negotiations more generally and thereby reduce transactions costs. Some other jurisdictions also publish reference prices, although often only for particular commodities, such as coal.

Table 5.2 **ARTC indicative access prices for selected routes**

Effective 1 July 2005

	Adelaide to Parkeston	*Crystal Brook to Broken Hill*	*Tarcoola to Alice Springs*	*Port Augusta to Whyalla*	*Adelaide to Melbourne*	*Melbourne to Albury*
Variable price per '000 GTK	$2.256	$2.550	$4.225	$3.547	$2.594	$2.270
Flagfall price per train						
Super premium						$815.87
Premium	$6 565.57	$772.92	$26.61	$151.36	$1 741.22	$562.52
High	$5 688.52	$669.87	$23.32	$132.04	$1 575.09	$493.80
Standard	$4 812.55	$565.74	$18.89	$11.65	$1 427.77	$383.25
Low	$4 376.70	$514.22	$17.75	$100.91	$1 378.40	$383.25
Indicative distance (kms)	1992.5	372	6.35	73	847.5	307.1

GTK = Gross Tonne Kilometres. Super Premium: Maximum train speed of 130 kph and maximum axle loading of up to 20 tonnes. Premium: Maximum train speed of 115 kph and maximum axle loading of 20 tonnes. High: Maximum train speed of 110 kph and maximum axle loading of 21 tonnes. Length up to corridor standard maximum. Standard: Maximum train speed of 80 kph and maximum axle loading of 23 tonnes. Low: Off peak train paths.

Source: ARTC (2006).

Usage of two-part tariffs

The ARTC and rail infrastructure providers in Victoria and Western Australia publish reference tariffs in the form of a two-part charge, with the flagfall component to reflect the cost of occupying capacity and the variable charge reflecting both distance travelled and load carried for a particular service.

In Western Australia, the flagfall charge is recovered as a fee per service while the ARTC flagfall charge also incorporates a per kilometre charge. A request by PN to introduce a fee per service flagfall charge in Victoria was rejected by the ESC, which saw the proposed measure as favouring long-haul operators over short-haul operators. The ESC insisted on the inclusion of a distance based measure in the flagfall charge (ESC 2006b).

The ESC also limited the flagfall component of the charges to 30 per cent of total charges due to concern about high fixed charges deterring use of the network. While 'signing off' on the ARTC's current two-part charge, the ACCC also noted the potential for high fixed charges to deter above-rail operators from entering rail markets (ACCC 2002).

The views expressed by the ACCC and ESC highlight the degree to which regulators can be prescriptive about the structure of charges, as well as the level of charges, offered by rail infrastructure providers.

Charging for track damage

Access pricing regimes rarely include extra charges for additional wear-and-tear caused by faulty trains. The ARTC regime does, however, include penalty payments for exceeding contracted weights and axle loads (ACCC 2002). The ARTC has installed on-track monitoring devices to detect defective and overweight trains. As observed by the BTRE, use of penalty payments or forced withdrawal of faulty trains from use has the potential to lead to above rail operators utilising more compliant vehicles and minimising wear-and-tear on rail infrastructure (BTRE 2003d).

What is the impact of regulators on pricing?

The impact of economic regulation and regulators on rail infrastructure cost recovery and pricing decisions (and thereby rail's competitiveness) is not likely to be as strong as the influence of regulators in other areas of infrastructure provision. Given that rail transport typically faces strong competition from other transport modes (particularly road), market pressures are likely to represent a greater constraint on pricing by rail infrastructure providers than the regulatory regime, except in some areas of the bulk freight market (especially coal).

The ARTC has observed:

> On the interstate network, pricing is constrained more by intermodal competition in many markets than by regulatory pricing limits. Revenue extracted by infrastructure providers on the interstate network falls short of full economic cost. (sub. 11, p. 25)

The decisions of regulators are most likely to impact on the bulk freight market and especially where above-rail firms have significant sunk investments (that is, where infrastructure providers are more likely to obtain ceiling prices).

That said, pricing may be constrained more generally to the extent that regulators place limits on the ability of rail infrastructure providers to price discriminate between customers, which could generate greater revenue within the price bounds.

These, and other issues related to economic regulation of rail, are taken up in chapter 10.

5.4 Is rail freight infrastructure subsidised?

Historically, many government-owned railways in Australia have not recovered their costs or received a return on their assets. This raises questions about their long-term commercial viability, particularly for assets transferred to the private sector.

Costs are not being recovered

The ACCC has observed that the ARTC typically is unable to cover assessed full economic costs at prevailing market prices on most routes. In information provided to this inquiry, the ARTC has noted that, on the section of its network with the highest level of cost recovery (Dry Creek in Adelaide to Parkeston, near Kalgoorlie), access charges would need to double to reach ceiling limits imposed by regulators based on assessments of full economic costs (sub. 11).

Research undertaken for the Australasian Railway Association (ARA) by Port Jackson Partners Limited quoted similar levels of cost recovery for intermodal freight on the Rail Infrastructure Corporation’s (RIC) network in New South Wales (PJP 2005). This situation is typical of rail infrastructure providers except in the bulk freight area, notably for coal. For example, the circumstances for QR are likely to be quite different, given that almost 90 per cent of the freight it carries (by tonnage) is coal (QR, sub. 53).

Box 5.2 **Performance of various market segments in rail freight**

When discussing the ability of rail freight infrastructure providers to cover their economic costs, it is important to differentiate transportation of different commodities on particular corridors.

On the major interstate corridors, because of strong intermodal competition (particularly from road), rail infrastructure providers typically earn revenue below the economic costs of providing services as determined by the regulator. The ARTC has a strategy of pricing at competitive price levels to maintain volumes and achieve long-term viability through market growth. A further element of this strategy is investment in improved rail infrastructure (such as passing loops), designed to help increase the market share of rail.

Advantages rail has in the transport of coal mean that rail infrastructure providers are generally able to make profits on these routes. Indeed, in the past, the Commission has noted that profits from coal have cross subsidised other loss making areas in rail transport, although governments and regulators now recognise the inappropriateness of such cross-subsidies (PC 1999c). Horizontal separation of rail networks has also limited such cross subsidisation.

Specialised grain lines are usually reliant on community service obligation payments from government and often have little commercial value (BTRE 2004). These lines are often toward the end of their useful life and would normally only be upgraded or maintained if government subsidies were provided.

The transport of iron ore, especially in the Pilbara region, likely would be very profitable if carried by commercial rail providers. However, a combination of geography and business strategies – and possibly government policies – have resulted in it being primarily transported by private rail.

Sources: BTRE (2004), PC (1999c).

The ARTC has stated that it has a strategy of increasing volumes on its tracks and it anticipates that this will ensure long-term economic viability.

> ARTC has sought to set access pricing at a level that will enable rail to be competitive with road in markets served by the interstate network. With the current level of utilization of ARTC's network, however, pricing at this level results in the amount of revenue collected by ARTC not being sufficient for the long-term economic sustainability of its network, valued at a depreciated optimized replacement cost level. It is ARTC's strategy to grow volumes in the long term, such that rail can remain competitive and achieve long-term sustainability of its asset. (sub. 11, p. 22)

This implies that the Australian Government, as the owner of the ARTC, is prepared to accept relatively low levels of return in the short- to medium-term, presumably in the belief that to do so is in the entity's long-term financial interest. It is likely that other rail infrastructure providers take a similar approach.

DRAFT FINDING 5.4

Rail infrastructure providers are unable to cover the assessed full economic costs on many routes, and often fall well short of doing so. Exceptions to this mainly involve the transport of bulk freight, particularly coal.

Government financial contributions to rail freight infrastructure

The question of whether either road or rail freight infrastructure provision is subsidised, and to what degree, is clearly important in assessing competitive neutrality. As noted in chapter 3, relative subsidisation of either mode would encourage freight users to substitute towards it, resulting in efficiency losses from the distortion of choices about which mode to use and from 'over-consumption' of freight services overall (assuming there was a net subsidy to freight), as well as from the distorting effects of raising taxes to pay for the subsidies. Were the subsidised mode inherently less efficient than the alternative mode, efficiency losses would be even greater. (The opposite would be true if the subsidised mode were more efficient.)

From a competitive neutrality perspective, the inability of many rail infrastructure providers to cover economic costs implies that above-rail operators are not paying the full cost of the infrastructure they use.

Participants expressed conflicting views on this. For example, Robert Gunning stated:

> … it is clear that, on any reasonable basis, the publicly provided rail freight network currently operating in Australia significantly fails to pay its way or make any reasonable contribution to covering infrastructure cost, unlike every other commercial sector including the trucking industry. (sub. 19, p. 2)

The contrasting view of Balance Research was:

> … that rail, particularly in its inter-capital operations, was already near-commercial. (sub. 49, p. 8).

There are three main ways in which rail freight could be effectively subsidised:

- tolerance of low rates of return;
- direct government subsidies; and
- community service obligations (CSOs).

Rates of return have generally been low

The profitability of the publicly owned rail sector as a whole in 2004-05, as measured by the rail sector's return on the *book value* of assets was well below the risk free rate for 10-year Australian Government bonds (2.9 versus 5.4 per cent). However, returns on assets varied significantly across railway enterprises, with the ARTC and QR earning returns above the risk free bond rate (table 5.3) (PC 2006a).

Table 5.3 **Rates of return of publicly owned rail infrastructure providers**[a]

	2002-03	*2003-04*	*2004-05*
Rail Infrastructure Corporation (NSW)			
Return on assets	-4.1	-44.2[b]	-5.0[c]
Return on equity	-4.6	-49.6[b]	-6.4[c]
Queensland Rail (Queensland)			
Return on assets	5.4	5.4	6.7
Return on equity	5.6	4.5	8.1
Australian Rail Track Corporation (Aust)			
Return on assets	8.2	82.7[d]	14.2[e]
Return on equity	9.2	86.5[d]	15.3[e]
Whole of rail sector			
Return on assets	0.9	-7.1[b]	2.9
Return on equity	-0.7	-11.5[b]	2.0

[a] The returns of some enterprises have been affected by industry and financial restructuring. [b] The negative returns posted in 2003-04 were primarily the result of RIC writing down assets leased to the ARTC by $3 billion. [c] On 5 September 2004, RIC leased the NSW interstate and Hunter Valley rail corridors and dedicated metropolitan freight lines to the Sydney ports to the ARTC for 60 years. This diminishes the comparability of 2004-05 data with 2003-04 data. [d] The ARTC recorded high returns in 2003-04 because of a special government grant of $450 million and an equity injection. [e] The ARTC received a special government grant of $100 million in 2004-05.

Source: PC (2006a).

As is evident in table 5.3, assessment of rates of return is complicated by the presence of one-off government grants and equity contributions to the infrastructure providers. For example, the ARTC received government grants of $450 million in 2003-04 and $100 million 2004-05. This money was used to fund improvements to the ARTC network. In the absence of these grants, the Commission estimates that the ARTC's return on assets would have been less than five per cent in both 2003-04 and 2004-05.[4]

Assessments also are complicated by issues involving valuation of assets. A study of the ARTC's profitability in 2000-01 found that the estimated return on the book value of assets (that is, consistent with the methodology in table 5.3) was

4 Estimated by removing the value of government grants obtained in each year from the both the revenue received and assets held by the ARTC.

6.7 per cent. However, applying a DORC method for asset valuation (typically used by regulators) saw the return on assets drop to 0.92 per cent. The highest rate of return on assets using the DORC valuation was 3.8 per cent on the Adelaide to Melbourne route (NECG-Clayton Utz 2002).

Tolerance of low rates of return on assets or equity by public sector owners of corporations supplying rail infrastructure services, particularly if sustained over a number of years, *could* be viewed as an implicit subsidy to infrastructure providers and users. Private sector owners, or lessees, of rail infrastructure assets also might accept comparatively low current rates of return if they expected government contributions to be forthcoming in the future to support the infrastructure. This is not to imply that observing rates of return that are low necessarily means a subsidy is being provided. Even private sector businesses sometimes are willing to accept low returns for a time, if they are confident their marketing strategy will enable them to earn adequate returns within a reasonable period. However, in the context of attempting to achieve competitive neutrality between the use of road and rail freight infrastructure services, tolerance of low rates of return could be overlooked as a potential source of relative subsidy to rail freight vis-à-vis road freight.

DRAFT FINDING 5.5

Rates of return on rail infrastructure have generally been low and, if tolerated by public sector owners for long periods, could amount to implicit subsidisation.

Direct government subsidies

For as long as rail infrastructure providers are unable to cover the full cost of providing services, they are likely to be reliant on government subsidies in one form or another. This means that, in practice, rail typically relies on periodic investment by governments to maintain service viability, which is in some cases provided as CSOs (see below) and in others as direct grants. Sometimes assistance is ongoing, while other times it is of a more sporadic nature.

The Railway Technical Society of Australasia observed:

> It is clear that without government grants or equity into the ARTC the interstate rail infrastructure could not be upgraded. The funding provision of rail infrastructure is provided partly by retained earnings and debt by the ARTC, as well as grants from the Commonwealth Government. Access pricing has not been sufficient to fund all the necessary infrastructure upgrading. (sub. 65, p. 3)

In some cases, the direct government grants to rail have been sizeable.

- Governments heavily subsidised the construction of the Tarcoola to Darwin railway, with provision of $480 million in up-front capital payments (made up of

$165 million each from the Australian and NT Governments, and $150 million from the SA Government) and $79 million in stand-by funding on commercial terms. Private sector funding for the project totalled around $750 million (Williams et al. 2005).

- Under the AusLink Investment Programme, the Australian Government is providing the ARTC with $550 million to improve the north–south corridor between Melbourne and Brisbane, with a further $270 million specifically to install concrete sleepers on this corridor. Another $544 million is being provided for various other rail and intermodal projects on the AusLink network (DOTARS 2006f). To provide some perspective on the significance of these grants, the ARTC obtained just under $239 million in access revenue in the year to June 30 2005 and just under $390 million in revenue from ordinary activities over the same period (ARTC 2005).
- In 2005, a deal was struck between the Australian and SA Governments to jointly contribute $30 million towards upgrading the Eyre Peninsula rail system. The Australian Government will provide $15 million with a matching grant from the SA Government, industry and local councils. The Eyre Peninsula rail line carries over two million tonnes of grain each year, but is in very poor condition. The government injection was widely viewed as essential to the ongoing viability of the rail line (Anderson and Conlon 2005).
- The Tasmanian government and PN have signed a memorandum of understanding, subject to further negotiation, to maintain rail track between Hobart and the three northern ports of Burnie, Devonport and Bell Bay (track which has otherwise been threatened with closure). Under the proposed deal, the Australian Government will provide $78 million for capital works, and the Tasmanian Government $4 million a year for ten years. PN will invest around $38 million in rolling stock upgrades. It is intended that any deal would include an agreement to ensure third party access to rail infrastructure, with the creation of a new access regime (Cox 2006).
- PN, as the below-rail operator in Victoria, made its most recent proposed access arrangement for above-rail operators contingent on obtaining $31 million from the Victorian Government for ‘freight support’. The lack of certainty surrounding this funding request represented one reason why the ESC rejected the proposed agreement (ESC 2006a). Subsequently, the ESC has stated that after consideration of the market bearable prices for rail freight, some level of government support is likely to be required to maintain the viability of rail freight services (although this is likely to be between $9 million and $19 million, rather than PN’s estimate of $31 million) (ESC 2006a, 2006e).[5]

5 PN has challenged the ESC’s decision in the Victorian Civil and Administrative Tribunal.

DRAFT FINDING 5.6

Direct government subsidies to rail are common and, in some cases, have been sizeable.

Community service obligations

Prior to recent reforms, governments recognised public benefits of non-commercial functions of publicly owned rail infrastructure providers by directly funding their operating deficits. Today, governments typically supply infrastructure providers with explicit 'compensatory' payments for providing CSOs.

The rail sector relies heavily on the provision of CSOs (defined here based on their categorisation by governments). In 2004-05, around $2.7 billion was provided to publicly-owned rail providers. These payments were overwhelmingly for passenger services, though some were related to low volume freight services (PC 2006a).

Some branch lines rely almost entirely on CSOs for their viability. A 2004 report on restricted grain lines in New South Wales found that access charges on these lines covered only three per cent of annualised infrastructure costs on average, and as little as one per cent on some lines (NSWGIAC 2004).

It is uncommon for explicit CSO payments to be made to private operators. Nevertheless, CSO payments to publicly owned providers could be 'passed on' to private above-rail operators through lower access fees or, where private providers own below-rail infrastructure, by covering 'commercial' access fees.

If used inappropriately, the provision of CSOs could amount to a subsidy for the commercial operations of rail infrastructure providers.[6] This could happen, for example, if CSOs related to infrastructure jointly used by both freight and passenger transport (although this could be prevented by funding CSOs purely at avoidable cost).

Based on publicly available information, it is not always clear which services CSOs are intended to benefit. They sometimes are provided to rail operators as a consolidated payment. Sometimes they are provided directly to infrastructure providers or, in other cases, to above-rail operators to cover 'commercial' access charges. Greater transparency of CSO payments would provide greater assurance

6 It is also possible that rail operators could be under-compensated for provision of CSOs, which could disadvantage the competitive position of rail freight relative to road (although not if road operators were also similarly under-compensated for CSO expenditure on roads).

that such payments do not raise competitive neutrality issues (notably between road and rail).

Further, ensuring transparent, explicit budget funding of CSOs would encourage clarification regarding their intent, and help ensure ongoing adequacy of funding (PC 2005b). It would also subject them to annual scrutiny to ensure programs are appropriate, cost effective and reflective of government priorities (Humphry 1997).

DRAFT FINDING 5.7

Community service obligation payments to rail are substantial, but their incidence and subsidisation effects are unclear. There would be benefits in making the objectives and extent of CSO payments more transparent and requiring them to be explicitly funded on-budget. Greater transparency of CSO payments would provide greater assurance that they do not raise competitive neutrality issues, while consistent use of on-budget funding would help ensure ongoing scrutiny of their appropriateness.

Implications for competitive neutrality

The presence of government subsidies has obvious implications for the debate over competitive neutrality.

Firstly, subsidies — both explicit and implicit — affect competition between the road and rail modes, potentially leading to inefficient modal choice.

A second implication is that if road is the pricesetter in its competition with rail freight, and road prices were to rise, presumably so would those rail access prices currently constrained by road prices. This could potentially help to fund increased investment in the rail system. However, if higher prices and revenues merely displaced public subsidies, rail track operators would not receive any increase in revenue. When the QCA sought clarification from QR regarding how CSO payments were determined in Queensland, QR responded that ‘Transport Service Payments are assessed as the difference between efficient costs and access revenue’ (QCA 2005, p. 142). This highlights the potential for higher access fees to merely displace public contributions.

The possibility of subsidisation also creates ‘gaming’ incentives for rail operators to try to seek public contributions for necessary investment rather than risking their own capital. This highlights the need for transparent and rigorous cost-benefit analysis of rail projects (chapter 10).

DRAFT FINDING 5.8

Rail infrastructure operators generally are unable to fully cover economic costs and often are reliant on government subsidies of various forms to maintain viability. These subsidies are potentially significant in affecting competition between road and rail freight.

DRAFT FINDING 5.9

If heavy vehicle road charges were to increase, this might allow below-rail operators to become more financially viable — either by attracting greater volumes of traffic or by increasing their charges. But if government subsidies were consequently reduced or withdrawn, track operators might be little or no more financially viable than before.

The competitive neutrality implications of rail infrastructure pricing are discussed further in chapter 7. Other issues relating to rail infrastructure regulation are discussed in chapter 10. Suggestions as to how the performance of the rail sector could be improved are contained in chapter 11.

6 Road and rail freight externalities

Key points

- Road and rail freight transport generate a range of significant 'external' effects — such as accidents, air pollution, noise, greenhouse gas emissions and congestion.
  - These 'externalities' are also created by passenger traffic and often vary greatly between different locations (for example, urban and rural) and at different times.
- Overall, road freight transport generates much higher external costs than rail, particularly in urban areas — however, for both modes, most costs are relatively low on the predominantly rural interstate freight corridors where road and rail mainly compete.
- Because transport activities provide substantial benefits and there are costs involved in reducing externalities, some positive level of transport externalities will be socially efficient.
- Policies aimed at reducing external costs should target the *cause* of the externality and offer opportunities for achieving minimum cost abatement.
- Governments often have addressed transport externalities by means of regulations. These have imposed significant costs on freight operators, some or all of which will have been passed on in charges.
- Because of difficulties in defining and measuring externalities, and their significant variability between different times and locations, imposing a uniform externality tax on freight transport, rather than targeting the sources of the externalities, would be an ineffective and inefficient means of achieving reductions in externalities.
- Similarly, selectively taxing freight transport to address externalities which have multiple sources (such as greenhouse gases) would be ineffective in reducing the externality while imposing undue costs on those industries using freight services relatively intensively.

The terms of reference direct the Commission to 'assess the full economic and social costs of providing and maintaining road and rail freight infrastructure, if it judges this to be feasible'. Such costs are to 'include environmental and safety impacts of different transport modes'. The Commission has also been asked to assess both existing studies of economic and social costs and the information or research required to improve the quality of estimates.

In this chapter, the external costs — including environmental and safety impacts — that arise in the carriage of road and rail freight are identified and analysed. Section 6.1 briefly outlines the nature of the externality 'problem' and its relevance to the use and pricing of road and rail freight infrastructure in Australia. Section 6.2 discusses the size of the major externalities arising from freight transport and the extent to which these are already internalised in the decisions of transport operators. More detail is provided in appendix C. Some possible implications of the analysis in this chapter for road and rail freight pricing policy are examined in section 6.3, together with a consideration of whether further information collection or research which might improve the estimates of externalities is appropriate for the purposes of pricing the use of freight infrastructure.

6.1 Introduction

Externalities (also referred to as spillovers or external effects) exist where production or consumption decisions made by an individual, firm or government have effects on others which the decision-maker does not have an incentive to take into account (chapter 3). As a result, activity levels may be too high where external costs (such as pollution) are present and not adequately taken into account, and too low where there are external benefits (such as community cohesion). Both passenger and freight transport services using road and rail infrastructure generate a range of significant, largely negative, externalities (section 6.2).

What is an efficient level of externality?

While negative externalities impose costs on individuals or the community, there are benefits from the activities that generate them, as well as costs in reducing the externalities. The latter include the transactions costs of developing and implementing policy measures. For example, in order to reduce the level of air pollution in larger urban areas, with resultant benefits to residents, regulations have required changes to fuels, engines and exhaust systems of cars and trucks, at significant cost to road users and involving some implementation and enforcement costs.

Because of both the loss of benefits otherwise resulting from the activity causing externalities and the costs of amelioration, the optimal or efficient level of an externality rarely will be zero. The efficient level will occur where the marginal cost of reducing the externality equals the marginal benefit. At this point, the externality is said to be efficiently 'internalised' and no longer 'policy relevant' (chapter 3).

Reducing the externality beyond this level would result in additional costs greater than the additional benefits.

Positive externalities imply that it is desirable to increase the level of output of the activity that creates them, even where private costs of doing so are greater than private benefits.

What should be done to address externalities?

The identification of policy-relevant externalities and the appropriate means of addressing them, are fraught with difficulties. The mere observation of external impacts is not sufficient to establish the case for policy intervention. However, identifying and assessing the efficient level of an externality is often problematic (section 6.2) — for example, the observed average levels of external costs may not be a good indicator of the marginal costs saved by further reductions in the externality.

Moreover, even where policy-relevant externalities are appropriately identified, the desirable policy responses require careful consideration. This is particularly so for a mobile activity like transport, given that a number of the associated externalities are location and time dependent and often are produced in small amounts by a large number of individuals and firms. Ideally, intervention should involve policies that target the *cause* of the externality and provide opportunities for minimum cost abatement (section 6.3). It is important also to consider the possible efficiency consequences of different allocations of responsibility for the costs of dealing with externalities (box 6.1).

Box 6.1 **Should the polluter always pay?**

An important issue in dealing with negative externalities is which party should meet the cost of reducing them — the party generating the externality, the party affected or the wider community. Traditionally, the economics literature prescribed a tax on 'polluters', equivalent to the external costs imposed by their activities, in order to achieve an 'efficient' level of an externality.

However, Coase (1960) demonstrated that if property rights are well defined and negotiations between the parties involved were feasible at low cost, the efficient level of an externality could be achieved regardless of which party had the property rights — in this case, either the right to generate or to prohibit an externality. In this situation, on pure efficiency grounds, it would not be relevant whether the polluter or the party affected paid for measures to reduce or compensate for the externality. However, in practice, there usually will be substantial transactions costs (for example, because of a large number of parties) and information asymmetries which need to be considered when assessing the likelihood of efficient solutions from particular assignments of property rights (chapter 3).

In dealing with externalities, governments often have required those deemed to be creating the externality (the polluter or impacter) to bear the cost of reducing or alleviating its effect. Since 1972, the OECD has recommended the 'polluter pays' approach as the preferred method for addressing environmental externalities, partly reflecting the perceived lower transactions costs of such an approach. However, the absence of any requirement for contributions from those benefiting from lowering externalities may create excessive demands for externality abatement — rigorous cost–benefit analysis of externality policies would be needed to determine appropriate reductions.

The wider community may have views regarding the fairness of requiring one or other of the affected parties to pay for an externality. In this regard, the polluter pays approach is often portrayed as an equitable solution to externality abatement. However, caution is necessary in applying fairness criteria. For example, in the case of noise from trucks, if a freight corridor went through a greenfields location where housing was later established, homeowners would already have been 'compensated' for the cost of the noise by lower land prices. Also the allocation of rights may have some efficiency impacts if it affects the costs, or likelihood, of achieving an efficient outcome. For example, allowing those adversely affected by an externality to avoid all costs associated with reducing that externality will not place any limit on the level of abatement they seek. This may result in externalities being reduced beyond the point where the benefits of abatement exceed the costs.

Sources: Buchanan and Stubblebine (1962); Coase (1960); OECD (1975).

Externalities from transport activities are generated both by passenger and by freight transport. In the case of road, while a single truck will generally cause higher external costs than a single car, there are many more passenger journeys. Lowest cost abatement would require addressing both types of road transport concurrently.

DRAFT FINDING 6.1

The economically efficient level of an externality is not zero but, rather, occurs where the marginal benefit of reducing external costs equals the marginal cost of doing so. Negative externalities arising from the production or consumption of goods and services can result in inefficiently high levels of the activities generating them. To achieve minimum cost abatement, governments should focus policies on addressing the underlying causes of an externality.

Externalities from freight transport

It is widely recognised that there are a variety of external costs generated by both passenger and freight use of road and rail infrastructure. The most significant examples are:

- road and rail accidents occurring in both urban and rural areas,
- air pollution, of which road transport (passenger and freight) is a major cause in large cities at certain times;
- greenhouse gas emissions which add to global warming;
- road congestion, which is a significant cost at certain times and locations in the largest cities; and
- noise from both road and rail transport, and intrusion effects, particularly from heavy vehicles and larger passenger vehicles.

At the same time, a number of participants (for example, Coles Myer Limited (sub. 47) and Great Southern Railway (sub. 12)) have argued that freight and passenger transport also generate some external *benefits* (such as supporting regional development) that would justify government contributions from general revenue for freight infrastructure. However, these benefits of transport infrastructure should be able to be captured by freight customers and, hence, providers should be able to recoup them in freight prices. Mohring argues that:

> … the benefits that nonusers derive from transportation improvements are not net benefits that can be added to those derived by the improvements' users. They are, rather, transfers of benefits initially received by highway users to those that provide services that are complementary to highway use. (Mohring 1993, p. 413)

However, to the extent that investment in freight infrastructure reduces other distortions in the economy, there could be an argument for some subsidy of its provision. For example, if cheaper freight charges reduce the market power of regional monopolies, this would represent an externality benefit not capable of capture by freight infrastructure providers or freight operators. However, these sorts of effects are unlikely to be large or pervasive, hence the focus here is on negative externalities.

Identifying 'policy-relevant' externalities

It is likely that some of the costs of apparent externalities of freight transport are borne by freight operators. Some external costs are moderated ('internalised', at least in part) via means such as legal liability, pricing or regulation. The costs these mechanisms impose on transport operators are then like any other costs of providing freight services and will be incorporated in freight pricing. The policy-relevant externality component is only that part of costs not appropriately taken into account by those generating them.

Various estimates have been made of the total external costs arising from freight transport, and of the extent to which they currently are internalised by freight transport operators. While there are a number of factors which can lead to large variations in estimates of particular freight transport externality costs, it is clear that a number of these costs are significant, especially for some locations and times.

In particular, the magnitude of observed externalities from road freight activities compared with rail freight has led to concerns that modal choice may be distorted. However, the major part of most road freight externalities occurs in capital cities, where rail will generally need to use road transport for the urban pick up and delivery of contestable freight. To this extent, a portion of road freight externalities will still be incurred even when rail freight is used as the principal transport mode. This will reduce the impact of (non-internalised) road freight externalities on relative freight costs and modal shares.

Appropriately addressing any policy-relevant externalities is likely to generate net social benefits, including by helping to ensure that the choice of transport mode is not distorted. However, achieving such 'competitive neutrality' would be a by-product of policy measures to reduce externalities, rather than being the primary objective of those interventions.

DRAFT FINDING 6.2

In some cases, markets or government interventions internalise at least part of external costs. In road and rail transport, externalities such as the costs of accidents, pollution, congestion and noise are usually created concurrently by both passenger and freight services. In addressing these costs, competitive neutrality between transport modes should be the outcome of implementing efficient externality policies, rather than the objective of those policies.

6.2 Quantifying externalities from road and rail freight

There have been many studies, over a number of years, estimating the costs of some or all of the externalities associated with road and rail transport. Estimates of total externality costs of road and rail freight transport are based on aggregating cost estimates from more detailed studies of particular externalities, some of which are noted below and discussed in more detail in appendix C. In most cases, these studies examine the combined externality costs from passenger and freight traffic but some also estimate road and rail freight transport 'shares' of externality costs and others focus even more narrowly on the costs in corridors on which road and rail freight compete. In some cases, estimates are not made of the extent of internalisation of the total costs identified.

This section examines the available information on various freight transport externalities to obtain a sense of the magnitude of policy-relevant externalities and the extent of differences between road and rail freight. In the time available, it has not been feasible for the Commission to undertake its own empirical assessments.

Traffic accidents

Accidents involving motor vehicles (including freight vehicles) are a very large cost associated with road use. Costs from crashes involving freight trains are considerably lower in aggregate, although individual incidents can involve high costs.

What costs do road accidents impose?

There have been numerous studies in Australia and abroad estimating the costs imposed by road crashes on those directly involved and the community (appendix C). The selection in box 6.2 highlights the sensitivity of results to assumptions such as discount rates and the valuation of life.

Box 6.2 Estimates of accident costs

Estimates of the cost of road accidents vary significantly, depending on the methodology and assumptions used.

- BTCE (1994) estimated the cost of road crashes in Australia in 1993 at $6.1 billion, updated to $6.9 billion in 1999 values (using the CPI) in BTE (1999b).
- Using a somewhat different methodology, BTE (2000) obtained much higher estimates of around $15 billion in 1996 (over $18.5 billion in 2004-05 prices).[1] It described this estimate as 'conservative', particularly because the valuation of loss of life and reduced quality of life could be considerably higher than its estimates.
- Cox (AAA, sub. 45, appendix A) used a 7 per cent (real) discount rather than the 4 per cent employed in BTE (2000), thereby lowering the accident costs estimate from $15 billion to $13.2 billion. Connelly and Supangan (2006) used the BTE (2000) approach and estimated the cost of road crashes in 2003 at around $17 billion.
- Cox (AAA, sub. 45, appendix A) updated the BTE estimates for price changes and the decline in fatalities but also used a 7 per cent rather than 4 per cent discount rate. He estimated road accident costs in 2004-05 as $15.5 billion.

Studies of accident costs are discussed further in appendix C.

The degree of internalisation and the freight share also need to be estimated

The extent to which accident externalities are taken into account (internalised) by road users, raises issues of both principle and measurement. At the conceptual level, Martin (2005), in observing wide variations in various European estimates of accident costs, argued:

> Ultimately, it is the definition of external accident costs that is adopted that determines both the total value and the variation. Commonly used definitions of external accident costs range widely … (Martin 2005, p. 3)

For example, it can be argued that adult road users have an informed understanding of the costs and risks involved in driving and take these into account in various ways: making a decision to drive, when choosing a car, the route taken and the manner of driving.

The Department of Transport and Regional Services (DOTARS) submitted:

> … there is no clear consensus at this time on the nature of the externality, with the consequence that there is likely to be an insufficient basis for both reliable measurement and charging. (sub. 69, p. 18)

1 Inflated by increases in the GDP deflator from 1996 to 2004-05.

Legal liability rules imposed by legislation and the courts will internalise a significant part of the property damage caused by road accidents. Many drivers take out insurance to limit the extent of their personal outlay for an ‘at fault’ accident. Insurance imposes a known up-front cost to cover the possibility of a large cost in the event of an ‘at fault’ accident. While internalising property costs of accidents ‘on average’, insurance is likely to lessen the cautionary impact that liability rules place on driver behaviour. However, this averaging effect is reduced by the variation in insurance premiums to reflect a driver’s accident record and insurance company requirements for some co-payments by the insured party in ‘at fault’ accidents.

All jurisdictions have compulsory ‘no fault’ insurance of drivers for the costs personal injuries to themselves and others in an accident. However, there may be some under recovery of costs where there are legislative restrictions on damages payouts. If court judgements were considered to provide a more accurate (albeit disputed) assessment of personal injury costs than the legislative maxima, then these restrictions could in some cases result in some accident costs not being internalised by insurance premiums.

For individual drivers, costs of their personal injuries and property damage not covered by various insurance or legal remedies, are met by them, and hence, could be considered internalised in their travel decisions (modal choice, driving pattern, route etc.). Drivers and firms also self insure. Compulsory excesses on insurance policies (which sometimes may be waived in return for higher premiums) ensure that some degree of self insurance will occur.

The level of road crashes also reflects decisions made and costs incurred by governments aimed at reducing the number and severity of accidents — for example, road safety programs, changed road laws, additional policing and fines and expenditure which improves the safety of roads. Declining accident rates will tend to reduce road crash costs and any associated externalities. Various initiatives in road design, road rules enforcement, measures to influence driver behaviour, motor vehicle design and safety features, and drivers’ concern about road safety, have seen an 18 per cent decline in road deaths between 1996 and 2003, while fatalities involving articulated trucks declined by nearly 12 per cent (ATSB 2005). The declines have been greater on a per vehicle and per kilometre travelled basis.

At the empirical level, further estimation is required to generate a road *freight* share of total motor vehicle accident costs and then to estimate the extent to which these costs currently are internalised by freight operators. Hence, estimates of externality costs from road crashes involving freight vehicles are subject to additional uncertainty (box 6.3). Estimates of accident costs vary by something over 10 per cent (BTRE forthcoming compared to BTE 1999b) to around 90 per cent (Tasman Asia Pacific 2000 compared to BTE 1999b).

Box 6.3 Road freight accident cost estimates accounting for internalisation

- BTE (1999b) (using BTCE (1994) data) estimated that the externality cost of accidents involving articulated trucks in 1999 was $0.17 billion (0.16 cents/ntkm) or around 3 per cent of road freight costs on its 'average' freight route.
- However, Tasman Asia Pacific (2000) (for the Australian Trucking Association) argued that the extent of internalisation of accident costs was much greater than assumed by the BTRE and estimated uninternalised accident costs of 0.014 cents/ntkm — about one tenth of the BTE estimates.
- DOTARS (sub. 69) reports BTRE (forthcoming) as providing estimates of average accident externality costs for trucks on inter-capital corridors in 2002-03 at least 10 per cent lower than the BTE (1999b) estimates.
- Applying the BTE (1999b) methodology to the Connelly and Supangan (2006) update of the much higher BTE (2000) road crash cost estimates, gives an estimate of external cost of road crashes involving articulated trucks of $0.42 billion in 2003.[2]
- Cox (AAA, sub. 45) estimated the externality component of total road vehicle accident costs in 2004-05 at around $5 billion, but argued that 40 per cent of this should be levied on drunk and speeding drivers leaving $3 billion attributable to remaining drivers. Of this, he estimated that $0.26 billion was attributable to articulated trucks and $0.11 billion to other trucks.

While there remains significant uncertainty regarding the extent to which accident costs are allowed for by road users (including freight operators), the level of costs is significantly lower after accounting for internalisation.

Accident costs are lower for rail

There is a much lower incidence of accidents involving freight trains, although the costs involved in individual incidents can be large. BTRE (2002b) 'conservatively' estimated the cost of all rail accidents (excluding apparent suicides and collisions with road vehicles) in Australia in 1999 as $133 million. The bulk of these involved passenger trains. Laird (2005) suggests a 30 per cent share for freight resulting in a

2 BTE (1999b) applied this methodology to the BTCE (1994) estimate of road crash costs in 1993 (updated to 1998-99 prices) to obtain an articulated truck accident cost externality of $0.17 billion for 1998-99. The BTCE (1994) estimates of road accident costs were much lower than BTE (2000) because the latter included additional costs such as long term care, made better estimates of others such as traffic delays and used a lower discount rate.

cost of $40 million, or 0.031 cents/ntkm of rail freight when averaged over all freight carried. This was very close to the 0.03 cents/ntkm BTE (1999b) estimated for its 'representative' inter-capital rail route.

However, a significant part of these costs are likely to have been covered by insurance or self insurance by infrastructure providers and freight operators. Only those crash costs not appropriately met through insurance or the court system would be externalities for rail freight on an 'at fault' basis.

Air pollution

Urban air pollution — a significant proportion of which is caused by road use and (to a much lesser extent) rail traffic — can have significant adverse effects on both the length and quality of life. Motor vehicles are a major source of urban air pollution. Of the motor vehicles share, articulated trucks are estimated to contribute 6 per cent and rigid and other trucks 21 per cent (BTRE 2003e). On the other hand, rail's contribution to urban air pollution is minimal.

Where data on air pollution outside of capital cities are available, the general indication is that particulate matter tends to be the main pollutant. However, its main sources are bushfire smoke and dust (including mining and agricultural dust) rather than motor vehicles (BTRE 2005d).

Estimates of the health costs of road transport emissions vary widely

The BTRE (2005c) estimated the annual economic cost of air pollution from motor vehicles in 2000 to be in the range $1.6 billion to $3.8 billion. Updated to 2004-05 prices the range is $1.8 billion to $4.3 billion (midway estimate $3.0 billion).[3] It observed that the cost estimates vary 'substantially with changes to key assumptions such as the value given to a life and loss of quality of life, the assumed motor vehicles share of estimated pollution and the impact of pollution on health' (p. xiv).

A number of other studies have estimated the health impacts of motor vehicle emissions in Australia and produced a wide range of results, reflecting the inherent difficulty and uncertainty involved in such estimates. Brindle et al. (1999) reviewed Australian studies and found a range of $50 million to over $5 billion. Watkiss (2002) adapted overseas studies to Australian conditions and estimated annual health costs from motor vehicle emissions of around $3 billion. The Bus Industry Confederation (BIC 2001) also adapted the findings of a European study and

[3] This range reflects the uncertainty of the link between particulate matter concentration and mortality rates (BTRE 2005d).

estimated the cost of air pollution from road transport in capital cities at around $4.3 billion.

The Department of Health and Aging noted:

> The current research is not conclusive, with areas requiring further research including isolation of the individual impacts of each pollutant on human health and the threshold levels of air pollution required for adverse health impacts. (sub. 57, p. 3)

Health costs depend on vehicle type and transport mode

While estimates of total health costs generated by transport vary significantly, the relative locational and modal variations are somewhat clearer.

- Trucks account for a disproportionate share of urban health costs. BIC (2001) estimated that the use of rigid trucks within capital cities accounted for around $1.2 billion in health costs, cars about the same, and articulated trucks around $0.3 billion.
- Health costs associated with inter-capital freight are small but much higher for road than rail. BTE (1999b) estimated costs of pollution from freight transport on inter-city corridors of 0.004 cents/ntkm for rail and 0.01 cents/ntkm for road.
- Health costs per kilometre travelled are much higher in urban areas. Tsolakis et al. (2005) estimated the health cost of heavy vehicles in urban areas to be 20 times higher per tonne kilometre travelled than in rural areas.

Extent of internalisation of freight vehicle air pollution costs?

What might be an ‘acceptable’ or ‘efficient’ level of air pollution is very difficult to judge. The National Environment Protection Measures (NEPM) for Ambient Air Quality provide some indication of what are considered to be acceptable levels of the various air pollutants. These standards were introduced in 1998, and were based on overseas studies of the health effects of air pollution. They are currently under review (NEPC 2005).

The Department of the Environment and Heritage (DEH 2004) indicated that over the period 1991-2001, there was a downward trend in lead, carbon monoxide and nitrogen dioxide levels. Particulate matter and ozone remained near or above the NEPM standard levels, and no downward trend was evident. In the future, average emissions per vehicle (of the same vehicle class) will continue to fall as older vehicles are replaced by those that meet the more stringent emission standards progressively introduced over the last 20 years. New fuel standards will have a more comprehensive and immediate effect.

Regulations have internalised a substantial part of the costs of air pollution from transport sources, but in so doing they have imposed significant costs on freight operators which must be borne irrespective of whether they operate predominantly in rural areas (where the health costs of emissions are low), or in urban areas.

The BTRE (2005d), Australian Automobile Association (sub. 45) and Truck Industry Council (sub. 13), all indicated that fuel and engine standards and technological improvements have been effective in reducing motor vehicle emissions in the past 20 years (appendix C). BTRE (2003e) indicated that without the standards introduced up to 2006, levels of several air pollutants in metropolitan areas would be significantly higher than otherwise in 2020.

The NTC (sub. 17) indicated that the cost of meeting Euro V standards (to be introduced in 2011) will be around $2500 to $3600 per vehicle. The ATA (sub. 9) argued that the cost may be $13 000 or more per truck and decreases in fuel efficiency by up to 6 per cent compared to current Euro III engines are expected. These engine standards also reduce truck productivity because the required technologies take up extra space and add to vehicle weight. The Truck Industry Council (TIC) stated that:

> To meet the ADR 80/01 emission standards and ADR 83/00 noise standards effective from 1 January 2007 the additional weight will vary between 180–280 kgs. This results in a loss of payload. (sub. 13, p. 1)

Noise

Many activities, such as industrial and social activities, generate noise but road and rail transport are especially significant sources — at least in certain parts of urban areas and country towns. The NRTC (2001) estimated that nearly 40 per cent of Australia's population was exposed to 'undesirable' traffic noise, with another 10 per cent exposed to 'excessive' traffic noise. This noise can have 'nuisance' and social/amenity effects, as well as health impacts.

Transport noise is seen as a problem but cost estimates vary

Participants to this inquiry pointed to community concerns about excessive transport noise, particularly from freight transport (appendix C). Assessing and valuing the impacts of noise with any precision is difficult, however. In part, this reflects general difficulties measuring externalities (discussed above). In addition:

- many factors influence the extent of noise costs — including the extent and type of the noise, and the time at which it occurs; and

- most Australian noise cost estimates have been derived by adjusting international results to try to make them applicable to Australian conditions, but there has been no ‘new work’ since 2001 (Cox, AAA, sub. 45, appendix A, p. 6).

Reflecting these issues, and the different assumptions and methodologies used, estimates vary widely across studies (appendix C). At a general level, however, they tend to indicate that freight noise costs are:

- *higher for road than for rail transport* — BTE (1999a), for example, estimated noise costs on its ‘representative’ freight routes of 0.034 cents/ntkm for road and 0.02 cents/ntkm for rail;
- *higher in urban than in rural areas* — Port Jackson Partners (2005), for example, assumed road noise costs of between 3 cents and 50 cents per thousand ntkm in rural areas and between 6 cents and $1.32 per thousand ntkm in metropolitan areas;
- *low relative to the costs of some other externalities*, especially air pollution and accidents — John Cox (AAA, sub. 45, appendix A), for example, estimated that, for all vehicles, noise costs accounted for 16 per cent of road externality costs, much lower than accidents and air pollution (although the urban noise costs of heavy vehicles exceeded their total accident externality costs), while the ATC (2004b) default noise externality values for rail freight (in cents/ntkm) were lower than any other of the externalities included.

Although the per unit noise costs of passenger traffic tend to be relatively low, their contribution to overall noise costs can be high, given the larger (urban) traffic volumes involved. BIC (2001), for example, attributed over 60 per cent of Australian urban road noise costs to passenger cars, yet their marginal noise costs were 0.3 cents/km compared with 5 cents/km for heavy trucks.

Extent of internalisation of noise externalities?

Various noise reduction measures have been taken by government (noise barriers, planning measures), individuals (noise insulation, location decisions) and the freight industry under government regulation (engine and exhaust technologies, rail noise barriers). While these measures have reduced noise levels (for given traffic volumes), this does not mean that they have done so to the optimal extent or in the most efficient way. Indeed, participants highlighted various issues with some current measures, including that they do not address all important noise concerns, sometimes only apply to new vehicles or construction, can impose high costs and harm efficiency, and differ for road and rail (appendix C).

The efficiency impacts of movement restrictions were highlighted by the NSW Minerals Council, for example. It commented that restrictions on public road receivals at the Port Kembla Coal Terminal (PKCT) resulted in:

> … an inefficient use of a multi-million dollar asset and importantly inhibits PKCT's ability to take up their current excess ship loading capacity. (sub. 10, p. 13)

Similarly, Coles Myer Limited argued that considerable efficiency benefits would derive from removing regulations restricting the size of vehicles and their hours of operations on some local roads, and suggested further that:

> … a more effective approach could involve by-laws relating to noise, and actual axle weights rather than vehicle size or hours of operation. (sub. 47, p. 9)

The TIC (sub. 13) also observed the increase in weight, decrease in payload and increased costs associated with meeting both emissions and noise standards.

These issues do not of themselves mean that the current approach is inappropriate. The important issue is whether the measures are the most 'cost-effective' way to deal with the externality. The uncertainties in measuring both the extent of the noise problem and the costs of particular amelioration measures make it difficult to make an overall assessment.

What can be said is that some level of noise and disturbance is an inevitable part of urban living. Hence, it could be argued that, except for more extreme cases, noise and loss of amenity is internalised by the decision to live in a large urban area and the choice of particular parts of the city in which to live. For example, the South Australian Freight Council argued that:

> People and businesses that build homes and facilities adjacent to major transport corridors should also expect to be impacted by the negative externalities emanating from users of that route. (sub. 35, p. 2)

Nonetheless, traffic noise can impose significant costs on residents, particularly when unanticipated traffic growth occurs. The Eastern Metropolitan Regional Council (Perth), for example, noted that noise assessments and abatement measures considered in new road and highway construction works do 'not address the noise impacts from freight in existing areas, many of which were not designed for the current and future volumes of freight traffic' (sub. 14, p. 6).

'Intrusion'

So-called intrusion costs of certain road transport vehicles (especially larger passenger vehicles and freight trucks) are a somewhat loosely defined group of factors that disturb pedestrians, residents and other drivers. Some of the components of intrusion costs such as accidents, air pollution and noise have already been considered above and are dealt with to some degree by government policies addressing these issues. However, sometimes it is difficult to differentiate intrusion costs from these other road freight externalities. Residual factors might include fear of accidents, visual pollution or simply a dislike of trucks on roads. The Country Women's Association of NSW commented:

> Rail is preferred for freight because we know the costs of road sharing between huge mechanical monsters and school buses; between road trains, and the family car; between B-doubles and inexperienced drivers. (sub. 2, p. 1)

Changing social attitudes together with the significant increase in road freight traffic, particularly B-doubles, appears to have increased the perception of intrusion costs. Such costs also can apply to larger passenger vehicles, such as four wheel drives and SUVs.

Intrusion costs are somewhat subjective and likely to vary significantly from person to person and are, therefore, very difficult to measure. They have not been estimated in any of the studies considered here, although estimates of accident, air pollution and noise costs may contain an 'intrusion' component. However, the forecast doubling in non-bulk land freight volumes within the next twenty years, together with a shift towards larger trucks for interstate freight, suggests that perceived intrusion impacts will increase.

Governments have used a variety of regulatory, planning, and traffic management measures to reduce the sense of intrusion from road transport, particularly heavy freight vehicles, often imposing costs on freight transport operators and users. These include divided highways, town bypasses, passing lanes, planning restrictions and measures to reduce air pollution and noise from trucks. Because those suffering intrusion generally have not been required to meet costs of abatement, it is difficult to estimate the value of the benefits involved.

Greenhouse gas emissions

Changes in climate induced by increased concentration of greenhouse gases in the atmosphere — referred to as the greenhouse effect — are now generally recognised as a significant externality arising from the use of fossil fuels. Generally, the externality impacts of greenhouse induced climate change are considered likely to be adverse, although some regions and activities might benefit from higher temperatures and changed rainfall distributions. CSIRO argued:

> Climate change will have social, economic and ecological impacts. There will be both winners and losers. All our natural ecosystems are vulnerable to climate change. (CSIRO 2001, p. 1)

Both road and rail transport in Australia use substantial and increasing amounts of fossil fuels. In 2004, road and rail transport contributed around 13.6 per cent of Australia's total greenhouse emissions[4] — most of these emissions being produced by passenger and light commercial vehicles. Trucks' share of Australia's emissions was estimated to be around 2.7 per cent, while rail freight generated about 0.4 per cent (BTRE 2005c). Australia's estimated share of global emissions is about 1.4 per cent.

While the general link between the use of fossil fuels and global warming is widely accepted, uncertainty remains regarding the exact mechanisms involved and, in particular, the likely impacts and their related costs, especially in the longer term. Hence, although the costs could be large in some cases, specifying the exact size and dispersion of these effects with any precision remains highly problematic. For this reason, BTE (1999a) did not include an allowance for greenhouse emissions when estimating externality costs of freight transport.

A number of estimates of notional prices for carbon emissions ranging from $10 per tonne to $40 per tonne have been suggested (appendix C) and these could be used to place a greenhouse cost on freight transport. However, these estimates are either simply assumptions or are observed values which are highly sensitive to the actual or hypothetical constraints placed on emissions (for example, emissions quotas in the United Kingdom). Prices for emission rights observed in countries with carbon trading schemes reflect the emissions targets or other regulatory constraints in those countries, rather than an independent assessment of the marginal benefits of reducing greenhouse emissions or the economy-wide or world-wide marginal costs involved in reducing them.

Based on a 'price' for greenhouse emissions of $10 per tonne, the ATC (2004b) default values for including a cost for greenhouse emissions in transport investment evaluations, are $0.70 per/thousand ntk for road freight and $0.30 per/thousand ntk for rail. For a 20 tonne load between Melbourne and Sydney, these values represent around $12 for road and $5 for rail.

Some *ad hoc* internalisation of the costs of freight transport greenhouse emissions has been imposed by Commonwealth, State and Territory government regulations, particularly for road freight. These include programs specifically aimed at reducing greenhouse emissions, as well as regulations directed at reducing urban air pollution from trucks but which simultaneously generate some reductions in greenhouse emissions.

4 Including an estimate of emissions from power generation for electric railways.

Stricter quality standards for diesel fuel have enabled the use of more expensive trucks with reduced exhaust emissions and improved fuel efficiency. However, over time, requirements for other emissions and safety equipment have reduced fuel efficiency. Declines in greenhouse emissions will occur as trucks with pollution reduction equipment replace older trucks. Other policies have provided subsidies to reduce greenhouse emissions in freight transport. For example, the alternative fuels conversion program provides subsidies for conversion of vehicles to natural gas operation.

External costs on freight corridors

A number of the externalities generated by freight transport are considerably lower in the rural areas which make up the bulk of the interstate freight corridors on which road and rail principally compete. Air pollution, congestion and noise are generally issues for large urban centres, while greenhouse emissions are lower per tkm because of greater fuel economy on highways. Nonetheless externalities generated by road freight on these corridors are well above those for rail.

BTE (1999b) estimated that, in 1998-99, for an ‘average’ interstate road freight haul of 1125 kilometres, charging for average — not internalised — accident, congestion, air pollution (non-greenhouse) and noise externalities would have added around 4.7 per cent to the freight cost of a full container.[5] For rail, on an ‘average’ 1200 kilometre freight route, estimated freight costs would have risen by about 1 per cent if the average level of these externalities had been incorporated. DOTARS noted that these externality cost estimates were being updated but concluded that for both road and rail inter-capital freight externalities were ‘quite small in comparison with the total costs of moving freight on these routes’ (sub. 69, p. 25).

DRAFT FINDING 6.3

There is a range of externality costs related to freight transport. However, the externality component is often difficult to determine, both in principle and empirically. Estimated costs of particular externalities range widely due to different methodologies and assumptions. What can be said is that:

- ***external costs of freight transport are generated jointly with passenger transport, are much higher in urban areas than in rural areas and are higher for road freight than for rail freight;***

5 Greenhouse gas externality estimates reported by DOTARS (sub. 69), suggest that the road freight externality cost might rise by about one third if greenhouse emissions were included.

- ***there appears to have been significant internalisation of externalities (except for greenhouse emissions) through regulation, legal liability and various other means.***

Congestion

Road and rail infrastructure have finite capacity. If there is sufficient demand for that infrastructure at any time, traffic flow will begin to be inhibited and both freight and passenger transport users of the infrastructure will experience congestion costs such as extra travel time and increased operating costs. Congestion can be distinguished from some other externalities in that its costs largely are borne by infrastructure users themselves and that it is partly a function of the level of infrastructure provided.

Road congestion

Beyond a certain level of traffic, both freight and passenger vehicles entering a road space at a particular time increase the level of congestion on that road. As the road approaches capacity, congestion and the costs associated with it (such as time loss, increased fuel use and air pollution) increase significantly. In this situation, the marginal congestion cost imposed by additional vehicles entering the limited road capacity will be rising and will be above the average congestion costs being experienced at that time. As explained by the BTCE:

> Road users considering whether to join a congested traffic stream would normally take account of the travel time and vehicle operating costs they would expect to incur. These are the private costs against which they would weigh the benefits and, beyond a certain point, decide not to travel. But road users do not take account of the fact that their decisions to travel increase congestion and impose *additional* costs on others. (BTCE 1996, p. 21)

As a result, traffic levels, and the resultant congestion, will increase above the efficient level — that is where marginal travel costs for all users equal marginal benefits of undertaking travel at that time. To this extent, there will be a congestion cost externality which potentially could be addressed by a range of government policies.

The BTE (1999a) provided estimates of the total social costs of congestion (beyond *free flow* conditions) on capital city roads in 1995 of around $12.8 billion.[6]

[6] The BTE emphasised that their analysis was exploratory in nature and was restricted to commuter travel to work in the morning peak. The data were for different years for different

Ninety per cent of this cost occurred in Sydney, Melbourne and Brisbane. For 2015, the BTE projected that total congestion costs could rise to as much as $30 billion in the absence of major road developments.

However, free flow conditions are an ‘unrealisable hypothetical situation’ (BTCE 1996, p. 26). Because there are significant benefits from trips made even at congested times, the efficient level of congestion costs is not zero and will involve less than ‘free flow’ conditions — only the excess of marginal costs (including congestion costs) over the benefits of marginal trips at congested times are policy-relevant external costs. Those making travel decisions are faced with the average cost of congestion and hence this part of congestion costs is internalised in their decision making. It is because marginal congestion costs are above average costs at peak traffic periods that inefficient decisions are made.

BTCE (1996) estimated that the value of net benefits from optimal (variable) peak period congestion pricing in the five largest state capitals in 1995 would have been $1.1 billion per annum. In addition, BTRE (2002b) reported that fuel usage at congested times would be reduced by 30 per cent if optimal congestion pricing were introduced. Impacts on other transport externalities and the collection and administration costs of congestion tolls would also need to be allowed for in estimating the final net social benefits of reducing congestion. In the longer term, road construction and traffic management measures, in some instances, will be the most efficient solution to congestion.

The costs of congestion are largely absorbed within the road transport sector, although there will be flow-on impacts such as longer and less certain delivery times to users of road freight services and employers of road users. Other road transport externality costs which do affect other members of the community also will vary with congestion levels — air pollution and greenhouse emissions will tend to be increased by congestion, while accident rates and severity, as well as noise, will vary with traffic density and flow.

Since congestion is created by both passenger and freight vehicles, reductions in either would reduce it. For Melbourne, the Victorian Competition and Efficiency Commission (VCEC 2006) noted that freight vehicles (mostly light commercial) represented about 12 per cent of vehicle traffic but tended to avoid the worst congestion periods. However, because of their size, slower acceleration and greater

cities and did not allow for changes in the road system in the years immediately preceding the estimates.

braking distances, individual trucks create more congestion than a passenger vehicle.[7]

For the most part, congestion is only a significant cost in large capital cities at particular times. Nonetheless, there are situations on non-urban roads where traffic is travelling below desired (and allowable) speeds, often as a result of being held up by large freight vehicles. Participants at the Commission's Emerald Roundtable (appendix A) commented on the increasing travel times on the Capricorn Highway to Rockhampton due to an increasing number of large trucks using the road.

Based on a United Kingdom study of congestion costs for rural dual carriageways, BTE (1999b) assessed a rural congestion cost of 0.03 cents per net tonne kilometre on its 'average' 1125 kilometre road freight haul, representing around 0.6 per cent of estimated total freight costs for that route.

DRAFT FINDING 6.4

The costs imposed on road users by congestion are:

- *in general, a significant problem only in large urban centres at particular times and locations;*
- *generated by both passenger and freight traffic, with passenger vehicles being the main cause.*

Rail freight

In a number of instances rail freight and passenger services compete for the use of rail infrastructure at the same time, with passenger services usually given preference by the infrastructure provider. The costs involved in this rail 'congestion' are discussed in chapter 10.

In some contexts, freight trains can impose congestion costs on motor vehicles. For example, participants at the Commission's Emerald Roundtable noted the long delays in travelling between sections of the town when a freight train is passing through.

7 This congestion differential will be less in periods of very heavy congestion where heavy vehicle acceleration and braking characteristics will add little to the road space it effectively requires.

Other externalities

A range of other costs, which may not be fully recognised in road-use decisions by freight operators, are generated by the use of freight transport infrastructure. While often highly localised, the costs can be important to those affected and may be amenable to efficient policy solutions.

- Dust (both raised by and from freight carried) is an important issue, particularly in rural areas — for example, due to unsealed roads or shoulders or the nature of commodities carried. For example, the Duaringa Shire Council pointed to the 'dark side' of the coal boom, which included increased coal dust in the town of Blackwater (sub. 66, p. 1). Participants at the Commission's Emerald roundtable also noted the increased coal dust problem, although several viewed this in the context of the major benefits to the region of increased coal mining activity. Reductions in dust have been achieved by sealing roads, regulation of large freight vehicles (ALTA sub. 38) and measures taken by freight operators (for example, QR 2005).
- Surface and ground water pollution can be caused by road and rail transport in both the building and use of transport infrastructure. Particularly after rain, sediment from roads can significantly add to pollution of waterways. Default water pollution externality values recommended by the ATC (2004b) for freight vehicles were 1.5 cents/ntkm for light vehicles, 0.07 cents/ntkm for medium vehicles and 0.01 cents/ntkm for heavy vehicles and 1 per cent of this for rural areas. However, some road expenditure aimed at reducing water pollution is incorporated in the determination of heavy vehicle charges. In the rail sector, both the ARTC (sub. 51) and ARA (sub. 33) noted that rail charges incorporate drainage and wastewater disposal/management costs.
- Road damage caused by heavy vehicles, while left unrepaired, can increase the maintenance costs of other vehicles (for example, WA Local Government Association (sub. 15)). However, Newbery (1988) demonstrated that, under certain conditions, the externality component of additional vehicle maintenance costs is low (appendix C). In any event, when road charges are determined, heavy vehicles are allocated the bulk of attributable costs of repairing road damage (chapter 4).

6.3 Implications for freight infrastructure pricing

This section considers policies that could be used to address those costs resulting from road and rail freight transport activities, which have not been already internalised in the costs and prices of freight operators. The primary objective of such policies should be lowest cost (including transactions costs) achievement of efficient levels of the relevant externalities. As noted previously, any implications for levels of freight carried and competition between freight modes (competitive neutrality) would be outcomes, rather than explicit objectives, of efficient externality abatement policies. In addition, equity and fairness considerations for those bearing the costs of an externality also can influence policy choices.

Box 6.4 Some participants' views on transport externality policies

Participants expressed a range of views about the appropriate way to address the range of externalities generated by freight transport.

The Australian Local Government Association (ALGA) supported a combination of measures for addressing externalities where practicable:

> ALGA is strongly supportive of current environmental reforms applying to trucks including measures to improve emissions, reduce noise and improve crash worthiness. These measures will go some way to ameliorating the impacts of trucks on communities. The noise, pollution and safety impacts of heavy vehicles remain however key issues, they impose very real costs and should be reasonably addressed through the pricing system to the extent that is practicable. (sub. 42, p. 6)

The Transport Workers Union (sub. 16) argued for government to bear the costs of addressing some externalities such as rest areas for long distance truck drivers.

The Australian Rail Track Corporation (sub. 51) argued that rail regulations required rail to meet the costs of some externalities that were not charged to road. The Truck Industry Council (sub. 13) expressed concern that off-road use of diesel did not have to meet the same regulated emission standards required of freight vehicles.

The Queensland Government saw the need for planning solutions:

> Large volumes of bulk freight movements can impact on roads and tracks and the amenity of adjoining communities. The most efficient access routes for freight vehicles may have other impacts on local communities such as increased noise and air pollution. The challenge is to move bulk freight by the mode and the route that best balances efficiency with broader transport impacts. (sub. 40, p. 10)

Because most transport externalities, to varying degrees, are generated by both freight and passenger transport, externality policies ideally should address both simultaneously. While policy details may differ between freight and passenger transport, partly reflecting the exact type and extent of the externalities they create, policies that only address one source will miss some opportunities for lowest-cost reductions in externalities. Particularly where passenger transport is not included, policies may prove to be relatively ineffective in achieving abatement.

Also, the potential for substitution between transport modes suggests that all transport modes should be considered together when examining externalities. The Maritime Union of Australia (sub. 48) and the South Australian Freight Council (sub. 35) argued for such an approach.

A single charge for all freight externalities?

A number of participants have argued for the imposition of a general charge on both road and rail to cover the cost of major freight externalities. John Cox (for the AAA) commented:

> Charging on the basis of such full social costs (not just road use costs) is necessary to produce efficient resource allocation outcomes. (sub. 45, appendix A, p. 1)

The South Australian Freight Council noted some possible outcomes of an externalities charge:

> A universally applied charge to recoup costs, including externalities — across all 4 modes — could lead to sea freight emerging as a viable alternative in domestic long haul freight markets. Sea freight generally has a better environmental and safety performance compared to the other modes, and infrastructure provision/ maintenance costs can be relatively minor (you do not need to build shipping lanes). Coastal shipping could experience a renaissance. (sub. 35, p. 1)

Such charges generally are proposed as the amount necessary to achieve efficient choices between freight modes (competitive neutrality), particularly between road and rail, to be imposed on both modes as a charge per litre of fuel consumed or per tkm travelled. Other participants supporting such an approach included the Lachlan Regional Transport Committee (sub. 25) and Philip Laird (sub. 23).

Some major deficiencies

An all-encompassing averaged, externalities charge imposed on each sector of freight transport would lead to some reduction in the level of externalities, both by reducing the demand for freight transport and by encouraging a shift towards modes producing lower externalities. However, it has a number of critical deficiencies as a means of achieving efficient levels of the externalities concerned.

The significant averaging implied in a comprehensive externalities charge means that while there would be some efficiency improvements in cases where users are charged no more than the externalities they generate, in others where the average charge is greater than externalities, efficiency losses would be incurred. This is particularly relevant to freight carried through rural areas (such as the major interstate freight corridors) where average externality costs are much lower than in urban areas.

Average road or rail use is a poor proxy for the generation of external impacts, many of which are time as well as location specific. A general levy does not encourage externality abatement by means other than reducing the network-wide volume of freight carried, and relatively large reductions in output (and the loss of the associated community benefits) may be required to achieve relatively small reductions in the various externalities covered by the levy. Modelling work conducted for this inquiry (appendix G) indicates that road freight volumes are not particularly responsive to price increases.

A general levy does not provide incentives to reduce the externality by introducing new technologies which may cut externalities by significantly more and at lower cost than merely the volume reduction effect of the costs imposed by the levy. Hence, it is more akin to a tax on a business input than an externality charge, — imposing costs on business for little reduction in some external costs.

To the extent that the charge was imposed through a particular input (for example, fuel), the use of which was reasonably correlated with one or more of the externalities, resultant economising on use of that input would lead to some further reduction in production of those externalities. However, the diverse range and location of externalities emanating from freight transport — such as accidents, urban air pollution, congestion, greenhouse gas emissions and noise — means that there is no single tax base which is closely related to all of them.

Because of the absent, or very limited, link to the causes of an externality, a comprehensive levy would not operate as an effective price for externalities, as the charge does not decline even if a freight operator reduces the amount of externality produced. In noting the many dimensions in which most transport externalities vary (for example, time, location, engine type) the BTRE observed:

> Failure to recognise these different dimensions in an externalities charging arrangement — through an aggregated 'all externalities' charge, say — would result in a charge that is more akin to a tax. Such a charge would not reflect the marginal social cost of the externality and so fail to capture much of the benefits from the resulting changes in behaviour. (BTRE 2004, p. 18)

Similarly, with regard to using fuel taxes to impose an externalities charge, Queensland Rail observed:

> ... to address externalities optimally fuel taxes would need to be imposed at differing rates according to the type of transport mode (and perhaps vehicle type), place and time. However, fuel excise is applied at a uniform rate nationally with differentiation only possible through a costly administrative rebate mechanism. (sub. 53, p. 40)

Also, as outlined in section 6.2 and appendix C, there are substantial uncertainties in estimating both the costs of particular freight transport externalities and the extent to which these have already been internalised by freight providers. This further increases the risk that an across-the-board externalities levy would significantly overcharge some freight providers, creating efficiency losses which may offset or even exceed any efficiency improvements from the charge.

The ARTC argued that at least a minimum estimate of externalities which had not been internalised by freight operators should be included in freight costs.

> The inclusion of nominal charging for externalities on both modes (net of internalised cost) will create greater awareness and impetus for improved assessment of these costs. Through more refined research over time the charges can be reviewed. (sub. 51, p. 7)

Queensland Rail (sub. 53) also suggested this possibility. This approach would limit, but not eliminate, the possibility of inefficiently high charges on operators generating below average externalities. However, it would still suffer from the other deficiencies of an aggregate charge discussed above.

Some participants (for example, the Victorian Government sub. 55) have noted the possibility of applying a charge on road freight equal to the estimated gap between total road and rail externalities. Such an approach, while allowing for the average difference in all externalities between road and rail, would not fully account for the estimated total costs of road externalities. Nor does it allow for externality gaps between rail and other modes, or the possibility that rail should bear some externality charge. Also, it suffers from all the deficiencies of an average externalities charge, including not allowing road freight operators to reduce externalities by means other than reducing the amount of freight carried (some of which would have transferred to rail), implying, in effect, that increased rail use is the preferred abatement method.

DRAFT FINDING 6.5

An all-encompassing, uniformly applied, externalities charge on freight operators would be an inappropriate and inefficient mechanism for reducing freight transport externalities, many of which are time and location specific. It effectively would impose a tax on freight transport, rather than bringing about cost-effective externality abatement.

Direct charges for specific externalities

The shortcomings of an overall average charge for freight externalities could, in principle, be addressed by pricing individual externalities separately, through charges that were closely related to the marginal externality costs produced by particular freight journeys. Such an approach would allow freight operators to reduce the externality charge by lowering the externality costs they imposed. If set at the marginal benefit of further externality abatement, such a charge can elicit optimal levels of an externality.

To levy specific externality charges efficiently, it is necessary to be able to measure the extent of an externality (such as pollution or noise) produced by a particular journey. In many cases, this will be impracticable or very expensive and a proxy may need to be used — for example, fuel usage in urban areas might be considered a reasonable proxy for air pollution. Contributions to greenhouse gas emissions can be closely related to the consumption of particular types of fuel and hence also would be amenable to direct pricing if marginal costs of emissions could be estimated. Because road use is the cause of congestion costs, and is becoming easier to monitor using modern technologies, pricing linked directly to the externality may be becoming more feasible.

However, if there are significant instances where the proxy used does not accurately reflect the generation of the externality (for example, location and time), there will be efficiency losses from inappropriately high charges (amounting to an implicit 'tax'). These would need to be offset against gains from situations where efficient externality reduction had occurred.

Uncertainty regarding the magnitude of particular externality costs and what the efficient level of those costs might be, suggests caution in implementing charges. The Australian Logistics Council submitted:

> … we are concerned that currently available estimates of externality costs are not sufficiently robust or disaggregated to allow the implementation of externality charges that will allow transport infrastructure pricing to make a genuine contribution to the efficient reduction of these costs in freight transport. (sub. 7, p. 5)

Hence, the Council argued that any externality charges on freight transport should be at the lower end of informed estimates and only implemented if disaggregated mechanisms were available reflecting the large differences in externalities which exist in different environments.

Even then, unless the externality can be directly monitored and priced, the charge would reflect average externality costs, not those imposed by particular journeys, vehicles and drivers. Hence, while 'on average' the charge may reflect lower-end estimates, there would still be some individual road freight services systematically over charged. Charges which varied with attributes closely linked to the creation of the externality could reduce this problem — for example, higher registration fees for trucks with less pollution control equipment or an insurance levy rising for those with poor driving records, would be less likely to lead to over charging at an individual level. In all cases, the transactions costs of introducing a pricing system would need to be compared with the expected benefits of charging for externalities.

DRAFT FINDING 6.6

Direct pricing of particular externalities in some cases offers the potential to achieve relatively efficient abatement of external costs. However, the difficulties *and related costs of identifying and monitoring externality costs for particular freight journeys limit the circumstances in which pricing can be used effectively and efficiently. In order to reduce the likelihood of overcharging for journeys which generate low externalities, any direct charge would need to be set at the lower bound of estimated externality costs and vary with the level of external costs (such as by location).*

Regulatory approaches

In many cases, governments have chosen to use regulatory approaches to address transport (both passenger and freight) externalities. In relation to externalities from road and rail transport, the Ministry of Transport New Zealand noted:

> … simply altering user charges is only one way of addressing the issues noted here. There is a wide range of measures — regulation, design, education and taxation — that can be taken to reduce environmental externalities. (Ministry for Transport New Zealand 2005b, p. 14)

Coles Myer Limited (CML) commented:

> While CML welcomes a review of price structure that will encourage efficiencies, it believes externalities such as environmental, safety and security concerns should be addressed through regulation and standards that are consistent across Australia, not through additional charges and certainly not through varying charges by individual jurisdictions. (sub. 47, p. 3)

And the ATA argued:

> Instead of increasing freight prices through the implementation of charges, thereby reducing output and hence externalities, it is often cheaper and better when a good can be produced by various combinations of inputs, to reduce emissions by varying inputs. For example, introduce emission standards that mandate for reductions in the individual pollutants. This is a common approach adopted by government in Australia. (sub. 9, pp. 13–4)

Well-formulated regulatory approaches can have the advantage of directly addressing the cause of an externality. However, regulation still imposes costs on those creating externalities by requiring higher cost technology or methods of operation, and these costs often are not transparent. With regard to exhaust emission standards, the TIC commented:

> It should be noted that these standards are applicable throughout the industrialised world. Whilst the TIC supports the adoption of these new environmental standards, which have now removed over 90 per cent of harmful pollutants from diesel engine exhausts, they have come at a significant cost. (sub. 13, p. 1)

While regulation sometimes can be targeted directly at reducing a particular external cost, it also can have major shortcomings. Some of these are due to poorly constructed regulations but others reflect inherent problems with using regulatory approaches or the difficulties confronting all policy approaches in addressing particular freight transport externalities. As with other abatement policies, regulatory approaches are faced with uncertainty about the benefits of reducing externalities and the level at which further reductions would not be socially efficient.

In this regard, a focus on the polluter pays approach (box 6.1) in much externality regulation can result in those adversely affected by an externality facing no constraint on the level of abatement they demand. Governments too incur little direct cost in imposing regulations. These factors could result in externality abatement being pushed beyond the point where marginal benefits are less than marginal costs and where further reductions would decrease social welfare. Pertinent to this, the ATA (sub. 9) argued that increasing the exhaust emission standards for heavy vehicles were now very expensive to implement, while the further reductions in harmful emissions were relatively small.

Also, the majority of transport emissions are produced by passenger vehicles. Minimum-cost achievement of any desired level of total emissions would need to target each source. The ATA commented:

> It is assumed that if each emitting sector was to reach a target of pollutant abatement (commensurate to their contribution) and as determined by the NEPM concentrations, then industries would be reaching an efficient level of abatement. It is suggested that the trucking industry is achieving far more abatement than is its fair share of the problem and is thus at a competitive disadvantage to other competing modes. (sub. 9, p. 15)

Ideally, regulations should target the source of the externality, and allow those producing externalities to choose minimum-cost abatement methods. If regulations impose prescriptive, input-based solutions to reducing externalities, more efficient abatement methods may be precluded.

The significant variation in the generation and cost of some freight transport externalities between different locations and times can mean that some regulatory solutions impose costs in situations where an externality is not being created or the external costs are low. For example, pollution reduction equipment required on heavy vehicles might appropriately reduce pollution costs in urban areas, but could impose significant ‘excess’ costs on operators using intrastate and interstate routes on which pollution externalities are lower.

In its submission, the Middle Way Pty Ltd noted that regulatory solutions, if applied only to new vehicles, can create significant cost differences in the short term:

> The operators of those vehicles that perform poorly create real health and environment problems in urban areas. They also enjoy an unfair advantage in the market by avoiding either the capital investment in vehicle replacement or the ongoing costs of engine maintenance programs, both of which are costed into the budgets of the better performers. Progress at the national level will be strongly influenced by the rate of modernisation of the truck fleet, but because there is no incentive in the road user pricing system to remove the worst performers from the road, its turnover is not particularly rapid. (sub. 20, p. 3)

DRAFT FINDING 6.7

Largely because of difficulties in pricing some freight transport externalities, regulatory approaches often have been the favoured method of reducing these costs. In some circumstances, this might be the most efficient and effective policy response. However, if regulation is to achieve efficient outcomes for these externalities, it needs to:

- *be based on a rigorous cost–benefit assessment indicating that the benefits of reducing an externality are greater than the costs involved;*
- *be targeted at all significant sources of the externality;*
- *where feasible, be performance based and allow freight operators to choose the means of achieving a given externality-reduction target; and*
- *to the extent possible, allow for any time or location specific characteristics of many externalities.*

Should lower externality-intensive alternatives be subsidised?

Where the ‘pricing’ of externalities is not feasible or is not being undertaken, some have suggested providing some form of subsidy to the mode producing lower externality costs, as an alternative approach to reducing externalities.

In developing cost–benefit profiles for investment in the interstate rail network for the ARTC, Booz-Allen & Hamilton (2001b) included estimates of certain net external costs (greenhouse emissions, accidents, noise, air pollution and road maintenance) saved by switching freight from road to rail — that is, reflecting the gap between road and rail freight externalities. As no direct revenue would be received by the infrastructure owner for this reduction in net externalities, including such benefits in investment decisions implies that some form of subsidy (for example, government contributions to the investment) will be provided. Taxes raised to finance such subsidies would have distortionary impacts of their own.

However, these externalities may be internalised in other ways, now or in the future life of the investment — such as being included in investment evaluations for road projects or in evaluations of regulatory options such as emission controls, which might deal with them more directly. In addition, a shift in freight from road to rail may not be the most efficient means of abatement.

Also, as noted in section 6.2, estimates of the size of externality costs are subject to considerable debate and uncertainty. Including them as revenue in rail investment evaluations is the equivalent of a 'risky' income stream in that the value of the returns is particularly unclear.

In calculating road charges for B-doubles, the NTC's third determination proposed to reduce registration fees so that they were not more than those for road trains, in order to allow for the lower accident rates of B-doubles compared with road trains and the environmental benefits of their greater fuel efficiency. Like the externality levy proposals discussed above, this subsidy approach does not deal directly with the externalities concerned. Many of the relative safety benefits of B-doubles should already be incorporated in insurance premiums. Emissions reduction in transport would be more efficiently handled directly, rather than by partial *ad hoc* adjustments to pricing.

These reductions in registration charges will encourage increased freight services (including related externalities) by the subsidised vehicles as well as distorting relative freight prices compared with other possibly even lower externality-generating modes such as rail and sea.

DRAFT FINDING 6.8

Including an allowance in rail infrastructure investment decisions, or making selective adjustments to road freight infrastructure pricing for the average impact of road externalities, is unlikely to be an efficient way of dealing with freight transport externalities. It does not address the externalities directly, nor assess optimal levels of an externality, nor consider opportunities for other, possibly lower-cost, abatement alternatives.

Policies for specific externalities

The above discussion covered principles for policies dealing with freight transport externalities in general. Greenhouse gas emissions and road traffic congestion are two transport externalities with some important characteristics that are particular to them:

- greenhouse is a global, rather than a regional or national, issue; and

- conversely, road congestion is particularly time and location specific, with the costs largely borne by road infrastructure users themselves and partly internalised in road use decisions.

Greenhouse gas emissions

The creation and impacts of greenhouse gas emissions are global phenomena. Australia currently produces about 1.4 per cent of global emissions, of which road and rail freight jointly have a 3 per cent share.

The major response of the Australian Government to global warming has been to sign, without ratifying, the Kyoto Protocol to the United Nations Framework Convention on climate change.[8] Under the Kyoto Protocol, Australia has agreed to a non-binding greenhouse gas emissions target for 2008–12 of 108 per cent of 1990 levels. As part of the process for reaching this target, a diverse range of largely regulatory policies, covering various parts of the economy, have been implemented under national and jurisdictional greenhouse strategies. These have included a number of policies for the transport sector, including freight transport.[9] The Australian Government has indicated that Australia is currently on target to meet its Kyoto Protocol target (Campbell 2005).

In addition, Australia has developed policies at a regional and bilateral level. Australia is part of the Asia-Pacific Partnership on Clean Development and Climate, established in 2005, which is to collaborate to develop and deploy cost-effective, cleaner energy technology and practices. Australia also has established climate change partnerships with a number of countries.

A number of participants have argued for incorporation of a greenhouse emissions levy into freight infrastructure pricing. They suggested that such a levy would encourage freight to transfer to lower greenhouse gas emitting transport modes, thereby reducing Australia's greenhouse footprint. For example the Maritime Union of Australia contended:

> It is our view that given the relatively low emissions by domestic shipping, particularly when compared to road transport, and given the urgency of national and international efforts to reduce greenhouse emissions which are contributing to climate change,

---

8 The Kyoto Protocol was agreed to in 1997. Under it, industrialised countries were given targets to limit or reduce their greenhouse gas emissions by 2012.

9 Most recently, from 1 July 2006, all businesses wishing to claim more than $3 million in fuel tax credits in a financial year are required to join the Australian Government's Greenhouse Challenge Plus programme. This programme involves member businesses measuring their greenhouse emissions, developing abatement action plans and reporting to the Government on their actions.

indicates that we must factor such considerations into freight pricing arrangements. (sub. 48, p. 4)

Conversely, with regard to achieving minimum-cost reductions in greenhouse gas emissions, the AAA argued:

It is inappropriate for the transport sector (or any other sector) to go it alone in emissions reductions. Rather, any policy should have the broadest possible coverage. There are two broad categories of policy that satisfy this principle: a uniform carbon tax (or carbon equivalent) or some form of emissions trading scheme. (sub. 45, p. 13)

Given the significant uncertainties regarding the marginal costs and benefits of achieving greenhouse gas reductions, it would be poor policy to single out a particular sector, especially a significant business input, for the use of tax-based instruments. Transport inputs would be taxed while other inputs also causing greenhouse emissions would be tax free. This inappropriately distorts the choice of business inputs. It also leads to distortions in the markets for final goods and services: for example, industries which produced relatively high greenhouse emissions but which used little freight would be favoured by such a tax. It would not be clear whether the costs of achieving any resultant reduction in emissions was higher or lower than other abatement measures that Australia or other countries might take. DOTARS argued:

… charging for freight transport greenhouse emissions could only take place within a suitably comprehensive agreed international and national greenhouse pricing framework. (sub. 69, pp. 21–2)

In addition, in the absence of a comprehensive global agreement on emissions reductions, actions taken by Australia which impose costs on domestic industries might lead to some production being transferred to competitors in other countries such that global environmental outcomes could conceivably be worsened.

COAG (2006a) has announced a new national Climate Change Plan of Action, with a high-level interjurisdictional group to oversee its implementation. Further policy developments, such as taxing emissions (and, in particular, freight transport emissions) would seem to be best taken as part of this national plan and in the context of the post-Kyoto international agreements on climate change policy.

DRAFT FINDING 6.9

In the absence of economy-wide greenhouse pricing mechanisms, it would be economically costly to pursue national emissions targets by applying taxing instruments solely to key business inputs such as freight transport.

Road congestion

Because it is readily observable and is restricted to relatively few times and locations, road traffic congestion (particularly in urban areas) is one transport externality that potentially is amenable to some form of road pricing solution. This is particularly pertinent in the short term, when the opportunities for expansion of road capacity (through, for example, investment in infrastructure) are likely to be limited. DOTARS (sub. 69) argued that external costs of congestion can, in principle, be reliably measured and that the monitoring and charging technology needed to implement congestion pricing was available.

The AAA argued that congestion should be excluded from any general freight transport externalities tax. Rather, it considered congestion externalities should be priced directly.

> … congestion pricing should be seen as part of comprehensive transport reform and, if it were introduced, it should only apply to vehicles actually operating in congested conditions. (sub. 45, p. 17)

Congestion externalities can be reduced in several ways

Tolls which cover the gap between the average congestion costs faced by marginal users and the marginal costs they impose on other road users could efficiently reduce congestion costs.

To achieve efficient reductions in congestion, tolls would need to be applied to both passenger and freight vehicles to reflect congestion levels experienced at particular locations and times. While appropriate congestion tolls may vary somewhat for different sorts of vehicles, congestion is a cost created by all vehicles and efficient reduction of congestion will occur when those trips which are least valued are tolled off. Christopher Boulis argued:

> To be efficient, all vehicles, not just heavy vehicles, should be charged for the costs of congestion, since they all contribute to its existence. (sub. 46, p. 8)

As with other large-scale infrastructure assets, expansion of road capacity is often most efficiently undertaken in large amounts rather than incrementally. As a result, even when investment in new capacity might eventually be justified, there are likely to be periods during which it is efficient to have some level of congestion for which pricing might be a cost-effective solution.[10]

---

[10] New road capacity will attract those who were previously discouraged from using roads by the level of congestion. Nonetheless, congestion would initially be lower than its previous level and benefits will accrue to both existing and new users. If demand for road use expands over time (for example, due to population growth) congestion may eventually return to previous levels and

However, if capacity expansion is cost effective, congestion in some locations might be a relatively short-term problem — significant revenue from congestion tolls would signal high benefits from expanding road capacity. Tolls are only a longer-term solution where other alternatives are not cost effective. In some cases, investment in traffic control measures may also efficiently reduce congestion. VCEC canvassed a wide range of options for reducing congestion in Melbourne and several Victorian provincial cities. It noted:

> There is usually a number of ways to address any congestion problem. Whether the best solution is chosen depends on the quality of the project evaluation process. (VCEC 2006, p. xxiv)

The Commission has previously recommended (IC 1994 and PC 2005e) that pricing options for managing urban road congestion be further examined. COAG (2006) has established a review into transport congestion (with a focus on national freight corridors) in Australia's major cities, including consideration of options for managing congestion. The review reports to COAG by December 2006.

Tolls to alleviate congestion might not increase road freight transport costs

The net impact on freight vehicles of congestion tolls would be variable. Losers would be those 'tolled off' (possibly to travel via different routes or at different, less suitable, times) and those freight providers paying the toll but for whom the value of benefits from reduced congestion is less than the toll. Those for whom the benefits of reduced and more predictable travel times and lower operating costs outweighed the toll would gain, as would those attracted back to travelling at peak hours and for whom the value of lower congestion costs also outweighed the toll.

Because the major costs of road congestion are in capital cities, it will affect, to some degree, the costs of rail, since rail will generally need to use road for pick up and final delivery. Efficient road congestion pricing, in some cases, will reduce the net costs of rail freight by reducing operating costs of urban trucks and allowing greater flexibility in determining when to operate them.

Road expenditure is often directed at reducing congestion costs (and providing other benefits) by building new roads, widening existing roads or providing passing lanes. In this situation, the externality cost is reduced by road spending which presumably provides benefits, including benefits of reduced time delays and lessened safety risks from slower vehicles, which are greater than the costs involved. If the

tolling may be appropriate. In some cases a combination of expanded capacity with some level of congestion tolls may be appropriate. However, the investment in road infrastructure will still be providing benefits as congestion will be lower than without it and more users will be obtaining benefits from using roads.

correctly attributable part of this expenditure is charged to heavy vehicles through the NTC charging determination, 'on average', they will have met the costs of reducing this congestion.

