22 May 2006

Principles for an efficient road and rail infrastructure charging regime

Australasian Railway Association

NERA
Economic Consulting

MMC Marsh & McLennan Companies

Project Team

Adrian Kemp

Greg Houston

Katherine Lowe

Elisabeth Ross

NERA Economic Consulting
Darling Park Tower 3
201 Sussex Street
Sydney NSW 2000
Tel: +61 2 8864 6500
Fax: +61 2 8864 6549
www.nera.com

Contents

Executive Summary

NERA Economic Consulting has been asked by the Australasian Railway Association to consider principles for the development of an efficient road and rail infrastructure charging regime. This report has been developed in the context of a Productivity Commission review into road and rail infrastructure charges in Australia.

This study is the second of two undertaken by NERA on behalf of the Australasian Railway Association. The first study compares the existing regimes for rail infrastructure charging in each of the main rail jurisdictions in Australia with the current road infrastructure charging regime. The conclusions from that study have been taken into consideration in the development of this paper.

Our approach has been to review various studies that have investigated efficient access charges in the context of either road or rail infrastructure. In our view, the existing literature does not adequately explore the implications of various access charging approaches for competition and efficiency in the freight transport market. It is this question that is the focus of this paper.

Competition in freight transport should be an objective of the regime

As we observe from our comparative assessment of existing road and rail infrastructure charging regimes, the existing infrastructure charging regimes seek to achieve a large number of objectives. The key point of difference between the road and rail regimes is the emphasis on efficiency – for most rail regimes, efficiency is the main objective, while for the road regime it is cost recovery. These differences in objectives have led to differences in the underlying approaches to infrastructure charges, which are likely to affect competition in the freight transport market.

It is therefore important to clarify the existing objectives for road and rail infrastructure charging regimes, preferably into a single efficiency objective. Principles can then be developed to assist with interpreting the efficiency task. A single objective would improve the certainty of the charging regime, and improve consistency resulting in benefits to the infrastructure provider and freight transport markets.

In this regard, we also believe that it is not possible to consider road and rail infrastructure charging in isolation. To ensure that each is consider together, an efficient road and rail infrastructure charging regime should include the objective of seeking to improve the efficiency of the freight transport market through competition.

Efficient infrastructure charging approaches

There are a number of possible approaches to determining infrastructure charges. Marginal cost pricing is considered appropriate where infrastructure is not intended to be renewed, and thereby maximises the use of existing infrastructure. In general however, some recovery of capital infrastructure costs is generally considered appropriate to provide incentives for new infrastructure investment. This creates an expectation that an infrastructure investor is reasonably likely to recover its investment, plus a rate of return commensurate with the risks involved.

The use of multi-part tariffs, including a fixed 'access' charge plus a variable 'usage' charge, is one approach to recover the fixed costs of providing infrastructure. To ensure that competition is not adversely affected in the freight transport market, the approach to including costs in the variable and fixed charges for road and rail infrastructure should be consistent. Consistent in this context means that the same methodology should be used to calculate each cost item, and government contributions should be the same proportion of the total cost of providing road or rail infrastructure services.

Treatment of operating costs is similar between road and rail infrastructure

In general, the current approach to including operating costs into both road and rail charging regimes is similar. Both regimes include most of the costs that are directly attributable to the provision of infrastructure services to road and rail freight operators.

Treatment of capital costs needs further consideration

In contrast, the approach to the recovery of capital costs is significantly different between road and rail infrastructure charging.

For road infrastructure, there is no recovery of the capital costs relating to historical infrastructure investment prior to the introduction of PAYGO, and for new investment, only the actual costs incurred are included in charges. This means that there is no recovery of the financing costs associated with the smoothing involved with the investment cost recovery arrangements. In addition, some costs are excluded from charges to road users, for example a proportion of local road infrastructure costs.

For rail infrastructure, charges generally lie between a floor and ceiling price band. Ceiling prices reflect the historical costs of existing infrastructure investment, valued predominately on the basis of the depreciated optimised replacement cost methodology. Any new infrastructure (apart from that provided by government) is recovered in its entirety, including an allowance for a return on the investment. In practice, however, because it is not possible to recover the ceiling costs from many routes, rail freight operators pay only a portion of the total capital cost.

An efficient road and rail infrastructure charging regime

To ensure that competition is not adversely affected between road and rail freight transport operators, the following areas need to be addressed. For the road charging regime:

- inclusion of a return to capital, to account for the financing costs associated with road infrastructure investment; and
- historical road assets should be valued using a DORC methodology identical to rail assets, and included in the cost base.

For the rail charging regimes:

- equivalent treatment of land and easements in DORC valuations.

Government contributions should be an equal proportion of the total cost of providing either road or rail infrastructure

The treatment of government contributions between both road and rail infrastructure varies between the existing regimes. The National Transport Commission (NTC) includes a large proportion of government infrastructure investment in charges (albeit excluding an allowance for the cost of capital), however some local government infrastructure costs are excluded. For rail charges, government infrastructure investment is usually netted out of the revenue recovered from rail operators.[1] This means that the government contribution is not recovered from rail operators.

Competitive neutrality between road and rail transport operators requires any government contributions for infrastructure provision to be an equal proportion of the total cost of providing road or rail infrastructure.

An efficient road and rail charging structure

An efficient road and rail infrastructure charging structure requires:

- Charges to reflect the cost of providing infrastructure – this requires the removal of any cross-subsidies that may arise between alternative users, particularly in terms of how they access infrastructure. Mass-distance charges are one way of ensuring this requirement is satisfied by both road and rail infrastructure charges;

- Variable charges should reflect marginal costs, with fixed charges recovering remaining capital costs – this requires a standardisation in the approach to capital cost recovery, and treatment of government capital contributions for each infrastructure sector.

Transitioning to an efficient infrastructure charging regime

To maximise the potential efficiency benefits associated with reforms to the road and rail infrastructure charging regimes, we suggest that the initial focus be on the main interstate freight corridors. It would be possible to calculate an asset value for both road and rail infrastructure in a consistent manner for these routes, and to address our concerns by ensuring that infrastructure investment is depreciated and earns a rate of return commensurate with its risks.

Government contributions can then be adjusted over a number of years to transition existing charges to a more competitively neutral basis, while also providing improved incentives for efficient new infrastructure investment.

Best practice principles for road and rail regulatory institutional design

As part of this study, we also developed principles for road and rail regulatory institutional design and assessed the existing regimes against these principles. The principles include:

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[1] As QR is vertically integrated, government owned business, contributions from government can occur via equity injection or via the purchase of services directly by the government.

- transparency and predictability (to create an appropriate climate for infrastructure investment);
- adaptability of the regime to respond to changes in circumstances, through a transparent and equitable process;
- taking account of compliance costs and therefore unnecessary duplication of effort;
- enforceability of the arrangements; and
- accountability of all parties and mechanisms for review and appeal.

A number of specific concerns with the current regulatory approaches in road and rail arise from this consideration. They are:

- the incentives within the current road infrastructure charging methodology for efficient investment in, or provision of, road infrastructure, because of the National Transport Commission approach of including actual infrastructure costs into charges, without considering whether the costs are efficiently incurred; and
- the need to align the objectives between the two regimes, to ensure that the methodological approaches to setting infrastructure charges do not lessen competition in the freight transport market.

Policy areas for further consideration

In summary, the priority policy conclusions that we identify in this paper are:

- the need to define a single regulatory objective, ideally emphasising efficiency in the use and provision of, road and rail infrastructure;
- any proposed changes to road and rail infrastructure charging regimes should have regard to the impact on competition in the freight transport market;
- any new future capital expenditure for road or rail infrastructure should be fully included in the cost base to calculate charges, including the cost of financing infrastructure investment;
- the proportion of cost recovery from operators should be consistent for road and rail infrastructure, with historical asset costs being based on a DORC valuation;
- there is a need to examine the treatment and extent of government contributions to the provision of both rail and road infrastructure, and how these are included in charges;
- the rail regulatory institutional structure should be reviewed with the aim of developing a nationally consistent approach to minimise the cost of regulatory compliance by rail operators; and
- the road regulatory institutional structure should be reviewed to improve accountability and transparency of decision making, and to provide incentives for efficiency improvements in the provision of and investment in future road infrastructure.

1. Introduction

NERA Economic Consulting has been asked by the Australasian Railway Association (ARA) to consider principles to apply to the development of an efficient road and rail infrastructure charging regime in Australia. This issue is particularly important at this time because the Productivity Commission has recently commenced a review of road and rail freight infrastructure pricing in Australia. The study will assist the ARA to consider issues surrounding the development of an efficient road and rail infrastructure charging regime in light of the Productivity Commission's review.

This study is the second of two undertaken by NERA for the ARA in relation to road and rail infrastructure charging. The first entitled, *A comparative assessment of road and rail charging regimes in Australia*, provides an overview of the different rail regimes currently in place in the key rail jurisdictions in Australia and compares these against the existing road regime. The analysis highlights the main differences between the various regimes, in particular in relation to cost items included in charges, approaches to price structures and regulatory methods and institutional structures. We draw upon this analysis as part of our considerations in this report.

The Productivity Commission's review follows the recent Council of Australian Government's communiqué of 10 February 2006, outlining a new National Reform Agenda with a renewed focus on competition issues in a number of key infrastructure areas. These areas include energy, transport, infrastructure regulation and infrastructure planning. In the transport sector, COAG agreed to:[2]

> Improve the efficiency, adequacy and safety of Australia's transport infrastructure by committing to high priority national transport market reforms including to:…
>
> - harmonise and reform rail and road regulation within five years, including productivity-enhancing reforms, improved road and rail safety regulation and performance-based standards for innovative vehicles that do less road damage.

The terms of reference for the Productivity Commission review indicate that its purpose 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.

To assist the ARA and the Productivity Commission's review, this report develops principles that should be applied for an efficient road and rail charging regime. Our approach is to review the objectives for road and rail infrastructure charging and to define the concept of competitive neutrality, before examining the significant economic literature that discusses efficient pricing of access to monopoly infrastructure. This involves a consideration of marginal cost pricing, Ramsey pricing and multi-part tariffs. Unlike much of the existing literature, we also examine the implications of alternative access pricing approaches for infrastructure, on competition in the freight market, particularly between road and rail modes.

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[2] Page 6, Council of Australian Governments Meeting, 10 February 2006, Communiqué.

Next, we draw upon our comparative assessment review of the existing rail and road charging regimes to consider the main differences in cost items included in road and rail charges. From this examination, we identify what items should be properly included in an efficient charging regime, which minimises negative competitive impacts in the freight market. This includes a discussion on the appropriate treatment of government contributions.

Finally, we develop 'best practice' guiding principles to evaluate alternative regulatory approaches and institutions for the road and rail infrastructure charging regimes. Applying these principles to the existing road and rail charging regimes allows the identification of a number of issues for future policy consideration.

The general approach taken in this study is to identify policy issues and guiding principles rather than develop firm recommendations or evaluate alternative regulatory or institutional options. The future detailed work that will be necessary to harmonise road and rail infrastructure charging regimes, and examine the implications of possible options, will need to be clear about these principles in the first instance. Once general principles have been established and agreed amongst interested stakeholders, the next stage of examining proposed detailed regulatory reforms can commence.

The remainder of this report outlines our analysis in more detail:

- Chapter 2 defines the regulatory efficiency objective, defines competitive neutrality as it applies to the road and rail freight market, and examines the economic theory relating to pricing access to monopoly infrastructure;

- Chapter 3 outlines the requirements for an efficient road and rail infrastructure charging regime that considers the impact on competition in the freight market. We discuss costs that should be included in an efficient road and rail infrastructure charging regime, the treatment of government contributions, and the structure of efficient charges;

- Chapter 4 discusses how to transition to the efficient road and rail infrastructure charging regime as outlined in chapter 3;

- Chapter 5 develops 'best practice' principles for regulatory and institutional design and applies these principles to examine the current road and rail charging regimes; and

- Chapter 6 provides our conclusions and identifies the policy steps that could be undertaken simply and easily, and which could result in potentially large initial efficiency benefits.

2. Principles for efficient road and rail infrastructure charges

Part of the Productivity Commission's review of road and rail freight infrastructure charging focuses on principles for the development of an efficient road and rail infrastructure charging regime. The Commission indicates that it:[3]

> considers that a key contribution of this review would be to establish a framework and principles for pricing road and rail infrastructure

While there has been significant work undertaken to examine questions surrounding efficient access charges in rail and, separately, the approach to pricing for road infrastructure[4] there has not been a systematic examination of the principles for efficiency for these two infrastructure sectors together, and the implications for efficiency in the freight transport market.[5]

In this chapter, we aim to examine the principles that are appropriate for an efficient road and rail infrastructure charging regime. In the next section, we define the objectives for an efficient road and rail charging regime, acknowledging that there are three areas of interest – the road infrastructure sector, the rail infrastructure sector, and the freight transport market.

In section 2.2 we consider the importance of competition for driving efficiency in the freight transport market. We go on to define the concept of competitive neutrality in this context.