Further research

In assessing the 'full economic and social costs of providing and maintaining road and rail freight infrastructure', the terms of reference direct the Commission to 'assess what information or future research could improve the quality of the estimates'. With regard to the externalities component of social costs, a number of submissions have argued that further research is needed to identify accurately the size of freight externalities and the extent to which they have been internalised by freight operators. The South Australian Government noted that recent Australian estimates of transport externalities were based on overseas data and argued:

> It is widely recognised in transport circles that there is a need for estimation of externality values based on Australian data. To date, no major initiative of this type has occurred, or is scheduled to occur. (sub. 61, p. 7)

And the Rail, Tram and Bus Union (RTBU), in noting the uncertainties in estimating the social costs of transport, commented:

> The RTBU believes the approach of the PC Inquiry should be to provide a direction and timetable for further work that needs to be done to refine the already considerable body of work to Australian conditions and methodological issues that may need to be addressed by further research. (sub. 43, p. 14)

Most considered that these refined estimates could then be used as a basis for an externality charge for road and rail freight which would help achieve competitive neutrality between the modes. However, as discussed above, the case for an all-externalities charge, or even charges for most individual externalities, is weak. Hence, better estimates of the total size of particular externalities, simply obtained in order to impose a 'more accurate' externalities tax, would do little to achieve low-cost abatement to efficient levels.

Nonetheless, freight and passenger transport impose a variety of substantial external costs and policies that have been used to reduce these costs have required significant expenditure by those in the transport sector and by government. Particularly for freight transport, which is a significant business input, it is important to seek appropriate externality abatement at least cost.

In noting the significant uncertainties in costing externalities, the Department of Health and Aging considered that:

> A wider benefit of costing externalities of transport would be to provide information on the social costs and benefits of transport infrastructure. It is relevant to consider these in decision-making about national transport market reforms in order to more accurately calculate the net benefits to the community of such reforms. (sub. 57, p. 9)

The above discussion suggests that a number of major information and analysis deficiencies inhibit the assessment of existing policies and the formulation of future policies for addressing freight (and implicitly passenger) transport externalities:

- the need to more accurately define and measure externality costs and to measure the benefits of abatement. For some costs such as accidents both the definition of the externality component and the valuation of accident costs remain contentious. For others such as noise costs, overseas data is heavily relied on in obtaining valuations;
- the extent to which costs are currently internalised by road and rail users is often unclear. The existing level of observed costs often is the result of significant expense incurred by the transport sector and government to reduce externality costs. Knowledge of the costs and benefits of further abatement are imperative for determining what further reductions are appropriate; and
- the costs and benefits of the often wide variety of potential abatement options across passenger and freight transport, together with any other externality sources, need to be investigated and compared simultaneously when determining minimum cost abatement policies. For example, a number of participants have questioned the costs imposed on interstate road freight vehicles by regulations designed to address essentially urban related pollution and noise externalities.

DOTARS (sub. 69) reported that the BTRE is currently producing updated estimates of the major externalities in the inter-capital freight market. This analysis is of particular relevance to competitive neutrality between road and rail. It does not cover externalities generated by passenger vehicles or in common with other sources. As externalities are usually generated concurrently by passenger and freight transport and, in some cases, other sources, any analysis of abatement options would need to cover all sources and recognise the substantial variability in most freight externalities between urban and regional areas.

DRAFT FINDING 6.10

Further research into transport externalities in Australia is required to assist the introduction of the most cost-effective policies for attaining efficient abatement of external costs. Research should focus on:

- ***the nature and size of transport externalities; and***

- ***the extent to which these externalities already are internalised, particularly by policies affecting the decisions of passenger and freight transport users.***

The BTRE is best placed to undertake this research.

6.4 Summing up

Externality costs of road and rail freight and passenger transport are both significant and diverse and, in many cases, are highly time and location specific. For freight transport, some externalities (for example, accidents) have been internalised, at least to some degree, by market mechanisms. Governments have addressed others mainly by regulations, which often have imposed significant costs on freight providers. These regulations have achieved reductions in externalities, but it is not clear that they have achieved efficient levels of abatement of externalities, or done so at least cost.

Where possible, greater use of incentive-based policies such as pricing should be used to address externalities as they offer incentives to seek out minimum cost abatement strategies and better identification of efficient levels of externalities. Where regulations are used, they need to be based on rigorous cost—benefit analysis to determine the most efficient options, and be performance based.

A general externalities charge for freight transport would be a costly policy because it would not recognise the diverse nature of transport externalities, nor provide incentives for achieving efficient levels of abatement of externalities. In addition, the significant difficulties in measuring the costs imposed by externalities would make the setting of such a charge problematic. The competitive neutrality implications of freight externalities are discussed in chapter 7.

7 Implications for competitive neutrality

Key points

- There is no compelling evidence to support the contention that road freight is subsidised *relative* to rail, on either the inter-capital corridors or in regional areas.
- Whether road freight infrastructure use is subsidised on the inter-capital corridors is unclear.
  - B-double charges under-recover costs attributable to their road use based on *network-wide* allocations, but there is evidence that the costs imposed by these vehicles on the inter-capital corridors are significantly lower than for the rest of the road network.
  - Charges on six-axle articulated trucks *over*-recover their network-wide attributable costs and do so even more when they are travelling on low cost corridors.
  - There are significant cross-subsidies within truck classes by distance travelled and load.
- Government subsidies to the rail sector provide further complications in assessing relative subsidisation across modes. Significant government contributions to the interstate rail network are unlikely to be recouped, given rail's inability to fully cover its economic costs on these lines.
- It is likely that both road and rail freight transported in regional areas are subsidised to a significant degree.
  - Road charges based on network averages will tend to under-recover costs on relatively high (unit) cost rural roads.
  - However, subsidies to rail in these areas also are significant, with levels of cost recovery achieved on some lines that are too low, if the expectation is that services will continue.
- While the non-inclusion of externalities in transport infrastructure pricing is likely to favour road relative to rail overall, the competitive neutrality implications are limited. Externalities in both modes are already internalised to a significant degree and externality costs (per tonne kilometre) on the interstate corridors are relatively low.
- If road charges were to increase, modelling suggests that even substantial increases are unlikely to have a significant impact on rail's modal share.

7.1 Introduction

A central purpose of this inquiry, as stated in the terms of reference is 'to assist COAG to implement efficient pricing of road and rail freight infrastructure through *consistent and competitively neutral pricing regimes*…'(emphasis added).

The concept of 'competitive neutrality' was originally applied to the competitive environment between public sector agencies and private businesses operating in the same market. In such cases (for example, the provision of public utility or community services), the products of competing enterprises were likely to be highly substitutable, so that the distortions created by any favourable treatment to particular producers could be substantial. In the present context, competitive neutrality relates to competition between public sector providers of road freight transport infrastructure and commercialised providers of rail infrastructure offering *similar* services. Although potential for substitution between these modes exists, it is more limited because of differences in the services provided by each mode (chapter 3).

The Commission does not consider that 'consistent and competitively neutral pricing regimes' require that charges in each mode 'look the same', either in terms of their structure or their estimation methodology. Currently, road and rail operators employ quite different approaches to setting charges (chapters 4 and 5). The approaches used in each mode reflect, at least to some degree, the inherent characteristics of the mode (chapter 3).

For example, rail price ceilings approved by access regulators are calculated based on a lifecycle valuation of the infrastructure. In road, where producing such a depreciated optimised replacement cost (DORC) valuation would be a more formidable task, the costs of road infrastructure are proxied by current capital expenditure (the PAYGO approach). In addition, road charges are applied on a network-wide basis, while rail charges vary by specific lines. This reflects the fact that below-rail operators control access to particular sections of track and hence charge users directly, whereas for road, there is limited capacity to control access to the network, other than at extremely high cost.

The fact that the pricing regimes are different is not, in itself, an issue from a competitive neutrality perspective. Rather, competitively neutral pricing requires that prices reflect the relative (marginal) costs in each mode. The extent to which current road and rail pricing regimes achieve recovery of their respective infrastructure costs is discussed in chapters 4 and 5. Importantly, key differences in the approach to setting road charges — the use of PAYGO and the treatment of common costs — do not, in themselves, provide a relative subsidy to road users (chapter 4). Nonetheless, reforms to implement more cost-reflective road user charges (chapter 8), would increase consistency with the rail pricing regime.

DRAFT FINDING 7.1

Different pricing structures for the use of road and rail infrastructure do not, in themselves, imply a lack of competitive neutrality. Competitively neutral pricing requires that prices reflect relative marginal costs in each mode.

A number of inquiry participants have argued that achieving competitive neutrality in the pricing of road and rail freight infrastructure and its use is very important for the efficiency of freight transport. The BCA argued:

> Establishing competitive neutrality in road and rail pricing is an essential first step in facilitating an efficient inter-capital freight system. (sub. 32, p. 5)

Engineers Australia supported a sustainable transport system and argued that:

> Competitive neutrality is essential for efficient economic decisions in both the immediate future and for the long term and will enable the evolution of the most appropriate transport mode for Australia's circumstances. (sub. 5, p. 1)

However, the National Association of Forest Industries was more cautious:

> Competitive neutrality in the context of road and rail should be considered separately to previous cases in Australia's microeconomic reform agenda, where intervention promoting competitive neutrality has been successful. … The fact that the product or service was highly substitutable encouraged competition and promoted incentives for improvement and innovation as well as delivering lower costs. … Intervention to promote competitive neutrality made sense in these cases. However, its application to road and rail may be quite different to these cases, and as such, may fail to deliver the same level of benefits. (sub. 37, p. 4)

The South Australian Government argued that competitive neutrality should not be the dominant focus when setting road charges.

> With regard to road charging, any departures from efficient economic pricing principles to mirror financial regulatory arrangements for privatised rail operations need to be justified according to economic principles (i.e. second best pricing, with optimal departures from efficient pricing) not the concept of competitive neutrality as between public and private providers per se … (sub. 61, p. 8)

Reflecting different technological, cost and service characteristics, road and rail freight transport, for the most part, compete in a relatively small segment of the freight market — principally non-bulk freight on the inter-capital corridors, but also, in some circumstances, carriage of bulk commodities (chapter 2).

Drawing on the analysis of costs and potential subsidisation of road and rail freight in the preceding chapters, this chapter pulls together the implications for competitive neutrality between the two modes, and the potential consequences of relative price changes for activity levels in each.

Although this chapter focuses on the intermodal issues, competitive neutrality also has an *intra*modal dimension. The current averaging of road user charges — by vehicle mass, distance and location of travel — leads to significant cross-subsidies between heavy vehicles. These cross-subsidies have the potential to distort fleet choices as well as the use of the network at the margin (chapter 4).

7.2 Assessing (relative) subsidies to road and rail freight

Achieving the highest-value use of resources in an economy generally requires that prices are equal to the marginal (social) cost of producing and consuming *all* goods and services. This would also ensure that choices between goods and services are 'competitively neutral': that is, *relative* prices reflect their *relative* costs. If prices of road and rail did not reflect their relative costs, there would be inefficient diversion of freight from a lower cost to a higher cost mode. Additional inefficiency could arise if prices for one or both modes were subsidised, because then there would be 'over-consumption' of freight services overall.

Do trucks competing with rail pay their way?

The level of heavy vehicle cost recovery would bear on competitive neutrality and efficiency if trucks competing with rail did not pay an appropriate share of road infrastructure costs. Indeed, a number of participants claimed that subsidies in the road user charging system were a source of competitive disadvantage for rail:

> The obvious distortion in infrastructure access charging between road and rail is a significant contributor to the failure of rail to compete with road in what are natural rail corridors. … It will not be easy to restore competitive neutrality after decades of pricing distortions. (ARA, sub. 33, p. 8)
>
> … road freight cannot be said to meet its infrastructure costs and operates with an implied subsidy. This places rail at a general disadvantage and significantly limits the scope for realising optimal economic returns. (Engineers Australia, sub. 5, p. 8)

The contestable freight market is primarily non-bulk freight transported on the inter-capital corridors. Six-axle articulated trucks, and, increasingly, B-doubles, are the most common vehicle configurations for transporting freight on these routes. To a lesser (but increasing) extent, the modes also compete in the transportation of bulk freight in regional areas — the haulage of grain and forestry products, for example.

To the extent possible, this section will assess the extent to which revenues from road user charges from these large articulated trucks travelling on the inter-capital corridors or in regional areas recover the costs associated with their road use.

Are trucks on the inter-capital corridors subsidised?

A number of participants to the inquiry suggested that the unit costs of heavy vehicle road use may be lower on the inter-capital corridors than on other parts of the road network (NTC, sub. 17, Victorian Government, sub. 55). This reflects the economies of scale associated with constructing more durable roads and the higher traffic densities on these routes.

Empirical analyses of costs on the major corridors have generally been constrained by a lack of expenditure and traffic flow data for those corridors. Two studies that have been undertaken using corridor-specific data, BTE (1999a) and BTRE (forthcoming), estimated that the avoidable cost of heavy vehicle use on the corridors — particularly the Sydney–Melbourne and Melbourne–Adelaide corridors — is significantly below the avoidable cost of using an average arterial road.[1]

More importantly, BTE (1999a) estimated that the unit *total* cost (including capital and a share of common costs) imposed by a six-axle articulated truck on the Sydney–Brisbane corridor was less than half the total cost per kilometre imposed by the same vehicle using an average arterial road. Of the corridors considered by the BTE, only Adelaide–Perth was estimated to have higher than average unit costs (chapter 4).

If costs, in fact, are lower on the east coast corridors, this should be taken into account when drawing conclusions about the true level of subsidies for trucks travelling on these routes.

- Based on current expenditure and use data, articulated trucks with six-axles or less, more than recover their *network-wide* attributed costs and also make some contribution to common costs (chapter 4). If these trucks also travel proportionately more on the lower cost corridors, then on average, these trucks are *more than* recovering the costs associated with their infrastructure use.
- B-doubles, on the other hand, on average do not recover their network-wide attributed cost (chapter 4). However, this apparent B-double 'subsidy', may in reality be lower (or even non-existent) once the lower cost of the roads these vehicles mostly use is taken into account.

[1] The avoidable cost of road use is the cost imposed by each vehicle in terms of periodic and routine maintenance and the need to undertake road rehabilitations (chapter 4).

The analysis of cost recovery is further complicated, however, by cross-subsidies to individual trucks *within* vehicle classes. Those trucks travelling longer than average distances or carrying heavier than average loads are (all else equal) cross-subsidised by other trucks within the class (chapter 4). While the available data do not allow identification of which trucks are travelling the longest distances, it is likely that a significant proportion of the B-doubles or six-axle articulated trucks that do travel in excess of the average annual distance for their class, are involved in line haul operations on the major corridors. These vehicles travelling further than average pay less (per tonne kilometre) than vehicles travelling shorter distances within their class (chapter 4). So, even though an *average* six-axle articulated truck more than recovers the costs it imposes, individual semi-trailers travelling further than average may not.

Are trucks on regional roads subsidised?

Articulated trucks competing with rail for the carriage of bulk freight in regional areas travel proportionately more on lightly trafficked arterial and local roads. Analysis in chapter 4, using National Transport Commission data (NTC 2005b), suggests that the costs imposed by articulated trucks using local roads is significantly higher than the costs they impose on average arterial roads (table 4.4).

A number of participants noted that the cost of road use on lightly trafficked routes is likely to be higher than for other roads. For example, the Victorian Government (sub. 55) noted that charges on the low traffic routes were likely to increase under a location-based charging regime. Similarly, the NTC commented:

> … individual road user pricing for rural areas may result in relatively higher prices due to fewer heavy vehicle kilometres over which to distribute fixed costs. (sub. 76, p. 17)

As current charges are based on network-wide costs, everything else equal, vehicles travelling in regional areas will receive a cross-subsidy from vehicles within their class using lower unit cost roads. Again this analysis is complicated by potential cross-subsidies within classes because of dispersion in distance travelled and gross vehicle mass.

The implications for competitive neutrality of these cross-subsidies are unclear. Where trucks travelling on regional roads compete with rail for the carriage of freight (particularly bulk commodities such as grain), these subsidies have implications for competitive neutrality. However, it is also necessary to establish the degree of *relative* subsidisation between the modes on these routes (see below). Moreover, to the extent that rail operations in regional areas require road for pick-up and delivery, the apparent subsidies to road freight may also advantage rail.

Do trains competing with road pay *their* way?

As discussed in chapter 5, many rail infrastructure providers are unable fully to cover economic costs and often fall well short of doing so. This implies that above rail operators do not pay the full cost of the infrastructure they use.

As long as rail infrastructure providers are unable to cover the full economic costs (externalities aside) of providing services — and this is typically the case on the interstate corridors — they are likely to be reliant on government subsidies in one form or another to avoid deterioration in service quality or, ultimately, service shutdowns.

As discussed in chapter 5, there are various ways in which rail freight effectively can be subsidised. One is tolerance by governments of financial losses or low rates of return earned by government-owned rail infrastructure providers. This could substitute for explicit government contributions that otherwise might need to be provided to maintain a commercial entity's viability. Explicit forms of government contributions typically involve government grants for infrastructure provision or rehabilitation, or payments identified as funding community service obligations (CSOs).

It is clear that the rail sector relies heavily on government financial contributions and, while these mostly relate to passenger rail services, some freight services are also subsidised. However, the extent to which these subsidies benefit rail freight that is in competition with road — which is predominately on interstate and other major corridors — is less clear.

That said, some government contributions do clearly directly benefit rail in its competition with road. For example, recently, sizeable grants were provided to the Australian Rail Track Corporation explicitly to improve rail's viability on the North–South corridor between Melbourne and Brisbane.

The competitive neutrality impacts of other government contributions are more difficult to assess. Many of the contributions are payments for CSOs. While these payments are initially made to below-rail operators, they ultimately are intended to benefit rail users or other groups in the community. Some may be designed to benefit particular industries or regions (such as payments to maintain low volume rural freight services, and particularly transport of grain). However, depending on how they are designed or used, there is potential for CSOs to subsidise the commercial operations of rail infrastructure providers. As it is not always clear at which services CSOs are directed, it is also unclear whether or not in some cases they improve the competitive position of rail freight relative to road in locations where they compete.

What can be concluded about relative subsidisation?

The evidence to support the contention that road freight is subsidised *relative* to rail on either the inter-capital corridors or in regional areas (externalities aside) is neither conclusive nor compelling.

Charges for six-axle articulated trucks (currently the most widely-used vehicle configuration for transporting freight on the interstate corridors), on average, over-recover the attributable costs of their infrastructure use. Charges for B-doubles, on the other hand, under-recover their network-wide costs, but where these trucks travel on the lower cost corridors, whether a 'true' subsidy exists is not clear. The issue is further complicated by cross-subsidies within truck classes for vehicles that travel further than average or carry heavier than average loads. These complexities, along with the fact that rail receives substantial subsidies on the interstate corridors, make it difficult to conclude that road is, in reality, subsidised relative to rail.

Assessing relative subsidies in regional areas is harder still. It is likely that road freight transported in regional areas is subsidised to a significant degree. However, subsidies to rail in these areas also are significant, with very low levels of cost recovery achieved on some lines (chapter 5).

The analysis so far has been concerned only with the 'private' cost of freight transportation — that is, the cost actually borne by the users themselves. Potential differences in social costs (private plus external costs) across modes, and their implications for competitively neutral pricing regimes, also need to be assessed.

7.3 Relative costs of externalities

A number of participants have argued that charging for the costs of externalities imposed by road and rail freight transport is important in achieving competitively neutral pricing regimes. The ARTC argued:

> Efficient, competitively neutral pricing principles that deliver appropriate investment signals must contemplate the impact of both road and rail use on external elements. (sub. 11, p. 33)

And Engineers Australia contended:

> The cost of externalities originating from both road and rail freight transport are met by the community at large. Neither mode incorporates the costs of externalities into infrastructure access prices. This is a serious distortion in the path of achieving competitive equilibrium and economic efficiency generally. (sub. 5, p. 9)

Others with similar views included the Tasmanian Government (sub. 36), Australasian Railway Association (sub. 33), Philip Laird (sub. 23), Queensland Rail (sub. 53) and the Business Council of Australia (sub. 32). In particular, these participants noted that average external costs of road freight transport were higher than those for rail freight. Most anticipated that an allowance for externalities (in infrastructure charging or via a fuel tax) would create a competitively neutral environment leading to the transfer of some freight from road to rail and a consequent beneficial reduction in external costs.

Various studies, outlined in chapter 6 and appendix C, confirm the significant costs of accidents, air pollution, noise, greenhouse gas emissions and congestion generated by road transport, including freight transport. While rail freight (and rail passenger services) also impose similar types of costs, they are proportionately much lower per unit of freight carried than for road. However, difficulties in both defining and measuring transport externalities mean that valuing the gap between road and rail is problematic.

The discussion in chapter 6 nevertheless suggests that the *policy-relevant* impacts of these divergences in external costs on competitive neutrality are limited. There is already significant internalisation of a number of road freight externalities through means such as regulatory requirements, insurance (reflecting liability for accident costs), road expenditure and road laws — all of which impose costs on road freight operators. Greenhouse gases — where road freight generates significantly more emissions than rail — are an exception. However, in the absence of national or global abatement schemes, the valuation to place on emissions is very uncertain, and singling out the transport sector to pay for greenhouse gas emissions could prove costly (chapter 6).

In addition, competitive neutrality issues with rail are relevant principally only for a subset of the truck fleet; namely, articulated vehicles travelling (mainly in rural areas) on the major freight corridors. However, the highest externality costs (per tonne kilometre) for road freight (and road passenger) transport are in urban areas. As rail generally needs truck pick up and delivery of inter-urban freight, externality costs such as accidents, air pollution, noise and traffic congestion in urban areas will be, to a significant extent, common to road and rail freight journeys.

The appropriate policy response to differences in externalities between modes involves efficiently addressing externalities at their source within each mode. Some abatement costs would be borne by freight operators and the outcome would be competitively neutral with respect to externalities. Approaches such as an all-encompassing externalities levy on trucks (through, say, a decrease in diesel fuel rebates) as a means of attempting to achieve intermodal competitive neutrality are unlikely to be cost-effective means of abatement and may impose unnecessarily high costs on freight transport (chapter 6).

7.4 What are the implications for freight activity and modal shares?

On the basis of available information, it is not clear that increasing road user charges for trucks competing with rail would improve competitive neutrality or economic efficiency. But even if road prices were to increase, the Commission's modelling suggests that very large relative price changes (far larger than could be justified under any plausible cost allocation scenario) would be required to have any significant impact on freight demand or modal shares.

Quantifying the impacts of higher road charges

The Commission has modelled the impact of changes in road user charges on freight activity and modal shares (appendix G). A change in road charges, such that road user charge revenues exactly recover the costs currently allocated to each class, is estimated to have a negligible impact on road and rail freight activity and modal shares (figure 7.1).

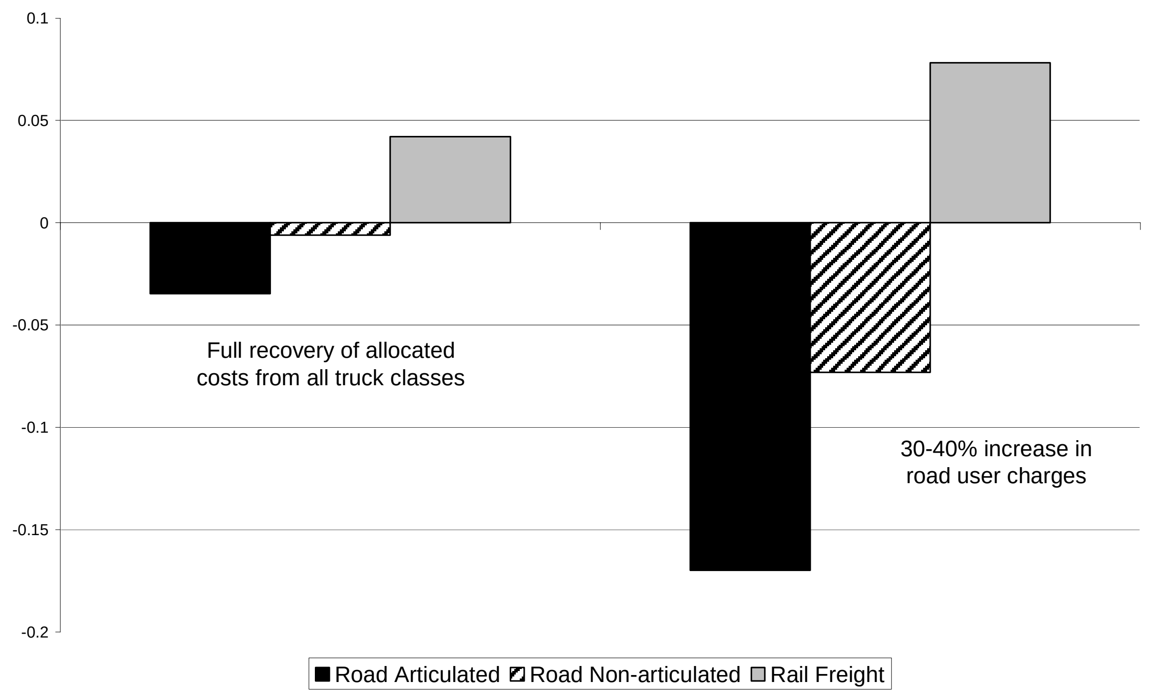
Even under a scenario where road user charges increase substantially — an almost 30 per cent increase for non-articulated trucks and over 40 per cent for articulated trucks[2] — the change in demand for transport services is estimated to be very small. Demand for freight carried by articulated trucks (in tonnes) is estimated to decrease by 0.17 per cent, while rail tonnes carried increases by about 0.08 per cent (figure 7.1) Total freight transport demanded decreases as a result of the increase in charges.

The comparatively small impact on activity reflects the small share of truck operating costs accounted for by road user charges (3 to 4 per cent) as well as the fact that freight represents a small proportion of costs for most user industries.

The relative increase in road prices is also estimated to lead to an increase in market share for rail at the expense of road freight carried by articulated trucks. However, these changes are very small, with the modal share of articulated trucks decreasing by about 0.075 per cent while that of rail increases by just over 0.2 per cent, reflecting their smaller initial share of the market.

2 These charge increases are estimated by applying BTE (1999a) cost attribution parameters and common cost estimates to current road expenditure (appendix G).

Figure 7.1 **Change in freight output from increasing road charges**
% change, tonnes



Source: appendix G.

However, it should be noted that the cross-price elasticities on which these estimates are based are aggregate measures, not differentiated by location. For non-bulk freight on the inter-capital corridors where road and rail are close substitutes, the impact of relative price changes is likely to be more pronounced. Nonetheless, sensitivity analysis suggests that even with high cross-price elasticities (potentially in line with the elasticities on particular corridors), the impact of price changes on aggregate freight demand and modal share would not be large (appendix G).

How would rail respond to higher road prices?

The estimates discussed above are based on the assumption that below-rail operators do not respond to an increase in road infrastructure charges by increasing their charges; but rather, that they allow the benefits to flow to them via increased freight volumes. However, if revenues received by rail infrastructure operators do not currently cover the costs of providing services, they may respond by increasing their charges in line with increases in road charges, leaving relative prices and modal shares unchanged.

Higher rail prices potentially could help to fund increased investment in the rail system. However, if higher prices and revenues merely displaced public subsidies, rail track operators would not receive any increase in revenue. As noted in chapter 5, Queensland Rail has indicated that CSO payments are assessed ‘as the difference between efficient costs and access revenue’ (QCA 2005, p. 142). This highlights the potential for higher access fees to displace public subsidies.

7.5 Summing up

Central to this inquiry is the need to examine claims that large articulated trucks (particularly B-doubles) competing with rail for freight on major interstate corridors, do not pay their share of road costs, or adequately account for other costs they impose on the community. However, the question of competitive neutrality between modes is more complex than it often is portrayed.

The extent of any subsidisation of road *relative* to rail for the use of freight infrastructure on the important inter-capital corridors is unclear. While it is possible to say that B-double charges under-recover costs based on *network*-wide allocations, there is evidence that the costs imposed by these vehicles on the major corridors are significantly lower than for the rest of the road network. Six-axle articulated trucks will over-recover their attributable costs when travelling on the low cost corridors. However, in regional areas, it is likely that road freight transported on either B-doubles or six-axle articulated trucks is subsidised to a significant degree.

The picture is further complicated by government subsidies to the rail sector. Significant government contributions to the interstate rail network and regional rail lines appear unlikely to be recouped given rail’s inability to cover its costs on these lines, absent the subsidies.

While the non-inclusion of externalities in transport infrastructure pricing is likely to favour road relative to rail overall, the competitive neutrality implications are limited. Externalities in both modes are already internalised to a significant degree and, in any case, externality costs on the interstate corridors are relatively low. Externalities are most efficiently dealt with directly rather than through an across-the-board increase in road user charges, which might create greater distortions than it corrects.

Even if a relative price change in favour of rail were justified on competitive neutrality grounds, modelling suggests that the impact of any (plausible) change on freight activity and modal shares is likely to be limited.

DRAFT FINDING 7.2

Determining the extent to which current infrastructure charging achieves competitive neutrality is complicated by:

- *the averaging of road user charges and the resulting cross-subsidies between heavy vehicles (which sometimes act in opposite directions), making it difficult to determine the outcome for those trucks competing with rail;*
- *various forms of capital and operating subsidies provided to rail freight; and*
- *the existence of external costs, which are greater for road freight, but which are significantly lower (per tonne kilometre) for both modes on the corridors where road and rail compete.*

Based on the available evidence, there is no compelling case for increasing charges for road freight infrastructure users on competitive neutrality grounds. If charges were to increase for road, modelling suggests that even substantial increases are unlikely to have a significant impact on rail's modal share.

These results suggest that rail's performance on the major corridors relates largely to factors other than subsidised charges for road freight infrastructure. That said, there is clearly the potential to make charging for the use of road infrastructure more cost reflective (chapter 8), as well as to improve efficiency within each mode (chapter 10).

PART 3

8 Efficient pricing of road and rail: principles and reform options

Key points

- Charges for the use of both road and rail freight infrastructure should be set to recover the total costs of providing (efficient) freight infrastructure, and structured to avoid distorting consumption choices.
  – Prices charged to individual users of freight transport network services should at least cover the directly attributable costs of providing the services they consume.
- The technical feasibility of more finely-tuned road user charges, such as mass–distance and location-based charges, is a necessary but not sufficient condition for them to be economically worthwhile.
- Distance-based road user charges could provide an intermediate step from an input tax to a form of direct road pricing, but may not be worthwhile in their own right.
- Mass–distance location-based charges have the potential to bring substantial efficiency benefits, but may also entail substantial costs and would pose some formidable implementation challenges.
  – In particular, institutional arrangements for providing roads would need to change to help realise the full benefits of pricing reform, as well as to gain community acceptance for change.
- Despite commercialisation of rail infrastructure, prices may not be as efficient as they could be because of access regulation and structural arrangements, as well as government subsidies.

The terms of reference state that the purpose of the inquiry is ‘to implement efficient pricing of road and rail freight infrastructure through consistent and competitively neutral regimes, in a manner that optimises efficiency and productivity in the freight transport task and maximises net benefits to the community’. The terms of reference further specify that ‘prices charged should reflect all costs in each mode’, and note that ‘there are benefits in a national pricing regime’. The inquiry is specifically required to:

> … investigate options for transport pricing reform, including moving to mass, distance and location charging of freight transport. In considering distance based charging regimes the review will:

- consider principles and practical options for the structure of the different pricing regimes;
- estimate the impact of charging regime options, including on transport operators and users and specific locations;
- consider options for implementing any new pricing regime, including the practical costs and benefits of alternative technology options; and
- provide advice on options for the design of and timeframes for implementing mass distance location based charging regimes, taking into account adjustment issues. The review will not address fiscal implications which will be assessed by governments following the review's completion.

This chapter discusses and develops principles for efficient pricing of road and rail freight transport infrastructure, as well as examining the advantages and disadvantages of various pricing reform options, particularly for road use. Potential impacts of pricing options are also outlined. Recommendations for reform and implementation options are presented in chapter 11.

8.1 Introduction

Currently, unlike most other economic activities, there is no 'market' for road infrastructure services. Instead, road infrastructure is provided by all levels of government, with spending decisions based on economic or other criteria, and road freight transport providers taxed an amount broadly assessed to represent their 'fair' share of that spending.

Although much effort is made attempting to fine-tune current taxes and charges so that heavy vehicle road user charges in aggregate relate as closely as possible to the actual road costs they impose in aggregate, the flexibility of currently-available charging instruments is limited, as is the information base for attributing costs. This results in averaging of allocated network-wide expenditure across and within truck classes, such that charges are highly unlikely to reflect the cost of the actual road services individual trucks use. This has potential implications for the efficiency of road investment and use, as well as the efficiency of choices of truck and transport mode.

A crucial issue for this inquiry to assess, therefore, is the scope for implementing more cost-reflective road user charges, which would make them appear more consistent with rail charging arrangements. Importantly though, consistency does not require identical pricing structures to be applied across modes. Pricing structures that promote efficient use and provision within each mode generally also will promote competitive neutrality.

For road infrastructure, new technologies, such as GPS monitoring, potentially enable the use of more flexible charging instruments, which not only open up the possibility of more precise charging within the current institutional arrangements, but also the prospect of a shift to more commercial or market-oriented provision of road services, underpinned by road user prices rather than taxes. But the *technical* feasibility of more finely-tuned road user charges, such as mass–distance and location-based charges, is a necessary but not sufficient condition for change to be *economically* worthwhile. Whether or not changes to charging arrangements would deliver net benefits to the community will depend on a range of factors, including:

- *the structure and level of charges*. The capacity to monitor and charge for road use may not promote efficiency if charges are set at an inappropriate level. (Principles of efficient pricing are discussed below.) For example, while new charging technologies might generate additional information about road use, they will not of themselves improve understanding of the link between road use and road damage, which is needed for setting cost-reflective prices;
- *the scope for charges to encourage efficient behaviour by road users and providers*. In particular, whether responses to price signals are efficient is largely a function of the institutional and regulatory environment within which road infrastructure services are provided;
- *the transaction costs* of implementing, complying with and enforcing new systems, including technology costs; and
- *the adjustments costs and distributional effects* of change, and how these are addressed.

DRAFT FINDING 8.1

The technical feasibility of more finely-tuned road user charges, such as mass–distance and location-based charges, is a necessary but not sufficient condition for them to be economically worthwhile. In particular, the potential benefits of direct road user charging will be heavily influenced by the institutional setting within which such charging operates, as well as by the transaction costs of the pricing system itself.

In contrast to road infrastructure, rail freight infrastructure services — which are inherently more ‘excludable’ than road services — are nowadays provided by commercial entities, with variable charges able to be set to reflect much more closely the marginal cost of services consumed (subject to transaction costs of differentiating prices). That said, there are several factors that may lead to inefficient pricing of rail freight infrastructure including its natural monopoly characteristics, access regulation and government subsidies to certain rail freight services that compete with road.

8.2 Pricing principles for road and rail infrastructure

As noted earlier, the terms of reference state that efficient pricing of transport infrastructure should maximise net benefits for the community. Economic efficiency requires that appropriate quality goods and services are produced at the least cost, and that 'optimal' levels are produced and consumed, where these levels reflect the opportunity cost of resources and, importantly, the preferences of consumers. In a market economy, prices that reflect marginal social costs are central to bringing about efficient matching of supply and demand. They efficiently ration supplies of goods and services and the use of existing assets, provide information about the opportunity cost of using scarce resources, and signal the need for investment/disinvestment in a particular activity. Hence, if prices are 'right', so too will be investment.

Importantly, though, prices do not perform these functions in an institutional vacuum: they foster efficient outcomes only when their signals elicit appropriate behavioural responses. Where supply is centrally planned, for example, prices can ration demand (according to capacity and willingness to pay) and provide information, but do not necessarily bring about efficient production and investment.

Achieving the highest-valued uses of resources generally requires prices equal to the short-run marginal social cost for *all* goods and services, thus ensuring that choices across goods and services are 'competitively neutral', that is, they reflect their relative marginal costs. In competitive markets, absent externalities and other distortions, with constant or increasing average costs, pricing at short-run marginal cost (SRMC) also will ensure that average total costs are (just) covered over time — ensuring that efficient producers will receive a 'normal' rate of return on their investments, including an appropriate margin for risk. Consequently, producers will have an incentive to invest efficiently over time.

But the substantial and lumpy investments and economies of scope involved in road and rail infrastructure and, hence, decreasing average costs over substantial ranges of use, may render marginal cost pricing infeasible and possibly inefficient. As the Australian Logistics Council (ALC) observed:

> … encouraging efficient investment requires that the prices are set at a level that allows the investor to recover the full cost of its investment, including an appropriate rate of return. Pricing to encourage the efficient use of infrastructure, on the other hand, needs to focus on the marginal costs: the additional costs associated with a small increase in use of the infrastructure by infrastructure users with particular characteristics. Prices based on these marginal costs may not raise enough revenue to provide an incentive to invest in new infrastructure. (sub. 7, p. 3)

DRAFT FINDING 8.2

Achieving the highest-valued use of resources generally requires prices for goods and services being equal to their short-run marginal social costs. This would also ensure that choices are 'competitively neutral'; that is, that they reflect relative costs. However, the substantial and lumpy investments and economies of scope involved in road and rail infrastructure are likely to render short-run marginal cost pricing infeasible and possibly inefficient.

Efficient pricing of road and rail infrastructure

For both road and rail infrastructure, average costs are likely to be above marginal costs for significant ranges of use. In these circumstances, marginal-cost pricing (for all units sold) generally will not provide an adequate return on existing assets and, of greater relevance for economic efficiency, may not provide adequate incentives for infrastructure providers to undertake efficient investment over time, replacement or otherwise.[1] The challenge is to identify possible pricing options that meet the costs of providing efficient infrastructure services, while not significantly impeding efficient use of that infrastructure at the margin. The main pricing options are outlined in box 8.1.

At one end of the spectrum — and usually (although not necessarily) linked to government provision of the service — is marginal cost pricing combined with subsidisation of capital costs from general taxation revenue. At the other, are various self-financing options, including reliance on fluctuating short-run marginal cost pricing to deliver adequate revenue over the long term, average cost pricing, fully-distributed cost approaches, prices reflecting long-run marginal costs and multi-part pricing and/or Ramsey pricing. Some of these approaches can be combined. For example, the fixed or access component of a two-part charge might be varied according to willingness to pay.

1 In the absence of cost-based price regulation, natural monopoly providers will have an incentive to undertake investments that, on balance, reduce their costs.

Box 8.1 **Pricing options for road and rail infrastructure**

Short-run marginal cost (SRMC) pricing combined with subsidisation of fixed costs

Public provision of services subsidised from taxation allows prices to equal marginal cost, but there will be offsetting efficiency losses from raising taxes to fund public investment. In addition, there is a risk of inefficient investment and production because of the absence of market signals and commercial disciplines.

SRMC pricing (including congestion charging) over time

It is conceivable that, over the life of an asset, if demand increases over time and for long enough periods, total costs could (eventually) be recovered by SRMC pricing, because marginal opportunity costs will incorporate the marginal cost of supplying the service, plus congestion costs incurred by users. With large lumpy investments, SRMC pricing could mean losses for many years, with no certainty of ever covering costs.

Fully distributed (financial) cost approaches

Such approaches essentially allocate financial costs according to accounting rules or formulae. (The current approach used by the NTC to allocating road expenditure essentially is a fully distributed cost approach.)

Average cost pricing

Average cost pricing for all units sold will recoup total costs of provision but may lead to a significant efficiency loss (through forgone consumption) where marginal costs are significantly below average costs and demand is price sensitive.

Long-run marginal cost (LRMC) pricing

If prices are set equal to LRMC, users pay for the incremental operating and capital costs of their consumption of a service. However, common costs, which are not attributable, may not be recovered under this approach.

Ramsey pricing

Prices are set in inverse proportion to the price responsiveness of consumers, so that unattributable costs are recouped in a way that least distorts consumption and output.

Two or multi-part pricing

Multi-part pricing structures, allow common costs to be recouped via access or joining fees, incremental capacity costs via ‘flagfall’ charges and marginal costs via variable, use-related charges. While the variable charge encourages appropriate consumption by those who pay the entry fee (subject to income effects of the access charge), those with a low willingness to pay for the service may be excluded from consuming it at all.

Pricing for cost recovery

The terms of reference state that 'prices charged should reflect all costs in each mode', thus apparently ruling out short-run marginal cost pricing of road and rail freight infrastructure services (supported as necessary by funding of fixed and common costs from general revenue).

While an effective tax on freight transport (a production input) to pay for (at least some of) the unattributable costs of transport infrastructure may not be the least-distorting tax available, there are strong reasons for imposing a self-financing constraint on transport infrastructure, even though it may mean that consumption levels are somewhat less than the theoretical ideal. First, there is the risk of inefficient investment decisions if consumer willingness to pay for the total costs of providing the service is not tested. As observed by the Ministry of Transport NZ:

> How do we know that the road is justified in the first place? Society is better off with the road if the sum of the benefits to all users exceeds the sum of all the costs. If all traffics are meeting their SRMC, there is still no guarantee that collectively the benefits equal or exceed the total costs … Full cost recovery is thus a legitimate economic objective. (2005b, p. 19)

In addition, the model of subsidised government provision is (implicitly) predicated on omniscient, welfare-maximising provision of 'optimal' infrastructure. But experience shows that the absence of competition and a profit incentive, coupled with the availability of a subsidy to cover total costs, generally leads to inefficiently high-cost service provision.[2] Consequently, corporatisation and privatisation of public utilities in the 1980s and 1990s, coupled with the introduction of competition where feasible, significantly enhanced productivity and service delivery (PC 2006b).

Self financing also means that consumers/beneficiaries (as a group) pay for the service, rather than non-users, so that there is no redistribution of income arising solely from transport pricing. In this sense, self-financing can also be considered to be 'fair'.

DRAFT FINDING 8.3

Principally to provide a signal about net economic benefits and to allow arrangements that encourage more efficient service delivery, the total costs of providing freight infrastructure appropriately should be met from users of that infrastructure rather than from taxpayers in general. Self-financing is also 'fairer', in the sense that only beneficiaries of the infrastructure, in the aggregate, pay for it.

2 A subsidised private provider might also be inefficient, to the extent that shareholders allowed managers to appropriate or waste some of the subsidy.

Could short-run marginal cost pricing cover total costs?

Under certain conditions, total costs and optimal capacity expansion of the road network can be fully funded from prices set equal to short-run marginal cost, including the opportunity costs of congestion (Gillen 1997, Newbery and Santos 1999). Essentially, these conditions require divisible capacity and constant returns to scale in road construction, which may be the case where economies of scale in providing additional capacity are balanced by diseconomies of scope in providing additional pavement durability for heavy vehicles.[3] Drawing on work by Small et al. (1989), the Department of Transport and Regional Services (DOTARS) noted that:

> … twin marginal cost pricing of road wear (for heavy vehicles) and congestion (for all vehicles in peak periods or at other times when roads are congested) respectively could cover at least 80 per cent of long-term capital and maintenance costs for urban roads. (sub. 69, p. 2).

This suggests, however, that cost recovery would still require prices on average to exceed marginal costs, even in urban areas. Moreover, DOTARS went on to observe that:

> On non-urban roads in Australia, where there may be limited or no congestion, road infrastructure will exhibit some economies of scale. Consequently, charging users to achieve full cost recovery is likely to entail prices that substantially exceed the short-run marginal cost of use. (sub. 69, p. 2)

Nonetheless, even if there are substantial economies of scale and decreasing average costs, it is conceivable that short-run marginal (opportunity) cost pricing when capacity utilisation is being approached or has been reached generates sufficiently high prices to exceed average costs. Thus, over the life of the asset, if demand increases over time and for long enough periods, fixed costs could eventually be recovered by such pricing.

However, this pricing model normally is not adopted for major infrastructure for several reasons. Infrastructure users may value predictability of prices and, thus, enter into long-term contracts with providers to smooth the price peaks and troughs that otherwise would occur (for example, with prices more closely reflecting long-run marginal costs). Indeed, smoother pricing paths may send clearer signals to consumers about the costs of providing the service, particularly if long periods of low prices encourage inefficient investments (such as inappropriate location decisions) by users who expect low prices to continue indefinitely (IC 1992b).

3 This ignores numerous other costs not directly related to road construction including the cost of land and network traffic management.

Applied to the network as a whole, moreover, short-run marginal cost pricing (including a congestion charge) could mean that users of congested facilities, in effect, would cross-subsidise other roads that may never reach capacity. In this case, there could be a risk that congestion charges on some roads would be kept inefficiently high, by under-investing in capacity, in order to fund other uncongested roads. As Gillen notes:

> If the excess demand is in fact a reflection of past under-investment, then pricing is not the solution but rather the price required to 'clear' the market is so high as to provide prima facie evidence that investment should be undertaken. (1997, p. 215)

Such charging — which means that prices could reach very high levels in some periods — also often is infeasible for political reasons. (The public response to rising petrol prices of late is indicative.) Thus, typically, prices of road and rail, on average, will need to exceed short-run marginal costs to cover fixed and common costs. In any event, currently there is no congestion charging in Australian cities. Hence, the substantial capital costs of providing road capacity must be recovered from road users in other ways.

Ramsey and/or multi-part pricing

Even in the presence of large fixed infrastructure costs and a requirement for a natural monopoly to be (just) self-financing, efficient levels of output (consistent with prices equal to short-run marginal cost) may be feasible if there is no requirement to set uniform prices. Typically, this will require some form of multi-part or two-part pricing (for example, an up-front access fee for the first unit plus a variable charge for additional units), or different prices for different customers of the same, or different, goods and services (according to willingness to pay), or some combination of the two approaches. In this way, unattributable fixed costs can be allocated fully to customers, but with marginal consumers and/or marginal sales making little, if any, contribution.

As a result, the efficiency loss that otherwise would arise from average cost pricing could, in principle, be reduced or even eliminated, with marginal units sold at prices equal to marginal or avoidable cost. The limits of such pricing, in practice, are set by the transaction costs (particularly the informational requirements) of doing so, and the ability of the provider to prevent arbitrage across market segments.

Several participants supported recovery of fixed and common costs based on the principle of willingness to pay. For example, the South Australian Government commented that:

> … where marginal cost usage charges lead to under recovery of financial costs, efficient pricing requires that the revenue gap be raised with minimum efficiency loss.

> These methods take into account the overall benefit that the user is able to gain from having access to the infrastructure. They also acknowledge that different operators on different routes have the ability to earn vastly different rates of return. In contrast, fixed charges assume that all users are able to gain the same benefits and value the existence of or access to the system the same. (sub. 61, p. 5)

Queensland Rail likewise observed:

> … the recovery of common road costs should follow the pricing objective that is applied in rail (and other) infrastructure industries — namely that, prices should be set in such a way that minimises the distortions to consumption with the objective of recovering the full cost of infrastructure provision … In allocating common costs, distortions to consumption would be minimised where prices are charged so that products whose output is less sensitive to higher charges pay relatively more of the common costs. As for rail, such price discrimination is likely to be efficient and desirable because common costs constitute a significant proportion of the total road costs to be apportioned and different traffics have differing capacities to pay. (sub. 53, p. 7)

The fixed and common costs of both road and rail are significant. Road has the advantage that its substantial common costs can be spread across passenger as well as freight markets. (Rail also serves both passenger and freight markets but its passenger market on interstate and regional freight lines is much smaller than for road.) Rail has the advantage of information about the types of freight being carried and for some freight (for example, coal), there may be little haulage competition. Rail track operators therefore may have scope to discriminate more finely between types of freight than can road infrastructure providers (except where they operate single purpose lines).

If Ramsey pricing principles were applied to each mode, the mark-up over marginal cost for freight with the highest price elasticity of demand could be low. As freight that could switch most easily between modes would likely have relatively high modal price elasticities, prices for contestable freight in each mode may bear little mark-up over marginal costs, and the modal choice would not be distorted. In this case, discriminatory prices in each mode would bring about efficient output levels while covering total infrastructure costs (Ministry of Transport NZ 2005b).

DRAFT FINDING 8.4

Prices set to recover each mode's total costs, which accord as closely as possible to Ramsey principles, have the potential to promote efficient use of road and rail freight infrastructure, while meeting a self-financing requirement.

- *While users should be required to cover at least the marginal costs of their infrastructure use, their contribution to (unattributable) fixed or common costs should be inversely related to the price responsiveness of their demand for the* *services provided, thus minimising efficiency losses arising from discouraged consumption.*

Though efficient, such pricing may be regarded as inequitable, however, because those users with few alternatives (and, hence, less price sensitive demand) may be required to pay more. Moreover, given the information requirements and other hurdles, in practice, Ramsey pricing at best is likely to be applied in a ‘rough and ready’ manner. Nonetheless, even this is likely to be superior (in terms of efficiency) to other allocation methods.

Allocating common and fixed costs: implications for competitive neutrality

If Ramsey pricing could not be applied even roughly in either road or rail, then allocation of fixed and common costs could distort modal choice by distorting relative modal prices for contestable freight. Boiteux (1971) and others (box 8.2) show that to minimise distortion of the choice of transport mode, relative distortions from marginal cost prices in each mode should be equalised for contestable (demand interdependent) freight. Depending on the initial relative prices and demand elasticities, this could require, for example, increasing road charges to encourage a demand switch to rail, such that the gap between rail’s price and marginal cost was narrowed. Modal choice effectively would then still be based on *relative* marginal costs of road and rail.

This limited version of optimal taxation principles essentially would involve application of Ramsey pricing jointly across both modes. As for Ramsey pricing within a mode, this would require knowledge of the relevant elasticities and, furthermore, assumes the existence of a benevolent, omniscient planner.

Ramsey pricing and current rail and road charging arrangements

Anything like ideal Ramsey pricing is unlikely to be feasible in either mode in practice, and inevitably there will be some consumption foregone at the margin. For example, some above-rail operators complain that flagfall fees applied by some rail infrastructure providers discourage access by certain, particularly smaller, trains (see, for example, Great Southern Railway, sub. 12). Provided these potential users could pay for the marginal costs (including any congestion costs) of using the track, the access fee may be inefficiently deterring consumption of rail services at the margin.[4] There is some suggestion that the capacity of some below-rail operators to

4 Nonetheless, if a commercial (vertically-separated) infrastructure provider does not reduce its fee to provide additional access, this suggests that the costs of doing so outweigh the benefits. Differential pricing may be constrained by regulation, however.

discriminate in pricing may be deliberately constrained by competition regulation in some jurisdictions, even where it would not lead to monopoly profits (chapter 10). It may also be constrained by vertical separation of some rail operations.

Box 8.2 **'Optimal' taxation principles and transport pricing**

In the absence of marginal cost pricing for all goods and services (for example, because of decreasing costs), optimal taxation involves applying a set of taxes and subsidies that minimises distortions from marginal cost prices across the economy.

Baumol, Panzar and Willig (1982) apply the same principle at the industry and firm level. For example, where an industry must cover its costs, but one firm is making losses (for example, because of decreasing costs), it may be efficient to tax another profitable firm to subsidise it. If each firm in the industry is required to cover its costs, it may be efficient to tax one firm to shift some consumption and production to another exhibiting decreasing costs. The optimum is achieved where the marginal loss from raising the tax equals the marginal gain from reducing the cost/price (and increasing consumption) of output of the rival firm.

However, Baumol, Panzar and Willig go on to observe that 'autarkic' Ramsey optimality — that is, each firm efficiently covers its costs without regard to the effects its actions have on other firms — may be the 'best that generally can be hoped for in a decentralised market' (1982, p. 344). With independent pricing, any two firms producing the same goods in equilibrium must have equal marginal costs that equal the market price.

That said, pricing systems devised by infrastructure providers often are quite sophisticated. For example, Queensland Rail applies complex multi-part reference tariffs (sub. 53).

As discussed in chapter 4, under the present fully distributed cost approach to setting heavy vehicles charges, the common and fixed costs of road infrastructure are apportioned according to various allocation rules. Heavy vehicles pay for a range of capital costs of road considered to be attributable to heavy vehicles. Allocation of the large common costs of road according to vehicle kilometres travelled has attracted particular criticism, mainly because this allocation rule results in a relatively small proportion of common costs being allocated to road freight operators.

It is not clear whether application of Ramsey pricing to road would deliver markedly different outcomes than currently. DOTARS (sub. 69) suggested that both passenger and freight demand is inelastic with respect to price, albeit with freight demand somewhat less price sensitive. It observed that a fuel related charge might roughly approximate Ramsey pricing if demand elasticities across truck types are assumed to be roughly uniform. Commission estimates (appendix F) of freight demand elasticities by broad truck class also suggest that demand is inelastic, but that demand for freight carried by articulated trucks is somewhat more price sensitive than other freight categories. This could reflect greater scope for competition from rail in this market segment and/or greater price sensitivity of the type of freight (mainly non-bulk interstate freight) carried by articulated trucks. All else equal, this suggests that a relatively low allocation of common costs to articulated trucks might be reasonably efficient (chapter 4).

Heavy vehicles, in aggregate, currently meet their *attributable* short and long-run costs, and make some contribution to common costs of road infrastructure use. Particularly for heavy vehicles travelling on major corridors, current charges may be above the long and short-run marginal costs of them using these particular roads (chapter 4). For major rail corridors, access prices exceed marginal costs but appear to be well below the long-run costs of providing these services. Moreover, two or multi-part charging structures, if appropriately calibrated, would help to reduce marginal pricing distortions in rail. As noted by Ergas:

> … it might be desirable to increase road prices over marginal costs if rail prices were themselves above marginal costs. But it is not clear that this is the case for inter-modal freight, or if it is the case, that the extent of the gap is sufficient to make much of a difference, given the starting point in terms of relative prices: that is, given the fact that current variable road charges on the major and thicker north–south routes may themselves be above marginal costs. (PC 2006b, p. 305)

Overall, there would not appear to be a *prima facie* case for increasing road charges to correct for a marginal price distortion in rail.

DRAFT FINDING 8.5

Where transport modes are substitutable, and where pricing structures lead to disproportionate departures from marginal cost pricing in each, joint application of Ramsey pricing principles could minimise these distortions. In practice, the substantial informational requirements must be weighed against potential marginal efficiency benefits. Rough application of Ramsey pricing principles in each mode is likely to offer the best practical solution.

'Financial' or economic costs?

In principle, both road and rail freight currently are *expected* to pay their way, in the sense of covering total costs of the respective services. But what are the costs that should be covered? Under the PAYGO system, actual financial outlays on roads (capital and current) are recovered at the end of the period in which they are made, via a fully-distributed cost approach. For rail, on the other hand, total costs are the estimated long-run economic costs of providing services over time. The ALC expressed the view that

> … the focus … should be on the economic costs rather than financial costs. ALC readily acknowledges that it is much easier in practice to set prices on the basis of financial costs; as the Commission points out in the Issues Paper 'estimating economic costs in practice is not straightforward and, moreover, may be limited by data availability'. But in this case, as in many others, it is better to be approximately right than precisely wrong. (ALC, sub. 7, p. 2)

Both the ARTC and ARA (subs 11 and 33) argued that for consistent and competitively neutral pricing, road charges for freight users should be based on assessed economic costs of capital, preferably using a Depreciated Optimised Replacement Cost (DORC) methodology, which is applied to the ARTC network by the ACCC. This recommendation largely reflected a view that the PAYGO system provided a capital subsidy to road users (chapter 4).

The main *conceptual* differences between PAYGO and an *optimised* life-cycle methodology (such as DORC) are that under the latter approach:

- a rate of return and depreciation are paid each year to the asset owner (compared with an upfront payment for new capital assets under the PAYGO system); and
- annual payments are related to an assessment of the *efficient* costs of providing services into the future (the provision of which may not necessarily require using all existing assets and technologies).

As discussed in chapter 4, there is no *inherent* subsidy in a PAYGO approach relative to an annualised approach to recovery of capital costs, although there may be some intertemporal cross-subsidisation among road freight users if network capital spending is uneven over time. Intertemporal cross-subsidisation is cited as a possible source of pricing inconsistency leading to competitive non-neutrality between road and rail, because current road users may be benefiting from roads built and paid for by other road users in the past. This could be the case, for example, if there were little or no new capital spending being undertaken. However, as noted by Booz Allen Hamilton in a study for the Ministry of Transport New Zealand, if network spending is in a steady state and if it:

> … already includes an element of new capital expenditure, adopting a charge on capital need not result in additional costs to motorists at all. (Ministry of Transport NZ 2005b, p. 24)

In other words, if replacement of the network roughly balances the rate of its depletion, then charges under PAYGO and annualised approaches would be broadly similar.

A potentially major difference between the two approaches is that actual road spending may not be efficient. A DORC methodology (or any alternative approach involving optimisation) is intended to provide an estimate of the *efficient* costs of providing required services in future (with the objective of sending appropriate signals to infrastructure providers). In contrast, although a PAYGO system does not preclude efficient investment (which depends on the appropriateness of investment-decision making criteria), payments nevertheless reflect what is or has been spent, rather than the efficient costs of providing road infrastructure services consumed. The NTC noted:

> The PAYGO approach implicitly assumes that all expenditure decisions concerning the road network are … based on economic criteria and that the expenditure budget is optimised … There are a number of potential difficulties with this assumption.
>
> Firstly, a significant proportion of road agency budgets in Australia are allocated to roads where there is no economic justification for that expenditure. Community Service Obligations play a major role in the decision making process in constructing and maintaining certain roads. In Australia a significant proportion of the road network is provided solely for the purposes of amenity rather than being economically justified. This is particularly the case for local roads in rural areas where the level of road design provided is often in excess of what is economically justifiable given current and future expected usage. In this instance the level of this road expenditure is usually determined taking into account political or social considerations to meet the needs of particular interest groups. (sub. 73, p. 19)

If roads have been built, or built to a higher standard, for social or other non-economic reasons, it would not be appropriate for freight users to meet the full costs of these roads. On the other hand, some other roads may require major upgrades to maintain service levels. Without undertaking a full assessment of the efficiency of the road network (and the efficiency of construction and maintenance activities) it is simply not possible to conclude whether ‘efficient’ charges would be higher or lower than currently. (As noted by the NTC (sub. 73), the informational requirements for assessing economic costs for the network as a whole are likely to be formidable.)

The principal advantage of adopting a forward-looking, life-cycle costing and pricing methodology for roads would be a much closer link between road charges and road services consumed and provided. According to the NTC:

> The main advantage of the whole lifecycle cost approach is that it provides the best alternative to determine the optimum cost of maintaining the road network over a period of time ... In addition, the whole lifecycle cost approach allows for the optimisation of road network expenditure to achieve the required asset condition. It also establishes a direct relationship between road network expenditure and road user charges revenue as the present value of the lifecycle maintenance cost can be used as the basis for establishing road user charges. (sub. 73, pp. 31–2)

However, while charges could better reflect the economic costs of road service provision, their influence on investment decisions might be limited under the current institutional framework. While forward-looking prices are designed to give infrastructure providers appropriate incentives to deliver efficient investment, under existing institutional arrangements, whereby the consequent revenues do not accrue directly to road providers, this link is indirect, at best. For example, if road user charges increased, reflecting the long-run economic costs of providing efficient road services, there would be an expectation that over time, increased revenues would be spent efficiently to maintain and/or improve roads. But under current funding arrangements there could be no guarantee that road spending would increase to levels implied by higher charges, leaving road freight users paying for a standard of service they were not receiving.

On the other hand, if institutional arrangements for providing roads were to shift to a more commercial model, where the road provider assumes investment risk, a switch from the current fully-distributed financial costs approach, to direct road user charges based on economic costs, would be necessary (chapter 9). Again as noted by the NTC:

> A whole lifecycle cost approach opens up the ability to develop road user charges for different states, road types and even road sections (theoretically). Such charging would require technological advances that would essentially enable the tracking of different vehicles and the roads they utilise. (sub. 73, p. 32)

DRAFT FINDING 8.6

Ideally, prices should be set to reflect the economic rather than financial costs of providing infrastructure services, so that prices reflect the costs of efficiently providing services into the future, rather than actual capital costs already incurred. In practice:

- *Estimating the economic costs of the road network would be a challenging task, requiring judgements to be made about the appropriateness of existing road infrastructure and likely future requirements.*
- *To capture the full efficiency benefits of such pricing, prices reflecting economic costs should be able to elicit efficient investment. This requires institutional and incentive frameworks that link revenues to investment and which encourage price-responsive decision-making.*

How should land be valued?

Several participants (for example, Queensland Rail, sub. 53) suggested that road user charges should incorporate an annual rental for the land on which the road network is built.

Opportunity cost is the appropriate approach to land valuation from an economic efficiency perspective. It assists the government (and private investors in infrastructure) in making decisions on the efficient location of the network by signalling to users the land use costs of their transport decisions — their willingness to pay indicating that they value the current use of land more than its next best use.

But what is the appropriate concept of opportunity cost for estimating the cost of the land on which rail and road networks are built? For road and rail networks as a whole, the opportunity cost of land — its value in the next best use — is likely to be relatively low. Without a road network, for example, and the benefits of access which the network confers, alternative uses and, therefore, land values, are likely to be significantly constrained. Even in urban areas, the opportunity cost of land on which the road network is built may be quite low, *absent* the benefits of access conferred by the network. The implication is that there would be little to be gained from relocating the entire network. On rural corridors, the next best use of road and rail land would most probably be agricultural activities suited to particular areas, though even this use may be constrained without ready access to markets.

The answer is likely to be different, though, if the question were 'what is the appropriate cost of land to be factored into decisions about expansion or repositioning of roads or rail track?'. The opportunity cost of land then would be its current market value, including the access value conferred by the existing road and rail networks. In other words, decisions to claim additional land should take into account its current value, to test whether the particular project will bring net benefits.

Under the current PAYGO approach, land acquisition costs are incorporated in road expenditure, which subsequently is partially recouped from road freight infrastructure users according to cost allocation templates (chapter 4). But there is no explicit annual payment for land rental under a PAYGO system, just as there is no annual rental payment for capital. Moreover, most rail pricing regimes (except for Queensland) do not appear to include land in the regulated asset base (chapter 5 and appendix E). This would suggest that treatment of land in road and rail charging arrangements generally is consistent.

DRAFT FINDING 8.7

Opportunity cost is the appropriate approach to land valuation from an economic efficiency perspective. For road and rail networks as a whole, the opportunity cost of land is its value in the next best alternative use, without the benefits conferred by access to transport networks. For incremental road and rail projects, the appropriate land value is its market value without the project.

Subsidies, cross subsidies and community service obligations

Prices that embody subsidies (or taxes) can inefficiently distort consumption and production choices. Such subsidies and taxes also may involve unanticipated or undesirable redistributions of income.

A price is generally considered to be subsidy free if it is equal to, or exceeds, its directly attributable or incremental costs of production. In other words, as discussed in chapter 4, the pricing structure is considered to be 'subsidy free' if those otherwise paying for the road network pay no more when heavy vehicles also use the roads. For this to hold, heavy vehicles must at least cover their attributable costs (Faulhaber 1975).

DRAFT FINDING 8.8

Prices charged to users of freight transport network services should at least cover the directly attributable or incremental costs of providing the services they consume.

This does not mean that some subsidies to road or rail may not be justified:

- Some taxes or subsidies may promote efficiency — for example, if they correct a distortion such as an unpriced externality.
- Some apparent subsidies to rail or road infrastructure may provide services that benefit the community at large and the costs of which therefore are appropriately borne by all of the community rather than just freight infrastructure users.
- Strictly-speaking, a government subsidy to meet the fixed or common costs of providing infrastructure need not result in inefficient outcomes, *provided* the investment is efficient (and the tax raised to pay for the subsidy is non-distorting), and that the subsidy does not distort choices between modes. That said, such a subsidy would conflict with the express desire of COAG (for sound reasons) that freight users should cover the full costs of providing the infrastructure they use.

A critical question then for efficiency and competitive neutrality is to identify potentially inefficient subsidisation of a transport mode or service, or cross-subsidisation within a mode.

This is especially difficult under current network averaging of allocated road expenditure across broad truck classes. While the evidence suggests that, currently, trucks as a whole pay for their allocated share of road spending, the extensive averaging embedded in the PAYGO system gives rise to apparent cross-subsidies between trucks and truck classes. For example, the cost of services in the part of the network one user accesses might differ significantly from the network average. There are several other sources of potential cross-subsidisation created by averaging within the PAYGO system and by current road charging instruments, as well as problems of cost attribution between freight and other road uses (chapter 4). The extent to which alternative charging structures could reduce the degree of averaging, and give more efficient price signals to road freight users, as well as road investors, is discussed in the section below.

For rail, there may be implicit subsidies to government-owned rail infrastructure providers arising from tolerance of low rates of return. However, the extent of any subsidy is difficult to determine, given that rates of return may fluctuate over time in any market. Explicit subsidies also are paid to some rail freight networks and their users from time to time. While some of these are specifically to finance investment on major rail corridors, others often are described as payments to meet so-called Community Service Obligations (CSOs). As discussed in chapter 5, these payments often are effectively passed on to private above-rail operators via lower access fees. Payments for CSOs also are evident for some (especially rural) roads, where the level of use would not justify them but where there are considered to be wider social benefits. Some of the costs of these roads are borne by heavy vehicle users, as noted by the NTC:

> The current regime implicitly deals with community service obligations and industry subsidies through the averaging process within the pricing regime. Prices are currently based on average costs across four road types and usage within the various vehicle categories. This means that vehicles that operate below the average (low cost roads and low annual kilometres) are subsidising those that operate above the average (high cost roads and annual kilometres). (sub. 67, Summary, p. 1)

Both road and rail infrastructure provide a range of services in addition to freight services (for example, regional community access, pedestrian access to roads) which cannot feasibly be charged directly to beneficiaries, the costs of which are more appropriately borne by the community at large. For roads, an issue is whether some of the costs of providing these services are being met from freight users under current allocation arrangements. Effective taxation of road freight (an intermediate input) is unlikely to be the least-distorting way of funding roads built to deliver community benefits.

For rail, the absence of information about the objectives of such payments and how they might affect freight prices, raises the possibility that they are effectively providing subsidies to some services. As observed in chapter 5, greater transparency of CSO payments would provide greater assurance that such payments do not raise competitive neutrality issues. A more explicit enunciation of objectives might also foster greater consideration of how to achieve them as efficiently as possible.

DRAFT FINDING 8.9

To ensure that road and rail freight users are neither taxed to pay for, nor subsidised by, community service obligation spending, expenditure undertaken for such purposes should be undertaken in a transparent manner, with objectives made explicit and pursued in least-cost ways.

The costs of spillovers should be reflected in freight prices

The attributable costs of freight transport include the full social costs of freight haulage, not just the direct costs of providing and maintaining the infrastructure. With the exception of road congestion, most externalities related to freight are not derived directly or solely from the use of infrastructure — there is a range of other inputs (including fuel, vehicles and drivers) involved in the generation of external costs, such as accidents, noise and air pollution.

As discussed in chapters 3 and 6, efficient (lowest-cost) abatement of externalities, generally requires measures that target their source as directly as possible and take into account the marginal cost–benefit trade-off so that efficient levels of the externality are achieved. The cost of these efficient abatement measures should then be efficiently reflected in the costs (and prices) of freight.

'Efficient' prices also must take into account transaction costs

Although it is desirable to match prices of a good or service as closely as possible with the costs of supplying a particular good or service, in practice, the transaction costs (including the costs of gathering information and adjusting price schedules, as well as costs incurred by consumers) of implementing prices that precisely match marginal costs are likely to preclude such pricing, even in competitive markets. Hence, inevitably there will be a considerable degree of price averaging — over time, across customers and units sold. A commercial operator, for example, will weigh the additional revenues from introducing more cost-reflective pricing against the additional costs of doing so, including any additional costs incurred by customers (which could reduce what they are prepared to pay the supplier). For this reason, it is unlikely that efficient charging would require cost estimation and attribution to the *n*th degree. Consequently, introducing more cost-reflective pricing for road infrastructure use in order to promote consistency and competitive neutrality between road and rail, without taking into account transaction costs, could lead to net efficiency losses.

DRAFT FINDING 8.10

The transaction costs of achieving greater pricing accuracy must be weighed against the potential efficiency benefits.

8.3 Road infrastructure pricing reform options

Principles for efficient pricing provide a guide for change from current arrangements, but the extent to which they can be implemented is limited by a number of factors, including the feasibility of pricing instruments. Until recently there simply has been no cost-effective *direct* road pricing instrument.

Most of the discussion regarding road pricing reform centres on mass–distance and location-based charging, which have the capacity to reflect the costs of road use more accurately than fuel taxes and registration fees. While technological developments have greatly improved the technical feasibility of such charging instruments, the extent to which they generate net efficiency benefits, in economic terms, depends on their implementation costs versus the benefits they bring. The latter will be a function of the efficiency gains from more accurate price signals, provided costs of using roads can be accurately established and charged for. These benefits may be large or small, depending on the size of desirable price changes and the responses to them, and whether some responses are constrained (for example, because of regulations or institutional arrangements).

Moreover, in addition to efficiency objectives, infrastructure pricing proposals inevitably will be assessed against other criteria including fiscal implications for governments, and the acceptability of impacts on communities, consumers and producers.

The Commission is not in a position to undertake a full cost–benefit analysis of various options for road pricing reform. Nevertheless, the potential advantages and disadvantages of major options, as well as their technical feasibility, are discussed. Potential efficiency, intermodal and distributional impacts are also examined, although these impacts depend largely on the assumed application, structure and level of charges, as much as on the charging instrument itself. Discussion of potential impacts is also hampered by a lack of information about current patterns of road use by heavy vehicles. Implementation issues and ramifications of different pricing options for institutional arrangements are also examined. Overseas experience with mass–distance charging is discussed in appendix D.

Mass-*distance* charges

While the term mass–distance charging tends to be used generically to describe all direct forms of road user charge, a charging system that monitors distance only, and one that monitors travel by location (and possibly actual load mass) are very different in their application and impacts.

Measuring distance travelled by heavy vehicles over a defined period appears to be the most technically feasible option for road pricing reform (box 8.3).

Box 8.3 **Measuring *distance* travelled**

Options available for measuring the distance a vehicle travels include on board units (OBUs) — such as odometers or hubodometers — distance licence systems, or toll stations at the entrances and exits of particular roads.

The technology, or combination of technologies, used will be influenced by the policy option adopted. A policy to charge for the distance travelled in total might require different technology to that which would be employed if distance charges are to be varied by road type or time of the day.

Various options for monitoring distance have been implemented internationally. Often a combination of technologies is used for verification purposes. For example, hubodometers are used for verification of paper licences in New Zealand, the OBUs used in Switzerland use a combination of global positioning systems (GPS) and microwave technology and Germany's OBUs combine GPS and mobile technologies (appendix D).

Some countries use time rather than (or as a proxy for) distance travelled. For example, Belgium, Denmark, and Sweden use time-based charges (for 3, 6, 9, or 12 month periods) are used. These charges are scaled according to the damage the vehicle causes to the road infrastructure and the environment (that is, by vehicle and emission class). This is similar in operation, although different in purpose, to Australia's current system of vehicle registration charges.

In its simplest form, mass–distance charging would involve accurate measurement of the distance travelled by trucks over a particular period, but not according to particular trips. Within the current network-wide charging system, this would reduce the need for averaging of costs within truck classes, because actual distance could be measured. Unlike fuel excise, mass–distance charges could also be readily differentiated by truck class, reducing the need for variations in registration charges to reflect different attributed costs.[5]

[5] The NTC stated that a differential fuel excise is infeasible because it would be 'extremely costly administratively, and potentially subject to rorting'. (sub. 17, p. 68)

With currently available technologies, mass–distance charges could not differentiate trucks by their *actual* load mass on particular trips or even on average (box 8.4). This might necessitate assuming a single maximum or average weight/loading for each vehicle in a class and then applying the charge by the distance travelled. This approach is used in New Zealand (where the heavy vehicle charging system assumes vehicles are un-laden 55 per cent of the time), Switzerland (where a connected trailer is assumed to be fully loaded), and Germany (where the trailer load is determined according to the number of axles).

Potential benefits of distance charging

The major potential benefits of mass–distance charging, where charges necessarily are still based on network-wide costs, would be to give users a somewhat better signal about the average network damage they impose (influencing their use of the network), and to reduce somewhat the amount of cross-subsidisation between heavy vehicles within the current network cost allocation parameters (table 4.3).

However, it is not unambiguously the case that removal of one level of averaging within the current system would improve efficiency. For example, it is conceivable that those trucks currently travelling more kilometres each year than the average for their truck class, use roads for which the attributable costs, on average, are lower. In other words, because it is not clear which trucks benefit from, and which are disadvantaged by, network averaging of costs across different types of road, it is uncertain whether distance-based charges would exacerbate or alleviate cross-subsidisation. The efficiency impacts of mass–distance charging will also be affected by the level and structure of charges.

Perhaps the greatest potential benefit of mass–distance charging is that it is a ‘price’ rather than a tax. As discussed below, this could facilitate a more direct institutional link between road user charges, revenues and road spending.

Potential costs

As noted above, distance-based, network-wide charging schemes for heavy vehicles are in place in several countries. The administrative and enforcement costs of schemes operating in New Zealand and Switzerland, for example, are less than 10 per cent of revenue collected, although these figures exclude compliance costs incurred by transport operators (including the costs of installing technology). While these costs are significantly lower than for location-based charging systems (see below), they are significant and must be weighed against the potential efficiency benefits, not the revenue collected.

Box 8.4 **Measuring truck mass**

Accurate determination of mass may be the most difficult aspect of implementing mass-distance-location charging.

Currently-available options for monitoring vehicle mass include strategically placed weigh-in-motion (WIM) stations or the determination of vehicle weight (by static weighers) and axle information at depots before and after each trip.

WIM technology describes equipment installed in roads or on roads to weigh vehicles as they pass over them. This technology relies on a 'mass sensor' which produces a signal from the instantaneous dynamic wheel mass of a moving vehicle.

WIM systems usually also contain a vehicle classification and/or identification sensor — options include the use of a picture or video image and/or the use of 'smart cards' carried on board the vehicle, which interact with a base station adjacent to the WIM system — a processor and data storage unit and a user communication unit. There are approximately 18 different WIM system types currently being used in Australia. The most common of these is the CULWAY system of which there are over 140 installations Australia wide (Austroads 2000).

In a report on weigh in motion technology, Austroads suggest that:

> ... the location in which the mass sensor is installed will significantly influence its performance. Many different mass sensors have been trialled, giving acceptable and accurate results in the laboratory … Unfortunately, very few of these sensors, when installed in a road pavement, exhibit anywhere near laboratory achieved results. (2000, p. 2)

On-board weighing technology is equipment that is built into a vehicle and weighs the vehicle or axle loads during its journey. This technology is already used by some Australian transport operators for commercial purposes and its accuracy is considered to be reasonable. However, on-board weighing technology currently does not appear to provide adequate rigour for regulatory application. The IAP feasibility project found that while vehicle identification, location, time, distance travelled and speed could be identified within an 'acceptable' level of accuracy with current technology, trailer identification, real-time non-compliance reporting and vehicle mass needed further development (Austroads 2003).

Several operability issues also need to be addressed. For example, currently, there is no unified standard in Australia that would allow any prime mover system of identification and weighing to communicate with any prime mover in-vehicle unit (Austroads 2000).

Potential distributional effects

The distributional impacts of distance-based charging will depend on the types of freight carried by those trucks travelling more than average distances each year. It is often assumed that this would disadvantage freight carried from and to rural and remote areas. However, road freight carried on longer trips to rural areas may not pay more: it could be the case that articulated trucks travelling many shorter, inter-capital trips (for example, between Melbourne and Sydney) travel greater than average distances (compared with their truck class) each year. Thus, without detailed information about what freight is carried where by trucks travelling the longest distances each year (and for which charges would rise compared with current charging arrangements), distributional effects are uncertain. For trucks travelling shorter distances, of course, all else equal, charges would fall.

As discussed in appendix G, the Commission has modelled a road pricing scenario in which current cost allocations are met in full across truck classes. In a sense, this scenario approximates simple mass–distance charging because existing under- and over-recoveries between vehicle classes (reflecting the limitations of the fuel excise) would be eliminated. Although, for reasons noted above, it is not possible to say how *individual* trucks would be affected (within vehicle classes), charges for articulated trucks would rise on average. While all the impacts are estimated to be extremely small, not surprisingly, relatively higher charges for articulated trucks induce some shift in road freight from articulated to non-articulated trucks and to rail (figure G.2).

Implementation and institutional issues

Distance-based charges would still require charges to be based on whole-of-network costs because they would provide no information about which roads particular trucks or truck classes were using. Therefore, mass–distance charges of themselves need involve little or no change in current arrangements for *setting* road charges.

However, by replacing the diesel fuel excise for heavy vehicles, and possibly some part of registration charges collected by the States and Territories, tax revenue streams would likely be affected. In particular, a move away from road user taxes to a pricing instrument (even though still quite blunt) raises the issue whether it is appropriate for the revenue from such charges to flow into consolidated revenue. The alternative is for revenues to flow directly to a body charged with allocating revenues to road projects, such as a road fund. As discussed in chapter 9, a road fund has the potential to improve the efficiency of road spending. The independence of a road fund, in turn, is likely to be heavily dependent on its ability to access a dedicated stream of revenue. While a road fund could be financed from hypothecated fuel and other road-related tax revenue, a mass–distance charge potentially could provide an independent, direct revenue stream.

Other major implementation issues include the need for all heavy vehicles to have appropriate on-board technology (unless paper-based distance monitoring systems are used in parallel); the costs of this technology; the period over which the system is to be implemented; and development of appropriate monitoring and enforcement arrangements.

Another important consideration is the need to use technologies that can be adapted to provide more finely-tuned pricing over time, such as location-based charging systems, if this were considered to be a desirable longer-term objective. Distance-based charges thus could establish a ‘platform’ for the introduction of location-based charges.

DRAFT FINDING 8.11

Introduction of simple mass–distance charges solely to remove one of many levels of averaging in the current system may not justify the costs (and possible distributional impacts).

- ***However, distance-based charges could establish a ‘technological’ platform for location-based charging, providing an intermediate step from an input tax to a form of direct road pricing.***
- ***Mass–distance charges also could provide a dedicated (and certain) source of funding for a road fund.***

Mass–distance *location-based* charges

An extension of network-wide mass-distance charging is to differentiate charges by location, sending signals according to the type and location of road being used. The monitoring of location would allow heavy vehicle charges to vary by road type and, therefore, potentially more accurately represent the costs users impose on different parts of the road system (assuming these different costs can be measured with reasonable precision).

Once charges can be varied by location, they also could incorporate time-related, location-specific congestion charges and possibly target some other externalities. They also could track actual vehicle mass by location, when reliable and cost-effective weigh-in-motion technologies become available.

Internationally, as far as the Commission is aware, there is no example of charges being varied by location to account for the varying damage done to different road types by a vehicle, although some systems have limited capacity to track vehicle location (mainly to ensure they keep to authorised routes) (appendix D). The Intelligent Access Program (IAP) in Australia similarly aims to monitor compliance with designated higher-mass truck routes, rather than to facilitate charging by location on a wider scale.

While location-based charges have the potential to facilitate more accurate road infrastructure pricing, they inevitably break down averaging of network-wide costs. As discussed below, this would necessitate significant changes to current institutional arrangements.

Box 8.5 **Monitoring vehicle location**

The monitoring of a vehicle's location could be achieved by one or a combination of tolling stations, communication beacons, driver logs and OBUs, including GPS technology. Driver logs and/or GPS systems could be cross checked by the random placement of beacons/cameras in the same way as speed restrictions are enforced.

Telematics could be used to collect charges, possibly in real time, in a manner similar to current eTolling arrangements. The use of telematic technology for commercial vehicles — both large transport operators and small fleet operators — is increasingly being used for fleet management purposes (Austroads 2003). The IAP provides heavy vehicles with improved access to the road network in return for monitoring of compliance via vehicle telematic means.

The implementation of location based charging would require accurate mapping of Australia's road system in order to ensure all roads are categorised.

There are two broad approaches to implementing location-based charging:

1. Charges could be set to reflect marginal costs of using particular roads or road types, with an access fee (such as an annual registration or other charges) reflecting a contribution to network-wide capital costs.
2. Alternatively, location-based charges could be calculated on a 'stand-alone' basis. For example, two-part charges for a particular road (such as a major corridor) or road type could reflect the operating and capital costs of that road or road type. Such an approach is advocated by the ARTC (sub. 11), at least for major corridors where road and rail compete.

The potential benefits of location-based charges

The main potential efficiency benefits of location-based charging are:

- improved signals to road users about the marginal damage their road use imposes, discouraging them from using roads unsuited to heavy vehicle use and vice versa; and
- improved signals to road providers about the demand for road capacity and quality (such as pavement durability), with the potential for more efficient road provision.

In short, the main potential benefits of location-based charging come from more efficient use of the existing network and from the provision of a more efficient network over time.

The Australian Local Government Association agreed, observing that:

> Mass distance charging, combined with the adoption of appropriate technologies, offers a more precise link between road use and road damage. It also offers the opportunity to provide appropriate price signals to promote optimum use of the road system and particular freight routes, including at the local level. Additionally it provides opportunities to invest in the road system to provide levels of service that equate more accurately to usage. (sub. 42, pp. 4-5).

DOTARS suggested that substantial benefits of location-based charging would come from:

> … shifts in the pattern of heavy vehicle road use — away from lower standard, higher marginal cost roads to higher standard, lower marginal cost roads — induced by application of differentiated axle-load road wear based charges. (sub. 69, p. 13)

This, in turn, they suggested could lead to more efficient road spending. In particular, DOTARS observed that benefits could come from a more direct link between charge revenues and road expenditure because, currently, road spending may be budget constrained and, as discussed earlier, not always 'economic'. The ALC stressed the need for such a link if the full benefits of more cost-reflective road user charges were to be harnessed:

> … pricing improvement may lead to improved *road use* behaviour (the demand side response to improved pricing) but there is no mechanism by which it can lead to improved *investment* behaviour (the supply side response to improved pricing). This is particularly important as there is some reason to believe that the economic returns from the supply side response are likely to be very much higher than the economic returns from the demand side response. (sub. 7, p. 4)

Estimating the potential benefits of location-based charges is not straightforward, however. As noted above, transport efficiency has been less of an objective of new road pricing systems introduced overseas than revenue raising. The NTC reported estimates of productivity gains from replacing existing restrictions on some heavy vehicles accessing the network with pricing, which suggest that the benefits from more efficient use of the existing network could be large:

> A mass distance charge, however, has the potential to revolutionise the way roads are used. The major efficiency is the increase in utilisation of roads with greater mass limits. The benefits of operating at higher masses are conservatively estimated to be around five times the costs. Therefore, greater wear of roads (particularly those designed at a high service standard) can be easily justified by the increased benefit associated with that wear. (sub. 17, p. 71)

This would remove one type of distortion, but not that brought about by network averaging of costs. Moreover, the estimates of benefits could be distorted by the averaging of road costs — if a high-cost road were priced to reflect the actual costs of its use rather than the network average, the mass limit may then have little effect.

The Australian Livestock Transporters Association (sub. 38) presented case studies suggesting that non-price barriers to road use effectively impose a tax of between 15 and 20 per cent on the transport of livestock to Dubbo, while the lack of a link between pricing and road provision led to significant road bottlenecks.

Various studies suggest that improved road infrastructure price signals could bring about significant productivity gains in the road transport sector, including from improved investment decisions (box 8.6).

Box 8.6 **Potential efficiency gains from location-based charges**

Preliminary modelling undertaken by Victorian Treasury in support of the National Reform Agenda estimated that improvements in the road pricing structure would lead to productivity increases of 5 per cent as well as improved road cost savings. (VicDTF 2005)

Recent studies, including an OECD report (2006a), have found that efficient road infrastructure investment induces productivity increases in an economy. Infrastructure spending on an established road network, however, would not be expected to elicit such large gains in productivity as those experienced during the completion of such a network. The infrastructure spending envisaged for Australia encompasses productivity gains associated with both the augmentation and upgrade of a network.

Source: appendix G.

The Commission has modelled a five per cent productivity improvement in the road freight sector as an ‘outer envelope’ response to more cost-reflective pricing, which results in both ‘static’ and ‘dynamic’ efficiency gains. On this basis, GDP would increase by around 0.25 per cent or $2 billion (2004 dollars). However, these estimated gains exclude the costs of implementing monitoring and billing systems and the compliance costs incurred by operators (discussed below).

Potential costs

The cost of implementing a location-based road user charging system are likely to be substantial. Costs could be reduced if such charging were limited to parts of the network (although this could also compromise the benefits). Location-based charging overseas does not apply to entire networks but, in some cases, is applied to significant parts of networks.

For example, in Germany, truck use of autobahns (about 12 000 kilometres of road) is electronically monitored and charged for. The cost of this system is high, however, with an annual administration and enforcement cost of around $1 billion, or almost one quarter of revenue collected. As noted earlier, these costs (*plus* the compliance costs incurred by truck operators, which are not included in the $1 billion) should be compared with the efficiency benefits, not the revenue. (A major objective of a number of road charging schemes operating in Europe has been to charge foreign trucks in transit. Therefore, the efficiency impacts on truck operators and freight costs have not been a major concern.)

Although the German system is considered to be among the costliest, even if the cost for Australia were half this amount (around $500 million per year), this would require a permanent increase in productivity of at least 1.25 per cent for the road freight sector. A New Zealand study (New Zealand Business Roundtable 1997) estimated that location-based charges for New Zealand highways would cost the equivalent of about 40 per cent of annual expenditure on those roads. Although productivity benefits of this order of magnitude could be achieved, the lower the costs the better, especially where the magnitude of efficiency gains may be uncertain. This suggests that there would be some benefit in using pricing technologies that 'piggy-back' on tracking technologies already used by truck operators.

The substantial costs also underscore the need to ensure that appropriate institutional, regulatory and incentive arrangements are in place to encourage the largest possible benefits. For example, cost-reflective prices will not deliver the full potential for efficient responses if road use is constrained by regulation or if investment responses are constrained by funding and institutional arrangements.

Potential distributional impacts

The distributional impacts of location-based road user charges are likely to be pronounced, precisely because current network averaging would be dismantled. Even if location-based charges only applied on some roads (such as the major corridors) this would have implications for charging for the rest of the network (because the remaining network spending 'pool' would be reduced).

As discussed in chapter 4, the available, albeit limited, evidence suggests that the costs of heavy vehicles using major corridors may be considerably lower than the costs of them using lightly used arterial and particularly local roads. As noted by the South Australian Government:

> For freeways and highways, the links are more complex. With respect to pavement costs, on these more heavily constructed roads, pavement depths are designed

> specifically with heavy trucks in mind. At the same time, once those pavements are built, marginal pavement usage cost is low because the pavement is designed to accommodate heavy trucks … On the other hand, capacity costs on these roads are determined by overall truck and passenger vehicle traffic levels. (sub. 61, p. 10)

The Victorian Government also observed the likely impact of traffic levels for location-based charges:

> The Victorian Government also notes that the aggregation and averaging of cost data leads to cross-subsidisation on the basis of location. This occurs because of the large differences in the numbers of heavy vehicles using different parts of the network. For example, location based charging would be likely to result in relatively lower unit prices for access to high volume routes like Melbourne to Sydney, as opposed to low use routes. (sub. 55, p. 4)

Hence, with economies of scale in road construction with respect to pavement depth, not only are the marginal costs of heavy vehicles using major corridors likely to be lower than current network averages, but unit capital costs are also likely to be lower because of high traffic volumes. Conversely, the costs of local roads, including local rural roads, are estimated to be substantially above current network average costs. Coles Myer observed that:

> Moving to a location pricing model, would seriously disadvantage many retailers, who by necessity must be located in or near residential areas. Additionally road user charges related to distance travelled and marginal road damage would disadvantage regional communities competing for local and international markets and relying on road transport for all items brought into the region. (sub. 47, p. 9)

The NTC likewise observed the potential for significant adverse impacts on regional communities reliant on road transport, due in part to the lack of alternative transport modes in these areas:

> … some communities may face greater differential pricing. Rural and regional areas are particularly susceptible to this due to the associated long distances, road types and lack of scale economies associated with low traffic density. A movement away from the current approach of average prices across road types and within vehicle classes is likely to result in a considerable price decreases in transport for some locations and considerable increases in others. The impact is heightened by the general lack of an alternative form of transport. Normally higher prices would provide an incentive for modal shift — i.e. movement of freight from road to rail. However, most rural and regional areas have only limited, if any, access to the rail network. Therefore the ability to mitigate the increased transport costs is limited. The choices for freight users in some locations in response to higher prices that reflect the true cost of using the relevant roads are therefore to reduce road use, relocate or accept lower profit levels. Thus, a move to direct pricing may have significant distributional and transitional implications, which would need to be managed in some way. (sub. 67, p. 1)

Potential adverse distributional impacts do not undermine the case for pricing reform but, as the NTC observed, would have to be managed. Queensland Rail (QR) observed that such impacts had been a feature of other reforms:

> Consideration of how losers might be compensated is an important component of the reform process but is not unique in the Australian reform processes over the past decade. (sub. 53, p. 3)

Direct payments by governments to support access to remote and regional communities (CSO payments) are an obvious method of achieving this. Indeed, in many ways, explicit CSO payments for road access would be superior to the current approach which does not allow easy scrutiny of road expenditure undertaken on social rather than economic grounds. Again, as noted by the NTC:

> The problem with the current approach is that the cross subsidy is non-transparent and very indiscriminate. Recipients of the benefit may not be targeted beneficiaries.
>
> Going forward it is expected that community service obligations will become more transparent. This is always preferable as it is clearer who is being targeted and whether the approach taken is being successful in achieving the objective. (sub. 67, Summary, pp. 1-2)

As noted earlier, greater transparency in funding CSOs, with objectives made explicit, would help to ensure that these objectives are met in least-cost ways.

Mass–distance location-based charges would also have implications for modal choice and the rail freight transport sector. If charges for heavy vehicle use of major corridors were to fall, this could *intensify* competition between the two modes. Higher road charges for rural roads would assist rail where the two modes were in competition (for example, for some bulk freight tasks), but could reduce demand for both road and rail freight where the two modes complemented each other.

Implementation issues

There are numerous implementation issues that would need to be resolved before introducing mass–distance location-based charges, including:

- *Application of the charges to trucks and roads.* Location-based charges might be applied only to a subset of vehicles (for example, only articulated trucks), or a subset of roads (for example, major corridors and arterial roads). Partial application of location-based charges might be a step towards more comprehensive road user charges, and could be targeted to address major perceived problems with current network averaging. (For example, any intermodal distortions could be addressed by application of mass–distance location-based charges on major corridors only). However, the partial introduction of road user charges by truck class or by road type would give rise to ‘boundary’ issues by applying different charging arrangements for different types of road or vehicle.

- *How should the charges be set and who should set them?* Location-based charging requires reasonably accurate knowledge of the costs of different trucks using particular roads, or road types, if road-specific charging is to deliver efficiency gains. For consistency, although charges could vary across roads and jurisdictions, there would need to be an agreed mechanism for calculating and setting charges, and a single billing system.
- *Charging for fixed and common costs — stand alone or network-wide?* Location-based marginal cost pricing coupled with network-wide averaging of capital and common costs would send signals to road users and government owners about the short-run costs of using particular roads, but not the long-run costs. In addition to some ‘unfairness’ because users of high marginal cost roads would effectively cross-subsidise users of high capital cost/low marginal cost roads, the disconnect between revenue and road spending would remain. The alternative is to treat different roads/road types on a stand-alone basis. Covering total road costs by location, as for rail, would reveal whether certain roads, built to a certain standard, should be maintained at that standard, downgraded or, indeed, upgraded or expanded. But, as discussed earlier, under current road funding and institutional arrangements, the link between such signals and investment decisions is indirect at best. Stand-alone location-specific charging would also likely require annualised costing of assets, to smooth capital charges across users as the asset is consumed.
- *Charging for passenger vehicles.* Even if the location-based charge is not applied to passenger and other light vehicles, ‘stand-alone’ location-based charging for heavy vehicles would require road owners to receive revenues raised from petrol taxes or registration charges to allow appropriate funding of the road infrastructure. (Congestion charging obviously would require direct charging of light vehicles.)

Institutional implications of location-based charges

As road charges become more disaggregated, the greater the institutional implications. As for distance-based charges, location-based charges would affect revenues from fuel taxes and possibly registration fees, raising the question of where the revenues should flow. Revenue from location-based charges *could* flow into consolidated government revenues, as they do currently, although this would likely limit the potential benefits to the efficiency gains from better signals to road users, and possibly better informed road spending decisions. However, the benefits of improved price signals may not necessarily be reflected in spending decisions if revenues do not flow to road providers, linking demand for and the supply of roads. Institutional arrangements then would need to be altered to allow road agencies to both collect revenues and provide and maintain roads, subject to meeting enunciated objectives. Institutional arrangements consistent with direct road user charging are examined in chapter 9.

Adjustment costs and community acceptance

Overseas experience strongly suggests that new road user charging schemes are successfully implemented only where the community understands and supports the objectives of the schemes, and net community benefits can be demonstrated. Distributional impacts are also important. Indeed, according to Tsolakis et al.:

> … to render marginal cost pricing schemes publicly acceptable it is necessary to recycle the revenue generated in such a way as to keep most population subgroups at least equally well off. (2006, p. 38)

Austroads also note that hypothecation of revenues is regarded 'as an essential element in terms of achieving new charge acceptance' (2006, p. 39). A number of participants to this inquiry expressed a similar view, including, for example, the Western Australian Local Government Association:

> … 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. (sub. 15, p. 13).

In this sense, institutional reform in road funding and provision are as important for community acceptance of road user charges as they are for bringing about the largest possible efficiency gains from them.

In addition to these high level requirements, any pricing scheme would also need to be relatively simple to understand and comply with, including, for example, having a simple, single billing system.

DRAFT FINDING 8.12

Mass–distance location-based charges have the potential to bring substantial efficiency benefits. But they also could entail substantial costs and pose some formidable implementation challenges. In particular, institutional arrangements for providing roads would need to change to deliver the full benefits of pricing reform. This suggests that a cautious, incremental approach would be warranted to allow satisfactory resolution of these issues.

8.4 Rail pricing reform options

Issues in pricing reform for rail infrastructure are quite different from those for road infrastructure pricing reform because below-track rail operations already are run along commercial lines. Instead, issues relate mainly to the impact of access regulation (and also structural arrangements) on pricing efficiency, as well as the impact of government contributions on access prices.

Access regulation and vertical separation of rail freight operations could be affecting the ability of below-rail providers to set prices in a way that allows them to recover a greater amount of total costs, reducing their reliance on government assistance. For example DOTARS noted that:

> Regulations that facilitate third-party access to infrastructure may undermine objectives of cost recovery, through siphoning off the benefits of investment to third parties. (sub. 69, p. 17)

These issues are examined further in chapters 10 and 11.

Some participants also raised the efficiency of some rail pricing structures, suggesting that there was scope for more finely-tuned pricing and greater flexibility within those structures. According to the South Australian Government:

> In rail freight, the Australian Rail Track Corporation (ARTC) charges a flagfall rate, and a variable rate based on gross-tonne-kilometres. The charges apply equally to all users. This is a simple model to administer and is transparent, but has been designed around large inter-modal trains.
>
> Alternatives to gross-tonne-kilometres could be developed that more accurately reflect an infrastructure "consumption" model. This could consider the effects of different train types and charge in proportion to the amount of asset used (this is similar to the use of "friendly suspensions" for trucks and their ability to apply higher axle loads). Peak load pricing may also be worth consideration. (sub. 61, p. 10)

If ARTC is operating in a fully commercial manner, presumably it will assess the costs and (revenue) benefits of adopting different charging arrangements. But, in addition to the possible influence of access regulation on pricing structures, there remains a question about the commercial focus of government-owned rail entities. As discussed in chapters 10 and 11, the Commission sees some benefits in stricter application of the commercialisation model to government-owned rail corporations.

9 Reforming road institutions

Key points

- The institutional arrangements which underpin any road-use pricing regime are important to its success and to the overall efficiency of the road freight sector.
- Road pricing policies will have the capacity to achieve more efficient outcomes (strengthen market discipline, and influence supply and demand the most) when there is an explicit link between road-user prices, revenues received and efficient road expenditures.
- In Australia, however, road infrastructure is funded primarily through governments' consolidated funds, as part of the annual budgetary process. While the present charging arrangements, in principle, allow sufficient revenue to be collected to recover recent *past* road expenditure, there is no systematic relationship between road-user prices and decisions about desirable *future* road expenditures.
  - Present road funding arrangements potentially lead to inefficiencies and distortions in road management and investment decision-making.
  - Future road infrastructure requirements in Australia will increase, placing greater pressure on the current road funding model.
- Full implementation and application of the AusLink decision-making framework across all jurisdictions would likely lead to some improvement in road investment decisions. However, it is yet to be seen how effective the AusLink processes will prove to be in practice.
- Options for institutional change include road fund and public utility models. Each seeks to bring a more commercial approach to road provision and funding, and to strengthen the financial discipline on investment and expenditure decision-making.
- While running roads more like a (government) business would help align road demand and supply, there are, presently, serious limits to what is both feasible and desirable, including:
  - the capacity to charge directly for the provision of road services;
  - the need to address monopoly, access and interconnection features of the road network; and
  - the resolution of constitutional, legal, political, and administrative issues that arise given existing roles and responsibilities in Australia's federal system.

The institutional arrangements which underpin any road-use pricing regime are important to its success and to the overall efficiency and productivity of the road freight transport sector. This chapter identifies obstacles and distortions to the efficient provision and funding of roads that arise from the current institutional arrangements. A number of alternative approaches to the provision of roads which might help to overcome deficiencies in the current arrangements are examined. They range from measures aimed at strengthening the existing institutional arrangements for managing and funding roads to a more commercial approach to the provision of road freight infrastructure.

9.1 Deficiencies in current funding arrangements

It is generally accepted that road pricing policies will strengthen market discipline, and influence supply and demand the most, when there is an explicit link between road-user prices, revenues received and decisions about future road expenditures to be undertaken (Heggie and Vickers 1998; Roth 1996; Newberry and Santos 1999).

In Australia, while there is a link between revenues received from heavy vehicle road-user charges and road expenditure on account of heavy vehicles, it is, in effect backward-looking. That is, charges are set to ensure that revenues received match recent *past* road expenditures. So, even if road transport agencies were somehow to be assured of receiving the revenue generated from current heavy vehicle charges, there would be no direct connection between the revenues they would receive and (appropriately evaluated) efficient *future* levels of road spending attributable to heavy vehicles.

In practice, however, with some exceptions (box 9.1), the linkage between revenues received and efficient future levels of road spending is fractured in a number of respects.

- The revenues received by Governments from heavy vehicles, for the most part, are treated as general revenues and road transport agencies must compete with the bids of other budget-funded public sector agencies for their funding allocations.
- The revenues from charges and taxes on light vehicles' road-use not only also flow into general revenues, they bear no relationship at all to either current road expenditure or (efficient) future road funding requirements. Even if road agencies were to directly receive revenues from appropriately set heavy vehicle charges, they would be reliant on Governments allocating to them an appropriate share of revenues from light vehicle road-use to fund future road expenditures.

- There is a substantial mismatch between road-use related revenues received by different levels of Government and their road expenditure responsibilities: intergovernmental grants offset this to some extent, but there are questions about their 'adequacy' and about incentives they might create which could distort efficient decision-making.

Box 9.1 **Some relationship between road revenue received and road spending**

At the Commonwealth level, all road-user related revenues received from heavy and light vehicles are treated as general revenues. An exception is Federal Interstate Registration Scheme (FIRS) revenues, which are collected by the States and Territories according to where the relevant heavy vehicles are registered, deposited with the Department of Transport and Regional Services (DOTARS), and then allocated to the States and Territories according to a tonne kilometre (tkm) formula.

At the state level, Victoria, Western Australia, Tasmania, the ACT, and the Northern Territory, all treat registration revenues as general revenue and road spending allocations are determined in the budget context. However, there are some exceptions:

- In Victoria, a $17 increase in base motor vehicles registration fees (annually indexed) introduced in 2003 is allocated to the Better Roads Victoria Trust Fund managed by VicRoads and the Department of Infrastructure (with a special emphasis on projects that contribute to economic development).
- In Queensland, while registration revenue is treated as general revenue, it is largely allocated to the road agency for spending on roads, but with Treasury oversight of spending decisions. In South Australia, there is formal hypothecation of registration revenue to the Highways Fund, but Treasury oversight of spending from the Fund.
- New South Wales is a stand-out case. All road-user related fees and charges are paid (hypothecated) into the Roads and Traffic Authority Fund and spent at the discretion of the NSW Roads and Traffic Authority.

The absence of a systematic relationship between heavy vehicle road charges, and decisions about future road spending was identified by a range of participants as the key 'road governance' issue in Australia that needs to be addressed (box 9.2).

Box 9.2 Disconnect between road revenues and expenditures

Participants in the inquiry raised, as a key issue, the institutional disconnect between road prices, revenues, expenditures and investment:

> The circle that characterises typical commercial relationships is broken. Revenue that is derived from road user charges flows into general revenue, and there is no systematic relationship, even at the aggregate level, between funds made available for investment in roads and the revenues that are gathered from road users. (Australian Logistics Council, sub. 7, p. 4)

> Another feature of the current arrangements is the institutional separation of decision-making on investment and access prices. Decisions regarding expenditures on road infrastructure are made by government road agencies at various levels of government and independently of pricing decisions made by the NTC and of revenues generated by the charges. (ACCC, sub. 44, p. 5)

> A major policy issue for consideration during the review is the linkage between past and future expenditure on transport infrastructure with the revenue raised through charging for its use. While this appears to be less of an issue overall for the rail system, it is a major issue for the road system, with no clear linkages evident to users. (Tasmanian Government, sub. 36, p. 3)

> This inquiry has potential to increase charges for road use, consistent with costs imposed by users. However, no mechanisms are in place to ensure that funds collected in relation to use of the local road system by freight vehicles are returned to Local Government to supplement their revenue base and allow upgrading … (Local Government Association of Queensland, sub. 30, p. 2)

> … there is [currently] little relationship between the cost of maintaining freight transport infrastructure, the revenue raised from the freight sector by the fuel excise or expenditure by the Commonwealth on roads. (New South Wales Government, sub. 50, p. 14)

DRAFT FINDING 9.1

Under current institutional arrangements, heavy vehicle road-user charges are set, in principle, to recover current road spending allocated to heavy vehicles, rather than to fund efficient future levels of road expenditure. Moreover, for the most part, the revenues received from the charges are treated as general government revenues rather than as funds directly available for spending by road agencies. There is no systematic linkage between how charges are set and the revenues they generate, on the one hand, and decisions about desirable future levels of road funding, on the other.

9.2 Implications of the 'disconnect' in road demand and supply

There are potential efficiency impacts

Various participants in the inquiry raised concerns about the efficiency consequences of the disconnect between road charges, revenue received and funds available for future road expenditure and investment (box 9.3). The potential distortions and inefficiencies include:

- *Poor investment signals* — Charges paid by road users do not fulfil the normal functions of prices in the market place. Ideally, pricing signals would flow through to investment by indicating to road managers which parts of the road network are most valued by users. However, currently, road expenditure and investment decisions are determined as part of the annual budgetary process. Heavy vehicle charges reflect network-wide costs actually incurred, rather than providing signals to budget decision-makers about the value transport operators attach to use of different parts of the road network.

  There can be high costs associated with inappropriate investment decisions, the existence of which may influence the efficiency of the road sector for long periods after initial construction (for example, over-investment in low value parts of the road network and underinvestment in high value parts of it). Poor investment choices today can lock road users into suboptimal usage patterns for the future.

- *Incentives to protect road assets* — Strong incentives currently exist to protect or preserve road assets rather than make better use of them. Road agencies can be reluctant to allow increased mass, knowing that this will lead to more rapid deterioration of 'their' asset without any assurance that they will receive the revenue required to maintain or enhance it. At the same time, from the perspective of road users, there is no effective mechanism to allow them to choose to pay for a higher level of asset consumption, irrespective of the potential productivity gains.

- *Lack of certainty in investment* — Because roads currently are financed from general revenues, road agencies effectively compete for funds against other government policy priorities. This creates a level of funding uncertainty and can leave road funding vulnerable as political priorities change and fiscal constraints arise. Unpredictable budget funding can be particularly problematic for managing large road construction projects, most of which last many years. It can also mean that annual road maintenance and rehabilitation expenditure may be vulnerable to budgetary stress.

Box 9.3 **Participants' views on the efficiency implications of a disconnect between road revenues and expenditures**

A number of inquiry participants pointed to the potential efficiency losses and other distortions arising from the absence of a systematic link between road charges, revenues and expenditures.

Poor investment pricing signals

> Pricing will only improve investment decisions if it results in more direct linkage of revenue and expenditure. The [current] lack of this linkage in the road sector would suggest that it would be difficult for pricing signals to flow through to investment. (NTC, sub. 17, p. 79)

> [the current] … institutional arrangements for the ownership and management of roads, including the receipt of revenue and allocation of funding, do not signal or facilitate efficient investment. (Queensland Rail, sub. 53, p. 88)

> For as long as this continues to be the case, one of the two main benefits of improved infrastructure pricing – better signals on what investment is justified and where – cannot be realised in the road sector. (Australian Logistics Council, sub. 7, p. 4)

Incentives to protect road assets

> Since the [road] agencies are effectively rewarded for reducing internal cost rather than for maximising the net value of services provided, they have an incentive to limit the service capabilities of the assets provided and impose prescriptive regulations on the way in which roads can be used. (Australian Logistics Council, sub. 4, p. 5)

Funding uncertainty

> Because [road] agencies do not receive direct funding from infrastructure users they are subject to the budget process for capital and maintenance funding and compete with other departments and agencies. Budget allocation is based on cost benefit analysis as well as political priorities. This can create uncertainty on future funding. (NTC, sub. 17, p. 19)

Road charges 'just another tax'

> Thus the revenue from the variable component of the heavy vehicle road charging regime, the diesel fuel excise, becomes part of consolidated revenue. As a road user charge the diesel fuel excise, although stated in terms of 20 cents per litre … is essentially indistinguishable from the fuel excise paid by motorists in general. (Engineers Australia, sub. 5, p. 7)

> While formally these payments are described as a road user charges, in practice they are treated as a tax. (Australian Logistics Council, sub. 7, p. 4)

Acceptability

> … the Australian Government should not increase heavy vehicle charges without a commitment to return funding to the freight network. The failure by the Australian Government to commit to re-investing increased fuel excise charges into freight infrastructure under the Third Heavy Vehicle Determination was a major obstacle to reform. (Queensland Government, sub. 40, p. 4)

> This lack of a relationship between charges and expenditure was raised as an issue during consultations on the Third Determination. (Tasmanian Government, sub. 36, p. 3)

Other consequences

Road charges are perceived as 'just another tax'

Unlike for users of rail freight infrastructure, who generally pay charges (flagfall plus variable) set for each 'stand-alone' freight haul, charges for road freight infrastructure users consist of a combination of an upfront annual registration charge unrelated to actual road use and an indirect use-related charge embedded in diesel fuel prices. Not surprisingly, given this, heavy vehicle charges are widely regarded as taxes rather than 'prices paid for services'. Correspondingly, even though under current institutional arrangements for setting heavy vehicle charges, an increase in charges would reflect an actual increase in spending attributable to heavy vehicles' road use, proposals to increase charges are likely to meet the same resistance as tax increases typically receive — and for similar reasons: there is no capacity for those paying the charges to respond to inappropriate or inefficient expenditure decision by withholding their financial contributions, or diverting them to alternative suppliers.

There is weak accountability to road users

Because expenditures on roads are determined as part of periodic allocations of public funds, rather than in direct response to demand, the accountability of road managers is to Government, not road users. That accountability to Governments, moreover, is likely to be more about whether monies are spent as appropriated, and whether expected *outputs* were delivered, than about whether *outcomes* best met the needs of users.

If road users wish to influence the way the road network is managed, they have to engage in the political process to obtain changes in budget allocations and priorities. This can be a time consuming and difficult way to effect change, including because the priorities voters want to signal span a mix of different policies.

DRAFT FINDING 9.2

Heavy vehicle road-user charges, as currently determined and applied, understandably appear to road operators more like taxes than prices. Moreover, they offer, at best, weak signals to decision-makers about the desirable level and pattern of future road spending and, combined with funding arrangements for road spending, create incentives for road managers to preserve existing road assets rather than facilitating their optimal use.

Is there adequate investment in the road network?

A variety of studies suggest that investment in road infrastructure in Australia may not be adequate.

In their recent report on the infrastructure needs for Australia, *Infrastructure: Getting on with the Job,* the Committee for Economic Development Australia (CEDA 2005) note:

> Much of Australia's infrastructure is at a crossroads. Following two decades of under-investment, vital elements of the nation's infrastructure are in serious disrepair, if not crisis. Australia's infrastructure – investment sunk in land, such as roads … is struggling to cope with the cumulative demands of Australia's sustained period of economic growth
>
> There is a serious backlog of infrastructure investment, in water, energy and transport, estimated at $25 billion, which require immediate attention. (p. 5)

Empirical work carried out by Econtech for the Australian Council for Infrastructure Development suggested that road infrastructure underinvestment in Australia is about $10 billion (Econtech 2004).

In their 2005 Australian Infrastructure Report Card, Engineers Australia rated the adequacy of road infrastructure poorly, with national roads being only adequate overall, despite upgrade work on the eastern seaboard. (The relative ratings were: *national roads C+, state roads C, and local roads C*-). Engineers Australia (2005) point to the need for an increase in investment in key infrastructure (including roads) in Australia:

> Infrastructure renewal studies undertaken within various infrastructure sectors throughout Australia have generally found that the level of investment in infrastructure renewal and maintenance is not sufficient to maintain service level standards or achieve the best lifecycle cost outcomes. There is an immediate need for increased funding for maintenance and renewals. (p. 8)

Engineers Australia (2005) also note that inadequate provision of road infrastructure in Australia, in particular, relates to shortcomings of the current funding mechanism:

> One of the major concerns of Engineers Australia has been the level of funding allocated to maintenance of Australia's road infrastructure. Existing infrastructure is, in some cases, in a disturbing state …
>
> … Lack of funding for infrastructure is a fundamental issue. Budgetary commitments to critical infrastructure elements are often only short-term … There are numerous competing priorities for limited funds and there is little provision for funding to address changing community expectations and levels of service.

> … Recent public debate has emphasised the need for much better funding mechanisms to provide for current infrastructure needs and, just as importantly, to provide infrastructure for future generations (pp. 3–9)

The recent NSW Auditors-General's performance audit of the condition of State roads reported that their structural condition and expected life is declining as a consequence of deferred road rebuilding works:

> While the level of rebuilding may fluctuate around the long term target, the RTA [Roads and Traffic Authority of NSW] has not achieved its target at any time this decade. The average expected life of State Roads is 40 years, but the current rebuilding rate means that RTA will need to get 83 years out of them on average. While still in service, 16 per cent or 3,000 kilometres of the network has reached its expected life and its future performance is unpredictable. (The Audit Office of New South Wales 2006, p. 4)

In developing the AusLink strategy for the Brisbane–Cairns corridor, DOTARS (2006h) identified the relatively poor condition of the road pavement as one of the six key strategic issues for the corridor, with some sections of road pavement 'already over 30 years old and have major safety deficiencies' (p. 7).

Supported by detailed case studies, the Australian Livestock Transporters Association (ALTA) argue that suboptimal investment in the road network has led to infrastructure bottlenecks that have stopped certain roads being uprated for modern heavy vehicles:

> … The main constraints to uprating of the roads identified in the case study include inadequate length of turning lanes, short merging lanes, low bridge heights and insufficient line-of-sight for multi combination vehicles to undertake turns without disrupting through traffic. (sub. 38, p. 2)

In addition, the ALTA notes that the current prescriptive regulations and infrastructure bottlenecks have resulted in a productivity barrier to their industry, effectively amounting to a tax:

> The ALTA believes these non-price barriers [failure to adopt best-practice regulation] impose a significant "tax" [between 15 and 20 percent] on the [costs of the] road transport sector and, hence, users of road transport services. The non-price barriers arise from the failure of some state governments to adopt best-practice regulation of road users. They also result from the presence of "infrastructure bottlenecks" that have stopped certain roads being uprated for use by modern multi combination vehicles. (sub. 38, p. 1)

While it can be difficult to empirically determine the extent to which efficient investment is taking place across the road network, these studies suggest that there is inadequate or distorted investment in parts of the Australian road network. However, within this inquiry, the Commission has not been able to undertake the detailed analysis necessary to make conclusions on the overall adequacy of road investment.

DRAFT FINDING 9.3

Current road funding arrangements potentially lead to inefficiencies and distortions in road management and investment decision-making.

The Commission is not in a position to assess the many claims suggesting that road infrastructure expenditure is, and has been for some time, inadequate. However, a range of evidence suggests that there is scope to improve investment outcomes by making decisions more responsive to the needs of road users.

9.3 Pressures on the current road funding model

As noted previously, the demands on Australia's road transport infrastructure are expected to increase in the future, with a projected doubling of the freight task within 20 years:

> Freight forecasts from the Bureau of Transport and Regional Economics (BTRE), generally regarded as Australia's leading transport research organisation, suggest that the land transport freight task will double within the next 20 years. These conclusions are generally supported by others working in this field and validated in the Department of Transport and Regional Services AusLink White Paper. (SKM 2006, p. 7)

Given that economic growth is contributing to most of the future road infrastructure requirements then, provided there is proportional growth in public revenues, there should be sufficient public funds to finance most of the requirements. However, this may not necessarily be the case for a number of reasons.

First, the freight task is projected to grow faster than GDP growth (BTRE 2006b).

Second, there currently are, and increasingly will be in the future, pressing public policy issues competing for scarce taxpayer funds, such as rising health care needs associated with population ageing (PC 2005a). DOTARS has observed:

> Requirements for increased public spending on transport infrastructure will be harder to meet in the face of budgetary pressures, lack of land, and the effect of growing environmental and social costs. (DOTARS 2004, p. 14)

Third, there can be community resistance and political unwillingness to have tax burdens grow in line with income growth (OECD 2006b). This is relevant to heavy vehicle charges, which are regarded as taxes rather than prices paid for road services. The failure of the National Transport Commission's (NTC) Third Determination could be seen as a manifestation of this.

The current road funding model in Australia can be expected, therefore, to come under increasing pressure in dealing with future road infrastructure requirements and other challenges facing Australia's national road network.

DRAFT FINDING 9.4

Future road infrastructure requirements are expected to increase substantially, placing greater pressure on the current budget-based road funding system. Alternative funding arrangements increasingly will need to be considered.

9.4 Institutional approaches

It is generally agreed that there are flaws in Australia's current institutional arrangements for charging heavy vehicles for the costs associated with their use of the road system, and for the allocation of funds to meet future road infrastructure needs. What is not immediately obvious, however, is what reforms to road pricing and funding, and to the institutional arrangements that would be needed to support and sustain them, would be feasible as well as desirable.

Several participants to the inquiry emphasised that the potential success of any new road pricing framework is necessarily dependent on complementary institutional reform.

> … one of the most important functions of improved infrastructure pricing is to encourage and reward investment in infrastructure. But improved pricing will only do this if it is supported by an appropriate fiscal framework and institutional structures. (Australian Logistics Council, sub. 7, p. 4)

> … the road sector is hindered by the failure to link pricing signals with investment ... Pricing reform will be limited in its impact if the institutional arrangements are not addressed. (NTC, sub. 17, p. 93)

> The reform of road pricing will require reform of the current institutional arrangements for heavy vehicle charges and the provision of road infrastructure, including the objectives of road agencies, their governance structure and their funding arrangements. (Queensland Rail, sub. 53, p. 86)

Strengthening decision-making processes

A starting point for considering improvements to current road provision and funding arrangements are measures aimed at strengthening the *current* road-related decision-making processes. A well functioning road infrastructure funding mechanism should include a clear project selection process, strong stakeholder involvement and public transparency (OECD 2006b). This is consistent with the new decision-making framework developed as part of the AusLink apparatus — *The National Guidelines for Transport System Management 2004* (the 'Guidelines'). The AusLink methodology aims to improve 'transparency, consistency and clear objectives in assessments' for transport planning and project appraisal across all Australian jurisdictions, including AusLink (ATC 2004a) (box 9.4). A number of participants expressed support for the AusLink approach. For example, Pacific National (PN) note:

> The good news is that the Australian Government already has in place a framework within which pricing issues can be addressed as part of a strategic approach to land transport infrastructure. Despite the current limitations of AusLink, this process can be modified to provide more efficient, competitively-neutral outcomes for freight market transport challenges in key corridors. (PN, sub. 41, p. 3)

In support of road project decision-making, the principal elements of the AusLink methodology include:

- strategic merit tests to assess how well a project fits with the Government's objectives;
- cost–benefit analysis at the detailed level; and
- a business case that brings together the results of the strategic merits test and detailed cost–benefit analysis together with any other analyses (for example, financial and environmental) relevant to the particular project. (DOTARS 2006b)

The AusLink decision-making framework has been endorsed by the Australian Transport Council (ATC) and is intended to be progressively implemented across all jurisdictions. However, full implementation as envisaged may take time, because:

- the approach proposed in the Guidelines represents a substantial shift in the approach to transport planning and management;
- it is recognised that different jurisdictions will be differently placed to move to the new approach; and
- in a number of jurisdictions, investment programs for the short-term have already been committed to by Governments.

Box 9.4 National Guidelines for Transport System Management

The Australian Transport Council Guidelines are intended for use by anyone developing or appraising a project proposal for government funding. Importantly, the Guidelines have been developed collaboratively by all levels of Government in Australia.

Specifically, the Guidelines aim to:

- serve as a *national* approach to strategic planning and project appraisal for land transport;
- complement and inform the existing practices in individual jurisdictions;
- be applicable to road, rail and multi-modal infrastructure projects, and to non-infrastructure proposals that improve the management of transport infrastructure;
- promote consistency in the way proposals are assessed within the same mode and across modes, and by different jurisdictions and individual analysts;
- promote transparency, consistency and clear objectives in assessments; and
- provide a framework for strategic planning and for appraisal of specific proposals by *all* jurisdictions in Australia, including AusLink.

Source: ATC (2004a).

Nevertheless, full and timely application of the guidelines across all levels of Government in Australia would be desirable. However, the success of the AusLink framework in supporting and improving road investment decision-making will depend on how rigorously the methodology is applied to project planning and appraisal in practice. In particular, the integrity of the funding decision-making framework relies on decision-making being undertaken in a transparent and consultative way, with full engagement of interested parties.

DRAFT FINDING 9.5

Full implementation and application of the AusLink decision-making framework across all jurisdictions would likely lead to some improvement in road investment decisions. However, it is yet to be seen how effective the AusLink processes will prove to be in practice.

Alternative models for institutional change

While strengthening approaches to evaluation of proposed freight infrastructure projects or programs might have a substantial pay-off in terms of how public sector funding is allocated between competing proposals, there remains significant potential for improving road funding decision-making through reforms to the institutional frameworks that support decision-making processes. A key requirement would be that decisions about funding and charging should reflect, to the greatest extent possible, how a commercial operator of road infrastructure would set and structure prices (‘charges’) and determine future expenditure — capital as well as recurrent.

A range of potential institutional reforms could help achieve a more commercial approach to road provision and funding, and a better connection between road demand and supply. Running roads more like a business inevitably involves devolution of decision-making and responsibility for road provision and funding (box 9.5). It also necessarily means a greater capacity to charge directly for road access and use.

Although numerous variations are possible, there are, in essence, four broad models:

1. *Departmental model, with hypothecation of road revenue* — roads are managed, and investment decisions made, through a government department, as is done currently, but with hypothecation of revenue from road taxes and charges to fund road investment and expenditure.
2. *Dedicated Road Fund* — devolution of responsibility for management and funding of roads to an autonomous road fund manager/agency. Dedicated sources of revenue are paid directly to the Fund, usually from specific road-related taxes and charges, and separate from governments’ consolidated funds. The Road Fund is responsible for the allocation of road funds in an efficient and transparent way.
3. *Public utility model* — involves the commercial operation of publicly owned roads. In this model, financially viable road companies are established which have responsibility for all or parts of the road network. Road companies are owned by Governments but governed along commercial lines — with a management board, statement of corporate intent and profit objectives (that is, reasonable returns on capital). Road companies have the authority to charge road users directly for road access and use.
4. *Privatised model* — full private ownership and management of at least parts of the road network. Road companies would directly charge road users and be subject to all business laws as well as government regulation of monopoly features of the road network.

Box 9.5 The road provision and funding task

The provision and funding of road infrastructure can be considered in terms of the following key road-related tasks:

- Setting overall road-related outcomes.
- Undertaking project appraisals.
- Deciding on the aggregate level of expenditure on road provision.
- Deciding how that expenditure is to be allocated between different projects — new construction, rehabilitation and maintenance of existing roads.
- Supervising project delivery to ensure decisions have been implemented efficiently
- Charging for the use of roads.

The way in which these tasks are undertaken can differ considerably, depending on:

- who is responsible for undertaking the task;
- accountability for outcomes achieved; and
- how performance is monitored.

The institutional options involve a different mix of accountabilities, responsibilities, independence (from political influence) and transparency of decision-making in carrying out the road provision and funding task. The capacity of the different institutional approaches to align road demand and supply, and therefore improve the overall efficiency of investment and ultimately the road network, will largely depend on the extent to which they promote a more *direct* relationship between:

- road use and road charges;
- road service providers and road users; and
- road revenue, and road expenditure and investment.

While some institutional options may provide a basis (or step) for moving to other approaches, particular elements from different options may be considered desirable. The relevant questions are what are the key institutional features that would improve governance of the road network; and to what extent would they address the identified shortcomings in current arrangements for road pricing and for road provision and funding.

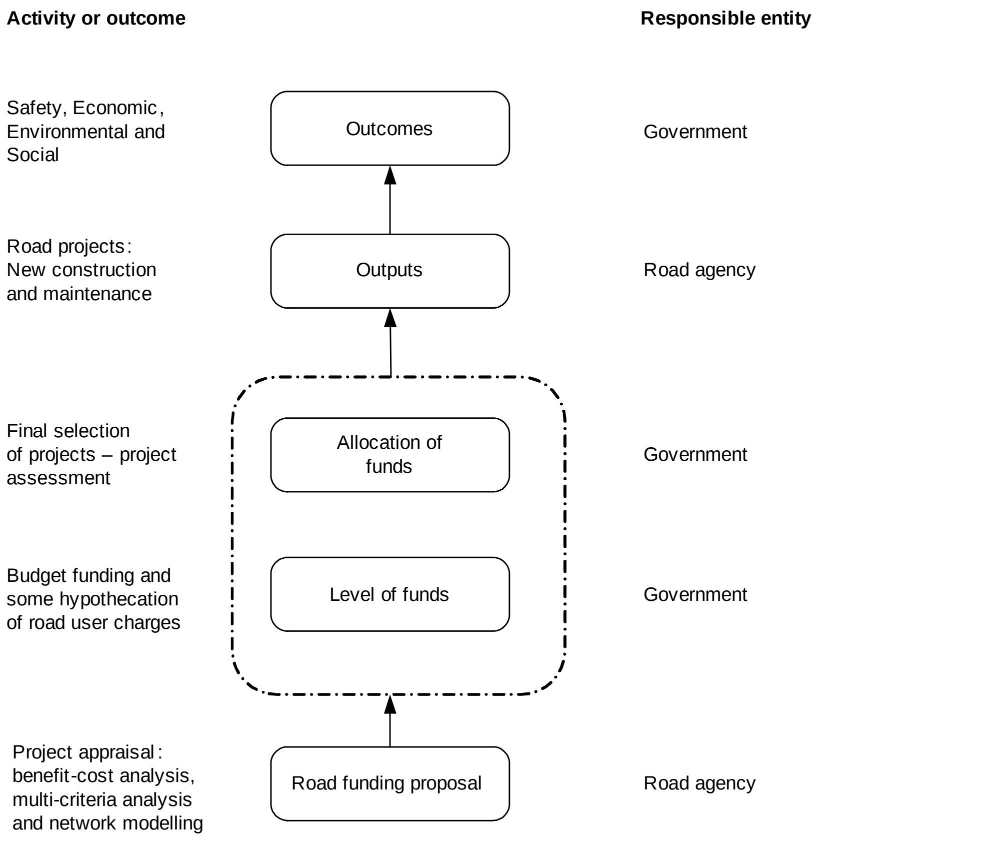
The key features and relative merits of each model are examined, as well as important issues that would need resolution in seeking to implement them in Australia.

9.5 Departmental approach, but with hypothecation?

The existing departmental approach

Under the current 'departmental' model of road provision, Governments make decisions about the aggregate level of funds to be invested in road infrastructure for any particular year and the allocation of those funds. It decides what road projects will be undertaken, including the balance between road maintenance and new construction. Government road agencies are primarily funded from consolidated revenue appropriated through the annual budget process, with some hypothecation. Figure 9.1 provides a stylised illustration of the relevant tasks and accountabilities in the existing departmental model.

Figure 9.1 **Current departmental approach**



Once decisions have been made on what road projects will be undertaken and the necessary funding is provided, it is then the responsibility of the road agency to deliver the approved projects. The road agency is primarily accountable to government for delivering road projects. Road authorities are essentially managed and funded as a government department, rather than a commercial entity. Unlike corporatised Government Trading Enterprises (GTEs), for example, road authorities receive virtually no income from their services.

Given the lack of direct charging for road use under the department model, performance monitoring of road authorities by Government can be difficult. Governments cannot readily use traditional measures of financial performance to monitor directly the performance of road agencies. Instead, oversight and performance monitoring has the tendency to focus on the extent to which approved projects have been completed ‘on time and within budget’.

The willingness of Governments to fund road programs is determined by the priority that is placed on roads relative to other government programs, in the context of overall available budget funding. In practice, road-related investment and expenditure decisions typically are constrained and influenced by a mixture of political and institutional considerations, as well as by community expectations. Annual budget allocations for road funding may therefore bear little relationship to underlying needs or to users’ willingness to pay. As Heggie and Vickers (1998) note:

> [With budget allocation] There is no hard budget constraint (that is, no direct link between revenues and expenditures), no price to ration demand (do users want more or less of particular road services?), and expenditures are not subjected to the rigorous tests of the marketplace (how much road spending can the economy afford?). (p. 19)

The NTC point to a level of investment uncertainty from budget funding:

> Because agencies do not receive direct funding from infrastructure users they are subject to the budget process for capital and maintenance funding and compete with other departments and agencies. Budget allocation is based on cost benefit analysis as well as political priorities. This can create uncertainty on future funding. (NTC, sub. 17, p.19)

The Government is directly accountable to the electorate for road-related outcomes. However, current funding arrangements do not readily allow road users to signal their preferences to road operators. The primary mechanism road users have to influence the way the road network is managed, and investment priorities determined, is to operate through the political process to effect change.

DRAFT FINDING 9.6

The departmental approach to funding road provision is characterised by poor accountability to road users, the absence of pricing that is responsive to costs and demand, and the lack of a systematic link between road revenues and efficient future expenditure. It provides a weak connection to the underlying needs of road users and their willingness to pay.

Hypothecation of road revenue

A possible modification to the traditional departmental process for funding roads is to provide for hypothecation of road revenue. This is where at least some revenue from road tax bases (such as vehicle registration charges and fuel excise tax) is legislatively earmarked for road spending. That is, there is a pre-commitment of taxes or charges to support, or fully fund, road expenditure and investment. Funds typically are channelled through governments' consolidated revenue accounts to road departments and agencies.

The benefits of hypothecation are that the earmarked tax revenue can lead to more efficient expenditure decisions, particularly when the taxes chosen are levied only on road users who benefit from those expenditures (Newbery and Santos 1999; Heggie 2006). A pre-commitment of future road revenues may also reduce uncertainty in funding and help facilitate the proper design and management of multi-year road investment programs. That said, however, the benefits of road charging linked with hypothecation are very much dependent on the institutional arrangements and decision-making processes that support it.

Hypothecation of road revenue will have only a limited effect on efficient road expenditure and investment decision-making where the earmarked taxes cover only a proportion of road expenditure, where road funds are derived from other non road-related revenue sources or the hypothecated road revenue is used for other purposes by Government. This is because road spending would effectively bear little relationship to the road taxes or charges levied.

While hypothecation has the potential to reduce uncertainty about what road funding will be available to spend in the future, and improve the efficiency of road spending decision-making, two particular problems arise in the current Australian context:

- With few exceptions, road agencies currently are unable to receive road revenue directly and still need budget authorisation by Governments for road spending (that is, the department model, where funding is an integral part of the political process). At the same time, the revenues available for road spending depend on the level of charges set by Government.
- Road charges hypothecated based on a PAYGO approach reflect what is currently being spent on roads, not desirable future spending on maintenance and new construction. This can provide incentives to spend what is received in any particular year, thereby potentially resulting in over (or under) investment.

Although arrangements can be put in place to address these problems, essentially they require institutional arrangements that extend beyond the 'departmental' model. For example, separate and independent management and allocation of funds, ‘forward-looking’ charges and revenues that reflect prospective road expenditures, and the capacity to adjust the level of road charges. These requirements would be better handled through a Road Fund model, as discussed next.

DRAFT FINDING 9.7

Hypothecation of the revenue from road charges and taxes can yield benefits, but these are unlikely to be realised within the existing departmental model.

9.6 A Road Fund?

Road Funds come in various forms. However, they generally have the common objective of providing regular finance to support spending on roads, keeping the revenues separate from the governments’ consolidated account and allocating road funds in an efficient and transparent way.

To promote achievement of these objectives, a Road Fund needs to be more than just hypothecation by another name. In particular, it requires governance arrangements that are a significant step-up compared with the model of a general government agency funded by hypothecated revenues. That is, such a Fund requires a significant devolution of responsibility and decision-making away from direct government control to an autonomous agency, directed by an independent board tasked with managing the funding of recurrent and capital road expenditures.

The key elements of a Road Fund typically include the following:

- Revenues from road related taxes and charges are dedicated to road expenditure and are deposited in a separate stand-alone fund, rather than consolidated revenue. Road expenditure is largely or fully funded by road users.
- Governance according to a corporate structure, at arms-length from Government, with an independent board (and independent Chairman) overseeing the fund, supported by a secretariat managed by a Chief Executive Officer.
- The allocation of road funds by the board according to pre-specified assessment criteria (with the road works usually undertaken by separate road agencies and Local Governments).
- Oversight to ensure effective delivery of road projects and accountability of road agencies.

Road Funds have been around in different forms for a number of years (New Zealand 1953, and amended in 1996 and 2004; Japan 1954; United States 1956). Funds were also implemented in many developing countries (during the 1970s and

1980s) and transition economies (in the 1990s) though with limited success. So-called first-generation funds were characterised by poor financial management and governance, no distinction between road-user charges and general taxes, leakage (unauthorised withdrawals) and difficulties collecting road taxes and charges (Heggie and Vickers 1998; Roth 1996; Newberry and Santos 1999). Moreover, there also was no assurance of efficient allocation between maintenance, rehabilitation and new investment (McCleary 1991). Modern Road Funds (such as those operating in South Africa, Japan, New Zealand and the United States) are structured along more commercial lines (see box 9.6 on the New Zealand system).

Box 9.6 **New Zealand's Road Fund**

Land Transport New Zealand (LTNZ) is a Crown Entity responsible for land transport funding and safety in New Zealand. It has three 'statutory independent' functions:

- Determining whether particular activities should be included in the National Land Transport Programme (activities means a land transport capital project, transport service, or maintenance programme).
- Approving funds for land transport activities.
- Approving procedures for procurement of activities.

The statutory objective of LTNZ is to 'allocate resources and to undertake its functions in a way that contributes to an integrated, safe, responsive, and sustainable land transport system'. (*Land Transport Management Amendment Act 2004*)

LTNZ purchase of road outputs is financed through the National Land Transport Fund (NLTF) which receives revenue from fuel excise, road user charges, and motor vehicle registration and licensing fees. LTNZ recommends to Government the level of these charges.

The executive structure of LTNZ is akin to a corporate model. It is governed by a 6 member board appointed by the Minister of Transport.

LTNZ has a high level of autonomy in deciding how funds will be allocated and carrying out its other functions. Key objectives, outputs and operating principles are determined by Government and specified in Statute, a Statement of Intent and annual Performance Agreements.

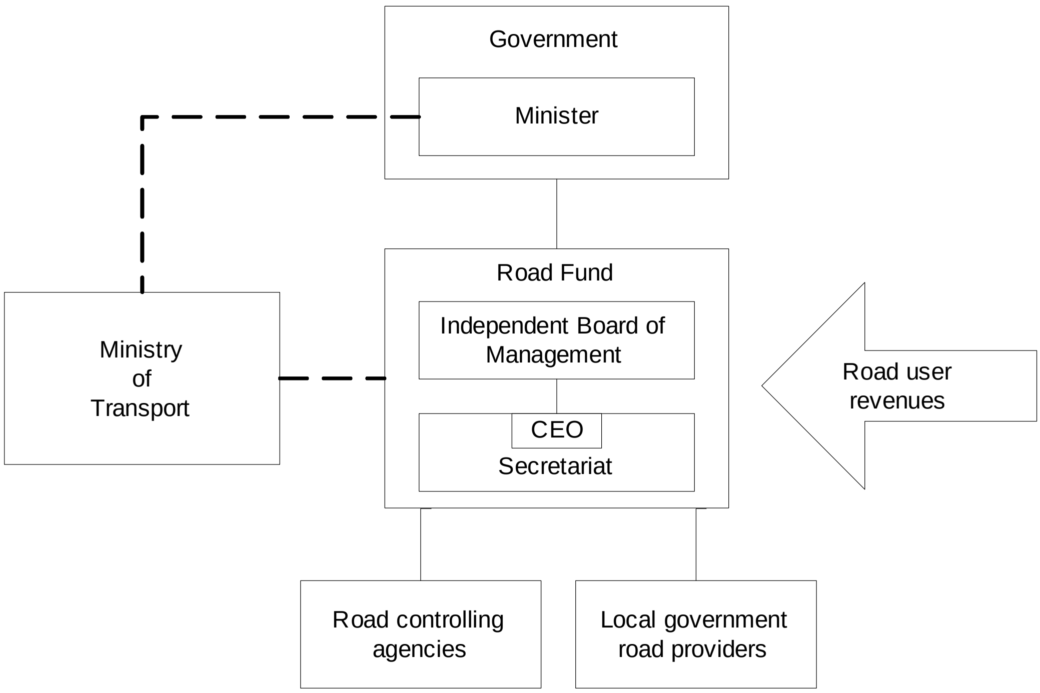
The performance of LTNZ is evaluated against the performance agreement with the Minister of Transport. Reporting requirements include the production of an annual report which is audited and tabled in Parliament.

Sources: LTNZ (2005a; 2005b); Land Transport Management Amendment Act (2004).

The Road Fund approach provides an example of a funder–provider split in the delivery of road outputs (figure 9.2). This is because the Fund itself does not undertake detailed investment appraisal or road project delivery. Rather, it relies on road controlling agencies and Local Government for these functions. In this way, the Fund essentially acts as a 'banker' in allocating funds for road outputs. It takes an active role in allocating funds where the business case is strongest and according to pre-specified criteria that seek to maximise the benefits to the community.

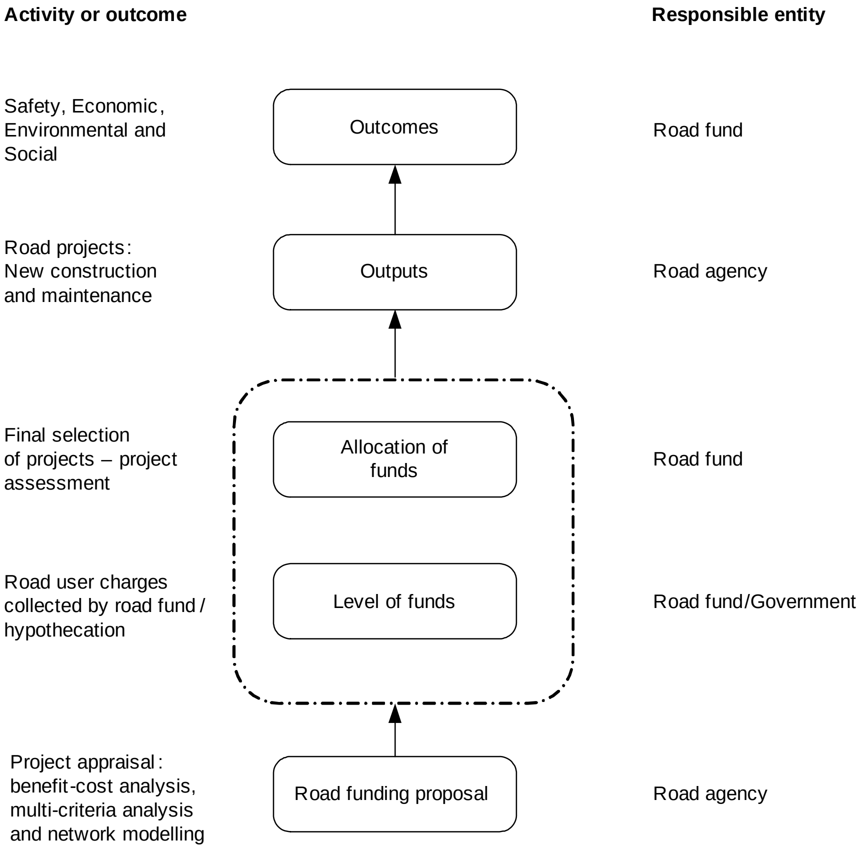
There is a further separation of tasks at the road *provider* level. It is increasingly the case (in Australia and overseas) that the road agencies' planning and management functions are separate from the actual implementation of roadworks. This separation addresses the potential conflict of interest that may arise when road agencies act as the customer (or client) for the services provided, as well as the provider of those services.

Figure 9.2 **Road Fund–broad institutional arrangements**



Under this approach, road provision effectively is delegated to the Road Fund (figure 9.3), with Government setting the strategic focus, key decision-making parameters and specific outputs and outcomes it requires. For example, objective(s), operational principles and goals are typically specified in legislation, Statements of Intent or Performance Agreements with the Government. In this way, the Road Fund board has the autonomy to determine what road projects will be undertaken with available resources, against project selection criteria shaped by Government. The Fund is therefore primarily accountable to the Government for delivering its mandated task. The mechanisms through which performance is evaluated are similar to government departments and GTEs. These include annual disclosure and reporting requirements to the legislature.

Figure 9.3 **Allocation of responsibility under a Road Fund**



What are the advantages of a Road Fund?

A Road Fund approach to road governance can help to strengthen the linkage between road users and providers, and road revenue, expenditure and investment. Its advantages largely derive from the potential for increased transparency, independence of decision-making and funding, and a more commercial governance structure:

- *Greater financial and decision-making independence* — The Road Fund framework provides a relatively high degree of financial independence from Governments' annual budget processes, particularly when fully-funded by road users and road revenues flow directly to the fund. This helps promote a link between road prices, revenues, expenditures and investment. Control over revenue requirements can also mean increased scope for forward planning, particularly if the fund is able to borrow to finance economically justified road works and can influence the level of the road charges applying to users. In this way, road revenue and funding remain 'budget neutral'. The prospect of a more stable flow of road finance could be expected to enhance investment certainty, planning and decision-making. The institutional arrangements that underpin a

Fund also provide a relatively high level of independence in decision-making. Road funding priorities and allocation decisions are effectively at the discretion of the Fund board, at some remove from Government and political decision-making, albeit guided by particular parameters and operating principles set by Government.

- *Improved transparency and accountability* — Road Funds involve the separation of control over funding from implementation responsibilities, the separation of road user charges (both direct and indirect) from general taxes and improved governance of these funds. As a result, the overall transparency of road funding and provision is improved. This can help strengthen the financial discipline on investment and expenditure decision-making as road funding priorities, trade-offs and project allocations are subject to wider scrutiny. A greater level of acceptance and compliance with the road charging framework may result due to improved visibility of what is paid for roads and (the merits of) what is actually received.
- *Strengthened governance arrangements* — A corporate management structure whose executive is overseen by an independent board, and who have a strong interest in well managed (and funded) roads, can improve financial performance and commercial decision-making. Indeed, this structure is the underlying basis of the corporatisation model applying to GTEs in Australia. A corporatised structure could also change the incentive system facing the Fund by recasting road users as customers, rather than taxpayers, and improve responsiveness to road user preferences (Heggie 2006). In this way, the relationship between road providers and users may be strengthened. At the same time, responsibility for delivering pre-specified road outputs and outcomes, within a formal accountability framework, imposes a performance discipline on the Fund board and management.

What are the limitations?

Given that Road Funds are a strengthened form of hypothecation, similar limitations can apply. The potential efficiency benefits from a Road Fund approach can be limited if the revenue source is unrelated to road use, the road charges/taxes cover only a proportion of road expenditure (and revenue is necessarily obtained from other sources), or if notionally hypothecated road revenue can be easily diverted to other purposes. These factors can reduce the likelihood of the Road Fund model enhancing the efficiency of road expenditure and investment decisions.

Inefficiencies and funding uncertainty may still arise if road-related revenues are channelled through Governments' consolidated revenue account to the Road Fund. Unless formally 'locked in', the level and allocation of hypothecated revenue to the fund may be subject to competing government priorities. The funding stream could be expected to be more certain if road revenues are deposited directly with the Fund. A number of countries (including New Zealand) have introduced legislation to achieve this.

Where road revenue is hypothecated to the Road Fund, potential inefficiencies can still arise if the road charge is incorrectly determined, resulting in over (or under) investment in the road network. A formal mechanism would therefore need to be in place for adjusting charges to ensure that the Road Fund generates only revenues needed to meet desirable future requirements. This means that the board should have the power to set road charges, or at least make recommendations to Government as to their appropriate level. It also means that the road board should be permitted to carry forward under-spending in any particular year and if necessary, borrow funds against future revenue streams.

Key design and implementation issues

The governance and regulatory aspects of a Road Fund are critical to the success of devolved road management and financing, as overseas experiences attest. Box 9.7 identifies a number of best-practice principles that should underpin a Road Fund. However, implementing the Road Fund model in line with these principles in Australia would pose a number of challenges in Australia, principally because of different responsibilities of different levels of Government.

A major objective of a Road Fund is to link road revenues to (efficient) road spending. A threshold issue is how this can be achieved given the current mismatch between revenues from the current heavy vehicle charging system (most of which accrue to the Commonwealth) and road use and expenditure across jurisdictions.

One possible approach is simply for each jurisdiction to establish a Road Fund, funded by revenues (road related or not) that it collects. (Some States virtually do this now, by hypothecating at least parts of road related revenues to funds. The degree of autonomy in decision-making about spending the funds varies, however). For example, the Australian Government could establish a Road Fund to provide a dedicated source of revenue to finance national roads and each State would establish an appropriately designed Fund (or transform one they already have) to finance the roads for which they are responsible. There could be some significant benefits from this approach if each Fund were granted dedicated funding sources and, importantly, given appropriate autonomy to allocate funds efficiently. But this model would not address the jurisdictional inconsistency between *national* heavy vehicle charges and expenditures incurred.

Box 9.7 Some best-practice design features for a Road Fund

- *Clear objectives and principles* — The economic, environmental and social goals of the Road Fund should be clearly specified by Government, along with guiding principles for carrying out tasks. These can be embodied in legislation, a Statement of Corporate Intent and a performance agreement with the Minister (which is publicly available). This not only provides guidance for investment and expenditure decision-making by the fund, but it also facilitates accountability and provides a reference point for performance monitoring.
- *A corporate governance structure* — A Road Fund approach to road governance involves a greater devolution of responsibility for road provision and funding. As is the case with many GTEs, a representative management board should oversee the operations of the Road Fund. The board should be presided over by an independent Chair and supported by a Secretariat managed by a Chief Executive Officer (CEO).
- *Fully funded by road users* — The basic expenditure to be financed through the Road Fund should be fully funded by road users, and not from transfers from general tax revenues (that is, the Road Fund should be financially independent). The Road Fund board should recommend the level of the road tariff which should be regularly adjusted to meet current and future road spending requirements. The Road Fund should also have the provision to borrow against expected revenues.
- *Strong legal basis* — Key to an effective Road Fund is a strong legal basis. Ideally, this means establishing the Road Fund under its own Act or legislation. The legal instrument should outline the fund’s governance structures, key functions and operation in sufficient detail. It is also important that the legal instrument guarantee not only the source, but also the automaticity of the channelling of funds to the Fund.
- *Independence of Road Fund executive* — The independence of the Road Fund executive (including the board of management, chairman, CEO and the Secretariat) is important to road management and funding decision-making in the public interest. The Road Fund board should be comprised of members with relevant competence and experience, nominated through a transparent process. Appointments should be based on merit.

Sources: Gwilliam and Shalizi (1997); Gwilliam and Kumar (2002); Heggie and Vickers (1998); Heggie (2006); PC (2005b); OECD (2005a); PricewaterhouseCoopers (2000); Roth (1996).

A single *national* Road Fund would be consistent with network-wide heavy vehicle charges, but clearly could only be established with inter-jurisdictional cooperation. Under a national Fund, appropriately set heavy vehicle charges would be hypothecated to it, with funds then allocated across jurisdictions according to agreed criteria. Importantly, though, because roads are provided jointly for heavy and light vehicles, the Fund would also need to receive other revenue, such as from petrol excise, to ensure adequate road funds were available in total. (If the Fund only received revenues from heavy vehicles charges, there would be no mechanism for ensuring that network-wide spending was appropriate.)

Although this approach potentially could deliver substantial benefits by making a direct and transparent linkage between heavy vehicle charges and efficient road expenditure, there are a number of issues that would require inter-jurisdictional agreement, including:

- What parts of the road network would the Road Fund finance?
- What would be the road revenue sources for the Road Fund?
- How would charges be set?
- How would funds be allocated between road spending proposals and different levels of Government?

What roads would be funded?

In Australia, a range of possible options exist for financing the road network through a Road Fund. At one extreme, the Fund could finance all roads (as is the case in New Zealand). This option would necessarily require an overarching national roads program that would, for example, need to detail agreed cost-sharing arrangements with State and Local governments and agreed procedures under which Governments would manage their share of road funding.

The more the road network is disaggregated for road funding purposes, the greater would be the need to effectively target the road-user charges and taxes. For example, potential issues arise where revenue is derived from a fuel excise tax paid by all road users, and not just heavy vehicles. What proportion of fuel tax would go to the Road Fund? What proportion would be paid by heavy vehicles versus passenger motor vehicles? How would it be channelled to the Fund (hypothecated directly or indirectly channelled through consolidated revenue)? Alternatively, the Fund could finance major freight routes (for example, the National Highway System plus major arterials).

What revenue sources?

Governments would need to assign responsibility for funding road maintenance and new construction to the Road Fund. State and Territory Governments would therefore need to be willing to allow revenue received from both heavy vehicles and at least some part of the revenue received from light (including passenger) motor vehicles, (including registration fees and charges) to go to the Fund, along with control over individual decisions relating to road funding.

The participating governments could influence road funding priorities and decision-making only at arms length through, for example, a Performance Agreement, Statement of Intent and/or legislative direction.

How would revenue requirements and charges be set?

Within broad parameters agreed by Governments, a mechanism would need to be in place for the Road Fund (board) to set and adjust the road charges to ensure that sufficient revenues are generated to meet future expenditure requirements, but does not generate excessive revenues. For example, road agencies could submit planned spending programs to the Fund for inclusion, where appropriate, in a multi-year Road Plan.

For heavy vehicle charges, this would require the current PAYGO funding mechanism to be modified such that charges (diesel excise or distance-based charges) are based on estimated efficient *future* spending, rather than being based on what has currently (or recently) been spent on roads.

How would the funds be allocated?

A crucial issue is how the funds raised from road taxes and charges would be allocated by the Fund to the State and Territory road agencies. The allocation process would need to be administratively simple, transparent and (not least) perceived as ‘fair’, but the overriding criterion should be national economic efficiency. There are two main approaches:

- *Formula-based system* — this would involve allocating funds based on network and traffic characteristics. For example, specific parameters could include the length of road, vehicle volumes, vehicle numbers, or just population.
- *Cost–benefit analysis* — this would involve allocating funds based on a more careful assessment of road network needs. Road projects would be evaluated using a cost–benefit analysis and ranked according to expected net benefit and overall priority. This is the approach used in New Zealand.

Both approaches could be used in combination. For example, block allocations could be made by the Fund for routine road maintenance on a formula basis, with funding of major projects based on their assessed net benefits. The AusLink national projects methodology provides an example of a national process for assessing and approving road projects.

DRAFT FINDING 9.8

Compared with present arrangements, a Road Fund model would facilitate more efficient decision-making, funding and provision of road infrastructure. Appropriately-designed, a Road Fund could provide a regular and reliable source of road finance, improve governance of road funds and efficiently discipline road spending. However, to be effective, a Road Fund needs to have a dedicated source of funds, a significant degree of autonomy and transparent processes for allocating funds efficiently.

Implementing this model in Australia would pose a number of particular challenges, principally because of different responsibilities of different levels of government. While each jurisdiction could operate its own fund, a single national road fund would provide a more direct and transparent linkage between heavy vehicle charges and efficient road expenditure. However, there are a number of issues that would require inter-jurisdictional agreement, including:

- ***which road-related revenues would be hypothecated to the Fund (vehicle registration fees, fuel excise taxes and/or some form of mass-distance charge);***
- ***how future revenue requirements and heavy vehicle charges would be determined; and***
- ***criteria for efficiently allocating funds to road projects and between road agencies.***

9.7 Public utility model?

While the Road Fund model, in effect, involves corporatisation of the road funding *allocation* tasks, the public utility model entails corporatisation of the overall task of providing roads and operating the road network. It accordingly represents the commercial provision of publicly owned roads and the greatest devolution of responsibility for providing roads, short of full private ownership and provision. A number of inquiry participants considered that a more commercial approach of this kind for managing the road network would improve the efficiency and performance of the road sector (box 9.8).

Box 9.8 **Towards a more commercial approach?**

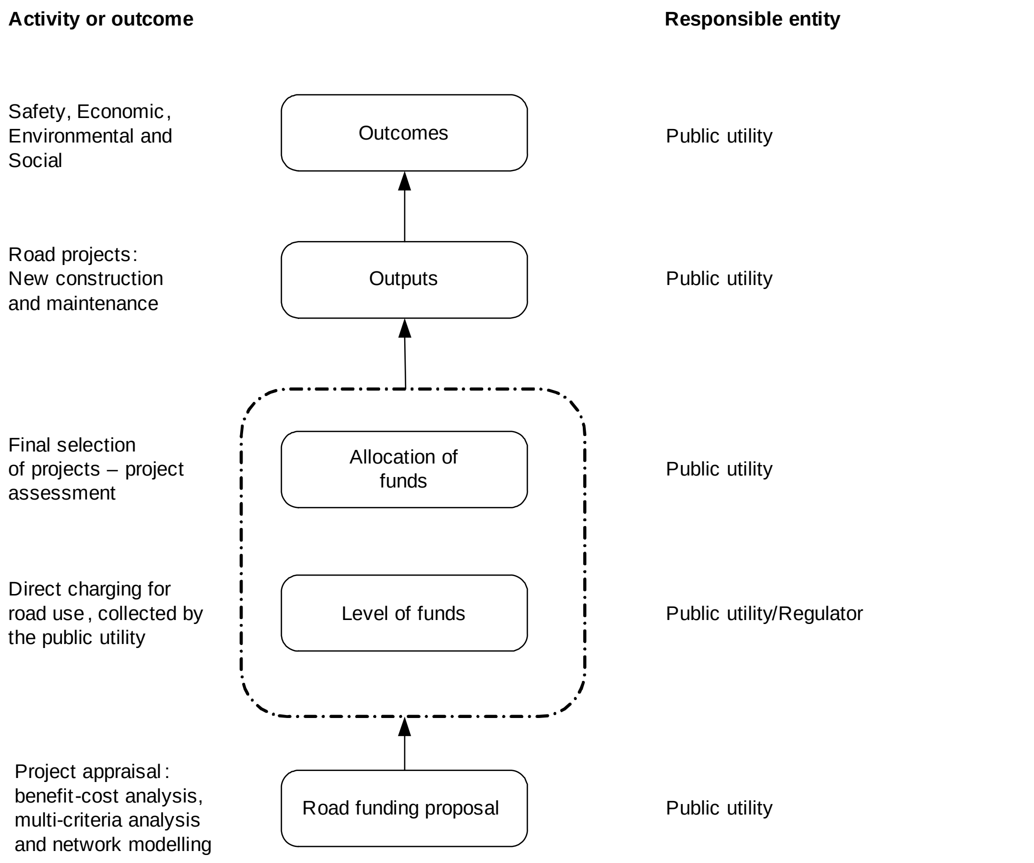
A number of inquiry participants argued that a more commercial governance structure should be the basis for road reform.

> [Queensland Rail] notes that as a matter of history railways have made the transition from non-commercial government agencies to public and private commercial organisations. This has also been the experience in other infrastructure industries in Australia. Clearly a more commercial governance structure for road infrastructure should be a cornerstone of future reform. (Queensland Rail, sub. 53, p. 91)
>
> There is scope in the longer term for more innovative approaches to the management of land transport infrastructure. Corporatisation and privatisation in the rail sector has delivered a range of benefits including improved efficiency of the network, focussed investment strategies and reduced costs to the taxpayer …
>
> … A similar approach should be considered for road. Corporatisation of the inter-capital city road network for example in a way comparable to the ARTC model could substantially assist with the much needed de-politicisation of the current road funding and pricing arrangements, offering an overall benefit to the economy through improved management. (Australasian Railway Association, sub. 33, p.15)
>
> Transport should generally be delivered by dedicated, corporatised or preferably privatised agencies, with charging and pricing set against criteria of full cost recovery and reflecting market forces (which would permit differential charging and pricing based on time-of-day usage). (Australian Chamber of Commerce and Industry, sub. 56, p. 9)

The essence of the public utility approach to road governance is the establishment of a road company (or companies) tasked with total responsibility for funding and running the road network like a business (figure 9.4). The road company (or companies) are governed according to a typical corporate structure and have a commercial objective (that is, to achieve a reasonable return on assets). Shares in the corporatised road companies reside with Government.

To the Commission’s knowledge, the public utility approach to road governance has thus far not been implemented in any developed country. Nevertheless, the public utility model has attracted debate in a number of jurisdictions, and in New Zealand was recommended by the Roading Advisory Group in the late 1990s (box 9.10).

Figure 9.4 Public utility model



Key elements of the public utility model

The public utility model of road provision is broadly akin to the operation of other regulated public utilities. The key elements generally include the following:

- the creation of one or more companies charged with operating the road network (or parts of the road network);
- the companies are owned by Government and have a traditional commercial structure, with a board of management and chairman, chief executive and Statement of Corporate Intent;
- they are able to own and manage their road assets, charge for their use, and borrow and invest capital against future demand;
- road companies are required to be successful businesses, earning an adequate rate of return on their assets, paying taxes and paying dividends; and
- they are subject to the suite of business laws, including corporations law, competition law, pricing and information disclosure regulations, as well as safety and environmental laws applying to other commercial building and construction

companies. As is the case with other network industries, regulation would be necessary to deal with monopoly features of the road network as it relates to pricing and interconnection. Additional oversight may also be necessary.

Box 9.9 **The Australian Automobile Association proposal**

In its submission to the 1997 Neville Inquiry into Federal funding of roads, the Australian Automobile Association (AAA) proposed that Australia adopt a public utility model for road provision. A corporatised road agency, Federal Roads Corporation (FRC), was proposed that would operate according to the principles established for Government Trading Enterprises. Specifically, the FRC would:

- fund investment in nationally important road projects for a designated road network (referred to as the Australian Road Network for Economic Development);
- be managed by a board which is accountable to Parliament for the FRC's commercial performance;
- be established as a corporation subject to corporations law;
- have targets for returns on assets and dividends to Government, based on the needs of the industry, and its legacy of performing and non-performing assets;
- not be subject to the constraints of government employment policies or the benefits available from government borrowing;
- be separated from all regulatory functions (pricing, safety and operational regulations) which should be placed outside of the FRC;
- be liable for all government taxes and charges;
- have any community service obligations identified, costed and directly funded by Governments in order to make these subsidies transparent; and
- be able to enter into contracts and raise loans.

The Inquiry considered that the AAA's proposed corporatised road agency approach had merit as an alternative mechanism to provide accountability, transparency and efficiency in Commonwealth road funding. However, the Inquiry considered that these outcomes could be achieved within the existing road funding structure (subject to the recommendations of their report) without the need to establish another administrative body.

Source: AAA (1997); SCCTMR (1997).

Objectives

Under a public utility model, the primary objective of the road company, as for other commercial entities, would relate to achieving adequate returns. At the same time, the public utility approach allows Government to pursue social and environmental goals that would not typically be pursued for commercial reasons. Government can do this by:

- purchasing particular road outputs or outcomes;
- pursuing social goals through universal service obligation and community service obligation frameworks; and
- setting the regulatory environment within which the road utility operates.

As with any commercial enterprise, the road company would have autonomy in planning and implementing its corporate plan and Statement of Corporate Intent.

Accountability

The accountability of the public utility for its financial performance would be principally to Government, through the corporate reporting framework, which includes specific financial and other performance disclosures.

Accountability for delivering road services would be to road customers, who pay a fee for services. In the case of specific social or environmental road outputs, the Government would effectively be the customer. For example, the Government may contract with the road company to provide roads in rural areas which would not otherwise be provided on commercial grounds alone.

Box 9.10 Proposal by New Zealand Roading Advisory Group

In 1997, a Roading Advisory Group (RAG) was tasked with providing the New Zealand Government with robust proposals to ensure a safe, sustainable, fair and efficient road system at reasonable cost. In its report to Government, RAG proposed a public utility framework for managing, funding and pricing New Zealand's road network. Some of the key features of the proposed model include:

- Road companies would be owned by the Crown and/or Local Government.
- All road assets (comprising State Highways and local roads) would be transferred to road companies.
- Road companies would have both governance and equity shares. Governance shares provide control of the company, while equity shares would provide claims over company assets. It was proposed that shareholders in road companies be allowed to trade shares with each other.
- The general structure of the companies would embody the principles of the *New Zealand Companies Act 1993*.
- Road companies would be required to be successful businesses, including making profits and paying taxes.
- Road companies should take over full responsibility for price setting and direct charging for road use.
- All regulation of road companies would be explicit, and not be handled through ownership structures.
- Road companies would be required to consult with appropriate road users before setting or charging prices.
- Existing common law road access rights would be retained and made part of statute law.

Source: RAG (1997).

Potential benefits of the public utility model

Given that there is no experience elsewhere to help evaluate how a public utility model for roads would operate in practice, consideration of the potential benefits is necessarily in-principle.

To the extent that the public utility model could be implemented as envisaged, the efficiency of road provision could be improved because the commercial imperative means that road companies (managers) would have an incentive to:

- provide roads only where they cover their cost**;**
- manage and optimise risk;

- find least-cost ways to provide roads; and
- be more customer-focused in road service provision.

In turn, road users, faced with clear price signals and the actual cost of their road use, would have greater incentives to:

- make efficient transport choices; and
- make efficient use of the road network.

With a more direct linkage between road provider and users, road managers could be expected to be more responsive to user demands and accountable for their decisions than government departments. A more responsive system would potentially deliver better management and investment decisions, because road managers have stronger incentives to align investment decisions with road user requirements. Commercial road managers on the lookout for opportunities are likely to be better and more rapidly informed about potential business opportunities in their areas than are government agencies concerned with operating the existing system. Government road departments and agencies, moreover, would be more likely to be required to respond to political than to economic priorities. They are also constrained by purchasing and appropriation rules designed to protect the public interest.

As part of developing its proposal for a public utility approach to road provision in New Zealand, the Roading Advisory Group (RAG) commissioned independent studies to assess the potential impact of road reform on investment patterns, maintenance, road use, regions (particularly lower socioeconomic regions), households and administrative structures. The studies concluded that there would be overall efficiency benefits from reform due to a number of factors. As the former Chairman of RAG states:

> These [impact studies] showed that there would be identifiable national economic gains through more rational investment, cost-effective maintenance standards, reduced administration costs, efficient road charges, and use of congestion pricing. Even on conservative projections, net economic benefits would be considerable, particularly for industrial and agricultural users, the more so once investment decisions became better aligned to users' requirements. (McLay 2006, p. 384)

It is important to note that the potential efficiency benefits from a public utility model rely on a commercial pricing framework being in place for roads. Commercial pricing implies less averaging of costs between different road users, thereby improving allocative efficiency. Implementation of commercial pricing would however require resolution of a number of practical issues when considered from a 'network-wide' perspective.

Limitations and implementation issues

Under the public utility model, road companies are required to be self financing, thereby relying on payments from road users for road access and use. There is, however, a substantial public good aspect to the road network and the feasibility, and desirability, of direct charging across the whole network under the public utility model is a crucial issue.

Any commercial model relies on the capacity to monitor and charge for road use. That is, simple ways are needed for paying for road use, preferably without vehicles having to stop, and ensuring that payments for road use get to the road companies. Some roads can be viably tolled, but the majority of the road network cannot. While mileage travelled can be determined through electronic technology such as Global Positioning Systems (GPS), and makes direct billing for road use potentially feasible, it would be prohibitively costly to implement on a broad scale (from both an administrative and compliance cost perspective).

In the absence of a direct charging mechanism, the commercial road operator would need to rely on existing funding sources. This has efficiency implications when applied to a commercial model, as such funding is based on the average costs of road provision; does not readily allow road users to signal their preferences to the road operator; and funding allocations would be largely unaffected by the road operators performance. Funding based on direct user charges, therefore, offers greater efficiency under a public utility model provided the charging mechanism is cost-effective (this is presently not the case).

It is also unclear how the commercial goals of the public utility would be affected by the Government as the owner and primary shareholder of the road company. Business managers typically have a clear single objective — that is, to earn an adequate rate of return on their assets. However, under the public utility model, road managers may be required to pursue and make trade-offs between a mix of commercial and non-commercial goals. For example, a road manger may be required to take into account the income distribution impacts of increased prices, or be prevented from closing uneconomic roads.

A key question that would need to be resolved when considering how a public utility model might apply in the Australian context is, what would be the appropriate number, configuration and coverage of each road business? Relevant factors include the need for road companies to be financially viable, geographically coherent with an obvious relationship to specific communities and large enough in size to develop economies of scale and scope. Identifying all of the road assets to be transferred to any new road company would be a complex task in itself.

A range of different configurations can be considered: for example, a single road company for the whole of Australia; a number of geographically based road companies each combining the National Highway, state roads, and local roads in a region or series of regions; or separate road companies responsible for just the main trucking corridors.

The nature of the road asset itself is monopolistic and changes to the governance structure will not alter this. The potential would exist for road companies to use market power in an anti-competitive way (for example, by restricting road access to users and monopoly pricing). While there is much experience in regulating the monopoly, access and interconnection features of capital intensive network industries (for example, the electricity, telecommunications and gas sectors) regulation of the road network presents its own set of regulatory issues and challenges. For example, different road companies operating different parts of the road network (for example, local roads, arterials, national highway, regional or State and Territory networks) raise significant interconnection problems. What are the appropriate terms and conditions, including price, for one part of the road network to connect with another? The greater the number of road companies, the more that interconnection becomes an issue.

DRAFT FINDING 9.9

The public utility model could bring greater potential benefits than a Road Fund by introducing market incentives to the provision of roads. Government road enterprises faced with a commercial imperative could be expected to deliver greater efficiencies and innovation in the provision of road infrastructure services.

However, implementation of the public utility model would require cost-effective location-based pricing and raises some important additional implementation issues relating to market power, distributional impacts and public access.

9.8 Some (more) private provision of roads?

The full private ownership and provision of roads has not been implemented in any jurisdiction on a network-wide basis. This is largely due to serious concerns about monopoly power, high transaction costs relating to access, interconnection issues for the multiple users of the road network and the need to effectively deal with community access and public interest issues. At the same time, the public good characteristics of large parts of the road network make it neither feasible nor desirable to provide roads privately.

That said, however, the private sector can, and already does, provide different aspects of road management and provision, with varying degrees of autonomy, for different elements of the road network. The scope for private involvement in the management and provision of roads ranges from the private sector contracting to provide specific services (design, build, operation, maintenance) for publicly owned roads to full private ownership of the road (box 9.11). There is evidence that private sector involvement in providing different aspects of road management and provision, for discrete parts of the road network, can produce efficiencies (for example, Roth 1996 and 2006, Zietlow 2006, Roden 2006, Poole and Orski 2006).

Box 9.11 **Private sector involvement in providing roads**

There are examples in Australia and overseas of private sector provision and ownership of discrete parts of the road network through different mechanisms.

- In Australia, private sector investors have built 12 inner-urban expressways, about half of them tunnels, with minimal government support beyond initial environmental clearance and permitting. While the first Australian investor-built project (the Sydney Harbour Tunnel) required government guarantees of traffic levels, the others were all built at investor risk.
- Italy’s first toll motorway, from Milan to Lake Como, was opened in 1924. Half of Italy’s toll motorways are now fully investor-owned by the publicly traded and internationally active Autostrade SpA.
- In the United States, the largest private road investment proposed to date is $7.2 billion for the first major project of the Trans-Texas Corridor from north of Dallas to south of San Antonio.
- A private consortium led by CINTRA/Macquarie has paid the city of Chicago $1.83 billion for the rights to receive the Chicago Skyway tolls for 99 years.
- Canada’s Highway 407 near Toronto, the United Kingdom’s M6 motorway and Dartford crossing, and the SR91 Express Lanes in California are all examples of privately owned and operated roads.

Sources: Peters (2006); Roth (2006); Samual (2006).

There are many overseas cases of specific roads, or road networks, which operate under concession agreements with government. This is where temporary ownership of the road is assigned to private sector operators for a specified period of time. They are typically freestanding toll roads with concession periods of 15 to 35 years (Heggie 2006). In Japan and France, for example, there is no central government funding of roads because most major roads are tolled, and financed with bonds sold on the strength of prospective toll revenue streams (Roth 2006).

DRAFT FINDING 9.10

The private ownership and provision of roads on a network wide basis is currently neither feasible nor desirable. However, private sector involvement in providing road management and/or provision of elements of a road network can yield efficiencies.

9.9 Summing up

In Australia, road infrastructure is funded primarily through Governments' consolidated funds, as part of the annual budgetary process. While the present charging arrangements, in principle, allow sufficient revenue to be collected to recover *current* road expenditure, there is no systematic relationship between road prices, revenues received, and decisions about desirable *future* road expenditures. Decisions about future investments in roads are effectively de-linked from decisions about the current levels of heavy vehicles charges and from revenue generated by them.

The present road funding arrangements potentially lead to inefficiencies and distortions in road management and investment decision-making. While it is difficult to determine empirically the extent to which efficient investment is taking place across the Australian road network, a variety of evidence suggests that it is likely that there is scope to achieve outcomes more responsive to the needs of road users, especially on some parts of the road network.

Institutional options examined involve a greater reliance on market mechanisms to guide road use and investment decisions, and less on political control. They aim to strengthen, to varying degrees, the commercial disciplines on road provision and funding by running roads more like a business. This could be expected to better align supply and demand and promote a more direct relationship between: road use and road charges; road service providers and road users; and road revenue, expenditure and investment. Running roads more like a business invariably means a greater devolution of decision-making and responsibility for providing roads.

A starting point is measures aimed at strengthening the existing decision-making processes for road planning and investment. A well functioning funding mechanism that is underpinned by strong local stakeholder involvement, transparency and a robust cost–benefit analysis can be expected to improve investment decision-making. Full implementation and application of the AusLink decision-making framework will contribute to this.

More ‘radical’ models for institutional change would introduce a commercial emphasise to road provision and funding, and strengthen the financial discipline on investment and expenditure decision-making. Options are: earmarking of road taxes and charges aimed at fully funding road outlays *(hypothecation)*; the management and allocation of road funding along commercial lines at some remove from Government *(Road Fund)*; the commercial provision of publicly-owned roads (*public utility model)*; and full private ownership and provision of roads *(privatisation)*.

The different governance arrangements have strengths and weaknesses in the context of the overall road network, with the corporatised (public utility model) and privatised approaches to road provision essentially untested. The prospect of running roads more like a business necessarily requires a greater capacity to charge directly for the provision of road services. While it may be feasible to charge directly for use of some parts of the road network, the economics do not presently make it viable network-wide. A greater commercial emphasis to road governance across the whole network also raises serious monopoly, access and interconnection issues that would require resolution. Moreover, important constitutional, legal, political and administrative issues also arise given existing roles and responsibilities in Australia’s federal system.

It would therefore be necessary to clarify a range of difficult (and some possibly intractable) issues before seeking to develop more commercial models of road funding and provision. Two options are raised for further consideration in chapter 11.

10 Addressing non-price impediments

Key points

- A number of regulatory impediments hinder the efficiency and productivity of both road and rail freight transport and possibly affect modal choices.

Road freight

- The current prescriptive approach to regulating heavy vehicles (mandating how to achieve regulatory standards) inhibits innovation and limits the efficiency and productivity of the road freight sector, and raises costs to road freight users.
- Full implementation of the National Transport Commission's Performance-Based Standards (PBS) project is a priority reform in achieving a shift to a cost-effective regulatory framework for heavy vehicles with the potential to enhance the productivity of road transport. The extension of the coverage of PBS approaches to other aspects of heavy vehicle regulation would yield further productivity gains.

Rail freight

- In view of the lack of market power for many vertically separated providers of rail infrastructure, particularly on the interstate network, there is a case for refocussing access regulation.
- Regulatory fragmentation can inhibit the efficient operation of trains across Australia and impede effective competition and coordination. It also increases transactions costs and investor uncertainty. There is both a need and scope for much greater national consistency in regulatory frameworks, covering both economic and non-economic issues.
- There currently is potential for access regulation to discourage investment in rail infrastructure.
- To provide further certainty for investors and regulators, the inclusion in State based access regimes of an objects clause and pricing principles similar to those recently included in Part IIIA of the *Trade Practices Act 1974* is desirable.
  - In particular, regimes should explicitly allow price discrimination where this has the potential to increase efficiency.
- A stricter application of the corporatisation model to government owned railways would lead to improved industry performance. Particular priorities include greater clarification and transparency of objectives, improved transparency of the external governance role of ministers, and a general strengthening of accountability.

The terms of reference ask the Commission to identify competition, regulatory and access constraints to the economically efficient pricing and operation of road and rail freight transport and to recommend options for reducing or eliminating them.

This chapter examines potential impediments and obstacles that specifically relate to the regulation of road (section 10.1) and rail (section 10.2) infrastructure provision or use. Potential issues that arise for both modes also are examined (section 10.3), as are possible bottlenecks that may hinder the seamless transfer of freight across modes (section 10.4). Possible measures to address particular impediments to the efficient operation of road and rail freight transport are suggested. In some cases, a way forward is the full implementation of existing reform initiatives and processes; in others, new initiatives may be required. The Commission seeks further comments from participants on some of the issues and on policy options for addressing them.