Section 2.3 examines approaches to pricing access to either road or rail infrastructure. This includes a discussion on marginal cost pricing, and approaches to allocating costs above the marginal cost. The implication of these alternative pricing approaches for allocative, productive and dynamic efficiency of the infrastructure market is considered. Finally, the impact of alternative pricing approaches for competitive neutrality in the freight market is discussed.

The key conclusions arising from this discussion are:

- the promotion of efficiency in the use, provision of, and investment in, road and rail infrastructure should be the primary objective of a combined road and rail infrastructure charging regime;
- because road and rail infrastructure is an intermediate input to the provision of freight and passenger transport services, when designing approaches to efficiency in the road and rail infrastructure markets, one should be mindful of implications for efficiency in the freight transport market;
- productive, allocative and dynamic efficiency in the freight market requires that, to the extent there is substitution in transport services between road and rail, competitive neutrality is maintained between the regulatory access charging regimes;

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3 Productivity Commission (2006), page 6.

4 See for example, BTRE (2003a), NERA (1998), BTRE (2003b), NTC (2004), Freebairn, (1998).

5 BTRE (1999) examines the question of competitive neutrality between road and rail, however there are a number of assumptions made in the paper, which while appropriate for the context in which it was written, mean that a more detailed examination of competition issues between the road and rail freight markets is yet to be undertaken.

- competitive neutrality means ensuring that the regulatory objectives, legal and institutional structures, treatment of costs and government contributions, and pricing structures are consistent between each mode;

- the absence of consistent treatment in these matters will have implications for competition between road and rail transport operators, to the long term detriment of customers in the freight transport market; and

- while two-part tariffs ensure that there are appropriate incentives for investment in road and rail infrastructure by allowing the reasonable expectation of recovery of fixed costs, the approach to allocating costs amongst operators, and particularly between road and rail, has important competitive effects.

2.1. Objectives of the regulatory regime

Our comparative assessment study identified that the objectives of the current regulatory regimes for road and rail infrastructure pricing are very different. These differences mean that the current approach to road and rail pricing diverge, with implications for efficiency in the freight market.

The objective of road infrastructure pricing as approved by the Australian Transport Council (ATC) and implemented by the National Transport Commission (NTC) is:[6]

> prices should promote optimal use of infrastructure, vehicles and transport modes.

This objective for the promotion of optimal use of infrastructure is subject to a number of constraints including:

- full recovery of allocated infrastructure costs while minimising both the over and under recovery from any class of vehicle;

- cost effectiveness of pricing instruments;

- transparency;

- the need to balance administrative simplicity, efficiency and equity (eg impact on regional and remote communities/access);

- the need to have regard to other pricing applications such as light vehicle charges tolling and congestion.

The NTC needs to ensure these constraints are satisfied prior to considering the efficiency question. In addition, the NTC must also determine the relative importance of each constraint against the others, since at times they are likely to conflict.

In contrast to road, rail infrastructure charges are based, in general, on a negotiate and arbitrate regulatory approach as defined in the relevant state-based regime, or in the case of inter-state rail network operated by the Australian Rail Track Corporation (ARTC), within its

6 NTC, Road Use Pricing Principles.

access undertaking. The regimes have different specified objectives, but the common elements of these regimes include:

- promotion of the efficient use of infrastructure;
- non-exploitation of monopoly position by infrastructure providers;
- incentives to reduce infrastructure costs; and
- promotion of third-party access to infrastructure.

The current objectives in both regimes focus on efficiency in the use of road and rail infrastructure (allocative efficiency), and on minimising the cost of infrastructure provision, (productive efficiency). However, these efficiency objectives are mixed in with a number of other objectives including cost recovery in the case of road infrastructure provision, and non-exploitation of monopoly position in the case of rail infrastructure provision.

There are two concerns that arise upon examining the existing objectives for the road and rail infrastructure charging regimes. The first is the omission of any reference to the promotion of efficient investment in infrastructure, and the promotion of competition between freight transport modes, both of which can lead to dynamic efficiency benefits. The current regulatory objectives overlook two important potential sources of efficiency.

The second concern is the large number of objectives that each of the regimes is seeking to achieve. By having many objectives, the regulatory approaches necessarily need to trade off between incentives for the achievement of the various regulatory objectives. This can create unnecessary uncertainty and problems with consistency in the regulatory approaches used in each regime.

Ideally, the regulatory regimes for both road and rail infrastructure charging should have a single objective, which is the promotion of efficiency. This would ensure that there is certainty, consistency and clarity in the regulatory purpose, thereby minimising the scope for differences in regulatory treatment affecting competition between each mode.[7] A single regulatory objective can then be supplemented by regulatory principles that seek to provide additional guidance on the approach to achieving the regulatory objective, without detracting from the regulatory purpose embodied in the single objective. The use of a single regulatory objective is also being considered in reforms being undertaken in the energy industry for similar reasons.[8]

The Ministerial Council of Energy, while considering reforms to the regulatory and institutional structures for the energy industry, identified problems associated with conflicting objectives in the existing regime and the implications of those conflicts for certainty within the regime. To this end, the MCE is considering the adoption of a single regulatory objective and has sought to develop pricing principles that provide guidance on the application of the regulatory objective. In this way, certainty in the application of the regulatory regime is expected to be improved.

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7 We discuss this further in section 2.2.

8 Expert Panel on Energy Access Pricing, (2006).

When considering the objective of efficiency, economists generally identify three forms of efficiency. These are:

- efficiency in the use of infrastructure - commonly called allocative efficiency;
- efficiency in the provision of infrastructure – commonly called productive efficiency; and
- efficiency associated with the maximisation of opportunities to improve ongoing efficiency in the use and provision of infrastructure over time – commonly called dynamic efficiency.

In addition to these three forms of efficiency, in the context of a road and rail infrastructure charging regime, we are also interested in efficiency in the provision of freight services. We discuss this issue further in section 2.2 below.

Efficiency in the use of infrastructure requires both an appropriate level of use, meaning utilisation of the existing rail and road infrastructure, and an appropriate mix of use between road and rail infrastructure. Both of these requirements are achieved through an infrastructure charging framework that reflects the cost of providing infrastructure services to both road and rail freight operators.

Efficiency in the provision of infrastructure generally has two aspects. The first requires that road and rail infrastructure services, including asset renewals and day-to-day operations, are provided at least cost by the infrastructure provider. It reflects both cost efficiency, and the provision of an appropriate quality of infrastructure service. The second requires the provision of adequate new infrastructure investment at least cost.

Dynamic efficiency is where new technology, innovative practices or ideas provide opportunities to reduce the costs or improve the quality of providing infrastructure services. It is generally considered by economists to be encouraged through the development of competition in the delivery of services. Dynamic efficiency can therefore be enhanced through reducing potential barriers to competitive entry by infrastructure users.

The current road and rail infrastructure charging regimes do not comprehensively address these three forms of efficiency. In addition, the current regimes include additional objectives that detract from the efficiency objective, causing uncertainty in the regulatory regimes and inconsistency in the approach between regimes.

This suggests that a single efficiency objective for road and rail infrastructure charging of efficiency in the use and provision of, and investment in road and rail infrastructure would deliver improved outcomes from the regulatory infrastructure charging regime. In practice, an infrastructure charging regime may need to trade off incentives for the achievement of each of the three components of efficiency. For example, incentives to maximise the efficient provision of road or rail infrastructure are likely to come at the expense of efficiency in the use of infrastructure. These tradeoffs will depend critically on the circumstances facing a particular industry, at a particular point in time. The need for tradeoffs in the regulatory objectives however, should not reduce the importance of focusing an infrastructure charging regime on efficiency.

In response to proposals to include an objective for Part IIIA of the Trade Practices Act (TPA), the Federal Government has introduced a Bill[9] which proposes the following objects clause be included:

> The objects of this Part are to:
>
> (a) promote the economically efficient operation of, use of and investment in the infrastructure by which services are provided, thereby promoting effective competition in upstream and downstream markets; and
>
> (b) provide a framework and guiding principles to encourage a consistent approach to access regulation in each industry.

Similarly the MCE Expert Panel proposed the following objects clause for the National Electricity Law, noting that efficiency was the primary objective, which in turn is in the long term interests of consumers:[10]

> The object of this law is to promote efficient investment in, and efficient operation and use of, electricity services for the long term interests of consumers of electricity with respect to price, quality, reliability and security of supply of electricity and the reliability, safety and security of the national electricity system.

In light of the proposed objects clause for Part IIIA of the TPA and recommendations in other industries, we recommend the following objective for a road and rail infrastructure charging regime:

> to promote efficient investment in, and efficient operation and use of, road and rail infrastructure, thereby promoting competition in the freight transport market.

This objective aims to highlight the importance of promoting efficient investment in road and rail infrastructure, in addition to its efficient operation and use. It is the result of seeking efficiency in each of these areas that promotes competition in the freight transport market. We consider the implication of seeking efficiency in the road and rail infrastructure charging regimes on competition in the freight transport market in the following section.

2.2. The importance of competitive neutrality

With the promotion of efficiency as the primary overarching objective of a new road and rail infrastructure charging regime, the implications of seeking efficiency in the provision of road and rail infrastructure for the freight transport market are also important to consider. Ideally, we should seek to promote efficiency in both the provision of road and rail infrastructure and within the freight transport market. In doing so, we would expect net benefits to the welfare of Australians to be maximised.

Competition is generally considered by economists to be the best way of promoting efficiency, and in particular, dynamic efficiency in an industry. For the efficiency benefits to ensue, competition needs to be effective, meaning that there needs to be sufficient

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9 Trade Practices Amendment (National Access Regime) Bill 2005.

10 Page 40, Expert Panel on Energy Access Pricing, (2006).

competitors such that no one provider can dominate a segment of the market, thereby having sufficient market power to influence prices.

In the context of freight transport provision, this means maximising the opportunity for multiple providers to compete with each other. There are two ways this can occur. The first is within a particular transport mode. Ideally, regulatory systems should ensure the free entry of freight providers within a particular mode, whether it is road or rail. This means removing any legal barriers to entry and ensuring that access terms and conditions are fair and equitable. Current access pricing arrangements for rail infrastructure, seek to remove these barriers to competition for rail transport operators. Similarly, there are no legal or institutional barriers for new operators entering the road transport industry.

The second is by ensuring that competition between transport modes is not inhibited. Competition between modes can be inhibited by different legal or regulatory treatment and/or differences in infrastructure charges that are unavoidable by the operator. Ensuring there are no differences in legal or regulatory treatment between the potentially competitive modes suggests that the regulatory treatment for access to road and rail infrastructure should be the same. This treatment relates to all aspects of regulation from the regulatory objectives to specific treatment of costs included in prices and government contributions.

Eliminating differences between the methodologies used to determine the costs included in road and rail infrastructure charges is therefore an important part of ensuring competition between transport substitutes is not inhibited. The impact of input cost differences on competition between competitors is not a unique problem for the road and rail freight transport market. It also arises for example, in access charging disputes to bottleneck infrastructure where access price discrimination between competitive operators can impact on competition between those operators. In this example, the only difference in an access charge that is not anti-competitive is when the direct cost of providing access to competitive operators is different.

However, when access charges differ for reasons unrelated to differences in the direct cost of providing access, then the resulting input cost differences affect operators' ability to compete equally. Some marginal operators may even exit the industry because differences in access charges mean that they are no longer able to compete against other operators. This results in the inefficient provision of the good or service in the competitive industry, as a result of unjustified differences in access charges between competitors.

While this example relates to competition within an industry that uses common bottleneck infrastructure, it is analogous to the affect on competition in an industry that uses different infrastructure that is regulated differently. If an unavoidable infrastructure charge, such as charges for rail or road infrastructure, is calculated using different regulatory methodologies, then this will result in the inefficient use of the two modes of transport, compared with the circumstance where infrastructure charges are calculated using consistent methodologies. The efficiency losses in this situation could also be potentially large.

It is desirable therefore, to maximise efficiency in the provision, use and investment of road and rail infrastructure in addition to efficiency in the freight transport market, to ensure that the regulatory methodology used to calculate the costs included in road and rail infrastructure charges is consistent. This will promote competition between road and rail transport

operators for the benefit of freight transport customers. It is this consistent regulatory treatment[11] that is necessary for the promotion of competitive neutrality.[12]

We therefore interpret competitive neutrality as requiring:

i. an absence of differential treatment of operating and capital costs included in road and rail infrastructure charges; and

ii. a common approach to the treatment of government contributions.

In summary, there are two issues that are important to any consideration of an efficient road and rail infrastructure charging regime. The first is developing a clear objective for the regime, ideally being efficiency in the provision, use and investment in, road and rail infrastructure. The second issue is to consider the implications of different regulatory approaches to achieve efficiency in the infrastructure provision sectors on competition in the freight transport market. It is therefore important to consider both efficiency in the use, provision and investment in road and rail infrastructure, and competitive neutrality in the road and rail freight market, when designing an efficient road and rail infrastructure charging regime.