10.1 Prescriptive road regulation

As indicated in chapter 6, in relation to the externalities associated with the use of road infrastructure to transport freight, regulations may be an effective way of achieving socially efficient outcomes. However, regulation is not costless. The cost to road freight operators of meeting regulatory requirements are as much a charge on their road use as fuel excise and registration fees. Minimising the costs to transport operators of achieving (appropriate) safety, environmental, social and economic outcomes is important to ensuring that the road freight task is undertaken in a socially and economically beneficial way.

In Australia, the regulatory framework for the road sector is characterised predominately by prescriptive rules. These include rules relating to vehicle mass, dimensions and configurations that aim to control the amount of road and bridge wear. They also include rules that aim to determine safety-related outcomes and environmental performance (box 10.1).

Box 10.1 Trucks face many prescriptive regulatory standards

In Australia, there is an array of prescriptive rules for heavy vehicles aimed at achieving particular economic and safety outcomes. The following examples are indicative:

Dimensions

- General access:
  - Heavy vehicles that have general access to the road system are limited to a width of 2.5 metres, a height of 4.3 metres, and a length of 12.5 metres for a single vehicle and 19 metres for a combination.
- For vehicles with restricted access:
  - Maximum lengths for B-doubles, 25 metres; for Double road trains, 36.5 metres; and for Triple road trains 53.5 metres.

Mass limits

- General mass limits:
  - Single steer axle 6 tonne; twin steer axle 11 tonne; tandem axle 16.5 tonne.
- General mass limits for different combinations:
  - R12 – Rigid Truck with one steer axle and a tandem drive axle (22.5 tonnes)
  - B-double – prime mover with two 3 axle trailers (62.5 tonnes)

Source: NTC (2006e).

The OECD (2005b) note that, to maximise efficiency as well as achieve other (social and environmental) outcomes from road transport infrastructure, regulatory regimes need to respond to a number of challenges, flowing from:

- increasing specialisation of the freight task and the associated emergence of different needs in different locations, innovative vehicle design and new approaches to shifting freight;
- disparities between the performance of the heavy vehicle fleet and the adequacy of design of infrastructure (for example, low and high speed off-tracking, and pavement and bridge condition); and
- differences in infrastructure standards between regions, jurisdictions and for different road functions (for example, primary arterial roads, local access roads).

The traditional prescriptive approach to regulating roads does not respond effectively to changing needs and can lead to inferior economic, environmental and social outcomes. This is because, among other things:

- in an industry that is faced with changing technologies and differentiated customer needs, adaptability and rapid take-up of new technologies are constrained by prescriptive regulations; and
- prescriptive vehicle standards may be designed to protect the critical or weakest points in the road infrastructure but, in practice, are necessarily applied to all or most of the road network.

Efficiency implications of current prescriptive rules for road freight

Potential efficiency losses from under-utilisation of current road network capacity are emphasised by the National Transport Commission (NTC) as resulting from the current prescriptive regulatory framework:

> The NTC recognises that there is room to get more out of Australia's freight transport network. There is spare capacity on the network, partly as a result of prescriptive vehicle standards and partly because the current regulatory approach adopts a 'one size fits all' mentality, which constrains transport options. (NTC 2006b, p. 6)

Likewise, the Australian Livestock Transporters Association (ALTA) state:

> … one arm of government can propose and fund a road upgrade but lack of regulatory "access" can mean the new infrastructure may just sit as an expensive museum piece, playing less than its potential role in driving our economy to its economic limits. (sub. 38, p. 3)

ALTA also suggests that the current prescriptive approach to road regulation is incompatible with an efficient cost recovery mechanism:

> The non-price barriers arise from the failure of some state governments to adopt best-practice regulation of road users … Until these non-price barriers to the efficient provision of transport services in Australia are removed, the ALTA believes it would not be appropriate on economic efficiency grounds to increase road user charges even if such charges were designed to efficiently recover costs associated with the use of roads in Australia. (sub. 38, p. 1)

The very nature of prescriptive regulation involves the challenge of trying to match a specific regulatory standard with the desired performance outcome. Any mismatch can have important efficiency implications. As the OECD (2005b) notes:

> Prescriptive regulations have a limited ability to ensure that vehicles behave in a desirable manner for the road and traffic conditions in which they operate. In addition, the link between most existing prescriptive rules and performance outcomes is tenuous and not well recognised. (p. 42)

For example:

> … Important road safety measures (e.g. stability for high centre of gravity vehicles during emergency manoeuvres in higher traffic volumes) may not be adequately regulated, or may be unnecessarily restrictive (e.g. for highly stable vehicles limited to the same prescriptive rules as other, less stable vehicles)
>
> … Axle group mass limits are not the sole determinant of 'wear and tear' on pavements and bridges. While they are significant, the contributions of other factors, such as horizontal tyre forces, are not well understood and generally uncontrolled under present rules in most jurisdictions (p. 42)

Prescriptive regulations and the current road funding model are interlinked

The prescriptive approach to regulating road infrastructure is, to some extent, associated with, and supported by, the current budget funding model for roads (chapter 9). Faced with uncertainty about whether their budget funding will meet spending needs, road agencies have strong incentives to protect or preserve existing road assets rather than to maximise the value of the road asset. They may be reluctant to allow increased mass, knowing that this will lead to more rapid deterioration of their assets without any guarantee that they will receive the revenue required to maintain or enhance the road asset.

The Australian Logistics Council note:

> Another harmful consequence [of current funding arrangements] is the generation of an 'asset preservation' rather than a 'service provision' attitude in road agencies. Since the agencies are effectively rewarded for reducing internal cost rather than for maximising the net value of services provided, they have an incentive to limit the service capabilities of the assets provided and impose prescriptive regulations on the way in which roads can be used. (sub. 7, p. 5)

Likewise, the NTC argue that the absence of a mechanism to recover additional road costs provides little incentive for road managers to expand the road network to a socially optimal level.

> The current regulatory system, relying on prescriptive limits on vehicle mass, dimensions and configurations, presents little need to road agencies to align usage of the road network with the maximum net benefits that can be obtained from its use. There is no mechanism by which any additional costs can be recovered and reflected in the funding available to road managers. (sub. 17, p. 95)

That said, it also needs to be acknowledged that there may be some instances where it would be socially cost-effective to restrict access to parts of the road network.

The benefits of moving to performance-based regulation

There have been calls for a more performance-based approach to regulating road freight use and users, whereby regulatory standards would specify the performance required from vehicle operations rather than mandating how this level of performance is to be achieved.

In an important initiative, the NTC Performance-Based Standards (PBS) project (box 10.2) has identified a set of 20 performance standards to replace current prescriptive standards, which would apply to different road types and form the basis of an alternative regulatory regime for heavy vehicles (NRTC 2003a, NRTC 2003b). These include longitudinal (low and high speed) and directional performance (low and high speed), plus infrastructure performance measures related to pavement and bridges.

Box 10.2 **NTC Performance-Based Standards project**

The NTC and Austroads are developing a regulatory framework for Performance Based Standards (PBS) for heavy vehicles. The aim of the PBS project is to improve road safety, protect road infrastructure and promote innovation.

On 10 February 2006, the Council of Australian Governments (COAG) committed to PBS as a key transport productivity reform. COAG concluded that implementation of PBS requires binding and effective national decision-making processes.

- It is expected that the PBS framework will include a single trans-national body responsible for administration of the proposed regime and vehicle approvals.
- 20 performance-based standards will be implemented as part of the PBS package.

The timetable requires the NTC to submit the PBS legislation to Ministers by May 2007, with jurisdictions expected to implement it by the end of 2007.

- A high level Policy Steering Committee (PSC), including senior Federal and State government officials and industry representatives, has been formed to oversee the national policy direction of PBS reform.
- An Interim Review Panel (IRP) has been formed to test and refine the expected PBS process. IRP can come to a ‘national view’ but, until PBS legislation is in place, SMART heavy vehicle applications still require state-by-state permit approval.

Source: NTC 2006c; NTC 2004b.

A performance-based framework for regulating the use of roads has a number of potential advantages over a prescriptive model.

First, it could provide a better match between road infrastructure and vehicles, potentially enhancing the productive capacity of both. Specifically, there is greater potential to account for significant differences in the characteristics and capabilities of road infrastructure (strength, condition, geometry etc) and variations in the performance of vehicles. Vehicle standards would no longer be set to match minimum capacity across the network, but can vary so that both vehicles and infrastructure have matched requirements, but differing at different parts of the network.

Second, a performance-based approach can provide greater flexibility for infrastructure users to be innovative (for example, more efficient axle configurations and coupling arrangements), and achieve least-cost solutions to regulatory problems. As the NTC note:

> Over the longer term, PBS is seen as the key productivity reform that replaces one-size-fits-all rulemaking, as it will provide a regulatory framework for operator-driven flexibility in vehicle design and operation, subject to agreed safety and asset standards. (sub. 17, p. 22)

The need to move to a performance-based regulatory framework for roads has been identified by the Queensland Government as necessary to meet the challenge of providing and maintaining road networks that will carry growing traffic volumes, a new mix of vehicles, and increased axle loads, while protecting community amenity:

> … To meet these national freight challenges there appears to be a need to shift from a regulatory environment based around prescriptive rules and asset preservation, to one which facilitates greater utilisation of transport infrastructure assets on a sustainable basis. (sub. 40, p. 12)

As part of its review of Australia's freight task ('Twice the Task'), Sinclair Knight and Merz (SKM) (2006) identify as a key reform priority the need to actively progress implementation of enhanced PBS and innovative vehicle design approaches. In particular, they emphasise the potential ability of PBS to increase vehicle capacity and efficiency without corresponding increases in road impacts.

> There is significant evidence that Australia's history [of] accommodating past increases in [the] freight task has been facilitated by increases in vehicle capacity. Performance Based Standards (PBS) provides an opportunity to provide increased vehicle capacity without as great an increase in vehicle mass, dimensions, traffic and road impacts as might otherwise be the case. There is also evidence that little vehicle productivity increase is likely without further measures to encourage and support potentially beneficial projects. (SKM 2006, p. 110)

SKM suggest a potential productivity gain across the road freight sector of 3 per cent from a move to a PBS approach to regulating vehicle standards.

The potential productivity benefits achievable from a move to a performance-based approach to regulating roads are inherently linked to an appropriate road pricing mechanism. As the NTC note:

> If vehicle operators could determine how much infrastructure wear they were prepared to pay for, PBS provides the additional controls to ensure the vehicle can safely operate at the desired mass and a means of specifying the level of infrastructure wear that will result. (sub. 17, p. 22)

In summary, there would appear to be considerable benefits in moving to a more performance-based approach to regulating heavy vehicles. In particular, PBS can increase the productive capacity of both road infrastructure and heavy vehicles and better meet the demands of a rapidly evolving road freight sector.

Implementing the NTC's Performance-Based Standards

A performance-based approach to regulation has been adopted in other policy domains (for example, occupational health and safety, and environment regulation), both in Australia and overseas. There are, however, few overseas examples where such standards have been implemented in the transport sector — although Canada and New Zealand are expecting to make more use of performance-based standards in the future.

In Australia, COAG has recently endorsed the NTC PBS project as a key productivity reform for the road sector.

> Over the longer term, PBS is seen as the key productivity reform that has the potential to replace prescriptive rulemaking, as it would provide a regulatory framework for operator-driven flexibility in vehicle design and operation, subject to agreed safety and asset standards. (COAG 2006a. Appendix C, p. 13)

The Commission understands that some of the elements of the PBS project (box 10.2) are in place while others are yet to be implemented (including required legislation). In the meantime, operational aspects of PBS are being assessed and approved by the Interim Review Panel and respective State jurisdictions. The interim arrangements have been criticised by many operators as lacking government accountability and nationally consistent outcomes (NTC 2006), and imposing high compliance costs and delays in getting new innovative truck configurations (SMART heavy vehicles) assessed and approved (FCL 2006). Implementation of the PBS project, as envisaged, would need to address these concerns.

Is existing regulation appropriate and achieving its objective?

In addition to direct regulation of heavy vehicle mass, dimensions and configuration, other regulations aimed at achieving environmental or social policy outcomes impact on the road freight sector. The Commission understands concerns have been raised as to the necessity or appropriateness of other broader regulation affecting road freight. In addition, concerns have been expressed about the adequacy of the processes that have generated regulation (outside the realm of the NTC).

It is important that any decision to regulate road freight operators is justified: that is, regulation is necessary, cost-effective and in the public interest. Where regulation is necessary, decisions on the most appropriate regulatory instrument should be made only after full consideration of alternatives. At the same time, there should be a process in place for the systematic review of existing regulation impacting on the road transport sector, in line with COAG's recent commitment that all governments undertake targeted annual public reviews of existing regulations to identify priority areas for reform.

DRAFT FINDING 10.1

Performance-based regulation is likely to result in greater efficiency and productivity in the road freight transport sector than the existing, largely prescriptive, regulatory framework. The Commission considers that a move to a performance-based regulatory framework for heavy vehicles is a priority reform. Full implementation of the Performance Based Standards project under the National Transport Commission should be implemented as soon as feasible.

The Commission seeks input from participants on other regulatory impediments to the efficient operation of the road freight transport sector.

10.2 Rail specific issues

Participants identified a number of non-price impediments to efficient performance of the rail sector. Many saw them as being a significant problem for the performance of the rail freight sector. Given the importance of productivity to rail sector performance, as highlighted by the Commission's modelling for this inquiry, dealing with non-price impediments should be a high priority for governments.

Major potential impediments identified by participants included:

- structural separation;

- train path allocation;
- regulatory fragmentation;
- the appropriateness of access regulation regimes in particular; and
- a lack of commercial focus by some rail operators.

Vertical separation vs. vertical integration

A key element of the post-Hilmer reform process in rail has been the separation of below-rail infrastructure provision from above-rail operations.

There are significant benefits stemming from vertical separation. These include promotion of above-rail competition, encouragement of market diversity and reduced scope for abuse of market power. Vertical separation can also lead to improved coordination of freight flows across infrastructure networks (via a streamlined access process) and expand the geographic market of above-rail operators (BTRE 2003d).

The issue of vertical separation was considered by the Commission in its 1999 Inquiry Report *Progress in Rail Reform*. The Commission recommended that train operations be vertically separated from track infrastructure on the interstate network, and that the infrastructure should be managed by a single network manager (PC 1999c).

The Commission also noted that vertical separation (and access regulation) may be less appropriate in markets where there is limited scope for more than one above-rail operator. Competition from other modes of transport, and low volumes, may make the probability of profitable competitive entry into the rail market fairly low in many markets.

Regarding structural separation of infrastructure generally (not specifically for rail), the OECD has stated:

> As a general principle, structural separation should be carried out unless for any given separation, evidence can be produced showing that the efficiency benefits of integration outweigh the harm to competition. In other words, there should be a presumption in favour of structural separation approaches. The competition authority should have the power to block re-integration. (OECD 2000, p. 48)

In Australia, structural separation has seen competition more strongly emerge on the east–west rail corridor. As observed by the Australian Rail Track Corporation (ARTC):

> There is little doubt since the introduction of competition reforms in the rail industry in the mid 1990's that competition for rail freight services has taken hold most on the east-west interstate network. ARTC considers that this has occurred for a number of reasons including … horizontal and vertical structural arrangements on the bulk of this network that promoted above rail competition. (sub. 11, p. 12)

However, the possible benefits of structural separation need to be weighed against the potential costs — including a loss of economies of scope, transaction and coordination costs, information costs, possible loss of commercial sustainability, potential complications in pricing efficiently, and adjustment costs.

In this regard, the Rail, Tram and Bus Union stated:

> Australia should rethink the policies of mandated access and on track competition. They have serious flaws. (sub. 43, p. 7)

Different market circumstances mean that no single structure is likely to be appropriate for all rail networks. The potential costs and benefits need to be assessed on a country-by-country — and, indeed, region by region — basis.

Coordination and investment issues

In research undertaken for the Australasian Railway Association (ARA), Port Jackson Partners Limited noted a number of co-ordination problems stemming from vertical separation:

- *Operational links*: There can be potentially significant cost trade-offs and burdens placed on the track owner or track operator due to decisions of the other party. For example, if the wheel profile of a train is not in alignment with the grind profile of the track, significant maintenance costs may be incurred. Similarly, the speeds at which trains can travel safely on tracks affect the operations of the above-track operator. Moreover, the above- and below-rail operators need to separately monitor train movements through the system, resulting in duplication of effort.
- *Investment decisions*: Efficient operation of a rail system requires synchronised and complementary investments in track, terminals and rolling stock (for example, investments in longer trains require parallel investments in longer passing loops). Any uncertainty regarding the likelihood of the complementary investment taking place potentially reduces investment incentives.
- *Risk management*: In the event of a rail accident, losses are incurred by both the above- and below-rail operator. Vertical separation requires cooperation between operators with regard to risk mitigation. This is a simpler process for a vertically-integrated operator.

- *Marketing*: Winning new customers requires service and reliability undertakings that are made more complex in a vertically separated environment. For example, the ability to offer discounts to new customers may be undermined by a lack of coordination between above- and below-rail operators (PJP 2005).

The OECD has highlighted that vertical separation may restrict pricing options for infrastructure services. While Ramsey pricing is still possible in a vertically separated environment, it is much more difficult because the below-rail operator does not negotiate directly with the ultimate customer. This can have negative implications for cost recovery and efficient pricing, particularly where trains carry mixed cargoes (PC 1999c, OECD 1999).

It also has been argued that vertical separation can be detrimental to investment incentives. Pacific National (PN) stated in their submission:

> In the last three years, PN's Intermodal Division has invested $220 million in rollingstock and terminals to cope with growth in demand, compared with $42 million invested by the ARTC, the track owner. This lack of alignment is creating an environment in which delays in new track investment are common. (sub. 41, p. 24)

Investment levels — above- and below-rail — might be lower in a vertically separated environment due to differing incentives between the above- and below-rail operators. Below-rail operators might have reduced incentive to make investments that would improve above-rail performance and vice-versa. Investment also may be inappropriate due to information asymmetry between the above- and below-track operators (BTRE 2003d).

The need for a 'case by case' approach

As noted by the Commission in 1999, questions surrounding the appropriate institutional structure of the rail sector and the relative merits of structural separation versus integration are complex, and require a case by case approach.

The potential benefits of vertical separation are significant, but separation can also lead to coordination problems and reduce incentives to invest. Ultimately, in some circumstances, separation can undermine the viability of a rail operation. This could occur where vertically separated operators have difficulties in adopting pricing strategies (such as Ramsey pricing) enabling them to adequately recoup costs, or where above-rail operators are vulnerable to 'cream skimming' by other above-rail niche operators.

For vertical separation to increase above-rail competition, there needs to be a prospect of profitable entry into above-rail markets. However, most rail networks typically face strong intermodal competition and struggle for commercial sustainability, particularly where there are low volumes of freight. Vertical separation is likely to compromise the commercial sustainability of these networks.

In contrast, the relative lack of commercially-feasible intermodal competition on the coal networks in New South Wales means that competition to reduce freight rates is largely limited to competition between above-rail operators (that is, within the rail mode). Even here, however, the coordination and potential investment issues associated with vertical separation mean there is no unqualified presumption in favour of separation.

Regarding the interstate track, evidence on the merits of vertical separation appears mixed, with above-rail competition achieved on the east–west network but few discernible benefits evident to this point on the north–south corridor. The different competitive position of rail in terms of road on these corridors means that the optimal structure might be different on each.

Interestingly, the OECD (2005c) has recently noted that while many countries have seen entry of new rail freight providers following vertical separation, the number of entrants has typically been small and their share of the total freight task has remained quite low. Overall, the OECD finds that the role of vertical separation in improving the performance of rail is unclear:

> In conclusion, although there is a wide range of experience with different modes of competition and different degrees of vertical separation in the rail industry, it is not yet possible to draw a clear picture as to the appropriate role of vertical separation in the overall reform of the rail industry. At this stage it appears that there are other factors, such as corporate governance and effective design of subsidy mechanisms (where they are necessary) which have at least as large an impact on the overall performance of the rail industry. (OECD 2005c, p. 13)

DRAFT FINDING 10.2

There appear to be no benefits, and some costs, in maintaining or implementing vertical separation on regional rail networks where infrastructure providers are unable to exert market power.

The Commission seeks further evidence from participants regarding the impacts of vertical separation or integration on the interstate track and on the major regional coal lines.

Alternative approaches

The United States approach of separating the national rail network into interconnected regional networks has been suggested as a possible model for

Australia (Ergas in PC 2006b). In the United States, a small number of vertically integrated rail operators operate in neighbouring regions and cooperate with each other on access prices and conditions. Since each network benefits from being able to run trains to and from destinations on other networks, there is countervailing power in negotiating access or trackage rights.

The approach taken in the United States and Canada has been described by the Bureau of Transport and Regional Economics (BTRE) as that of 'vertical integration without the presumption of a right of third-party access' (2003d, p. 107). Regulation is largely confined to preventing major anti-trust abuses, with the emphasis of legislators being placed on ensuring rail operators obtain enough revenue to remain commercially viable.

Ergas, however, identified major limitations to the viability of such an approach in Australia, including relatively low rail freight densities and the need to address necessary maintenance before such a system could be adopted (although these problems exist in Australia regardless of the system adopted). The United States and Canada also have a long history of privately owned, profitable freight routes, which cannot be said for Australia or many other railway systems in the world.

Another quite different approach has been followed by Sweden. This involves vertical separation of above- and below-rail operations, with below-rail charges based on marginal social costs. The resulting revenue shortfall is funded by taxpayers through consolidated revenue (PC 2006b).

As road in Sweden is funded in the same manner as rail (that is, road infrastructure prices are also set to recover only marginal social costs), the system can provide for competitive neutrality between modes. It would, however, be very difficult to adapt the Swedish system to Australia. The adoption of such a model would involve considerable costs to taxpayers. Self-evidently, it would be inconsistent with obtaining full cost recovery. (There is more discussion of marginal social cost pricing of rail (and road) infrastructure in chapter 8.)

Path allocation with congestion

One area impeding the performance of rail, in which pricing could play a greater role, is in the allocation of capacity. While the Australian rail infrastructure sector is characterised by excess capacity overall (BTRE 2003d), there are situations of excess demand at particular times and particular locations (for example, on some coal lines). The current resources boom is an example of such a time.

Generally, passenger trains have priority over freight trains when train paths are allocated. It has been argued that this is particularly a problem in Sydney, limiting rail freight's ability to compete on the north–south corridor. A recent study of the corridor, commissioned by the Department of Transport and Regional Services (DOTARS), estimated that problems in metropolitan Sydney accounted for between 20 and 50 per cent of rail's reliability problems on the Melbourne–Brisbane route (Ernst and Young et. al. 2006).

Coles Myer Ltd commented:

> Delays to rail traffic entering and leaving Sydney undermine rail's competitiveness and retard the movement of rail freight between Melbourne and Brisbane. (sub. 47, p. 2)

This 'passenger priority' is rarely factored into access charges.

PN has highlighted:

> Given that the average speed of passenger trains is higher than for freight trains … the outcome is that freight trains are often "run down" and then have to wait to allow passenger trains to pass before they can proceed. The cost of passenger priority is borne by freight trains but this is not internalised into any access pricing. (sub. 41, p. 13)

The NSW Minerals Council noted:

> Under the *Transport Administration Act 1984* (NSW), passenger trains are accorded a priority on the Hunter rail network. This passenger traffic does not pay the full price of access, while at the same time it enjoys the highest priority of access. Coal trains pay essentially all the costs of that network yet they receive only third or lower priority to access, behind passenger trains and scheduled freight services. (sub. 10, p.15)

On the other hand, the NSW Government stated:

> Although the freight rail industry has expressed some concerns … the Sydney metropolitan rail network is overwhelmingly "paid for" through NSW Government funding and from fare revenue from passengers…In comparison, access charge revenue from rail freight operators is relatively small … (sub. 50, p. 9)

Generally incumbent rail operators have access rights 'grandfathered'. This means that while newly competing operators are likely to pay the same amount for access to rail infrastructure, they may not be able to access it at the most commercially desirable times. As the BTRE has noted, 'non-priced systems can perpetuate inefficient capacity allocation and inhibit competition' (2003d, p. 86).

There is a case for introducing more flexible approaches to allocation of scarce train paths on the basis of highest value. In particular, there appears to be room for greater use of pricing to allocate capacity. The ARTC has moved to an approach of allocating mutually exclusive capacity to the access proposal with the highest net present value (NPV) of future returns. As noted by the ARTC, this does not necessarily mean access will go to the access seeker prepared to pay the highest price:

> If in fact it is an 80km/hr freight service for four years against an intermodal service for eight years … then effectively … the NPV of those will be different without going anywhere near an auction on price because the prices are generally published. (ARTC in ACCC 2002, p. 88)

Use of auctioning of capacity would reveal the true valuations access seekers place on their use of available track. Information obtained during the auction process would allow the below-rail operator to maximise the profit of the entire network by choosing the optimal mix of train schedules (PC 1999c).

There is a range of potential problems with auctioning, however, including relatively high transactions costs, disruption to existing contractual arrangements, co-ordination problems, higher levels of uncertainty and potential dominance by large incumbent operators. As noted by the Commission in its 1999 rail report, these practical problems pose a challenge in developing a path auctioning system, but do not rule out the concept. Many of the arguments used against auctioning, particularly regarding the potential to create uncertainty for investors, highlight the importance of allocating train paths for appropriate lengths of time and the need to ensure existing contracts are protected, rather than limiting the potential applicability of auctioning.

DRAFT FINDING 10.3

Greater flexibility in the allocation of train paths has the potential to promote greater efficiency. Auctioning potentially has significant benefits but may not be cost effective. Development of cost effective mechanisms designed to reveal valuations placed on train paths by users is to be encouraged.

Path allocation can present particular problems where train operators are vertically integrated, as conflicts may arise between the financial interests of the rail operator and efficient allocation of train paths. One way of dealing with this is by creating ring-fenced units within vertically integrated operators. Examples of this are QR Network Access and the Pacific National Network and Access Division in Victoria. Even where these business units are run independently and with separate balance sheets, these measures may not ensure non-discrimination between access seekers if the business units are in a subsidiary relationship to a parent company running its subsidiaries to benefit the company as a whole (PC 1999c).

Regulatory fragmentation

Concerns have often been expressed about the extent of regulatory fragmentation in the rail sector. Chris Corrigan, speaking at the BTRE's 2005 Transport Colloquium as (then) Managing Director of Patrick Corporation, described the regulatory environment for rail from his company's perspective:

> There are seven different track owners with whom the three above rail operators would need to negotiate access if they wished to operate nationally.
>
> There are 9 Acts covering rail safety and 3 different rail safety investigators, NSW, Victoria and ATSB covering the rest of the country.
>
> There are 15 Acts with powers over Occupational Health and Safety nationwide affecting rail operations and there are 76 Acts with powers over environmental management with which a national freight operator must comply.
>
> That's the glorious way in which rail operates in this country today. (Corrigan 2005, p. 6)

Although there has been considerable reform in the rail industry over the last decade, it has largely occurred jurisdiction by jurisdiction, resulting in the emergence of a multiplicity of standards and regulatory bodies. There are two principal areas of fragmentation:

- differing requirements and conditions for rail safety accreditation in most jurisdictions, with seven rail safety regulators (compared with one in the United States); and
- multiple access regimes across the national rail network which have been evolving on different pathways.

Regulatory fragmentation can inhibit the efficient operation of trains across Australia and impede effective competition and coordination, while increasing transactions costs and uncertainty (with, again, potentially negative consequences for investment).

Impact of regulatory fragmentation

One effect of a lack of coordination is higher operating and transactions costs for rail operators. PN has stated:

> Without question the multiple regimes and access agreements create significant administrative cost and burden. In addition, and potentially more importantly, there are likely to [be] efficiency losses as track owners do not efficiently co-ordinate their approaches to investment, planning and train management. (sub. 41, p. 23)

The ARTC expressed similar sentiments:

> In order to achieve competitive neutrality between road and rail modes, it is necessary to increase the level of consistency and certainty in regulatory treatment across jurisdictions. This is particularly relevant to the rail mode where safety and economic regulation is largely undertaken by state based jurisdictions. Road pricing and safety regulation, whilst not perfect, is much closer to being undertaken on a national basis. (sub. 11, p. 40)

This regulatory fragmentation exacerbates problems stemming from the long-standing lack of inter-operability across different rail systems. Different loading and rail track gauges still limit the potential for both competition and service coordination. Similar problems stem from jurisdictional differences in operating standards, signalling and communications systems. While issues relating to differences in technology across jurisdictions are not discussed further here, the Commission understands a forthcoming BTRE publication will discuss opportunities for greater technological, as well as regulatory, harmonisation.

The hurdles facing productivity performance in the rail sector have been highlighted by the ARA:

> [It is] … very difficult to improve [productivity] when you have got seven safety regulators, seven economic regulators, four different signalling systems, 72 different occupational health and safety regulations, all state based. (Nye quoted in McKay 2006, p. 10)

COAG has recognised:

> A national system [of regulation] is crucial to Australia’s economic and social well being. It is essential that decisions made in one jurisdiction should be mutually recognised elsewhere. There should be an integrated, national and efficient decision-making framework to gain access to the national road or rail network. (COAG 2006a, appendix C, p. 14)

DRAFT FINDING 10.4

There is considerable scope for greater national consistency and coordination in rail access regimes, pricing and other regulatory frameworks — including in operational practices and technical standards.

The decision of the Australian Transport Council (ATC) to give the NTC responsibility for improving safety, efficiency, and compliance in the rail sector from its inception in 2004 has the potential to reduce the level of regulatory fragmentation. There is some evidence that benefits of this are being seen already in the area of rail safety.

Rail safety regulation

At its June 2005 meeting, the ATC agreed that all jurisdictions would base rail safety regulation on a draft national safety bill (intended to be a model for jurisdictions to follow). This was designed to ensure that there would be a nationally consistent legislative approach to rail safety regulation. The draft bill was adopted by the ATC in June 2006 and a target of July 2007 was adopted for all jurisdictions to implement legislation based on the draft bill (NTC 2006d).

This is a significant step forward in reducing regulatory fragmentation. However, there is some concern about how closely individual jurisdictions are implementing the nationally agreed draft bill. The ARA also has noted that even following adoption of the draft bill, there will still be 'seven safety regulators interpreting the same bill in a different way' (Steketee 2006).

In addition, and in a further move toward greater harmonisation, the February 2006 COAG meeting agreed to request the ATC to recommend an approach for establishing a nationally consistent approach to interstate rail safety regulation, potentially including a single system of operator accreditation, regulatory oversight and rail regulator recruitment and training. COAG has requested that the ATC reports back to it by the end of 2006 (COAG 2006a).

DRAFT FINDING 10.5

There are efficiency gains to be obtained from a single institutional framework for safety regulation of rail. The adoption of nationally consistent rail safety regulation legislation by July 2007 is, therefore, a priority.

A national approach to regulating rail access

Third party access regimes for rail infrastructure services were introduced as part of the National Competition Policy reform process to promote above-rail competition. Third party access regulation sets out principles for access seekers to negotiate with infrastructure providers to attempt to reach agreeable terms and conditions. Regimes also contain provisions and mechanisms for dispute resolution where parties are unable to reach agreement.

The National Access Regime was introduced under section IIIA of the *Trade Practices Act 1974*, and most State Governments have also established access regimes for rail infrastructure. As noted in chapter 5, while all jurisdictions base access regulation on the same principles, there are a number of differences in the way the access regimes operate, creating inconsistencies across jurisdictions. The multiple regimes and regulators also increase transaction costs for rail operators.

At its February 2006 meeting, COAG agreed to adopt reform measures aimed at a more consistent national approach to economic regulation of rail, and regulation of 'nationally significant' infrastructure more generally. This included the signing of a *Competition and Infrastructure Reform Agreement* to provide for a simpler and more consistent national system for economic regulation of infrastructure (box 10.3) (COAG 2006a). Specific proposals are to be available for consideration by COAG in early 2007 (COAG 2006b).

Box 10.3 **COAG agreement on greater national consistency for infrastructure regulation**

COAG agreed at its February 2006 meeting to adopt measures designed to promote a more nationally consistent approach to regulation of nationally significant infrastructure. This included the signing of a *Competition and Infrastructure Reform Agreement.*

It was agreed that, wherever possible, third party access to infrastructure services should be on the basis of terms and conditions commercially agreed in negotiations between the access seeker and the operator of the infrastructure. Where third party access regimes are needed, it was agreed that the Competition Principles Agreement would be amended to incorporate the following principles:

- all third party access regimes will include objects clauses that promote the economically efficient use of, operation and investment in, significant infrastructure;
- all access regimes will include consistent principles for determining access prices; and
- where merits review of regulatory decisions is provided for, the review will be limited to the information submitted to the regulator.

The Agreement also includes:

- new requirements that regulators will be bound to make regulatory decisions under an access regime within six months, provided the regulator has been given sufficient information;
- all State and Territory access regimes to be submitted for certification by 2010 following agreement on a streamlined certification process; and, importantly for rail,
- the implementation of a simpler and consistent national system of rail access regulation for agreed nationally significant railways using the ARTC access undertaking as a model.

Source: COAG (2006a).

The COAG agreement, and particularly the adoption of a simpler and nationally consistent system of rail access regulation, should assist in reducing regulatory inconsistencies across jurisdictions and in reducing transactions costs for rail operators. The Australian Government has indicated a preparedness to legislate for a single national regime should it find the progress under COAG arrangements unsatisfactory.

A single national economic regulator?

Various participants have suggested a single national economic regulator for rail. The ARTC stated:

> Rail needs to have a single national regulator in respect of economic regulation. This would deliver a comparable framework to that used for road. It is not necessary that the same regulatory body be used for both modes. It is more important that the regulatory objectives and mechanisms be consistent. In any event, economic regulators need to operate independently from government decision making. ARTC would strongly support a recommendation by the Commission to adopt the ACCC as the single regulator for the national rail network. This would deliver the required consistency and independence in access regulation and pricing. (sub. 11, p. 50)

There are a number of potential advantages in having one national economic regulator and one national economic regulatory regime. These include:

- economies of scale and scope in undertaking the regulatory task (that is, the average cost of making and administering rail regulation might decline);
- the ability to design the most effective regime for cross-border operations might be enhanced;
- lower enforcement costs;
- lower compliance costs of dealing with just one regulator and one set of laws; and
- pooling of expertise and resources which may reduce the risk of regulatory error and increase the speed, quality and consistency of regulatory decisions. The risks associated with different interpretations of the law are reduced.

There may also be some disadvantages stemming from having one regulator and one set of laws, including:

- the ability to design the most effective regime for the circumstances of a particular jurisdiction (or rail operation) is constrained (PC 2004a); and
- the consequences of regulatory error may be much more significant with one national regulator.

A single national economic regulator for rail would presumably require a single regulatory regime. It is not clear at this stage whether this is called for.

DRAFT FINDING 10.6

There are significant potential economic benefits from achieving a nationally consistent approach to access regulation of the rail sector. The reform measures agreed by COAG in February 2006 represent a way forward to achieving such consistency. Progress of the current agreed COAG reforms should be monitored to determine whether there are likely to be additional net benefits from moving to a single national regulator or regulatory regime.

The Commission seeks comments from participants on the desirability of moving to a single national regulator or regulatory regime for rail infrastructure.

How beneficial is access regulation for rail?

While regulatory fragmentation is a significant issue, there are more fundamental concerns about the appropriateness of access regulation itself in the case of rail services. The bulk and non-bulk sectors of the rail market raise different issues about regulatory appropriateness.

As noted in chapter 5, the prices charged for the transport of rail freight, within ceiling and floor limits, generally are determined through negotiation. The degree of (potential) competition from other modes of freight transport will shape where in the range the negotiated outcome is likely to occur.

Except for some specific bulk freight commodities — coal in particular —– rail freight charges appear likely to be constrained by inter-modal competition, rather more than by price ceilings set by economic regulators. That is, road freight charges probably are currently the principal determinant of rail freight charges (adjusting for other important influences such as timeliness, reliability and service quality). While not inconceivable, it is hard to envisage a set of circumstances in which rail could become a price-maker, rather than a price-taker, for non-bulk freight on most of the major inter-capital corridors. The impact of regulators' decisions is, therefore, not generally as great as in most other regulated areas of the economy (where the regulated ceiling price is more typically the price charged).

The ARTC has observed:

> On the interstate network, pricing is constrained more by intermodal competition in many markets than by regulatory pricing limits. Revenue extracted by infrastructure providers on the interstate network falls short of full economic cost. (sub. 11, p. 25)

The Australian Competition and Consumer Commission (ACCC) has noted that the ARTC appears to be recovering revenue well below the economic cost of providing services. It has further stated 'prices negotiated between ARTC and access seekers will therefore generally reflect a competitive outcome' (ACCC 2002, p. 115). On this account, concerns about market power and the ability of access seekers to obtain competitive prices seem misplaced.

This casts doubt on the need for rail freight infrastructure charges for non-bulk freight to be regulated at all (particularly in areas where above- and below-rail operations are vertically separated, which includes the entire interstate track except for Queensland). There seems to be little dispute that rail freight faces significant competition from other freight modes, and especially from road. Even in areas such as grain transport, where rail faces somewhat less competition, high levels of competition in final product markets are likely to preclude rail infrastructure operators from earning monopoly rents.

The decisions of regulators are most likely to be influential in the bulk freight market and where above-rail firms have significant sunk investments. (That is, where infrastructure providers are more likely to be able to realise ceiling prices.)

On this basis there is likely to be a strong case for price regulation primarily on coal lines in New South Wales and Queensland and, potentially, those parts of the network where below-rail operators also run above-rail services.

While access regulation in the non-bulk freight market seems superfluous, this does not mean it is costless. In addition to administration costs and compliance costs attached to preparation and enforcement of regimes, the regulations may restrict operator behaviour (for example, by precluding discriminatory pricing strategies) in a manner that may reduce efficiency. (This is discussed in chapter 5.)

DRAFT FINDING 10.7

In view of the lack of market power of vertically separated below-rail operators competing with road freight, there is likely to be a strong case for price regulation only for coal lines in New South Wales and Queensland and for those parts of the network where below-rail operators also run above-rail services.

The Commission seeks comments from participants regarding the appropriateness of the current coverage of access regimes for rail infrastructure. What might be the effects of removing access regulation on the vertically separated elements of the interstate track?

Rail regulation and investment

As previously noted, regulation is never costless. Even in those areas where rail infrastructure providers are able to obtain ceiling prices, and hence price regulation might appear most warranted, potential costs arise from the effect regulation has on investment incentives. As Queensland Rail (QR) has commented:

> For traffics where rail haulage still predominates, such as coal, the regulatory arrangements create a significant risk of a service provider under-recovering the true cost of service provision. QR considers that price distortions arising from the limitations of the regulatory framework that applies to rail will also have an impact on incentives to invest in rail infrastructure. (sub. 53, p. 72)

The ARA has stated:

> The issue of providing infrastructure investment to address bottlenecks has recently been profiled with a marked increase in overseas demand for Australian commodities. The capacity to meet infrastructure investment requirements of above rail operators, and those industries dependent on the infrastructure, has found to be constrained by price ceilings and regulatory returns, where the balance of regulatory setting is weighted towards efficiency vis-à-vis sustainability. This raises some significant questions about the appropriateness of the current rail pricing regime that denies the market the capacity to meet and fund their own investment requirements. (sub. 33, p. 8)

The existence and implementation of access regulation is likely to affect incentives to invest in rail infrastructure. Access regulation will only improve the efficiency of investment in rail infrastructure where there are well informed regulators with access to regulatory instruments that permit isolation of monopoly ‘rents’ accruing to successful projects through inefficient pricing or restrictions on access. Failing this, access regulation has the potential to discourage investment (PC 2001b).

The limited information and imperfect tools available to regulators reduces the likelihood of accurately striking a balance between curtailing monopoly rents and allowing infrastructure providers to earn a satisfactory return on their investment.

The Commission has previously noted the potential for regulatory errors to be asymmetric in nature. Regulators tend to place limits on upside benefits of investment, but fail to adequately recognise downside risk. This increases the potential for access regulation to dampen investment incentives.

In its review of the National Access Regime, the Commission made a number of recommendations designed to increase investor certainty and reduce investment disincentives (box 10.4). These recommendations included insertion of an objects clause giving primacy to economically efficient use of, and investment in, infrastructure, and pricing principles to guide regulators, and were supported by participants in this inquiry. For example, QR observed:

> … it is critical that any access regime defines a clear overarching objective, which is based on ensuring the efficient use of existing infrastructure and optimal investment in new capacity. (sub. 53, p. 77)

On the importance of having an objects clause along the lines of that proposed by the Commission, the Australian Government's Exports and Infrastructure Taskforce suggested:

> It is important that this economic efficiency interpretation is the overriding objective of access regulation and that alternative 'laundry lists' do not distract from the consistent application of this central objective (Exports and Infrastructure Taskforce 2005, p.40).

Many of the Commission's recommendations were incorporated in the *Trade Practices Amendment (National Access Regime) Bill 2006*, which was recently passed by the Commonwealth Parliament.

DRAFT FINDING 10.8

The recent adoption of the recommendations from the Productivity Commission's 2001 National Access Regime report, particularly relating to the inclusion of an objects clause and pricing principles, is likely to reduce the potential for access regulation to discourage investment.

A number of State based regimes still contain conflicting objectives with relatively little guidance from governments on which should be given priority. The State based regimes would benefit from clearer prioritisation of objectives. Inclusion of an objects clause and pricing principles similar to those recently included in Part IIIA of the Trade Practices Act would go some way to providing greater certainty for investors. This is consistent with the Competition and Infrastructure Reform Agreement supported by COAG in February 2006.

Box 10.4 **Productivity Commission Review of Part IIIA**

The Commission reviewed Part IIIA of the *Trade Practices Act 1974* in 2001. While the Commission found the national access regime had some strengths, there was also concern about the potential for access regulation to deter investment in essential infrastructure. To lessen this risk, the Commission proposed new measures to be incorporated into the regime to facilitate efficient investment.

Those measures included provision for binding ministerial rulings regarding whether Part IIIA declaration criteria are met for proposed infrastructure facilities, exemptions to Part IIIA for government-sponsored infrastructure projects awarded by competitive tender and consideration of measures such as fixed-term access holidays.

The Commission also proposed a number of modifications to Part IIIA to ensure access regulation was better targeted and more workable. These included:

- inserting an objects clause and pricing principles to guide regulators and industry and to discourage unwarranted divergence across industry-specific regimes;
- strengthening the coverage criteria to ensure that mandated access would only be required where it would promote a *substantial* increase in competition;
- streamlining the coverage criteria applying across the regime's different access routes to reduce the scope for inconsistent determinations;
- enhancing the prospects for negotiated outcomes and ultimately effective arbitrations, through modifications to the negotiate-arbitrate framework; and
- improving administrative efficiency and transparency to address cumbersome and protracted arrangements (PC 2001b).

The Government subsequently endorsed the thrust of the Commission's recommendations, including agreement on insertion of an objects clause and pricing principles, changes to declaration thresholds to ensure declaration takes place only where the expected increase in competition is material, provision for facility owners to lodge post-declaration undertakings and placement of additional obligations on Ministers to provide reasons for their decisions on declaration applications and other access arrangements.

Decisions on the practicality of mechanisms such as access holidays and truncation premiums were deferred, as was a decision on whether to initiate a process to develop productivity based approaches to setting access prices.

Regarding access holidays, in a recent response to the Commission's Review of the Gas Access Regime, the Ministerial Council on Energy agreed to introduce into that regime a new option for a 15 year regulation exemption for proposed pipelines or distribution networks that do not meet the criteria for coverage under the Gas Access Regime.

Source: PC (2001b); MCE (2006).

Length of access agreements

An issue relevant in a vertically separated rail environment is the duration of access agreements. Above-rail operators have stated that it is difficult to obtain access agreements longer than five or ten years. Whether such agreements provide sufficient investor certainty was raised by PN:

> PN is only able to secure short term access agreements (and associated short term certainty on price and paths agreements) in some jurisdictions, despite rollingstock investment horizons which are typically 20 years or more. (sub. 41, p. 25)

While relatively short-term access agreements may be designed to promote above-rail competition, they are likely to also reduce certainty and, therefore, potentially reduce investment incentives. On the other hand, a requirement for lengthy access agreements could become a significant barrier to entry for start-up operators with small volumes and uncertain futures.

Lack of commercial focus of government operations

Despite corporatisation, concerns remain that government-owned rail operators are insufficiently commercially focussed. Governments, as shareholders, appear to have neither demanded nor enforced the same degree of commercial discipline as is placed on private sector operators (see for example PC 1999c). There are a number of possible reasons for this, including:

- while most government railways are corporatised, the remaining problems may reflect difficulties in the implementation of the corporatisation model;
- governments still subject their rail operators to multiple, and often conflicting, objectives, including some relating to social welfare, without guidance on prioritisation;
- governments as shareholders facing budget constraints (and observing poor returns in rail) are often reluctant to provide adequate equity funding or allow railways to borrow on their own behalf, even when justified commercially; and
- governments often have difficulties in maintaining an arm’s length relationship with their railway boards due to community pressures.

Stricter application of the corporatisation model to government owned railways may produce further gains and resolve some of the above issues. Others consider that inherent limitations of the corporatisation model will always lead to suboptimal economic and financial performance, and that private sector alternatives to government provision should play more of a role — such as competitive franchising and/or contracting out and full privatisation.

While there may be merit in suggesting a larger role for the private sector, it seems reasonable to conclude that, for the reasons outlined above, the corporatisation model is yet to be fully implemented or tested. Opportunities almost certainly exist for improving the performance of government-owned rail operators by more strictly applying the corporatisation model.

In 2005, the Commission completed a three-year study analysing external governance arrangements for government trading enterprises (GTEs), the findings of which are highly relevant to the rail sector. The study (PC 2005b) noted that priority areas for reform included:

- clarification and public scrutiny of the rationale for ongoing government ownership of the corporatised entities;
- greater clarification and transparency of objectives (both commercial and other public interest), together with their prioritisation or weighting;
- the need to make a clearer distinction between external and internal governance, with improved transparency of the external governance role of ministers; [1]
- greater independence of corporate boards, with CEOs appointed by, and accountable only to, the boards; and
- a general strengthening of accountability, including the public availability of statements of corporate intent that express objectives as target outcomes.

The study also noted the importance of adequately resourced performance reporting, and of ensuring that community service obligations are fully funded from government budgets (PC 2005b). As recommended in chapter 11, stricter application of the commercial model to government-owned railways would seem desirable.

The Commission seeks participants' views on the performance of government-owned rail providers.

10.3 More general road-rail issues

Some non-price impediments to efficient performance span both road and rail modes. One major issue that has been raised again in this inquiry is the consistency of investment criteria applied to road and rail projects.

[1] External governance refers to the authority and systems utilised by ministers and government agencies for the control and supervision of public organisations. Internal governance refers to the systems of direction and control within an organisation, and is the responsibility of the governing body, usually a board, and senior management of the organisation (PC 2005b).

Different investment criteria for road and rail projects

It is often asserted that governments traditionally have underinvested in rail relative to road, due to the use of different investment criteria when assessing potential projects. The tendency for governments to use different criteria for assessing road and rail projects was noted by the Commission in its 1999 Report (PC 1999c). Rail projects often have been assessed using financial criteria without consideration of wider benefits to society such as reduced travel times (for both passenger and freight transport) and fewer accidents. Road projects have more frequently been subjected to wider cost–benefit analysis.

The Australian Government observed in the AusLink Green Paper:

> Rail infrastructure projects are commonly appraised on financial rather than economic cost–benefit criteria. Financial analysis presents higher hurdles than economic analysis by excluding benefits for organisations or groups and only considering those for the investor. Financial analysis also has to take account of corporate taxation and does not include consumers' surplus gains, which can make an important difference for large lumpy investments (DOTARS 2002, p. 27).

The Western Australian Government also has observed:

> Government's decision to invest in roads is mainly driven by social and community factors, but private rail infrastructure owners' decision to invest in rail is driven on the basis that a commercial return can be attained. The different approaches to investment decisions does not help to maximize, where possible, rail freight share for the benefit of the community and the environment. (sub. 27, p. 11)

The use of different investment criteria across modes need not invariably 'favour' investment in one mode over another. For example, a road project involving significant social costs may be less likely to proceed if social effects are incorporated in the cost–benefit analysis relating to it. That said, there are likely to be gains from governments subjecting all transport investment proposals, regardless of mode, to stringent and consistent evaluation processes. This is a key feature of planning under the AusLink program. As noted in the AusLink White Paper:

> It [AusLink] provides an integrated corridor approach to planning. This new approach focuses on meeting future passenger and freight needs in the best way, irrespective of the transport mode rather than focusing on separate rail and road transport modes. This is the cornerstone of the AusLink approach to planning and funding land transport infrastructure. (DOTARS 2004, p. ix)

The Australian Transport Council has endorsed *National Guidelines for Transport System Management* designed to achieve consistency in evaluation of projects across modes, and these are being progressively implemented across jurisdictions. It has been agreed by COAG that the guidelines will be implemented in all jurisdictions by December 2006 (COAG 2006a).

One difficulty associated with cost–benefit analysis of ‘competing’ investment options is dealing with social impacts. The importance of doing so accurately is highlighted in the ATC guidelines:

> Competitive neutrality would require that the externalities produced by two modes be dealt with on the same basis. For example, if road produced an externality that was unpriced and rail did not produce that particular externality at all, road users would pay a price that was below the full cost they impose on society … As far as investment is concerned, competitive neutrality should be achieved, if investment projects in both modes are identified and evaluated on an equal basis … the BCA [benefit-cost analysis] methodology is well suited to ensure equal treatment in principle. In practice, it requires assumptions and parameters to be aligned and appraisals to be undertaken in an objective manner, which is what these guidelines are aiming to promote. (ATC 2004a, pp. 47-48)

As noted in the guidelines, it is ultimately incumbent on government departments to ensure that project proposals are correct in their methodology and consistent in assumptions and parameter values. Departments must be particularly aware of hazards such as ‘double counting’ of externalities (for example, including road accidents as a cost of a road project, and simultaneously including avoidance of the same road accidents as a benefit in an alternative rail project when assessing the relative merit of the two projects) or including externalities that have been largely internalised (see discussion in chapter 6). Various methods of dealing with externalities need to be considered if cost–benefit analysis is to be done effectively.

Despite development of these guidelines, doubts have been expressed about the extent to which final investment decisions reflect the outcomes of agreed evaluation, rather than political priorities. The ARA stated in its submission:

> Theoretically Auslink offers a common analytical approach for road and rail infrastructure investment, including assessing investment across modes. However, in practice, political decisions on investment have been made under the AusLink banner without reference to the common AusLink methodology. (sub. 33, p. 12)

While there is a strong case for including community service obligations in evaluations, both they and the evaluations as a whole should be made transparent.

DRAFT FINDING 10.9

Adoption of the ATC guidelines on investment evaluation across all jurisdictions by December 2006 should promote more consistent investment decisions and improve the efficiency of investment in transport infrastructure.

Some inquiry participants have suggested that governments should increase investment in both road and rail to make up for perceived past inadequacies, particularly with regard to rail infrastructure. However, spending now to make up for what was perceived as inadequate investment in earlier periods only makes economic sense if that spending today will earn adequate returns in the future. Within this inquiry, the Commission has not been able to undertake the detailed work necessary to make conclusions about the adequacy of road and rail investment. However, adoption of consistent evaluation guidelines and thorough cost–benefit analysis should reduce the *potential* for sub-optimal investment decisions for both road and rail. Further ways of improving investment decisions for road are discussed in chapter 9.

Remaining regulatory restrictions on freight movement?

Historically, regulations restricted the movement of certain commodities to rail. While these measures have been almost entirely removed, there may be merit in a suitable body, such as the NTC, undertaking a stocktake of current regulatory restrictions on freight movement (ideally across all modes). The stocktake could identify any remaining anticompetitive regulation and, where desirable, make recommendations for reform.

The Commission seeks information from participants identifying any remaining regulatory restrictions on freight movement. In particular, are there any remaining regulations that effectively restrict particular commodities to rail or to road?

10.4 Enhancing intermodal connections

Intermodal connections provide the means of transferring freight from one mode of transport to another at key points along the logistics chain. The seamless transfer of freight across modes is important to the efficiency of the national freight system as a whole, and in promoting efficient investment to cater for particular transport tasks. It is important to identify and address any bottlenecks that may diminish otherwise desirable transfers of freight across transport modes.

The terms of reference for this inquiry ask the Commission to include access to, and competition between, intermodal facilities when assessing impediments to efficient freight infrastructure. The Commission is aware of various studies looking at intermodal issues, including the National Intermodal Terminal Study (prepared by Meyrick and Associates for DOTARS), the Freight Infrastructure Advisory Board report in New South Wales, and the South East Queensland Intermodal Freight Terminal Study.

There has been much discussion about infrastructure bottlenecks in recent times. The Reserve Bank of Australia has suggested that supply bottlenecks have held back export growth, particularly in the mining sector (RBA 2005). The Australian Government's Exports and Infrastructure Taskforce found that:

> In the absence of decisive policy action, significant infrastructure bottlenecks constraining Australia's exports are likely to develop over the next five to ten years. The areas of principal concern are port channels, road and rail access to major ports and rail track. In addition, there will be a need for new water supply infrastructure, electricity generation plants and gas pipelines. (Exports and Infrastructure Taskforce 2005, p. 5)

There has been relatively little input on these issues provided to this inquiry, given its pricing focus. The major issue raised was bottlenecks at major ports.

The Maritime Union of Australia stated:

> … there is a considerable body of evidence that indicates that the road and rail interface at ports is at times, and in some ports, impacting on the efficient flow of goods through ports. (sub. 48, p. 8)

In New South Wales, it is anticipated that an expansion of facilities at Port Botany will put considerable pressure on surrounding roads. In response, the state government has adopted a policy to increase the proportion of container freight carried by rail to and from the port from the current 20 per cent to a target of 40 per cent. This target has been described by Meyrick and Associates (2006a) as 'exceptionally aggressive'. The Managing Director of Patrick Corporation, speaking in 2005, said:

> … the current NSW government has set a target for container rail movement to and from the port of 40% as a minimum by 2011.
>
> This figure is demonstrably unsupportable and unachievable due to the lack of rail infrastructure, specifically in the form of inland rail terminals capable of handling forecast volumes.
>
> Patrick estimates Port Botany will require 59 round-trip rail services per day by 2011. Patrick can only identify inland rail terminal accommodation for a maximum of about 14 services a day. (Corrigan 2005 p. 5)

A report was commissioned in 2004 advising on the most efficient way of achieving the 40 per cent target. The report from the Freight Infrastructure Advisory Board — known as the 'Brereton report' — recommended that the 40 per cent rail share target 'must be met and if possible exceeded' (FIAB 2005, p. 4). Measures proposed to achieve this included:

- an expansion of intermodal terminal capacity;
- the ARTC taking control of the Sydney metropolitan freight network,

- construction of a Southern Sydney dedicated rail freight line between Macarthur and Sefton;
- implementation of a national truck tracking scheme; and
- the implementation of a freight infrastructure charge of $30 per TEU (that is, 20 foot equivalent container) that would be fully rebated for containers carried to or from port by rail, or for containers carried to or from the port during designated off peak hours (FIAB 2005).

The report is under consideration by the New South Wales Government. The New South Wales Government notes that it is currently 'enhancing the capacity of the existing Botany Freight Line as part of the expansion of Port facilities' (sub. 50, p. 10).

Under the AusLink program, the Australian Government has stated that it will invest $110 million to improve rail access between Port Botany, the intermodal facilities at Chullora and Enfield and the interstate connections to these facilities. Further, as part of the AusLink funded upgrade of the Sydney–Melbourne rail line, it has been announced a dedicated freight line is to be constructed between Macarthur and Sefton by the ARTC at a cost of $192 million (Meyrick and Associates 2006a).

The Port of Melbourne plans to lift the percentage of containers transported to and from it by rail from the current 17 per cent to 30 per cent by 2010. By 2035, the port expects to be handling four times more containers annually than it does now. In response the port has adopted by following strategies:

- encouraging use of B-doubles and Super B-doubles (that is, longer 30 metre B-doubles capable of carrying additional containers) at the expense of semi-trailers;
- optimising truck trips to reduce total distance travelled;
- improving the scope, capacity and convenience of the surrounding road network;
- supporting the development of on-port rail terminals; and
- promoting further integration of rail and stevedoring operations (Port of Melbourne Corporation 2006).

The Commission seeks further input from participants on intermodal issues affecting the efficient transport of freight and appropriate strategies.

10.5 Summing up

Beyond the pricing framework applying to road and rail freight transport infrastructure, a number of regulatory impediments are identified that can hinder the efficiency and performance of the freight transport sector in Australia.

The current prescriptive approach to regulating heavy vehicles (mandating performance standards to be achieved and how to achieve them) is likely to limit the efficiency and productivity of the road freight sector, and raise costs to users of road freight services. A performance-based framework for regulating heavy vehicles (mandating only the performance standard to be achieved) will more likely lead to continuing productivity gains and innovation in the road freight sector. Adopting a more performance-based approach to regulating heavy vehicles is a priority reform and full implementation of the NTC PBS project is an important way forward.

A number of regulatory impediments also have been identified in the rail sector. There is considerable room for greater national consistency and coordination in both safety and access regulation. Moreover, in view of the lack of market power of vertically separated below-rail operators (particularly in the non-bulk freight market), there is a case for winding back much of the access regulation in the rail sector. The Commission seeks further comment on the appropriateness of current access regulation.

Performance of the rail sector would be improved by a stricter application of the corporatisation model to government-owned railways. There is also potential for obtaining greater efficiency of investment in both the road and rail sectors. The full adoption by all jurisdictions of the ATC's guidelines on investment evaluation would assist in this regard.

11 Improving efficiency in road and rail: ways forward?

Key points

- There are a number of measures that could be taken in the short term that would improve efficiency and productivity within both the road and rail sectors.
- For rail, broadly-based benefits would accrue from addressing a range of regulatory impediments, stricter application of corporatisation principles, and transparent funding of community service obligations.
  - There also is scope for moderating rail access regulation, as well as investigating whether allowing vertical re-integration of some networks would promote their long-term viability.
- For road freight, efficiency benefits in the shorter term would come from regulatory reforms (particularly moving to performance-based regulation) and improved decision-making frameworks for road projects.
- More fundamental reforms of road infrastructure pricing and provision would deliver potentially bigger benefits but at much higher cost, and pose major implementation challenges that would need to be satisfactorily resolved.
  - Two models warrant further consideration: a road fund, and direct user charging and more commercially-oriented management for the major freight routes.
- A range of studies suggest that efficiency-enhancing measures that could be implemented in the short term could deliver productivity gains of the order of 5 per cent in both modes. This would generate an increase in GDP of around 0.3 per cent and lead to expansion of both sectors, though more so for rail freight.
  - More fundamental reform of road pricing and provision has the potential to generate additional benefits, but their magnitude is far more speculative.

Competitive neutrality is an important facet of achieving efficiency in road and rail freight transport provision and use, but the available evidence suggests that neither neutrality nor modal choice is being significantly compromised by current charging arrangements. For many rail lines, which already have been placed on a commercial footing, the more pressing issue is what efficiency-enhancing regulatory and structural measures might help to secure their long-run viability. For the road network, a threshold issue is whether direct road user charging and more commercially-oriented road provision are feasible and economically worthwhile.

This chapter draws together analysis presented in earlier chapters to outline measures that the Commission considers would clearly promote productivity within each mode. It also presents more fundamental reform options for the pricing and provision of both road and rail that have potential to yield more substantial efficiency and productivity gains, particularly for road, but which also present some difficult issues that would need resolving and on which the Commission seeks further input.

11.1 Improving the efficiency of rail freight

Clearly, there are deficiencies in current road infrastructure pricing arrangements. Yet the implications of this for the competitive position of road relative to rail appear not to be significant, given the available evidence about the magnitude of road pricing distortions for major corridors, as well as the limited effects road infrastructure prices appear to have on modal choice.

In the Commission's assessment, more certain, larger and more broadly-based benefits would accrue to rail infrastructure providers and users from addressing a range of impediments *within* the sector, particularly the adoption of policies that foster ongoing improvements in rail freight productivity and which promote cost recovery. As discussed in chapter 10, major impediments in the rail sector include the legacy of a century of inconsistent state-based regulation, as well as issues arising from the comparatively recent structural separation and commercialisation of rail networks and accompanying access pricing regimes.

As also discussed in chapter 10, while corporatisation of government-owned below-rail infrastructure operators has led to improved performance, it would appear that the corporatisation 'model' has not been applied as well as it might. Stricter application of the corporatisation model to government-owned railways, including greater clarity of corporate objectives, improved transparency of the external governance role of ministers, and a general strengthening of accountability appear warranted. (Of course, many of these governance issues would be resolved if rail networks were privatised.)

A commercial focus also requires that any Community Service Obligations (CSOs) required of commercial operators are funded directly and transparently by governments. This would ensure that rail operators are not required to pay for such services, as well as promote least-cost achievement of CSO objectives.

DRAFT RECOMMENDATION 11.1

The corporatisation model should be more strictly applied to government-owned railways in order to improve industry performance. Particular priorities include greater clarity of objectives, improved transparency of the external governance role of ministers, and a general strengthening of accountability.

Greater transparency of funding of Community Service Obligations — including enunciation of objectives, and demonstration of how contributions will achieve stated objectives at least cost — should be introduced as soon as possible, among other things, to facilitate fully commercial provision of rail freight operations.

On the regulatory front, there are several worthwhile initiatives underway aimed at streamlining incompatible operational regulations. For example, as discussed in chapter 10, COAG is pursuing a nationally consistent approach to interstate rail safety regulation, possibly including a single system of operator accreditation, regulatory oversight and rail regulator recruitment and training. Such reforms have significant potential to reduce rail freight costs, particularly on interstate corridors and should be implemented as soon as possible.

DRAFT RECOMMENDATION 11.2

National consistency and coordination in rail regulatory frameworks — including of safety, operational and technical standards — should be expedited.

Economic regulation of rail infrastructure operators may also be affecting the sector's efficiency and even long-term viability. As discussed in chapter 10, there are potential economic benefits from adopting a nationally-consistent approach to access regulation of the rail sector. The February 2006 COAG agreement to adopt a nationally-consistent approach to regulation of all nationally significant infrastructure, including rail, should help to achieve this. Progress of the reforms should be monitored to determine whether there are likely to be additional net benefits of moving to a single national regulator or regulatory regime.

But more fundamentally, access regulation, designed to encourage above-rail competition, may be constraining scope for efficient pricing by below-rail operators and impeding efficient investment. The need to balance costs and benefits of access regulation has been recognised in recent amendments to the National Access Regime, which include amendments to the objects clause giving primacy to economic efficiency of operation and use of, and investment in, infrastructure, new thresholds to ensure that access declaration occurs only where the expected increase in competition is 'material', and the introduction of pricing principles that allow multi-part and discriminatory pricing where they promote efficiency.

DRAFT RECOMMENDATION 11.3

Progress in implementing the February 2006 COAG agreement to adopt a nationally-consistent approach to regulation of all nationally significant infrastructure, should be monitored in relation to rail to determine whether there are likely to be additional benefits in moving to a single national regulatory regime and regulator.

The objects clause, declaration thresholds and pricing principles (which, among other things, allow for multi-part pricing and price discrimination when they aid efficiency) now embodied in Part IIIA of the Trade Practices Act should be incorporated in all rail access regimes.

More fundamentally, the potential market power of many below-rail operators is effectively constrained by competition from road or coastal shipping. Therefore, the administrative costs and potential distortions arising from access regulation are likely to outweigh the benefits that would otherwise flow from additional competition. Accordingly, there is a strong case for moderating or even revoking some access regimes.

Continued price regulation may only be required on coal lines in New South Wales and Queensland where operators are more likely to have significant market power (because of the limited scope for coal to be carried by road), and on any parts of the network where competition from other modes is weak.

DRAFT RECOMMENDATION 11.4

There appears to be scope to moderate or even revoke access regulation where pricing by vertically-separated below-rail operators is significantly constrained by competition from road and sea freight transport operators. Building on COAG's agreement to promote nationally-consistent access regulation of major infrastructure, a process should be established for reviewing the need for access regulation of vertically-separated rail networks.

Overall, regulatory and governance reform of rail freight transport has the potential to bring significant productivity benefits as well as an improved investment capability. Commission modelling of indicative productivity gains suggests that use of rail freight transport expands significantly in response to productivity growth, reflecting the competitiveness of the markets it serves as well as its relative capital intensity. Indeed, for these reasons, rail is projected to increase its share of the freight task when the two modes are assumed to benefit from identical productivity increases (appendix G).

More fundamental structural reform of rail?

Vertical separation of rail lines can be viewed as useful policy 'experimentation' that has brought some benefits, but several years' experience now in Australia and overseas suggests that scope for competition is often limited by low traffic densities and consequent low returns (chapters 5 and 10). Vertical separation of Australian rail operations (particularly the interstate network) has had mixed results — with competition emerging on the east–west corridor, but not on others, including the north–south corridor.

Thus, for many rail networks, there appears to be a tension between promoting above-rail competition and achieving commercial viability. As discussed in chapter 10, vertical separation could constrain scope for cost recovery (by reducing scope for efficient price discrimination) as well as impose impediments to efficient operations (for example, by impeding natural synergies between above-and below-rail operations). Vertical separation may also impede efficient investment (for example, impeding synchronisation of above-and below-rail investments).

Whether these costs outweigh the benefits of above-rail competition (or at least the benefits of potential competition), justifying vertical reintegration of some networks, is unclear. A decisive factor will be the degree of competitive pressure at the margin from other transport modes. Nonetheless, the potential impacts of vertical reintegration on rail's viability and overall economic efficiency warrants further consideration. Vertical reintegration would require prior privatisation of below-rail operations, however, to preclude reversion to full government provision of rail freight transport.

DRAFT RECOMMENDATION 11.5

Given the mixed success of vertical separation in encouraging above-rail competition, whether allowing vertical reintegration of particular rail lines or networks would promote their commercial viability should be subject to detailed independent examination.

The Commission seeks the views of participants about the potential costs and benefits of reintegration on specific rail networks.

11.2 Improving road's performance

Although under the current charging system, road freight users receive only very blunt signals about the costs they generate by using particular roads, the Commission is not confident that there are significant changes that could be made to current cost allocations under this system that would unambiguously improve efficiency. (Some minor changes are suggested in chapter 4, such as the inclusion of enforcement costs in the network cost 'bundle'.)

That said, increased transparency of funding of road CSOs would help ensure, among other things, that these expenditures are well-targeted and are not being paid for by the road freight sector. And, as also noted in chapter 4, with current charges and increasing road spending, heavy vehicles *in aggregate* soon will cease to cover even their attributed network costs.

The major impediments to improved efficiency in the road infrastructure sector under current pricing and institutional arrangements are that:

- road charges reflect average costs of the road network so that road freight operators do not receive signals about the costs they generate when using particular roads; and
- providers of roads (government road agencies) for the most part do not directly receive revenue from road user charges, as these generally flow into consolidated revenues.

Use of particular roads by freight operators, therefore, will be inefficient (there will be overuse of high-cost roads and under-use of low-cost ones). As discussed in chapter 9, road provision also is likely to be inefficient because road providers do not receive appropriate price signals about the need for additional road capacity or strength, and cannot even be certain of receiving adequate recompense for road expenditure in the aggregate.

The link between revenue from charges and road funding is further complicated by the fact that the bulk of the revenue from heavy vehicle charges accrues to the Australian Government (via the fuel excise), yet the bulk of road spending is undertaken by State and Territory road agencies and local governments. In response, road agencies and local governments often regulate road access by heavy vehicles, prohibiting truck use of certain roads and/or by prohibiting certain types of vehicle, in order to contain road maintenance and replacement costs. Such blunt mechanisms significantly constrain freight transport productivity.

Some immediate policy actions

A longer-term solution would involve fundamental change in road pricing and institutional arrangements for funding and provision of roads (discussed below). However, there are several reforms that could be implemented in the short-term to improve productivity. These include, in particular, a shift away from prescriptive regulations that impede innovations in truck design (discussed in chapter 10).

DRAFT RECOMMENDATION 11.6

Prescriptive regulations that restrict particular types or configurations of heavy vehicles from using all or some roads, should be replaced, where possible, with performance-based regulations to promote flexibility, innovation and greater productivity in the road freight sector. The proposed package of Performance Based Standards to be agreed upon and implemented by all jurisdictions by end 2007 is a major step forward and it is important that the announced timetable is met.

As discussed in chapters 6 and 10, however, there are other regulations affecting the road freight industry, some of which impose high costs. Much of this regulation, especially in the environmental area, appears to have been introduced without rigorous evaluation of the costs and benefits.

DRAFT RECOMMENDATION 11.7

Regulations applied to the road transport sector should be rigorously evaluated in accordance with regulatory impact criteria, to identify least-cost approaches and demonstrate net benefits. The appropriateness and cost-effectiveness of existing regulations in the sector also should be systematically reviewed, consistent with COAG's commitment that all governments undertake targeted annual public reviews of existing regulations.

Some participants pointed to instances where heavy vehicle operators would be willing to pay for particular road upgrades. There may be opportunities from time to time for road freight infrastructure users to reach agreements with road providers for specific roadwork. The scope for such arrangements is likely to be confined to circumstances where potential benefits mainly accrue to a small group of road users, such that 'free-riding' is less likely to occur. That said, the potential benefits for a particular industry (such as livestock transport) or production centre (such as a mine) could be large. Consequently, arrangements between freight operators and road providers to upgrade particular roads and remove infrastructure bottlenecks should be encouraged. Any such contributions from the private sector for road provision should be excluded from the cost base for determining heavy vehicle road user charges (in the same way as local government developer charges and toll road revenues currently are excluded).

The Commission seeks the views of participants as to whether there are impediments to arrangements between heavy vehicle operators and road *providers which would allow heavy vehicle operators to pay directly for particular road upgrades.*

Some of the restrictions and regulations applying to truck use on parts of the road network may reflect inefficient road-investment decisions. Measures aimed at strengthening road investment decision-making processes more broadly would bring larger efficiency gains. Guidelines to strengthen transport planning and appraisal processes have been adopted within the AusLink framework endorsed by COAG: it is important that they are adopted and consistently applied across other levels of government as soon as possible.

DRAFT RECOMMENDATION 11.8

To improve existing investment decision-making frameworks, road infrastructure funding mechanisms should include a clear project selection process, stakeholder involvement and public transparency, including formal procedures for public consultation. These principles have been broadly adopted as part of the AusLink framework for investing in the national highway system and endorsed by COAG. They should be applied across all jurisdictions as soon as possible.

Together, these changes could generate significant benefits for the road sector and the economy. Drawing on a range of studies that estimate the potential productivity gains from such reforms, the Commission has modelled an indicative 5 per cent productivity improvement in the road freight transport sector. This would lead to an increase in GDP of around 0.25 per cent.

Notwithstanding the gains that could be achieved by these reforms, some deficiencies would remain — principally, the lack of price signals resulting in inefficient infrastructure use and provision.

A way ahead for road pricing and institutional reform?

The terms of reference ask the Commission to 'provide advice on options for the design of and timeframes for implementing mass distance location based charging regimes, taking into account adjustment issues'. As discussed in chapter 8, there are two main pricing reform options — mass–distance charges (which would require monitoring total distance travelled over a defined time period) and mass–distance *location*-based charges (which would add a requirement to track vehicle use of particular roads). (As noted in chapter 8, measuring actual vehicle *mass* is probably the most technologically challenging aspect of mass–distance charging. For the foreseeable future, charges for load-related vehicle damage could only be differentiated by heavy vehicle class, as they are now).

Technological developments have made these charging instruments feasible. In particular, distance-based charges are being used in a number of countries, and in some cases, linked to use of certain roads. While the administrative, enforcement and compliance costs are currently substantial, over time pricing technology will improve and become less expensive, particularly as freight transport operators themselves increasingly employ satellite monitoring technologies for logistical purposes.

That said, the technical feasibility of pricing instruments is merely a necessary *not sufficient* condition for change. The extent to which such instruments can deliver *net* benefits to the economy depends on their implementation costs versus the benefits they bring. The latter will be a function of the efficiency gains from more accurate price signals. These in turn, depend on:

- *The structure and level of charges*. The capacity to monitor and charge for road use may not promote efficiency if charges are set at inappropriate levels. This requires a better understanding of the relationships between road use and road damage, as well as pricing structures that can minimise consumption distortions while fully covering costs. Importantly, who sets the charges, and the incentives they face, will also affect outcomes.
- *The extent to which charges can elicit efficient behaviour by users and also by providers.* The scope for efficient responses to price signals, to a significant extent, will be a function of the institutional and regulatory environment within which road freight infrastructure is provided.

This highlights the interconnection between the potential benefits of pricing reform and institutional frameworks: prices do not operate in an institutional vacuum, while different institutional frameworks are largely a response to available pricing instruments. (It is no accident that roads are charged for, and provided in, the manner in which they are currently.) Charging and institutional arrangements cannot be considered independently of each other: they are two sides of the same coin.

Advantages and disadvantages of various pricing and institutional reform options for roads were examined in chapters 8 and 9. While there are many challenges, three options that might feasibly be pursued are outlined below: the first considers pricing reform within current institutional arrangements; the second, institutional reform with limited (or no) pricing reform; while the third (and most ambitious) approach would complete the circle between road user pricing and provision.

What scope for better pricing under current institutional arrangements?

Current heavy vehicle charges are based on average costs across the network, with charge revenues (from diesel excise and registration fees) accruing to Federal, State and Territory Governments and, for the most part, treated as general revenues. Within this network approach, *distance-based* road user charges would remove some levels of averaging currently imposed by the limitations of using diesel excise as a proxy for distance travelled.

In this sense, moving to distance-based charges would allow current network cost allocations to be matched more precisely by heavy vehicle charges. For example, distance-based charges would reduce the need for averaging of costs within truck classes (because actual distance could be measured) and allow assessed costs for each truck class to be accurately allocated. Unlike fuel excise, distance-based charges could also be readily differentiated by truck class.

While distance-based charges of themselves need involve little or no change in current arrangements for *setting* road charges, by replacing the diesel fuel excise for heavy vehicles, and possibly some part of registration charges collected by the States and Territories, tax revenues flowing to different jurisdictions would likely be affected.

The costs of administering distance-based charging systems in use overseas, generally are less than 10 per cent of revenues. But these costs exclude the compliance costs incurred by truck operators (including the costs of 'on-board units'). In addition, the potential efficiency benefits of distance-based charges will be smaller than for *location-based* charges because trucks would still be charged for a network 'bundle' of costs. Without information about what freight is carried where by trucks travelling the longest distances each year (for whom charges would rise compared with current charging arrangements), the distributional effects of distance-based charges are uncertain.

On balance, in the Commission's view, introduction of simple mass–distance charges *solely* to remove one of many levels of averaging in the current system may not justify the costs (and possible distributional effects), especially given that existing fuel taxes are administratively simple and cheap and are themselves (imperfectly) related to distance travelled.

But there are other possible justifications for their introduction. Arguably, the major potential benefits from such a regime could come from establishing a 'technological' platform for location-based charging, if and when it became feasible and cost-effective. Simple mass–distance charges therefore could provide an intermediate step from an input tax to a form of direct road price, although clearly the scope for smooth transition would require on-board monitoring technologies that could be adapted to monitor location. Mass–distance charges could also provide a dedicated (and certain) source of funding for a road fund, as discussed below.

While distance-based charges would complement the current charging arrangements, mass–distance *location-based* charges would require some fundamental changes, because the network-wide averaging which underpins the current charging system would be undermined. Even if revenues from location-based charges continued to flow into consolidated revenue, they could still generate benefits from providing:

- *Better signals to road users.* Location based-charges are more like prices in that they reflect the costs associated with heavy vehicle use on different roads. This would provide road users with better signals about the costs incurred by use of different roads and provide incentives for them to use lower cost roads.
- *Better signals to road infrastructure providers.* The revenues generated from particular roads would provide signals to road infrastructure providers about where future spending might best be directed.

Given the implementation challenges and substantial costs associated with introducing location-based charges, it would be desirable to ensure that the greatest possible benefits from pricing reform could be achieved, by establishing a more direct link between road charges and road provision (discussed below). Moreover, linking road revenues to spending would likely improve community acceptance of such reform.

Linking revenues and road spending — a national road fund?

Road funds have been established in a number of other countries as a means of broadly connecting road user charges and road spending decisions. Essentially they involve devolution of responsibility for management and funding of roads to an autonomous manager or agency, usually overseen by an independent board.

A possible road fund model for Australia, drawing on discussion in chapter 9, is set out in box 11.1. While it would be possible to have road funds operating in each jurisdiction, a national road fund would appear to be required, given the current inter-jurisdictional mismatch between revenue flows from heavy vehicle charges and road spending.

The national fund would assess efficient levels of future road spending for national highways and major freight arterials, and set forward-looking charges for heavy vehicles (using either existing fuel taxes or distance-based charges). Some part of petrol excise collected from passenger and light vehicles would also need to be hypothecated to the fund to cover projected road spending, or government road owners would need to commit to levels of road funding.

Box 11.1 A model for an Australian road fund?

Design features of a national road fund would need to include:

- The fund or associated body would, with the assistance of government road agencies, determine efficient levels of spending on roads covered by the fund.
- Charges on heavy vehicles would be set by the fund to raise their allocated share of projected efficient spending (including a contribution to common costs).
  - Charges could be the current mix of fuel taxes and registration charges, or fuel taxes could be replaced by a simple mass–distance charge (at least for trucks) to reduce the imprecision of the fuel excise.
  - Distance-based charges would have the advantage of providing a dedicated source of revenue to the fund. As now, these charges would reflect network-average costs.
- To ensure adequate funding of roads covered by the fund, a portion of fuel taxes raised from passenger and light vehicles would also need to be hypothecated to it, or where road owners raise their own revenues (for example, from registration fees), there would need to be some means of ensuring adequate total road funding, such as matching conditions.
- The fund should be allowed to borrow against future revenues where feasible.
- Funds for capital works would be allocated to road agencies on the basis of transparent and publicly-available cost–benefit rankings of projects, probably combined with block allocations for maintenance and smaller projects.
- Making road users (especially road freight users) pay for CSOs, would undermine a key rationale for having the road fund. Governments should pay for projects designed to achieve such objectives from general taxation.

The major potential benefits would be the explicit linking of charges and road spending, forward-looking charges linked to efficient future spending, and greater public transparency and consultation in project evaluation. Whether the potential benefits are realised would depend largely on:

- the level of autonomy and governance of the fund. Transparency and other mechanisms to preserve autonomy would be critical; and
- agreement among jurisdictions about criteria both for setting charges and allocating funds.

This remains a ‘centralised’ approach, however, largely reflecting the charging instruments that underpin it. If location-based charges become cost-effective, appropriately set road user charges could accrue directly to government road owners according to use of particular roads, thus removing the need for a central fund to distribute network revenues. However, a national fund could evolve to having a role in setting nationally-consistent, location-based heavy vehicle charges.

DRAFT FINDING 11.1

A national road fund has the potential to improve the efficiency of road spending decisions, but, to achieve this, it would need to operate with a high degree of autonomy reinforced by appropriate governance arrangements and transparent processes, and also would require inter-jurisdictional agreement about processes and criteria for setting heavy vehicle charges and allocating funds. These are complex issues on which further input is sought.

The Commission seeks participants' views about the feasibility of establishing a national road fund, particularly how inter-jurisdictional issues might be resolved.

Closing the circle: location-based charges and more commercially-oriented road provision?

Location-based charging represents a quantum leap from distance-based charges, necessarily breaking down network cost averaging. The main efficiency benefits would come from improved signals to road users about the marginal damage their road use imposes (discouraging them from using roads unsuited to heavy vehicles and encouraging them to use roads built for that purpose), and improved signals to road providers about the demand for road capacity and quality (such as pavement durability), potentially leading to more efficient road provision. Mass–distance location-based charges also open up the prospect of commercially-oriented provision of roads.

As far as the Commission is aware, no other country has introduced location-based pricing for an entire road network — location-based pricing systems in Europe essentially monitor distance travelled on only some roads, with charges set primarily to tax trucks in transit rather than attempting to price road use efficiently. Even these limited systems are expensive to operate.

For Australia, the distributional impacts of location-based road user charges are likely to be pronounced, precisely because current network averaging would be dismantled. There is potential for significant adverse impacts on regional communities reliant on road transport, due both to their higher costs and the lack of alternative transport modes.

Given the high technology and administrative costs, and the likely significant distributional impacts of introducing location-based charges for the network as a whole, it might prove to be more feasible to introduce location-based charges on a partial basis, either for particular trucks or particular roads.

The NTC (sub. 17), for example, has advocated using the Intelligent Access Program (IAP) to introduce location-based charging for heavy vehicles that exceed mass limits. Potential efficiency benefits would come from replacing some prescriptive regulations (such as mass limits) with 'incremental' pricing so that overweight vehicles paid for the additional damage they caused. Certainly, the IAP program provides an architecture for trialling 'telematic' and global positioning system monitoring technologies, including their reliability and enforceability. However, this approach would involve a mix of whole-of-network and partial road-specific charging for use of a particular road.

Commercially manage part of the network?

Another option would be to limit location-based charges to specific parts of the network (while continuing effectively to 'tax' freight operators' use of other parts). As suggested by some participants, this could focus on the major freight routes, with a government business enterprise established to manage them.

Implementation issues are far from trivial, however, and if not appropriately dealt with, would affect both community acceptance and the economic pay-offs. Issues that would need to be resolved include:

- *what technology would be used?* Tracking and charging for use of long-distance roads is likely to be expensive — it would be less expensive to 'piggy back' on technologies already employed by freight operators;
- *how would location-specific charges mesh with rest-of-network charges?* For example, would location-based charges be discounted (or users directly reimbursed) to reflect network-wide charges applying through the fuel excise? If this were not done, road users would be paying twice, which would likely encourage inefficient route substitution as well as hinder road user acceptance of change; and
- *how would non-freight use (particularly passenger traffic) be charged for?* Stand-alone, location-based charges require *all* users to pay for the asset so that efficient charges can be set to raise adequate revenues. Non-freight use could either be charged for directly or by apportionment of fuel taxes or registration charges to the road owner.

Other transitional issues arise from the need to shift from a PAYGO system to annualised charges over the life of the asset. This could be problematic for relatively high-cost roads. It is worth observing that toll roads have been introduced only for new road infrastructure or where existing roads have undergone major upgrades. Road users are more likely to accept road-specific charges for new or greatly enhanced roads, but not for existing roads — for which they consider, not without justification, that they have already paid. And, although limited application of location-based charges might appear to limit distributional impacts, there could be ripple effects for users of other roads, because the residual network spending 'pool' would be reduced. Further, depending on whether direct charges were significantly higher or lower than current network-wide charges, there could be adverse impacts on users of highways.

Nonetheless, if these implementation issues could be appropriately resolved, more commercially-oriented management of major freight routes could bring significant efficiency benefits by promoting optimal maintenance and pavement durability, and by being more innovative and responsive to user demand. Moreover, major highways would be run and priced as for rail infrastructure, which should remove any lingering concerns about competitive neutrality. But the implementation issues should not be underestimated.

DRAFT FINDING 11.2

Location-based charging on major freight routes has the potential to bring significant additional efficiency benefits, especially if accompanied by more commercially-oriented road infrastructure provision. But the formidable implementation issues, including how to resolve 'boundary' issues and how to charge for non-freight road use, as well as the potential distributional implications flowing from a breaking down of network averaging and cross-subsidisation within current charging arrangements, require detailed investigation.

The Commission seeks participants' views about the feasibility of introducing more commercially-oriented management for the major freight routes, the potential benefits and costs, and how pricing, network 'boundary' and other implementation issues could be resolved.

Concluding remarks

At this stage, the Commission is not advocating creation of a road fund or more commercially-oriented provision of part of the network, but is seeking comments from participants about their feasibility, potential costs and benefits, and how the various implementation issues might be resolved.

While clearly there is a widely-shared aspiration for a more commercial approach to road pricing and provision, the challenge is to devise practical, low-cost solutions that yield unambiguous gains and are broadly acceptable. If nothing else, the options set out above are designed to elicit responses that might help to clarify what is likely to be feasible, and what is not.

In the meantime, the Commission has identified a number of measures that should be implemented as soon as practicable to improve efficiency and productivity within both sectors. They include regulatory reform as well as improved investment decision-making frameworks. They would at least begin to make a link between what trucks pay and road spending that is undertaken, promoting broader understanding and acceptance of charges and any warranted increases in them.

APPENDIXES

A Public consultation

The Commission received the terms of reference for this inquiry on 23 February 2006. Following receipt of the terms of reference, the Commission placed notices in the press and appropriate publications inviting public participation in the inquiry. Information on the inquiry was also circulated to people and organisations likely to have an interest in it, and to all rural and remote councils. The Commission released an issues paper in March to assist inquiry participants in preparing their submissions.

The Commission received 76 submissions (table A.1) and visited or otherwise discussed the issues involved with a number of individuals and organisations (table A.2). Roundtables were also held in Emerald (Queensland) and Canberra. The participants from the roundtables are listed in tables A.3 and A.4. The Commission thanks all those who have contributed to the inquiry to date.