2.3. Approaches to charging for access to road and rail infrastructure

The choice of approach to charging for road and rail infrastructure will depend on the characteristics of the industry and the objectives that are being sought through pricing. In terms of characteristics these include the extent of excess infrastructure capacity, the existing uses of the infrastructure, and the extent of economies of scale.

As a matter of economic theory, prices that are set at marginal cost are expected to result in an efficient outcome. This general approach however needs to be qualified as it assumes a static market and does not take into consideration the implications for financial viability of the infrastructure industry and the need to provide appropriate incentives for ongoing infrastructure investment. Deviations from marginal cost pricing are therefore likely to be appropriate in certain circumstances. There are a variety of approaches that have been used to price above marginal cost, to recover fixed costs. However, the choice of approach has implications for the balancing of the efficiency objectives as discussed in section 2.1 above.

In this section we discuss the economic theory underlying marginal cost pricing as a basis for considering an efficient charging regime for road and rail infrastructure. This discussion is based on a large amount of literature on infrastructure pricing and pricing for public utilities that has developed over the last 20 years.[13] In so doing, we consider approaches to recovering more than the marginal costs, including average cost pricing, Ramsey pricing and multi-part tariffs. The implication of these approaches for achieving our efficiency objective is considered in detail.

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[11] We consider further what is meant by consistent treatment in chapter 3.

[12] Like many authors we also draw a distinction between the uses of the term competitive neutrality as ensuring that the provision of goods or services by Government in competition with the private sector is neutral. In this instance, competitive neutrality refers to the identical treatment of regulatory and uncontrollable input costs to ensure there is no lessening of competition in the freight transport market.

[13] See for example, BTRE (2003a), NERA (1998), BTRE (2003b), NTC (2004), and Freebairn, (1998).

Much of the existing literature on efficient infrastructure charging focuses on maximising efficiency in a particular industry or is otherwise fairly general. However, this section considers the implications of implementing an efficient pricing regime in the road and rail infrastructure sector individually, and also on competitive neutrality in the freight market. This aspect of the infrastructure charging problem is not adequately addressed in the existing literature and raises a number of issues that need to be considered.

2.3.1. Marginal cost pricing

As a matter of principle, it can be shown that efficiency is maximised when prices are set equal to marginal costs. Marginal cost is the cost associated with providing the next infinitesimally small increment of supply. It differs from the related concepts of incremental cost and avoidable cost by the size of the increment of supply. Incremental cost usually refers to the average cost of increasing supply by one unit. It takes into consideration the lumpy nature of capital investments that may be needed to increase supply and divides the total cost of a supply increment, by the increase in supply a new capital investment may produce. Avoidable cost in contrast, is the average cost that would no longer be incurred if existing capacity was no longer used.[14]

The intuition behind the marginal cost pricing rule in economics is straightforward. It assumes that once an investment is made, it is beneficial to maximise its use, especially if there is no alternative use for the infrastructure. Take for example a major highway connecting Dubbo and Sydney. It would not make sense, given a number of qualifications that will be discussed later, after spending $100 million building the road for it to not be fully used. If there was a specific charge for using the road and drivers choose not to use the road because the charge seeks to recover capital costs in addition to any operating costs, then this would not be an efficient use of the new road. However, if charges only equal the marginal costs of using the road, perhaps relating to wear and tear, then more drivers are likely to use it, and the road would be considered efficiently utilised.[15]

When examining the application of the marginal cost pricing rule, there are a number of issues that need to be considered. The first is what costs to include in marginal costs. For rail infrastructure, Freebairn (1988) identifies marginal costs as including: "traffic sensitive repairs and maintenance costs; in special cases a congestion premium; and, non-traffic sensitive operating costs when the decision to close a line is feasible."[16] For road infrastructure these might similarly include: road wear and tear included in road maintenance costs; and, a congestion premium.

Kahn (1988) provides a good description of the costs to be included in marginal cost:[17]

> the essential criterion of what belongs in marginal cost and what not, and of which marginal costs should be reflected in price, is causal responsibility. All the purchases of any

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[14] See Kahn, (1988), page 66.

[15] This example is not to suggest that marginal cost pricing is the answer to road infrastructure charging. It is simply to highlight the intuition between marginal cost pricing and efficiency in economics.

[16] Freebairn, (1998), page 291.

[17] Kahn, (1988), Volume I, page 71.

> commodity or service should be made to bear such additional costs – *only* such, but also *all* such – as are imposed on the economy by the provision of one additional unit.

This suggests that the costs to include in marginal cost pricing are all of the variable costs, including future costs, arising from the use of a good or service at a particular point in time.

The second issue is that ideally, marginal costs should include the external costs associated with use of road and rail infrastructure. These social costs include noise and air pollution, and safety regulatory costs, in addition to the congestion impacts. We discuss the inclusion of external costs in charges in section 3.1.3 below.

The third is to consider the timing for the calculation of marginal costs. The preceding discussion focused on the concept of short run marginal cost (SRMC) meaning that there is no opportunity to increase the capacity of existing infrastructure. In this way, SRMC is likely to fluctuate based on capacity constraints, hence the inclusion of congestion charging in the earlier definition of the costs included in SRMC.

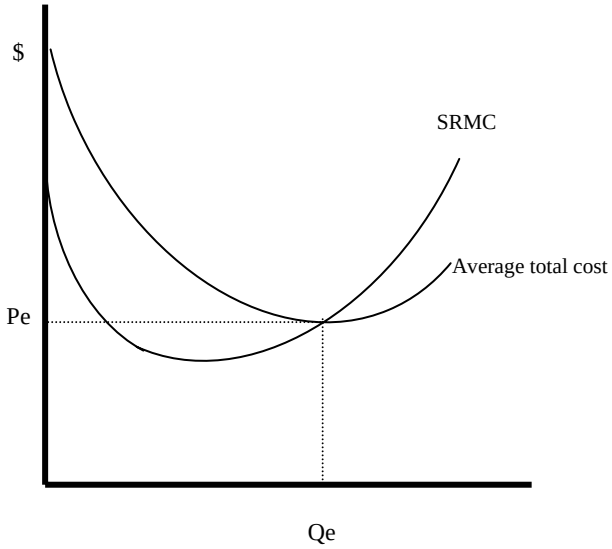
The alternative marginal cost concept is called long run marginal costs (LRMC) and is where infrastructure capacity is allowed to vary, meaning that it includes the costs of increasing capacity by one unit. Which concept of marginal cost is appropriate depends on the objectives of the regulatory regime. It is important to realise when thinking about the concept of LRMC that it is a forward looking concept. It does not simply equal the SRMC plus a return on, and allowance of depreciation for historical capital investment. Rather, LRMC is the marginal opportunity cost of providing access including the incremental cost of increasing capacity by one unit in the future. It therefore needs to reflect current technology and methodologies for constructing new infrastructure in its assessment.

While theory suggests that marginal cost pricing will deliver an efficient outcome, the concept of efficiency that it is based on is somewhat limited. It assumes that we are only interested in maximising the efficient use of the existing infrastructure, or in other words maximising allocative efficiency.

In practice, however, when formulating an infrastructure charging regime, we are also interested in ensuring that there are appropriate incentives for dynamic efficiency, meaning incentives for ongoing efficiency improvements through time associated with the adoption of new technology and innovation, and for efficient investment in infrastructure. For this end, it is important that a potential infrastructure investor has a reasonable expectation that it will recover the costs of investing in the new infrastructure. Without this reasonable expectation, it is unlikely that a rational investor would ever invest in new infrastructure.

For a competitive industry, pricing at short-run marginal cost may produce an expectation that investment costs will be recovered in the medium to long term. This is because, while SRMC may be below average total costs for much of the time, as demand increases through time, including congestion costs in SRMC will result in these costs exceeding average total costs. Over the medium to long term, the extent of over recovery of average total costs when demand is high, may be sufficient to offset under-recovery when demand is low, thereby resulting in the infrastructure owner recovering all of their investment costs over the life of the asset. This situation is shown diagrammatically in Figure 2.1 below.

Figure 2.1
Relationship between SRMC and Average Total Cost



Relying on SRMC exceeding the average total cost to recover infrastructure costs in the medium to long run is however, likely to be considerably uncertain for road and rail infrastructure, and relies on the infrastructure provider knowing, and being able to modify infrastructure charges in response to changes in underlying conditions. In practice, SRMC are not likely ever to exceed average total cost, since capacity is likely to be increased before this eventuality. This is because it is desirable to avoid capacity constraints in road or rail infrastructure, due to the expected cost to users of the freight services from constraints. In general therefore, infrastructure capacity often exceeds current usage.[18]

One of the key problems with a marginal cost based pricing approach, therefore, is its inability to recover the capital investment costs, which has implications for dynamic efficiency in the provision of road and rail infrastructure. We discuss approaches to resolving this, by deviating from the marginal cost pricing approach in the subsequent section below.

Further problems with applying marginal cost pricing include:

- it can result in fluctuations in prices charged to operators, thereby creating uncertainty and administrative difficulties in its application, particularly for road infrastructure; and
- it creates incentives for the infrastructure provider to not expand infrastructure capacity because of the super-normal profits that are generated when capacity is constrained.

Finally, Kahn (1988) highlights that marginal cost pricing may not provide the appropriate pricing guide in an individual market or industry, unless it is applied in all markets in the

[18] The recent problem with insufficient investment in coal loading capacity in Dalrymple Bay highlights the cost implications of capacity constraints arising.

economy. This observation is particularly relevant to consideration of a pricing approach for both road and rail infrastructure. Kahn explains the problem as follows:

> If, for example, the price of a good A is held above marginal cost, perhaps by monopoly or by disproportionately heavy taxation, then it may produce a worse instead of a better allocation of resources to push the price of its substitute, B, down to marginal cost. …
>
> The "first best" solution, in the foregoing example, would be to reduce the prices of both A and B (and of all other goods and services in the economy) to marginal costs; the "second best" *might* be to keep the price of B above its marginal cost, perhaps by means of an excise tax, in order to avoid distorting buyers' choices between it and A.

This example highlights the importance to efficiency of consistent pricing approaches for infrastructure services that are substitutes. As we have discussed, the "first best" solution of pricing at marginal cost is unlikely to be appropriate to the road and rail infrastructure industries because of the problems associated with cost recovery and investment. The "first best" regulatory approach however is likely to be treating both the road and rail infrastructure industries consistently. The following section approaches that have been developed to allocate the recovery of fixed costs, while minimising the efficiency implications for the use of road and rail infrastructure.

2.3.2. Pricing to recover fixed costs

There are a number of approaches that have been developed to address the issue of the recovery of fixed infrastructure costs, without deviating significantly from the goal of maximising allocative efficiency. These include:

- funding fixed costs directly via government subsidies;
- charging on the basis of average costs;
- implementation of Ramsey pricing; and
- the use of multi-part tariffs.

In the remainder of this section, we discuss each of these approaches and consider their application to road and rail infrastructure pricing.

Funding fixed costs via a government subsidy

One approach to funding the fixed cost gap where a marginal cost pricing approach is adopted is via the use of taxation revenue through a government subsidy. If tax revenue could be collected at no cost, and also did not distort productive outcomes, then this would be the most appropriate approach to funding the cost gap. In practice however, this is unlikely to be the case.

The approach of using taxation to fund capital costs for infrastructure has been implemented in the rail infrastructure industry in Sweden. Access charges are based on marginal cost, with all infrastructure investment being provided by the government owned and operated rail infrastructure provider, Banverket. This approach has resulted in access charges in Sweden

being the lowest in Europe and rail freight having a modal share of 24 per cent in 2004, compared with 38 per cent for road freight.[19]

The main problem with using direct government subsidies for the entire costs of road and rail infrastructure is that it removes any incentives that the rail or road infrastructure providers may have for efficiency improvements in their investment decisions. This is one of the problems with the current approach to determining road capital expenditure requirements in the current government funded model. These incentive effects would need to be considered if a complete government funded capital cost approach was implemented.

Average cost pricing

Average cost pricing involves dividing the total costs of providing the good or service by the expected demand for the good or service. In this way, so long as actual demand equates to expected demand then the total costs, including fixed capital costs, are recovered.

This approach may be intuitively appealing because every operator is treated equally with respect to input costs for the provision of freight transport services. However, there are a number of problems with its application. The first is that it relies on being able to adequately value the capital costs of infrastructure provision and is therefore sensitive to assumptions regarding the valuation approach, depreciation and an appropriate rate of return to apply.

The second is that, while recovering the actual historical total costs,[20] these costs are sunk and therefore are not relevant from an economic efficiency perspective. By including these costs, allocative inefficiencies are generated, leading to some operators no longer utilising the infrastructure compared to the marginal cost pricing approach. While these allocative inefficiencies from average cost pricing may not outweigh the benefits for dynamic efficiency, to the extent that alternative approaches exist, they are likely to be preferred.