Table A.1 **List of submissions**

Individual or organisation[a]	*Submission number*
Brohier, Mr Peter	1, 3, 58, 59, 60, 70, 71, 72, 74
Country Women's Association of NSW	2
The Country Regions Council of WA (Inc.)	4
Engineers Australia	5
WA Long Distance Owners & Drivers Association Inc	6
Australian Logistics Council	7
Rail Tram and Bus Union (Qld Branch)	8
Australian Trucking Association	9
NSW Minerals Council Ltd	10
Australian Rail Track Corporation Ltd	11, 51
Great Southern Railway Ltd	12
Truck Industry Council	13
Eastern Metropolitan Regional Council	14
WA Local Government Association	15
Transport Workers Union of Australia	16
National Transport Commission	17, 63 *, 67, 73, 76
Victorian Farmers Federation	18
Gunning, Mr Robert	19
The Middle Way Pty Ltd	20

(Continued next page)

Table A.1 (continued)

Individual or organisation[a]	*Submission number*
Balance Research	21, 49
Australian Bureau of Statistics	22
Associate Professor P.G. Laird	23, 68
Transport Certification Australia	24
Lachlan Regional Transport Committee Inc	25
Bundaberg Railway Historical Society	26
Western Australian Government	27
Northern Territory Government	28
Australian Council for Infrastructure Development Limited	29
Local Government Association of Queensland Inc	30
NSW Road Transport Association Inc.	31
Business Council of Australia	32
Australasian Railway Association Inc	33
Leaver, Mr Bill	34
South Australian Freight Council Inc	35
Tasmanian Government	36
National Association of Forest Industries	37
Australian Livestock Transporters Association *	38
NSW Farmers' Association	39
Queensland Government	40
Pacific National	41
Australian Local Government Association	42
Rail Tram and Bus Union	43
Australian Competition and Consumer Commission	44
Australian Automobile Association	45
Boulis, Mr Christopher S	46
Coles Myer Ltd	47
Maritime Union of Australia	48
NSW Government	50
Australian Road Train Association Inc	52
Queensland Rail	53
Integrity Testing Pty Ltd	54
Victorian Government	55
Australian Chamber of Commerce and Industry	56
Department of Health and Ageing	57
Government of South Australian	61
Council of Mayors (South East Queensland)	62
Raptour Systems *	64
Railway Technical Society of Australasia	65
Duaringa Shire Council	66
NatRoad Limited	75

[a] An asterisk (*) indicates that the submission contains confidential material not available to the public.

Table A.2 **List of visits**

Individual or organisation
Australasian Railway Association Inc
Australian Automobile Association
Australian Competition and Consumer Commission
Australian Department of Transport and Regional Services
Australian Local Government Association
Australian Rail Track Corporation Ltd
Australian Trucking Association
Austroads
BHP Billiton
Booz Allen Hamilton Limited (NZ)
Bureau of Transport and Regional Economics
Business Council of Australia
Department of the Prime Minister & Cabinet
Economic Regulation Authority
Essential Services Commission
Essential Services Commission of SA
Fremantle Ports
Independent Pricing and Regulatory Tribunal (IPART)
Infrastructure Partnerships Australia
Local Government Association of Queensland
Main Roads (WA)
Minerals Council of Australia
Ministry of Transport (NZ)
National Farmers' Federation
National Transport Commission
NSW Cabinet Office
NSW Treasury
NSW Ministry of Transport
NSW Roads and Traffic Authority
NSW Minerals Council
NSW Road Transport Association Inc
NT Treasury
NT Department of Planning and Infrastructure
NT Department of the Chief Minister
NZ Business Roundtable
Pacific National
Patrick Corporation
Planning and Transport Research Centre, Curtin University
Public Transport Authority (WA)
Queensland Department of Main Roads
Queensland Department of the Premier and Cabinet
Queensland Department of Treasury
Queensland Transport
Queensland Rail
Queensland Trucking Association

(Continued next page)

Table A.2 (continued)

Individual or organisation
Road Transport Forum (NZ)
SA Department for Transport, Energy and Infrastructure
SA Department of Treasury and Finance
South Australian Freight Council
The Treasury
Transit NZ
Transport Certification Australia
Transport Forum WA
Transurban (Vic)
Transurban (NSW)
VicRoads
Victorian Department of Premier and Cabinet
Victorian Department of Treasury and Finance
Victorian Department of Infrastructure
WA Department for Planning and Infrastructure
WA Department of the Premier and Cabinet
WA Department of Treasury and Finance
WA Department of Industry and Resources
WestNet Rail

Table A.3 **Roundtable attendees, Emerald (Queensland)**

Individual or organisation
2PH Farms
Australian Wheat Board
Beale, Dr David
Central Highlands Development Corporation
Central Queensland Local Government Association
Clothier, Mr Leon
Emerald Shire Council
Ensham Resources
Fairweather, Mr Lindsay
Pacific National
Patterson, Mr Robert
Peter Maundrell & Company
Queensland Department of Main Roads
Queensland Transport
Queensland Trucking Association
Rolfer, Ms Christine
Sampson, Mr Don
Schmidt, Ms Sue
Simon National Carriers
Ward, Ms Carlie

Table A.4 **Roundtable attendees, Canberra**

Individual or organisation
ACT Department of Treasury
ACT Government
Australasian Railway Association
Australian Automobile Association
Australian Competition and Consumer Commission
Australian Livestock Transporters Association
Australian Trucking Association
Bureau of Transport and Regional Economics
Department of the Prime Minister and Cabinet
Department of Transport and Regional Services
Meyrick & Associates
National Transport Commission
NERA Economic Consulting
NSW Cabinet Office
NSW Ministry of Transport
NSW Roads and Traffic Authority
Queensland Department of the Premier and Cabinet
Queensland Transport
Scrafton, Professor Derek
SA Department for Transport, Energy and Infrastructure
The Treasury
Victorian Department of Infrastructure
Victorian Department of Treasury and Finance
WA Department for Planning and Infrastructure

B Issues in road infrastructure cost allocation

This appendix provides a more detailed discussion of some of the material presented in chapter 4. In particular, it focuses on alternative models of cost allocation and the implied impact of these allocations on heavy vehicle cost recovery. The cost allocation models discussed in this chapter provide the basis for some of the pricing shocks used in the modelling for this inquiry (appendix G).

Section B.1 summarises some Australian cost allocation studies for both road maintenance and capital expenditure. The Commission has assessed the impact of these alternative models of cost attribution and common cost estimates on expenditure allocated to heavy vehicles. Section B.2 considers some international cost allocation models and their applicability to Australian roads. Section B.3 provides further estimates of the current level of heavy vehicle cost recovery in Australia, based on the National Transport Commission's (NTC) current cost allocation methodology.

B.1 Australian cost allocation studies

A number of Australian studies have investigated the relationship between road damage (or expenditure) and road use. This section summarises the results of some of these studies and considers the implications of adopting their cost attribution parameters and common cost estimates for the level of expenditure allocated to heavy vehicles. The impacts of alternative methods of allocating common costs are also investigated.

Attributing the cost of road service provision

Tables B.1 and B.2 summarise the parameters for attributing maintenance and capital expenditure to road use adopted or estimated in some previous studies. Estimates of the percentage of road expenditure treated as common are also presented. These alternative attribution parameters and common cost estimates have been applied to current road expenditure data to compare expenditure allocated to heavy vehicles relative to the current cost allocation methodology.

The current cost attribution parameters are from the NTC's Second Heavy Vehicle Pricing Determination (NRTC 1998) and are summarised in table 4.1. The attribution parameters and common cost estimates for pavement and bridge expenditure are based on work carried out by the Australian Road Research Board (ARRB), particularly Martin (1994). Other attribution parameters (such as those for earthworks, servicing and operating expenditure, and low cost traffic improvements) are based on estimates prepared by Austroads for the Inter-State Commission model (NRTC 1998).

Some of the studies presented in tables B.1 and B.2 are based on categories of expenditure that differ from the NTC's expenditure categories. For example, the Bureau of Transport and Communications Economics (BTCE 1988) distinguish between road rehabilitation expenditure undertaken to restore road condition and expenditure on upgrading pavements during rehabilitation. The NTC data does not provide such a breakdown (section B.3). In some cases, assumptions have been made to allow the parameters to be applied to the NTC data. These are summarised in the notes below the tables.

Table B.1 **Previous cost allocation studies: maintenance expenditure**

Study	*Expenditure*	*Attributable cost*	*Attribution variable*	*Change in expenditure allocated to heavy vehicles*[a]
		%		$m
ARRB in NTC (2005c)	• Routine and periodic pavement maintenance	32	ESA-km	-99 (-6.1%)
BTCE (1988)	• Routine pavement maintenance	66	ESA-km	+590[b] (+36%)
	• Periodic pavement maintenance	100	ESA-km	
	• Restoration element of road rehabilitation	100	ESA-km	
	• Bridge maintenance	100	VKT (60%), PCU-km (20%), AGM-km (20%)	
BTE (1999a)	• Routine pavement maintenance	80	ESA-km	+487 (+30%)
	• Periodic pavement maintenance	80	ESA-km	
	• Road rehabilitation	80	ESA-km	
	• Bridge maintenance	67	VKT (15%), PCU-km (26%), AGM-km (26%)[c]	
Martin (2006)	• Routine and periodic pavement maintenance • Road rehabilitation	55 (National Hwy[d]) 62 (National Hwy[e]) 52 (Rural Hwy/Rural Strategic) 51 (Main local)	ESA-km	
NTC (2005c)	• Routine pavement maintenance	74	AGM-km (37%), PCU-km (37%)	-2[f] (-0.1%)
	• Periodic pavement maintenance	70	AGM-km (60%), PCU-km (10%)	
Pacific National (sub. 41)	• Road rehabilitation	100	ESA-km	+308 (+19%)
Rosalion and Martin (1999)	• Periodic and routine pavement maintenance	55	ESA-km	+91 (+5.6%)

[a] Change is relative to the base case (Second Determination) cost allocation parameters. Common cost estimates from all studies are allocated according to VKT. [b] Expenditure allocated to heavy vehicles is based on attributing all rehabilitation expenditure using the parameters for the restoration element of pavement reconstruction. This gives an upper bound on the allocation to heavy vehicles. Attributing all the expenditure using the upgrading formula (table B.2) gives a lower bound change in heavy vehicle cost allocation of $543 million (33%). [c] The percentages are not provided in BTE (1999a) so this breakdown of attribution variables has been assumed. This gives the (approximate) midpoint between the lower bound allocation (all attributed by VKT) — a change of $440m (27%) and the upper bound (all attributed by AGM-km) — a change of $548m (34%). [d] Lightly trafficked National Highway (average annual daily traffic 400-10 000). [e] Heavily trafficked National Highway (average annual daily traffic 10 000-50 000. [f] The decrease of $2 million is estimated based on adopting the NTC cost allocation parameters for routine and periodic maintenance expenditure. Other changes to the cost allocation process recommended in the Third Determination (road train adjustment for travel on unsealed roads and community service obligations) would lead to a larger decrease in expenditure allocated to heavy vehicles.

Table B.2 **Previous cost allocation studies: capital expenditure**

Study	*Expenditure*	*Attributable cost*	*Attribution variable*	*Change in expenditure allocated to heavy vehicles*[a]
		%		$m
BTCE (1988)	New construction and duplication[b]	100	VKT and PCU-km (% varies by road type)	lower bound[c]: -162 (-10%)
	Bridge reconstruction	100	VKT (60%) PCU-km (20%) AGM-km (20%)	upper bound[d]: +203 (+12%)
	New bridges	100	AGM-km (30%) VKT (40%) PCU-km (30%)	
	Upgrading element of road rehabilitation	100	ESA-km (60%) VKT (20%) PCU-km(20%)	
BTE (1999a)	Pavement construction	45	ESA-km	+117[e]
	Bridge construction	45	AGM-km	(+7.2%)
	Land acquisition	10	PCU-km	
	Earthworks	10	ESA-km	
	Other	10	PCU-km	
Pacific National (sub. 41)	Pavement construction	100	ESA-km	+548 (+34%)

[a] Change is relative to the base case (Second Determination) cost allocation parameters. Common cost estimates from all studies are allocated according to VKT. [b] New construction and duplication is assumed to include new pavement construction as well as land acquisition, earthworks and other extension/improvement expenditure. [c] Lower bound estimate is based on the BTCE's most conservative attribution of construction costs (50% attributed by VKT and 50% by PCU-km). Other assumptions are that all road rehabilitation expenditure is for upgrading roads and all capital expenditure on bridges is for bridge reconstruction. [d] Upper bound estimate is based on attributing construction costs 10% by VKT and 90% by PCU-km (based on the BTCE allocation weighted most heavily towards trucks). Other assumptions are that all road rehabilitation expenditure is for restoring roads and that all capital expenditure on bridges is for new bridges. [e] The NTC groups land acquisition, earthworks and other asset extension/improvement expenditure as a single category. This has been allocated across vehicles on the basis of PCU-km. As the BTE recommends allocating earthworks expenditure on the basis of ESA-km this figure understates the allocation to heavy vehicles.

Other than the parameters for attributing pavement maintenance expenditure in the NTC's Third Heavy Vehicle Pricing Determination (NTC 2005c), and those from ARRB (in NTC 2005c), all the alternative parameter estimates in table B.1 would lead to a greater share of road expenditure being allocated to heavy vehicles, relative to the current methodology. In fact, adopting the BTCE (1988) or BTE (1999a) parameters would increase the expenditure allocated to heavy vehicles by approximately 30 per cent compared to the current methodology. This is a result of both a higher share of road expenditure being treated as attributable under these approaches and the choice of equivalent standard axle kilometres (ESA-km) as the basis for attributing pavement maintenance expenditure. The choice of ESA-km as the attribution parameter also implies a proportionately bigger increase in cost attributed to the heaviest trucks (B-doubles and road trains) relative to the current allocation.

It is also interesting to note that all the studies summarised in this table, other than the NTC's analysis for the Third Determination, attribute both routine and periodic pavement maintenance expenditure across vehicles on the basis of ESA-km. The NTC (sub. 17) argue that the factors influencing pavement maintenance expenditure are not well understood (box. 4.8).

Fewer studies have been undertaken on the relationship between road use and capital expenditure. Nonetheless, of the studies summarised in table B.2, only the parameter estimates used by CRA International in its case study for Pacific National (sub. 41) would lead to a significant change in heavy vehicle cost allocation. This stems from their attribution of 100 per cent of new pavement construction expenditure to heavy vehicles.

In addition to the studies summarised in tables B.1 and B.2, Associate Professor P.G. Laird (sub. 23) presents an alternative method for estimating the costs allocated to heavy vehicles. Using a formula to determine the proportion of separable costs, he attributes pavement maintenance costs across vehicle classes using ESA-km, and capital costs on the basis of average gross mass kilometres (AGM-km). He allocates common costs on the basis of passenger car unit kilometres (PCU-km). He estimates that heavy vehicles impose a cost of $3392 million on the road system (sub. 23, p. 7), more than double the estimates based on the NTC methodology. For heavier trucks, Laird's estimates differ even more significantly from those based on the NTC's parameters. For example, he attributes about 130 per cent more costs to B-doubles with nine or more axles.

Allocating common costs

In addition to issues with quantifying the common costs of road service provision, a number of participants to this inquiry also expressed views on the appropriate way to allocate common costs across road users. Some of the alternative parameters suggested for allocating these costs, along with the impact these allocations have on the expenditure allocated to heavy vehicles, are presented in table B.3.

Allocating common costs on the basis of PCU-km (rather than vehicle kilometres travelled (VKT) as used in the Second Determination), would lead to a significant increase in the expenditure allocated to heavy vehicles, and to the biggest vehicles (B-doubles and road trains) in particular. Using other use-related measures such as AGM-km or ESA-km would have an even more significant impact, although these have not been suggested in the context of this inquiry.

Table B.3 **Parameters for allocation of common costs**

Study	*Parameter*	*Change in expenditure allocated to heavy vehicles*[a]
NTC (2005c); BTCE (1988)	VKT	No change
PJP (2005); P.G Laird (2006); AAA (sub. 45)	PCU-km	+$384m (+24%)
AAA (sub. 45)	Number of vehicles	-$171m (-10%)
	PCU weighted number of vehicles[b]	-$45m (-2.8%)
BTE (1999a)	PCU-km, VKT, AGM-km (varies by cost category)	positive

[a] Change is relative to the base case (Second Determination) method of allocating common costs (by VKT). [b] Calculated by multiplying the PCU for each vehicle class by the number of vehicles in that class.

The Australian Automobile Association (sub. 45) argues that it is more appropriate to allocate common costs using parameters not related to road use. Using either the number of vehicles, or a PCU weighted number of vehicles, would lead to a lower allocation to heavy vehicles.

B.2 Cost allocation approaches overseas

It is useful to consider the cost allocation models used internationally when assessing the best way forward for allocating costs across road users in Australia. However, the differences in policy aims and environmental conditions between countries need to be taken into account. Although there are lessons in the experience of other countries, it is unlikely that any cost allocation model developed for an overseas charging system would translate directly to Australia's circumstances.

Those countries for which the Commission has been able to locate detailed information about attribution parameters generally allocate road expenditure along similar lines to Australia (table B.4). However, there are some notable exceptions:

- In Australia that portion of bridge, periodic and routine maintenance which is considered attributable (50 per cent) is attributed by AGM-km, whereas most other countries, including Switzerland, Germany, and Canada, attribute at least some portion of maintenance expenditure by ESA-km. In fact, the European

Commission recommended EU countries use both ESA-km and GVM-km to attribute maintenance expenditure (EU 2003).

- The attribution parameters for new capital construction vary between countries. In Switzerland, new investments are attributed by GVM-km; in the UK capital costs are attributed by maximum GVM-km (15%) and PCU-km (85%); and in the USA new pavement capacity, new lanes and the construction of new bridges are allocated by PCU weighted vehicle miles travelled (VMTs) — these all differ from Australian attribution of capital costs by ESA-km (for pavement) and PCU-km (for bridges).
- Although Australian road user charges recover the cost of operating the heavy vehicle charging system, enforcement and road policing expenditure are excluded. This differs from many countries — such as Germany, the UK, and Canada — where some portion of enforcement and traffic police expenses are attributed to road users, including heavy vehicles, by VKT.
- Externalities — such as pollution — are not incorporated into Australian road user charges. However, compensation for externalities from road use make up a substantial portion of heavy vehicle charging in countries such as Switzerland and Germany. In these countries, charges also vary by vehicle emission category.

The focus, or at least the explicit focus, of most heavy vehicle charging systems internationally — particularly those of European countries — seems to be much less on 'cost recovery' and 'efficient allocation of charges' than under the Australian system. Rather, international heavy vehicle pricing systems tend to focus on recovering costs from foreign vehicles, influencing demand for road use (to meet congestion and environmental policy goals) and, in some cases, addressing intermodal issues. For example, one of the aims of the European Commission's 2003 'Eurovignette' amendment directive is to 'rebalance the modal split' (appendix D).

Heavy vehicle charging arrangements in countries such as Germany, Belgium, the Netherlands and Switzerland were introduced primarily to ensure that vehicles entering from outside the country contribute to the cost of the road network, particularly where the vehicle in question is in transit to another country (NTC 2004a). As Australia is not accessible by road from any other country and heavy vehicle charging is implemented nationally (rather than on a state by state basis), this benefit of direct charging does not exist in Australia (appendix D).

Countries, including Germany, consider addressing externalities, such as greenhouse gas emissions and other air pollution, among the aims of their heavy vehicle charging regimes (NTC 2004a). In fact, the 'externalities' component accounts for more than three quarters of heavy vehicle charges in some countries.

As well as reflecting different policy aims, the inclusion of an externality component in road user charges by international regimes reflects that greater congestion and higher traffic densities make externalities a larger concern in the United Kingdom, Unites States and the European Union than they are in Australia. Additionally, focusing on only one source of greenhouse gas and air pollution, while not taxing emissions from other sources, might have a distortionary effect. Road user charging is therefore not considered to be the most efficient means of addressing such externalities in Australia (chapter 6).

As cost recovery is not the explicit focus of most overseas regimes, it is not surprising to find that other countries have placed less emphasis on the relationships between road use, road expenditure and road charges. As the NTC noted:

> …the cost allocation rules for a number of the non-pavement road works are based on limited analyses. A scan of international practice revealed that overseas approaches are generally fairy arbitrary, or specific to local conditions and cannot readily be translated to Australian circumstances and road types. (sub. 17, p. 66)

Indeed, in researching overseas cost allocation, the Commission found the Australian approach to be more transparently documented and justified than the other countries considered.

Another reason for being cautious when looking at international attribution methods is Australia's unique climate. In countries such as Canada, climatic conditions are a major cause of road costs. Factors such as temperature, frost, thaw action and moisture cause pavement deterioration independently of traffic flow, as well as intensifying pavement deterioration caused by heavy vehicles (TC 2005a). As Australia's climate differs significantly from colder countries, the relationships between weather, vehicle use and infrastructure costs in these countries have limited relevance here.

Table B.4 further outlines the cost allocation methodologies used in a number of countries. Additional information about international road user pricing regimes and the technologies they employ is included in appendix D.

Table B.4 **International heavy vehicle cost allocation**

Country	*Expenditure*	*Attribution variable*	*Additional heavy vehicle attribution considerations*	*Comments*
Switzerland (LSVA)	New investments	GVM-km	• Charges vary by kilometre, class of road, pollution category and road type.	• Externality charges (air pollution, noise and accident costs) account for 85% of heavy vehicle charges. • The road account assumes that 100% of the cost of national roads, 90% of cantonal roads & 70% of municipal roads are related to motorized traffic.
	Maintenance costs	ESA-km		
	Capacity costs	PCU-km		
Sweden	Four types of investment & 14 maintenance expenditures are allocated with differentiation between fixed and variable costs.	Fixed-costs are allocated by PCU-km & ESA-km and variable costs are allocated by ESA-km.		• The Swedish road authority uses a pavement management system to determine the appropriate road maintenance strategy and activities.
Germany	Maintenance and replacement costs	100% ESA-km	• Charges vary by engine emission classification. • In 2003, total costs for federal motorways was €7.51 billion. Of this amount €3.4 billion (45%) was attributed to heavy vehicles. • It has been calculated that charging heavy vehicles €0.15 per km would cover their attributable cost.	• 70% of road infrastructure costs are capital costs.
	Traffic police	VKT		
	All other factors	PCU-km		

Austria		A combination of ESA-km, VKT by vehicle type and GVM-km is used.	• The amount attributed to vehicle classes is calculated using an econometric approach. • Charges vary by the number of axles (charges are €0.13 for 2, €0.18 for 3 and €0.27 for 4 or more axles). This fee covers heavy vehicles using motorways and selected 'trunk' roads.	• Through traffic accounts for approximately 90% of all road traffic crossing the Austrian Alps.
UK	Capital costs	15% max GVM-km and 85% PCU-km		• Foreign trucks account for approximately 4% of total truck distance travelled in 2003.
	Police costs	VKT		
	Maintenance costs	14 items are allocated using one or two allocation factors (VKT, GVM-km, ESA-km & PCU-km)		
USA	New Pavement capacity/lanes	PCU-VMT (PCU weighted vehicle miles travelled)	• Pavement reconstruction, rehabilitation and resurfacing was approximately 25% of federal costs in 2000. • In total, trucks are assessed to account for approximately 32.9% of federal road costs (with 71% of this amount paid by trucks). • Combination trucks were estimated to pay only approximately 80% of federal cost, and single unit trucks were estimated to pay approximately 90%.	• Social costs associated with motor vehicle use were estimated to range from $30-$349 billion per annum. • Passenger vehicles account for about 93% of vehicle miles travelled, while single unit and combination trucks account for 3 and 4% of travel respectively. • Expenditures are calculated by highway type and then distributed across vehicle classes by VMT on each highway type. • As the distribution of travel on different highway types varies substantially by vehicle class, the distribution of federal obligations by improvement type & highway class greatly influences the distribution of cost responsibility between vehicle classes.
	Pavement reconstruction, rehabilitation & resurfacing	ESA-km and the use of a 'mechanistic' pavement distress model		
	Construction of new bridges	PCU-VMT		
	Provision of additional strength to support heavier vehicles	Weight and axle spacing GVM-VMT		
	System enhancement (system management, safety projects, bicycle/pedestrian facilities, environment related costs).	'Several different factors'		
	Other attributable costs (e.g. drainage, pavement width etc.)	VMTs by class of vehicle		

New Zealand		ESA-km A cost allocation model is used to apportion costs by weight & vehicle type (number of & configuration of axles).	• In NZ road costs are estimated using a PAYGO approach.	• Up to 50% of costs for local roads are covered by developer rates. • The road user charge currently raises about 46% of total expenditure on the NZ road system.
Ministry of Transport NZ (2005a)	Capital Return (non-recoverable $1.9b, recoverable $750m).	Based on RCAM (MoT Road Cost Allocation Model)	• Study allocates 56% to cars, 15% to LCV (light commercial vehicles), 6% to MCV (medium commercial vehicles) and 21% to HCV (heavy commercial vehicles)	• Also calculates $1.8 billion per annum of social costs (accident and environmental), which they allocated to vehicle classes using Land Transport Safety Authority data.
	Maintenance exp ($755m)	RCAM	• Cars (56%), LCV (15%), MCV (6%), HCV (21%)	
	Depreciation ($20m)	RCAM	• Cars (57%), LCV (15%), MCV (7%), HCV (21%)	
	Admin & research ($44.6m)	RCAM	• Cars (60%), LCV (15%), MCV (6%), HCV (18%)	
	Emergency services ($217m)	RCAM	• Cars (75%), LCV (15%), MCV (3%), HCV (6%)	
EU (EU 1999, 2003: Directive 1999/62/EC and amendment)	Capital costs for new investment & replacement of assets (includes depreciation & interest).	VKT	• Vehicle categories are split up into 'damage classes' depending on how many axles, type of suspension and max permissible gross laden weight. • The EU directives explicitly state that road user charges in member countries should promote the use of road friendly and 'less polluting' vehicles through charge/tax differentiation.	• The UNITE (Unification of accounts and marginal costs for transport efficiency) project is intended to advance the establishment of comparable transport infrastructure policies/charges in EU countries through the provision of appropriate methodologies and empirical evidence. • Under the 1999 directive, user charges are not mandatory, however, the directive states that all framework conditions set out in the directive should be fulfilled in case of their opting to levy such charges. The 2003 amendment broadened the directive by requiring that the Eurovignette apply to all trucks weighing 3.5 tonnes or more (from 2012) and that charges vary by emission standard (from 2010) (appendix D).
	Maintenance	ESA-km, GVM-km		
	Operation	PCU-km		
	Administration	VKT		
	Police	VKT		
	Accident costs	VKT by road type. (Risk involved per accident & vehicle type, minus the insurance premium.)		

Canada	Base & initial paving non-recurring	ESA-km and PCU-km	• The allocation of infrastructure costs is calculated by 'multiplying unit cost by inventory of roads per class'. (That is, the relative weight given to ESA-km and PCU-km varies by road type, depending on the proportion of road expenditure considered to be 'basic standard' and the proportion to be higher standards needed for heavy vehicles.) • Cost allocation assigns approximately 75% of the total to light vehicles and 25% to heavy vehicles.	• The Transportation Association of Canada (TC) estimated total financial road costs in Canada for 2000 to be between $16.5 and $25 billion and estimated cost recovery, in total, to be between 67% and 91% of that amount.
	Base and initial paving recurring	ESA-km and PCU-km		
	Initial construction	100% PCU-km		
	Maintenance and rehabilitation	ESA-km and PCU-km		
	Winter maintenance	100% VKT		
	Bridges	ESA-km and PCU-km		
	Policing	100% VKT		
Denmark	administration, winter maintenance, other maintenance, reconstruction & capital investment	VKT, PCU-km and ESA-km are used.	• Cost attribution takes into account two different road types as well as the three attribution variables.	• It is unclear which attribution variables are used for which expenditure type.

Sources: Applied Research Associates (2006); EU (1998, 2003); Link et al. (2000); Ministry of Transport NZ (2005a); NTC (2004a); US Department of Transportation (1997, 2000); TC (2005b, 2006)

B.3 Estimating heavy vehicle cost recovery

This section supports the analysis of cost recovery by heavy vehicles in section 4.4. In addition to providing a more detailed breakdown of some of the tables presented in section 4.4, the impacts of the proposed Third Determination charges on heavy vehicle cost recovery, had they been implemented, are also presented.

All road use and expenditure data, from which the estimates presented in chapter 4 and this appendix are calculated, are sourced from the NTC's Third Determination (2005b). Expenditure data are the average of expenditure in the years 2002-03, 2003-04 and budget expenditure in 2004-05, converted to 2005-06 prices using the BTRE road construction and maintenance price index. The figures presented do not include the road train adjustment for restricted routes.

The cost estimates are derived from the NTC expenditure reporting categories. The expenditure categories included for each type of cost are discussed in more detail below. Where costs are indicated as 'Second Determination' this means they are estimated using the Second Determination cost allocation template (table 4.1). Second Determination revenues are calculated on the basis of the current road user charge component of the fuel excise (19.6 cents per litre) and the 2005-06 heavy vehicle registration fees.

Third Determination costs are calculated based on the proposed cost allocation template under the Third Determination. Third Determination revenues are calculated based on the recommended road user charge component of the fuel excise (22.1 cents per litre) and the recommended heavy vehicle prime mover and trailer registration charges (NTC 2005b).

Classifying costs

This section outlines the definitions of costs used to produce the estimates in tables B.4 to B.8. The short run marginal (avoidable) cost of road use is defined in box 4.2 as the cost of an additional unit increase in use at the current level of infrastructure provision. Capital spending (expanding network capacity or improving road condition) is excluded from this definition because the network capacity is fixed in the short term. Under the current heavy vehicle charging regime, short run marginal costs can be considered as the wear and tear on the road network from road use as well as ongoing service and operating expenditure.

In terms of the NTC template this includes categories: A (servicing and operating expenditure); and the attributable component of categories B (periodic and routine maintenance); C (bridge maintenance/rehabilitation), D (road rehabilitation); and E (low cost safety/traffic improvements). There is some question, however, about whether all these categories are appropriately defined as maintenance costs (box B.1).

Attributable costs are defined as the costs incurred as the result of a particular road use (box 4.2). For heavy vehicles this is the additional construction costs necessitated by their use of the road network, plus the wear and tear they impose on the network. This includes the expenditure categories discussed above in addition to the attributable component of category F (asset extension/improvements).

The two components of costs allocated to heavy vehicles are their attributable costs and a share of the common costs in the categories B to F.

Box B.1 **Defining cost estimates**

There is some question over whether the activities that fall under some of the NTC expenditure categories are more appropriately viewed as maintenance or capital. For example, the NTC (sub. 73, p. 11) consider that periodic maintenance and road and bridge rehabilitation expenditure may be considered as capital expenditure because they occur at a frequency of less than one year (for any given road).

The Commission considers the definition of maintenance or capital expenditure should relate more to the nature of the activity undertaken rather than the frequency with which it occurs. Martin (1994, p. 3) defines maintenance expenditure as:

> … the expenditure incurred as preserving and restoring the existing road infrastructure to a level of performance that does not exceed that of the original design.

He defines capital expenditure as:

> … the expenditure incurred in creating and replacing road infrastructure, and in increasing the space and/or load capacity of existing infrastructure above its existing design capacity.

Under Martin's definitions, periodic maintenance would be defined as maintenance expenditure. Road/bridge rehabilitation expenditure would also be classified as maintenance expenditure to the extent it repairs damage to the pavement or bridge structure. However, any rehabilitation spending that improves the asset — deepening pavements during road rehabilitation, for example — is capital expenditure. Martin (1994) notes that a number of rehabilitation activities have both a restorative and strengthening aspect.

While Martin (1994) distinguishes between rehabilitation activities in his cost allocation template, the NTC expenditure template does not provide a break down that would allow a similar approach. Consistent with the BTE (1999a), the Commission has classified both pavement and bridge rehabilitation expenditure as maintenance expenditure.

Estimating cost recovery by vehicle class

Figure 4.1 in chapter 4 presents estimates of the costs (attributed and allocated) and revenue (based on the current road user charge component of the fuel excise and 2005-06 vehicle registration fees) by broad truck class, in order to assess the level of under- and over-recovery by truck class. Table B.5 presents the estimates underlying this chart as well as the estimates of costs and revenues based on the recommended charges and cost attribution parameters from the Third Determination.

Table B.5 **Over and under recovery by vehicle class**[a]

Vehicle type	*Attributable cost*[b]	*Allocated costs*[c]	*Total revenue*[d]
	$m	$m	$m
Second Determination[e]			
Rigid trucks	350	470	550
Articulated trucks ≤ 6 axle rig	480	563	584
B-doubles	262	291	211
Road trains	152	165	125
Buses	58	85	103
Third Determination[f]			
Rigid trucks	358	472	600
Articulated trucks ≤ 6 axle rig	484	563	633
B-doubles	263	291	251
Road trains	117	128	148
Buses	61	86	114

[a] Road expenditure and vehicle use data are from the Third Determination (NTC 2005b). Expenditure data is the average of expenditure in the years (2002-03 to 2004-05). [b] Attributable costs are the capital and maintenance expenditure attributable to each vehicle class. [c] Total allocated cost is the cost of capital and maintenance expenditure attributable to each vehicle class plus the common costs allocated to each vehicle class on a VKT basis. [d] Total revenue includes total fuel charge revenue plus registration revenue for each class (including spare trailers). [e] Expenditure is allocated across vehicle classes using the current (Second Determination) cost allocation template. The figures presented do not include the road train adjustment for restricted routes. Revenue estimates are calculated based on the current road user charge component of the fuel excise (19.6c/L) and 2005-06 heavy vehicle registration fees. [f] Expenditure is allocated across vehicle classes using the Third Determination cost allocation template. The figures presented do not include the road train adjustment for restricted routes. However, other adjustments to road train cost allocation recommended under the Third Determination (adjustment for travel on unsealed roads and community service obligation expenditure) have been included. Revenue estimates are calculated based on the recommended road user charge component of the fuel excise (22.1 c/L) and the recommended heavy vehicle prime mover and registration charges.

Data sources: NRTC (2000); NTC (2005b).

Similarly, table B.6 includes the estimates of the cost (short-run marginal, attributable and allocated) and revenue per litre of fuel by truck class presented in table 4.2. Table B.6 also presents these estimates in terms of cents per kilometre of heavy vehicle travel. Table B.7 presents the same breakdown of costs and revenues by litres of fuel consumed and by kilometres of travel, based on the recommended charges under the Third Determination.

Table B.6 **Costs and revenues by vehicle class (Second Determination)**[a]

Per litre of fuel consumption or per kilometre travelled

Vehicle type	*SR Marginal cost*[b]	*Marginal revenue*[c]	*Attributable cost*[d]	*Allocated costs*[e]	*Total revenue*[f]
Per litre of fuel consumed (c/L)					
Rigid trucks	12	19.6	19	25	29
Articulated trucks ≤ 6 axle rig	16	19.6	26	31	32
B-doubles	20	19.6	35	39	28
Road trains	22	19.6	37	40	30
Buses	9	19.6	14	20	24
Per kilometre travelled (c/km)					
Rigid trucks	4	6	6	8	9
Articulated trucks ≤ 6 axle rig	8	10	13	15	16
B-doubles	12	11	20	22	16
Road trains	16	14	27	29	22
Buses	3	6	4	6	8

a Road expenditure and vehicle use data are from the Third Determination. Expenditure data is the average of expenditure in the years (2002-03 to 2004-05). Expenditure is allocated across vehicle classes using the current (Second Determination) cost allocation template. The figures presented do not include the road train adjustment for restricted routes. **b** The short run marginal costs for each vehicle class are estimated by excluding capital and non-attributable costs from the cost allocation. **c** Marginal revenue is the road user charge component of fuel excise, currently set at 19.6c/L. **d** Attributable costs are the capital and maintenance expenditure attributable to each vehicle class. **e** Total allocated cost is the cost of capital and maintenance expenditure attributable to each vehicle class plus the common costs allocated to each class on a VKT basis. **f** Total revenue includes total fuel charge revenue plus registration revenue (based on 2005-06 registration charges) for each class (including spare trailers).

Data sources: NRTC (2000); NTC (2005b).

Table B.7 **Costs and revenues by vehicle class (Third Determination)[a]**
Per litre of fuel consumption or per kilometre travelled

Vehicle type	*SR Marginal cost*[b]	*Marginal revenue*[c]	*Attributable cost*[d]	*Allocated costs*[e]	*Total revenue*[f]
Per litre of fuel consumed (c/L)					
Rigid trucks	12	22.1	19	25	32
Articulated trucks ≤ 6 axle rig	16	22.1	26	31	34
B-doubles	21	22.1	35	39	33
Road trains	18	22.1	28	31	36
Buses	9	22.1	14	20	26
Per kilometre travelled (c/km)					
Rigid trucks	4	7	6	8	10
Articulated trucks ≤ 6 axle rig	8	11	13	15	17
B-doubles	12	13	20	22	19
Road trains	13	16	20	22	26
Buses	3	7	5	7	9

[a] Road expenditure and vehicle use data are from the Third Determination. Expenditure data is the average of expenditure in the years 2002-03 to 2004-05. Expenditure is allocated across vehicle classes using the Third Determination cost allocation template. The figures presented do not include the road train adjustment for restricted routes. However, other adjustments to road train cost allocation recommended under the Third Determination (adjustment for travel on unsealed roads and CSO expenditure) have been included. [b] The short run marginal costs for each vehicle class are estimated by excluding capital and non-attributable costs from the cost allocation [c] Marginal revenue is the recommended road user charge component of fuel excise (22.1c/L). [d] Attributable costs are the capital and maintenance expenditure attributable to each vehicle class. [e] Total allocated cost is the cost of capital and maintenance expenditure attributable to each vehicle class plus the common costs allocated to each class on a VKT basis. [f] Total revenue includes total fuel charge revenue plus registration revenue (based on recommended registration charges) for each class (including spare trailers).

Data source: NTC (2005b).

Estimating cost recovery by individual vehicles

Table 4.3 in chapter 4 presents estimates of over- and under-recovery by some truck classes at the 25th and 75th percentile of distance travelled. Table B.8 also presents these estimates at the 10th and 90th percentiles.

Table B.8 **Over- and under-charging for some truck classes**[a]

By percentile of distance travelled

	10th percentile		*25th percentile*		*75th percentile*		*90th percentile*	
	Allocated cost	Revenue	Allocated cost	Revenue	Allocated cost	Revenue	Allocated cost	Revenue
	$	$	$	$	$	$	$	$
2 axle 7-12t rigid	100	400	100	400	1800	2000	2700	2900
6 axle articulated	2200	6100	5600	8100	26 500	19 900	36 000	25 400
9 axle B-Double	17 000	15 900	25 800	19 900	57 200	34 200	73 600	41 600
Double road trains	700	9100	12 500	14 400	50 900	31 600	65 700	38 200

[a] ABS (2005b) presents data on distance travelled in 5000 km ranges. The costs and revenues at each percentile are calculated from the midpoint distance of the range in which the truck at that percentile falls.

Data sources: ABS (2005b); NTC (2005b).

Table B.9 includes the estimates of the cost and revenue per kilometre of heavy vehicle travel on arterial and local roads. The same data are presented by litre of fuel consumed in table 4.4 in chapter 4.

Table B.9 **Arterial/local road cost comparison**[a]

	Arterial roads			*Local roads*		
Vehicle type	*SR Marginal Cost*[b]	*Attributable cost*[c]	*Allocated costs*[d]	*SR Marginal Cost*[b]	*Attributable cost*[c]	*Allocated costs*[d]
	c/km	c/km	c/km	c/km	c/km	c/km
Rigid trucks	3	5	8	5	7	8
Articulated trucks						
≤ 6 axle rig	7	12	15	12	18	19
B-doubles	11	19	22	19	28	29
Road trains	15	25	28	25	38	39
Buses	3	4	7	4	5	6

[a] The road expenditure and use data is from the Third Determination. The current (Second Determination) cost allocation parameters are used to attribute road damage. [b] The short run marginal costs for each vehicle class are estimated by excluding capital and non-attributable costs from the cost allocation. [c] Attributable costs are the capital and maintenance expenditure attributable to each vehicle class. [d] Total allocated cost is the cost of capital and maintenance expenditure attributable to each vehicle class plus the common costs allocated to each vehicle class on a VKT basis.

Data sources: NRTC (2000); NTC (2005b).

C Quantifying externalities of road and rail freight

In chapter 6, the external costs of road and rail freight, and some of their policy implications, were discussed. This appendix provides some of the background empirical material that underpins the analysis and conclusions of that chapter. Specifically, it presents additional cost estimates from various studies, and outlines the nature of, and some issues that arise in measuring, the externalities discussed in chapter 6.

C.1 Accidents

Estimating accident costs involves various steps, none of which is straightforward. The first involves estimating the number of accidents, and the number of vehicles and casualties (death and injury) — data for which are often incomplete. Also required is an assessment of the types of costs associated with these accidents, and a valuation of the costs (which includes valuing human life (box C.1) and reduced quality of life, and choosing a discount rate for converting future costs to current values). Further estimation is required to estimate a freight share of total accident costs, and the extent to which costs are currently internalised by freight operators.

Differences in assumptions, costs included and valuation methods across studies lead to significant variations in, and uncertainty about, estimates of aggregate accident costs. Further uncertainty surrounds estimates of the *externality* component of these costs that is attributable to freight vehicles. Indeed, estimating the externality component is particularly contentious (Department of Transport and Regional Services (DOTARS), sub. 69). One approach involves estimating the difference between the (financial) cost of insurance and accident costs, but not all measured non-insurance costs necessarily represent an externality.

Box C.1 **Valuing human life**

Three main methods are used for valuing life or health status.

The *restitution cost* approach values diminished health status in terms of the resources required to restore a victim and relatives to the earlier state (UK DH 2004). The compensation allocated in court decisions is one means of deducing this cost.

The *human capital* approach values a person's life in terms of the production (at market prices) that would be lost if the person died or were ill. Within this broad approach, a number of variations are possible. For instance, earnings are sometimes presented as gross estimates, and time not used in market work is sometimes valued as if it were used in the market. There are many problems with the human capital approach, especially relating to what it implies about what makes a life valuable.

The *willingness to pay* approach is the most widely used. Its underlying premise is that what a consumer is willing to pay for a good or service represents its economic value (in a broad sense) (UK DH 2004). It assesses how much people are willing to pay for small changes in their own or their household's risk of death or injury, from which an implicit value of a 'statistical' life (VOSL) can be estimated. There are two broad approaches to assessing willingness to pay:

- 'revealed preference' techniques, which involve observing actual situations in which people trade the risk of death or injury for financial or other benefits — such as in labour markets or daily decisions (such as purchasing decisions) — thus providing an indication of the price individuals are willing to pay to vary the risk of death or injury; and
- 'stated preference' (contingent valuation) techniques, which involve the use of surveys to determine preferences for hypothetical situations.

The resulting VOSL estimate represents 'the *value of the reduced probability of death* that is experienced by the affected population, *not the value of the lives that are saved ex post*' (Viscusi and Aldy 2003, p. 6; emphasis added). The VOSL estimated in US labour studies tends to fall between US$3.8 million and US$9 million (in year 2000 dollars), with a median value of US$7 million, although some estimates have exceeded US$12 million. Outcomes from product market studies tend to be similar. Estimates for other countries also vary, but tend to be lower than for the United States (Viscusi and Aldy 2003). According to one estimate, the value of life in Australia is about $3.7 million ($162 561 per year) (Pollard 2006), while BTRE (2005d) used $1.3 million ($1.5 million in 2004-05 prices) in its analysis of the health costs of air pollution. Department of Health and Aged Care guidelines (2001) recommend using a VOSL of $150 000 per year for environmental health studies, and a 5 per cent discount rate (DOHA, sub. 57).

Numerous studies have estimated road accident costs.

- The Bureau of Transport Economics (BTE 1999b), updating Bureau of Transport and Communications Economics (BTCE 1994) estimates for price increases (using the CPI), estimated road crash costs in 1999 to be $6.9 billion.

- BTE (2000) provided what it described as a ‘conservative’ estimate of the costs of all road crashes in Australia in 1996 as around $15 billion. Major components of these costs included estimates of loss of life and quality of life (12 per cent), loss of earnings in the workplace and returns to labour in the household and community (21 per cent), medical and care costs (16 per cent), vehicle costs (27 per cent), and travel delays (10 per cent).
  - These were much higher than the BTCE (1994) estimates because they included additional costs such as long-term care, made better estimates of others such as traffic delays, and used a lower discount rate.
  - The BTE recognised that the value of loss of life and reduced quality of life as a result of road crashes may be considerably higher than its estimates. For this and other reasons, it considered that its estimates were at the ‘lower bound’ (BTE 2000, p. 24). However, Cox (Australian Automobile Association (AAA), sub. 45, appendix A, p. 8) noted that ‘most transport economic valuations use a discount rate closer to 7 per cent than 4 per cent’, and that using this rate lowered the BTE (2000) estimate of accident costs in 1996 from $15 billion to $13.2 billion.
- Cox (AAA, sub. 45, appendix A) updated the BTE (2000) estimates for 1996 to 2004-05 prices, adjusted for the decline in fatalities between 1996 and 2004, and used a real discount rate of 7 rather than 4 per cent. He estimated road accident costs in 2004-05 as $15.5 billion.
- Connelly and Supangan (2006) used the BTE methodology and updated the accident cost estimates for changes in price levels and the numbers and types of accidents. They estimated the cost of road crashes in Australia in 2003 at around $17 billion,[1] or approximately 2.3 per cent of GDP. They noted that this accords with some recent estimates in other developed countries which also put road crash costs at between 2 and 3 per cent of GDP.

Estimating the degree of internalisation

Various attempts have been made to estimate the freight externality component of total accident costs.

- Based on accident rates, and assuming that articulated trucks accounted for 5 per cent of accident costs, with only 50 per cent of costs internalised through insurance, BTE (1999b) estimated the externality cost of articulated trucks to be $0.17 billion in 1999 (in 1998-99 prices).

1 Fatalities fell from 1970 in 1996 to 1621 in 2003, but Connelly and Supangan (2006) indicated that hospitalisations have increased ‘quite substantially in recent years’.

- Applying this methodology to the Connelly and Supangan (2006) update of the BTE (2000) estimates, gives an external cost of road crashes involving articulated trucks of $0.42 billion in 2003.

- Tasman Asia Pacific (for the Australian Trucking Association (ATA)) questioned the BTE assumption that 50 per cent of road freight accident costs were not currently internalised. Based on its analysis of the components of BTE's estimated road crash costs, it argued that:

  … the BTE's assumption that trucks travelling the 'representative' route only pay 50 per cent of their road accident costs cannot be substantiated. If any accident costs are external to the road freight industry they are likely to be less than eight per cent of total accident costs incurred by road transport operators on the 'representative' route. (Tasman Asia Pacific 2000, p. 18)

- Cox (AAA, sub. 45, appendix A) estimated the externality component of total road vehicle accident costs in 2004-05 at around $5 billion, but argued that 40 per cent of this should be levied on drunk and speeding drivers, leaving $3 billion attributable to remaining drivers. Of this, he estimated $0.26 billion was attributable to articulated trucks and $0.11 billion to other trucks.

- Unpublished BTRE work (cited in DOTARS (sub. 69)) estimates external accident costs attributable to heavy vehicles of 1 cent/vkm on four-lane divided roads, and between 3 and 6 cents/vkm on two-lane single-carriageway roads.
  - It also estimated costs of up to 3.4 cents/km (in 2002-03 prices) on inter-capital corridors linking the five mainland State capitals, which was lower than earlier estimates, including the BTE (1999b) estimate of 0.16 cents/ntkm (which equated to 3.8 cents/km in 2002-03 prices).

Rail freight accident costs

BTRE (2002b) 'conservatively' estimated the cost of all rail accidents (excluding apparent suicides and collisions with road vehicles) in Australia in 1999 as $133 million. The bulk of these involved passenger trains. Laird (2005) suggested a 30 per cent share for freight resulting in a cost of $40 million or 0.031 cents/ntkm. This was very close to the 0.03 cents/ntkm that BTE (1999b) estimated for its 'representative' inter-capital rail route.

BTE (1999b) estimated that half the rail freight accident cost was met through insurance. so the externality component was 0.015 cents/ntkm, or about 0.3 per cent of estimated rail freight hauling costs.

C.2 Air pollution

Transport, especially road transport, causes a significant proportion of urban air pollution. Road transport contributes most of the nitrogen oxide and carbon monoxide emissions in capital city airsheds, and is a significant source of particulate matter emissions (BTRE 2005d).[2] In 2000, cars were estimated to have caused almost half the particulate matter emissions from motor vehicles in metropolitan areas; light commercial vehicles 18 per cent; articulated trucks 6 per cent; rigid and other trucks 21 per cent; and buses 6 per cent (BTRE 2003e).

Rail's contribution to urban air pollution is small — in 2000-01, the proportion of carbon monoxide, sulphur dioxide, nitrous oxide and particulate matter emissions attributable to rail was well below 2 per cent in most capital city airsheds.

Urban air pollution can have significant adverse effects on both the length and quality of life of those living in urban areas. These impacts are not always as directly observable, nor as easily attributable to transport activities (box C.2), as other transport externalities such as accidents and noise. There has been considerable research conducted on urban air pollution in general, and the impacts from transport in particular, both in Australia and overseas.[3]

Where data on air pollution outside of capital cities are available, the general indication is that particulate matter is the main pollutant and its main sources are bushfire smoke and dust (including mining and agricultural dust), rather than motor vehicles (BTRE 2005d).

BTRE (2005d) attributed health impacts to road vehicles by estimating the level of pollutant emissions from transport sources, linking health outcomes (asthma, bronchitis, respiratory disease and cardiovascular disease) to these emissions, and then assigning a value to these outcomes.

2 Unless otherwise indicated, this section refers to particulate matter with a diameter of 10 microns (10^{-9} m) or less. Particulate matter is assumed to be representative of the impacts of all air pollution. Use of a surrogate avoids double counting due to the correlated effects of the different pollutants. (BTRE 2005d)

3 By comparison, very little is known about the health impacts of indoor air pollution despite an indication that indoor pollution levels are comparable to levels outdoors, and despite Australians spending considerably more time indoors than outdoors (BTRE 2005d).

Box C.2 **Air pollution from motor vehicles**

For most air pollutants, the health impacts are predominantly respiratory. Children, the elderly and those who have respiratory conditions are the most susceptible. Some pollutants are considered 'unlikely to affect people's health at very low levels' (BTRE 2005d, p. 8). For other pollutants, such as particulate matter, it may be that any level affects human health.

The extent to which air pollutants from motor vehicles have adverse health effects depends on the time, and location in which, they are emitted (a given quantity of pollutant will have a larger impact in an area of greater population density) and the presence of other pollutants (different pollutants can have correlated impacts on health). For particulate matter, the size of the particles may also be important — recent research indicating that smaller diameter particulate matter can have very significant health effects. A high proportion of road dust particles are relatively large in diameter.

The level of pollution emitted by a vehicle depends on vehicle type, the vehicle's condition and age, the emission abatement technology installed, the type of road and its congestion level, and whether the vehicle is driven hot or cold.[4] The contribution that poorly maintained vehicles make to total vehicle emissions is unknown.

Source: BTRE (2005d).

Based on a number of assumptions and exclusions,[5] the annual economic cost of air pollution from all motor vehicles in 2000 was estimated to be between $1.6 billion and $3.8 billion (midway estimate $2.7 billion).[6] Mortality was the main element of this cost — between $1.1 billion and $2.6 billion. Around 86 per cent of mortality costs, and approximately 90 per cent of morbidity costs, were in capital cities. The number of premature deaths in capital cities due to motor vehicle emissions was estimated to be about 1200 per year.

The BTRE (2005d, p. xiv) observed that the cost estimates vary 'substantially with changes to key assumptions'. For example, if the proportion of measured particulate matter pollution attributed to motor vehicles was increased from 35 to 45 per cent for capital city areas, and to 20 per cent in all non-capital city areas, the central estimate increased to approximately $3.7 billion. Conversely, a reduction in motor

4 The *type* of pollutant emitted depends on the fuel being used — diesel engines produce higher levels of particulate matter (and a higher proportion of the smallest particulate matter), and lower levels of carbon monoxide and hydrocarbons, than do petrol engines.

5 For example, it used a value of a statistical life of around $1.3 million, and based morbidity costs on an assumed value per healthy year of life lost due to disability of about $50 000. Rail, sea and air modes were excluded due to a lack of consistent data. Indications are, however, that their contributions to total emissions of air pollutants are minimal. (BTRE 2005d)

6 This range reflects the uncertainty about the link between particulate matter concentration and mortality rates (BTRE 2005d).

vehicles' assumed share of particulate matter emissions in capital cities to 20 per cent reduced the central estimate to around $2.1 billion.

A number of other studies have estimated the health impacts of motor vehicle emissions. These produced a wide range of results, reflecting the inherent difficulty and uncertainty involved, and different assumptions made.

- A review of Australian studies (Brindle et al. 1999 for the Australian Road Research Board) reported a wide range of health costs associated with air pollution from road transport — from around $20 million to over $5.3 billion.
- The lower bound estimate was by Segal (1995; more recently published in 1999), who estimated that health costs resulting from transport emissions were between $20 million and $100 million. This study focused only on the health effects of ozone and air toxins and excluded particulate matter.
- Watkiss (2002) (for the Australian Government Fuel Taxation Inquiry) adjusted findings from studies conducted overseas to Australian conditions and estimated annual health costs from motor vehicle emissions of around $3 billion.
- The Bus Industry Confederation (BIC 2001) adapted the findings of a European study and estimated the cost of urban air pollution from road transport at around $4.3 billion (about $3.7 billion in capital cities) (it does not appear to have used a surrogate pollutant, so this may be an overestimate).

Health costs by vehicle type and transport mode

Unlike BTRE (2005d), a number of other studies have estimated the proportion of pollution-related health costs attributable to specific vehicle classes.

- On the basis of the BTRE's midway estimate ($2.7 billion), Cox (AAA, sub. 45, appendix) estimated the costs of air pollution generated in urban areas by light and heavy vehicles to be around 1.38 cents/km and 11.42 cents/km respectively.
- Using BTRE (2003e and 2005d), Laird (sub. 23) estimated the health cost of air pollution from articulated trucks to be approximately 0.65 cents/ntkm in capital cities and 0.13 cents/ntkm in rural areas. For trains, the cost for travel in capital cities was 0.22 cents/ntkm and 0.04 cents/ntkm in rural areas.
- The Australian Transport Council (ATC 2004b) published default values for externalities for the purpose of project evaluation, which have been adopted by the States and Territories (Victorian Government, sub. 55). The health cost of air pollution for rail was estimated to be 0.3 cents/ntkm. For travel within rural areas, the cost for road freight ranged from 0.09 cents/ntkm for light vehicles to 0.004 cents/ntkm for heavy vehicles, with the cost for passenger vehicles estimated to be 0.01 cents/vkm. Within urban areas, the estimated costs were

considerably higher: 0.87 cents/ntkm for heavy trucks to 22.2 cents/ntkm for light freight vehicles,[7] and 2.2 cents/vkm for passenger vehicles.

- Tsolakis et al. (2005) estimated the health cost of freight transport to be zero for light trucks and 0.10 cents/tkm for heavy vehicles in rural areas, and 10 cents/tkm and 2.1 cents/tkm respectively in urban areas. For passenger vehicles, estimated costs were 0.02 cents/vkm in rural areas and 2.1 cents/vkm in urban areas.
- BIC (2001) estimated that the use of rigid trucks within capital cities accounted for around $1.17 billion of air pollution-related health costs (the same as cars), and articulated trucks around $0.28 billion (representing about 31 and 8 per cent of total health costs respectively).
- BTE (1999a) reported estimated costs of pollution from interstate freight transport on its 'representative routes' of 0.004 cents/ntkm for rail and 0.01 cents/ntkm for road. These estimates are low because over 90 per cent of inter-city travel is in rural areas where the cost of pollution is lower.

The BTRE (2005d), AAA (sub. 45) and Truck Industry Council (TIC, sub. 13) all indicated that fuel and engine standards (box C.3) and technological improvements have been effective in reducing vehicle emissions in the past 20 years. The effectiveness of regulations and standards in reducing air pollution is reflected in BTRE (2003e) projections of metropolitan air pollution levels from motor vehicles. One scenario indicated that, without the standards introduced up to 2006, levels of several air pollutants in metropolitan areas would have been at least 20 per cent higher in 2020 is now expected.

The Department of the Environment and Heritage (DEH 2004) indicated that over the period 1991 to 2001, there was a downward trend in lead, carbon monoxide and nitrogen dioxide levels. Particulate matter and ozone remained near or above National Environment Protection Measures standard levels, and no downward trend was evident. Differences in results across locations, however, highlight the fact that various location-specific and non-transport factors influence pollution outcomes.[8]

7 The estimated costs for light vehicles are considerably higher than for heavy vehicles in ntkm terms (compare these estimates with Cox (AAA, sub. 45, appendix)) because light vehicles must travel greater distances to carry the same weight of freight.

8 For example, particulate matter was a problem for Launceston (due to smoke from wood heaters); sulphur dioxide for Mt Isa (due to industrial activity); and ozone was a problem for Sydney. The situation was much the same in 2004 (EPHC 2006). Standards for particulate matter and sulphur dioxide were exceeded in a small proportion of monitoring stations around the country. Ozone levels are still a concern in the Sydney region.

Box C.3 Fuel and engine technology and standards

Diesel vehicles

- The phase-in of new emissions standards for diesel vehicles began in 2002-03 and is to be completed in 2011 (Euro V). These involve considerable reductions in emissions, particularly for particulate matter and nitrous oxides.
- From 1 July 2006, some diesel trucks will be required to meet certain emissions-related obligations (such as demonstrating compliance with a maintenance schedule) in order to retain their fuel tax credits.
- Diesel fuel has contained 90 per cent less sulphur since January 2006. Stricter sulphur limits will be mandatory from 2009.

Petrol vehicles

- Since the mid-1980s, new petrol vehicles have been required to run on unleaded petrol and have catalytic converters, which have also reduced levels of carbon monoxide and hydrocarbons. Leaded petrol has now been phased out, and airborne lead pollution is no longer considered a problem in major Australian cities.
- The phase-in of more stringent emissions standards for new petrol vehicles began in 2003-04, and will be completed in 2010 (Euro IV). Standards for emissions of particulate matter do not apply to petrol vehicles.
- New petrol standards compatible with new engines have also been introduced.

Other transport modes

- According to the Australian Trucking Association:

  … there are no regulated emission standards for heavy diesel engines used in new rail locomotives, nor a requirement that they use automotive diesel, which must achieve a national standard for sulphur levels. (sub. 9, p. 18)
- Ship and boat emissions are mostly unregulated and there are few regulations for aircraft emissions, but most of these emissions occur outside urban airsheds.

Sources: ATA (sub. 9; 2005; 2004); BTRE (2005d); DOTARS (2006e; 2006g); NTC (sub. 19).

Although regulations have internalised at least some costs of air pollution from transport sources, they have also imposed significant costs on all operators, even if they operate mainly in rural areas where the health costs of their emissions are low.

The NTC (sub. 17) indicated that the cost of meeting Euro V standards (box C.3) will be around $2500 to $3600 per vehicle. The ATA (sub. 9) argued that the cost may be considerably higher — around $13 000 or more per truck. These engine standards also reduce truck productivity because the required technologies take up extra space and add to vehicle weight. Commenting on requirements relating to both emission and noise standards, the TIC noted:

> To meet the ADR 80/01 emission standards and ADR 83/00 noise … the additional weight will vary between 180–280 kgs. This results in a loss of payload.
>
> Costs vary between $4,000 for a light duty truck (up to 8.5 tonnes GVM) to $10,000 for a heavy duty prime mover. (sub. 13, p. 1)

The ATA suggested that the adoption of selective catalytic reduction technology to meet the Euro V standard ‘is expected to accrue a 0–6% fuel efficiency penalty compared to today’s Euro III engines’ (sub. 9, p. 18).

C.3 Noise

Both road and rail transport generate noise — that is, unwanted or detrimental sounds and vibrations (Forkenbrock 2001; VTPI 2005). For road transport, noise can result from tyre contact and vehicle engines, auxiliary systems such as compression brakes, refrigeration, and other intermittent sources (such as loads) (BIC 2001). Sources of rail freight noise include locomotive noise, vibration and ‘wheel squeal’, which can occur at terminals, marshalling yards or along train lines (WA Local Government Association, sub. 15). Passenger trains also create noise.

According to OECD (1990), transport (especially road traffic) is the greatest source of noise, ahead of building and industry. In Australia, Brown and Lam (1994) estimated that about one-third of urban residences were either located on roads with high traffic volumes or close enough to busy roads to experience significant traffic noise. NRTC (2001) estimated that nearly 40 per cent of Australia’s population was exposed to ‘undesirable’ traffic noise, with another 10 per cent exposed to ‘excessive’ traffic noise. Participants to this inquiry pointed to community concerns about excessive transport noise, particularly for freight transport (box C.4). Concerns about noise reflect the potential negative effects of excessive transport noise, including ‘nuisance’ and social/amenity effects, as well as health impacts.

Quantifying noise costs is difficult. Even the first step involved — measuring noise levels — is not straightforward (box C.5). The impact of noise is highly localised, and the extent to which transport noise is, or is perceived to be, a problem varies according to a number of interdependent factors. These include the characteristics of the producer of the noise (railway noise, for example, tends to be perceived as less of a problem than road transport noise at equivalent decibel levels), the nature of the noise produced, and the environment in which the noise is produced. In addition, noise costs tend to be higher at night, and where existing (transport and non-transport) noise levels are low.

Box C.4 **Participants' views on transport noise**

Road noise

Many of the traffic related complaints received by Local Government refer to noise associated with freight movements. This is particularly relevant to built up areas close to highways and areas involving steep inclines where engine brakes are commonly used. (Eastern Metropolitan Regional Council, sub. 14, p. 5)

Whilst the extent of community complaint and the associated external costs … associated with motor vehicle noise pollution remains unclear, it would appear from the myriad of government responses to the issue that it is a source of community concern. (Australian Trucking Association, sub. 9, p. 19)

Consideration of external costs [including noise] will also be important. These are key concerns in major urban areas (eg in the Brisbane Urban Corridor) where significant freight movement take place. The quality of life of residents can be significantly impaired by use of suburban streets by heavy vehicles. (Local Government Association of Queensland, sub. 30, p. 1)

Rail noise

The freight rail also creates excessive noise impacts, particularly in Hazelmere. (Eastern Metropolitan Regional Council, sub. 14, p. 5)

Some surveys in Sydney … have suggested that train noise is more a problem than road noise. (Robert Gunning, sub. 19, p. 6)

Valuing the impacts is also problematic. Valuation methods include estimating willingness to pay for a quieter environment and health costs. Hedonic pricing studies have also been used. These infer a noise cost by estimating traffic noise exposure and measuring the reduction in the rentals or prices of houses that are exposed to noise above a certain threshold (holding other factors constant).

Estimates depend heavily on a study's aims, assumptions and methodology. This is particularly important when considering Australia noise cost estimates. Most studies have been conducted overseas, with Australian estimates derived by adjusting international results to try to make them applicable to Australian conditions. Moreover, according to Cox, 'there has not been any new work carried out on the costs of noise pollution in Australia since 2001' (AAA, sub. 45, appendix A, p. 6); studies since then presumably representing updates of previous work.

Box C.5 **How do we measure what we hear?**

Noise is characterised by the logarithmic perception of sound by the human ear and is measured in decibels (dB).

As well as being affected by the pressure of sound, the human ear is sensitive to the frequency of sound. Thus, an 'A-weighted' measure of noise — dB(A) — is generally used (the A-scale corresponds to the range of frequency perceptible to the human ear). Zero dB(A) is the faintest sound humans can hear. The logarithmic nature of the scale means that (for most people) noise of 60 dB(A) sounds twice as loud as noise at 50 dB(A), and noise at 70 dB(A) sounds four times louder than noise at 50 dB(A).

Although it attempts to capture two aspects of noise, the traditional dB(A) measure may not accurately capture the impact of all traffic noise, such as that associated with engine brakes (which is low frequency and characterised by pulses or variations that tend to cause more annoyance than the actual decibel level).

Because dB(A) measures noise at a particular point in time, various indexes are used to measure noise over a period of time. For example, Leq is an 'energy averaging' technique that represents fluctuating noise as the equivalent continuous sound level in dB(A) over a time period.

Sources: BIC (2001); Forkenbrock (1999); Infras/IWW (2000); NTC (2006a); NRTC (2001); VTPI (2005).

Estimates of noise costs

Various studies provide noise cost estimates attributable to road for Australia.

- Tsolakis et al. (2003) estimated noise costs of between $16 and $32 per thousand tkm for light vehicles, and $2–4 per thousand tkm for heavy vehicles.
- Based on a 1998 US study, BIC (2001) concluded that total Australian urban road noise costs ranged from $668 million to $1.8 billion a year, mostly in capital cities. Most of this was due to passenger cars, with between 9.7 and 11.4 per cent attributed to light duty vehicles, and between 15.8 and 26 per cent attributed to rigid and articulated trucks. The central estimate of $1.2 billion compared with $534 million based on an hedonic pricing study. It also estimated marginal noise costs: 0.3 cents/km for cars, 1.8 cents/km for medium trucks, and 5 cents/km for heavy trucks. On the other hand, Laird (2005) suggested that, combining the cost estimate with updated data on distances travelled, the unit costs of articulated vehicles would be 8.07 cents/km.
- Cox (AAA, sub. 45, appendix A) estimated urban Australian road transport noise costs of about $1.1 billion (for 2004-05), 7.1 per cent of which was attributed to light commercial vehicles, with rigid and other trucks, and articulated trucks, accounting for 37.8 and 10.8 per cent of total costs

respectively. Unit noise costs were 0.42 cents/km for light commercial vehicles and 8.4 cents/km for heavy vehicles. *Overall*, noise costs were lower than the other external cost categories included, accounting for 14.7 per cent of road costs. For heavy vehicles, however, urban noise costs exceeded their accident costs.

Other studies have estimated and compared noise costs for road and rail freight.

- BTE (1999a) estimated that noise costs on its 'representative' freight routes were 0.034 cents/ntkm for road and 0.02 cents/ntkm for rail.
- Based on various previous studies, Port Jackson Partners (2005) assumed noise costs for road of between 30 and 50 cents per thousand ntkm in rural areas and between 6 cents and $1.32 per thousand ntkm in metropolitan areas. The equivalent values for rail were much lower at 0–20 cents and 4–20 cents respectively per thousand ntkm. (Most of the overall difference in external costs between rail and road was due to differences in accident costs, however.)
  – The NTC (2006a, p. 27) suggested that the noise 'externality values should probably be zero for rural inter-capital highways'.
- Laird (2005) also used various studies as a basis for estimating noise costs of about 0.07 cents/ntkm for non-metropolitan road haulage, 0.12 cents/ntkm for urban rail haulage and 0.04 cents/ntkm for non-urban rail haulage.
- Based on the methodology of Infras/WWW (2000) (which incorporates a willingness to pay and health-cost component), and using Austroads and ARTC data for road and rail respectively, ATC (2004b) provided the following default noise externality estimates for Australia (in 2001 Australian dollars).
  – For road freight transport in urban areas, 2.3 cents/ntkm and 0.23 cents/ntkm for light and heavy vehicles respectively. Zero costs were assumed for rural areas but it recommended the urban rate be applied for rural townships. These estimates were substantially lower than the sector's air pollution costs, but exceeded its climate change costs. In vkm terms, road freight noise costs also significantly exceeded the noise costs associated with passenger vehicles.
  – For rail freight transport, 0.004 cents/ntkm (the values for which were said to represent the benefit of diverting metropolitan tonnage from road to rail).

Various measures have been used to reduce noise externalities

Attempts to reduce noise externalities for both road and rail freight transport have taken various forms. For roads, attenuation measures have included:

- infrastructure construction, such as building roadside barriers to prevent noise reaching residences, and designing low-noise pavements to reduce tyre noise;
- insulation in houses to block out external noise;
- in-service maintenance standards for heavy vehicles;
- design standards for new vehicles, implemented under the Motor Vehicle Standards Act 1989, relating to engine and exhaust technologies that produce lower noise emissions;
- environmental planning policies; and
- movement restrictions on specified types of vehicles.

In the rail sector, measures have included noise guidelines, licensing arrangements, and the construction of noise walls, although the NTC (sub. 17, p. 36) noted that the situation varies across jurisdictions.

Participants highlighted various issues with some current noise reduction measures (box C.6). As noted in section C.2, for example, the TIC (sub. 13) observed the increase in weight, decrease in payload and increased costs associated with meeting standards ADR 80/01 (emissions) and ADR 83/00 (noise).

The efficiency impacts of movement restrictions were highlighted by the NSW Minerals Council (sub. 10), as well as by Coles Myer Limited, which argued:

> … there could be considerable benefit [including increased transport efficiency and fewer vehicles on the road] in the introduction of larger vehicles on interstate routes and where possible for local distribution … This process is also retarded by local regulations restricting the size of vehicles and their hours of operations on some local roads. (sub. 47, p. 9)

C.4 Greenhouse gas emissions

Greenhouse gases comprise a variety of naturally-occurring gases (including water vapour, ozone, carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O)), as well as manufactured chemicals, such as hydrofluorocarbons and perfluorocarbons. These gases increase the Earth’s temperature above what it would otherwise be by trapping energy from the sun — in a process known as the ‘greenhouse effect’.

Various human activities produce greenhouse gases

Although some greenhouse gases and the greenhouse effect are a natural part of the climate system, they can be augmented by some human activities. Indeed, climatic changes induced by an increased concentration of greenhouse gases in the atmosphere are now generally recognised as a significant externality arising from the use of fossil fuels. The Commonwealth Scientific and Industrial Research Organisation (CSIRO) has stated:

> Evidence that human activity has increased the greenhouse effect has mounted rapidly in recent years. (CSIRO 2005)

The externality impacts of greenhouse-induced climate change are generally considered likely to be adverse (particularly to the environment), although some regions and activities might benefit from higher temperatures and changed rainfall distributions. CSIRO argued:

> Climate change will have social, economic and ecological impacts. There will be both winners and losers. All our natural ecosystems are vulnerable to climate change. (CSIRO 2001, p. 1)

Because both road and rail transport in Australia use substantial and increasing amounts of fossil fuels, they are a potential source of greenhouse gases, and therefore potential contributors to climate change.

Greenhouse gas emissions are generally measured in terms of CO_2 equivalent (CO_2-e) emissions, comprising CO_2, CH_4 and N_2O. BTRE (2005d) estimated that in 2004, greenhouse gas emissions from all road and rail transport (including an estimate of emissions from power generation for electric railways) were 76 939 gigagrams of CO_2-e direct emissions — around 13.6 per cent of Australia's estimated net greenhouse emissions.

- These estimated emissions had grown by 36.5 per cent since 1990 (compared with 2.3 per cent growth in total emissions) and were forecast to grow by a further 35 per cent by 2020.
- Freight transport contributed less than one quarter of total road and rail emissions: close to 20 per cent by trucks and about 3.2 per cent by freight trains.
- Trucks (excluding light commercial vehicles) generated around 2.7 per cent of Australia's total greenhouse emissions, while rail freight made up 0.4 per cent.
- Australia's share of global emissions was about 1.4 per cent.

Greenhouse externality cost estimates for transport

While the general link between the use of fossil fuels and global warming is widely accepted, uncertainty remains regarding the exact mechanisms involved and, in particular, the likely impacts and their related costs, especially in the longer term.

This is why BTE (1999a) did not include an allowance for greenhouse emissions when estimating externality costs of freight transport.

Various studies have, however, suggested notional prices for carbon emissions, which could be used to place a greenhouse cost on freight transport (by combining these prices with estimated vehicle emission rates). The ATC (2004c, p. 55) noted, however, that the 'valuation of greenhouse gas emissions is speculative at this point in time'. In assessing Australian transport externalities:

- Laird (2002) used a rate of $25 per tonne of CO_2-e emissions;
- BIC (2001) assumed $40 per tonne;
- ATC (2004c) suggested $10 per tonne for evaluating transport infrastructure projects — recommending the lower end of previous estimates because 'there are no definitive estimates of the cost of greenhouse gas emissions' (ATC 2004c, p. 55); and
- the NSW Government (sub. 50) noted that the trading price in its Greenhouse Gas Abatement Scheme in April 2006 was approximately $15 per tonne.

These estimates are either purely assumed values or are highly sensitive to the actual or hypothetical constraints placed on emissions (for example, emissions quotas in the United Kingdom).

Port Jackson Partners (2005, p. 88), reviewing past studies of the cost of greenhouse emissions, used $20 per tonne (or $22 per tonne in 2004 prices), 'in an attempt to take a more forward-looking view'. This gave a mid-point road freight average greenhouse cost of $1.55 per thousand ntkm — around $50 for a 38-tonne load from Melbourne to Sydney. The mid-point rail freight greenhouse cost was 90 cents per thousand ntkm. Unpublished BTRE work (cited in DOTARS, sub. 69), using a value of $10 per tonne of CO_2-e emissions and an articulated truck emission rate of 1.4 kilograms/km, estimated climate change costs of between 1.2 and 1.5 cents/km across inter-capital highway links. This equated to 0.06–0.08 cents/ntkm.

Relatively few measures have been taken that could internalise some of these greenhouse costs of transport. To the extent that measures have been implemented, they have been relatively *ad hoc*, ranging from regulations to subsidies.

C.5 Traffic congestion

Road and rail infrastructure have finite capacity. If there is sufficient demand for that infrastructure relative to its capacity at any time, traffic flow will begin to be inhibited and both freight and passenger users of the infrastructure will experience congestion. Although the cost of this congestion is largely absorbed within the transport sector, there can be flow-on impacts, such as to users of freight services, employers of transport users, and the broader community. Specifically, the types of costs associated with congestion include:

- travel delays;
- increased driver and passenger stress;
- higher operating costs;
- reduced productivity;
- loss of amenity; and
- increased noise, air pollution and greenhouse gas emissions. (Accident rates and severity are also affected by traffic density and flow but, to the extent that congestion lowers traffic speeds, accident severity may actually decrease.)

Time costs tend to be the focus of economic analyses of congestion (BTCE 1996). This section focuses on road traffic congestion. Issues relating to rail freight congestion are covered in detail in chapter 10.

Road congestion varies across time and locations, and is influenced by many factors, including the nature of the infrastructure, alternative transport options, driver behaviour, and weather conditions (VCEC 2006).

Congestion is also affected by vehicle type. For example, larger and heavier vehicles cause more congestion than smaller, lighter vehicles because they occupy more road space, require greater braking distances and have slower acceleration.[9] The relative effect on congestion of different vehicles is measured in terms of 'Passenger Car Equivalents' or PCEs. Large trucks and buses generally have 1.5–2.5 PCEs, but this is higher through intersections, under stop-and-go driving conditions, or on steep inclines (VTPI 2005).

Vehicle speed also affects congestion costs — faster vehicles requiring more 'shy' distance between themselves and other objects (VTPI 2005).

Because congestion is a non-linear function, small decreases in traffic volumes on a very congested road can lead to significant reductions in delays — of possibly twice the percentage decrease in traffic volumes (VTPI 2005).

As a road approaches capacity, congestion and its associated costs increase significantly. In this situation, the marginal congestion cost imposed by additional

9 The congestion differential is lower in periods of very heavy congestion where heavy vehicle acceleration and braking characteristics add little to the road space they effectively require.

vehicles using the limited road capacity will be rising and above the average congestion costs experienced at that time.

Because there are significant benefits from trips made even at congested times, the efficient level of congestion costs is not zero and will be above free-flow conditions — only the excess of marginal costs (including congestion costs) over the benefits of marginal trips at congested times are policy-relevant external costs. Those making travel decisions are faced with the average cost of congestion and hence this part of congestion costs is internalised in their decisions. It is because marginal congestion costs are well above average costs at peak traffic periods that inefficient decisions are made.

In principle, the point at which demand becomes 'excessive' is when the marginal costs to society of congestion exceed the marginal benefits to society of efforts to reduce congestion (such as adding to road or other transport infrastructure) (VCEC 2006, pp. xvi, 53). It is, however, difficult to assess when this occurs in practice. The Victorian Competition and Efficiency Commission (VCEC) noted, for example, that:

> To assess whether congestion is excessive, information is needed on the marginal costs and benefits of increased traffic to individuals and society more broadly, as well as the benefits and costs of actions that reduce travel time on congested networks. (VCEC 2006, p. 55)

Thus, congestion cost measurement is very information-intensive, and made more difficult by the various time- and location-specific influences on congestion. Both economic (box C.7) and engineering approaches can be used to estimate congestion costs. Engineering approaches — which aggregate the additional travel time over free-flow conditions caused by congestion — are the most common method. Using information such as traffic speed, density and flow, such estimation results in a travel rate index (TRI) that represents the ratio of peak-period to free-flow travel times (that is, the extra time required to travel in peak periods).

Box C.6 **How can road traffic congestion costs be measured?**

Several economic approaches have been used to measure congestion costs:

- calculating the marginal delay caused by an additional vehicle entering the traffic stream, accounting for speed–flow relationships;
- determining the user fee needed to reduce demand to design capacity — reflecting the willingness-to-pay for road use; and
- calculating unit costs of current expenditures on congestion reduction projects.

They should all produce similar cost values (assuming capacity is expanded on the basis of vehicle delay costs as reflected in users' willingness to pay) but often provide different results in practice.

Source: VTPI (2005).

One problem with this approach relates to the use of free-flow conditions as the benchmark. Such a benchmark is not realistic, nor even necessarily desirable (discussed above), so estimates based on this overestimate congestion costs relative to what is economically efficient (VTPI 2005). VCEC (2006, p. 63) also noted that models that attempt to measure congestion 'are extremely sensitive to the specification of the road network, as well as the underlying data and assumptions'. Relatively few Australian studies have investigated congestion from an Australia-wide perspective (reports, such as VCEC (2006), tend to investigate congestion issues from the perspective of a specific city or region, not the country as a whole).

Road congestion costs are more significant issues in urban areas

The BTE (1999a) provided estimates of the total social costs of congestion (beyond free-flow conditions) on capital city roads in 1995 of around $12.8 billion.[10] Ninety per cent of this cost occurred in Sydney, Melbourne and Brisbane. For 2015, the BTE predicted that total congestion costs would rise to $30 billion. Commercial vehicles were not included in the data sets used by the BTE, hence no estimates are available of urban congestion costs attributable to heavy vehicles or benefits to them from reducing congestion.

BTCE (1996) estimated that the value of net benefits (travel time benefits only) for commuters from optimal (variable) peak period congestion pricing in the five

10 The BTE emphasised that its analysis was exploratory in nature and was restricted to commuter travel to work in the morning peak. The data were for different years for different cities and did not allow for recent changes in the road system at the time.

largest state capitals in 1995 would have been $1.1 billion per annum.[11] In addition, BTRE (2002b) reported that fuel usage at congested times would be reduced by 30 per cent if optimal congestion pricing were introduced.

… but road congestion issues also arise in non-urban areas

For the most part, congestion is only a significant cost in large capital cities at particular times. Nonetheless, there are situations on non-urban roads where traffic is travelling below desired (and allowable) speeds, often as a result of being held up by large freight vehicles. Participants at the Commission's Emerald Roundtable commented on the increasing travel times on the Capricorn Highway to Rockhampton due to an increasing number of large trucks using the road.

Based on a United Kingdom study of congestion costs for rural dual carriageways, BTE (1999a) assessed a rural congestion cost of 0.03 cents/ntkm on its 'average' 1125 kilometre road freight haul, representing around 0.6 per cent of haulage costs (as represented by its estimated door-to-door full container load rate) for that route.

C.6 Other externalities

Various other externalities, although receiving less attention in the literature and in submissions, can be generated by the use of freight transport infrastructure. These include dust, water pollution, intrusion and vehicle maintenance costs.

Dust

Both road and rail freight can create raised dust — a particular problem in rural areas, where unsealed roads dominate — or dust from freight carried. The Duaringa Shire Council, for example, pointed to the 'dark side' of the coal boom, which included increased dust in the town of Blackwater (sub. 66, p. 1). Coal dust blowing off passing coal trains was also identified as a concern in community consultations undertaken near another Queensland mine (QR 2005). Depending on the composition of the dust, it can have amenity and health effects.

Various methods have been used to deal with dust issues, and in some cases these internalise the cost to freight users.

[11] For Melbourne, this would have involved a toll of $1.26 per kilometre near the CBD, with charges falling to one tenth of this nine kilometres from the CBD. For Sydney, the area of high peak-hour congestion was more widespread, with maximum efficient tolls of $0.75 per kilometre but spread over a wider area.

- *Regulation* (with resultant costs for road providers), which is the usual means of handling such externalities. The Australian Livestock Transporters Association noted, for example, that the better performing and more efficient B-Double trucks that developed in the 1990s were required to 'have all wheels individually shrouded by mudguards to suppress dust, water and any small stones thrown up by the wheels' (sub. 38, p. 20).
- *Research and development* undertaken by firms, sometimes encouraged by environmental planning policies and/or other Government–industry initiatives. One Queensland Rail project, for example, has involved developing strategies to minimise coal dust emissions from coal trains, with trials used to assess the feasibility of installing the system at other mines (QR 2005).
- *Infrastructure provision*, such as the construction of sealed roads.

It appears, however, that the approach adopted in particular cases is not always the most efficient. The NTC commented, for example:

> In rural areas, all-weather access and sealed roads are often provided to meet the access and amenity needs of local communities (for example, sealing to reduce dust levels). Many rural local roads do not carry traffic volumes which justify this construction standard. (sub. 17, p. 109).

Water pollution

Road and rail transport can both cause local surface and groundwater pollution. This can arise during the construction of the infrastructure, as well as through the use of the infrastructure (including risks associated with transporting hazardous materials).

Potential sources of water pollution from road transport activities include runoff from vehicles, such as engine oil leakage and disposal, road surface, particulate matter and other exhaust pollutants, as well as tyre degradation (ATC 2004c). Infras/WWW (2000) observed that the two main categories of pollutants in road runoff are deicing salt and heavy metals. The former can contaminate drinking water supplies and tends to increase the mobility of heavy metals in soil, thereby facilitating contamination of groundwater, aquifers and streams. Most studies suggest chemical impacts tend to be localised near roads.

Potential rail sources of water pollution include washdown water, waste oil and other products from maintenance activities. Herbicides used in weed management can also contaminate water (Infras/IWW 2000).

A recent study of Brisbane's waterways found that the road network in Brisbane is one of the largest sources of water pollution.

- Within 40 minutes of a storm, several kilograms of contaminated sediment washed off a road the size of an average suburban street.
- About 40 per cent of oil and grease washing into two creek catchments came from roads.
- Up to one-third of toxic heavy metals in the catchments was due to residue deposited by vehicles. (O'Malley 2006)

This suggests that road-derived water pollution can be significant. The costs associated with such pollution will be affected by factors such as rainfall intensity, drainage path length, type of road and type of system.

The ATC (2004c) derived default water pollution externality values based on the control/mitigation cost approach, which values the social costs of implementing mitigation measures such as vegetation, sedimentation tanks, combined catchment and treatment of stormwater runoff. Urban freight cost estimates were 1.5 cents/ntkm for light vehicles, 0.07 cents/ntkm for medium vehicles and 0.01 cents/ntkm for heavy vehicles. Externalities in rural areas were assumed to be one-hundredth of the urban costs. This meant that rural external water pollution costs were, in practical terms, zero for medium and heavy vehicles, and 0.02 cents/ntkm for light vehicles. For rail, the water pollution externality estimate (based on Infras/WWW (2000) nature values) was 0.005 cents/ntkm.

Road and infrastructure design can try to overcome some potential water pollution problems — for example, replacing traditional 'curb and channelled roads' (which direct runoff directly to stormwater drains) with 'swales' (roadside vegetated ditches in which runoff can collect and filter through the soil to be broken down naturally by microbes) (O'Malley 2006). To the extent that infrastructure costs are higher (and passed on to users) in order to reduce pollution costs, some of the externality has already been internalised.

In the rail sector, both the ARTC (sub. 51) and ARA (sub. 33) noted that rail charges incorporate drainage and wastewater disposal/management costs. This would act to reduce the level of the water pollution externality that would otherwise be attributable to rail. Queensland Rail (sub. 53) also pointed to the inclusion of water quality as part of its environmental protection activities.

Intrusion

When it reaches certain 'excessive' levels, road traffic can come to be seen — by local drivers, pedestrians and residents — as an 'intrusion'. Although 'traffic intrusion' can result from all forms of (passenger and freight) traffic:

- it tends to be discussed in terms of increased non-local, through traffic (especially that which is diverted to local roads due, for example, to congestion or the imposition of tolls on nearby arterial roads); and
- particular concern tends to be generated by certain types of vehicle — especially trucks (although four-wheel drives also generate significant negative sentiment).

Various, often ill-defined, factors contribute to this sense of intrusion, making it difficult to specify and quantify the extent of the problem. For drivers of passenger vehicles, the increased traffic impedes traffic flow, especially at peak times. Larger heavy vehicles create further 'nuisance' by, among other things, obscuring the view of the road ahead. Pedestrians may feel less safe crossing roads or dislike the fumes associated with increased traffic. For residents, the noise, pollution and congestion associated with increased traffic (particularly larger vehicles such as trucks) can make communities feel less pleasant and safe. The City of West Torrens (2004, p. 2) noted frequent 'complaints about the intrusion of through traffic, and other non-residential traffic, and their impact on residential amenity'. Ku-Ring-Gai Council also noted that 'intrusion and through traffic into residential streets, is perhaps of most concerns', and that such concern is due to:

> … the loss of amenity and road safety concerns on local roads. This … comes about from increased noise levels generated by the traffic, excessive traffic speeds or, in other cases, delays and congestion because of the volumes and also difficulties in exiting driveways and for pedestrians crossing roads. (Ku-Ring-Gai Council 2002, p. 3)

As these examples illustrate, 'intrusion' in large part reflects the various individual externalities (such as pollution and congestion) generated by transport. Therefore, while intrusion involves some 'cost' to various communities in Australia, any estimation of these costs needs to avoid double counting. That is, it needs to isolate any additional costs associated specifically with intrusion (such as fear of accidents or simply dislike for trucks on the road) that are not already included in the cost estimates of the individual externalities. Isolating this portion is difficult, although the residual costs are likely to be low.