Ramsey pricing

Ramsey pricing is where common costs are allocated on the basis of the demand responsiveness of a particular operator to changes in the price of access, such that allocative efficiency losses associated with recovering the common costs are minimised. It proposes that low demand responsive operators pay a greater proportion of the common fixed costs compared to highly price responsive operators.[21]

To implement a Ramsey pricing regime, it is also important to consider whether there are substitutes for the product. To the extent there are substitutes, for example road transport compared to rail transport, it is important to consider the cross price elasticities between these

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[19] These modal shares are for long distance freight (> 100 km) and are based on data measured in billions of tonne km. Source: Marknadsanalys av godstransporterna och persontrafiken for ar 2004 and Bankverket memo 31 March 2005. The remaining 38 per cent is represented by international sea freight, 30 per cent, and domestic sea freight, 8 per cent.

[20] This assumes that capital costs have been estimated appropriately.

[21] Ramsey pricing for rail operators can also be based on the price elasticity of certain commodities transported, rather than specific operators. This allows more rail fixed costs to be recovered from commodities that have a less elastic demand response to changes in price. For an alternative description of Ramsey pricing see pages 38 to 40, BTRE (2003a).

substitute products. This is because, even if the price elasticity of demand is low in one market, because of competition between the markets, it would not be appropriate to have higher cost recovery from the lower demand elastic good as suggested by Ramsey pricing principles. By introducing higher cost recovery in the relatively inelastic good would result in substitution of demand to the substitute, thereby distorting the optimal consumption of the two goods.

This problem is likely to be present if Ramsey pricing principles were applied to road and rail infrastructure charges. Due to the substitutability of road and rail freight transport provision in some circumstances, by having higher recovery of capital charges in one market relative to the other, will result in distortions in the efficient mix of use of road and rail infrastructure that would otherwise result. [22]

In principle Ramsey pricing is fairly compelling, because it minimises the allocative efficiency problems associated with average cost pricing and also avoids the investment incentive problems of using direct government subsidies, by allowing the recovery of capital costs.

However, the key problem with the application of Ramsey pricing is its practical application. Ramsey pricing requires large amounts of cost and price data to ensure that robust estimates of price elasticities can be obtained for both the rail and road markets.[23] While it may be possible to collect data for rail operators and commodities, the likelihood of obtaining any data on road operators' responsiveness to price is very low.

Multi-part tariffs

In contrast to marginal cost pricing and average cost pricing, a multi-part tariff is where the tariff is split into two or more components. In the case of a two-part tariff there is usually a fixed charge to the operator for having the opportunity to access the infrastructure and a variable charge paid for actual use of the infrastructure. Where there are more than two parts, the variable charge is different depending on the quantity used. Where the variable charge varies with quantity, they are often also referred to as inclining or declining block tariffs. However, these pricing structures are more commonly used for electricity and water pricing in Australia as a way of providing demand signals to high consuming customers.[24]

Two-part tariffs are the current approach for road charging in Australia, and are also generally used for rail infrastructure charges.[25] Road charges currently include a fixed charge

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22 Pages 39 to 44, Brown and Sibley, (1986).

23 The Staggers Act 1980 in the United States contemplates the use of Ramsey pricing and the Surface Transportation Board as reproduced by the BTRE indicates: "the industries ability to earn revenue sufficient to maintain the existing extent of rail service does appear to depend to some degree on the use of differential pricing (STB 1998)." As the BTRE also identifies, the requirement for differential pricing is linked to the Staggers Act objective of revenue adequacy (BTRE (2003a) page 40). This highlights the importance of the regulatory objective when determining the optimal regulatory approach.

24 For example, Sydney Water has recently introduced an inclining block tariff where the water usage charge increases as water use increases. It is currently $1.20/kl for water use up to 400 kilolitres per annum and then increases to $1.48/kl for any water use above 400 kilolitres.

25 Some rail routes in Australia are currently priced entirely on a per tonne basis, with no fixed charge.

per vehicle and a variable charge via the diesel fuel excise. Similarly, rail access charges normally include a fixed charge and a variable charge relating to mass and distance.

The questions involved with using a two-part tariff revolve around the appropriate allocation of costs between the fixed and variable charge, and how those charges are levied. If the variable charge is linked to marginal costs, then so long as the fixed charge does not stop any existing or potential operators from using the infrastructure, allocative efficiency problems can be minimised. If however, the fixed charge is the same regardless of the size of the operator, then this may impact disproportionately on smaller operators. Alternatively, as we discuss above under Ramsey pricing, levying different fixed charges between operators in a mode may have implications for allocative efficiency between road and rail modes in the freight market.

The levying of the variable charge is also important, as ideally it should relate to the marginal costs attributable to access by an operator. This is likely to vary based on the impact of operations on the infrastructure through wear and tear and therefore should be linked to tonnages hauled and distances travelled. As we discuss further below, this may be easier to implement for rail infrastructure than road infrastructure.

To avoid concerns about entry and exit to the freight operators market, and its implications for competition and productive efficiency incentives, a number of authors propose allowing freight operators to choose between variable charge and fixed charge options.[26] However, as NERA (1998) identifies, offering charging structure options may have perverse impacts on competition in the train operator market. This is because, for a smaller operator paying an average cost variable charge, its contribution to fixed costs is likely to be lower than a larger operator. This means that the average input cost of access for the smaller operator is lower than the larger operator, affecting their relative competitiveness.

Importantly for this study, offering access charge structure options will compound the competitiveness issues between road and rail and is unlikely to be administratively feasible for road infrastructure.

To ensure competitiveness amongst operators within a mode, it is therefore important to have the same charging structure such that the relative contribution of operators to fixed costs is proportionate to their total utilisation of the infrastructure. The variable charge should also equate to the marginal costs of access. While there are likely to be some allocative efficiency concerns associated with recovering the fixed costs of access, the importance of dynamic efficiency for investment decisions will be maintained.

The complicating factor where there is competition between road and rail modes is that competitiveness between modes will be affected by differences in the proportion of fixed cost recovery between both operators and modes. This does not mean that the magnitude of cost recovery should be the same, as this would clearly distort the inherent relative competitiveness between road and rail infrastructure. To ensure the efficient use of road and rail infrastructure the proportion of total costs recovered from charges should be equal.

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[26] See for example discussion in BTRE Report 109 at page 41 and 42.

While actual competitiveness between road and rail freight modes will be affected by many issues, to highlight the potential distortions that result from differences in the regulatory approach to road and rail costs, we have developed a simplified example below.

Assume there are two road operators $Road_A$ and $Road_B$, and a single road infrastructure provider, I_{Road}. Now also assume that there are two rail operators, $Rail_A$ and $Rail_B$ and a single rail infrastructure provider I_{Rail}. The road and rail operators all provide freight services between two points X and Y and there is a highway and rail line between those two points. The total freight volume on both the road and rail infrastructure is 300 ntkms. Assume that the total costs (both variable and fixed) of providing the road and rail infrastructure are identical and equal to $200 million ($100 million to service 300 ntkms and $100 million of fixed costs).

Based on these assumptions, to ensure competition is not affected in the freight market, we would expect a road or rail freight transport operator to face the same average cost of access for a given amount of freight haulage.

Now, let us consider differences in the proportion of total costs recovered. Assume that all road and rail operators pay the same proportion of the total infrastructure costs in charges, say 90 per cent. As shown in Table 2.1 below, this results in the average cost for $Road_A$ and $Rail_A$ being $0.75/ntkm and for $Road_B$ and $Rail_B$ being $0.53/ntkm. In terms of competitiveness between the two modes, they are equally competitive as their average cost of $Road_A$ and $Rail_A$ are identical, and the average cost of $Road_B$ and $Rail_B$ is also identical. Competition between A and B in either mode is based on the economies associated with high freight volumes hauled, and therefore the ability to spread fixed costs over a larger freight volume.

Table 2.1
Example where the proportion of total costs recovered for road and rail infrastructure is equal

Freight operator	Variable costs ($ million)	Fixed cost ($ million)	Proportion recovered from charges (%)	Total costs recovered ($ million)	Total haulage (ntkm)	Average cost ($/ntkm)
- $Road_A$	33	50	90	75	100	0.75
- $Road_B$	67	50	90	105	200	0.53
- $Rail_A$	33	50	90	75	100	0.75
- $Rail_B$	67	50	90	105	200	0.53

The problem for competition in the freight market arises in this example where different proportions of cost recovery are used for road and rail infrastructure, Table 2.2. Now let us assume that for road operators, the proportion of total costs recovered through charges is only 70 per cent, while for rail it remains at 90 per cent. In this instance the average cost for $Road_A$ is now $0.58/ntkm while for $Rail_A$ it is $0.75/ntkm. This clearly results in $Road_A$ having a competitive advantage, simply as a result of the cost allocation system compared

with $Rail_A$. We would expect therefore, for an inefficient volume of freight to be undertaken by $Road_A$ compared with $Rail_A$. In this example, a similar result holds for $Road_B$ and $Rail_B$ where Rail has a competitive advantage due to road recovering a lower proportion of total costs.[27]

Table 2.2
Example where the proportion of total costs recovered for road and rail infrastructure differs

Freight operator	Variable costs ($ million)	Fixed cost ($ million)	Proportion recovered from charges (%)	Total costs recovered ($ million)	Total haulage (ntkm)	Average cost ($/ntkm)
- $Road_A$	33	50	70	58	100	0.58
- $Road_B$	67	50	70	82	200	0.41
- $Rail_A$	33	50	90	75	100	0.75
- $Rail_B$	67	50	90	105	200	0.53

While this example is relatively simple, it highlights that the proportion of total costs recovered in charges matters, in ensuring that, from an access pricing perspective, there are no distortions to competition in the freight transport market. While in rail, the negotiate and arbitrate regulatory approach using a floor and ceiling price allows the allocation of fixed costs to be negotiated between operators and the infrastructure provider,[28] for road, the same cost allocation is set for all providers through the registration fee and diesel fuel excise charge.

2.3.3. Which pricing approach is appropriate?

After examining the options available for pricing access to road and rail infrastructure, and its implications for efficiency both in the road and rail infrastructure markets and efficiency in the freight transport market, which is the appropriate pricing approach to use?

Clearly there are advantages and disadvantages from using any of the various options. Marginal cost pricing may produce the 'first best' outcome for a particular market by ensuring efficient use of the infrastructure, but it does not provide reasonable expectations that the infrastructure owner will recover its fixed costs. This has implications for efficiency in the investment of future capacity. It seems clear therefore that some, if not all of the costs of providing the infrastructure, including the fixed costs should be recovered in some way.

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[27] It is important to note that this is a very simplistic static example and therefore does not consider the dynamic affects of differences in average costs at one instance, on subsequent demand and average costs in future periods of time. This would need to be considered to determine the equilibrium outcome from this example on freight volumes and costs.

[28] In practice, whether negotiations are effective will depend on the relative market power of the two parties. The extent to which current charges are negotiated between rail operators and infrastructure providers is the subject of some debate.

From an economics perspective, two issues then arise. The first is what is the appropriate measure of the total costs of providing infrastructure investment? While the Productivity Commission refers to the recovery of the 'full economic costs' this is not a term normally defined in economics and can mean different things to the person being asked to determine it.[29] Ideally, economics tells us that the maximum cost that should be recovered from an efficiency perspective is the forward looking costs of providing the infrastructure. One way of determining this, is to consider the costs that a new hypothetical entrant would have to incur today to replace the entire network and therefore bypass the existing network entirely. If there was competitive entry into the market, this hypothetical new entrant cost would provide a constraint on the charges that the infrastructure provider could earn from providing the network.

This is the approach that is captured in the ceiling price within the various rail access agreements, and has also been used overseas in jurisdictions like the United States where access seekers or operators can have access prices reviewed by comparison to the 'stand alone costs' of providing access. The stand alone costs are considered the upper bound for access prices.[30]

By using the construct of the hypothetical new entrant, we consider the value of the assets today, rather than the historical costs of providing the network that currently exists. While in practice this involves an examination of the existing infrastructure network and its costs, it is more closely aligned to the appropriate economic consideration of fixed costs. It also importantly provides some risks to the infrastructure investor, to the extent that future technology may decrease the cost of infrastructure provision in the future, providing incentives to ensure that efficient investment decisions are made in the future.

Our discussion on the efficiency properties of marginal cost pricing and approaches to recovering fixed costs suggest that while there may be allocative efficiency losses associated with the recovery of fixed costs, the dynamic efficiency benefits are also important to consider. Theoretically, it is clear that Ramsey pricing in a single infrastructure industry will minimise the efficiency losses, however where there is competition between industries, it is likely to raise competitive and allocative efficiency concerns.

Multi-part tariffs are the last remaining feasible charging structure. With multi-part tariffs, the regulatory problem is to ensure that the allocation of fixed costs between operators is consistent to ensure there are no impacts on competition in the freight market. We will discuss this issue in detail in the following chapter.

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29 Page 20, Productivity Commission (2006).