Various approaches have been used to try to address concerns related to intrusion.

- In some situations, governments have used traffic management measures (such as 'traffic calming treatments', including narrowing local roads) and regulations to remove trucks from particular locations or at particular times. In this case, truck operators carry the costs of using alternative less preferred routes.
- Road investment, such as bypasses of country towns, is also used to decrease intrusion costs from cars and trucks. Under the NTC road charges process, heavy vehicles would be allocated a share of this cost. Such bypasses have not been universally popular in some communities, however, with some residents

concerned about the loss of business from the now diverted traffic. Such debates highlight that both costs and benefits derive from transport activities, both of which need to be considered when deciding on any remedial measures.

Vehicle damage/maintenance costs

All vehicles, but especially heavy vehicles, that travel on a road cause damage to its surface (chapter 4). Because road quality influences vehicle operating and maintenance costs, such road wear — to the extent that it is left unrepaired — may increase the costs of other vehicles (including other heavy vehicles) using the road. It may, therefore, create an externality.

The WA Local Government Association (sub. 15) pointed to empirical work indicating that higher operating costs are associated with pavement damage. According to Newbery (1988, pp. 297–8), 'on well-trafficked interurban roads', the average increase in operating costs was comparable to the direct cost of repairing the damage and 'therefore potentially of the first importance'.

Newbery demonstrated, however, that the *externality component* of road damage costs is likely to be very low. Specifically, he showed that, if roads are repaired when they reach a predetermined condition (not necessarily set optimally), traffic is the only source of road damage and traffic flow is constant over time, then the road damage externality is zero, and the average marginal social costs of road use are equal to the average road maintenance cost. Allowing for traffic growth and weather-induced damage, the externality is no longer zero. Empirically, however, it is still likely to be 'quantitatively negligible' (Newbery 1988, p. 295).

Thus, in principle, road authority maintenance programs are likely to incorporate a substantial proportion of overall road damage costs, including the potential externality component. The precise extent to which these programs and charges internalise the potential externality is an empirical question.

D Road Pricing Overseas

D.1 Introduction

Road user charges and tolls apply in a number of developed countries, mainly in Europe. In Europe, charging trucks for the use of roads has often been introduced for the purpose of charging foreign trucks in transit which otherwise would make little or no financial contribution to repairing the road wear they cause. Another common reason is to encourage a modal shift away from road.

Road user charges typically involve some form of mass–distance pricing based on averages. The fee rates are often lower for lighter trucks and for trucks that comply with more stringent emissions standards. Road user charges usually apply to travel on motorways only. The charging systems use a range of technologies — some countries use a paper licence system, whereas others use electronic methods. While the technologies that are in use overseas are relevant to Australia in considering possible changes to the current system, it is important to keep in mind that policy objectives differ. For example, the issue of foreign vehicles using the road network obviously does not apply.

This appendix examines the road pricing systems in use in New Zealand, Switzerland and Germany. These countries were chosen to illustrate the range of systems that are in use around the world. A subsequent section of the appendix briefly outlines some restrictions on the transportation of freight by road in these and other countries. Lessons from road user charging and tolling systems in these and other countries are then discussed.

D.2 New Zealand

New Zealand introduced a Road User Charge (RUC) in the late 1970s.[1] The RUC replaced a diesel fuel tax, and was intended to better reflect the cost of use of road infrastructure by heavy vehicles. The RUC is administered by Land Transport New

1 This section is drawn primarily from Toleman (2003).

Zealand (LTNZ), and the Commercial Vehicle Investigation Unit of the New Zealand Police is responsible for its enforcement.

Pricing determination and price structure

The RUC applies to all diesel vehicles and other vehicles weighing 3.5 tonnes or over travelling on public roads. Vehicles that are powered by fuel not taxed at the source — fuels other than petrol, liquefied petroleum gas (LPG) and compressed natural gas (CNG) — also are liable for the charge. Powered vehicles and unpowered vehicles (trailers) are licensed separately. (LTNZ 2006b)

The RUC is a distance-based charge. Distance licences can be purchased in 1000 kilometre units and the price of the licence is based on the following factors:

- the laden mass of the vehicle (rounded to the nearest tonne);
- whether the vehicle is powered or unpowered;
- whether there are one or two tyres on the axles; and
- whether the axles are close to each other or spaced apart (two axles are deemed to be close if they are less than 2.4 metres apart). (LTNZ 2006b)

Supplementary licences, which are charged at a higher rate than the standard RUCs, can be purchased in multiples of 50 kilometres. They are intended for transport of heavier than usual loads over short distances. Time-based licences can be purchased in one month units for special vehicles such as cranes. (LTNZ 2006b)

RUC rates are based on the assumption that the vehicle is unladen at least 55 per cent of the time. The cost allocation model determines the levels of the charge for each heavy vehicle category based on this assumption and measures of Equivalent Standard Axle (ESA) loads and kilometres travelled (appendix B).

National Land Transport Fund

The revenues from the charge — forecast to be around $680 million[2] for 2006-07 — flow to the National Land Transport Fund (NLTF). The fund is also sourced from a share of petrol fuel excise[3] and motor vehicle registration fees (LTNZ 2006a).

[2] For ease of comparison, all foreign currency amounts in this appendix have been converted to 2005 Australian dollars.

[3] There is an excise on petrol fuel to cover the costs of road use, but not on diesel fuel.

Of an estimated $2.1 billion in the fund in 2006-07, around $900 million is allocated to state highways (100 per cent of total funds allocated for capital and maintenance for state highways), $570 million to local roads (around 50 per cent of allocated funds) and $270 million to passenger transport (over 60 per cent of allocated funds) (LTNZ 2006a).

Transport funding decision making

The New Zealand Government determines the amount of money in the NLTF that will be spent each year on road safety projects. Decisions on how the rest of the funds are spent are left to the Board of Transfund New Zealand — within limits. The fund is not allowed to run at a deficit. In making funding decisions, the Board must have regard to the Government's transport policies and to its annual performance agreement with the Government. The performance agreement specifies how much money is to be spent in aggregate in each of the main areas that the fund is responsible for.

Transfund New Zealand ranks bids for funds made by land transport agencies and local authorities according to these considerations. According to Toleman (2003, p. 5), 'the Minister of Transport may not direct Transfund New Zealand on its decision on any specific land transport project.'

Technologies used

The New Zealand RUC system is based on simple technologies — it relies on paper licences which must be purchased prior to use and must be displayed on the vehicle's windscreen. Most vehicles subject to the RUC must have a hubodometer fitted for the purpose of verifying the distance travelled. For small diesel-powered vehicles including some cars (around 7 per cent of vehicles in New Zealand) odometers are used. The licence specifies the readings of the hubodometer/odometer at the start and end of the licence. The reading of the hubodometer/odometer must be between these two distances at all times.

Impacts of the RUC

The implementation of the RUC system is regarded as having been successful in terms of replacing the diesel tax with a charge that better reflects the costs imposed by heavy vehicles through their use of road infrastructure. Commenting on the New Zealand system, the Western Australian Local Government Association (sub. 15) suggested that the RUCs paid by the various categories of heavy vehicles are reflective of the costs associated with their use. However, the

Association (sub. 15, p. 16) also indicated that there could be a more direct link between RUCs and funding of roads:

> 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 …

The RUC has generally been well accepted by users overall, although there has been some debate about cost attribution parameters. Survey results indicate that around 4 per cent of revenues are lost due to evasion.

Administrative costs

In terms of the administrative costs of the RUC, these together with the costs of administering Motor Vehicle Registration (MVR) are fully covered by the NLTF. Based on an earlier funding forecast for 2004-05, administration costs are around 9 per cent of the combined revenue from RUC and MVR that flows to the fund.

The future of road user charging in New Zealand

As noted by Toleman (2003), the pressure on New Zealand's road network is increasing. Contributing factors include annual growth in road traffic of around 3.5 per cent, congestion in major cities and expected growth in particular industries, including timber production on the east coast of the north island. There is also rising public pressure to deal more effectively with the impact the transport system has on the environment. Of concern is noise and air pollution (the latter a particular problem in Christchurch and Auckland), polluted runoff water and accidents.

Recent advances in engine technology have been another source of pressure on the NLTF. Over the past decade, increased fuel efficiency has acted as a dampener on a key source of revenue for the fund. In order to maintain the growth in the fuel excise of the mid-1990s, the petrol fuel excise has been increased three times in the past decade. The most recent increase was in 2005, when it was changed from 15.98 to 20.28 cents per litre. New Zealand is said to be now at the point where there is considered to be limited scope for further increases in fuel excise rates.

The New Zealand Government is considering updating the current RUC system for heavy vehicles to a Global Positioning System (GPS) to achieve lower administration costs and a better match between road use and RUCs:

> While the administration of the system was extensively updated in the mid-1990s, it is now clear that changing circumstances will require further development to better reflect road use and to further simplify administration. (Toleman 2003, p. 8)

It is considered that an electronic charging system *inter alia* would reduce the administrative burden on both LTNZ and on some heavy vehicle operators by avoiding the need to refund users for travel on private roads. Currently, vehicle operators are required to keep records of the exact location and distance travelled on private roads in order for LTNZ to provide an appropriate refund (LTNZ 2006b). A move to an electronic system could possibly also reduce the transaction fee for purchasing a licence, which currently ranges from $3.05 to $8.65 per licence, and offer the benefits of more payment options.

D.3 Switzerland

The Swiss parliament first approved the collection of a Heavy Goods Vehicle (HGV) fee in 1978.[4] The initial proposal for a fee for HGVs was one that would be differentiated by weight and distance. However, it was determined that it was not feasible to implement such a fee at that stage. Instead, parliament agreed to a fee that would be differentiated by weight class only. The initial level of the annual fee was between $410 and $2500. By December 2000, the fee had increased to between $1100 and $6600. In 2000, the daily charge (irrespective of weight class) was $33.

In line with a general trend throughout Europe, there was rapid growth in traffic crossing the Swiss Alps in the 1990s. In 2000, most of the HGV traffic was along the Gotthard pass — of a total of around 1.4 million crossings of the Alps by HGVs, almost 1.2 million took this route. At the time, the weight limit on heavy vehicles in Switzerland was 28 tonnes. The low weight limit meant that around 600 000 trucks detoured through France or Italy each year. On the other hand, the relatively low fee encouraged trucks under the weight limit to travel through Switzerland.

The Swiss Agreement with the European Union

Switzerland's neighbours pressed for an increase in the mass limit and, after considerable discussion about how the new fee would be set and the level of the charge (the European Union wanted comparability in charges across the region), an agreement with the European Union was reached in 2001. The agreement was that Switzerland would lift the mass limit from 28 to 40 tonnes (Balmer 2003). In exchange, foreign (and domestic) vehicles would pay a Heavy Vehicle Fee (HVF; also known as the LSVA).

The mass limit was initially increased to 34 tonnes and a quota was placed on the number of foreign vehicles weighing between 34 and 40 tonnes that were allowed to

4 This section draws primarily from Krebs and Balmer (2002).

enter Switzerland. These trucks were also subject to higher fees. In addition, concessions were given to empty trucks and to trucks weighing under 28 tonnes. In 2005, the quotas and discounts were removed, the weight limit was raised to 40 tonnes and there was an increase in the HVF.

Consistent with broader transport policy in Switzerland, the aim of the HVF was to shift freight from road to rail.[5] It also aimed to lessen the impact of heavy vehicle freight transport on the Swiss Alps and to replace the flat-rate fee with a fee that more closely reflects the impacts on the environment and on the road network that trucks impose.

Pricing determination and price structure

The HVF applies to domestic and foreign trucks weighing 3.5 tonnes or over that travel within Switzerland or the Principality of Liechtenstein. It applies to travel on all roads and does not vary by type of road. This decision was made in order to prevent traffic changing route to non-toll roads (*The Economist* 2004).

The agreement between Switzerland and the EU dictated that the maximum level of the HVF that could be charged for a 300 kilometre trip from Basel to Chiasso is $260[6] — significantly higher than the daily fee of $33 that previously applied. The maximum price was set so that there would be consistency with neighbouring countries in arrangements for the use of roads. This maximum is consistent with the rate of the HVF calculated using an aggregate measure of the 'uncovered costs' of heavy vehicle traffic (box D.1).

Different rates of the HVF apply to different emission categories. This rate is then multiplied by the distance travelled and the maximum permissible weight of the truck/trailer combination to give the fee applicable for a given truck.

5 The Swiss Government has an objective of reducing the number of trucks crossing the Alps to around 650 000 (roughly half the number for 2001) (Europa 2005b). One measure taken to achieve this objective was the opening of a "rolling highway" in 2001. The rolling highway transports trucks between Germany and Italy by rail.

6 This maximum price will apply once the first New Alpine Rail Transversal (NEAT) tunnel is opened, or by the start of 2008 at the latest. Currently, the average price for a 40 tonne truck is around $230. (Europa 2005b)

Rebates for intermodal freight

According to Zunder and Ibanez (2004, p. 3):

> The system offers rebates to intermodal freight, and various water–road and water–rail ventures have been launched, using this subsidy to shift mode.

Box D.1 **HVF based on estimates of uncovered costs from HGV use**

The cost of externalities caused by road freight vehicles was estimated to be $960 million — comprising $380 million of health costs resulting from air pollution, $320 million for cleaning buildings dirtied by emissions from trucks, $240 million due to noise (based on differences in house prices between neighbouring houses situated in noisy and quiet areas), and $15 million due to the costs of accidents (uncovered insurance costs). (These estimates are based on a number of studies conducted in the late 1990s with the use of 1993 data; they are currently being updated.) Added to this amount, was $130 million in revenues that would be lost by replacing the flat-rate HVF with the new HVF, and $15 million in road infrastructure costs that were not covered by the fund.

In the second step towards calculating the fee, total tonne kilometres (tkms) covered were estimated based on distances covered by truck categories and their average admissible weights. A figure of 47 billion tkms was arrived at. In the next step, the uncovered costs were divided by the total freight task to give an average level of the fee of 2.4 cents per tkm. This fee is then differentiated by emission category.

Consistent with the stepwise introduction agreed to with the EU, the average level of the fee was constrained to 1.5 cents per tkm between 2001 and 2005.

Sources: Balmer (2003); Krebs and Balmer (2002).

Use of HVF revenues

One third of the revenues from the HVF go to the 26 cantons of Switzerland; the remaining two thirds to the Swiss Federation. Most of the funds that the Swiss Federation receives are used for rail projects including the New Alpine Rail Transversal (NEAT) tunnel project. Once the NEAT project is completed in around 2015, it is expected that travel times will be considerably shorter and annual rail freight volumes will be doubled to 60 million tonnes. As an additional measure to support rail, the Swiss Government will supply funds to allow cheaper train path prices.

Technologies used

An On Board Unit (OBU) is mandatory for domestic trucks and is provided free of charge, but the vehicle owner must cover the costs of installation and maintenance. The Swiss OBU combines a tachograph with GPS and microwave technologies. The tachograph measures distance travelled and begins recording as soon as the engine is started. Due to the relatively low accuracy of tachographs, at +/- 4 per cent (Oehry 2004), the OBU also records GPS measurements of distance travelled. Both are saved to a smartcard.

In addition to distance travelled, the smartcard stores information about the vehicle's maximum permitted weight and the emission category that the vehicle belongs to. Every month, this information is sent either via mail or via the internet to the customs authority so that the correct charge can be determined. For enforcement purposes, the OBUs have coloured lights that enable police to determine if the vehicle is legal, and there are dedicated short-range communication (DSRC) beacons at various locations along the road network to check that vehicles comply with the system (*The Economist* 2004).

DSRC beacons are located at Swiss borders and send a signal to OBUs that are fitted to foreign trucks to start recording. Foreign vehicles are not required to have an OBU. For those trucks without an OBU, there are self-service machines at around 100 entry points to Switzerland. On entry, the truck driver must specify a kilometre reading, declare the trailer status of the vehicle and select a payment option. On exit, the driver declares a kilometre reading and the charge is paid without the driver leaving the vehicle. Random checks are performed on vehicles exiting Switzerland.

One-sided interoperability

According to Krebs and Balmer (2002, p. 11), when the HVF was first implemented '… care was taken that the fee would be technically and administratively as compatible as possible with the systems planned in the EU.' While the Swiss OBUs can be used abroad, foreign devices currently cannot be used in Switzerland as more functions are required of the Swiss technology than the technologies in use in neighbouring countries. In future, the Swiss OBUs will be able to operate in countries that use radio toll systems so long as the technology meets the EU standards.

Box D.2 **A snapshot of the HVF**

- Length of roads covered: 70 000 kilometres
- Number of trucks involved: 55 000 (1700 foreign)
- Gross annual revenue: $670 million[7]
- System set up costs:
  - Roadside equipment and background system: $120 million
  - OBUs: $1000 each; $70 million in total[8]
- System operating and enforcement costs: $47 million; 5–7 per cent of revenue
- Personnel involved: 120 Swiss Customs officers

Sources: Hofstetter and Balmer (2006); NTC (2004c); Oehry (2006, 2004).

Changes in fleet and industry structure

The biggest impact of the fee was on the structure of the road freight industry in Switzerland. Smaller companies closed business or merged with other companies because they were not able to reduce costs by minimising the number of empty runs to the same extent as larger companies.

The introduction of the HVF also caused a significant change in the structure of the Swiss road freight fleet. There was a substantial increase in truck sales (45 per cent) in the year prior to the HVF. (A significant proportion of these new trucks weighed 26 tonnes or more.) As Queensland Rail (sub. 53, p. 66) explains:

> … the LSVA sets a strong incentive to use 'clean' vehicles and thus to renew the fleet. The differentiation of the fee between EURO emission classes is sufficiently high to make it profitable in many cases to replace older vehicles with new ones in order to meet the more demanding EURO II/III emission levels.

Changes in freight traffic

In 2000, annual growth in vehicle kilometres (vkms) travelled across the whole network was around 7 per cent. The flat HVF was doubled, but there was no effect on vkms travelled. However, following the introduction of the new (performance-related) HVF, in 2001 and 2002 there were reductions in vkms travelled of around 4 and 3 per cent, respectively (however, this is not fully

7 This figure is based on revenues in 2003; HVFs have since been increased.

8 Installation costs around $250 per unit. This cost is met by truck operators.

attributable to the HVF, as regulations that were introduced following the Gotthard tunnel accident in 2001 were also responsible for the fall in vkms). In 2003 there were no further reductions in vkms travelled. (Hofstetter and Balmer 2006)

Overall, in 2001 there was also a reduction in freight traffic across the Alps of around 2 per cent. Compared to 2000, in 2001 there was an 18 per cent increase in the number of Alps crossings by articulated trucks. This was offset by a 22 per cent reduction in the number of crossings by the lightest category of trucks subject to the HVF (rigid trucks without trailers). The number of crossings by the middle weight category of trucks (trucks with trailers), remained relatively stable.

There was little change in freight routes in 2001. There was some return of freight traffic that used to detour around Switzerland. Almost all were articulated trucks.

Successes and failures of the HVF

In line with its objective, the HVF has halted strong growth in heavy vehicle traffic in Switzerland. Because the fee is differentiated by emission category, the new fee is better targeted than the flat fee it replaced. As discussed above, the HVF has also created strong incentives for the renewal of the fleet of heavy vehicles. It is unclear, however, whether the HVF has been successful in achieving the policy goal of shifting freight from road to rail — in 2001, road's share actually increased from 30 to 34 per cent — although a shift may become evident with time.

A simple system

The HVF system is reasonably simple — the fee applies to travel on all roads, the fee structure is simple, and it is based on a well-established technology (DRSC) (Balmer 2003). According to Transport Certification Australia (sub. 24, p. 2),

> The Swiss system is a simple and elegant solution to a well defined problem. However, it does not readily lend itself to future expansion, if for example, the Swiss Government decided it wanted to specifically identify and charge differently certain road sections.

A relatively smooth transition

There were few problems experienced with the implementation of the HVF. There were no technical problems with the OBUs, and few compliance issues —

> The fraud in the field is very low, despite the fact that up till now only 12 stationary enforcement stations are in operation at strategic points on the motorways. (Hofstetter and Balmer 2006, p. 3)

The transition to the new scheme was relatively smooth because the Swiss Customs Authority had relevant experience in administering taxes (Balmer 2003). There were some administrative problems, however. These concerned the quality of the vehicle registry data supplied to the authority by the 26 cantonal authorities which were not in a consistent format. According to Hofstetter and Balmer (2006, p. 2), '… this was the reason for the majority of complaints.'

The HVF has been accepted by the public and by truck operators. It has the support of environmental groups. In 1998 the Swiss voted by referendum in favour of the HVF and the use of revenues from the fee for rail projects by 'a large majority' (Krebs and Balmer 2002, p. 13). The broader Swiss transport policy of encouraging a modal shift from road to rail also has public support:

> The Alpine Protection Article, which requires the transfer of transit traffic from road to rail, was also included in the Federal Constitution after a referendum in 1994. (Krebs and Balmer 2002, p. 13)

D.4 Germany

In 2003, Germany abolished the Eurovignette (box D.2), a road user charge which allowed trucks access to motorways for a defined period of time. It was anticipated that a new road user charge, known as the Maut, would soon be implemented. The new fee was designed to reflect the costs of using the motorway network more closely than the Eurovignette it replaced. The construction and administration of the new system was outsourced to a private firm, Toll Collect (Schulz 2006). There were several setbacks in delivering the new system, which meant that this did not happen until the start of 2005.

Box D.3 **European Commission's 'Eurovignette' Directive**

- The 1999 Directive on road user charges and tolls replaced the original 1993 Directive which was annulled in 1995. It aimed to reduce the differences in levels of charges between countries, to have charges that better reflected the cost of road use, and to 'move towards the principle of territoriality'. The Eurovignette came into force in 2000.
- Road user charges and tolls were limited to vehicles over 12 tonnes travelling on motorways, multilane roads similar to motorways, tunnels, bridges and mountain passes. They had to be in proportion to duration of use and could not discriminate against foreign vehicles.
- The Directive allowed Member States to differentiate road user charges by mass, by time of day and by vehicle emission category. It set minimum and maximum levels of charges.
- The Directive allowed Member States to adopt a common system. As a result, Belgium, Germany, Denmark, Luxembourg, the Netherlands and Sweden introduced the Eurovignette system, allowing users in these member countries access to motorways within these countries for a given period of time.
- In 2003 Germany became the first (and only) country to opt out of the Eurovignette.

2003 proposed amendment

- This proposal was agreed to in December 2005 and was aimed at meeting some of the objectives of the European Commission's 2001 White Paper (*European Transport Policy for 2010: Time to Decide*). The aims of the 2003 Directive are not only to charge for the provision and use of infrastructure, including external costs, but also to 'rebalance the modal split'.
- The amendment broadens the original directive by requiring that the Eurovignette apply to all trucks weighing 3.5 tonnes or more (from 2012 onwards). It also requires charges and tolls to vary by emission standards (from 2010 onwards).
- The amendment gives Member States greater flexibility by allowing charges on all roads, rebates for frequent users, and external costs to be included in road user charges. It was agreed that the following external costs can be charged for if they can be proven 'undeniable': congestion, pollution, noise, landscape damage, health costs and indirect accident costs that are not covered by insurance.

Source: Directive (1999/62/EC); EurActiv (2006).

Policy objectives of the Maut

According to Zunder and Ibanez (2004, p. 3), 'the German Government justified Maut on the basis of the high costs that foreign HGVs impose on the road network…’. The German Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU 2005, p. 1) stated that:

> The wear and tear on roads imposed by a heavy duty lorry with 40 tonnes of axle weight is about 60 000 times as high as that imposed by a passenger car. It is therefore the objective of the Federal Government to bring about a greater involvement of lorries into the financing of infrastructure measures by means of a use–related charge based on the polluter–pays principle. So far financing was completely covered by taxes and only to a very limited extent by the so called Eurovignette. Now, for the first time, a system of financing based on the actual use is to be set up and take the form of a distance related charge (MAUT).

Schulz (2006, p. 5), from the German Ministry of Transport, lists charging trucks for their use of the network and charging based on the polluter pays principle as two of several objectives:

- additional revenue for transport infrastructure funding;
- application of the ‘user pays’ principle;
- more efficient use of transport capacities;
- emission-related tolls to protect the environment; and
- fairer competition between road transport and the railways.

Use of revenues

Toll Collect receives approximately 20 per cent of the revenues from the HGV fee. In the first year, the gross toll revenue was over $4 billion. From the net revenue, around half is allocated to the road network, 38 per cent to the rail network and the remainder to inland waterways. Decisions on which transport projects receive funding are made by the government owned Transport Infrastructure Financing Society (Doll and Schade 2005).

Enforcement and administration of fines is the responsibility of the Federal Office for Goods Transport (BAG) (Toll Collect 2006). There are several means of enforcement — automatic checks via gantries, checkpoints, mobile patrols by BAG officers, and spot checks at the premises of German haulage companies. In 2005, checks were performed on around 18 million trucks (10 per cent of trips) (Schulz 2006).

Pricing determination and price structure

The Maut applies to trucks weighing 12 tonnes or more travelling on motorways. On average, the Maut is reported to be around 18 cents per kilometre travelled (Queensland Rail, sub. 53). The average rate of the fee was based on estimates of road use costs by trucks. However, it is unclear which direct costs were included in this calculation.

The lowest rate of the fee is 13 cents per kilometre and the highest is 20 cents per kilometre travelled. The HGV fee that a particular truck pays depends on the number of axles the vehicle has and the emission category it belongs to. Within the same emission category, trucks with three or fewer axles pay 1 cent less per kilometre travelled than trucks with four or more axles. There are three emission categories. Within the same axle category, trucks which comply with the most stringent standards pay 6 cents less than trucks which comply with the least stringent standards (Toll Collect 2006). The emission categories will be updated at the start of October 2006 and again three years later as new standards are phased in.

Lower fees for domestic trucks

As at October 2005, domestic trucks received a rebate of 4 cents per kilometre to ‘compensate the German haulage business’ (Doll and Schade 2005).[9] Zunder and Ibanez (2004, p. 4) reported that,

> … the European Commission announced in July 2003 a formal investigation into whether a proposed rebates system, due to commence once the toll has risen from its launch level to around €0.15/km[10] over the coming years, contravenes the EU state aid rules.

Technologies used

Of all road user charging systems in the world, the German system uses the most sophisticated technologies. The decision to use complex technologies was driven by the desire to implement a system that is able to perform other functions in addition to tolling (such as fleet management). *The Economist* (2004, p. 4) asserts that:

> Industrial policy was the main reason for embarking on this rather risky path. The German government wanted to help DaimlerChrysler and Deutsche Telekom, the national automobile and telecoms giants that are Toll Collect’s main shareholders, to develop exportable technology. This ambitious approach determined much of the system’s architecture.

---

9 It appears that this is not uncommon practice in Europe. In June 2006, the European Commission issued Spain and France with a ‘reasoned opinion’ (the first step towards legal action) for offering frequent users ‘excessively high discounts’ of 50 per cent and 30 per cent, respectively. According to EC policy, Member States may offer frequent users a discount of no more than 13 per cent of the toll to account for their reduced administration costs. (Directorate-General Energy Transport (EC) 2006).

10 Equivalent to around 0.22 Australian cents per kilometre in 2005.

The OBUs have a combination of GPS, mobile telecommunications technologies (GSM) and DSRC (Road Traffic Technology 2006). The OBU uses a digital map and the location of the vehicle as determined by the GPS to calculate the exact distance travelled. This information is sent to Toll Collect via the mobile telephone network (Queensland Rail, sub. 53). As a backup to the GPS, the OBU can communicate with the vehicle's tachograph or odometer to calculate distance travelled (Road Traffic Technology 2006).

Gantries with DSRC technology are placed along sections of the autobahns where there are non-toll roads running closely in parallel. The position information is used to validate the GPS data, because GPS is unreliable in these circumstances. There are also gantries with high definition cameras, which are used for enforcement purposes. (*The Economist* 2004)

Although the OBUs are not compulsory, 88 per cent of trips are billed via an OBU (Schulz 2006). They are provided free of charge to domestic truck operators, but the installation costs must be met by users (Kossak 2006). Infrequent users can choose not to install an OBU, but instead purchase a ticket for a journey either online or at a terminal (Road Traffic Technology 2006).

Problems with the technology

Aside from underestimating the number of OBUs required — 500 000 were needed but only 150 000 units were available — the introduction of the Maut was delayed mainly due to problems with the technologies used:

- Many of the OBUs were faulty.
- Too few DSRC gantries were built in time for the planned start date, and many were not functioning properly.
- The OBU software was unable to correctly price the distance travelled.
- The internet server could not cope with the number of online queries. (Toll Collect 2004)

The software was introduced in two stages, as the initial version was not able to be updated with changes to the network or fees; this was rectified in the second version which was installed in OBUs before the start of 2006 (Road Traffic Technology 2006).

Box D.4 **A snapshot of the Maut system**

- Length of roads covered: 12 000 kilometres
- Number of trucks involved: 850 000
- Gross annual revenue: $4 billion
- System operating and enforcement costs: approximately 24 per cent of revenues
- Personnel involved: 750 Toll Collect, 540 BAG

Sources: NTC (2004c); Oehry (2006).

Impacts of the Maut

One year after the introduction of the Maut, non-compliance had fallen from an initial 8 per cent to below 2 per cent (Europa 2005a; Kossak 2006). The high compliance with the system may be at least partly explained by changes to the fleet structure and to the freight route. Some trucks have taken different routes to avoid paying the toll:

> The excessive charges are forcing truck operators to bypass the motorway system in favour of the less direct highway system resulting in noise pollution and congestion on those roads. (Queensland Rail, sub. 53, p. 67)

As for Switzerland, the introduction of road user charging led to a significant change in the truck fleet. In the first six months of the Maut, the number of newly registered trucks weighing between 7.5 and 12 tonnes was almost 37 per cent higher than the number in the first half of 2004. There was actually a fall of over 5 per cent in the number of new registrations of trucks weighing between 12 and 18 tonnes during the same period. The overall increase in new registrations of trucks was under 5 per cent (Queensland Rail, sub. 53). According to Kossak (2006, p. 8), there was a ‘tendency to buy trucks with higher environmental standards’, although how strong this incentive was is unclear.

A year after the Maut was introduced, freight trucks had reduced the number of kilometres travelled with empty loads by 15 per cent (Kossak 2006). According to Kossak (2006), in 2005 there was little change in the structure of the industry, freight prices, consumer prices or modal shares. Such impacts may become evident with more time, however.

The main problem with the German Maut was the use of complicated technologies. This led to considerable delays in implementation and the German Government lost approximately $4 billion in revenue as a result (Road Traffic Technology 2006). There were no technical problems once the system was eventually introduced.

The future of the Maut

Transport Certification Australia (sub. 24) contends that the German system is more flexible than others (for example Switzerland). In contrast, the NTC (sub. 17, p. 91) observed:

> One of the biggest problems of the German system is its high degree of inflexibility. The German government specified its requirements to its consultants at a very high level. The System has been developed to deliver only those requirements. It does not allow for changes to be easily made.

A variety of sources indicate that the use of GPS and GSM technologies was intended to allow:

- changes to toll rates (Schulz 2006);
- extension of the network (Queensland Rail, sub. 53);
- lighter trucks and other vehicles to be charged (Queensland Rail, sub. 53);
- charges to differ by time and location (Zunder and Ibanez 2004);
- the provision of services such as traffic alerts, navigation and fleet management (Schulz 2006);
- functionality with the Galileo satellite system (Road Traffic Technology 2006); and
- interoperability with GPS systems in other European countries.

Whether these changes will be possible in practice remains to be seen. For example, it is unclear how readily the network could be extended to include other roads given the gantry system that is in place —

> The German Government is now seeking to extend the charging regime to other roads and is prevented from doing so (except at very high cost) by the limitations of the system. (NTC, sub. 17, p. 91)

D.5 Non-price impacts on road freight overseas

In evaluating road user charging and tolling systems overseas, it is important that these not be considered in isolation from regulations and government policies that might also have an impact on freight movements and modal shares. This section outlines a few such examples.

Bans on truck travel in Europe

A number of European countries, including Germany and Switzerland, have bans on trucks on either Saturday or Sunday each week and on public holidays. Mostly these bans apply at night only. Switzerland has more extensive bans than other countries. Trucks are banned all day on Sundays and on public holidays and also between the hours of 10 pm and 5 am on other days. This has a significant impact on modal shares, and is the main reason why rail carries a higher proportion of freight than does road through the Alps in Switzerland compared with Austria and France (Krebs and Balmer 2002).

Restrictions on truck configurations

Transport Certification Australia (sub. 24) indicates that the use of trailers in Switzerland and in Germany is significantly restricted. For example, in Switzerland, trucks cannot tow more than one trailer.

Emissions standards in New Zealand

Unlike other countries, the New Zealand RUC does not vary by emission category, but emissions standards do apply. New vehicle emissions standards were phased in between 2004 and the start of 2006. They apply to all vehicles manufactured after 1990. More stringent standards will be phased in by 2008. (LTNZ 2003)

D.6 Lessons

Experiences of some other countries with road user charging and road tolling are instructive.

Technology should be tailored to meet pricing objectives

The UK's Lorry Road User Scheme (LRUS) did not start at the beginning of 2006 as planned because it was not clear that the system was designed to meet policy objectives. The NTC (sub. 17, p. 91) stated that the 'technology was developed but it was not clear that it addressed the fundamental requirements of the government and stakeholders.'

According to the Western Australian Local Government Association (sub. 15, p. 16), the planned introduction of the LRUS was halted because it was 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.

A relative success story, however, in terms of meeting objectives cost-effectively, is the London congestion charging scheme which was introduced in February 2003. The scheme uses relatively simple technology (cameras, but no OBUs), but has achieved the objective of reducing congestion in inner London. Within the first few years of the scheme, the number of vehicles entering the charging zone was reduced by almost 20 per cent, with car trips were reduced by around a third. This was achieved with very little impact on the number of people travelling to inner London. More than half swapped to using public transport (Dix 2006).

Gaining public acceptance

As the Swiss, German and New Zealand experience has shown, acceptability of a road charging system is somewhat dependent on what it replaces. In New Zealand, the RUC replaced diesel excise and more closely reflected the costs of using the road network that trucks imposed. In Germany and Switzerland, the road user charges replaced a flat rate fee that allowed access to the network for a period of time. The new charges allowed truck operators to minimise the road user charges by updating the truck fleet and increasing the relative number of loaded runs. The German and Swiss experience also shows that it is easier to implement a new road user charge if it means that foreign trucks will pay for more of the costs they impose.

The Swiss HVF was widely accepted for other reasons too. Truck operators have accepted the fee because it has meant that they have been able to drive heavier trucks in Switzerland. The public and environmental groups support the fee as part of wider Swiss policy to transfer some freight traffic from road to rail.

Congestion charging in London and in Singapore also shows that charges can be accepted if they are used to fund non-road projects —

> … Singaporeans in general understand the rationale and support the government's transport policies, perhaps because these constitute an integrated package that increases the costs of driving but at the same time makes the option of public transport attractive. (Chu and Goh 1997, cited by Santos et al. 2004, p. 232)

Compliance and avoidance issues

London has experienced some problems with compliance — for example, it was allegedly discovered that there were around 100 cars with the same number plate (*The Economist* 2004). Such a problem can arise with a system that only uses cameras to identify vehicles.

Austria, on the other hand, has experienced very high compliance with its road pricing system (introduced January 2004). Each workday there are around 1.8 million transactions but only 800 people caught for non-compliance (Hofstetter 2006). Hoffstetter (2006) indicates that less than 2 per cent of vehicles are avoiding the tolls by using alternative routes, despite Austria having considerably higher road user charges than other countries in the EU (Zunder and Ibanez 2004).

Avoidance of tolls is also an issue in other countries. In France, the tolling of part of the motorway network has led to large flows of traffic onto toll-free roads, causing congestion on these roads (Zunder and Ibanez 2004). Likewise in Hungary, the introduction of charges for HGVs caused congestion, an increased number of accidents and the deterioration of some roads (CfIT 2006).

In some countries it is possible to avoid paying road user charges by taking advantage of exemptions to fees. For example, when the congestion charge was first introduced in Singapore, motorcycles, heavy vehicles and cars with three or more passengers were exempt from charges. This resulted in an increase in the number of small goods vehicles that were being used for private purposes, and cars were picking up bus commuters outside the restricted zone so that they would have at least three passengers (Chin 2002).

Costs of road user charging systems

Of the three road user charging systems examined in detail, it is likely that the complex German system was much more expensive to set up than the Swiss and New Zealand systems, due to the array of sophisticated technologies it employs. Aside from the roadside technologies required, providing the OBUs would have been much more expensive for Germany than for Switzerland — many more OBUs were required in Germany, and more sophisticated functions are required of the German OBUs than of the Swiss OBUs, including the calculation of the fee (table D.1). By comparison, it is probable that the costs involved in setting up the RUC system in New Zealand were minimal. There was no requirement to set up gantries or to equip trucks with OBUs as the system is paper based. The costs would have been predominately administrative.

While the set up costs were much higher for the German system than for the other countries, revenues from road user charging are considerably greater. However, operating costs represent a high percentage of these revenues.

Table D.1 **Comparing road user charging systems**

New Zealand, Switzerland and Germany.

	New Zealand	*Switzerland*	*Germany*
Network covered (km)	92 000	70 000	12 000
Vehicles involved (foreign vehicles)	110 000 (na)	55 000 (1700)	850 000 (na)
Gross revenue	$680 million	$670 million	$4 billion
Set up costs	na	$70 million OBUs, $120 other equipment	na
Operating/enforcement costs	admin. costs 9% of RUC and MVR revenues	5–7% of revenue	24% of revenues
Personnel	na	120 customs officers	750 Toll Collect, 450 BAG (enforcement)

na - not applicable or not available.

Sources: Hofstetter and Balmer (2006); LTNZ (2006a); NTC (2004c); Oehry (2006, 2004).

Simplicity versus flexibility

Road user charging systems appear to involve a trade off between simplicity and flexibility. The German system is high cost and complex in contrast to other systems. Due to the current limitations of GPS, the German system could not be extended to other parts of the network at low cost. However, the German OBUs are compatible with the Gallileo positioning system due for implementation by 2010. This system has promise of greater reliability and accuracy than GPS. It could therefore do away with the requirement of gantries to confirm vehicle location along toll roads, allowing an extension of the tolled network at low cost. It could also facilitate price differentiation according to road type.

In contrast, New Zealand's system is a relatively low cost, simple road user charging system but allows no flexibility to move towards pricing that would more accurately reflect the costs of use that an individual truck imposes. To do so would require the total replacement of the current system. Implementation of location-based charging in New Zealand would therefore be very costly.

D.7 Summing up

A number of countries have road user charges or tolling systems in place. These systems have been successful to varying degrees in meeting their objectives. The Swiss HVF system has low operational costs, achieved its objective of reducing road traffic through the Alps, and has been widely accepted by the Swiss. The New Zealand RUC better reflected the costs of road use than the diesel excise tax that it replaced. The RUC also has low operational costs. However, the Swiss and New Zealand systems are less adaptable than the German system. The potential to expand the German system has come at considerable cost, however.

There are no systems overseas where charges or tolls capture the marginal cost of use of road infrastructure, and there is no indication that this will occur in the near future. Most systems charge for use of only sections of the road network and involve charges that are based on averages. In some cases, charges are differentiated according to engine emission categories. In the majority of countries, a significant proportion of the collected revenues from the road user charge or toll is used to fund rail or public transport projects.

E Regulatory regimes for rail

Access regimes for rail infrastructure services were introduced as part of the National Competition Policy reform process to promote above-rail competition, encourage market diversity and prevent abuse of market power. The National Access Regime was introduced as part of section IIIA of the *Trade Practices Act 1974* (TPA), and most State Governments have also established access regimes for rail infrastructure.

Each regime sets out principles for access seekers to negotiate with infrastructure providers to attempt to reach agreeable terms and conditions. Each regime also contains provisions and mechanisms for dispute resolution where parties are unable to reach agreement. These provisions and mechanisms vary across regimes.

The National Access Regime

Under the National Access Regime, existing and potential above-rail operators can:

- request that the National Competition Council (NCC) recommend that the relevant Minister 'declare' access to the services of a particular infrastructure facility. If the facility is declared, the parties enter into negotiation, supported by legally binding arbitration, in order to reach legally agreeable terms and conditions;
- negotiate within the provisions of a legally binding 'undertaking' by the infrastructure service provider registered with the Australian Competition and Consumer Commission (ACCC); or
- negotiate within the provisions of state-based access regimes which may, or may not, be certified as 'effective' following a recommendation by the NCC (that is, certified as reflecting the relevant principles contained in the Competition Principles Agreement) (PC 1999c).

Any person may apply to have an infrastructure service declared. Applications are considered by the NCC which then makes a recommendation to the relevant Minister. The Minister decides whether or not to declare the infrastructure service. The Minister's decision is appealable to the Australian Competition Tribunal.

Criteria for declaration

The NCC cannot recommend that an infrastructure service be declared unless the Council is satisfied that all of the criteria set out in section 44G(2) of the TPA are met. These criteria are that:

- access (or increased access) to the service would promote competition in at least one market (whether or not in Australia), other than the market for the service;
- it would be uneconomical for anyone to develop another facility to provide the service;
- the facility is of national significance, having regard to:
  - (i) the size of the facility; or
  - (ii) the importance of the facility to constitutional trade or commerce; or
  - (iii) the importance of the facility to the national economy;
- access to the service can be provided without undue risk to human health or safety;
- access to the service is not already the subject of an effective access regime; and
- access (or increased access) to the service would not be contrary to the public interest.

The NCC must also consider whether it would be economical for anyone to develop another facility that could provide part of the service (TPA s. 44F(4)).

When considering the NCC's recommendation, the relevant Minister must also consider these matters.

If the service is declared, the parties are required to negotiate terms and conditions of access. If the parties are unable to reach agreement, they can either refer the dispute to private arbitration, or seek arbitration through the ACCC.

In practice, the National Access Regime has only been used to provide access to the Australian Rail Track Corporation (ARTC) network (via an undertaking under section 44ZZA), and the Tarcoola to Darwin railway (with the State and Territory based Tarcoola to Darwin access regime being certified under Part IIIA).

The ARTC undertaking

The Inter-Governmental Agreement signed in November 1997 leading to the establishment of the ARTC included a requirement that the ARTC provide an access undertaking to the ACCC allowing third party access to its network. An access undertaking was accepted by the ACCC in May 2002 to apply for five years.

Pricing principles within the undertaking specify floor and ceiling revenue limits which may be breached with the agreement of the parties. The undertaking includes provision for reference tariffs, designed to increase transparency and reduce transactions costs for access seekers.

The ACCC listed the following principles that it considered when assessing the ARTC's proposed undertaking:

Access pricing

- Access prices should be no more than the efficient costs incurred by the ARTC, including a normal commercial return on efficient investment.
- Access prices should provide the ARTC with incentives to provide services at efficient levels of cost and quality and to undertake efficient investment.
- Access prices should provide incentives for efficient use of rail track infrastructure.

Negotiation and arbitration

- Access processes should promote commercially negotiated outcomes in a timely manner.
- Access processes should provide timely and effective dispute resolution processes.

Enforcement

- The provisions in the Undertaking should be sufficiently clear to allow enforcement.

In calculating indicative access charges ('reference tariffs'), the ARTC uses floor and ceiling revenue limits based on building block methodology. The floor revenue is based on the incremental cost of providing a service, while ceiling revenue is based on the full economic cost, including service-specific costs, depreciation, allocation of indirect costs and a return on assets.

The ARTC's assets are valued using a Depreciated Optimised Replacement Cost (DORC) methodology. Where assets are provided by government, they are not included in the DORC valuation.

Where costs are unable to be directly attributed to a particular discrete segment of the ARTC network, they are allocated to segments with 60 per cent on a gross-tonne kilometre (GTK) basis, and 40 per cent on a track-kilometre basis (ACCC 2002).

The New South Wales regime

Below-rail infrastructure in New South Wales is controlled by three separate bodies. The ARTC controls the interstate track and the Hunter Valley coal lines, the Railway Infrastructure Corporation (RIC) controls other regional track and RailCorp controls the Sydney metropolitan track.

The New South Wales Rail Access Regime commenced in 1996 and was amended in 1999. In 1999, the NSW access regime was certified by the Commonwealth, although this was subsequently superseded by the NSW Rail Access Undertaking which took effect from 2004. This undertaking has not been certified.

Following the leasing of the interstate and Hunter Valley coal track in 2004, it was determined that the ARTC would lodge an access undertaking with the ACCC as soon as possible. This is yet to occur, meaning that the NSW access regime still applies to these tracks.

The pricing principles in the New South Wales Rail Access Undertaking state that:

- access revenues derived from every access seeker should at least meet the direct cost imposed by that access seeker. In addition, for any sector or group of sectors, revenue from access seekers and line sector community service obligations (CSOs) together should meet the 'full incremental costs' of provision of those sectors (the floor test);
- for any access seeker, or group of access seekers, access revenue must not exceed the full economic costs of the sectors which are required to operate on a stand alone basis (the ceiling test); and
- total access revenues together with any line sector CSOs must not exceed the full economic costs for that part of the network controlled by the access seeker.

Full incremental costs are defined to be 'all costs which could be avoided if a sector was removed from the system', and full economic costs as 'sector specific costs including a permitted rate of return and depreciation and an allocation of non-sector specific costs such as train control and overheads including a rate of return and depreciation on non-sector specific assets. All items are to be assessed on a stand alone basis' (RIC and RailCorp 2004).

Infrastructure providers are also required to maintain an unders and overs account with access seekers to ensure that any revenues temporarily received above ceiling prices will be compensated in the following access period.

The Independent Pricing and Regulatory Tribunal (IPART) is responsible for scrutinising compliance with the ceiling test, approving rates of return, reviewing mine life for the Hunter Valley, determining whether infrastructure providers have correctly complied with asset valuation criteria and ensuring operation of the unders and overs accounts. IPART is also to arbitrate in the event of an access dispute (RIC and RailCorp 2004).

Asset valuation is undertaken using the DORC valuation method under the NSW regime, with corridor foundation assets valued at zero. Only coal lines are considered to have any value for the purposes of calculating the asset ceiling, meaning that 94 per cent of route kilometres within the rail network are attributed no value for regulatory purposes (IPART 1999).

A distinctive feature of the NSW regime is that it allows for flexible arrangements between infrastructure providers and access seekers regarding capital financing. For example, infrastructure providers may recover investment expenditure via an explicit capital contribution, either as a one-off or over several years (RIC and RailCorp 2004).

The Victorian regime

Victoria has recently reformed its access regime. For declared rail infrastructure services, infrastructure providers must produce access agreements setting out terms and conditions for access (including reference prices). Pricing principles are set out in the *Rail Network Pricing Order 2005*, which also allows the Essential Services Commission (ESC) to determine a methodology for calculating prices.

The pricing principles state that infrastructure providers should not receive a return on capital for expenditure before 30 April 1999 (that is, before the leasing of rail infrastructure to the private sector). Assets otherwise are valued using depreciated actual cost (DAC) methodology (ESC 2006d).

Prices must be set with the objective of generating revenue such that, across all declared services, expected revenue is equal to a reasonable forecast of the efficient cost of providing those services (having regard to the standard and quality of those services) including financing costs associated with efficient capital expenditure incurred since 30 April 1999.

Pricing principles involve the use of a revenue cap incorporating a forecast revenue requirement, an under- and over- recovery mechanism, a cost pass through mechanism, a government contribution pass through mechanism and a quality standard adjustment mechanism.

The structure of prices allows for price discrimination where it aids efficiency. Indeed, the ESC has determined that common costs should be allocated on the basis of train kilometres, partly to compensate for the 'un-costed' priority given to passenger trains, but also partly because one of the ESC's legislated objectives is to promote the competitiveness of rail in the freight market (with freight usage of rail assumed to be relatively price elastic). While this was consistent with the preferred pricing strategy of Pacific National, the ESC required Connex to amend its access agreement to allocate common costs based on train kilometres (ESC 2006a).

The Queensland regime

Queensland Rail (QR) voluntarily submitted a draft access undertaking to the Queensland Competition Authority (QCA) in 1999, and agreement on an undertaking was reached in 2001. The undertaking was updated in June 2006. The undertaking sets out terms and conditions for initial negotiation of access agreements and contains reference tariffs for coal train services in central Queensland.

The QR undertaking is based on principles:

- limiting price differentiation between access seekers;
- of upper and lower price limits for individual services or combinations of services;
- of provision for QR to maximise the commercial utilisation of infrastructure; and
- of revenue adequacy defined as 'sufficient to achieve full recovery of efficient costs … including an adequate return on the value of assets reasonably required' (QR 2006, p. 51).

Upper and lower limits for access charges are established at levels ensuring there is no cross subsidy between individual train services or combinations of train services. The limits for individual services or combinations of services are not to fall below the expected incremental cost of providing access and not to exceed the expected stand alone cost of providing access. These costs refer to 'efficient' costs, not necessarily those actually incurred by QR.

Reference tariffs currently apply only to coal lines in central Queensland. For other lines, the main restrictions on prices are limits on price differentiation. QR is prevented from charging different customers different prices to transport the same freight in the same region unless it can demonstrate to the QCA that there are cost or risk differences.

The QCA has the role of assessing and approving third party access undertakings, arbitrating access disputes, enforcing access obligations and assessing competitive neutrality. The QCA also has the power to prepare and approve draft undertakings for declared services where the infrastructure provider does not comply with their responsibilities under the QCA Act.

The QCA insists that the reference tariff structure be cost-reflective, and that causative elements in the pricing structure be separately identified. QR's multi-part reference tariff includes:

- an incremental maintenance charge that is levied on a gross tonne kilometre (GTK) basis;
- an incremental capacity charge that is charged based on the number of train services;
- an allocated component of the reference tariff that is levied on an net tonne kilometre (NTK) basis;
- an allocated component of the reference tariff that is levied on a dollar per net tonne basis; and
- an electricity tariff that is levied on a GTK basis (QCA 2006).

Assets are valued using DORC methodology and, unlike other regulators, the QCA requires land be valued according to DORC principles.

The Western Australian regime

The rail access regime in Western Australia is governed by the *Railways (Access) Act 1998* and the *Railways (Access) Code 2000*. They provide for access seekers to negotiate terms and conditions of access and for arbitration where it is required, and they require infrastructure owners to not hinder access in any way.

Oversight of the access regime is maintained by the Economic Regulation Authority (ERA). Responsibilities include reviewing costs included in floor and ceiling prices, determining rates of return, agreeing to proposals from infrastructure operators and proposing amendments to the access regime.

Under the WA regime, the floor price is to be no less than the incremental costs to the infrastructure provider of providing the relevant service. Further, the total of payments by all operators and any other revenue related to the services provided must not be less than the total incremental costs of providing those services. Floor prices are based on efficient costs.

The ceiling price must be no greater than the total cost of providing access to the particular route to which access is sought. The sum of the prices paid by all access seekers must not exceed the revenue needed to operate (and provide access to) the relevant route. The value of land is not included in capital costs, and asset valuation is based on the Gross Replacement Value (GRV) of railway infrastructure. GRV can be defined as:

> … the lowest current cost to replace existing assets with assets that have the capacity to provide the level of service that meets the actual and reasonably projected demand and are, if appropriate, modern equivalent assets. (ORAR 2002, p. 1)

Third party and government contributed assets are included for the purpose of calculating floor and ceiling prices, although they also are treated as revenue to prevent cost over-recovery.

Non-sector-specific operating costs are allocated entirely on train movements (as the regulator believes there is a strong relationship between the number of train movements and operating costs), while overhead costs are allocated 50 per cent on a GTK basis, and 50 per cent on a train movements basis (ORAR 2003).

The South Australian regime

The majority of rail infrastructure in South Australia is governed by the *Railways (Operations and Access) Act 1997*, while the Tarcoola to Darwin railway is separately governed under the *AustralAsia Railway (Third Party Access) Act 1999*. Infrastructure regulation is overseen by the Essential Services Commission of South Australia (ESCOSA).

With the exception of the Tarcoola to Darwin railway, rail infrastructure in South Australia is subject to the South Australian Rail Access Regime. ESCOSA has the power under the South Australian Rail Access Regime to establish principles for determining floor and ceiling access prices. The floor price represents the lowest price the infrastructure provider could charge without incurring a loss, while the ceiling represents the highest price that could fairly be asked. Operators are able to charge prices not reflecting these principles, although in the event of an access dispute, an arbitrator must set a price between the floor and ceiling prices (ESCOSA 2005).

Assets are to be valued using DORC methodology, with allowable rates of return to be 'commensurate with the regulatory and commercial risks involved' (ESCOSA 2005, p.11). Land and formation works are valued at their historical cost, although land leased from the government for nominal rent is to be valued at zero.

The Tarcoola to Darwin regime

Access to the Tarcoola to Darwin railway is governed by the *AustralAsia Railway (Third Party Access) Code*, which has been certified as effective by the NCC. The code is a schedule to the *AustralAsia Railway (Third Party Access) Act 1999*, a bill passed by the South Australian and Northern Territory parliaments. The Tarcoola to Darwin Rail Access Regime involves the setting of floor and ceiling prices, with the role of ESCOSA largely limited to publishing guidelines outlining preferred methods of asset valuation and appropriate rates of return. ESCOSA may also act as an arbitrator in the event of an access dispute.

Under the Tarcoola to Darwin regime, in the event of arbitration being required, the price determined by the arbitrator will depend on whether the service required could be competitively delivered by another transport mode. If it is determined that it could be, the 'competitive imputation access price' will be set equal to the competitive above-rail freight price less the incremental above-rail cost of providing the relevant service (provided that this is between the determined floor and ceiling prices). Where there is no competitive alternative, the arbitrator will set a price between the floor and ceiling prices based on a wide range of criteria.

The floor price under the Tarcoola to Darwin regime must not be less than the avoidable below-rail cost of providing the railway infrastructure service. The ceiling price is to be set equal to the costs associated with providing the relevant service, assuming the access seeker would be the sole user of the infrastructure required, less the avoidable costs attributable to other users and a reasonable contribution from these users to fixed costs.

Assets are valued using DORC principles under the Tarcoola to Darwin regime, and government contributed assets are included for the purposes of calculating ceiling prices (unless there is no sustainable competitive price). The Tarcoola to Darwin regime is the only one in which government contributed assets are included in ceiling prices. ESCOSA has stated:

> … the stated purpose of the government assistance was to get the railway constructed and operating ... Subsidising prices below commercial levels was not the stated intention. From ESCOSA's perspective…the method of funding the railway is not relevant for ceiling price purposes, so that the regulated capital base for ceiling price purposes (and so for both the return 'on' capital and return 'of' capital components of

> the ceiling price) should be inclusive of the government-contributed assets. On efficiency grounds, therefore, there is no reason for the government-contributed assets to be distinguished from project-funded assets when setting ceiling prices. (ESCOSA 2003, p. 39)

Guidelines issued by ESCOSA for the Tarcoola to Darwin regime dictate that a schedule of reference prices must be provided to access seekers on application, although these reference prices are intended to be indicative only (ESCOSA 2003).

F Estimating road and rail freight elasticities

F.1 Introduction

In this appendix, the empirical relationship between the prices of, and the demand for, road and rail freight is explored. In addition, the extent to which freight demand is determined by other factors such as Gross Domestic Product (GDP) and trade is tested. This is accomplished through the estimation of a series of elasticity measures for the two modes of land transport — road and rail. A qualitative discussion of the importance of non-price service characteristics, such as flexibility and reliability, is also included.

Estimates of own- and cross-price elasticities aid in predicting the results of changes in relative freight prices on the mode share of freight transport between road and rail. In turn, this will assist in identifying the likely effect of various options for freight infrastructure pricing reform.

The estimates obtained in this study are not intended to be used as definitive predictions of the consequences of changes to relative freight prices, but rather to provide an indication of the signs and relative magnitudes of the land freight industries' price and income sensitivities.

Freight transport — the process of delivering a good or input to its final destination — is an input in the production process. Therefore, freight transport demand is linked to a particular level of total economic output, more so than (as in the case of final goods or services) being a function of its own price. As the demand for freight transport is a function of the demand for other goods, it is known as a 'derived demand'. Goods that have derived demands tend to be less price elastic than final goods and services.

When an input is a small percentage of overall costs, it tends to have a relatively inelastic demand. The freight task is typically a small proportion of intermediate inputs. For example, rail costs as a percentage of all intermediate inputs for grain are only about 1 per cent and road costs as a percentage of total intermediate inputs for livestock are about 2 per cent. However, freight transport is a higher percentage of total costs for other commodities, such as coal — for which rail freight costs account for almost 20 per cent of intermediate input costs — and cement — for which road freight costs account for over 10 per cent. As an input's share of costs increases, its demand tends to become less inelastic.

In addition to being affected by its share of costs, the elasticity of a good or service for which there is a 'derived demand' depends on many other factors, including the availability of viable substitutes (box F.1). Generally, the presence of competition causes the own-price elasticity of demand for a specific mode to be relatively more elastic than for the freight industry as a whole (Oum and Waters 2000).

Box F.1 **Conditions for assessing price elasticities of derived demands**

Following Stigler (1969), a service for which there is a derived demand — such as the demand for freight services — is referred to as a 'productive service'. Four conditions influence an assessment of the elasticity of a productive service:

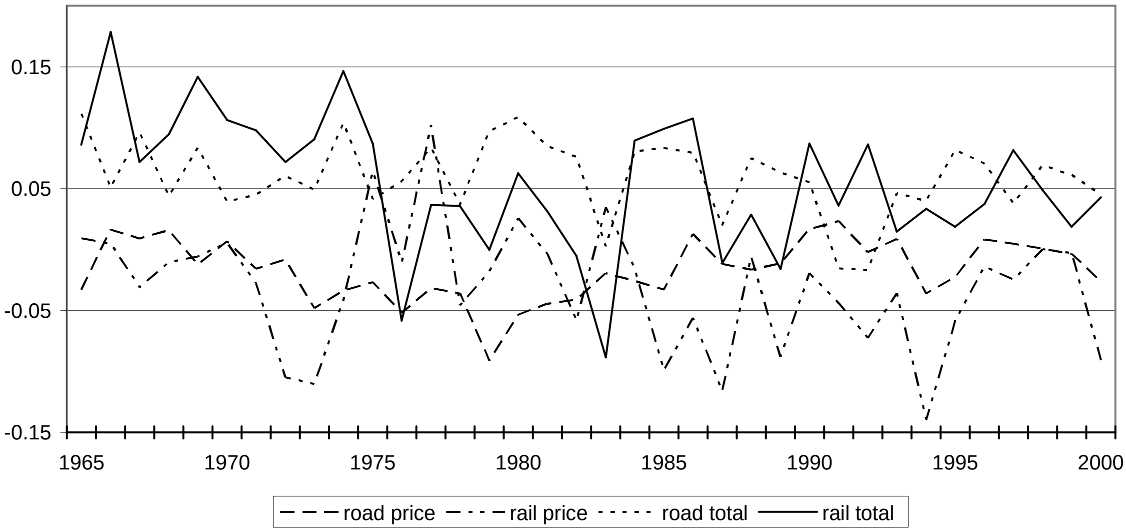
- The elasticity of demand for the final product or service. — for example as long as there continues to be a strong demand for coal, that industry is not expected to be overly sensitive to changes in the price of rail freight.
- The availability of alternative sources of supply of the service — the degree to which the market is contestable. For industries requiring frequent stops and dispersed delivery locations, rail is not necessarily a 'good' alternative. However, the availability of alternative road supply might result in high cross-price elasticities within that mode.
- The proportion of total cost that the price of the productive service comprises — small proportions tend to lead to inelastic price demands.
- The elasticity of supply of other inputs — greater elasticity in the supply of other inputs will result in more elastic demand for the productive service.

F.2 Quantity and price trends

Only general industry trends are discussed in this appendix, as a more detailed analysis is presented in chapter 2.

As seen in figure F.1, the growth in the freight task has been positive in most years, while the growth in freight prices has been negative. Rail quantities and prices exhibit greater volatility than road prices and quantities over the period examined. The growth in road freight overtook rail in the mid-1970s and, in most years, it has continued to exhibit faster growth than rail freight.[1] The relative growth of road, *vis a vis* rail, since the 1980s is likely to be related to the widespread introduction of large articulated trucks around this time. In addition, increases in road infrastructure expenditure from this time expanded the ability of road to service markets, contributing further to its growth (chapter 2).

Figure F.1 **Growth in quantity and prices, 1965 to 2001[a]**
Annual growth rates



[a] Road and rail total growth rates are calculated as changes in the natural log of output in billion tonne kilometres (tkms). Price growth rates are changes in the natural log of prices in cents per tkm.

Data source: BTRE (2006b).

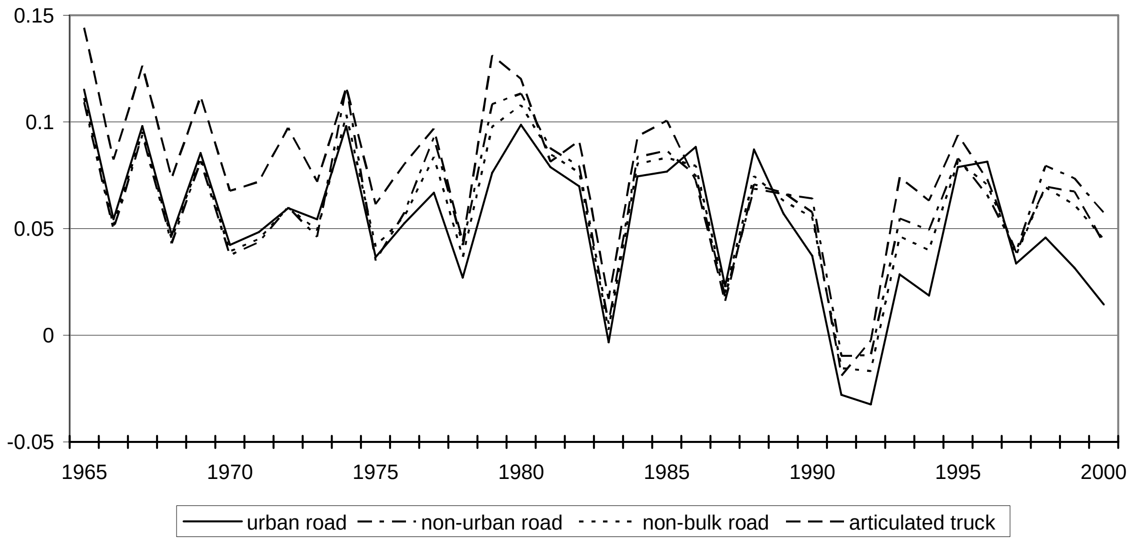
Road

Patterns in growth of various categories of road transport are shown in figure F.2 (chapter 2 and box F.2 contain freight type and vehicle category descriptions). The various types of road freight examined have largely similar growth rates, with articulated truck freight having the highest growth rate and urban freight having the lowest. Growth rates declined slightly for all freight types for periods in the 1980s and 1990s, coinciding with downturns in economic conditions.

1 The periods of faster rail growth with respect to road coincide with a downturn in the Australian economy. To the extent that these downturns affected domestic activity more than international trade, they would have had a greater impact on road than rail freight.

Figure F.2 **Growth rates in road transport, 1965 to 2001[a]**

Annual growth rates



a Road series growth rates are calculated as changes in the natural log of output in billion tkms.

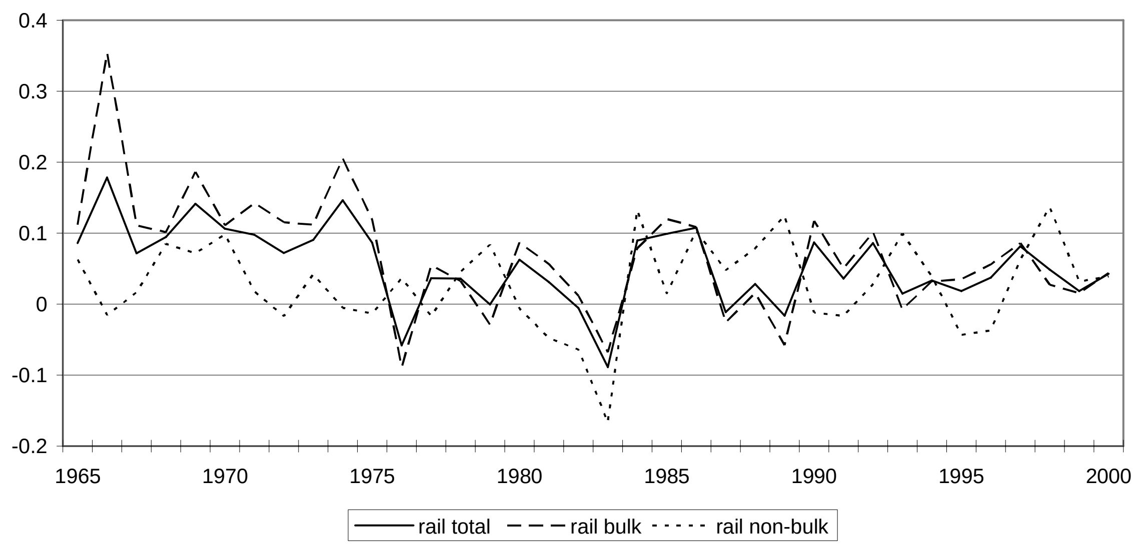
Data source: BTRE (2006b).

Rail

Growth rates for rail have slowed since the mid-1980s (figure F.3). This trend is most likely attributable to the widespread introduction of B-doubles and increased investment in road infrastructure. Rail freight tends to be dominated by bulk freight (BTRE 2006b; chapter 2). Figure F.3 shows that the growth rates of bulk freight are more stable than those of non-bulk. The greater volatility in the rail freight task, as observed in figure F.1, might be due to the more diverse nature of its non-bulk transport task. Total and bulk rail freight did not experience the same dip in growth rates in the 1990s as seen in all the other series. While general economic activity within Australia fell, exports continued to rise, sustaining rail freight in those years.

Figure F.3 **Growth rate in rail transport, 1965 to 2001[a]**

Annual growth rates



a Rail series growth rates are calculated as changes in the natural log of output in billion tkms.

Data source: BTRE (2006b).

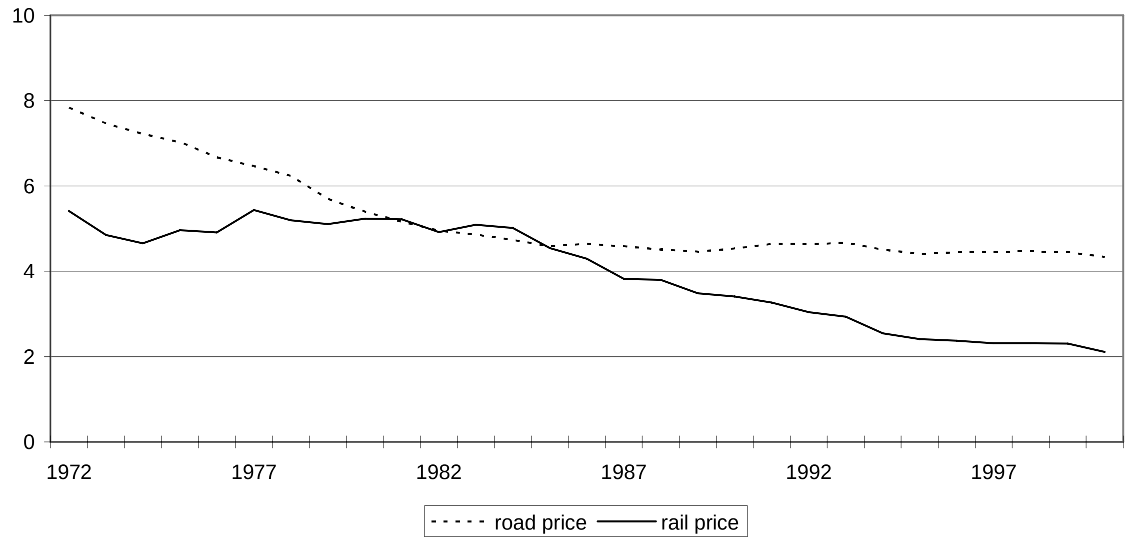
Prices

Figure F.4 shows the general price of road and rail freight between 1972 and 2000 in cents per tonne kilometre (tkm).[2] Both road and rail freight prices decreased, in real terms, over the period. This decrease in freight prices is evidence of productivity improvements linked with infrastructure upgrades and the increased use of larger and more efficient rolling stock and trucks (which have lowered operating and maintenance costs for operators), as well as reforms introduced since the late 1980s and 1990s, including increases in the legal gross vehicle mass (GVM) limits for trucks and increased commercialisation of the rail industry (BTRE 2006b; chapter 2).

Road prices were higher than rail prices for most of the observed period. However, road and rail freight prices converged between 1972 and 1983, with road prices decreasing and rail prices increasing overall. A divergence of prices between the modes has occurred post 1985, with rail prices falling faster than road.

2 The series graphed in F.4, and used for the estimation of price elasticities in this appendix, relate primarily to long-distance, non-bulk, inter-city freight. Therefore, these prices and the resulting elasticities might not accurately capture information about changes in the price of, and thus the price sensitivity of demand for, bulk and total freight.

Figure F.4 **Road and rail prices**
1989-90 cents per tonne kilometre



Data source: BTRE (2006b).

It is important to note that, while the road prices reported in figure F.4 are door to door, rail prices are terminal-to-terminal; that is, excluding pick-up and delivery costs. Therefore, the actual price differential facing freight users also depends on the cost of moving freight to the rail terminal from its initial position and from the rail terminal to its final destination. The competitiveness of rail pricing can be affected by the extent to which these pick-up and delivery costs are a substantial part of overall freight costs.

Pick-up and delivery costs do not vary with the distance travelled between rail terminals. Therefore, per tkm costs will be proportionately lower the further freight travels on rail. This makes it relatively easy for rail to compete, with the price of road's door-to-door service, on longer trips (PJP 2005).

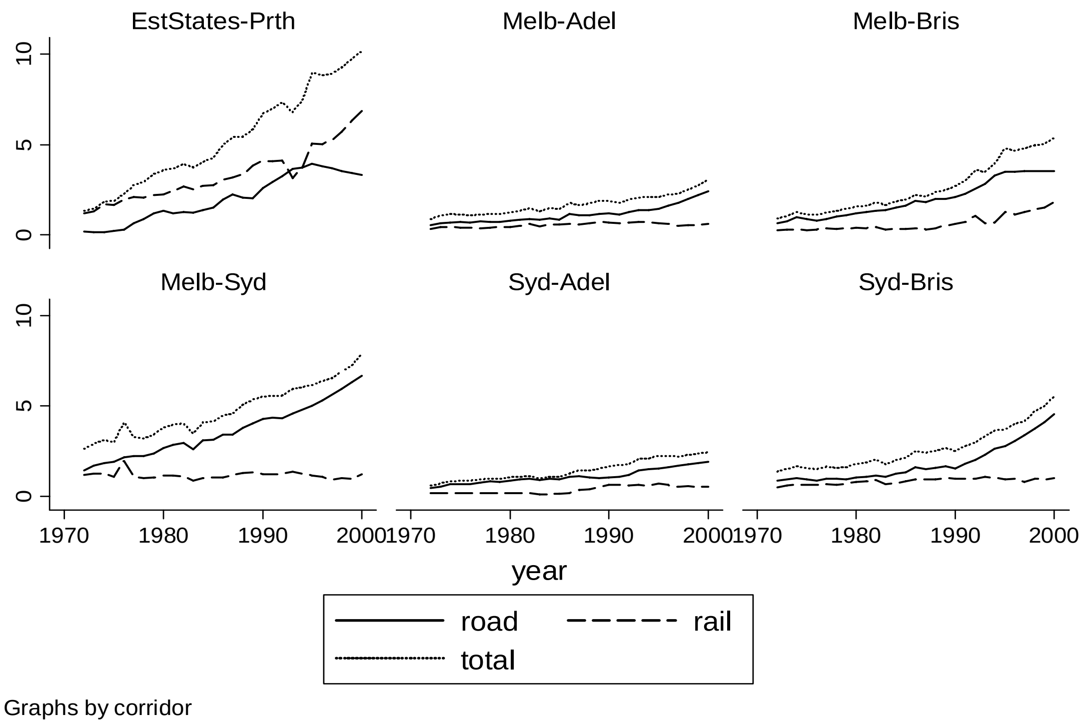
Corridors

Figure F.5 shows the quantity of road and rail freight on six major corridors between 1972 and 2000 in billion tkms. Total freight increased substantially over the period on all corridors, the most noticeable being on the Sydney–Melbourne and eastern states–Perth corridors.

The increased growth of road relative to rail freight observed in figure F.1 can also be seen on the individual corridors. The amount of freight moved by rail has remained steady on all corridors, other than the Melbourne–Brisbane and eastern states–Perth corridors. While the amount of freight moved by road has grown substantially on the majority of corridors. Rail freight dominates the eastern states–Perth corridor throughout the observed period. However, in total, more freight was moved by road than rail on all other corridors.

Figure F.5 **Mode share trends by corridor**

Billion tkms



Data source: BTRE (2006b).

The dominance of rail on the eastern states–Perth corridor and its upturn on the Melbourne–Brisbane corridor support the argument that rail has an advantage on long haul corridors due to economies of scale.[3] The fact that pick-up and delivery costs are a larger component of total costs on shorter trips could contribute to the dominance of road on the shorter corridors. The relative importance of non-price service characteristics, such as flexibility and reliability, on short and medium haul trips may also increase the popularity of road freight on these corridors. (NTC, sub. 17, Executive summary, p. 3).

3 While the distance should give rail a cost advantage on the Melbourne–Brisbane corridor, logistical problems with rail freight through New South Wales — due to restrictions on freight movement through Sydney during peak hours — is thought to contribute to road's continued dominance of this corridor (PJP 2005).

F.3 Literature

There have been numerous attempts to estimate elasticities of freight demand. The vast majority of these have been done for overseas markets and very few studies examine the situation in Australia. The studies generate a wide variation in the magnitude of freight price elasticity estimates. This variation is due to differences in estimation procedures, the type of data used, market coverage, demand definitions, as well as the level and definition of commodity groups (Graham and Glaister 2002).

Overseas studies

A World Bank commissioned study published by Oum et al. in 1990 remains the most widely cited international review of road and rail freight elasticities. This summary of freight studies from around the world finds the most likely range of rail freight own-price elasticities to be between -0.4 and -1.2, and the most likely range of road freight own-price elasticities to be between -0.7 and -1.1.

A more recent review of traffic demand elasticities conducted by Graham and Glaister (2002), finds similar results to Oum et al. (1990): the average freight traffic elasticity with respect to price was found to be -1.07 with the majority of values lying between -0.5 and -1.3.

A study by Bennanthan et al. (1992) estimated the income elasticity for road and rail freight for a cross section of developed and developing countries. Using GDP as a proxy for income, they developed a range for overall freight and individual freight mode for each country grouping. Income elasticities reported for developed countries were 0.86 for rail and 1.02 for road.

Australian Studies

There have been few comprehensive studies of the elasticity of freight demand produced for Australia. This is mainly due to the difficulty in obtaining the data needed to carry out meaningful analysis (BTE 1999a; BTRE 2006b; Kells 1997).

The most recent Australian studies to report freight transport elasticities are Kells (1997),[4] Bureau of Transport Economics (BTE) (1999a), Booz Allen and

4 Prepared for the National Road Transport Commission by the Melbourne Institute of Applied Economic and Social Research. This study includes a critique of a 1997 study done by Sinclair Knight Merz (SKM). Kells (1997) reports the SKM findings for road price elasticities of -0.5

Hamilton Consulting (BAH) (2001a),[5] MM Starrs Pty Ltd (MM Starrs 2005),[6] Meyrick and Associates (2006b)[7] and Ernst & Young et al. (2006).[8]

Kells (1997) uses time series data to investigate the impact of increased mass limits for heavy road vehicles on rail volumes on six major Australian transport corridors: Sydney–Melbourne, Brisbane–Sydney, Melbourne–Adelaide, Adelaide–Perth, Sydney–Adelaide and Brisbane–Cairns. The model (based on the BTE 1979 model) used to generate the elasticity estimates used quarterly data over the period December 1985 to March 1993. Rail freight data were not available in a reliable time series, so only road price elasticities were calculated.

Kells (1997) obtained a long-run own-price elasticity estimate for road transport of -0.77 for the Sydney–Melbourne corridor and applied this elasticity to all other corridors to estimate the impact of increased mass limits for heavy vehicles on road and rail demand. From this analysis, the study also reported implied cross-price elasticities for road (with respect to rail prices) of between 0.2 (Adelaide–Perth) and 2.6 (Sydney–Melbourne).

The paper stresses that more research and data are required to estimate demand elasticities for each of the main transport corridors in Australia. Indeed, Kells (1997, p. 15) states that:

> We set out to replicate the BTE (1979) analysis using newer data … This task was severely hampered by a dearth of time series data concerning freight transport volumes and prices.

BTE (1999a) also uses time series data, but estimates changes in mode share rather than individual road or rail demand. It estimates a freight transport logistic substitution model over the years 1971 to 1995 and uses a competitiveness index to investigate the changes in freight mode share from the implementation of alternative charging systems. MM Starrs (2005) calculated the resulting implied cross-price elasticity of demand for rail with respect to the price of road from the BTE (1999a) study to be 0.86.

The BAH (2001a) study is based on a survey it conducted to determine the effects of price and non-price service characteristics on changes in modal share as part of

---

and cross-price elasticities of between 1.5 and 3.4, but suggests that these findings are not robust.

5 Prepared for the Australian Rail Track Corporation.

6 Prepared for the National Transport Commission.

7 Prepared for the Victorian Essential Services Commission.

8 Prepared for the Department of Transport and Regional Services.

an evaluation of possible investment upgrades in the interstate rail system.[9] Elasticities were estimated for price (-1.1 for short and long haul) and three non-price service characteristic variables:

- transit time (-0.3 for long haul trips, -0.4 for short haul trips);
- reliability (0.6 for both long haul and short haul trips); and
- service availability (0.4 for long haul and 0.5 for short haul trips).

As with the BTE (1999a) study, these are choice, rather than demand, elasticities. The estimates reported in a modal share equation are not strictly comparable to those estimated using individual freight demand.[10]

MM Starrs (2005) based its freight elasticity estimates on an international literature review. For Australia, the study separated reported road price elasticity measures into short and long haul. Short haul values are between -0.5 and -0.7 and long haul values between -0.9 and -1.1. The cross-price elasticities are then derived using market shares. Thus, shorter corridors where rail currently has a low market share were calculated to have larger elasticity coefficients. Cross-price elasticities reported are between 0.61 and 0.75 (for long haul corridors) and 4.03 and 7.54 (for short haul corridors).

The elasticities used by Meyrick and Associates (2006b) are based on a weighted range of international and Australian studies, namely Oum et al. (1990), BTE (1999a) and BAH (2001a). The weights are based on percentage shares (of total Victorian freight volumes) for three main freight groupings: commodities (excluding grains), grains and elaborately transformed goods. They arrived at a weighted range for Victorian rail price elasticities of between -0.7 and -0.9.

The DOTARS commissioned report into the viability of the north–south rail corridor (Ernst & Young et al. 2006) included estimates of short-run price elasticities for rail of between -1.2 and -2.5, using monthly data from 2000 to 2005 collected by survey for the study. It also estimated elasticities for the non-price service characteristic of transit time, (-0.4 to -2.3), reliability (0.01 to 0.12), monthly capacity (0.7 to 0.8) and availability (0.16 to 0.24). The potential applicability of

9 As the data used are not publicly available, its reliability cannot be determined. It is therefore unclear whether the elasticities reported in BAH (2001a) are comparable to those generated in other published studies or to the work presented here.

10 Modal share or choice elasticities assume a fixed freight amount, only measuring substitution effects from price changes with no account of any income effects. Choice elasticities do not allow for the expansion or contraction of the freight industry as a whole in response to price changes.

these estimates, as well as the Meyrick estimates, to this inquiry is limited, as they are based on specific corridor studies.

Only Kells (1997), BTE (1999a) BAH (2001a) and Ernst & Young et al. (2006) report elasticities based on their own estimates. The other studies use estimates obtained from other Australian and international studies. Caution needs to be taken with the use of elasticities calculated from overseas data given the unique attributes and challenges of the Australian transport system (Kells 1997). Therefore, while international studies are useful in gaining an understanding of relevant issues and estimation techniques, it is important that policy decisions affecting the Australian freight transport industry are informed by analysis of Australian data.

That said, the task of using Australian data is severely hampered by the inability to obtain consistent, reliable, detailed data series. As freight tasks can vary significantly by commodity and corridor, detailed data are needed in order to provide meaningful insights for policy initiatives as well as price determinations. As Oum and Waters (2000, p. 209) state:

> … competition between modes, routes or firms give rise to a wide range of price elasticities … [thus] there is no short-cut to obtaining reliable demand-elasticity estimates for a specific transport market without a detailed study of that market.

F.4 Data

The data used in this study are based on time series data collected between 1964 and 2000 and included in a report recently released by the Bureau of Transport and Regional Economics (BTRE 2006b). The report was compiled over a ten-year period in order to construct, from a range of disparate data sources, consistent data sets describing the Australian freight sector.

This data differs from that used in previous studies as it is reported on a much more aggregate level. However, for the purposes of policy formation, this need not be a drawback. Indeed, it has been suggested that the use of aggregate data is preferable when the study's objective is to inform the policy debate (for example, Winston 1983). Further:

> … the use of aggregate data is more appropriate if the object of the study focuses on political decision-making and policy-supporting predictions … The goal of this kind of stud[y] is not to measure the reaction of one specific decision maker when certain changes occur, it is to analyse how complete flows will react to these alternat[ives]. In such cases, the resulting estimates are to be interpret[ed] as directional rather than to value the estimates on their magnitude. (De Maeyer and Pauwels 2003, p. 5)

Table F.1 **Summary of data sources**

Data Series	*Source*	*Description*
Australian domestic freight task	BTRE	Australian domestic freight task in billion tkms. The freight task is used in total and disaggregated by: • mode (rail and road); • load (bulk and non-bulk); • area (urban and non-urban); and • vehicle type (rigid and articulated). The data on rail freight were compiled, based on data from the Australasian Railway Association (ARA), the National Rail Corporation (NRC), Australian Bureau of Statistics (ABS) Freight Movements 2000-01 and individual rail annual reports. The road data were sourced from ABS Surveys of Motor Vehicle use. However, because there have been major methodological adjustments and changes to definitions, these data were ‘cleaned’ to make them comparable to the methods used in the most recent survey (2003) and consistent with other quantity series.
Interstate freight quantities	BTRE	Freight flows for interstate corridors in billion tkms from 1972 to 2000. (same sources as above)
Freight rates	BTRE	Interstate freight rates in 1989-90 cents per tkm for road and rail. This consistent annual time series of freight rates was compiled from various published and unpublished BTRE (previously BTE and BTCE) and ABS surveys. These road and rail price series relate to long-distance inter-city freight.
GDP	ABS	*Australian National Accounts,* ABS cat. no. 5206.0
Exports and imports	ABS	*Balance of Payments and International Investment Position,* ABS cat. no. 5363.0

Sources: ABS (2002a, 2002b); BTRE (2006b).

The BTRE (2006b) report provides the first comprehensive set of freight data for Australia and includes time series data for the major freight categories. Time series data have the benefit of being able to account for industry changes over time, as opposed to cross-sectional data that can only be used to analyse relationships between variables at one point in time.

The BTRE (2006b) report outlines the methodologies used as well as the results of modelling and forecasting undertaken. This includes the derivation of some series to fill in gaps in the available data and to estimate future freight trends (BTRE 2006b). Details of the specific data used in preparation of this appendix are included in table F.1. The freight and vehicle categories are described in box F.2.

Box F.2 **Freight type and vehicle categories**

Bulk and non-bulk

- Generally, bulk freight is freight that can be dropped or poured without damage and non-bulk freight is all other types of freight.
- Bulk freight comprises two thirds of the total freight task. Most of bulk freight is non-urban.
- Approximately 85 per cent of rail freight is bulk. Currently road performs approximately 75 per cent of the non-bulk freight task.

Total

- Total freight is the sum of bulk and non-bulk tkms. In 1999-2000, 37.3 per cent of total freight tkms were performed by road and 33.1 per cent were performed by rail.

Urban and non-urban

- Non-urban freight is the sum of 'interstate' and 'rest of state' freight. In terms of tkms, only 10 per cent of total freight is urban and 90 per cent is non-urban.
- In 1999-2000 approximately 32 per cent of road freight was urban. The urban freight task is carried out almost exclusively by road transport. Rail freight is therefore assumed to be 100 per cent non-urban.

Articulated

- Articulated trucks consist of a prime mover plus a semi trailer.
- Of urban road freight in 1999-2000, approximately 10 per cent was carried by light commercial vehicles (LCV), 38 per cent was carried by rigid vehicles and 53 per cent was carried by articulated vehicles.
- Of non-urban road freight in 1999-2000, approximately 1 per cent was carried by LCV, 8 per cent was carried by rigid and 91 per cent was carried by articulated vehicles.