30 For an overview of the use of stand-alone costs in the United States, see Surface Transportation Board (1996), Ex Parte No. 347 (Sub-No. 2), Rate Guidelines – Non-Coal Proceedings, December.

3. Efficient road and rail infrastructure charging

There are three issues that require examination when developing a road and rail infrastructure charging regime that seeks to achieve efficiency in the use, provision of, and investment in road and rail infrastructure, without adversely impacting on competition in the freight market.

The first is to ensure that the regulatory methodology adopted for, and costs included in, road and rail infrastructure charges are consistent. This means that the cost items included in charges and their regulatory treatment should be the same. As we have outlined in our comparative assessment study, the existing methods used to determine road and rail charges vary significantly. These methodological differences can potentially create large differences in the resulting road and rail infrastructure charges, thereby impacting on competition in the freight market.

The second is to ensure that government contributions represent the same proportion of the total cost of providing both road and rail infrastructure. If the proportion of the costs contributed by the government differs, then this will impact on competition in the freight transport market.

The third is to consider the implications of an infrastructure charging structure, which seeks to balance the objectives of efficiency, and includes consideration of the practicality of implementing any preferred structure.

Key conclusions from this discussion include:

- operating costs are generally treated appropriately in both of the current road and rail infrastructure charging regimes, except for the exclusion of police traffic costs from the road regime, however their inclusion is not expected to have an impact on competition between road and rail freight operators;
- options for an NPV neutral capital recovery methodology include a renewals annuity or a regulatory asset base approach, similar to the electricity and water sectors in Australia;
- in principle, an efficient road and rail regulatory regime should ensure that the costs of future capital expenditure should be fully included in the charging cost base, including the cost of finance and accounting for the value of time;
- to minimise competition impacts in the freight market, the same proportion of total infrastructure costs should be recovered from road and rail freight operators, meaning that government contributions should be an equal proportion of total road and rail infrastructure costs; and
- an efficient road and rail charging structure sets variable charges to the marginal costs of infrastructure provision, and fixed charges to the remaining capital costs. In general, charges should reflect the cost of providing the service to a particular operator, including an appropriate allocation of any fixed costs.

In the remainder of this chapter we discuss these conclusions in greater detail.

3.1. Cost items to include in a road and rail charging regime

In general, the current road and rail charging regimes seek to recover part of the cost of providing infrastructure and related services to users. The train infrastructure services include the provision of track, train operations, signalling and scheduling. Road infrastructure services are predominately new road infrastructure provision and repairs and maintenance of existing road infrastructure. Related services include safety regulation and pollution controls.

The cost items used can be broken down into operating, capital and external related costs. We discuss each of these cost items and their treatment in the following sections.

3.1.1. Operating costs

Both the road and rail infrastructure charging regimes seek to at least recover the cost of operating the infrastructure. These generally relate to the entire operating costs for rail infrastructure providers including labour and materials, head office and other related costs. For road infrastructure, the costs of the relevant main roads departments are ordinarily included in the costs used by the NTC for the determination of registration charges and the fuel excise charge.

The organisations that incur costs that should be properly included in a charging regime include:

- for road infrastructure:
  - main roads departments in each state;
  - local government road related costs;
  - safety regulators; and
  - traffic policing.
- for rail infrastructure:
  - infrastructure providers;
  - regulatory compliance costs; and
  - safety regulators.

To determine whether there are any additional operating costs, currently excluded from road and rail infrastructure charges, we identified any additional costs that would be avoided if road or rail freight operations ceased.

In the case of rail infrastructure, there did not appear to be any government or other organisational operating costs that are not included in the cost base, and recovered either through infrastructure or other direct charges.

In the case of road infrastructure, the only additional operating cost item related to the incremental cost associated with police traffic control from freight transport operations. We would expect that if there were no (or fewer) trucks on the road, then there could potentially be a reduction in the cost of police traffic expenses. In this case, an efficient regime should pass these costs onto road operators.

To examine whether road police traffic control costs were a significant expense, we investigated the recent budget papers for each of the jurisdictions. In addition, we looked at revenue received from fines, as this should ideally be netted out of any costs that are transferred to road users. The results of this analysis are contained in Table 3.1 below.

Table 3.1
Estimated actual net expenditure for traffic law enforcement (2004/05)

State	Income from Traffic Fines ($ million)	Traffic/Road Safety Expenses[2] ($ million)	Net Income ($ million)
New South Wales	238.5[2]	201.6	36.9
Victoria	313.6[3]	129.7	183.9
Queensland	186.0[3]	220.3	-34.3
Western Australia	44.0	103.9	-59.9
South Australia	70.9[3]	43.7	27.2
Total	853.0	699.2	153.8

Sources: State Budget Papers 2005/06.

Notes: (1) Expenses are for police traffic management or road safety operations noted in the 2005/06 Portfolio Statements. They may not include administrative expenses associated with the processing and collection of fines; (2) This figure was derived from statements in the NSW budget papers indicating that over 90% of income from fines were for traffic offences; and (3) These numbers do not specifically represent traffic fines, but general government income from fines. In every case budget papers noted that most of these fines were for traffic offences.

As is evidenced, police traffic control costs vary considerably between jurisdictions from $44 million in South Australia and $220 million in Queensland. Additionally, the share of those costs paid through revenue from fines also varies considerably. For example, in 2005 Victoria recovered 242 per cent of its police traffic expenses through fines compared with only 42 per cent by Western Australia.

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.

In this way, apart from police traffic costs, the current approaches to including operating costs in the road and rail infrastructure charging regimes are likely to have little impact on competition in the freight market.

3.1.2. Capital costs

Capital costs are the most significant component of road and rail infrastructure charges, accounting for a large proportion of the total costs included in current charges. This reflects the large infrastructure nature of the industry. As we outline in chapter 2, the approach to recovering capital costs should be such that it provides appropriate incentives for ongoing investment in the infrastructure, without adversely impacting on competition in the freight market.

Current approach to capital recovery

The current approach to include capital costs in charges for road infrastructure provides limited incentives to improve efficiency in the provision of infrastructure, or in investment in new infrastructure. The NTC currently uses historical road capital expenditure as a proxy for a capital charge. They indicate:[31]

> it is assumed that current expenditure provides a reasonable proxy for annualised costs of providing and maintaining roads for the current vehicle fleet.

The NTC calls this approach the PAYGO, or pay-as-you-go approach and indicate that it is equivalent to annualised costs if:[32]

- the network is reasonably mature and is neither expanding nor contracting significantly;
- across the network there is no overall deterioration in pavement or bridge condition;
- 'lumpiness' in investment is limited, so that across the network the amount spent on each type of road work does not fluctuate markedly;
- traffic growth is relatively small and steady; and
- the roadwork undertaken, and the road network itself, should be optimal (that is, road investment that is not economically justified does not occur, and investments that are worthwhile are not deferred).

The NTC takes a three year average of expenditure to smooth out any fluctuations in road capital expenditure in any particular year. The appropriateness of using the PAYGO approach depends on the extent to which these conditions hold, particularly in circumstances where road capital expenditure is increasing through time.

A key problem with the PAYGO approach is that it recovers the cost of undertaking an investment over a three year period, but not the financing cost associated with funding the investment during this period. This is a problem to the extent that road capital expenditure is growing through time.

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31 Page 8, NTC (2005).

32 Page 8, NTC (2005). We examine whether the PAYGO approach is equivalent to annualised cost in the following section.

The PAYGO methodology may be reasonable for a charging regime that seeks to recover the cash cost of infrastructure investment, as required of the NTC by the objectives underlying the charging regime. However, PAYGO provides limited incentives for efficient ongoing investment because the actual road capital expenditure costs are entirely recovered, irrespective of whether they are efficient.

This appears to be a critical deficiency in the current road capital cost funding approach, particularly for a new charging regime with an overarching efficiency objective, including efficiency in new road infrastructure investment.

Options for capital cost recovery

The options available for an efficient charging regime to recover capital costs are either a renewals annuity,[33] or by valuing the assets and determining a depreciation schedule and rate of return to apply. Both of these approaches will ensure that the cost of capital is recovered in net present value terms.

While either approach will recover the cost of capital, there are advantages and disadvantages with each approach. Renewals annuities have historically been widely adopted for bulk water assets in Australia, however in recent years there has been a shift away from this method of capital cost recovery towards more traditional regulatory asset base approaches.[34] The main reason for this shift has been concern about the ability of the bulk water infrastructure providers to finance infrastructure replacement work with debt, where cash flows reflect a renewals annuity.

The advantages of a renewals annuity are that it results in a stable ongoing payment to fund capital investment. This is particularly useful where capital investment is similarly stable.

The disadvantage is that a renewals annuity requires forecasts of capital expenditure well into the future –for at least ten years – and presumes that the infrastructure will be renewed. In some instances it may not be economic for infrastructure funded through an annuity to be renewed given prevailing conditions in the industry using the infrastructure. By including forecast capital expenditure in the annuity, this may result in inefficient future investment in infrastructure.

To avoid problems associated with obtaining long term forecasts and to ensure appropriate new investment decision making, regulatory asset bases are commonly used for regulated infrastructure businesses in Australia. These involve the valuing of the assets, followed by the rolling in of efficient capital expenditure, which is subsequently depreciated. The entire value of the assets earns a rate of return, to compensate for the cost of financing the expenditure, either by debt or equity.

The advantage of a regulatory asset base approach is that long term forecasts of capital expenditure requirements are not needed. The disadvantage is that a value of the asset base is

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[33] A renewals annuity is an annual payment that is calculated to pay for a stream of forecast capital expenditure into the future.

[34] See for details, Frontier Economics (2005), Review of pricing policies, A report prepared for Goulburn-Murray Water, March, Chapter 7.

required. This has proven particularly contentious when this approach has been implemented in other industries. The issue of asset valuation is considered further below.

When considering a new road and rail infrastructure charging regime, and particularly the implications for competition in freight transport it will be necessary to have a consistent approach to recovering capital costs between road and rail infrastructure charges. Currently PAYGO is inconsistent with the approach in rail, particularly in respect of the timing of recovery of capital costs over the life of the assets.

Recovery of historical capital costs

The treatment of historically provided assets is always a contentious issue. A range of approaches have been used in regulated industries throughout Australia. These include valuing assets at zero prior to a specified date (for example bulk water in New South Wales), DORC based values (Victoria electricity businesses), Ministerial setting of asset values (Victoria, water businesses) or other economic valuation techniques (metropolitan water and electricity businesses in NSW).

The economic issue with recovering the cost of historically provided assets is the incentive it creates for future investment. As we outline in chapter 2, efficiency in the use and provision of infrastructure is maximised if prices are set at the marginal costs, meaning that historical assets are valued at zero. As we have indicated, this approach creates problems for efficiency in future investment, meaning that recovery of future capital investment is a desirable feature of any road and rail infrastructure charging regime.

Valuing assets by an economic valuation technique[35] has been used where the status quo has been desired in existing charges. In the case of bulk water charges in New South Wales, an economic valuation of the assets resulted in a negative asset value given the historically low existing bulk water charges. In this instance, the regulator decided to write the asset values down to zero.

Where there is some positive value for the assets given existing prices, economic valuation results in that value becoming the value of the assets. It presumes that existing prices reflect the value of the services produced from the assets for society. By including new expenditure at full value, this means that the incentives for ongoing investment are retained.

The depreciated optimised replace cost methodology (DORC) is where existing assets are valued based on the replacement of infrastructure with modern equivalents, and reflects the cost of replacing the assets today. In this way, it represents the cost that would be incurred to replicate the assets in an efficient way, and presumes that this value is appropriate to be recovered for historical assets against the alternative of building a new infrastructure network. In effect, a DORC asset valuation creates the highest level of historical capital cost recovery before it becomes more cost effective for operators to seek to replicate the existing assets.

The difficulty with any asset valuation methodology for either road or rail infrastructure, is that freight operators are unlikely to be able to pay the access prices that result. A DORC

[35] Economic valuation techniques estimate the value of the assets implied from existing cash flows received by the infrastructure provider.

valuation for existing road infrastructure might be very large compared with DORC valuations of existing rail infrastructure. While notionally rail operators pay some contribution to historical assets via the DORC valuation, only a proportion of rail operators pay the ceiling price, so in practice the capital costs implied by DORC are also not fully recovered by rail infrastructure providers.

However, because there is some historical asset cost recovery in rail, despite rail infrastructure being initially provided by government, and no direct recovery of road infrastructure investment prior to the introduction of PAYGO, this creates differences in the underlying cost basis for infrastructure charges for freight operators between road and rail. As we have outlined earlier, these differences will have implications for competition in the freight market.

To ensure that there is no competitive disadvantage associated with the recovery of capital costs, all future or new capital expenditure should be recovered through a regulatory asset base or annuity approach. Whichever approach is used, the same approach should be applied to both road and rail operators.

Assets to be included in capital values

Ideally all assets directly related to the provision of road or rail infrastructure services should be included in any capital charging methodology, and allocated to the appropriate user of the infrastructure. Currently for example, for rail charges, all signalling, platforms and track infrastructure are properly allocated to users. Similarly, for road charges the cost of road infrastructure and associated assets are also allocated to users.

A contentious asset class that is treated differently in the current rail charging regimes and in the road charging regime is land and easements. In principle, land used for road or rail infrastructure should be included in any asset valuation. In practice, for new road infrastructure, the cost of land acquisition is included in new road capital costs and is therefore also included in the charges passed onto users. However, historical land values are not included in charges, as charges do not currently reflect historical asset values.

Similarly, for rail infrastructure, the value of land and easements is generally excluded from the DORC valuations used in ceiling prices. The exception to this approach is in the Queensland rail regime where land is valued at DORC.

There are some differences in the existing assets included in charges between the road and rail charging regimes. For example, rail charges include the cost of providing pedestrian footbridges and tunnels where required, fencing for urban areas and drainage and wastewater management costs. Similar costs incurred through the provision of road infrastructure are currently not included in charges, as they are part of excluded local government costs, or are met through alternative means, in the case of stormwater drainage management. These differences need to be resolved for an efficient road and rail charging regime.

Principles for the treatment of capital in an efficient charging regime

The principles for the treatment of capital expenditure for an efficient road and rail charging regime are:

- All future capital expenditure should be fully included in the cost base to determine charges, preferably using a regulatory asset base approach with an allowance for depreciation and a return on the investment; and

- The value of historical assets should be determined using the same methodology for road and rail infrastructure, preferably using the DORC methodology.

To ensure that competition between road and rail operators is not affected by the regulatory approach to calculating capital costs included in the charging cost base, the following areas of the current regimes therefore need to be addressed. For the road charging regime:

- inclusion of a return to capital, to account for the three year financing costs associated with road infrastructure investment; and

- historical road assets should be valued using a DORC methodology identical to rail assets, and included in the cost base.[36]

For the rail charging regime:

- equivalent treatment of land and easements in DORC valuations.

Allocation of road capital costs between heavy vehicles and passenger vehicles

The above discussion has been focused on the level of recovery of capital costs and its implications for future investment incentives and competition in the freight market. The allocation of capital costs between road passenger and freight vehicles is important to consider since it potentially has large implications for competition between modes in the freight market.

We outline in greater detail the cost allocation methodology used by the NTC in our comparative assessment study.[37] However, in general, costs that are considered attributable to road users are allocated on the basis of road use by vehicle type with a heavy reliance on the vehicle per kilometre travelled (VKT) measure.

In general, allocating costs on the basis of the vehicle type is likely to correspond to the impact various vehicle types have on the costs incurred in providing the infrastructure necessary for that vehicle type. There is however, some debate about whether the VKT measure is the most appropriate basis for cost allocation because it does not take into consideration the impact that vehicle weight and size has on road infrastructure costs.[38]

Alternative cost allocation bases include passenger car equivalent per km (PCU per km), equivalent standard axle per km (ESA per km) and average gross mass per km (AGM per

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[36] This does not imply that road operators should be charged the full historic costs of road infrastructure. As we outline in section 3.2, we argue that government contributions should be not linked to cost items as this can impact on competition in the freight transport market.

[37] See appendix G, NERA (2006).

[38] In addition, it is also important to consider the quality standard of road capital investment and whether this is being driven by the requirements of heavy vehicles or passenger vehicles.

km). By allocating more road infrastructure costs on measures that do account for weight and size, a greater proportion of road costs would be attributed to heavy vehicles.

There is some uncertainty about the 'right' cost allocation shares to apply to the various alternative bases for the purpose of allocating costs between vehicle types. Ideally, the measures would exactly represent the road infrastructure cost drivers, but in practice they need to be a close approximation.

The NTC has predominately allocated costs on the basis of the VKT measure. This results in a relatively low proportion of infrastructure costs being allocated to heavy vehicles, as passenger vehicles dominate the VKT measure. We have not been able to undertake a complete analysis of the NTC's cost allocation process as part of this study, but note that the current cost allocation proportions are at odds with those used in the UK. In work undertaken by NERA for the Department of Transport in the UK, NERA allocates a greater share of capital works costs (ie. resealing, road rehabilitation, bridge repair, pavement construction, land and earthworks) to the PCU per kilometre and AGM per kilometre measures, which are based on vehicle weight and size.[39] The difference arising from allocating costs predominately on the basis of VKT as opposed to AGM or PCU is not inconsequential and suggests that further work should be undertaken to understand the reasons for these differences.

3.1.3. Inclusion of external costs

The final cost area that is not well covered in the current charging regimes is the approaches to externalities. In this section we briefly outline the economics of externalities and approaches to including externalities into charges.

An externality is where the actions of an individual or corporation have an unintended impact on a third party. In the context of road and rail operations, the external impacts include pollution, noise, congestion and safety.

In general, efficiency is enhanced through the incorporation of the costs of externalities into prices for the good or service. In this way, any external costs are factored into the decision making process of the person using the service, and if the benefits outweigh the costs, including external costs, then its use is said to be efficient. There are two approaches to including the cost of externalities into prices. These are:

- the setting of standards or requirements that must be complied with; and
- the inclusion of a charge into prices to both compensate for the lost amenity associated with the external impact, or provide appropriate signals for the optimal production of external impacts.

A comprehensive examination of externalities and their charging is beyond the scope for this paper. However, the main issues that arise when considering externalities include:

[39] NERA (2000), *Lorry track and environmental costs*, UK Department of Transport.

- the approach used to value the externality – there are many approaches including willingness to pay studies, choice modelling and the travel cost method. A difficulty with any valuation methodology is that the result is strongly related to the assumptions used to estimate the external value;

- how best to internalise the externality – whether through standards increasing costs or through externality charges; and

- in the case of a specific externality charge, whether the charge should be on a variable or fixed basis.

In general, for sufficiently important external impacts, particularly if the demand for a good or service is relatively unresponsive to changes in its price, then standard setting is the most appropriate approach. By using standards as the approach to managing externalities, we presume that the cost of meeting the standard is at least equal to the benefit from avoiding the external impact entirely. In contrast, externality charges seek to modify use of a good or service, to take into account the external impact from using the good or service.

3.2. Treatment of government contributions

Under the existing infrastructure charging regimes for road and rail, there are both explicit and implicit subsidies provided for the provision of infrastructure. These have the effect of decreasing the charges to road and rail operators, compared to those based on the total costs as discussed in section 3.1 above.

In the case of road, the subsidies are implicit and result from the non-recovery of costs associated with historical road infrastructure assets, and the non-inclusion of the three year financing cost associated with new road infrastructure investment. In addition, arguably, the current cost allocation approach, including the removal of 75 per cent of urban and 50 per cent of rural local government related costs, is a potential subsidy to road freight operators who use local road infrastructure.

For rail infrastructure, the cost of new capital infrastructure investment is generally netted out of charges to operators, and the ceiling/floor charging framework results in not all historical asset costs being recovered.

The current levels of infrastructure cost recovery from both road and rail operators impacts on incentives for new infrastructure investment, and thereby dynamic efficiency. This is because it impacts on the expectation that an investor will be able to recover the costs of an investment, including a return commensurate with the risks involved.

The current approach to determining costs included in road and rail infrastructure charges therefore results in differences in the relative proportion of total costs provided by government contributions. In other words, there are differing proportions of total costs recovered from infrastructure users. This means that the relative subsidy, and thereby competitiveness between a road and rail provider will be adversely affected.

Ideally, to ensure that charges based on costs are competitively neutral for road and rail operators, government contributions should not be based on the inclusion or exclusion of specific cost items, for example by valuing historical assets at zero. If a DORC valuation of

rail assets results in capital costs being a lower proportion of total rail infrastructure costs, compared to a DORC valuation of road assets, then this will result in a lower relative subsidy for rail infrastructure, compared with road infrastructure.

Similarly, if both road and rail infrastructure providers were granted $100 million each year, and the total cost of providing road infrastructure was $250 million compared to rail of $150 million, then the grant would represent 40 per cent of road infrastructure costs, but over 66 per cent of rail infrastructure costs. This would place road operators at a disadvantage against rail operators, as a result of the different allocation of government funding.

The only approach to government funding for road and rail infrastructure provision that does not impact on competition between freight modes, is where the government contribution is an equal proportion of total costs. Importantly, this proportion should be based on the total infrastructure costs, calculated using a consistent methodology as outlined in section 3.1 above.

Finally, any government contribution should ensure that infrastructure users pay at least the marginal cost associated with their infrastructure use. This is the least cost that is appropriate from an economic efficiency perspective.

3.3. An efficient road and rail charging structure

The price structures used for infrastructure charges have implications for efficiency, as they affect a customer's decision to use a good or service. Given that we are interested in efficiency in the use and provision of, road and rail infrastructure and efficiency in the freight transport market, it is therefore particularly important to consider the implications of different infrastructure charging structures on efficiency in each market.

3.3.1. Charges should relate to the service being provided

The key principle for any charging structure is that charges should relate to the service being used. This means that there is no cross subsidisation between services provided by an infrastructure provider, and appropriate charging signals are given to the infrastructure user for the costs of its use. For rail infrastructure, this principle implies that charges should reflect the costs of a particular rail segment that is being used by the rail operator paying the infrastructure charge. Similarly, for road infrastructure, charges should ideally relate to the cost of providing particular road segments used by a truck operator paying the infrastructure charge.

In general, this principle can be expected to be more easily implemented for rail infrastructure charges compared with road infrastructure charges. As technology improves, it is likely to become more cost effective to monitor all road freight operators and record their usage of particular segments of the road infrastructure network in each state.[40] For rail operators however, the nature of co-ordinating access to rail segments means that linking usage to infrastructure segments is a common basis for determining rail infrastructure charges.

[40] Presumably, as GPS and other tracking technologies become more cost effective, it may be possible to link truck operator usage to particular road segments.

3.3.2. Structure of charges

Assuming that charges are linked to the use of particular infrastructure, the next issue is the structure of prices. As we outline in chapter 2, to maximise use of a segment of infrastructure, infrastructure charges should reflect the marginal cost of providing access. We also indicate that, to ensure ongoing infrastructure investment, it is important to provide a reasonable expectation to infrastructure investors that they will recover their capital investment costs, including an appropriate return on investment. This review indicates that, where it is no longer economically beneficial to renew existing infrastructure, infrastructure charges should be based only on the marginal cost of access. However, where infrastructure is expected to be replaced in the future, infrastructure charges should be set above marginal cost to reflect the cost of capital.

An appropriate way to provide for the cost of capital for road and rail infrastructure is through the use of multi-part tariffs. These split the cost recovery into at least two parts. The first is a fixed component, set to recover the fixed capital costs, and the second a variable component, set to recover the marginal costs.

Ideally, the split between the fixed and variable components should be the same for any operating unit accessing a particular segment of road or rail infrastructure. This allows operators using a particular mode to compete freely, although there may be adverse implications for relatively small operating units in terms of entry to an existing infrastructure segment.[41]

Similarly, the allocation of costs between fixed and variable components should be the same between road and rail modes so as to avoid any detrimental effect on competition in the freight market. To the extent that variable charges differ between modes, and these differences are not a result of different marginal costs, then this will affect on the relative competitiveness of one mode over the other.

By linking variable charges to marginal costs and fixed charges to the fixed costs, the infrastructure provider minimises its exposure to freight demand fluctuations. In this way, the risk and uncertainty of demand is allocated appropriately to the operator who is able to bear the risk, by being well placed to influence demand for its transport services.

There may be instances however, where a particular freight transport operator may wish to manage risk allocation between itself and the infrastructure provider in a different way, by altering the split between fixed and variable charges. This is consistent with providing flexibility to operators and infrastructure providers, and does not impact on the efficiency of the underlying pricing structure. Such a negotiated outcome is like to improve allocative efficiency and may assist in dealing with relatively small operating units, since the two parties are willing to engage in the variation.[42]

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[41] The allocation of fixed costs between operators will impact on their ability to enter the market in a particular segment. To the extent that smaller operators are deterred from entering into competition with an incumbent operator in a particular segment, this will impact on efficiency in the provision of freight transport services for that segment.

[42] This presumes that there is effective negotiation of charges and price structures between infrastructure providers and operators within the negotiate/arbitrate model. To the extent that there are differences in market power, in part due to the high cost of arbitration, then resulting price structures may not be efficient in practice.

Based on our examination of the current allocation of costs between fixed and variable component road charges, there is likely to be some significant allocative efficiency improvements associated with aligning the diesel fuel levy more closely with the marginal costs of road freight operators. The regulatory transaction costs of such an alignment are likely to be low, and importantly could result in significant improvements to competition in the freight market, particularly between modes.

The approach in rail is more likely to deliver a close alignment between variable charges and marginal costs, within the bounds of the floor and ceiling prices. In this respect, the existing approach in rail can be expected to result in an efficient allocation between fixed and variable charges.