Source: BTRE (2006b).

F.5 Statistical results

The price responsiveness of demand between road and rail and within the road transport industry is dependent on, among other things, complex interactions between the distance travelled and the type of freight carried. For example, while rail is generally thought to be most competitive in the transport of long distance bulk commodities, it can also be competitive carrying bulk over shorter distances (as is sometimes the case with coal) or non-bulk over long distances (such as transporting manufactured goods from Melbourne to Perth).

Road, on the other hand, dominates non-bulk freight, especially over shorter distances. Additionally, for certain non-bulk commodities (such as livestock) road carries freight long distances, as well as carrying certain bulk commodities (such as steel) both long and short distances. Thus, it is not clear cut, *a priori*, what the modal price sensitivities will be.

Data pre-testing

When dealing with time series data, 'pre-testing' is necessary to ensure the data meet the underlying requirements of the statistical approach being applied. Therefore, the data were tested for stationarity, structural breaks, cointegration and colinearity before our analysis was carried out.[11]

Possible structural breaks involving shifts in the mean, trend, and both the mean and the trend are tested for all potential break points between 1964 and 2000. Tests suggest that there are no significant structural breaks in the data series over the period considered, with the exception of rail bulk.[12] There was also no evidence of colinearity found in the data using the log form (the data form used here).

To test for stationarity, unit root tests were run for each series in both levels and differences to establish the order of integration. The results of the unit root tests suggest that all of the data are non-stationary in levels, but stationary in first difference.

To account for the non-stationary nature of the data, the vector error correction model (VECM) (Engle and Granger 1987) was used to estimate elasticities. This model relies on establishing a cointegrated series. Therefore, the Johansen cointegration test was performed on the data series to determine the number of cointegrating relationships between the variables. Each mode was tested with its own price series, the cross-price, GDP and a measure of trade. Upon examination of the data series, all appear to have a trend with the possible exception of rail non-bulk.[13]

By normalising the cointegrating equations on the log of the relevant road or rail freight series in the VECM, we are able to produce equations from which elasticity

[11] A supplement containing the details of this pre-testing is available upon request.

[12] That is, rail bulk shows evidence of a deterministic structural change in the mean and/or trend around which the series may be stationary. As this break occurs between 1965 and 1969, estimations which include the rail bulk series that begun with 1970.

[13] The diagnostics show that the non-bulk rail series exhibits signs of autocorrelation in its residual series and is not normally distributed, making interpretation of the significance of any estimation results problematic. Thus, it is not considered further. All other tests are shown to be in the acceptable range.

estimates can be obtained. The coefficients of the cointegrating equations are generally interpreted as long-run equilibrium relationships. Thus the elasticities generated can also be viewed as long-run. A supplement to this appendix, which details all the methods and results for the data pre-testing is available on request.

Elasticities estimates

The results of the VECM are shown in table F.2. Both freight types examined for rail (total and bulk) are shown to be inelastic with respect to own-prices. However only the elasticity estimate for total rail is significant, and then only at the 10 per cent level.[14] These results indicate that the demand for rail freight is likely to be driven by factors other than its own price. Bulk rail freight has come to be dominated by three commodities: coal, other minerals and grain. While rail is a significant proportion of costs for coal (as high as 20 per cent of intermediate inputs), its share of intermediate inputs for both ‘other minerals’ and grains is less than 1 per cent. Thus, bulk rail demand’s seeming insensitivity to its own price may be driven by the lack of a viable transport substitute in the case of coal, and the relatively small share of input costs for grains and minerals.

The influence of road prices on the two types of rail freight (cross-price elasticity) differs. Total rail appears to complement road freight (negative coefficient). This apparent (because it is not significant) complementarity, might be driven by the extent to which non-bulk influences total rail results. Given total rail freight is made up of bulk and non-bulk rail, the extent to which the results differ between total rail and bulk rail, can be attributed to non-bulk. Non-bulk rail consists of long distance, specialised freight tasks on which road could, conceivably, make up a higher proportion of costs at both ends of its task than bulk rail.

The cross-price elasticity for bulk rail freight with respect to the price of road is significant and of the expected sign, indicating the two modes are competitors. The coefficient implies that changes in the price of road freight have a small, but significant impact on the quantity of bulk rail freight demanded. This might reflect that an increasing portion of bulk freight is being contested by road, especially by articulated trucks. The bulk freight task is becoming more geographically dispersed in both origin and destination (BTRE 2006b). Rail does not currently have the infrastructure in place to compete effectively in these changing market conditions.

The road data results presented in table F.2 provide an indication of the diversity of ways to measure the road freight task (box F.2). Total and bulk represent types of

[14] These results are derived using non-bulk freight prices and thus might not represent the bulk and total freight tasks, contributing to the lack of statistical significance of the non-bulk estimates.

freight carried on roads; non-urban is a measure of an area where freight is carried; and articulated represents a form of road freight transport. These measures are presented to provide a variety of perspectives on the price sensitivity of the road freight task.[15]

Table F.2 **VECM coefficients[a,b]**

Standard errors are reported in parentheses

	Rail Mode		Road Mode			
	Total	*Bulk*	*Total*	*Bulk*	*Non-urban*	*Articulated*
Price rail	-0.254* (0.101)	-0.149 (0.096)	0.065 (0.039)	0.065 (0.039)	0.139* (0.053)	0.118** (0.050)
Price road	-0.106 (0.147)	0.286* (0.112)	-0.431** (0.064)	-0.431** (0.065)	-0.252* (0.089)	-0.502** (0.084)
GDP	1.09** (0.169)	0.231 (0.209)	0.742** (0.065)	0.746** (0.065)	0.559** (0.090)	1.105** (0.086)
Export[c,d]	**ne**	0.647** (0.123)	**ne**	**ne**	**ne**	**ne**
Imports[c,d]	**ne**	**ne**	0.617** (0.073)	0.615** (0.072)	0.943** (0.101)	0.634** (0.094)
Short-run parameter	-0.118 (0.165)	0.162 (0.159)	0.026 (0.078)	0.025 (0.078)	0.112 (0.097)	0.073 (0.098)

a All variables are in natural logs. The vector is normalised on mode (the coefficient of the relevant mode is equal to one). **b** Cointegrating coefficients (except for the mode variable) are reported as they would appear on the right-hand side of the cointegrating equation. **c** Export variable on the rail total is set to zero as the normalised variable for the second cointegrating equation, thus no coefficient is estimated. **d** Results for road using imports or exports are similar. Imports are reported as these equations performed slightly better. Imports were not a significant factor in the rail equations. **Denotes significance at the 5% level. *Denotes significance at the 10 per cent. **ne** – not estimated

Source: Commission estimates.

Road's own-price elasticities are all significant and inelastic (last four columns of table F.2).[16] Articulated truck freight, exhibiting the largest coefficient of -0.5, is the most price responsive of all the series shown in the table. As outlined in chapter 2, articulated trucks carry a mix of long and short haul freight including crude materials, food and manufactured goods. Given the greater diversity of its freight task, articulated trucks would be more price driven than, say, rail bulk freight which, for some commodities, is the only viable mode of freight transport.

Articulated trucks mainly run in non-urban areas. Thus, there is some overlap between what is reflected in the articulated truck and non-urban results. Despite this, non-urban road freight has the most inelastic demand of those examined,

15 Given the rail freight task is not as diverse, similar breakdowns are not available.

16 Again, these results rely on price data related to long-distance non-bulk inter-city freight and might not, therefore, apply to the urban freight task.

at -0.25. Freight carried on non-urban roads consists mainly of long haul interstate freight. The long haul interstate freight task is mostly non-bulk. These non-bulk freight tasks are dominated by consumer and manufactured goods, often imports, where freight is a small part of the overall costs. Also, given the diverse nature of the goods and logistics involved, rail is not always a practicable alternative.[17] The lack of viable competition tends to lead to inelastic demand (box F.1).

Currently, there is direct competition between road and rail in long distance non-bulk and some short distance bulk. Articulated trucks tend to carry bulk over short distances and non-bulk over long distances (chapter 2), thus competing directly with rail. The overlap between the non-urban and articulated truck freight tasks can be seen in the significance of the cross-price elasticity with rail of both measures. The fact that non-urban is only significant at the 10 per cent level reflects the fact that, as discussed above, articulated trucks are the only part of non-urban's freight task that is directly competitive with rail.

The significance of the coefficient on the cross-price for articulated truck freight is greater than the cross-price coefficient for bulk rail. This seems to indicate that demand for articulated truck freight is more strongly influenced by rail price than *vice versa*. This could be a reflection of the increased use of articulated trucks to carry bulk commodities that had once been carried by rail. Articulated trucks have a cost advantage over rigid trucks and, as stated in chapter 2, have used this cost advantage to expand market share. Therefore, markets in which rigid trucks may not have been competitive with rail are contestable by articulated trucks. The data could suggest that as articulated trucks price themselves to increase market share in competition with rail, rail has focused on other factors (specialisation of tasks and route for example) and is, in some markets, competing less with road on the basis of price.

Total and bulk road freight are derived from the same data series and thus the results for the two are very similar. Own-price elasticities are shown to be inelastic (-0.4) and significant, falling mid way between articulated truck and non-urban. Bulk road freight tends to be carried over shorter distances and thus does not compete with rail as directly as articulated truck road freight, but more so than non-urban.

Bulk road freight does not appear to be sensitive to changes in the price of rail. As stated above, this is because much of the road bulk task is carried over shorter distances, where rail does not have the sufficient infrastructure to be competitive

[17] In addition, it was not until 1995 that all interstate rail gauges were harmonised in Australia, to rail's competitive disadvantage.

(chapter 2). While most of bulk freight is carried in non-urban areas, it differs from the non-urban results because of the short-distance travelled.

Macro factors

In keeping with previous studies (Bennathan et al. 1992 and BTRE 2006c), measures of income elasticity are obtained using GDP as a proxy for income. For all tests other than rail bulk, this variable is significant and positive (table F.2). Both total rail freight and articulated truck road freight have income elasticities in excess of one, implying these modes respond more than proportionately to increases in national income. The quantity of bulk freight carried by rail appears to be influenced more by export levels than national income. Thus, the increase in the use of total rail when income increases, coupled with income's insignificance with respect to bulk rail, implies a relatively greater increase in non-bulk rail when income increases. Non-bulk rail freight covers a diverse range of commodities. Therefore, as economic activity expands, there is a relatively larger (albeit small overall) increase in the freight task of discretionary consumption items carried by non-bulk rail. The high income elasticity of articulated truck freight, which also carries a diverse commodity range, supports this.

The main influence on the demand for bulk rail freight is changes in exports. This is not surprising given the majority of freight carried in bulk on rail is destined for export markets (chapter 2).

While both imports and exports are a significant factor affecting road freight, only imports are reported in table F.2 as these models performed slightly better.[18] Judging by the size of the coefficient, imports appear to play a larger role in non-urban road freight than for other road freight tasks. Again, this may be a function of the nature of the interstate road task which tends to be dominated by manufactures, food stuffs and other import dependent items.

Non-price factors

Non-price service characteristics, such as those included in the BAH (2001a) analysis, play an important role in determining freight users mode choice (PJP 2005). However, in Australia, sufficient data do not exist to accurately estimate relevant demand elasticities both of, and with, these characteristics. The inclusion of incomplete data may miss important information or even bias the results. While we were unable to incorporate these variables into the estimates

[18] Performance was judged on overall goodness of fit using *F* and log likelihood statistics. Results for exports are available upon request.

reported here, we applied several other approaches in order to ascertain the degree to which non-price determinants influence relative freight demand.

The final statistic reported in table F.2 is a measure of the short run dynamics of the VECM system. It measures the influence of the change in the endogenous variable (for example rail total) from the previous period on that variable's change in the current period. It can be interpreted as the degree to which more (or less) of the use of that mode in the last period influences this period's use decisions. This has the potential to capture the effect of non-price determinants that are not reflected in the price or other economic activity variables on modal share choices.

While this short run adjustment parameter is almost always positive (the exception being total rail freight), it is never significant. It appears that, given these variables measure aggregate freight transport by mode over more than 30 years, changes such as overall economic activity and price swamp the effect of non-price determinants, to the extent captured by this variable.

Another approach to gauging the importance of non-price characteristics is to examine the changes in the price differential between road and rail over time. If road and rail are competitors (and cross-price elasticity estimates indicate that to be the case, for some freight types at least), any change in productivity or other cost-related factors should be reflected in the equilibrium price exhibited in each market.

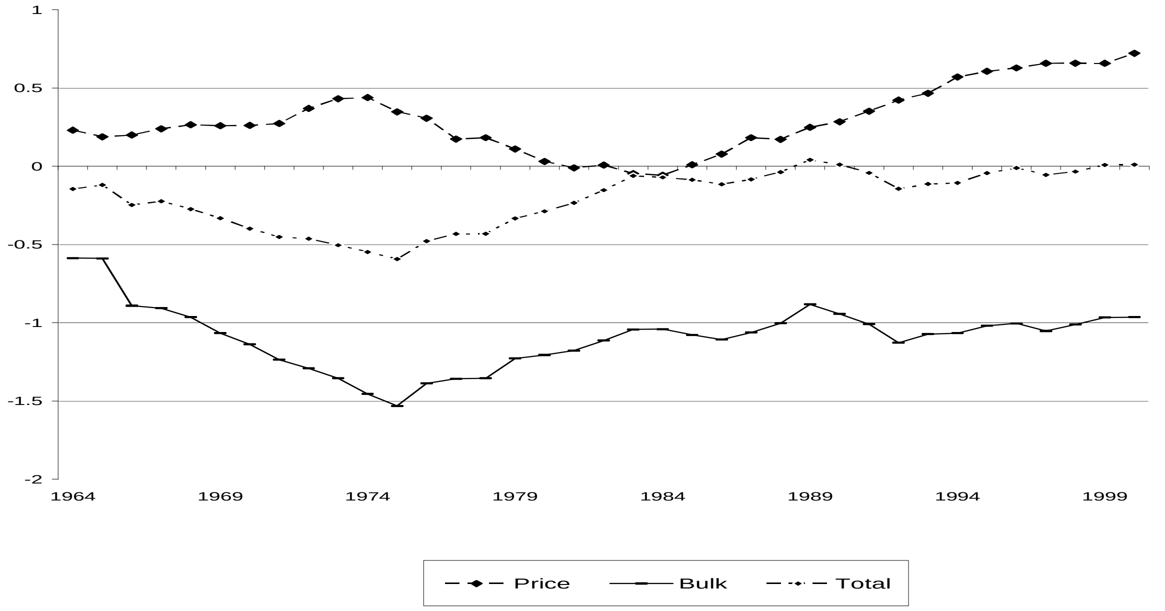
Changes in the price *differential* between the two modes could therefore reflect other, non-price characteristics. This could include a change in the underlying nature of transport demand, such as an increase in demand for a type of cargo that favours one mode over another. It could also represent quality differentials including such service attributes as reliability and flexibility.

Figure F.6 shows the change in the differential between the price of road and rail, the total freight task carried by road and rail, and the bulk freight task carried by road and rail between 1964 and 2000. Up until 1975, the price of road rose relative to rail and the use of road fell relative to rail. After 1975, as relative road prices started to fall, relative road use increased. This is consistent with freight transport decisions being made purely on the basis of relative price.

However after 1982, the pattern begins to change. While the relative price of road continues to rise steadily, the relative quantity of bulk road freight increases slightly and the relative quantity of total road freight barely changes. This would seem to indicate that road has been able to maintain or even increase its market share while raising its relative price. Thus non-price factors, such as reliability and flexibility, appear to be playing a role.

Attempts to statistically verify these observations are frustrated by the relatively small sample size. For the final report, the Commission proposes to undertake further analysis using techniques that can be applied to such a sample.

Figure F.6 **Differentials in freight values with respect to road**[a]



a The price series is the difference between road prices and rail prices both expressed in cents per tkm, converted into natural logs. While road prices are expressed on a door-to-door basis and rail on a terminal-to-terminal basis, this difference remains through the series so will not influence the pattern of the differential between the two. Both measures of freight output (bulk and total) are in tkm converted to natural logs.

Data source: derived from BTRE (2006b).

Corridors

So far, the results discussed in this study are based on aggregate data. Such results will be useful in determining overall effects of policy changes and outcomes of infrastructure investment decisions for Australia as a whole. However, efficient policy design would benefit from an understanding of how these effects are likely to differ throughout areas of Australia.

Although most studies use aggregate data, in order to facilitate analysis of the affect of reform on rural and regional areas, it is important that we investigate how the elasticities and effects of reform on individual corridors and for specific freight tasks vary from aggregate data (Oum and Waters 2000).

As discussed earlier, road and rail freight demand are likely to behave differently for different corridor lengths and in different regions. It is also likely that price and income elasticities will differ across Australia, as will the level of competition between road and rail. While in some situations, no contestability exists between road and rail, in others the two modes are close substitutes, and in some cases road and rail freight are complements.

Unfortunately, 'information on freight rates in Australia is scarce and of variable reliability' (BTRE 2006b, p. 283) and, although road and rail freight data are available by corridor between 1972 and 2000 (figure F.5), the associated prices are not. Therefore, due to a lack of sufficient price data, it was not possible to estimate elasticities for the individual corridors.[19]

The inability to produce robust elasticity estimates for individual corridors is disappointing and highlights the need for more detailed corridor-specific data.[20]

However, even the limited corridor data available provide some additional information. It is clear, from looking at these data, that the freight market and modal shares vary significantly between corridors. When interpreting the aggregate results, it is therefore important to acknowledge that these results may not accurately represent the freight market for individual corridors and regions.

Therefore, in different areas, freight mode share may react differently to industry reforms, changes in investment and any resulting changes in relative prices. This possibility must be taken into account when designing and implementing efficient freight infrastructure pricing and investment policies.

Summary

Table F.3 summarises the results presented in the literature and used in other Australian studies along with the results presented above.

The own-price elasticities estimated in this study, although lower, generally fall within the range of those reported in the literature. The income elasticities obtained are also consistent with those reported in other studies.

19 Despite the availability of data on freight movements by corridor and associated prices being limited to 14 years, two attempts were made in this study to estimate elasticities for the six corridors pictured in figure F.5. The first attempt used general prices as a proxy for corridor prices and the second attempt estimated corridor prices between 1986 and 2000 from the 1972-1986 data. However, none of these results were robust to statistical tests. This result is not surprising as the relationship between freight demand on individual corridors and general prices is expected to be weaker than the relationship between general prices and total freight demand.

20 Other studies have also found their results limited by a lack of current Australian freight price data (Kells 1997; BTE 1999a).

Table F.3 **Elasticity estimates**

	Own-price	*Cross-price*	*Income*
Rail			
Literature			
Oum et al. (1990)	-0.4 to -1.2		
BAH (2001a)	-1.1		
Meyrick and Associates (2006b) (Victoria only)	-0.7 to -0.9		
BTE (1999a)		0.86	1.23
Bennanthan et al. (1992)			0.86
Ernst & Young et al. (2006) (north–south corridor only)	-1.2 to -2.5		
Commission	*-0.25*	*0.3*	*1.1*
Road			
Literature			
Oum et al. (1990)	-0.7 to -1.10		
MM Starrs (2005)			
Short/Medium haul	-0.5 to -0.7	3.6 to 7.5	
Long haul	-0.9 to -1.1	0.6 to 0.75	
Kells (1997)	-0.77	0.2 to 2.6	1.24
Bennanthan et al. (1992)			1.02
Commission	*-0.2 to -0.5*	*0.09 to 0.14*	*0.6 to 1.05*

The values for the cross-price elasticities reported in previous Australian studies are based on market shares rather than estimated from freight data, as they are here. Because they do not allow for any change in total freight demand, cross-price elasticities derived from mode share elasticities can overestimate the cross-price elasticity or 'switching demand'. Thus, it is not surprising that the estimates of cross-price elasticities for both rail and road obtained in this appendix are lower than those reported in previous studies.

As previously discussed, the highly aggregated nature of the data series used in this study must be kept in mind when examining its results. Freight tasks tend to differ markedly between commodities and corridors. Thus, while cross-price elasticities between road and rail for Australia overall appear to be small, this is not expected to be representative of all freight markets. For example, where rail has a small market share and is a viable alternative to road (such as on longer distance corridors) the cross-price elasticity of demand may be quite high — such that a small drop in price would result in a large percentage increase in rail's market share. For other markets, such as those industries which use 'just-in-time' inventory management or with a dispersed freight task, rail is not likely to be practicable and any cross-price elasticity would, therefore, be very low.

Although, there are likely to be small areas of market contestability between road and rail, overall, the small values estimated in this report are consistent with the contention that only a small part of the road freight transport task actually competes with rail (Australian Trucking Association, sub. 9, p 12; Australian Rail Track Corporation, sub. 11, p. 29).

F.6 Summing up

The results obtained in this appendix are consistent with both economic theory and with what we know of competition in the freight industry. The low own-price elasticities calculated conform with the expectation that derived demand functions, such as those for production inputs, are inelastic relative to the demand for final goods and services. The low estimates of cross-price elasticities support the contention that only a small percentage of the aggregate freight task is contestable between road and rail. Additional encouragement is given by the fact that the results reported here are, for the most part, within the range of results reported in the relevant literature.

There are, however, three factors which limit the applicability of the results presented in this appendix. First, the data are aggregated across corridors and commodities. To the extent the elasticity estimates are based entirely on national data, the results may not be applicable for all parts of the freight task. Although the data needed to calculate reliable corridor freight price elasticities are not available, the work that has been done — in this appendix and in other studies (MM Starrs 2005; BAH 2001a; Kells 1997) — indicates that the own- and cross-price elasticities of road and rail freight are likely to differ between corridors and commodity groups. This is therefore an important area for further research.

Second, the data are based on historical trends over approximately the past 35 years. While the results are fairly robust in explaining the sensitivities of road and rail freight for the period 1964 to 2000, the extent to which the trends can be expected to, even broadly speaking, be repeated in the future will determine the degree to which forecasts can be made using these results.

The future of freight demand is expected to be in domestically produced commodities (minerals and agriculture products) and imports (consumer goods and raw materials) (BTRE 2006b). Thus, the export dominated freight task of the past might not be maintained and forecasts based on these demand patterns could be misleading. To the extent the values derived here were driven by old trends (previous technology, limited gauge for rail, etc.) they may not be appropriate for forecasting changes in price responses in future. However, they do cover a long range of trends in the market place and thus probably provide a good indication of long run price responsiveness in the aggregate.

Finally, the data, especially the price series, may be overly influenced by non-market factors. It is difficult to ascertain the extent to which prices (especially the rail freight price series) are influenced by regulatory regimes rather than market forces. If the prices identified by the BTRE (2006b) study and used in this report are a function of government policies (as opposed to market forces) and these policies are subject to change, then the underlying relationships between prices and freight indicated by the results presented here are likely to change as well.

G Modelling impacts of reform

Key Points

- Modelling indicates that changing current road user charges so that each truck class recovers its allocated costs, would have a minimal effect on overall demand for freight transport and only modest modal shifts to rail.
- Increasing cost allocation of truck charges by as much as 40 per cent, is found to have a limited impact on modal shares, in the aggregate.
- Increasing productivity for both modes in the model leads to a projected increase in the output of both road and rail freight industries and a small increase in rail's share.
- Increasing rail productivity in conjunction with an increase in road user charges does not lead to substantially greater gains for rail than when rail increases its productivity performance without road user charges increasing.
- The most effective way of improving rail's performance — and market share — is shown to be through improvements in its operating efficiency, rather than by increasing heavy vehicle user charges.
- Varying assumptions about the level of mode contestability between freight carried by articulated trucks and rail does not materially affect the outcomes of the model.
- Reform-related increases in productivity of 5 per cent for both road and rail would yield an estimated increase in GDP of $2.9 billion (in 2004 dollars).
- If road were able to achieve a 10 per cent productivity increase due to more fundamental reforms, estimated GDP gains are projected to be closer to $5.2 billion (in 2004 dollars).
- Export industries enjoy a relatively large gain from freight productivity increases.
- As would be expected, the model shows that regional areas dependent on road freight would experience larger declines in economic activity due to any increases in road user charges, but achieve relatively larger gains in output from increases in productivity.

This discussion draft explores the various options available to establish efficient pricing for road and rail infrastructure and implications for competitive neutrality. This appendix explores the implications of several of these options by modelling the impacts of potential reforms within a computable general equilibrium framework. The reform options examined fall into two broad categories: an exploration of the impacts of different charging regimes for heavy vehicles; and the impact of potential regulatory and institutional reforms in both the road and rail sectors.

G.1 Model framework

In order to quantify the economy-wide effects of different charging scenarios and potential reforms in road and rail institutional and regulatory arrangements, the Commission has used the Monash Multi-Regional Forecasting (MMRF) model, a version of the MONASH model (box G.1). This model provides a detailed commodity, industry and geographic breakdown of the Australian economy. The data are based on the preliminary 2001 input-output data published by the ABS (2006).[1]

Detailing the substitution mechanism

The version of MMRF-NRA (National Reform Agenda) applied here has been modified to allow for substitution between road freight carried by articulated trucks (hereafter referred to as 'articulated road freight' or 'articulated road') and rail freight, as well as between types of road freight (that is, between articulated and non-articulated trucks).

This modification includes the stipulation of relevant elasticity of substitution parameters for road and rail, as well as within the road freight sector. Based on the work presented in appendix F, the cross price elasticities for road and rail are estimated to be as follows.[2]

- The percentage change in the demand for the transport of freight by rail in response to a one per cent change in the price of road freight transport = 0.5.
- The percentage change in the demand for the transport of freight by road in response to a one per cent change in the price of rail freight transport = 0.2.

These elasticity measures were determined in aggregate, across the entire freight task. One of the benefits of MMRF-NRA is that it allows for a more detailed, albeit still rather broad, examination of the freight task at the commodity level. The Commission is unaware of any studies that estimate the cross price elasticity of transport modes by commodity for Australia. There are several overseas studies

1 Final data tables were not available in time for the production of this discussion draft, but are expected to be available for the final report.

2 Cross price elasticity are based on changes in the price of freight, not changes in road user charges.

Box G.1 **Overview of MMRF**

The MMRF model is a multi-regional applied general equilibrium model developed by the Centre of Policy Studies (CoPS) at Monash University.[3] It distinguishes eight Australian regions — six States and two Territories — and 56 industry/commodity types. The model recognises:

- domestic producers classified by industry and domestic region;
- investors similarly classified;
- eight region-specific household sectors;
- an aggregate foreign purchaser of Australian exports;
- right State and Territory governments; and
- the Australian government.

The model contains explicit representations of intra-regional, inter-regional and international trade flows based on regional input-output data developed at CoPS, and includes detailed data on State, Territory and Australian governments' budgets. Second round effects are determined on the basis of the model's input-output linkages, assumptions about the economic behaviour of firms and households and resource constraints. Important elements of the theoretical structure of MMRF include:

- producers respond to changes in the competitiveness of Australian industry;
- demand for Australian exports respond to the export price of Australian products;
- producers alter their use of labour, produced capital and agricultural land in response to changes in the relative cost of these factors;
- households vary consumption of particular commodities in response to changes in household income and relative prices of goods consumed; and
- productivity improvements reduce resource costs.

The model was modified for the current analysis to break road and rail transport into passenger and freight, based on ABS (2005b). Road freight transport has been further divided by truck class: 'articulated' (articulated trucks) and 'non-articulated' (rigid and light commercial vehicles). Market shares for the two road vehicle categories are based on ABS statistics (ABS 2005b) indicating tonnage carried by the general truck classes by state. Costs were determined using a combination of ABS statistics (ABS 2005b) on kilometres travelled in each state, and estimates of the running costs for various truck classes supplied by ARRB Transport Research. This allows for substitution between road articulated and rail freight as well as between road articulated and road non-articulated.

Source: PC (2005c).

3 Details of the model's theory and structure can be found in Dixon and Rimmer (2002) and Peter, Horridge, Meagher, Naqvi and Parmenter (1996). Applications of MMRF can be found in PC (1999b) and PC (2005c).

which do so, but all are dated. Two of these studies, both of which are over 20 years old, are presented in table G.1.

Table G.1 **Overseas studies of cross price elasticities**

By commodity

	Oum (1979)[a]		*Friedlaender & Spady (1980)*[b]	
	Rail to Road	Road to Rail	Rail to Road	Road to Rail
Fruit/vegetables/food	-1.006	0.452	-0.023	0.004
Lumber	-0.532	-0.512	-0.050	-0.129
Chemicals	-0.628	-0.942	na	na
Fuel oil except gasoline	-0.386	-1.043	na	na
Refined petroleum products	-0.956	-0.449	na	na
Metallic products	-1.176	-0.332	-0.059	-0.099
Non-metallic products	-1.047	-0.492	na	na
Paper, plastic, etc	na	na	0.007	0.003
Stone, clay	na	na	0.025	0.016
Iron/steel	na	na	-0.053	-0.013
Non-electrical machinery	na	na	-0.032	-0.010
Electrical machinery	na	na	-0.151	-0.061

a Oum's study is based on Canadian data with a base year of 1970 using compensated demand curves. **b** Friedlaender & Spady use a translog function on US data for 1972. na – not available.

Source: Oum (1979) and Friedlaender & Spady (1980).

As seen in the table, the differences in the reported elasticity values between the two studies are quite large. This may be attributed to the differences in the freight tasks and logistics networks between the two countries at the time. But it also highlights that different commodity tasks have different degrees of substitutability between rail and road freight transport modes. Overall, however, the majority of values cited indicate a low, or inelastic, cross price elasticity for road and rail.

Box G.2 **Process of model validation**

The model framework applied in this inquiry is the same as that being applied to, and refereed through, the NRA study currently being undertaken by the Productivity Commission (Commission). The model, MMRF-NRA, has been updated by the Centre of Policy Studies (CoPS) to facilitate the modelling requests of COAG. The process of model validation included a series of workshops attended by modelling experts and State and Territory government representatives. During the workshops, participants were consulted in order to obtain feedback on the Commission's approach and underlying model assumptions, providing jurisdictions with the opportunity to raise any concerns or queries about the model.

In order to determine the substitution elasticities within the road freight transport sector for Australia, reference was made to Oum's frequently cited review of the literature (Oum et. al. 1990). While this source provides indications of truck *own* price elasticities by commodity, no cross price elasticities between road and rail, or even between truck classes, are reported (table G.2). Again, the majority of values are shown to be inelastic, or price insensitive.

Table G.2 **Truck price elasticities by commodity**

Commodity	*Elasticities*
Chemicals	0.98, 1.87–2.31
Corn, wheat, etc	0.73, 0.99
Foods	0.32–0.65, 1.25–1.54
Fuel oil (except gasoline)	1.07
Lumber	0.14, 0.56, 1.55
Machinery	0.04–0.78, 1.09–1.23
Primary metals and metallic products	0.41, 0.18–0.28, 1.08–1.36
Non-metallic products	0.56
Paper, plastic and rubber	1.05, 2.01–2.97
Refined petroleum products	0.52, 0.66
Stone, clay, glass	1.03, 2.04–2.17
Textiles	0.43–0.77
Transport equipment	0.29

Source: Oum et al (1990) p. 27.

Given the lack of supporting data or empirical evidence, the choice of cross price elasticity is a difficult one (see, for example, BTRE 2006c and NTC 2005c). Indeed, the ACCC state:

> It is difficult to predict the quantitative modal shifts in response to any changes in inter-modal price relativities. It would depend, among other things, on the nature of the contestable traffic and the relative operational efficiencies of the two transport modes. (sub. 44, p. 9)

These operational efficiencies will vary by freight task — for example, type of commodity and distance — and across companies performing these tasks. Distance carried also plays a role in determining the degree of price sensitivity between the modes (NTC, sub. 17 and ACCC, sub. 44). Tables G.1 and G.2 provide evidence, albeit from overseas, of the degree to which price sensitivities can vary by type of freight.

The task of determining Australian elasticities is severely hampered by the inability to obtain consistent, reliable, and detailed data series for freight quantities and prices. The National Transport Commission (NTC) states that 'data constraints are pervasive, affecting almost all areas of the transport system' (NTC, sub. 17, p. 94). The NTC also states that:

> Although work has been undertaken on demand elasticities for roads and cross elasticities between road and rail it has been limited due to the lack of data to calculate elasticities. (sub. 17, p. 72)

Based on the evidence available, the Commission considers that the substitution elasticities presented in table G.3 represent reasonable price sensitivities between articulated road and rail freight, as well as between types of road freight, within the commodity and geographic structure of MMRF.[4]

However, given that all of the modelling scenarios discussed within this appendix are at least partially dependent on assumptions made about the contestability of the freight task, sensitivity tests are conducted. By applying substitution elasticities that are highly elastic, based on estimates derived for some of the freight corridors on which road/rail contestability is likely to be highest, the degree to which results are dependent on assumptions of price sensitivity can be determined.[5]

Table G.3 **Elasticities applied to the MMRF model**

Selected MMRF commodities

	Articulated Road/Rail	*Articulated Road/Non-articulated Road*		*Articulated Road/Rail*	*Articulated Road/Non-articulated Road*
Livestock	0.00	0.50	Wood Prods	0.75	0.50
Crops	0.70	0.75	Paper Prods	0.75	0.50
Forestry	0.60	0.50	Printing	0.90	0.90
Fishing	0.60	0.75	Petrol Prods	0.30	0.50
Coal	0.30	0.50	Chemicals	0.30	0.90
Oil	0.30	0.30	Rubber Plastic	0.50	0.90
Gas	0.30	0.30	Other NmMinProds	0.50	0.90
Iron/Ores	0.30	0.30	Cement Lime	0.20	0.50
Other MetalOres	0.30	0.30	Iron Steel	0.75	0.50
Other Mining	0.30	0.30	Basic NferMtl	0.75	0.50
Food	0.80	0.50	Metal Prods	0.75	0.50
Drinks	0.80	0.50	Transport Equip	0.50	0.30
Other Manuf.	0.90	1.00	Other Equip	0.50	0.50
Textile Cloth Foot	0.90	0.50			

4 MMRF uses a constant elasticity of substitution (CES) function which differs from a cross price elasticity. The two measures are related through cost shares as follows: $\varepsilon_{kj} = \sigma * \text{cost share}$, where ε is the cross price elasticity between *k* and *j* and σ is the CES measure between the two.

5 Specifically, using Starrs' estimates for short and medium haul freight. The method of deriving these estimates causes the author to acknowledge that they may be high, stating '… the increase in rail demand [using these values] is most likely over-estimated' (MM Starrs 2005, p. 13).

While the results of the elasticity estimation presented in appendix F, as well as the international literature, give greater credibility to the inelastic estimates, the sensitivity analysis arguably provides an 'outer' benchmark for the degree of contestability between the two modes. The results discussed below therefore are based on the inelastic estimates outlined in table G.3, while the more elastic results are discussed as a point of comparison.

G.2 Alternative approaches to heavy vehicle freight charges

The current heavy vehicle charging system has come under criticism for several reasons, notably regarding methods of cost allocation and the determination of the appropriate cost base (chapter 4). The first of the three pricing scenarios presented here addresses the issue of network cross-subsidisation between truck classes. Under the current heavy vehicle pricing system, charge revenues for some classes of truck, particularly rigid trucks, over-recover their allocated costs, while revenues from others, such as B-doubles, do not cover their allocated network costs. Further, in aggregate, heavy vehicles fail to recover their allocated network costs (section 4.2).[6]

The first scenario adjusts charges so that articulated (including B-doubles) and non-articulated trucks each exactly cover allocated costs. This is referred to as the fully allocated cost, or FAC, scenario. The net impact of these changes is to increase charges on articulated trucks and decrease them on non-articulated (table G.4).[7] This will ensure that heavy vehicles recover their allocated cost and that all network cross-subsidies across truck classes are removed.

Table G.4 **Changes to heavy vehicle charges to ensure all classes recover allocated costs**

	Current allocated cost	*Current charges collected*	*Change charges collected*	*Change charges collected*
	$m	$m	$m	%
Rigid trucks ('non-articulated')	470	534	-64	-11.9
Articulated trucks	1050	932	118	12.7

Data source: Commission estimates.

6 This does not include buses. When buses are included, heavy vehicles in aggregate do recover their allocated costs.

7 The change in price is applied to replicate an increase in registration charges on trucks.

Government revenues would increase slightly as articulated vehicles in aggregate now meet their allocated costs (table G.5).

Table G.5 **Changes to government revenues**

All heavy vehicle classes recover their allocated costs

	Current costs from heavy vehicles	*Current revenues*	*Change revenues*	*Change revenues*
	$m	$m	$m	%
Government	1520	1466	54	3.7

Data source: Commission estimates.

Another criticism of the current truck charging system is that costs are not properly allocated either to road vehicles as a group or between classes of heavy trucks (section 4.3). The next set of pricing scenarios investigates the impact of different costing models that apply alternative cost allocation rules. Tables B.1 and B.2 in appendix B outline some alternative models that have been put forward for allocating road maintenance and capital expenditure, respectively.

The two alternative cost allocation models applied here are the Australian Road Research Board (ARRB) (NTC 2005c) and the Bureau of Transport Economics (1999a) approaches. These models are chosen because they illustrate respectively, the most extreme increase and decrease in the costs allocated to heavy vehicles of the studies summarised in appendix B. As such, the cost allocations set out in table G.6 can be thought of as upper and lower bound estimates of possible alternative allocations to heavy vehicles within the current PAYGO, fully-allocated approach of determining heavy vehicle road user charges.

The first approach, based on an ARRB model (NTC 2005c), has a net impact of reducing charges to both articulated and non-articulated trucks, with the reduction for articulated trucks being greater than that for non-articulated (table G.6). The second is based on the BTE model (BTE 1999a) which increases charges to both classes of trucks. This time, articulated trucks experience a greater increase in charges than do non-articulated trucks (table G.6). The outputs associated with each of these scenarios will be referred to by their underlying model name.

Table G.6 **Changes to heavy vehicle charges under alternative attribution models**

	Allocated cost[a]	*Change charges*[b]	*Change charges*
	$m	$m	%
NRTC (1998) (base case)			
Rigid ('non-articulated') trucks	470	-	-
Articulated trucks	1050	-	-
1. ARRB in NTC (2005c)			
Rigid ('non-articulated') trucks	447	-23	-5.0
Articulated trucks	981	-69	-6.6
2. BTE (1999a)			
Rigid ('non-articulated') trucks	609	139	29.5
Articulated trucks	1485	436	41.5

[a] Common costs estimates from all studies are allocated according to vehicle kilometre travelled. [b] Change is relative to the base case (2nd Determination) cost allocation parameters.

Data source: Commission estimates.

Any change in costs allocated to heavy vehicles leads to a change in government revenues as passenger vehicle road user charges are independent of their allocated costs. The expected effects on government revenue of each approach are shown in table G.7.

Table G.7 **Changes to government revenues as a result of alternative cost attributions**

Study	*Revenue*[a]	*Change revenue*	*Change revenue*
		$m	%
NRTC (1998) (base case)	1520		
ARRB in NTC (2005c)	1428	-92	-6.1
BTE (1999a)	2094	574	37.8

[a] Revenue estimates are based on the assumption that road user charges are set to exactly recover allocated costs under each of the allocation scenarios.

Data source: Commission estimates.

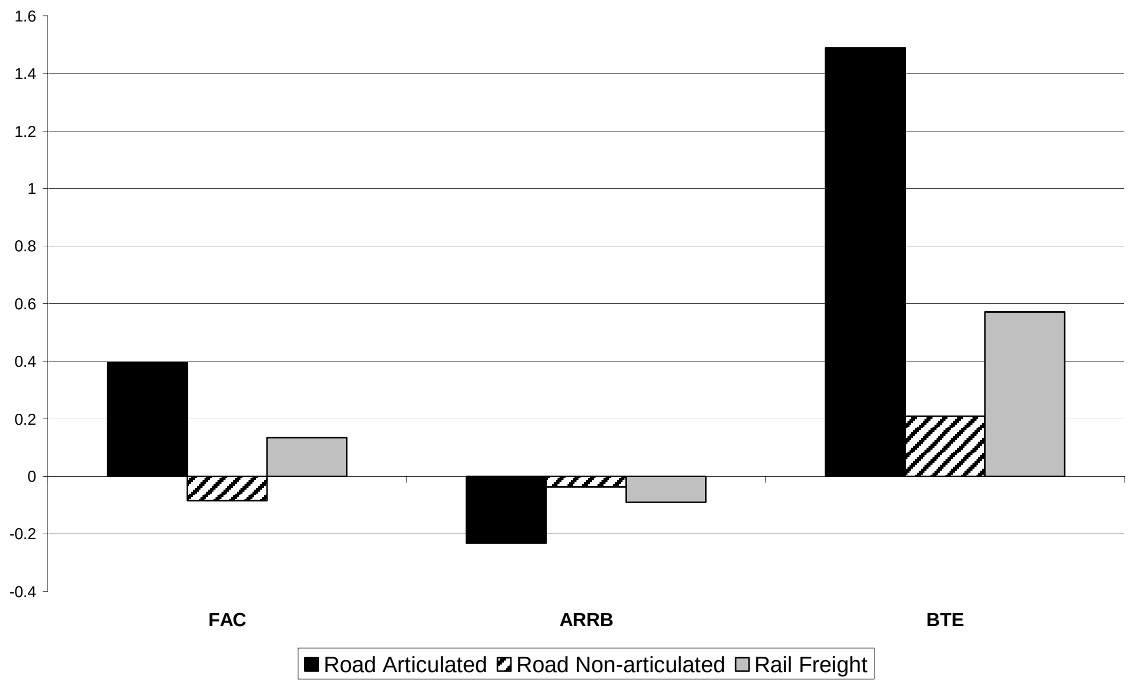
Results of changes in truck charges[8]

The effects, as modelled in MMRF-NRA, on freight prices and activity levels of each of the pricing scenarios are shown in figures G.1 and G.2. An increase (in the case of the BTE model) or reduction (in the case of the ARRB model) of charges

8 In this appendix, quantity changes in freight output will be expressed in tonnes while those for other economic variables, such as gross domestic product or exports, will be expressed in terms of changes in real values.

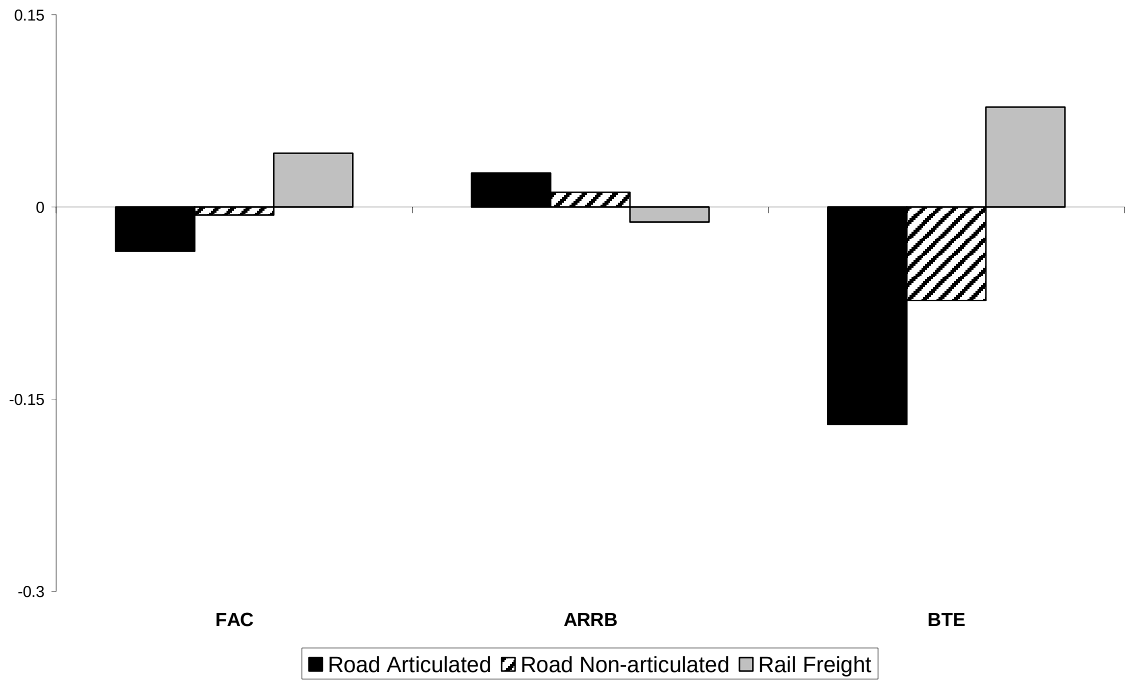
for articulated and non-articulated trucks increases or reduces the price of the respective transport services. Even the price of rail freight — which is not directly affected by any modification of road charges — will change, due to changes in total freight demand (so-called second-round effects). Figure G.1 shows that the percentage price changes are small in all three scenarios with a maximum change of about 1.5 per cent for articulated trucks in the BTE scenario. All other changes are below 0.6 per cent. This reflects the fact that road user charges are only a small percentage of total costs to the freight industry.

Figure G.1 **Change in price of road and rail freight, three pricing scenarios**
% change



Data source: Commission estimates.

Figure G.2 **Changes in freight output, three pricing scenarios**
% change, tonnes



Data source: Commission estimates.

These price changes induce output changes mainly by two mechanisms:

- First, all else equal (including the quantities transported), the change in relative prices induces substitution between modes of transport. The size of this effect depends on the price changes as well as on the elasticities of substitution.
- Second, the change in transport costs will feed through to the prices of the commodities transported and induce changes in demand for these commodities. This effect will have a greater impact the higher the share of transport costs in the price of a commodity, and the more price sensitive is the demand for the commodity.

The estimated changes in demand for transport services due to a change in road user charges are very small (figure G.2). In the FAC scenario, all changes are less than 0.05 per cent at the national level, with a slight increase in outputs of rail services and a small reduction for articulated trucks. In the ARRB scenario, the changes are even smaller, this time with a negligible increase for trucks and an even smaller reduction in output of rail services. Not surprisingly, the changes in demand for transport services are largest for the BTE scenario, which has the largest increases in charges for both articulated (+41 per cent) and non-articulated (+29 per cent) trucks (table G.6).

There is little subsequent change in industry activity as a result of any of the pricing scenarios. Again, this is due to the fact that truck charges account for only between 3 and 4 per cent of the operating costs of road freight providers (NTC 2005c). In addition, freight costs are, for most industries, a small percentage of overall input costs (thus limiting the second-round impacts on freight usage).

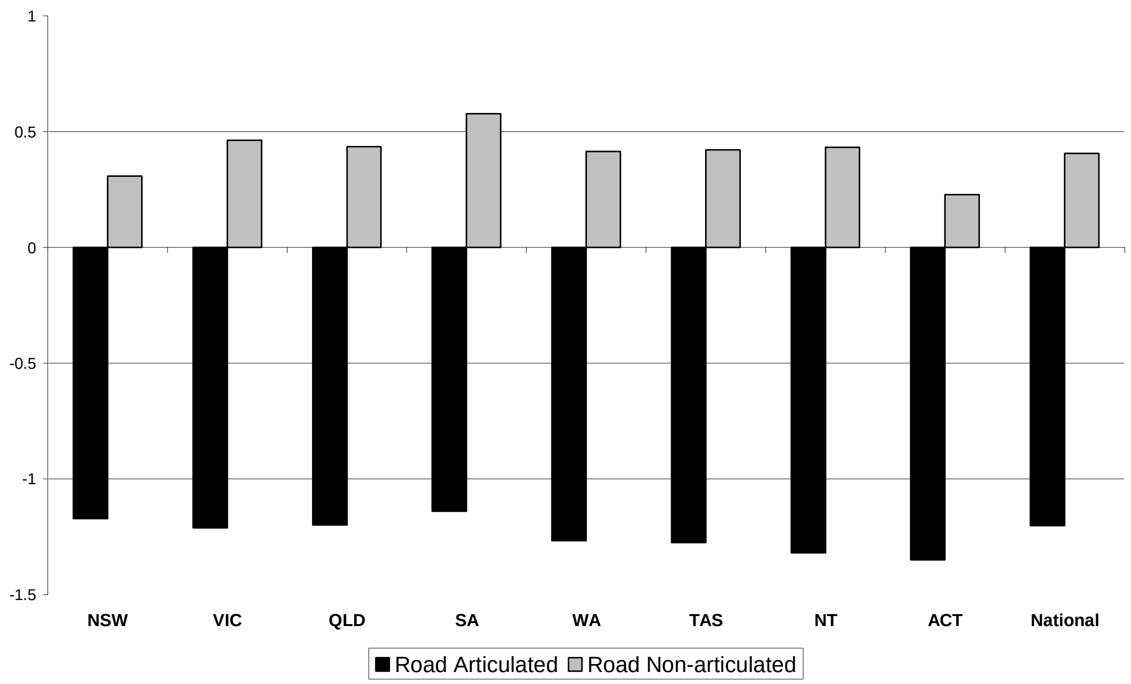
How are mode shares affected?

Given the small changes in freight prices and output induced by the FAC and ARRB scenarios, there is little movement in modal shares. Therefore, the discussion in this section focuses on the truck fleet and modal share changes resulting from the 'upper bound' BTE pricing scenario.

Figure G.3 shows that non-articulated truck freight gain market share within the road freight sector as a result of the BTE change. Although charges to both truck classes increase under this scenario, the charges on articulated trucks increase nearly 12 percentage points more than charges on non-articulated trucks. This allows non-articulated road freight to gain a price advantage and increase its intra-modal market share, to the extent that the two are substitutable for a given freight task.

Figure G.3 **Substitution between types of road freight, BTE price model**

% change, tonnes

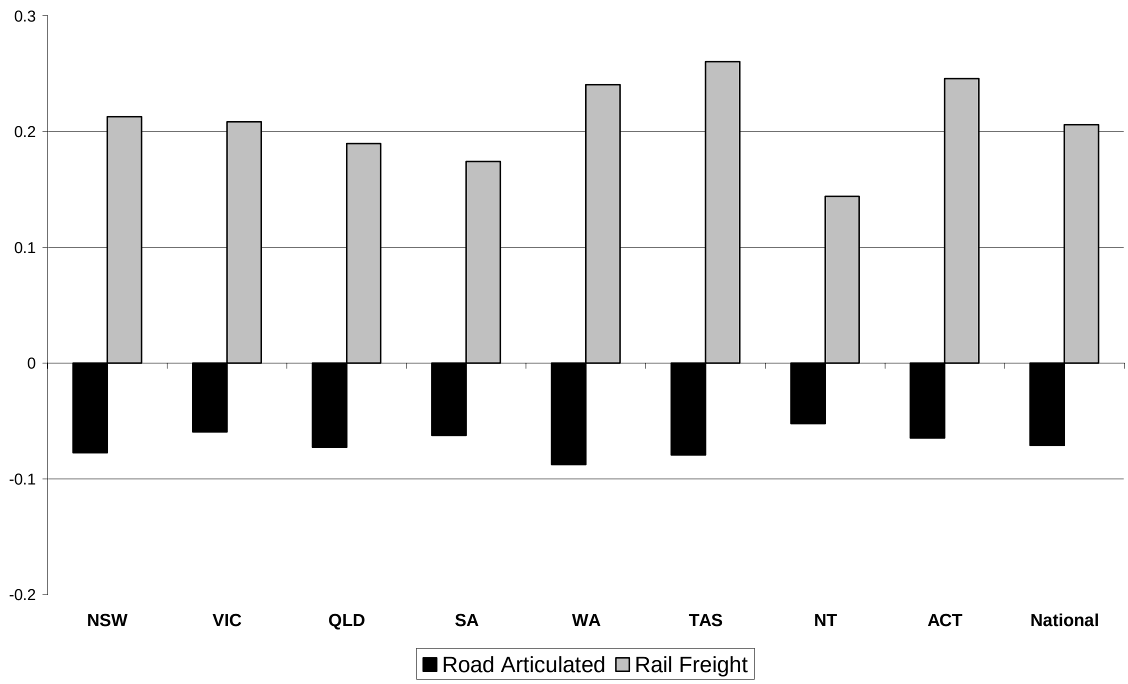


Data source: Commission estimates.

As the charges on articulated trucks increase, and to the extent this increases articulated road freight prices, rail stands to gain. The magnitude of the gains will be affected by the relative size of road's price increase and the degree of intermodal substitution assumed in the model. Figure G.4 shows that rail is able to increase its share of the contestable market as a result of the increased charges. These gains, for the most part, are very small, the largest being in Western Australia and Tasmania, where rail freight increases by 0.24 per cent and 0.26 per cent, respectively.[9]

Figure G.4 **Substitution between articulated road and rail freight, BTE scenario**

% change, tonnes



Data source: Commission estimates.

Assuming a more contestable road/rail freight market makes little difference to these overall results. When assuming high cross price elasticity values, nationally, road's share declines by only -0.17 per cent with rail's share increasing by 0.5 per cent.[10]

---

9 The apparently large increase in rail freight in the Australian Capital Territory is due to the small initial base of rail freight in that region.

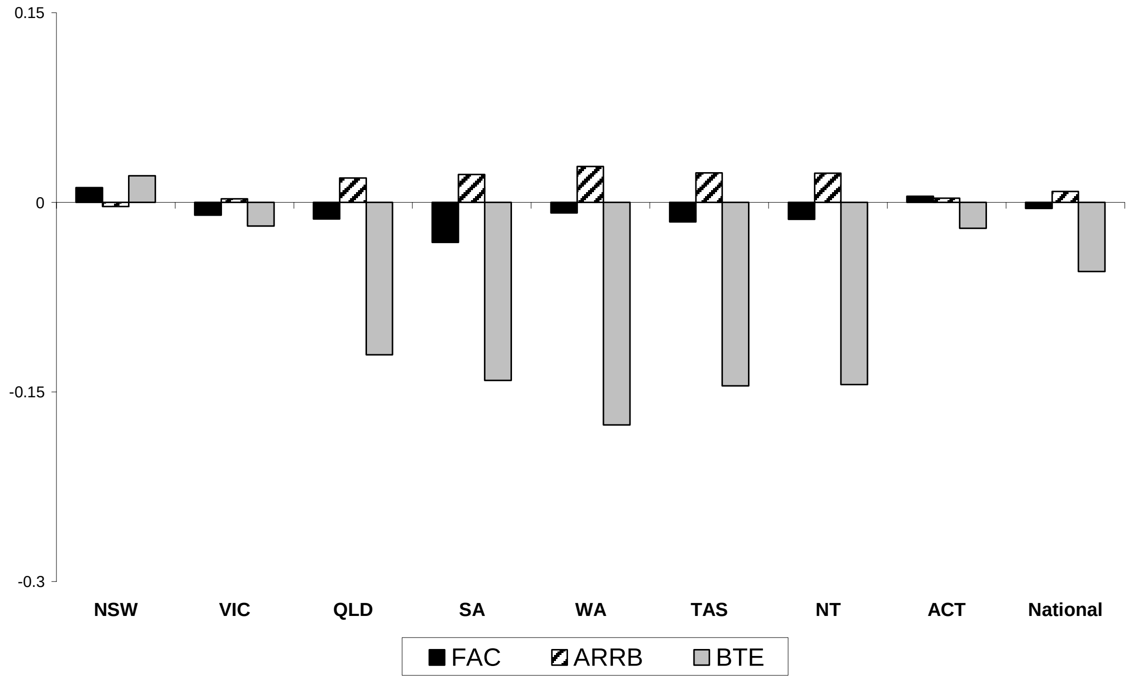
10 The change in modal share will not be equal because each mode starts with a different value base. Road has a larger economic base and thus a small percentage change in its share will lead to a larger gain for rail, given its smaller starting value.

How does changing relative charges between truck classes affect regional economic activity?

The various charging scenarios have very little impact on the economic activity, or Gross State Product (GSP) in each State and Territory (figure G.5). This result is not surprising, given the small changes in individual industry output that flow from changes in truck charges. Those jurisdictions with a relatively large freight task, in particular Western Australia and South Australia, experience the largest declines in output under the BTE price model. However, these effects are all very small, less than 0.2 per cent. Nationally, economic activity falls in the BTE scenario by a little over 0.05 per cent. In other words, there is virtually no change in the aggregate.

Figure G.5 **Changes in total output (GSP) by region from various charging options[a]**

% change, real



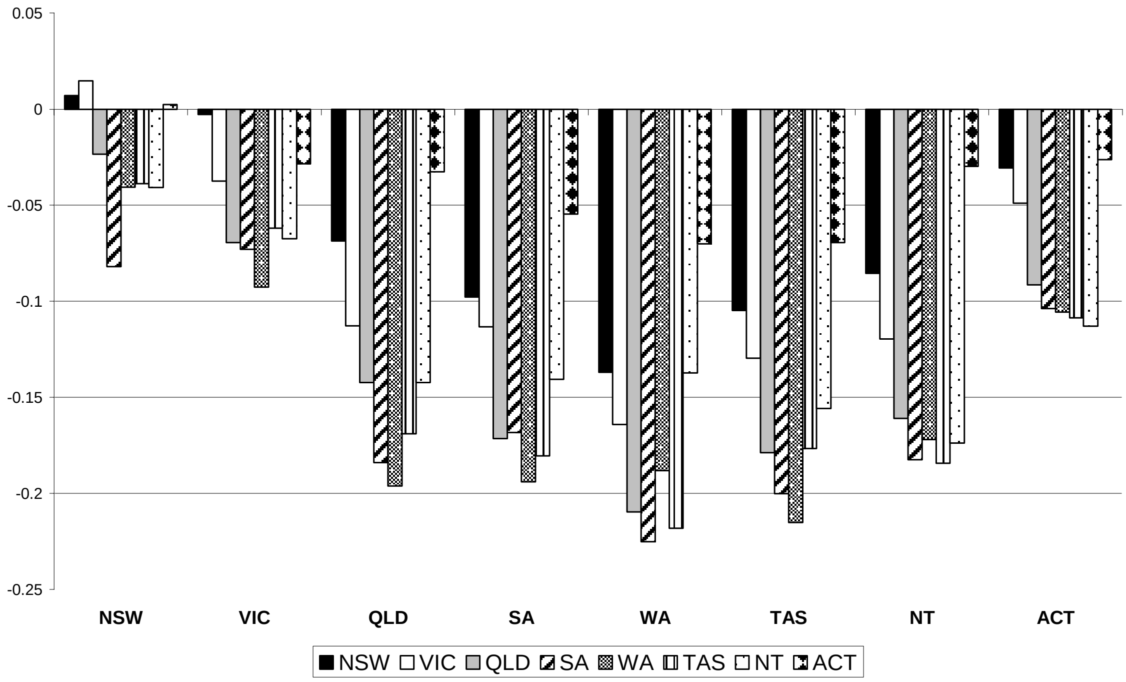
[a] National results refer to GDP.

Data source: Commission estimates.

Examining changes in regional flows of goods and services, the first two pricing scenarios yield virtually no change. The largest change in charges, those which result from applying the BTE model, elicit some, albeit very small, changes. Figure G.6 shows the size of the changes in flows of goods and services between jurisdictions, and figure G.7 shows the distribution of these changes within each jurisdiction.

Figure G.6 **Change in regional inflow of goods and services, BTE price model**

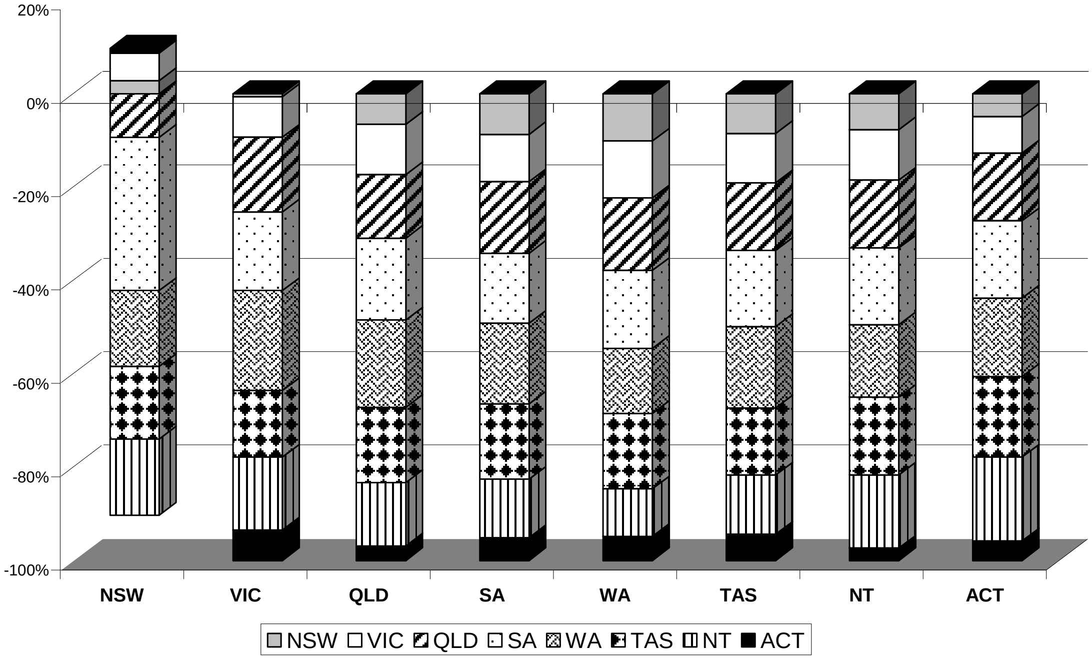
% change, real



Data source: Commission estimates.

As seen in figure G.6 the interstate flow of goods and services declines as truck freight charges increase. These declines, however, are all less than 0.25 per cent, as the change in truck user charges barely affects the price of industry outputs. Again, those jurisdictions with a comparatively larger freight task experience the largest declines.

Figure G.7 **Change in the distribution of the flow of goods and services for each region, BTE price model**[a]



[a] Each column indicates that region's total change in inflows from all domestic sources.

Data source: Commission estimates.

The relative distribution of the change in the sources of goods shows that losses are fairly evenly spread among regions. New South Wales increases goods sourced from within the State, as well as from Victoria, that is, switching to sources which are closer and thus, involve lower freight costs.

None of the proposed changes to the charging structure of heavy vehicles lead to significant changes in either freight demand or overall economic activity. While the BTE model, resulting in the largest changes in heavy vehicle charges, does lead to some reduction in freight output and regional output, these, again, are quite small.

If changing the truck charging system leads to improved resource allocation and therefore efficiency gains, in addition to those effects captured by the model, the results suggest that these efficiency gains need only be small to generate overall benefits to the economy in excess of the losses experienced through higher road user charges.

G.3 How are regulatory and institutional reforms likely to affect the freight industry?

The second set of scenarios examines the potential impacts of regulatory and institutional reforms within the land freight industry. Chapters 8, 9, 10 and 11 outline the case for these reforms as ways to promote more efficient road and rail freight transport. Some proposed measures to promote rail and road efficiency include:

Rail[11]

- Expediting national consistency and coordination in rail access regimes, pricing and other regulatory frameworks — including operating practices and technical standards, especially a single institutional framework for safety regulation.
- Stricter application of the corporatisation model to government-owned railways.
- Allowing rail operators freedom to adopt pricing strategies that facilitate greater recoupment of costs (such as Ramsey pricing approaches).

Road

- Removal of obstacles to direct deals between freight operators and road providers to upgrade particular roads and remove bottlenecks.
- Improving existing road funding and investment decision making, for example, by broader application of AusLink transparency and consultation principles.
- Replacing prescriptive regulations with performance-based regulations.

More fundamental road reforms

More fundamental reform could involve the commercialisation of road provision which is likely to be more efficient, innovative and more responsive to user demand and, thus, stimulate productivity gains. More commercial road provision could involve mass–distance location-based charges for national highways, for example. An alternative model outlined by the Commission is a road fund, which could also improve the efficiency of road spending and provision. However, because of the significant implementation issues involved in both approaches, the Commission has not recommended either approach, at this stage.

---

11 The degree to which these reforms have differential impacts on public and private rail operations will be dealt with in greater detail in the final report.

There are two general aspects of the anticipated impacts of the reforms outlined in this discussion draft. The first is the impact on the productivity of the freight industry itself. By reducing costs and improving resource allocation — such as by harmonising regulation across jurisdictions, or allowing rail to adopt efficient pricing strategies — the reforms will have the effect of enabling the land freight industry to produce a given output with fewer inputs, and thus, at less cost.

The second aspect of reform impacts is from an improvement in infrastructure spending. It has been shown that infrastructure spending has a positive productivity impact, not only on the freight industry, but on the wider economy as well (see, for example, Aschauer 1989, Otto and Voss 1996 and OECD 2006a).

Quantifying anticipated productivity gains

Anticipated impacts on the land freight industry

There are a number of studies examining potential productivity gains that could result from reforms in the transport sector. However, few involve actual estimation of effects. Most rely on historical change or judgement. This is due to a lack of empirical data, hindering the ability to satisfactorily quantify the link between reforms and changes in economic activity.

The Commission has previously examined the impact of National Competition Policy (NCP) reforms on major infrastructure, including road and rail, focusing on the effect on rural and regional areas (PC 1999b). Productivity gains anticipated from these reforms, at that time, were:

- rail — continued corporatisation and movements to ‘best practice’ could be expected to lead to capital, labour and materials productivity improvements of just over 8 per cent.
- road — adoption of NRTC proposals dealing with heavy vehicle charges, transportation of dangerous goods by road, mass limits, and other measures could be expected to lead to improved labour, capital and materials productivity of just under 3 per cent.

These are considered to be ‘outer envelope’ changes — the maximum (static) gain possible were the reforms to be fully implemented.

The Commission undertook a later study to examine actual changes experienced during the 1990s in the key infrastructure activities encompassed by the NCP reforms (PC 2005c). The report found increases in labour productivity (in terms of employment per unit of output) in rail of over 60 per cent during that period. The resulting increases in jurisdictional output (measured in conjunction with similar increases in labour productivity for ports) were then estimated and found to be between 0.25 (Australian Capital Territory) and 1 per cent (Western Australia).

The consulting firm, Sinclair, Knight Merz Pty Ltd (SKM 2006) outlined a series of proposals designed to lessen the socio-economic impacts of the anticipated doubling of Australia's freight task over the next 20 years. The report also indicates productivity gains associated with various reforms which are broadly consistent with proposals in this discussion draft. Totalled together, potential productivity gains are assessed to be around 10 per cent for road and 6 per cent for rail.

Preliminary modelling undertaken by Victorian Treasury estimated proposed improvements in the road pricing structure would lead to productivity increases of 5 per cent as well as improved road cost savings. In the rail sector, improved vertical integration and below-rail capital stock was estimated to reduce the cost of capital. In addition, productivity improvements of 16.5 per cent were anticipated as rail moves to 'world's best practice'. Together, these improvements in the road and rail sectors lead to an increase in Gross Domestic Product (GDP) of 0.15 per cent. The report stresses these findings are preliminary (VicDTF 2005).

In a much earlier study, Cox (1994) examined estimates of the impact of microeconomic reform on the transport sector. He cites various reports estimating productivity increases as a result of a number of reforms for the road sector of between 2 and 10 per cent, leading to increases in GDP of between 0.3 and 2.5 per cent.[12]

Potential impacts of improved infrastructure spending

It is generally accepted that improved infrastructure spending leads to economic gains (box G.3). However, there is debate about the size of these gains as well as the exact mechanism through which they affect economic activity (see, for example, Lakshmanan and Anderson 2002 and OECD 2006a). While the freight industry is an obvious beneficiary of any improvements in road and/or rail infrastructure spending, these improvements have wider economic impacts, including on government, households and non-freight users of the road and rail infrastructure. Generally studies measuring the direct impact of changes in infrastructure spending on GDP tend to pick-up these wider benefits while those focusing on the freight industry only may not.

[12] The GDP growth estimate of 2.5 per cent involved increased investment spending on road (through improved allocative measures) of almost $49 billion over 20 years. The other studies cited in Cox (1994) report increases in GDP, due to more efficient road spending, of between 0.27 and 0.5 per cent.

Box G.4 illustrates the general equilibrium effects of improvements in infrastructure spending on overall economic activity. The various institutional reforms outlined in this discussion draft are likely to increase the efficiency, and thus productivity, of infrastructure spending. Consequently, these reforms are modelled as a productivity increase in the production of road and rail freight services (box G.4).

Box G.3 Relationship between infrastructure spending and economic output

Productivity improvements leading to increases in economic output can come about in several ways. The first is through reductions in inefficiency using existing technology. Second, a shift in technological knowledge and capabilities can shift production abilities. Finally, differences in environmental or operating circumstances can affect input/output use. The reforms discussed in this report will feed into the economy mainly through the first type of productivity impacts. That is, improvements in institutional structures and regulatory reform should lead to a more efficient allocation of resources.

While the reforms suggested in this discussion draft may affect the rate of technological change in the road and rail industries — the second type of productivity increase — many of these changes are likely to occur regardless, and thus are not explicitly considered in the modelling, which is concerned with policy actions.

The exact nature of the link between public infrastructure spending and productivity improvements has been debated over the years (Fernald 1999). For such investment to lead to productivity gains, it must be a cause of, not a reaction to, economic growth. On balance, recent studies, including a recent OECD report (2006b), have found that road infrastructure investment does induce productivity increases in an economy.

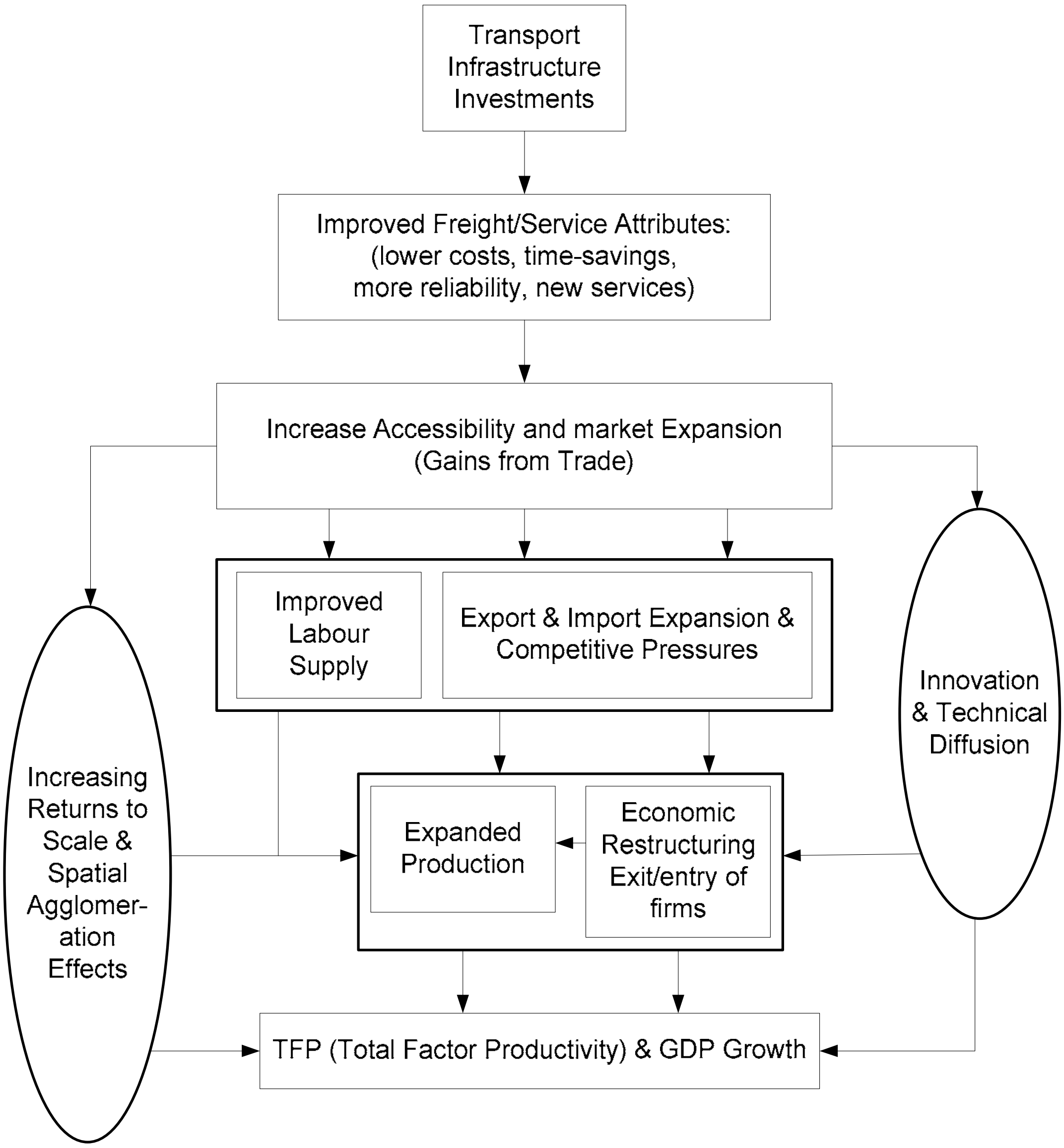
However, there is no consensus as to the extent to which these gains are still available. Fernald (1999) found that diminishing returns from infrastructure spending set in once the road network in the United States was completed (around 1973). This idea of declining returns from investment in mature networks is also supported by the OECD (2006b) and Song (2002). Infrastructure spending on an established and completed road network, therefore, would not be expected to elicit as large gains in productivity as those experienced during the completion of such a network.

> … the productivity enhancing benefits of additional infrastructure spending is determined by whether the infrastructure stock is in “wealth-maximising” equilibrium (i.e. is optimal). Where infrastructure stocks are below optimal, additional spending on infrastructure is productivity-enhancing, whereas additional spending on infrastructure is destructive of wealth when infrastructure stocks are above optimal (i.e. overbuilt). (OECD 2006b, p. 192)

The infrastructure spending envisaged for Australia encompasses both aspects of productivity gain; that is, spending associated with both the augmentation and upgrade of a network.

Sources: Fernald (1999); OECD (2006b).

Box G.4 **General equilibrium effects of infrastructure investment**



Source: Lakshmanan and Anderson (2002).

As transport infrastructure and service improvements reduce costs and increase accessibility for various market actors — input suppliers, labour and customers — markets expand as do market opportunities (especially with respect to overseas markets). A general equilibrium model captures these broader effects on economic activity.

Econtech (2004) applied a general equilibrium framework to investigate the impact of changing infrastructure investment on economic activity in Australia. The report argues that inadequate government spending has impeded investment in road and rail infrastructure and led to under-investment, especially for rail.

> The massive expansion in the rail sector [needed] reflects the aged nature of the capital stock in this industry so a significant amount of investment is required to improve the existing capital stock as well as expanding the capital stock. (Econtech 2004, p. 24)

The report bases its estimates of under-investment on a variety of sources including the Institute of Engineer's Annual Infrastructure Report Card, and reports by Australian Automobile Association, Allen Consulting and National Economics. Econtech determined that, based on these sources, the amount of under-investment warranted a 65.2 per cent increase in the capital stock of rail and an 18 per cent increase for road. Similar calculations were made for infrastructure investment in water, electricity and gas.

The results show that increasing infrastructure investment spending by these amounts, would increase GDP by 0.8 per cent. This implies an output elasticity of 0.13 according to Econtech. That is, a 1 per cent increase in infrastructure spending lead to a 0.13 per cent increase in GDP. Prices for the transport industry as a whole would fall by about 4.5 per cent while production volumes increase 5 per cent in rail and 2 per cent in road. As the exercise involved redressing reported under-investment in water, electricity and gas infrastructure, as well as road and rail, it is impossible to determine how much the results are solely attributed to changes in road and rail infrastructure spending.

AusLink's White Paper uses BTRE estimates (generated using MMRF) to highlight the potential benefits of increased transport efficiency on GDP. They state that a 1 per cent improvement in the efficiency of delivery of national transport services will increase annual GDP by approximately $500 million in 2002 prices (DOTARS 2004). This translates into an implicit output elasticity of 0.07.

Productivity gains applied in the model

Most of the studies outlined above have applied potential productivity gains determined through historical experience or expert judgement, rather than empirical estimation. These studies have generally used productivity increases of between 2 and 16 per cent. In order to capture all aspects of potential efficiency gains for both road and rail, the Commission has applied a 5 per cent productivity increase on *all* inputs to the production of the freight task: that is, a 5 per cent increase in the productivity of materials, capital and labour inputs, for both road and rail.

In applying this potential productivity gain within the context of the current modelling, several factors should be kept in mind.

First, the productivity increases described above are often the result of broad-ranging reform packages that potentially affect many aspects of the economy

(VicDTF (2005) and Cox (1994) for example). In that sense, they overstate potential gains from the types of reform proposed here.

Second, even those studies focusing on the freight sector generally consider only one type of productivity improvement, such as labour productivity, or one aspect of transport infrastructure, such as investment spending on roads (PC (2005c) and Cox (1994), for example). The reforms contemplated in chapters 10 and 11 potentially affect both labour as well as the capital spending of the freight companies themselves (for example, potentially larger trucks for road and upgrades in the rolling stock for rail). There are also potential reductions in other input costs as regulatory processes are streamlined.

Third, some of the productivity gains cited above (Econtech (2004) and DOTARS (2004), for example) are applied to, or derived from, changes in total public infrastructure spending (including sectors such as water or electricity). When determining the appropriate size of the productivity increase, the Commission is concerned with road and rail freight industries only.

Finally, while there are two potential sources of productivity gain — improved efficiency and resource allocation within the industry itself; and improvements in the efficiency of infrastructure spending in general — these two effects are not additive. Rather, they overlap and interact so that applying a separate productivity improvement for each could potentially lead to double-counting.

Is there more headroom for road?

Those studies examining increases in the productivity of the rail sector have shown substantial gains since the reforms of the 1990s. Indeed, as outlined in section 2.3, publicly owned railways enjoyed a 10 per cent per annum increase in productivity over that period. Thus, it would appear that the commercialisation of the rail industry has helped spur the rail industry to improve its performance. While more needs to be done (section 10.2 and 11.1), it is unlikely that rail could continue to make reform-related gains at the rates which followed the sweeping reforms in the previous decade.

Some of the more fundamental reforms proposed in the road sector, however, do have the potential to lead to greater productivity gains for this sector. Such ‘outer envelope’ productivity improvements could be as high as 10 per cent. This value is consistent with productivity gains which have followed the commercialisation of other sectors. Thus, a second scenario is investigated, where the road sector is able to achieve productivity increases of 10 per cent. The results of this scenario are discussed in the summary at the end of this section.

The Commission is seeking comments from participants about the feasibility of the simulated productivity increases for road and rail infrastructure, including any information that may help better quantify proposed reforms.

How does a 5 per cent productivity increase affect the freight task?

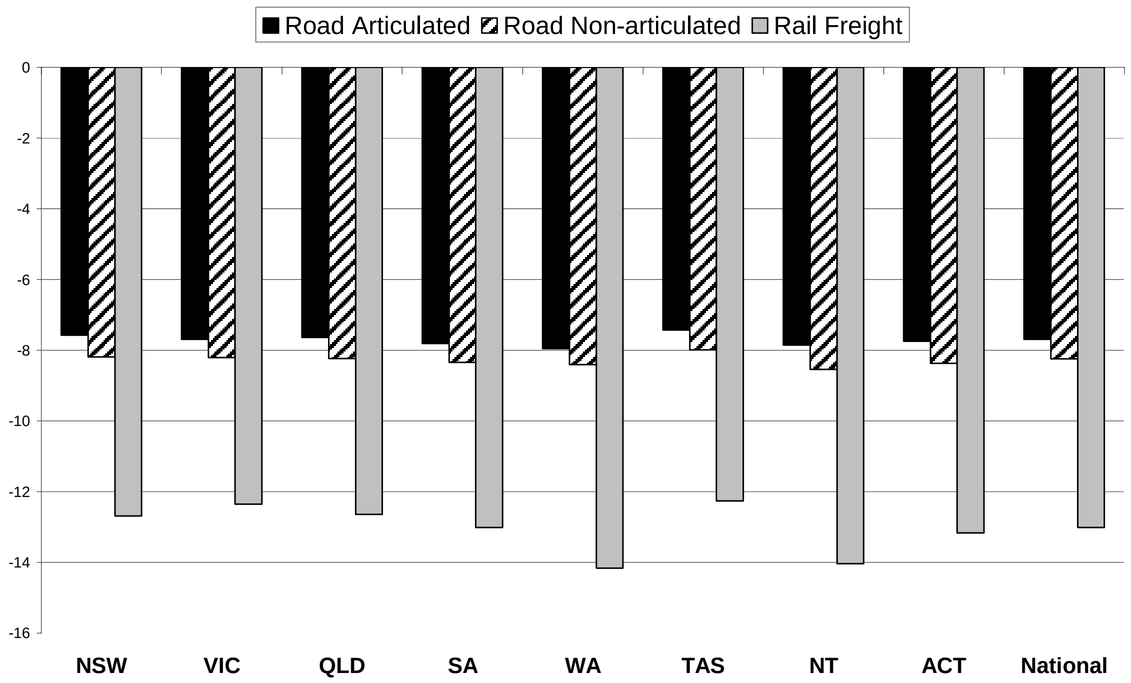
An increase in the productivity of the freight industry, all else equal, will reduce the price of freight. As the price of freight falls, demand expands and the output of both road and rail increase. This expansion is due both to the declining price of freight (first-round effects) and to an increase in demand because user industries' own output expands (second-round effects). This subsequent second-round effect will tend to bid up the price of freight, partly reversing the price declines associated with the initial productivity gains. For example, a reduction in the price of rail freight will lead to a reduction in the costs, and the transport-inclusive price of coal. This stimulates demand for coal, further increasing coal's demand for rail freight.

The same productivity increase applied to both road and rail, working its way through the mechanisms described above, leads to different final outcomes in price for each mode (figure G.8). As both road and rail output increase, road's second-round-induced price increases are more than rail's, given the greater costs involved in producing the additional output. This stems from the different cost structures between road and rail.

Rail's larger capital costs (roughly 17 per cent of rail's total costs versus about 6 per cent of road's) and smaller labour costs (less than 30 per cent of total costs for rail and more than 37 per cent for road) enable rail to expand output, at least in the short-run, at a lower marginal cost than road.

Figure G.8 **Change in the price of road and rail freight as a result of a 5 per cent productivity increase**

% change



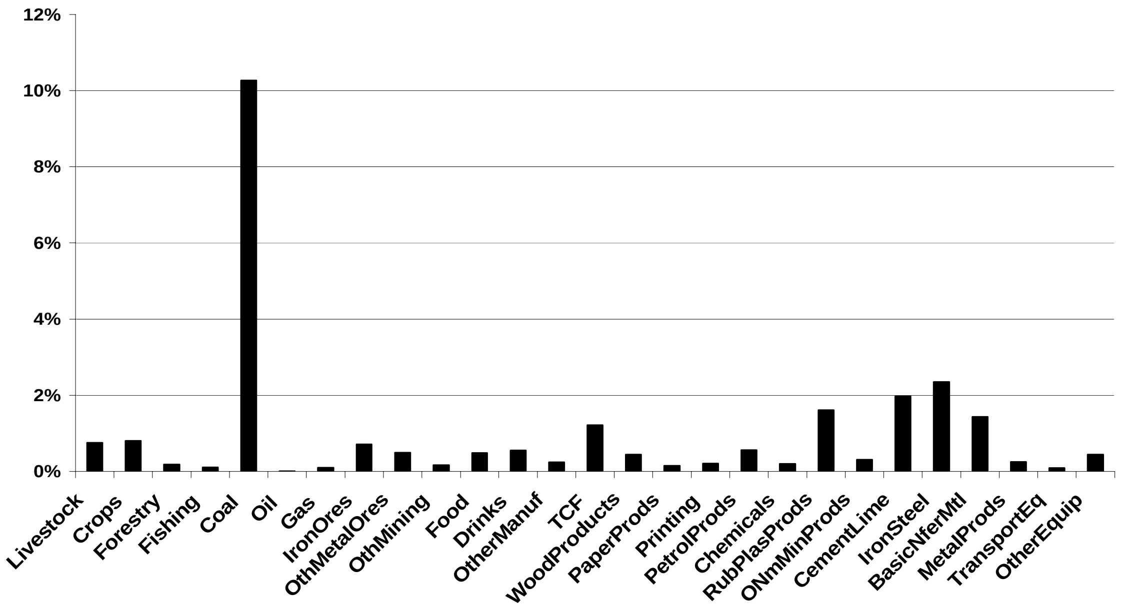
Data source: Commission estimates.

An additional factor influencing rail's ability to maintain a price decline larger than road (over 12 per cent on average for rail and 8 per cent on average for road) comes through the second-round effects. Rail is a small share of operating costs, with the exception of a few industries for which road is not a good substitute (figure G.9). Road represents a larger share of costs across a greater number of industries (figure G.10). Thus, the demand for road freight can be seen to be more price sensitive than the demand for rail freight whose price adjustment (i.e. increase) to the second-round increases in demand, are less.[13]

[13] These results are consistent with those found in the elasticity estimation work presented in appendix F, where rail's own price elasticity is found to be less than that of road's.