3.3.3. How should charges be levied?

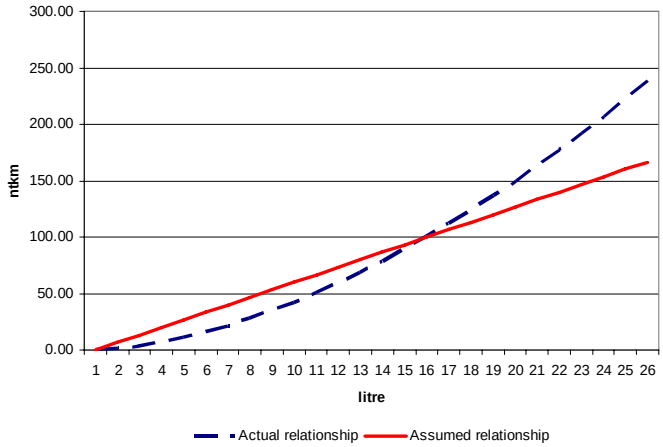
To satisfy the above price structure principles, an efficient road and rail infrastructure charging regime should have a variable charge that reflects the marginal cost of access. As we discussed in section 2.3.1 above, this should reflect the variable impact on the infrastructure from its use and include costs associated with wear and tear.

There may however be reasons to move away from a variable charge linked to variable costs and a fixed charge linked to fixed costs. One reason may be a desire to encourage new entrants to use existing infrastructure in competition with incumbent operators. When considering deviations from the ideal charging structure, it is important to consider the implications for efficiency, both within the particular transport mode and also between modes.

The ideal basis for levying a variable charge is therefore related to the weight of freight carried and the overall distance. The ideal charge would link weight to impact on freight infrastructure and link the variable charge to the impact relationship. A similar approach for distance would also be ideal. While in general, weight is unlikely to have a linear impact on infrastructure, it is likely to be well approximated by a charge that is linked to the mass carried. Similarly, we would expect the impact of freight transport to relate to the distance over which the freight is hauled.

Figure 3.1 is a hypothetical example of the potential biases associated with a linear mass/distance charging regime and how it over compensates for the damage of lighter, compared with heavier loads under a presumed weight impact relationship. To the extent that more fuel is required for higher net tonne kilometres compared to smaller net tonne kilometres, then a linear variable charge per litre results in lighter loads paying more than their actual impact as a variable charge. Similarly, heavier loads pay less than their actual variable impact. On average however, a charge per litre approximates an average mass/distance charge.

Figure 3.1
Relationship between litres and ntkms



The feasibility of any charging structure is an important consideration in its design. Linear mass/distance charges are currently used within the rail industry, and are set for particular line segments. To the extent freight is fairly homogenous along a segment, a linear approximation is likely to have relatively small impacts on allocative efficiency and competition between rail freight providers.

The current variable road charge for freight truck operators is implemented by means of the diesel fuel excise levy. Ideally, the levy would be calculated by the NTC by dividing the total marginal cost allocated to freight vehicles by expected diesel fuel demand, creating an excise expressed in dollars per litre. Assuming there is a linear relationship between fuel usage and mass/distance then the diesel fuel exercise may be a good approximation for a mass/distance charge for the industry on average. In practice however, the NTC considers the existing diesel fuel levy and determines whether it recovers sufficient revenue once the registration charges are taken into consideration. The levy is then modified to account for any difference in revenue compared with costs.

While the diesel fuel levy approximates a mass/distance charge on average, it can still affect competition between road and rail freight operators. To the extent that there are some truck operators who use less fuel per tonne/km, then these operators will have a competitive advantage over an equivalent rail operator. Given that the implications of competition between road and rail freight operators is important at the margin, meaning for the marginal truck and rail operator, then this might have efficiency implications.

Consider for example a truck operator who uses less fuel than average for each ntkm hauled. This operator will be paying lower costs compared to its road competitors and therefore will have a competitive advantage as a result of the road charging structure. Similarly, if a rail competitor is being charged an appropriate split between variable and fixed costs, then it would also have a competitive advantage (all other cost inputs being equal) as a result of the regulatory charging structure.

The problem therefore with the diesel fuel excise as an approximation for a mass/distance charge for road freight transport operators is its practical application. For the diesel fuel

excise to be effective as a variable charge reflecting the marginal costs of road infrastructure provision, the levy should ideally be explicitly based on estimated marginal costs. However, any such efficiency imperfections need to be considered alongside the costs and benefits of implementing a better targeted form of charging.

4. Transition arrangements

The efficient pricing principles that we outline earlier in this paper provide a high level framework for a road and rail infrastructure charging regime that also promotes efficiency in the freight transport market. To move from the existing road and rail infrastructure charging regimes to the proposed regime may require a significant reform effort, in a number of areas.

To assist with the transition to the proposed efficient road and rail infrastructure framework, in this chapter we suggest how reforms may be implemented. In so doing, we focus on areas where relatively minimal changes may result in the greatest potential benefits.

The main proposals that we focus on ensure that:

- the infrastructure charging cost base reflects the total cost of infrastructure provision, including a return on and of capital investment;
- government contributions are an equal proportion of the total cost of road and rail infrastructure provision; and
- institutional reforms occur to provide incentives for the efficient use and provision of road and rail infrastructure into the future.

In the remainder of this chapter we consider how these reforms might be implemented during a transition period.

4.1. Implementing changes to costs included in charges

Ensuring that the cost base for both road and rail infrastructure is consistently calculated is an important part of achieving a competitively neutral road and rail infrastructure charging regime, with associated benefits for incentives for efficiency. To achieve this, as we outline in chapter 3 above, requires:

- developing a consistent approach to the valuation, and inclusion of costs associated with, existing infrastructure assets;
- calculating asset values for existing road and rail infrastructure; and
- including a return on and of capital investment for both road and rail investment into the cost base used to determine charges.

4.1.1. Developing a consistent approach to valuing existing assets

To develop a consistent approach to valuing existing assets, it will be necessary first to identify each of the assets that are properly included in charges for road and rail infrastructure. As we outline in section 3.1.2, this will involve decisions regarding the approach to including land and easements, and other issues such whether to include the cost of footbridges, stormwater drainage management and noise fencing.

The general principle to apply for the inclusion or exclusion of costs is whether they are incurred as a result of providing the infrastructure to freight operators. If the infrastructure

would not have been needed, but for the provision of road or rail infrastructure, then it should be properly incorporated into charges for using the infrastructure.

The next step is to consider which methodology to use. Of the available methodologies, the Depreciated Optimised Replacement Cost methodology has good economic underpinnings, as it represents the cost associated with replacing the existing infrastructure with modern assets. It represents the cost that a new entrant infrastructure provider would pay to replace the existing infrastructure assets, and therefore is the maximum value that can appropriately be allocated to the existing assets.

4.1.2. Calculating DORC values for both road and rail infrastructure

Ideally, the existing asset value for road and rail infrastructure should be determined at a common point in time, since this maintains comparability between the two forms of infrastructure.

Given the difficulties associated with calculating DORC values for road and rail infrastructure, in the first instance it would be appropriate to focus on the main interstate freight corridors, between each of the capital cities of Australia. It is these routes where there is likely to be the most benefit associated with improvements in competition between road and rail freight operators, arising from reforms to infrastructure charging regimes.

A common approach to asset valuation is also a necessary first step to ensuring a common basis for evaluating AusLink infrastructure funding projects for road and rail infrastructure.

4.1.3. Including new capital expenditure into charges

Once a consistent asset value has been determined for existing road and rail infrastructure, the approach to including these costs into charges should be determined. This should involve the inclusion of new capital investment, which is then depreciated and earns a rate of return that is commensurate to the risks associated with the provision of road or rail infrastructure.

The assumptions used in the calculation of asset costs including the average asset lives and rate of return are not necessarily the same for road and rail infrastructure. For consistency, the same methodology should be applied, which can result in different assumptions being used.

4.2. Addressing approaches to government contributions

As we outline in section 3.2, to ensure that road and rail infrastructure charges are competitively neutral, government contributions need to be an equal proportion of the total cost of providing road or rail infrastructure.

Once the total cost of road and rail infrastructure has been determined for each of the main interstate freight routes, it will be possible to determine the total current implicit and explicit government contributions that are being applied. This will indicate whether there is a divergence in existing road and rail infrastructure charges, relative to those implied by competitively neutral charges.

To minimise the impact of moving to a more efficient road and rail infrastructure charging regime, the government contribution could be adjusted, in the first instance, to move charges to a more competitively neutral basis, and in the second, improve the incentives for efficient

infrastructure investment, by increasing the proportion of charges contributed by operators. The level of government contribution to the capital costs of providing infrastructure would therefore be a policy decision for government. There may be public policy reasons for having different levels of government contribution, particularly for regional areas, as we discuss in section 4.3 below.

A key advantage to this approach, versus an approach where government contributions are for specific infrastructure investment projects, is that it allows the market to provide appropriate signals for efficient infrastructure investment.

4.3. Road and rail infrastructure in rural, regional and remote Australia

While there are likely to be greater benefits associated with an initial focus on improving competitive neutrality and signals for efficiency improvement in the main interstate freight transport corridors, this does not mean that there are no benefits associated with reforms in rural, regional and remote road and rail infrastructure networks. The main benefit arises with improvements in the efficiency of new infrastructure investment, through improved accountability in infrastructure investment decisions. These benefits may arise, irrespective of direct competition existing between road and rail infrastructure.

However, there may also be public policy reasons for a greater government contribution for rural, regional and remote road and rail infrastructure, given the amenity values associated with the provision of this infrastructure in these areas. In this instance, and in line with our recommendations regarding government contributions, the arrangements should allow for a higher proportion of these costs to be contributed by government. This need not affect competitive neutrality, while still allowing improvements in the incentives faced for the provision of infrastructure. Any implications for investment incentives however, would also need to be taken into consideration.

4.4. Reforms to institutional arrangements

Any reforms to the road and rail infrastructure charging regimes will require reforms to the existing institutional structures to provide an appropriate basis for the new approach to infrastructure charging. While a detailed examination of the existing institutional arrangements for both road and rail will be further required, there are a number of observations that have arisen from the development of this paper.

First, we are concerned about the linkage between road costs and charges within the current road institutional charging regime. While the NTC undertakes a detailed examination of the costs, cost allocations and charges for heavy vehicles in Australia, the translation of these to registration fees and the diesel fuel excise is not direct. This is not assisted by the fact that the diesel fuel excise has been the subject of a number of government public policy objectives, including seeking to reduce its cost to business through the Energy Grants Credit Scheme.[43] To ensure that charges provide incentives for efficiency in the provision of infrastructure, they should be linked directly to the costs incurred.

[43] The Energy Grants Credit Scheme is being replaced on 1 July 2006 by a new scheme that seeks to simplify the existing approach to fuel excises.

Second, the current road infrastructure charging methodology does not provide any incentives for the efficient provision of road infrastructure. The capital costs of the state and territory road agencies are generally included in the charges passed through to road users, meaning that there is no incentive to seek cheaper, alternative methods of providing road infrastructure to meet the infrastructure need.

Third, it is important to remove any scope for political involvement in infrastructure investment and charging decisions. The current road institutional structure, where the NTC recommends charges to the ATC, which are then either approved or not, means that charges are subject to political decision. Avoiding Ministerial involvement in infrastructure pricing and access decisions has been one of the main motivations for the development of independent regulators in other infrastructure sectors such as energy and water. Direct political involvement in decision-making can hinder private participation in infrastructure provision and affect appropriate increases in charging. Any equity or impact concerns should then be addressed through transparent government contributions that do not distort underlying investment and use decisions.

Finally, it will be necessary to address the consistency concerns associated with differences in the underlying rail regulatory regimes in each of the state-based regimes and the ARTC undertaking. It will be useful to consider how the rail regulatory regime can become more effective compared with the current negotiate/arbitrate framework.

5. Current and alternative regulatory and institutional structures

The final area considered in this report is the principles for choosing a regulatory regime, including a regulatory approach and institutional arrangements. Currently the rail regimes in Australia have been predominately developed in line with Part IIIA of the TPA, although none of the state based regimes have been certified. They have all adopted a negotiate-arbitrate form of regulation with differing degrees of oversight by a state-based regulatory agency. In contrast, road regulation has developed nationally, and is focussed on recovering the costs of road infrastructure investment. Charges are recommended by the National Transport Commission for approval by the Australian Transport Council which comprises the transport Ministers from each state and territory.

This chapter considers the principles that should be used to evaluate alternative regulatory and institutional structure options. We draw upon recent experience from regulatory design considerations in the energy sector to develop 'best practice' principles for regulatory and institutional design.

By examining the 'best practice' principles, we examine how the current regulatory and institutional structures used for road and rail charging performs against these principles. We then consider which aspects of the regime should be considered further as part of the reform process to ensure that the regime is more consistent with these principles.

Key conclusions from this examination include:

- best practice principles include transparency and predictability, adaptability, taking account of compliance costs, enforceability and accountability;
- transparency and predictability of the road and rail infrastructure charging regimes could be enhanced by developing a single clear regulatory objective and clarifying the roles and scope of regulatory institutions, possibly within a more comprehensive national framework;
- adaptability of the regimes can be enhanced through ensuring flexibility in the legislative frameworks underpinning the charging regimes;
- taking account of compliance costs requires balancing the costs against the potential opportunity costs of not implementing a specific regulatory regime; and
- enforceability and accountability are essential considerations when examining the existing road infrastructure charging regime.

Current road and rail infrastructure charging regimes do not satisfy each of the principles. Improvements could be made to rail infrastructure regime by:

- clarifying and standardising the regulatory objectives for each regime;
- improving consistency in the application of regulation, potentially through the development of a national rail regulatory regime; and
- reviewing the practical effectiveness of the negotiate and arbitrate form of regulation.

Improvements could be made to the existing road infrastructure charging regime by:

- improving accountability and transparency of final charging decisions, particularly for new road infrastructure investment; and
- improving incentives within the regime for the efficient provision of existing road infrastructure services and efficient investment in new road infrastructure.

In the remainder of this chapter we discuss these conclusions in more detail.

5.1. 'Best practice' principles for regulatory and institutional design

It is important that, prior to considering any options for reforming the regulatory approaches and institutional designs for the road and rail charging regimes, criteria or 'best practice' principles be developed to evaluate options. These principles should provide guidance on the desirable characteristics for a regulatory regime, thereby assisting with the evaluation of proposed regimes.

In our view there are five key characteristics that a regulatory regime should possess.[44] These are:

- transparency and predictability (to create an appropriate climate for infrastructure investment);
- adaptability of the regime to respond to changes in circumstances, through a transparent and equitable process;
- taking account of compliance costs and therefore unnecessary duplication of effort;
- enforceability of the arrangements; and
- accountability of all parties and mechanisms for review and appeal.

Transparency and predictability are important in any regulatory regime because they serve to create certainty for participants in the regime, thereby promoting ongoing investment and efficient outcomes. This is particularly important for new entrants to a potentially competitive market, since a lack of predictability and transparency can result in difficulties evaluating commercial opportunities to enter a market. Minimising the barriers to entry is an important prerequisite to promoting competition in the freight market and delivering improvements in ongoing efficiency.

In practice, the transparency and predictability of a regulatory regime can be enhanced through the use of simple and clear regulatory processes that provide opportunities for industry participants to examine and comment on proposals. It can also be enhanced through the use of a single regulatory objective and the development of regulatory precedent, for example consistency in regulatory decisions on the rate of return or form of regulation adopted.

[44] These principles draw upon similar work undertaken by NERA in conjunction with Gilbert + Tobin for the Ministerial Council on Energy when considering alternative regulatory approaches to apply to the energy distribution and retail services in Australia. For further information see, NERA and Gilbert+Tobin (2005).

Regulated infrastructure industries are expected to evolve over time as competition emerges, industry players change and a better understanding of the application of regulation evolves. This means that it is important to have a regulatory regime that is adaptable to these changes, whilst still maintaining predictability and transparency. In a rapidly changing industry, this may warrant some flexibility in the regulatory approach, and process for changing the approach in a transparent way.

Taking account of the compliance costs of industry participants is likely to be an important consideration in evaluating a regulatory regime. The cost of regulation is often claimed by regulated businesses as a reason for adopting a more light-handed approach to regulation.

It is important to remember that regulation is only imposed where the market power characteristics of a particular industry, like for transport infrastructure, are such that the absence of regulation would be expected to result in detrimental impacts on the economy as a whole. Whilst regulation can certainly impose costs on participants, it is important in any evaluation of the regulatory costs of a particular proposed regime, that these costs are weighed against the potential opportunity costs (or benefits) of not imposing the regulatory regime. These opportunity costs will critically depend on the extent of market power, and the particular nature of the industry under examination. There is therefore a trade-off between the costs of compliance and the benefits of any given regulatory system which needs to be evaluated.

Any regulatory regime requires specific enforceability requirements, normally through the legislative arrangements underpinning the regime. These ensure that participants follow the requirements established within the regime and have some recourse when obligations are not met.

Finally, all parties should be accountable for their roles and responsibilities within the regulatory regime. This requires mechanisms for review and appeal of decisions, whether through arbitration, legal court mechanisms or review of regulatory decisions. These requirements impose discipline on decision making wherever required in a regulatory regime.

5.2. Evaluation against the 'best practice' principles

The current road and rail regulatory regimes have different advantages and disadvantages when evaluated against the 'best practice' principles.

Both of the current rail and road infrastructure charging regimes are transparent in their regulatory approaches, operating in defined frameworks. For rail these are either the state-based rail regimes or the ARTC Access Undertaking, all of which have formal requirements for information sharing with the involvement of a regulator for certain aspects of the regime. For road, the National Transport Commission operates a transparent process when developing its recommendations for the ATC on heavy vehicle charges. Some transparency is lost however, because the recommended charges require approval by the ATC, which may take other matters into consideration.

Both regimes are reasonably predictable in terms of the access prices that result, although the role of the ATC compromises this aspect in the case of road. There may be some difficulties with new entrants in the rail regimes, due to the differences in approach between the various jurisdictions.

The negotiate-arbitrate model that is widely used in rail access regulation in Australia is most adaptable to changing circumstances in the industry. It creates the framework within which the negotiation process operates, but leaves flexibility for the individual parties to negotiate outcomes suitable to the specific circumstances. In this way, it generates appropriate incentives for access. The regime itself is possibly less adaptable, but the need for adaptability is lower, given the form of regulation used.

The approach to road charging is much less flexible, since the NTC recommends charges that are then imposed in each of the jurisdictions following approval by the ATC. While truck operators can participate in the charging review process of the NTC, once approved they are unable to negotiate the charges. In terms of adaptability, because the regime is not codified, this provides flexibility to the NTC to change its approach on the basis of changing circumstances. In this way, the current road charging regime is adaptable to improved information and changing circumstances.

The compliance costs associated with the current road charging regime are relatively small compared to the current rail regimes. This is because of the economies of scale associated with centralising the review process with the National Transport Commission. The rail regimes are likely to have higher costs for participants, due to the negotiate-arbitrate approach used; however these need to be evaluated against the benefits from the flexibility in the regimes for the participants. In addition, for rail operators working between existing jurisdictions, the complexity associated with the marginally different approaches in each jurisdiction are likely to add significantly to the overall costs of the regime to operators.

Finally, the road regime is only accountable through political processes because of the approval process in the regime with the ATC. This means that participants are unable to seek any review or legal redress for perceived or actual errors in the decisions underlying the NTC recommendations. The rail regimes however provide specific review and arbitration processes that provide this accountability to all parties.

5.3. Specific concerns with the current regulatory approaches

The existing road and rail charging regimes have some further deficiencies in terms of the incentives created for the achievement of efficiency objectives, in each of the two infrastructure industries, in addition to efficiency in the freight market.

The current institutional structure for road charging involves relatively poor incentives for efficient investment in, or provision of, road infrastructure. As all charges are based on historical actual costs, and so state governments have limited incentives[45] to achieve productive efficiency outcomes. While most governments use competitive procurement methods for the building of road infrastructure, and this is expected generally to minimise the cost of road building, significant efficiencies may also be generated through the prioritisation process for road infrastructure projects. It is these dynamic efficiencies, where further gains may be possible.

[45] As road funding must compete with other government funding demands, this creates some incentives to minimise the cost of road infrastructure spending.

While the current structure is for the government agency responsible for roads to undertake road infrastructure investment decisions, it is still possible to develop a regulatory regime that provides improved efficiency incentives, without necessarily establishing a corporatised road infrastructure body.[46] This could be achieved by improving information on road expenditure, and greater transparency in the infrastructure investment decision making and prioritisation processes. The publishing of performance benchmarks, such as costs per kilometre of new road built, would allow road infrastructure costs to be compared both within and between states. This information could improve the cost efficiency of future road infrastructure projects.

The current institutional structure for rail infrastructure charging is more likely to provide incentives for the efficient use and investment in rail infrastructure. This is because of the ability for infrastructure providers to charge below the costs to recover all capital costs, where there is a lower capacity to pay for certain rail routes, thereby maximising the utilisation of existing sunk rail infrastructure. Similarly, new investment is only likely to occur where there is a reasonable expectation that the costs of the investment will be recovered, with a return commensurate with the underlying risks.

Part of the reason for the historical differences between the two regimes is the different underlying objectives. For road, the objective of cost recovery has been pursued and this has resulted in relatively poor incentives for efficiency in the resulting regime. For rail, efficiency has been promoted, however problems have arisen from different application of the regimes in each jurisdiction.

It is these differences in the underlying approaches that have implications for competition, and therefore the incentives for efficiency in the freight market. By resolving these differences, we would expect efficiency in the freight market to be enhanced.

[46] In our view, there may be benefits associated with reviewing the current governance structures and resulting underlying incentives for the provision of road infrastructure in each state and territory.

6. Conclusions

This paper has examined the development of an efficient road and rail infrastructure charging regime. This includes a discussion about the importance of having a single regulatory objective that seeks to maximise the efficiency of use and provision of road and rail infrastructure, particularly for new investment, without adversely affecting competition in the freight transport market.

While there are many alternative charging approaches, multi-part tariffs that involve variable charges linked to marginal costs and fixed charges reflecting the recovery of fixed costs is one approach to providing balanced incentives. Multi-part tariffs balance the need to maximise the use of road and rail infrastructure, whilst still providing incentives for ongoing future investment by allowing for the recovery of capital costs, including a return on infrastructure investment.

By examining the costs currently included in charges for road and rail infrastructure, we identify the key problem for competition in the freight market as differences in the capital recovery approaches. While the road PAYGO methodology recovers the actual cost of road capital expenditure, it does not recover the financing costs of the smoothing involved in the investment cost recovery arrangements. Further, by passing capital historical costs into charges, the incentives to improve the efficiency of the provision of road infrastructure are weakened.

The rail methodology provides for the recovery of capital costs, up to those relating to a DORC valuation of existing rail infrastructure assets. Because rail charges generally lie within a floor-ceiling range, in practice there is not likely to be full recovery of the DORC valuation.

To ensure that there are no distortions to competition in the freight market, government contributions should be based on an equal proportion of the total cost of providing road and rail infrastructure services. This issue should be a primary focus of any future reforms.

In summary, the priority policy conclusions that we identify in this paper are:

- the need to define a single regulatory objective, ideally efficiency in the use and provision of, road and rail infrastructure;
- any proposed changes to road and rail infrastructure charging regimes should have regard to the impact on competition in the freight transport market;
- any new future capital expenditure for road or rail infrastructure should be fully included in the cost base to calculate charges, including the cost of financing infrastructure investment;
- the proportion of cost recovery from operators should be consistent for road and rail infrastructure, with historical asset costs being based on a DORC valuation;
- there is a need to examine the treatment and extent of government contributions to the provision of both rail and road infrastructure, and how these are included in charges;

- the rail regulatory institutional structure should be reviewed with the aim of developing a nationally consistent approach to minimise the cost of regulatory compliance by rail operators; and
- the road regulatory institutional structure should be reviewed to improve accountability and transparency of decision making, to provide incentives for efficiency improvements in the provision of and investment in future road infrastructure.

References

BTRE (1999), *Competitive neutrality between road and rail*, Working Paper 40.

BTRE (2003a), *Rail infrastructure pricing: Principles and practice*, Report 109.

BTRE (2003b), *Land transport infrastructure pricing: an introduction*, Working Paper 57.

Brown, S., and Sibley, D., (1986), *The theory of public utility pricing*, Cambridge University Press, Cambridge.

Expert Panel on Energy Access Pricing, (2006), *Draft report to the Ministerial Council on Energy*, March.

Freebairn, J., (1998), 'Access prices for rail infrastructure', *The Economic Record*, Vol. 74, No. 226, pp. 286-296.

Frontier Economics (2005), *Review of pricing policies*, A report prepared for Goulburn-Murray Water, March.

Kahn, A., (1988), *The economics of regulation – Principles and institutions*, Volume I, The MIT Press, Cambridge Massachusetts.

NERA (1998), *An examination of rail infrastructure charges*, Final report for the European Commission.

NERA and Gilbert+Tobin (2005), *Public consultation on a national framework for energy distribution and retail regulation*, May.

NTC (2004), *Future heavy vehicle road pricing mechanisms information paper: Issues, options and international developments*, Paper prepared by SKM, Maunsell Australia and MM Starrs Pty Ltd.

NTC (2005), *Third Heavy Vehicle Road Pricing Determination – Draft Technical Report*, July.

Productivity Commission (2006), *Road and rail freight infrastructure pricing*, Issues Paper, March.

NERA
Economic Consulting

NERA Economic Consulting
Darling Park Tower 3
201 Sussex Street
Sydney NSW 2000
Tel: +61 2 8864 6500
Fax: +61 2 8864 6549
www.nera.com

NERA Australia Pty Ltd, ABN 34 092 959 665