Figure G.9 **Rail freight as a percentage of total operating costs[a]**

National average, selected industries

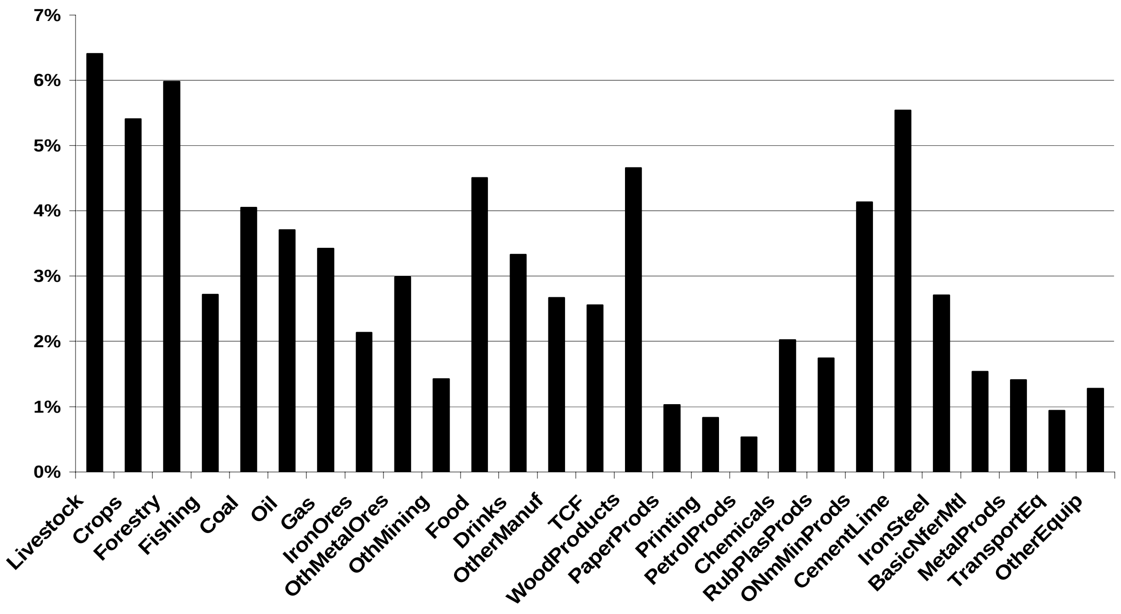


a Operating costs defined as intermediate inputs plus other costs.

Data source: MMRF database based on preliminary 2001-02 ABS input-output tables.

Figure G.10 **Road freight as a percentage of total operating costs[a]**

National average, selected industries



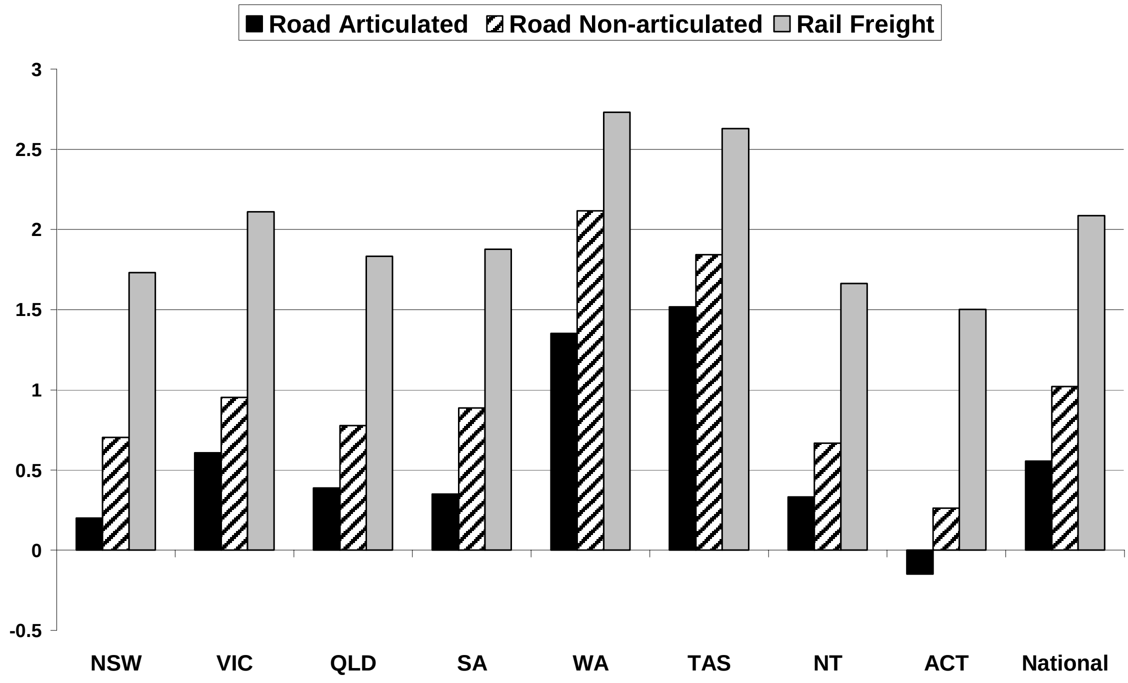
a Operating costs defined as intermediate inputs plus other costs.

Data source: MMRF database based on preliminary 2001-02 ABS input-output tables.

The change in total output of road and rail freight is shown in figure G.11. Nationally, rail's increase is nearly twice that of road's. This result stems from two effects. The first is the relatively large derived demand for rail due to the expansion of exports in industries which tend to be rail intensive (figure G.12). These industries, such as minerals-related industries, whose declining price improves their competitive position *vis a vis* overseas producers, increase exports, further increasing rail freight demand.

Figure G.11 **Change in output of road and rail freight industries as a result of a 5 per cent productivity increase[a]**

% change, tonnes



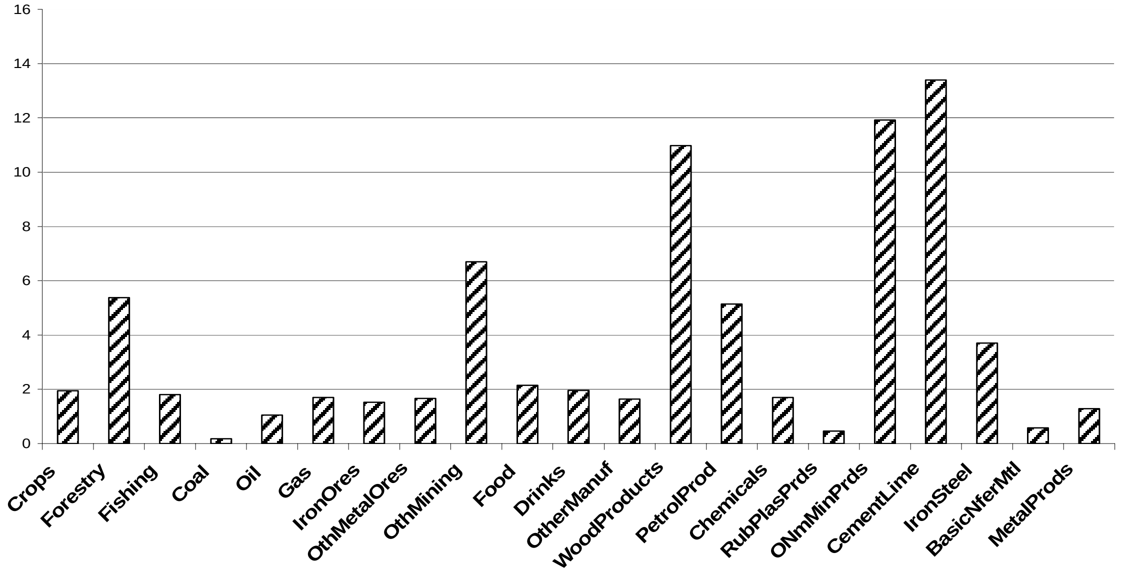
[a] Changes in the ACT's rail freight task are off a very small base.

Data source: Commission estimates.

The second source of rail's growth is the expansion of its mode share due to its ability to maintain relatively larger price declines (figure G.13). The size of the shift in mode share varies across regions, depending on the industries involved and the contestability of the market by each mode. In general, the average change in market share is small across most commodities in the economy. However, the small modal shifts translate into large percentage gains for rail. While road only loses small amounts of market share, it translates into relatively large quantities for rail, given

Figure G.12 **Changes in exports for selected industries as a result of a 5 per cent productivity increase**

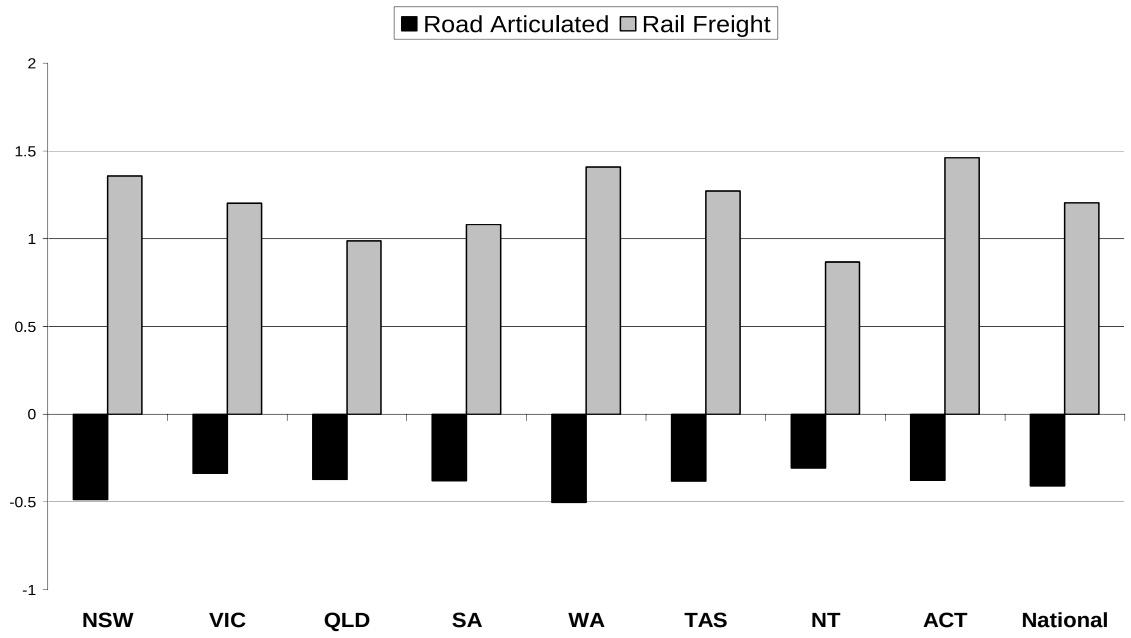
% change, real



Data source: Commission estimates.

Figure G.13 **Modal substitution between road and rail as a result of a 5 per cent productivity increase**

% change, tonnes



Data source: Commission estimates.

its small initial base, leading to the large percentage increases in rail's total output shown in the model results (figure G.11).

The effect on specific industry output of an increase in the productivity of the freight sector is shown in figure G.14. The industries experiencing the largest gains in output are iron/steel, iron ore, other metal ores and wood products. This growth is driven by relatively large increases in exports in these industries (figure G.12). Those industries with traditionally high export shares (such as grains — included in 'crops' in the figure — and coal) also expand their output (and exports) but not to the same extent as those industries starting from a smaller base. As stated above, many of the faster growing industries rely on rail for a major part of their freight task.

Box G.5 **The role of exports in wood products**

The forestry and wood products industries are located throughout Australia. Both hardwood and softwood plantations exist in all eight states and territories (NAFI 2006). Although it is only one of a number of inputs into the industry, freight costs make up a relatively large share of costs for the wood products and forestry industries compared to many other industries.

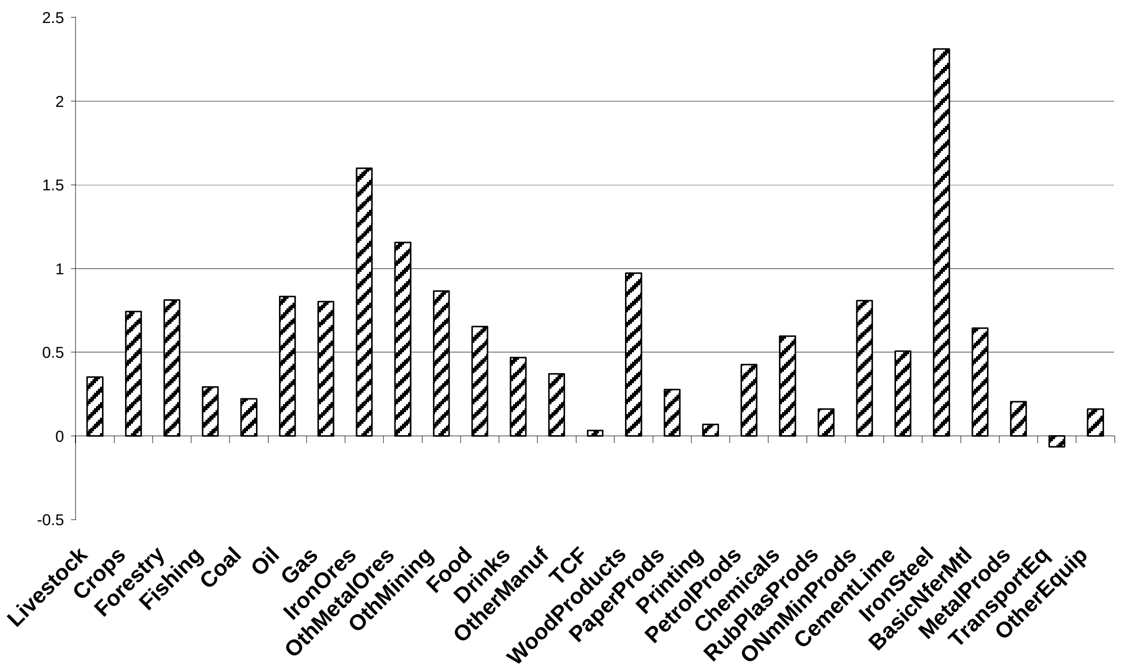
As their inputs and final products must be shipped large distances, improvements in freight productivity will benefit the woods products industry relatively more than those not as reliant on freight. Indeed, this industry experienced one of the largest increases in overall output, 1 per cent (figure G.14). The majority of that increase, 0.74 per cent, comes from an expansion in exports of wood products by Australian producers. Wood products were able to increase their exports by over 10 per cent due to the cost advantage gained through improvements in the freight task.

Source: Commission estimates.

The degree of substitutability between road and rail assumed in the model appears to play a relatively minor role in the outcomes discussed above. Applying the extremely elastic assumptions about mode substitutability does not dramatically affect modal share changes (nationally, road declines about 1 per cent and rail increases less than 3 per cent).

Figure G.14 **Change in industry output as a result of a 5 per cent productivity increase**[a]

% change, real



a The small decline in the transport equipment industry is a result of the increase in productivity of this input to the freight sector. In other words, fewer transport inputs are required to carry a given freight task.

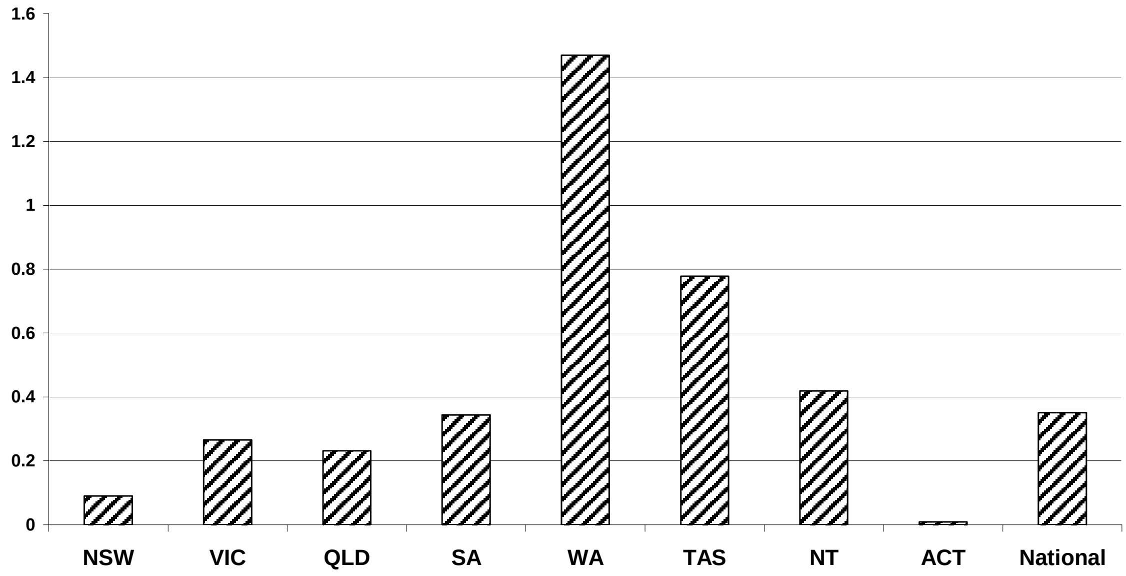
Data source: Commission estimates.

How do these changes affect regional economic activity?

The effect of the productivity increase on the performance of each mode in each region depends on that region's freight demand, the relative reliance on road and rail by industries located in each region, as well as on the changes in demand for the output of those industries (e.g. exports) in response to freight price declines. Those jurisdictions whose industries have high export content and large freight demands (such as Western Australia and Tasmania) tend to have the largest increases in economic activity (figure G.15). Overall GDP increases by just under 0.4 per cent.

Figure G.15 **Change in total output (GSP) as a result of a 5 per cent productivity increase[a]**

% change, real



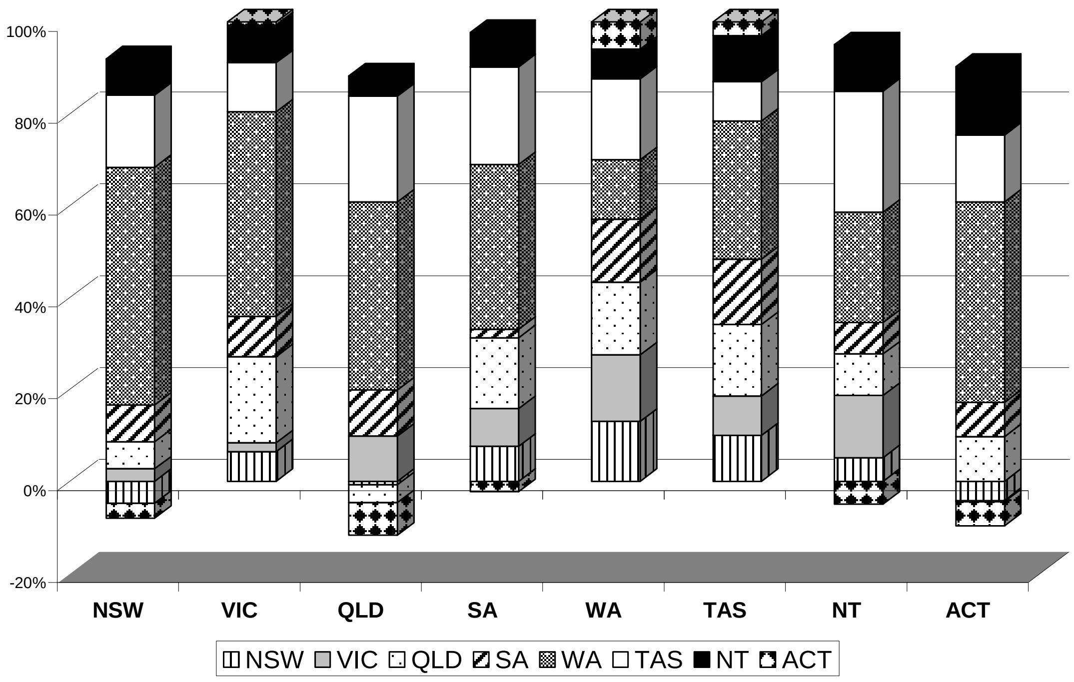
a National results refer to GDP.

Data source: Commission estimates.

Changes in the distribution of the inter-regional flow of goods and services as a result of the productivity increase are shown in figure G.16. As stated above, those regions with the largest freight task, and hosting those industries with large export gains, tend to benefit the most from a change in the productivity of the freight sector. Both Western Australia and Tasmania experience an increase in the flow of goods from all sources, while the largest increases in the inflows to each of the other jurisdictions is from these two States (especially Western Australia). The smallest increases, and even declines, in inter-regional flows arise mainly when goods and services are sourced from regions which are geographically close.

For example, the flow of goods and services from New South Wales and the Australia Capital Territory to Queensland, and the flow of goods and services within Queensland, fall as a result of an increase in freight productivity. Those goods sourced from Victoria, South Australia and Western Australia, increase their share of flows to Queensland. Queensland also increases the flow of its goods to all other regions. South Australia, also a state with a relatively large regional freight task, gains *vis a vis* the other regions.

Figure G.16 **Change in the distribution of the flow of goods and services between regions as a result of a 5 per cent productivity increase[a]**



a Each column indicates that region's total change in inflows from all domestic sources.

Data source: Commission estimates.

Several submissions emphasise the — often disproportionate — impact of freight costs on rural and regional Australia (Government of South Australia sub 61; Local Government Association of Queensland sub. 30; and the Australian Local Government Association sub. 42). The Government of Western Australia states that:

> Any increase in freight charges will increase the cost of living in remote areas and will exacerbate the already high levels of regional labour and skill shortages as well as increase the rate of urban drift. (sub. 27, p. 7)

The converse, as demonstrated by the modelling, is that increases in productivity greatly benefit these communities as the cost of freight (a relatively significant cost) declines.

Box G.6 **Regional changes in the iron and steel industry**

Production in the iron and steel industry is based mainly in New South Wales, South Australia and Victoria. Most of the industry's output is further processed domestically, and its carriage is currently dominated by road.

In response to changes to the heavy vehicle road user charging system, based on the BTE model, output in New South Wales and Victoria increases (despite rising iron and steel prices), driven by export sales. Intrastate and interstate flows within and between New South Wales and Victoria also increase. Given the short distances involved in shipping iron and steel over these hauls, road is relatively more attractive than in other states — so, despite the increase in its relative price, demand for road increases in New South Wales and Victoria.

In response to productivity increases in freight transport, the Victorian iron and steel industry benefits more from the reduced price of freight than the New South Wales and South Australian industries. This is because it consumes more freight services — its major inputs are shipped from greater distances. Conversely, purchasers of South Australian iron and steel output benefit relatively more from reduced freight prices. Output in South Australia subsequently increases relatively more. Shipping South Australian output is relatively more freight intensive — a larger proportion of the industry's output is used in domestic industries than New South Wales and South Australian output. Rail's share of the national task increases the most for iron and steel being shipped to Western Australia and the Northern Territory, and the least for iron and steel being shipped to Victoria. Again, this likely reflects the distances involved and rail's competitiveness on longer hauls.

Source: Commission estimates.

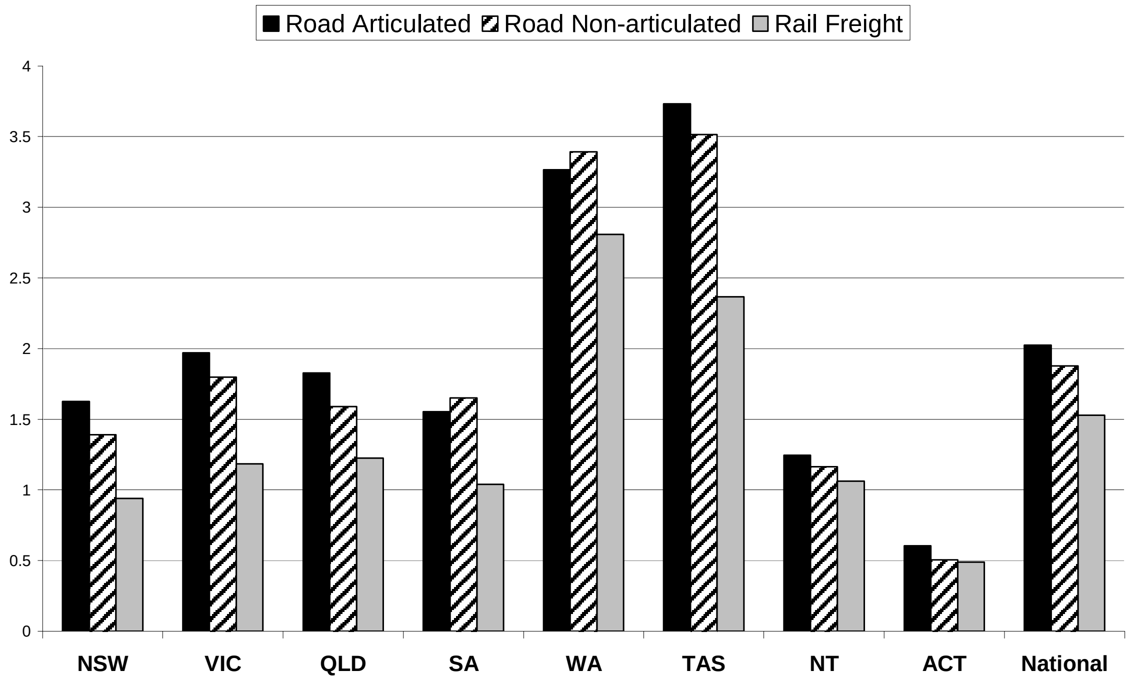
Impact of more fundamental reforms in road

As stated above, if more fundamental reforms were made in the road industry, there is the potential for greater productivity gains. Based on consideration of some existing studies' estimates, the Commission has modelled a 10 per cent increase in the productivity of road, along with a 5 per cent increase in rail to obtain some 'outer envelope' estimates of economic impacts.

Under this scenario, figure G.17 shows that, nationally, road expands its output by around 2 per cent while rail increases by 1.5 per cent. Thus, compared with the scenario presented above, rail barely loses its position when road's projected productivity gains double. When both modes are assumed to have 5 per cent increase in productivity, rail's output increases by just over 2 per cent while road's increases by less than 1 per cent.

Figure G.17 **Change in output of the freight industry as a result of a 10 per cent increase in road productivity and a 5 per cent increase for rail**

% change, tonnes

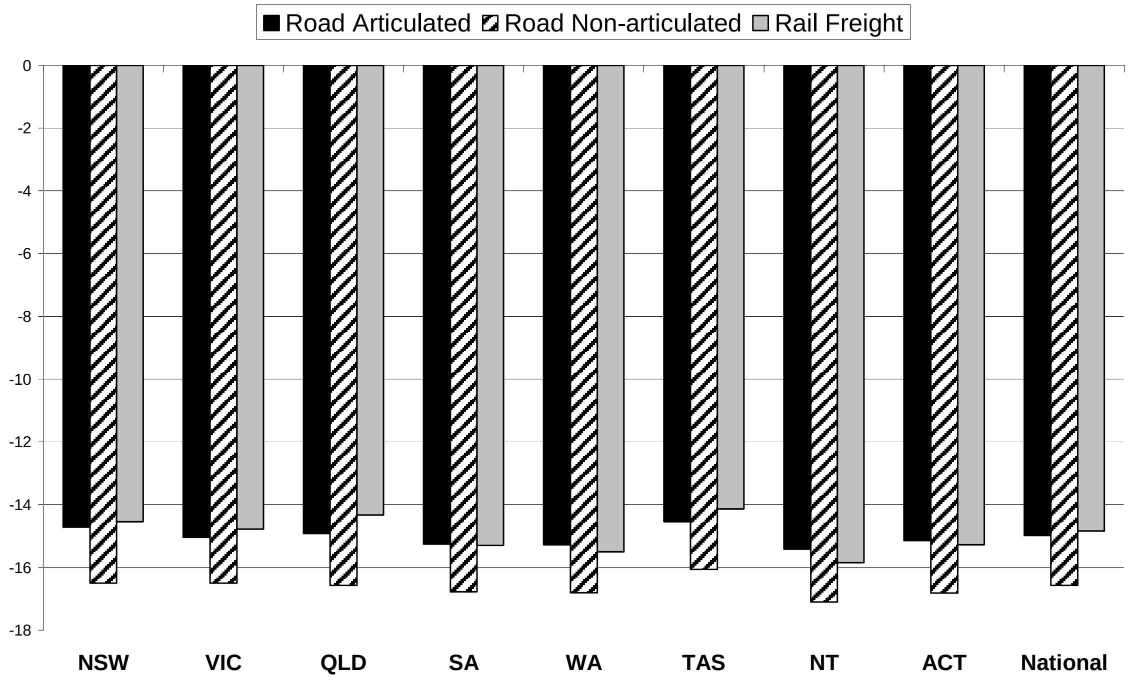


Data source: Commission estimates.

Rail's ability to maintain gains in the market place stems from its ability to maintain its price declines (figure G.18). Again, this is a reflection of the different cost structures of the two industries.

Figure G.18 **Price changes in the freight industry as a result of a 10 per cent increase in road productivity and a 5 per cent increase for rail**

% change

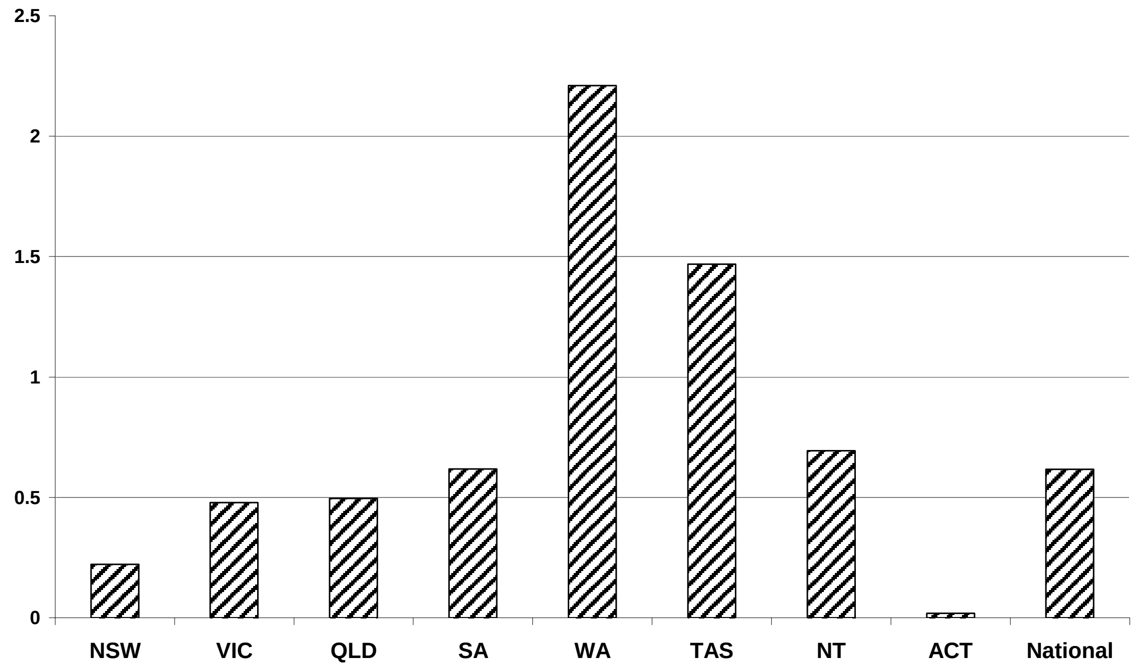


Data source: Commission estimates.

There is no doubt that on certain corridors and for certain commodities, road and rail compete head-to-head, and thus rail would stand to gain from any increases in road freight charges. However, what these results seem to indicate is that, over many freight tasks, road and rail are complements. A not insignificant portion of Australian economic activity relies on both modes (section 2.2). Thus, rail can be adversely affected (in aggregate) by increases in road freight charges as well as benefited from declines in these charges (box G.7). Figure G.19 shows that all jurisdictions experience an increase in economic activity and nationally, GDP increases over 0.6 per cent in this scenario.

Figure G.19 **Increases in total output (GSP) as a result of a 10 per cent increase in road productivity and a 5 per cent increase for rail**[a]

% change, real



a National results refer to GDP.

Data source: Commission estimates.

Box G.7 **Alternative rail response to increases in road user charges**

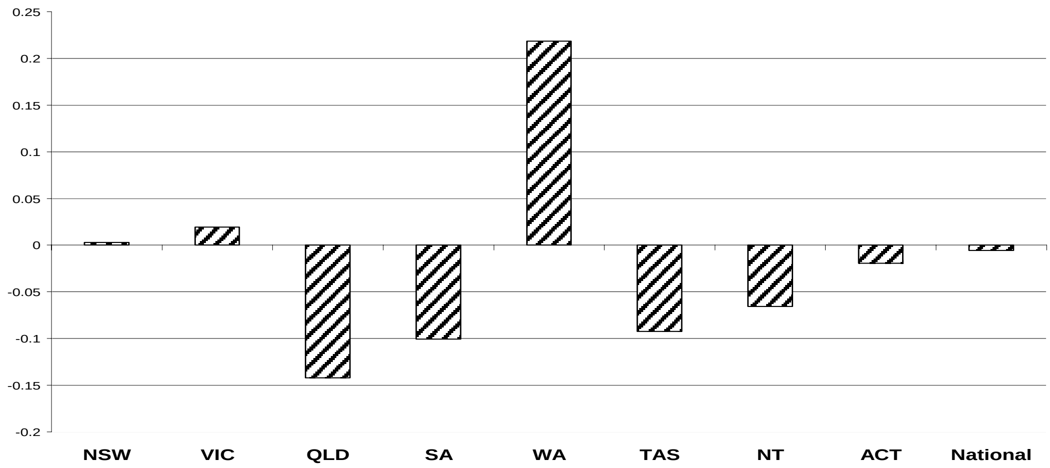
When modelling an increase in road user charges, it is assumed that rail responds by increasing output, rather than matching the price increase. However, an alternative scenario is that rail increases its charges, reducing immediate potential market share gains, instead providing increased revenue and the opportunity to enhance performance. This scenario is modelled as an increase in rail productivity — of 3 per cent — occurring when road user charges are increased per the BTE model.

In this scenario, rail is able to increase its modal share gains an additional 0.1 per cent (going from 0.2 per cent to almost 0.3 per cent gains). Total output changes (coming from increases in modal share as well as increased demand from improved service) are over 2.5 per cent nationally for rail, as opposed to less than 0.1 per cent when road user charges are increased alone. This increase in output, however, is only slightly more than when both road and rail's productivity is increased by 5 per cent. Again, this illustrates the limited gains available to rail through changing road user charges and the much larger potential gains from improving its own performance.

Another aspect of road and rail brought out by this scenario is their inter-dependence. This is highlighted by examining changes in jurisdictional output as a result of this scenario. While acknowledging that all changes are very small, there is still a discernable pattern. The only jurisdiction with clear gains is Western Australia, the state that relies most heavily on rail for its consumption goods. All other jurisdictions, relying on both modes, experience either no real change, or declines in outputs, despite rail's improved productivity.

Figure G.20 **Change in total output (GSP) from BTE pricing on road and 3 per cent productivity increase in rail**[a]

% change, real



a National results refer to GDP.

Source: Commission estimates.

Box G.8 **Measuring results using output elasticities**

An alternative approach to examining the relationship between infrastructure spending and economic output is through output elasticities. These measure the change in economic activity that results from an increase in public infrastructure spending. There have been several studies examining this relationship for Australia.

Otto and Voss (1996) look at changes in total public infrastructure spending and arrive at an output elasticity of 0.17 based on data for the period 1959–1992. Pereira (2001) found a much lower output elasticity of 0.017 for Australia using data spanning from the early 1960s to the late 1980s. Kam (2001) used a stochastic growth model to investigate the long- and medium-run effects of public infrastructure investment on economic output and estimated an output elasticity of 0.1 for the period 1930-31–1990-91. Finally, Song (2002) estimated the relationship between private investment spending and public spending with a more recent dataset — 1968–2001. Song observed diminishing marginal productivity of public capital (similar to that found for the United States in Fernald (1999)) and estimated its output elasticity to be 0.3.

These studies examine changes in total public infrastructure spending as opposed to changes in spending on road or rail. There are numerous studies that have estimated the output elasticities for road investment spending, while those for rail are less common.

The OECD (2006b) provides a summary of estimates for member countries. It looks at increases in public infrastructure transport spending (mostly highway spending) on GDP and reports a range of estimates between 0.15 – 0.80, and 0.34 – 0.70 for Australia.

The results presented in this appendix measure, indirectly, the affects of improved infrastructure spending by modelling productivity improvements on the freight industry itself. Therefore, it is possible to compare the 'end results' that is, implied output elasticities, from the modelling to those reported in the literature to determine their 'reasonableness'.

The implied output elasticities from the scenarios presented in this appendix are well within the range of those reported for Australia:

Scenario	*Implied output elasticity*
5 per cent productivity rise	Road 0.4 and Rail 0.2
10 per cent (Road)/ 5 per cent (Rail)	Road 0.3 and Rail 0.4
Literature(Australia)	0.017 — 0.70

References

AAA (Australian Automobile Association) 1997, *Submission to the Inquiry into Federal Road Funding,* Australian Automobile Association, Canberra, February.

Abrams, B., Cribbett, P. and Gunasekera, D. 1998, *A Comparison of Institutional Arrangements For Road Provision*, Staff Research Paper, Productivity Commission, AusInfo, Canberra, June.

ABS (Australian Bureau of Statistics) 2006, *Australian National Accounts: Input-Output Tables*, Cat. no. 5209.0.55, Canberra.

—— 2005a, *Australian Industry Experimental Estimates Industry Performance by ANZSIC Class, Australia, 2002-03*, Cat. no. 8155.0, Canberra.

—— 2005b, *Survey of Motor Vehicle Use Australia October 2004*, Cat. no. 9208.0, Canberra.

—— 2004, *Government Finance Statistics 2002-03*, ABS Cat. no. 5512.0, Canberra.

—— 2003, *Government Finance Statistics 2001-02*, ABS Cat. no. 5512.0, Canberra.

—— 2002a, *Australian National Accounts*, ABS Cat. no. 5206.0, Canberra.

—— 2002b, *Balance of Payments and International Investment Position*, ABS Cat. no. 5363.0, Canberra.

—— 2002c, *Freight Movements Australia: Summary (Reissue)*, Cat. no. 9220.0, Canberra.

—— 2002d, *Government Finance Statistics 2000-01*, ABS Cat. no. 5512.0, Canberra.

—— 2001, *Government Finance Statistics 1999-00*, ABS Cat. no. 5512.0, Canberra.

ACCC (Australian Competition and Consumer Commission) 2002, *Decision: Australian Rail Track Corporation Access Agreement*, Canberra, May.

ACIL Tasman 2004, *Trucking — Driving Australia's Growth and Prosperity*, Australian Trucking Association, Canberra.

Anderson, J. (Deputy Prime Minister and Minister for Transport and Regional Services) and Conlon, P. (South Australian Minister for Transport) 2005, *AusLink Agreement with South Australia*, Joint Media Release, 24 June.

Applied Research Associates 2006, *Estimation of the Representative Annualised Capital and Maintenance Costs of Roads by Functional Class, Final Report.* Commissioned by Transport Canada in conjunction with provincial and territorial transport agencies, March.

ARTC (Australian Rail Track Corporation) 2006, *ARTC Track Access Reference Pricing*, http://www.artc.com.au/about/reference.htm (accessed 27 June 2006).

—— 2005, *Annual Report 2005,* Adelaide.

Aschauer, David A. 1989, 'Is Public Expenditure Productive?', *Journal of Monetary Economics,* March, pp. 177–200.

ATA (Australian Trucking Association) 2005, *Changes to the Fuel Tax Act — Obligations of Trucking Businesses as of 1 July 2006*, Fact sheet, December, http://www.atatruck.net.au/factsheets/energy%20white%20paper%20checklist%20nov%202005%20(iii).pdf (accessed 13 July 2006).

—— 2004, *Trucks and Air Quality*, Fact sheet, July, http://www.atatruck.net.au/factsheets/fact%20sheet%20-%20trucks%20and%20air%20quality.pdf (accessed 13 July 2006).

ATC (Australian Transport Council) 2004a, *National Guidelines for Transport System Management in Australia,* Volume 1: Framework Overview, Guidelines Assessment Methodology Working Group, Canberra, November.

—— 2004b, *National Guidelines for Transport System Management in Australia,* Volume 2: Project Appraisal, Department of Transport and Regional Services, Canberra, November.

—— 2004c, *National Guidelines for Transport System Management in Australia*, Volume 3: Foundation Material, Guidelines Assessment Methodology Working Group, Department of Transport and Regional Services, November.

ATO (Australian Taxation Office) 2003, *Taxation Statistics 2000-01: A summary of taxation, superannuation and industry benchmark statistics 2000–01 and 2001–02,* http://www.ato.gov.au/taxprofessionals/content.asp?doc=/content/37484.htm (accessed 1 September 2006).

—— 2002, *Taxation Statistics 1999-00*, http://www.ato.gov.au/taxprofessionals/content.asp?doc=/content/19759.htm (accessed 1 September 2006).

—— 2001, *Taxation Statistics 1998-99,* http://www.ato.gov.au/taxprofessionals/content.asp?doc=/content/taxstats9899.htm (accessed 1 September 2006).

—— 2000, *Taxation Statistics 1997-98*, http://www.ato.gov.au/taxprofessionals/content.asp?doc=/content/taxstats9798.htm (accessed 1 September 2006).

ATSB (Australian Transport Safety Bureau) 2005, *Road Deaths Australia 2005 Statistical Summary*, Canberra.

Austroads 2005, *RoadFacts 2005*, Sydney.

—— 2003, *Intelligent Access program (IAP) Feasibility Project*, Sydney.

—— 2000, *Weigh-In-Motion Technology*, Sydney.

Balmer, U. 2003, 'Practice and experience with implementing transport pricing reform in heavy goods transport in Switzerland', Paper prepared for seminar on *Implementing Pricing Policies in Transport: Phasing and Packaging*, Imprint-Europe, Brussels, 13 May.

Battersby, B. 2006, *Does Distance Matter? The Effect of Geographic Isolation on Productivity Levels*, Treasury Working Paper 2006–03, April.

Baumol, W.J., Panzar, J.C. and Willig, R.D. 1982, *Contestable Markets and the Theory of Industry Structure*, Harcourt Brace Jovanovich, New York.

Bennathan, E., Fraser, J. and Thompson, L.S. 1992, *What Determines Demand for Freight transport?*, The Work Bank, WPS 998, Washington, DC., October.

BIC (Bus Industry Confederation) 2001, *Getting the Prices Right: Policy for More Sustainable Fuel Taxation for Road Transport in Australia*, Submission to the Commonwealth Fuel Tax Inquiry, Canberra, October.

Blum, U. 1997, 'Benefits and External Benefits of Transport: A Spatial View', in Greene D.L., Jones, D.W. and Delucchi, M.A. (eds), *The Full Costs and Benefits of Transportation: Contributions to Theory, Method and Measurement*, Springer-Verlag, Berlin, pp. 219–43.

BMU (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (Germany)) 2005, *Motorway Toll for Lorries: Due to Start on 1 January 2005*, http://www.bmu.de/english/mobility/current/doc/print/5834.php (accessed 1 August 2006).

Boiteux, M. 1971, 'On the Management of Public Monopolies Subject to Budgetary Constraints', *Journal of Economic Theory*, vol. 3, September, pp. 219–40.

Booz Allen & Hamilton Consulting, 2001a *Interstate rail network audit — evaluation methodology, Appendix A*, Prepared for the Australian Rail Track Corporation (ARTC), April.

—— 2001b, *Interstate rail network audit — Final Report*, Prepared for the Australian Rail Track Corporation (ARTC), April.

Brindle, R., Houghton, N. and Sheridan, G. 1999, *Transport-Generated Air Pollution and its Impacts — A Source Document for Local Government*, Research Report no. ARR336, ARRB Transport Research, Vermont South, Victoria.

Brown, A.L. and Lam, K.C. 1994, 'Can I play on the road, Mum? — Traffic and homes in urban Australia', *Road and Transport Research*, vol. 3, no. 1, pp. 12–23.

BTCE (Bureau of Transport and Communications Economics) 1996, *Traffic Congestion and Road user Charges in Australian Capital Cities*, Report 92, AGPS, Canberra.

—— 1995, *Greenhouse Gas Emissions from Australian Transport: Long Term Projections*, Report 88, AGPS, Canberra.

—— 1994, *Costs of Road Crashes in Australia — 1993*, Information Sheet 4, Canberra.

—— 1988, *Review of Road Cost Recovery*, Occasional Paper 90, Canberra.

BTE (Bureau of Transport Economics) 2001, *Logistics in Australia: A Preliminary Analysis*, Working Paper 49, DOTARS, Canberra, October.

—— 2000, *Road Crash Costs in Australia*, Report 102, Canberra, May.

—— 1999a, *Competitive Neutrality Between Road and Rail*, Working Paper 40, DOTARS, Canberra, September.

—— 1999b, *Urban Transport — Looking Ahead*, Information Sheet 14, DOTARS, Canberra, August.

BTRE (Bureau of Transport and Regional Economics) forthcoming, Road Impacts of Road-Rail Mode Shift Scenarios.

—— 2006a, *Demand Projections for AusLink Non-Urban Corridors: methodology and projections*, Working paper 66, DOTARS, Canberra, February.

—— 2006b, *Freight Measurement and Modelling in Australia*, Report 112, Canberra, March.

—— 2006c, *Transport Elasticities database*, http://dynamic.dotars.gov.au/btre/tedb/index.cfm (accessed 5 May 2006).

—— 2005a, *Australian Sea Freight 2002-03*, Information Paper 53, DOTARS, Canberra, March.

—— 2005b, *Australian Transport Statistics*, DOTARS, Canberra, June.

—— 2005c, *Greenhouse Gas Emissions from Australian Transport: Base Case Projections to 2020*, Report for the Australian Greenhouse Office and Department of the Environment and Heritage, Canberra, August.

—— 2005d, *Health Impacts of Transport Emissions in Australia*, Working paper 63, DOTARS, Canberra, July.

—— 2005e, *Public Road-Related Expenditure and Revenue in Australia (2005 update)*, Information paper 24, DOTARS, Canberra,

—— 2004, *Land Transport Infrastructure Pricing: An Introduction*, Working paper 57, DOTARS, Canberra, June.

—— 2003a, *An Overview of the Australian Road Freight Transport Industry*, Working Paper 60, DOTARS, Canberra, December.

—— 2003b, *Freight Between Australian Cities 1972 to 2001*, Information Sheet 22, DOTARS, Canberra, September.

—— 2003c, *Rail Accident Costs in Australia*, Report 108, Canberra, January.

—— 2003d, *Rail Infrastructure Pricing: Principles and Practice,* Report 109, Canberra, July.

—— 2003e, *Urban Pollutant Emissions From Motor Vehicles: Australian Trends to 2020*, Consultancy report prepared for Environment Australia, June.

—— 2002a, *Freight Rates in Australia*, Information Sheet 19, DOTARS, Canberra, August.

—— 2002b, *Greenhouse Policy Options for Transport,* Report 105, Canberra, May.

Buchanan, J.M. and Stubblebine, W.C. 1962, 'Externality', *Economica*, New series, vol. 29, no. 116, pp. 371–84.

Bus Industry Association, 2001, *Submission to the Commonwealth Fuel Tax Inquiry,* October.

Campbell (Senator the Hon.) Ian, 2005, *Australia Remains on Track to Kyoto Target*, Media Release, November.

Cameron, J. 2005, *Transport issues for the Australian Forest and Forest Products Industry*, Prepared for Australian Plantation Products & Paper Industry Council (A3P), May.

CEDA (The Committee for Economic Development of Australia) 2005, *Infrastructure: Getting On With The Job*, April, Melbourne.

CfIT (Commission for Integrated Transport (United Kingdom)) 2006, *CfIT's World Review of Road Pricing Phase 1: Lessons for the UK*, London http://www.cfit.gov.uk/docs/2006/wrrp1/pdf/wrrp1.pdf (accessed 18 August 2006).

Chin, K.K. 2002, Road pricing — Singapore's experience, Paper Prepared for Seminar on Implementing Reform on Transport Pricing: Constraints and Solutions, Learning from Best Practice, Imprint-Europe, 23–24 October, Brussels.

City of West Torrens 2004, *Strategic Directions Discussion Paper Number Nine — Traffic Management*, February, http://www.wtcc.sa.gov.au/webdata/resources/files/traffic_management.pdf (accessed 17 August 2006).

COAG (Council of Australian Governments) 2006a, *Communiqué*, Canberra, 10 February.

—— 2006b, *Communiqué*, Canberra, 14 July.

—— 2005, *Communiqué*, Canberra, 3 June.

Coase, R. 1960, 'The problem of social cost', *Journal of Law and Economics*, October, pp. 1–44.

Commonwealth of Australia Constitution Act 1900, http://www.foundingdocs.gov.au/resources/transcripts/cth1_doc_1900.pdf (accessed 24 August 2006).

Connelly, Luke B. and Supangan, Richard 2006, 'The Economic Cost of Road Traffic Crashes: Australia, States and Territories', *Accident Analysis and Prevention,* forthcoming.

Corrigan, C. 2005, 'Regulation - A Transport Industry Perspective', Paper presented to Bureau of Transport and Regional Economics Transport Colloquium, May.

Costello, P. (Treasurer) 2006, Fortescue Metals Group's Application For Declaration of Services Provided by the Mount Newman Railway Line Owned by the Mount Newman Joint Venture (The Mt Newman Service), Press Release no. 48, 23 May.

Cox, J. (Tasmanian Minister for Infrastructure) 2006, *Positive Sign for Tasmania Rail System*, Media Release, 15 August.

Cox, J.B. 1994, *Refocusing Road Reform,* Business Council of Australia, Melbourne.

CSIRO 2005, *Climate Change the New Reality*, Media Release 2005/222, 18 November, Melbourne.

—— 2001, *Climate Change Impacts for Australia*, Altkenvale.

Dakis, S. 2006, *Pacific National Rail Agreement*, ABC Rural, http://www.abc.net.au/rural/tas/content/2006/s1640843.htm (accessed 14 June 2006).

DEH (Department of the Environment and Heritage) 2004, *State of the Air: National Ambient Air Quality Status and Trends Report 1991–2001*, Canberra, April.

Department of Health and Aged Care 2001, *Health Impact Assessment Guidelines*, Canberra, September.

De Maeyer, J.D. and Pauwels, T. 2003, *A Literature Review on the Role of Quality of Service Attributes and Their Monetary Valuation in Freight Demand Models*, Working paper Series 2003011, Faculty of Applied Economics, University of Antwerp, Belgium, May.

DFAT (Australian Department of Foreign Affairs and Trade) 2006, *Australia's Forest Industry, Why Are Australia's Forests Different?*, http://www.dfat.gov.au/facts/forests.html (accessed 24 August 2006).

Directorate-General Energy Transport (European Commission) 2006, 'Road Charging: European Commission Sends Reasoned Opinion to Spain and France for Discriminative Road Pricing', *Energy and Transport in Europe Digest*, Newsletter no. 187, 30 June.

Dix, M. 2006, 'How much does the scheme cost: the London experience', Paper and presentation for the ECMT (European Conference of Ministers of Transport) Conference on Road Charging Systems: Technology Choice and Cost Effectiveness, Paris, 1 June.

Dixon, P. and Rimmer, M. 2002, *Dynamic General Equilibrium Modelling for Forecasting and Policy: A Practical Guide and Documentation of MONASH*, Elsevier, Oxford, United Kingdom.

Doll, C. and Schade, W. 2005, 'How using the revenues of the German HGV motorway system efficiently and equitable under different regulatory frameworks and institutional settings? Lessons from the EC-funded research project REVENUE', Paper presented at the fourth Infra-Train Conference, Berlin, 8 October.

DOTARS (Department of Transport and Regional Services) 2006a, *AusLink Commitment Now $15 Billion Following $2.4 Billion Boost for Road and Rail*, http://www.dotars.gov.au/department/statements/2006_2007/media/001trs.aspx (accessed 19 July 2006).

—— 2006b, *AusLink Investment Program*, http://www.auslink.gov.au/planning/auslink_investment_programme.aspx (accessed 19 July 2006).

—— 2006c, *AusLink Land Transport Funding*, http://www.auslink.gov.au/policy/overview/auslink_funding.aspx (accessed 19 July 2006).

—— 2006d, *Australian Logistics Industry Strategy*, http://www.dotars.gov.au/transport/freight/index.aspx (accessed 17 April 2006).

—— 2006e, E*missions Requirements for Diesel Heavy Duty Vehicles*, Canberra, 8 June, http://www.dotars.gov.au/roads/environment/impact/diesel.aspx (accessed 7 July 2006).

—— 2006f, *Rail and Intermodal Projects: AusLink on the Right Track*, http://www.auslink.gov.au/policy/programmes/rail/rail_projects.aspx (accessed 21 June 2006).

—— 2006g, *Summary of Emission Requirements for New Petrol Passenger Cars in Australia: 1972–2010*, Canberra, 8 June, http://www.dotars.gov.au/roads/environment/impact/emission.aspx (accessed 7 July 2006).

—— 2006h, *AusLink Draft Corridor Strategies*, http://www.dotars.gov.au/whatis/network/corridors/draft_corridors.aspx (accessed 29 August 2006).

—— 2005, *A Brief History of Australian Road and Rail*, http://www.AusLink.gov.au/policy/overview/background/history.aspx (accessed 25 May 2006).

—— 2004, *AusLink White Paper*, Canberra, June.

—— 2002, *AusLink Green Paper: Towards the National Land Transport Plan*, Canberra, November.

DTUP (Department of Transport and Urban Planning) 2003, *Eyre Peninsula Grain Transport Summary Report*, Government of South Australia, Adelaide, May.

Econtech 2004, *Modelling the Economic Effects of Overcoming Under-investment in Australian Infrastructure*, Report for AusCID, Econtech, Canberra, August.

ECMT (European Conference of Ministers of Transport) 2005, *National Systems of Transport Infrastructure Planning,* Roundtable 128, Transport Research Centre, ECMT/OECD, Paris.

Engineers Australia 2005, *Australian Infrastructure Report Card*, Engineers Australia, Barton,. www.infrastructurereportcard.org.au.

Engle, R.F. and Granger, C.W.J. 1987, 'Cointegration and Error-Correction Representation, Estimation and Testing', *Econometrica*, vol. 55, pp. 251–76.

EPHC (Environment Protection and Heritage Council) 2006, *Jurisdictional Monitoring Reports 2004*, Adelaide, 28 March, http://www.ephc.gov.au/nepms/air/juris_mon_reports_04.html (accessed 10 July 2006).

Ernst and Young, ACIL Tasman and Hyder Consulting 2006, *North-South Rail Corridor Study*, DOTARS, June.

ESC (Essential Services Commission, Victoria) 2006a, *Pacific National Access Arrangement Made by the Essential Services Commission under s 38ZJ(1)(a) of the Rail Corporations Act 1996*, Melbourne, June.

—— 2006b, *Pacific National Rail Access Agreement — Final Decision*, Melbourne, May.

—— 2006c, *Proposed Rail Access Agreements — Draft Decision*, Melbourne, April.

—— 2006d, R*ail Access Pricing Guideline*, Melbourne, January.

—— 2006e, *Victorian Intra-State Country Rail Network Affordability: Information Paper*, Melbourne, June.

ESCOSA (Essential Services Commission of South Australia) 2005, *South Australian Rail Access Regime: Changes to Regulator Components Final Decision*, Adelaide, October.

—— 2004, South *Australia Rail Access Regime: Information Kit*, Adelaide, May.

—— 2003, *Tarcoola–Darwin Railway: Access Pricing Provisional Guidelines*, Adelaide, August.

EU (Commission European), 2003, *Amending Directive 1999/62/EC on the charging of heavy goods vehicles for the use of certain infrastructures*, Brussels, July.

—— 1999, *Directive 1999/62/EC – Charging of heavy goods vehicles for the use of certain infrastructures*, Brussels, June.

—— 1998, *Fair Payment for Infrastructure Use: A Phased Approach to a Common Transport Infrastructure Charging Framework in the EU*, White Paper, Brussels, July.

EurActiv 2006, *Road Charging (Eurovignette)*, 27 February, http://www.euractiv.com/en/transport/road-charging-eurovignette/article-117451?_print (accessed 31 May 2006).

Europa 2005a, *Germany's High-Tech Road Toll System Successfully Launched*, 6 January, http://ec.europa.eu/idabc/en/document/3754/354 (accessed 27 July 2006).

—— 2005b, *Overland Transport*, Switzerland–European Union, January, http://www.europa.admin.ch/ba/expl/factsheets/e/landverkehr.pdf (accessed 17 August 2006).

Exports and Infrastructure Taskforce 2005, *Australia's Export Infrastructure*, Report to the Prime Minister, Canberra, May.

Faulhaber, G.R. 1975, 'Cross-subsidization: pricing in public enterprises', *The American Economic Review*, vol. 65, no. 5, pp. 966–77.

FCL (FCL Interstate Transport Services Pty Ltd) 2006, National Productivity – Constrained by Process, address by Greg Gibbins to the BTRE Transport Colloquium, Parliament House, Canberra, 14-15 June.

Fernald, J. 1999, ‘Roads to Prosperity? Assessing the Link between Public Capital and Productivity’, *American Economic Review,* vol. 89, no. 3, pp. 619–38, June.

FIAB (Freight Infrastructure Advisory Board) 2005, *Railing Port Botany’s Containers: Proposals to Ease Pressure on Sydney’s Roads*, Sydney, July.

FMG (Fortescue Metals Group) 2006, *Appeal to the Australian Competition Tribunal*, Media Release, Perth, 12 June.

Forkenbrock, D.J. 2001, ‘Comparison of external costs of rail and truck freight transportation’, *Transportation Research Part A*, vol. 35, pp. 321–37.

—— 1999, ‘External costs of intercity truck freight transportation’, *Transportation Research Part A*, vol. 33, pp. 505–26.

Freebairn, J. 1998, ‘Access Prices for Rail Infrastructure’, *Economic Record*, vol. 74, no. 226, pp. 286–96, September.

Friedlaender, A.F. and Spady, R.H. 1980, ‘A Derived Demand Function for Freight Transportation’, *Review of Economics and Statistics,* vol. 62, no. 3, pp 432–41.

FTI (Fuel Taxation Inquiry) 2001, *History of Fuel Taxation in Australia*, Background Paper to the Fuel Taxation Inquiry, Department of the Treasury, Canberra, September.

Gillen, D. 1997, ‘Efficient Use and Provision of Transportation Infrastructure with Imperfect Pricing: Second Best Rules’, in Greene D.L., Jones, D.W. and Delucchi, M.A. (eds), *The Full Costs and Benefits of Transportation: Contributions to Theory, Method and Measurement*, Springer-Verlag, Berlin, pp. 193–218.

Graham, D.J. and Glaister, S. 2002, *Review of Income and Price Elasticities of Demand for Road Traffic*, Report to the Department of Transport, London, July.

Greene D.L. and Jones, D.W. 1997, ‘The full costs and benefits of transportation: conceptual and theoretical issues’, in Greene D.L., Jones, D.W. and Delucchi, M.A. (eds), *The Full Costs and Benefits of Transportation: Contributions to Theory, Method and Measurement*, Springer-Verlag, Berlin, pp. 1–26.

Gwilliam, K.M., Kumar, A. 2002, *Road Funds Revisited: A Preliminary Appraisal of the Effectiveness of “Second Generation” Road Funds*, The World Bank, Discussion Paper, Transport Division, TWU-47, Washington.

Gwilliam, K. and Shaliza, Z. 1997, *Road funds, User Charges and Taxes,* World Bank, TWU-26, September.

Heggie, I. 2006, ‘Commercialising the Management and Financing of Roads’, in Roth, G. (ed.) *Street Smart: Competition, Entrepreneurship, and the Future of Roads*, The Independent Institute.

—— 1996, *Management and Financing of Roads — Lessons from Experience*, The World Bank, Washington DC, December.

—– 1995, *Management and Financing of Roads: An Agenda for Reform*, Technical Paper no. 275, The World Bank, Washington DC, March.

—— and Vickers, P. 1998, *Commercial Management and Financing of Roads*, World Bank Technical Paper No. 409, Washington DC, May.

Hofstetter, B. and Balmer, U. 2006, *The Swiss heavy vehicle fee: technical solution, operational experience and impact on transport*, imphttp://www.are.admin.ch/imperia/md/content/are/gesamtverkehr/verkehrspolitik/33.pdf (accessed 25 July 2006).

Hofstetter, H. 2006, Electronic tolling system in Austria, Paper and presentation for the ECMT (European Conference of Ministers of Transport) Conference on Road Charging Systems: Technology Choice and Cost Effectiveness, Paris, 1 June.

Humphry, R. 1997, *Review of GBE Governance Arrangements*, Canberra.

IC (Industry Commission) 1997, *Community Service Obligations: Policies and Practices of Australian Governments*, AGPS, Canberra.

—— 1994, *Urban Transport*, Report no. 37, AGPS, Melbourne.

—— 1992a, *Costs and Benefits of Reducing Greenhouse Gas Emissions*, Report no. 15, AGPS, Canberra.

—— 1992b, *Water and Waste Water Products*, Report no. 26, AGPS, Canberra.

Infras/WWW 2000, *External Costs of Transport: Accident, Environmental and Congestion Costs in Western Europe*, International Union of Railways, Paris.

IPART (Independent Pricing and Regulatory Tribunal) 1999, *Aspects of the NSW Rail Access Regime: Final Report*, Sydney, April.

ISC (Interstate Commission) 1990, *Road User Charges and Vehicle Registration: A National Scheme*, AGPS, Canberra.

James, D. 1996, *Beer and Cigs Up': A recent history of excise in Australia*, Background paper no. 5 1995–96, Parliamentary Research Service, Department of the Parliamentary Library, Canberra, April.

Kam, T.C.Y. 2001, *Public Infrastructure Spillovers and Growth: Theory and Time Series Evidence for Australia*, Department of Economics, Melbourne University, Working Paper no. 811, September.

Kells, S. 1997, *Effect on road and rail demand of increased mass limits for heavy road vehicles*, Prepared for the National Road Transport Commission (NRTC), Melbourne Institute of Applied Economic and Social Research, Technical Working Paper no. 34, Melbourne, December.

King, S. 2000, 'Access: what, where and how, Achieving Better Regulation of Services', Productivity Commission and Australian National University Conference Proceedings, AGPS, Canberra, November, pp. 63–93.

Kossak, A. 2006, 'Road pricing in Germany', presentation at the TRB 2006 Annual Meeting, Washington D.C., 24 January.

Krebs, P. and Balmer, U. 2002, *Fair and Efficient: The Distance-Related Heavy Vehicle Fee (HVF) in Switzerland*, Swiss Federal Office for Spatial Development (ARE), Berne.

Ku-Ring-Gai Council 2002, *Traffic and Transport Policy*, Prepared by Traffic and Transport Technical Services, Ku-Ring-Gai Council, NSW, October, http://www.kmc.nsw.gov.au/files/traffictransportpolicy2002.pdf (accessed 17 August 2006).

Laird, P. 2005, *Revised Land Freight External Costs in Australia*, Paper presented to the 28th Australasian Transport Research Forum, Sydney, September.

—— 2002, *Land Freight External Costs in Queensland*, Report for Queensland Rail, December.

Lakshmanan, T.R. and Anderson, W.P. 2002, *Transportation Infrastructure, Freight Services Sector and Economic Growth*, White Paper prepared for the U.S. Department of Transportation, Federal Highway Administration, January.

Land Transport Management Amendment Act 2004, http://www.legislation. govt.nz/browse_vw.asp?content-set=pal_statutes (accessed 20 July 2006).

Link, H., Stewart, L.H., Maiback, M., Sansom, T. and Nellthorp, J. 2000, *The Accounts Approach*, UNITE (Unification of accounts and marginal costs for Transport Efficiency), Deliverable 2, Funded by 5th Framework RTD Programme, ITS, University of Leeds, Leeds, October.

LTNZ (Land Transport New Zealand) 2006a, *National Land Transport Programme 2006-07*, Wellington, 28 June, http://www.ltsa.govt.nz/funding/nltp/2006/docs /nltp-book.pdf (accessed 20 July 2006).

—— 2006b, *Road User Charges*, Wellington, April, http://www.ltsa.govt.nz/ publications/docs/road-user-charges.pdf (accessed 26 May 2006).

—— 2005a, *Post election briefing for the incoming Minister of Transport*, www.landtransport.govt.nz/briefing-for-incoming-minister-2005.html (accessed 3 August 2006).

—— 2005b, *Statement of Intent: 2005 to 2008*, LTNZ, August, Wellington New Zealand www.landtransport.govt.nz.html (accessed 3 August 2006).

—— 2003, *Land Transport Rule: Vehicle Exhaust Emissions 2003*, Rule 33001, http://www.ltsa.govt.nz/rules/vehicle-exhaust-emissions-2003.html (accessed 31 July 2006).

LUCIS 2005, *Infrastructure leverage through the collaboration platform Steel link: a KPI driven approach*, Consultant's report for the Australian Logistics Council (ALC), Sydney.

Martin, Lyn 2005, 'External Accident Costs of Motor Vehicles Revisited', Paper Presented to Australian Transport Research Forum, Sydney, September.

Martin T. 2006, *Relationships Between Road Maintenance and Road Use: Heavy Traffic Roads*, NTC Heavy Vehicle Charges Cost Allocation Workshop, Melbourne, 10–11 April.

—— 2002, 'Estimating Heavy Vehicle Road Wear Costs for Bituminous-Surfaced Arterial Roads', *Journal of Transport Engineering*, vol. 128, no. 2, pp. 103–10.

—— 1994, *Estimating Australia's attributable road track costs*, Research Report no. ARR254, ARRB Transport Research, Vermont South.

Mathers, C., Vos, T. and Stevenson, C. 1999, *The Burden of Disease and Injury in Australia*, AIHW Cat. no. PHE 17, AIHW, Canberra.

MCE (Ministerial Council on Energy) 2006, *Review of the National Gas Pipelines Access Regime Decision*, May.

McCleary, W. 1991, 'The earmarking of government revenue: a review of some World Bank experience', *World Bank Research Observer*, vol. 6, no. 1, pp. 81–104.

McKay, R. 2006, 'Rail raises shield as Truss slams it', *Lloyds List Daily Commercial News*, 22 June, p. 10.

McLay, J. 2006, 'New Zealand's Path to a Good Road', in Roth, G. (ed.) *Street Smart: Competition, Entrepreneurship, and the Future of Roads*, The Independent Institute, California.

Meyrick and Associates 2006a, *National Intermodal Terminal Study*, February.

—— 2006b, *Rail Freight Price Elasticities*, Prepared for the Essential Services Commission (ESC), Melbourne, January.

Ministry of Transport New Zealand 2005a, *Surface Transport Costs and Charges: Main Report*, Booze Allen Hamilton, March.

—— 2005b, *Surface Transport Costs and Charges: Summary of Main Findings and Issues*, Booz Allen Hamilton, March.

MM Starrs Pty Ltd 2005, *Effect of Truck Charges on Rail*, Information Paper Prepared for the National Transport Commission (NTC), May, unpublished.

Mohring, H. 1993, ‘Maximizing, Measuring, and *Not* Double Counting Transportation-Improvement Benefits: A Primer on Closed- and Open-Economy Cost-Benefit Analysis’, *Transportation Research Part B: Methodological*, vol 27, no. 6, pp. 413–24, Great Britain.

NAFI (National Association of Forestry Industries) 2006, website http://www.nafi.com.au/briefings/index.php3?brief=5 (accessed 23 August 2006).

NECG (Network Economics Consulting Group), Clayton Utz 2002, *Submission to the ACCC on Behalf on Toll/Patrick*, Response to Draft Decision on ARTC Undertaking, February.

NEPC (National Environment Protection Council) 2005, *Review of the National Environment Protection (Ambient Air Quality) Measure*, Issues Scoping Paper, October, http://www.ephc.gov.au/pdf/Air_Quality_NEPM/air_review_draft_ISP_October_2005.pdf (accessed 24 July 2006).

Newbery, D.M. 2000, ‘Road pricing and road finance’, in Preston, J., Smith, H., and Starkie, D. (eds), *Integrated Transport Policy: implications for regulation and competition*, Ashgate.

—— 1988, ‘Road damage externalities and road user charges’, *Econometrica*, vol. 56, no. 2, pp. 295–316.

—— and Santos, G. 1999, ‘Road Taxes, Road User Charges and Earmarking’, *Fiscal Studies*, vol. 20, no. 2, pp. 103–32.

New Zealand Business Roundtable 1997, *Options for the Reform of Roading in New Zealand*, Astra DPS, Wellington, June.

NRTC (National Road Transport Commission) 2003a, *Performance–Based Standards: Phase A Standards and Measures Regulatory Impact Statement*, NRTC, Melbourne, December.

—— 2003b, *Performance–Based Standards: Regulatory and Compliance Processes*, Discussion paper, NRTC, Melbourne.

—— 2001, *A Review of the Noise Related Australian Design Rules and Engine Brake Noise*, Discussion paper for Comment, April.

—— 2000, *Updating Heavy Vehicle Charges*, Regulatory Impact Statement, NRTC, Melbourne, February.

—— 1999, ‘Who Carries What Where’, http://www.ntc.gov.au/ViewPage.aspx?page=A02301404400460020 (accessed 1 June 2006).

—— 1998, *Updating Heavy Vehicle Charges*, Technical Report, September.

NSWGIAC (New South Wales Grain Infrastructure Advisory Committee) 2004, *Report on Rail/ Road Options for Grain Logistics*, Sydney, January.

NTC (National Transport Commission) 2006a, *Freight and Mode Share Forecasts: A Review of 'The Future of Freight'*, Information Paper prepared for the NTC by Maunsell Australia Pty Ltd, March.

—— 2006b, *Improving the Regulatory Framework for Transport Productivity in Australia*, Position Paper, Melbourne, February.

—— 2006c, *Information Bulletin*, July.

—— 2006d, *National Rail Safety Bill Approved by Ministers*, Media Release, Melbourne, 6 June.

—— 2006e, *National Vehicle Standards, National Heavy Vehicle Standards, Dimensions, Mass Limits and Registration Charges*, http://www.ntc.gov.au/viewPage.aspx?page=A02300408400160020 (accessed 25 August 2006).

—— 2005a, *Intelligent Access Program (IAP) Stage 1, Implementation Regulatory Impact Statement*, Report prepared for the NTC by Austroads, September.

—— 2005b, *Third Heavy Vehicle Road Pricing Determination: Draft Regulatory Impact Statement*, Melbourne, October.

—— 2005c, *Third Heavy Vehicle Road Pricing Determination: Technical Report*, Prepared for Draft Regulation Impact Statement, Melbourne, October.

—— 2004a, *Future Heavy Vehicle Road Pricing Mechanisms Information Paper: Issues, Options and International Developments*, Report Prepared by Sinclair Knight Merz, Maunsell Australia, MM Starrs Pty Ltd and NTC, Melbourne, October.

—— 2004b, 'Performance-Based Standards Project', http://www.ntc.gov.au/Project.aspx?page=A02400215500000002000475 (accessed 25 August 2006).

—— 2004c, *Third Heavy Vehicle Pricing Determination: Narrowing the Options*, Discussion Paper, Melbourne, October.

OECD (Organisation for Economic Co-operation and Development) 2006a, *Decoupling the Environmental Impacts of Transport from Economic Growth*, Working Group on Transport, Paris, August.

—— 2006b, *Infrastructure to 2030: Telecom, Land Transport, Water and Electricity*, OECD, Paris.

—— 2005a, *Guidelines on Corporate Governance of State-Owned Enterprises*, Paris, April.

—— 2005b, *Performance–Based Standards for the Road Sector*, OECD, Paris.

—— 2005c, *Structural Reform in the Rail Industry*, Directorate for Financial and Enterprise Affairs Competition Committee, Paris.

—— 2000, *Structural Separation in Regulated Industries*, Background Paper to Working Party no. 2 on Competition and Regulation, Paris.

—— 1999, ‘Competition and Railroads’, *Journal of Competition Law and Policy*, vol. 1, no. 1, pp 149–228.

—— 1990, *Environmental Policies for Cities in the 1990s*, OECD, Paris.

—— 1975, *The Polluter Pays Principle – Definition Analysis, Implementation*, Paris, April.

Oehry, B. 2006, *Charging technology and cost effectiveness, GPS, GSM, DRSC, … What to choose?*, presentation at the ECMT (European Conference of Ministers of Transport) Conference on Road Charging Systems: Technology Choice and Cost Effectiveness, Paris, 1 June.

—— 2004, *Swiss Heavy Vehicles Fee LSVA*, 18 March, http://www.rapp.ch/documents/papers/CoR_SwissLSVA_interoperability_18march04_Oe.pdf (accessed 3 August 2006).

O’Malley, B. 2006, ‘All roads lead to our polluted waterways’, *The Courier-Mail*, 8 March, p. 10.

ORAR (Office of the Rail Access Regulator, WA) 2003, *Floor and Ceiling Costs to Apply to Westnet Rail: Determination of the Western Australian Independent Rail Access Regulator*, Perth, September.

—— 2002, *A Brief Comparison of the WA Rail Access Code Approach to Calculating Ceiling Cost with the Conventional Depreciated Optimised Replacement Cost Methodology*, Perth, July.

Otto, G. and Voss, G. 1996, ‘Public Capital and Private Production in Australia’, *Southern Economic Journal*, vol. 62, no. 3, pp. 723–38.

Oum, T.H. and Waters II, W.G. 2000, *Transport Demand Elasticities*, Handbook of Transport Modelling, Pergamon Press, Oxford, Chapter 12.

——, ——, and Yong, J.S. 1990, *A Survey of Recent Estimates of Price Elasticities of Demand for Transport*, The World Bank, WPS 359, Washington DC, January.

—— 1979, ‘A cross sectional study of freight transport demand and rail-truck competition in Canada’, *Rand Journal of Economics*, vol. 10, no. 2, pp. 463–82.

PC (Productivity Commission) 2006a, *Financial Performance of Government Trading Enterprises 2000-01 to 2004-05*, Commission Research Paper, Canberra.

—— 2006b, *Productive Reform in a Federal System*, Roundtable Proceedings, Canberra.

—— 2005a, *Economic Implications of an Ageing Australia*, Research Report, Canberra.

—— 2005b, *Financial Performance of Government Trading Enterprises 1999-00 to 2003-04*, Commission Research Paper, Canberra.

—— 2005c, *Modelling Impact of Infrastructure Industry Change over the 1990s*, Supplement to Review of National Competition Policy Reforms, Inquiry Report no. 33, Canberra.

—— 2005d, *Review of National Competition Policy Reforms*, Inquiry Report no. 33, AusInfo, Canberra.

—— 2005e, *The Private Cost Effectiveness of Improving Energy Efficiency*, Inquiry Report no. 36, AusInfo, Canberra.

—— 2004a, *Australian and New Zealand Competition and Consumer Protection Regimes*, Research Report, Canberra.

—— 2004b, *ICT Use and Productivity: A Synthesis from Studies of Australian Firms,* Commission Research Paper, Canberra.

—— 2004c, *Review of the Gas Access Regime*, Inquiry Report no. 31, AusInfo, Canberra.

—— 2001a, *Cost Recovery by Government Agencies*, Inquiry Report no. 15, AusInfo, Canberra.

—— 2001b, *Review of the National Access Regime*, Inquiry Report no. 17, AusInfo, Canberra.

—— 1999a, *An Assessment of the Performance of Australian Railways, 1990 to 1998,* Supplement to Inquiry Report Progress in Rail Reform, Canberra.

—— 1999b, *Modelling the Regional Impacts of National Competition Policy Reforms*, Supplement to Inquiry Report, Impact of competition Policy Reforms on Rural and regional Australia, Canberra.

—— 1999c, *Progress in Rail Reform,* Inquiry Report no. 6, AusInfo, Canberra.

—— 1998, *The Australian Black Coal Industry*, Inquiry Report no. 1, AusInfo, Canberra.

Pereira, A.M. 2001, 'Public Investment and Private Sector Performance – International Evidence', *Public Finance and Management*, vol. 1, no. 2, pp. 261–77.

Peters, M. 2006, 'Foreword', in Roth, G. (ed.) *Street Smart: Competition, Entrepreneurship, and the Future of Roads*, The Independent Institute, California.

Peter, M.W., Horridge, M., Meagher, G.A., Naqvi, F. and Parmenter, B.R. 1996, *The Theoretical Structure of MONASH-MMRF*, Centre of Policy Studies, Monash University, unpublished.

PJP (Port Jackson Partners) 2005, *The Future for Freight*, A Report Prepared For The Australasian Railway Association, Canberra, February.

Poole, R. and Orski, K. 2006, 'HOT Networks: A New Plan for Congestion Relief and Better Transit', in Roth, G. (ed.) *Street Smart: Competition, Entrepreneurship, and the Future of Roads*, The Independent Institute.

Pollard, R. 2006, 'The Price of a Life', *Sydney Morning Herald*, 2 March, p. 11.

Port of Melbourne Corporation 2006, *Port Development Plan 2006–2035*, Melbourne, August.

PricewaterhouseCoopers, 2000. *Sourcebook on Institutional Development for Utilities and Infrastructure,* Consultants Report prepared for UK Department for International Development (DfID), London.

QCA (Queensland Competition Authority) 2006 *Final Approval QR's 2006 Draft Access Undertaking*, Brisbane, June.

—— 2005, *Decision QR's Draft Access Undertaking*, Brisbane, December.

—— 2001, *Final Decision on QR's Access Undertaking*, Brisbane.

QR (Queensland Rail) 2006, *Draft Access Undertaking*, Brisbane.

—— 2005, *Dust Suppression Trials at South Walker Creek Mine*, December, http://www.freight.qr.com.au/Freight/News_room/Current/News_Articles/051205.asp (accessed 16 August 2006).

RAG (Roading Advisory Group) 1997, *Road Reform: The Way Forward*, Final Report, Wellington, New Zealand, December.

RBA (Reserve Bank of Australia) 2005, *Statement on Monetary Policy*, Sydney, February.

RIC (Rail Infrastructure Corporation) and RailCorp (Rail Corporation New South Wales) 2004, *NSW Rail Access Undertaking*, Sydney.

Rischard, Jean-Francois. 1998, 'Forward', in Heggie, I., and Vickers, P. *Commercial Management and Financing of Roads*, World Bank Technical Paper no. 409.

Road Traffic Technology 2006, *LKW-MAUT Electronic Toll Collection System for Heavy Goods Vehicles*, Germany, http://www.roadtraffic-technology.com/project_printable.asp?ProjectID=3227 (accessed 2 June 2006).

Roden, N. 2006, ‘Development of Highway Concessions on Trunk Roads in the United Kingdom’, in Roth, G. (ed.) *Street Smart: Competition, Entrepreneurship, and the Future of Roads*, The Independent Institute.

Rosalion, N. and Martin, T. 1999, *Analysis of Historical Data on Pavement Performance*, ARRB Transport Research Contract Report no. RE7134, Vermont South, Victoria.

Roth, G. 2006, *Street Smart: Competition, Entrepreneurship, and the Future of Roads*, The Independent Institute. California.

—— 1996, *Roads in a Market Economy*, Ashgate Publishing Limited, England.

Samual, P. 2006, ‘The Way Forward for the Private Provision,’ in Roth, G. (ed.) *Street Smart: Competition, Entrepreneurship, and the Future of Roads*, The Independent Institute, California.

Santos, G., Li, W.W. and Koh, W.T.H. 2004, ‘Transport Policies in Singapore’, in Santos (ed.) *Road Pricing:Theory and Evidence*, Research in Transport Economics, vol. 9, pp.209–35.

SCCTMR (Standing Committee on Communications, Transport and Microeconomic Reform), 1997, *Planning not Patching: An Inquiry into Road Funding*, Neville Inquiry, October, www.aph.gov.au/house/committee/cita/roading/content.htm (accessed 23 July 2006).

Schade, J. and Schlag, B. 2003, ‘Acceptability of Transport Pricing Strategies: An Introduction’, in Schade, J. and Schlag, B. *Acceptability of Transport Pricing Strategies*, Elsevier, Oxford, United Kingdom.

Schulz, G. 2006, ‘HGV tolls in Germany based on satellite and mobile communications technology: innovative, environmentally friendly and fair’, presentation at the ECMT (European Conference of Ministers of Transport) Conference on Road Charging Systems: Technology Choice and Cost Effectiveness, Paris, 1 June.

Segal, L. 1999, *Review of Health Costs of Road Vehicle Emissions*, Centre for Health Program Evaluation, Working Paper no. 94, Melbourne, August.

SKM (Sinclair, Knight & Merz Pty Ltd) 2006, *Twice the Task: A Review of Australia’s Freight Transport Tasks*, NTC, Melbourne.

Small, K., Winston, C. and Evans, C. 1989, *Road Work: A New Highway Pricing and Investment Policy*, Brookings Institution, Washington D.C..

Song, L.L. 2002, 'Public Capital, Congestion and Private Production in Australia', Melbourne Institute Working Paper no. 23/02, November.

Starkie, D. 1990, *The Private Financing of Road Infrastructure*, Rees Jeffreys Road Fund Transport and Society, Discussion Paper 11, UK, January.

Stigler, G.J. 1969, *The Theory of Price*, 3rd edn, Macmillan, London.

Steketee, M. 2006, 'A Federal State of Recalcitrance', *The Australian*, 24 June.

Synergies 2006, *Heavy Vehicle Road Pricing*, Information Paper, Brisbane.

Tasman Asia Pacific 2000, *Competitively Neutral Freight Rates for Road and Rail*, August.

TC (Transport Canada) 2006, *Full-Cost Investigation Project*, Economic Analysis Branch, Ottowa, March.

—— 2005a, *Estimation of the Relationship of Road Deterioration to Traffic and Weather in Canada*, BPR consulting group and Laval University, Québec, May.

—— 2005b, *Interim Estimates of the Financial Costs and Revenues Associated with the Provision of Road Infrastructure in Canada, Provincial Estimates 2000*, Full Cost Investigation Project, Economic Analysis Directorate, Ottowa, April.

Teja, R. and Bracewell-Milnes, B. 1991, *The Case For Earmarked Taxes: Government Spending and Public Choice*, Institute of Economic Affairs, London, UK.

The Audit Office of New South Wales 2006, *Auditor-General's Report: Performance Audit, Condition of State Roads: Roads and Traffic Authority of NSW*, August, Sydney.

The Economist 2004, 'The Road Tolls for Thee', 10 June, http://www.economist.com/displaystory.cfm?story_id=2724381 (accessed 3 August 2006).

Thorpe, N. and Jaensiriask, S. 2000, 'Public attitudes to TDM measures: a comparative study', *Transport Policy*, vol. 7, pp. 243–257.

Tirole, J. 1990, *The Theory of Industrial Organization*, MIT Press, Cambridge, Massachusetts.

Toleman, R. 2003, 'Fund and deliver: paying for land transport in New Zealand', Paper Presented at the Institution of Highways and Transportation Presidential Conference, Edinburgh, 5 September.

Toll Collect 2006, *Truck toll in Germany: user information*, http://www.toll-collect.de/pdf/benutzerinformation/web_einfuhrungstex_gb.pdf;jsessionid=A7BF3A28BC5BD2F0195AE79DC2E7B175 (accessed 26 July 2006).

—— 2004, *An Electronic Toll Collection System*, http://130.236.177.26/~TDMM32/documents/reports/tdmm32_group7.pdf (accessed 16 August 2006).

Tsolakis, D., Houghton, N., Lester, C. and Seethaler, R. 2003, *Valuing Environmental and Other Externalities*, Austroads Publication no. AP–R229/03, Austroads, Sydney.

Tsolakis, D., Patrick, S. and Thoresen, T. 2005, *Guide to Project Evaluation, Part 4: Project Evaluation Data*, Austroads, Sydney.

Tsolakis, D., Naude, C., Preski, K. and Karl, C. 2006, *Review of Recent Developments in Road Pricing, Including Freight*, Phase I: Key Issues and Experience, Austroads Project no. NS1015, Austroads, Sydney.

UK DH (Department of Health) 2004, *Policy Appraisal and Health: A Guide from the Department of Health*, revised draft, November.

US Department of Transportation 2000, *Addendum to the 1997 Federal Highway Cost Allocation Study*, Federal Highway Administration, May.

—— 1997, *Federal Highway Cost Allocation Study*, Final Report, Federal Highway Administration, August.

VCEC (Victorian Competition and Efficiency Commission) 2006, *Making the Right Choices: Options for Managing Transport Congestion*, Draft Report, April.

VicDTF (Victorian Department of Treasury and Finance) 2005, *Rewards from Reform: Higher Productivity and Labour Participation: Preliminary Modelling Results*, August, http://www.dtf.vic.gov.au/dtf/rwp323.nsf/ (accessed 26 July 2006).

Viscusi, W.K. and Aldy, J.E. 2003, 'The value of a statistical life: a critical review of market estimates throughout the world', *Journal of Risk and Uncertainty*, vol. 27, no. 1, pp. 5–76.

VTPI (Victoria Transport Policy Institute) 2005, *Transportation Cost and Benefit Analysis: Techniques, Estimates and Implications*, http://www.vtpi.org/tca/ (accessed 23 March 2006).

Watkiss, P. 2002, *Fuel Taxation Inquiry: The Air Pollution costs of Transport in Australia*, Report prepared for the Commonwealth of Australia, AEA Technology Environment, Oxon.

Williams, R., Greig, D. and Wallis, I. 2005, *Results of Railway Privatization in Australia and New Zealand*, World Bank Group, Transport Paper, Washington D.C., September.

Winston, C. 1983, 'The Demand for Freight Transportation: Models and Applications', *Transportation Research*, vol. 17A, no. 6, pp. 419–27, November.

Zietlow, G. 2006, 'Role of the Private Sector in Managing and Maintaining Roads', in Roth, G. (ed.) *Street Smart: Competition, Entrepreneurship, and the Future of Roads*, The Independent Institute, California.

Zunder, T. and Ibanez, N. 2004, *Road Pricing and Road Freight: European and National Strategies*, November, http://www.bestufs.net/download/articles/FOCUS_NOV_2004_road_price.pdf (accessed 31 May 2006).